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I dedicate this to my wife and best friend, Haley.

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ABSTRACT

It is commonly asserted that free market capitalism promotes economic efficiency at the expense of equality. This view is reflected in the common claim that the rich are getting richer and the poor getting poorer. The current research examines how economic institutions consistent with economic freedom, which approximates the degree to which a nation is committed to free market capitalism, impact economic inequality. Two common concepts of economic inequality are between-nation and within-nation inequality.

Chapter two can be thought of as an examination of how economic freedom impacts between-nation inequality. Institutions were largely spread throughout the world during the European colonization era, providing a natural experiment in history. The analysis simultaneously accounts for the two prevailing institutional theories of post-colonial development, settlement conditions and identity of the colonizer, to empirically examine the causal impact of economic institutions on comparative economic development.

The results suggest that favorable settlements conditions and colonization by Britain resulted in the development of more market-oriented economic institutions, resulting in sustained long-run economic development. The positive impact of favorable settlement conditions on institutional and economic development was partially offset when France, Portugal, or Spain was the colonizer. Poor settlement conditions led to poor institutions and economic stagnation, regardless of the colonizer. The results are robust to a number of alternative theories of economic development, suggesting that economic freedom is a positive causal determinant of modern levels of per capita income, and that institutional differences between countries are largely responsible for the large disparity in average living standards that exist in the world today. As such, a significant portion of between-nation inequality is attributable to heterogeneous levels of economic freedom.

How economic freedom impacts within nation inequality has been much less studied, partially because of the lack of inequality measures that are comparable across countries. Chapter three examines the concept and measurement of economic inequality. It describes the construction of a custom inequality dataset as well as several other inequality measures that are used for the analyses in chapters four and five.

Chapter four examines the ambiguous economic freedom-inequality relationship. A simple theoretical framework demonstrates this ambiguity. A review of the existing literature suggests that the empirical relationship follows the theoretical, as several studies have examined the issue empirically and reached somewhat conflicting results. Each of the main studies has employed a different econometric model, possibly providing an explanation for the inconsistent results. Using eight alternative measures of inequality, additional empirical analyses of the four main econometric models from the literature suggests that the same model specifications are often sensitive to the measure of inequality and/or economic freedom, country sample, and/or time period examined.

The analysis from chapter four suggests that additional research on the channels through which economic institutions impact inequality is needed. Chapter five is a first step in this direction, as it empirically examines the historical influence of factor endowments and legal tradition on the development of legal institutions and the rule of law, and their importance for determining modern levels of within-nation inequality.

Consistent with the Engerman-Sokoloff and Friedman Hypotheses, elites in society have historically sought to protect their status and perpetuate inequality by influencing the development of legal institutions and the rule of law in their favor at the expense of the remainder of the population. Factor endowments suitable for plantation relative to family farming and the receipt of the French civil law tradition aided the elites in their quest to perpetuate economic inequality through the creation of poor legal institutions, while endowments suitable for family farming and/or the receipt of one of the other legal traditions hindered these efforts. The results from this chapter suggest that legal and property rights institutions that promote equality before the law, which are characteristic of a market economy, result in more equitable distributions of income.

Chapter six offers conclusions, summarizing the key findings and practical implications of the current research, as well as identifying several related areas for future research.

CHAPTER ONE

INTRODUCTION

Douglass North, considered one of the founders of new institutional economics, was awarded the Nobel Prize in 1993 for pioneering the application of economic theory and quantitative methods as tools to help explain economic and institutional change. North (1993) defines institutions as "the humanly devised constraints that structure human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self-imposed codes of conduct), and their enforcement characteristics." Institutions, North argues, define the incentive structure of societies and are therefore the main underlying determinant of economic performance. The current research marks a contribution to the growing field of new institutional economics, and in the spirit of North, it consists of essays on the development of economic institutions and their role in shaping economic inequality. Data from the widely-cited Economic Freedom of the World (EFW) Index (Gwartney, Hall, and Lawson 2013) are used as the measure of economic institutions.

Many studies have found empirical evidence that economic freedom is positively associated with economic growth and development (see reviews by Berggren, 2003; De Haan, Lundström, and Sturm, 2006; Doucouliagos, 2005; and Hall and Lawson, 2013), but most of these studies have not established more than statistical correlation.[1] The grand transitions view of economic development (Paldam and Gundlach, 2008) suggests that institutional and economic development occur simultaneously such that the former is endogenous to the latter. In an effort to overcome the potential endogeneity of institutions and establish evidence that economic freedom is a causal determinant of development, chapter two examines the role of European colonization in shaping economic institutions supportive of economic freedom, and the importance of these institutions for comparative economic development in the former colonies.

Two views on colonization and institutional development exist that have previously been treated as alternative theories. First is the settlement conditions theory of Acemoglu, Johnson, and Robinson (2001, 2002), who argue that the settlement conditions faced by the European colonists determined the type of institutions established in the colonies. When the conditions

[1] To my knowledge, Faria and Montesinos (2009) is the only study that has used an instrumental variables estimation approach to attempt to establish causality.

were favorable for large-scale permanent settlement, the Europeans invested in the development of inclusive economic and political institutions to protect private property, creating an economic environment suitable for long-run economic growth. When the settlement conditions were unfavorable, on the other hand, extractive institutions were established that set the tone for economic stagnation.

Second is the identity of colonizer view, which suggests that the European colonial powers exhibited institutional heterogeneity such that the identity of the colonizer matters for the type of institutions transplanted in the colony (Klerman et.al. 2011; La Porta et.al. 2008). Specifically, England exhibited more liberal economic and political institutions than the other major colonizers such that its colonies were likely to receive institutions more favorable to sustained economic development than those of France, Portugal, or Spain (North, Summerhill, and Weingast, 2000; Landes, 1998).

Rather than treat the two views as alternative theories, an identification strategy is developed that simultaneously accounts for both the settlement conditions and colonizer identity views for the development of a broad measure of economic institutions and policies –the EFW index –that are mutually reinforcing in the growth process. Specifically, population density in AD 1500 (PD1500) is utilized as a proxy for settlement conditions. Regions with high indigenous populations provided unfavorable settlement conditions, whereas sparsely populated regions were more attractive for settlement. When settlement conditions were advantageous, better economic institutions developed, creating a favorable environment for sustained economic growth. The positive effect of favorable settlement conditions was bolstered when England was the colonizer. Indeed, Australia, Canada, Hong Kong, Singapore, and the United States are all former British colonies and were sparsely populated in AD 1500, and are among the most economically free and prosperous nations in the world today. Meanwhile, the economies of regions hit with a double whammy of poor settlement conditions and colonization by France, Portugal, or Spain received very poor institutions that have led to persistent underperformance.

The heterogeneity of colonial experiences impacted the development of economic institutions, and a divergence in the levels of income per capita among former colonies. Huge disparities in the average living standards now exist between the relatively free and prosperous nations and the unfree and underdeveloped nations, contributing to global economic inequality. Economists sometimes refer to differences in the average living standards among nations as between nation inequality (Pinkovsky and Sala-i-Martin, 2009). Thus we can ascertain that to the extent that poor institutions are responsible for economic stagnation, that they are also responsible for contributing to world economic inequality.

The other major aspect of global economic inequality is within-nation inequality. Just as differences in economic freedom have contributed to huge disparities in the average living standards across countries, one might also expect that the distribution of income within nations to vary depending on the mixture of institutions and policies. They do after all create the incentive structure faced by agents in the economy as well as determine the mechanism(s) by which resources are allocated. It has often been asserted by academics, politicians, and other public intellectuals that free markets are efficient at generating economic growth, but the cost is the creation of vast inequalities in society (e.g. Okun, 1975).

While there is rather broad agreement that economic freedom is positively associated with economic growth and development and chapter two provides evidence that the relationship is causal, only a few studies have explicitly examined the link between economic freedom and economic inequality, often reaching contrasting conclusions. The relatively poor quality of inequality data across nations has been suggested as contributing to the difficulty in developing a better understanding of how economic freedom impacts inequality. Hall and Lawson (2013) for instance suggest that "this strain of literature is quite small, and the international data on income inequality are so questionable that caution is still warranted in drawing any conclusion" (p. 8). Chapter three discusses the concept and measurement of economic inequality, describing some of the methodological issues and available sources of data. It also describes the construction of an inequality database containing eight alternative and relatively comparable measures of inequality that are used for the analysis in chapters four and five.

Chapter four provides an analysis of the ambiguous economic freedom-inequality relationship. Most researchers who have examined the relationship between the two concepts have assumed, at least implicitly, that it is an empirical issue. Berggren (1999) was the first to explicitly examine the issue, and in doing so, developed a simple theoretical model to conclude that with the exception of income redistribution, which reduces economic freedom and inequality, the relationship between the two variables is theoretically ambiguous. Berggren's framework, while insightful, is limited to a specific political economy case in which redistribution is progressive and is done without any economic cost. This framework is modified to allow for a wider range of political economies to account for scenarios including regressive redistribution and redistribution imposing an efficiency cost on the economy. The modified framework suggests that even Berggren's theoretical conclusion that redistribution reduces inequality is not generalizable, but is limited to a specific political economy case.

Chapter four also analyzes the results from the main cross-country empirical studies of economic freedom and inequality in greater detail. Several studies have found economic freedom to be negatively associated with inequality, while others have found the opposite or argued that the relationship is non-linear. These studies have reached different conclusions for a number of reasons, including the use of heterogeneous econometric specifications, datasets, country samples, and time periods. Armed with an inequality database consisting of eight alternative and relatively comparable measures of inequality, each of the four main econometric models from the literature is tested for robustness to alternative measures of inequality. Not only do the various models sometimes produce contrasting results, but the same model is often not robust to alternative measures of inequality and economic freedom, country samples, or time periods.

While these results, along with the extended theoretical model, do not prescribe exactly how economic freedom affects inequality, they do nonetheless render policy guidance. We are able to discern with confidence how policy or institutional changes will affect economic freedom, but how freedom-reducing changes impact inequality is much less certain in a dynamic world. Thus public decision makers should caution in pursuing institutional or policy changes with the intention of lowering inequality that will unambiguously reduce economic freedom.

Further study of the mechanisms and dynamics of the economic freedom-inequality relationship is needed to provide policymakers with better information on how these variables interact. Chapter five argues that the historical origins of legal institutions that protect property rights, one aspect of economic freedom, have shaped contemporary economic inequality.

Two theories of legal origins exist in the current literature. First is the endowments view of legal origins that is commonly associated with economic historians Stanley Engerman and Kenneth Sokoloff, but also has some affinity to the work of Acemoglu, Johnson, and Robinson (2001, 2002). It suggests that geographic and natural resource endowments largely influenced the types of institutions that began to emerge during the colonial era. When endowments were favorable for large plantation farming and industrial mining, an elite class of land owners managed to gain economic and political power, and were able to influence the development of legal institutions to protect their interests while at the same denying equal rights to the remainder of the population. This led to the creation and perpetuation of economic inequality, which Easterly (2007) refers to as structural inequality. When endowments were instead more favorable for smaller scale family farming, a large middle class emerged and more egalitarian legal institutions developed, creating an economy conducive to a more equitable income distribution.

Next is the legal tradition view popularized by La Porta et.al. (1997, 1998, 1999, 2008), which suggests that most legal systems that exist in practice today are based on either French civil law or British common law, and were obtained largely through conquest and colonization. French civil law is commonly associated with less secure property rights institutions and a weaker rule of law than British common law, and to some extent German and Scandinavian civil law. The contemporary legal institutions that evolved from the French civil law tradition are therefore less likely to offer widespread legal protections than the institutions that emerged from the other legal traditions.

In the spirit of chapter two, the two views on legal origins are treated as complementary rather than substitutes in developing an identification strategy that simultaneously accounts for endowments and legal traditions as determinants of contemporary legal institutions to estimate the potential causal impact of legal institutions on economic inequality. Specifically, a measure of the historical suitability of land for the production of wheat relative to sugar (LWHEATSUGAR) is used as the measure of endowments, and is expected to be positively associated with contemporary legal institutions, as measured by area 2 of the EFW index (EF2). The positive impact of this measure of factor endowments on legal institutions is predicted to be partially mitigated when a nation received French legal origins.

The 2SLS estimates suggest that countries with endowments favorable for family farming developed greater equality before the law, and as a result, are characterized by greater contemporary economic equality than countries whose endowments are more favorable for plantation farming. The positive impact of endowments on legal institutions, and hence inequality, was partially offset when a country received the French legal tradition. The empirical evidence provides support for the Engerman-Sokoloff hypothesis that legal institutions, which were influenced largely influenced by factor endowments and colonial history, are one channel through which the distribution of economic resources is determined. They also tend to support

Milton Friedman’s (1980) hypothesis that countries that pursue freedom, and hence equality before the law, tend to also achieve greater equality of economic outcomes.

Chapter six offers concluding remarks. The current research examines how economic institutions influence economic inequality. Economic institutions supportive of economic freedom promote economic growth and development, and therefore contribute to raising relative average living standards across countries. Economic liberalization can therefore contribute to reducing between nation inequalities, acting to reduce global economic inequality. The other major component of global inequality is within nation inequality. Theory and empirical evidence unfortunately do not yet provide a clear understanding of how economic freedom impacts the distribution of resources within an economy, although the development of the rule of law and institutions that promote widespread property rights protections do seem to be associated with more equality.

CHAPTER TWO

THE COLONIAL ORIGINS OF ECONOMIC INSTITUTIONS & COMPARATIVE ECONOMIC DEVELOPMENT

2.1 Introduction

The transition from the Malthusian income per capita stagnation to an era of sustained growth, marked by the onset of the Industrial Revolution, induced a remarkable tenfold increase of world income per capita (Ashraf and Galor, 2011). This remarkable growth has not benefited all nations equally, as data from the World Bank for 181 countries indicates that there is 60-fold difference in the level of income per capita between the upper and lower quartile of countries.[2] Despite substantial progress in our understanding of the causes behind the unparalleled contemporary growth and the inequality in living standards between nations, an overall consensus on the causes still proves elusive. This is evidenced by the emergence of three major theories of development in the economics literature.

First is the neoclassical growth theory and its extensions, which stress the accumulation of physical and human capital and technological change as the ingredients for economic growth (e.g. Galor, 2005; Lucas, 1988; Romer, 1986, 1990; Solow, 1956). This view ignores the impacts of other factors such as institutions and natural endowments. Next is the endowment theory of development, which suggests that some regions of the world are developmentally handicapped because of natural geographic and/or climatic conditions (Diamond, 1997; Landes, 1998; Sachs and Warner, 1997). One major aspect of the endowment theory suggests that labor is less productive in tropical than temperate regions because (1) hot temperatures in the tropics reduces the energy levels of workers, and (2) the disease environment is more fertile in the tropical climates such that the populations suffer from poor health conditions and high mortality rates (Sachs 2001, 2003; Sachs and Warner, 1997). Another aspect of the endowment theory suggests that proximity to water shipping routes and distance to major world markets are essential ingredients for development, suggesting that remotely-located countries and those without access to the ocean to ship and receive goods are destined for underdevelopment (Gallup, Sachs and Mellinger, 1999). More recent contributions to this line of work have focused on the long-lasting

[2] Income per capita, in constant 2000 $USD, among the 45 richest and poorest nations is $28,946 and $449, respectively.

effects of initial geographic and biological conditions on human characteristics that have been transmitted over generations, exerting an influence on modern economic performance. See Spolaore and Wacziarg (2013) for a review of this literature.

Third is the institutional theory of development, which contends that institutional arrangements determine the incentive structure faced by agents in an economy and are thus directly responsible for economic performance (Acemoglu, Johnson and Robinson, hereafter AJR, 2001, 2002; Hall and Jones, 1999, North, 1981, 1990, 1991). Some institutional arrangements incentivize productive economic behavior, creating an environment favorable for long-run growth; while others promote counter-productive or even destructive behavior leading to economic stagnation or decline, respectively (Baumol, 1990; Holcombe, 1998).

The current work constitutes a contribution to the institutional theory of comparative development and is most closely related to two strands of the literature. The first emerges from the seminal contributions of AJR (2001, 2002), who argue that settlement conditions determined European settlement strategies in the colonies. The hypothesis advanced by AJR is that Europeans were likely to settle in large numbers and invest in the replication of European institutions to protect private property and constrain the powers of government in colonies with favorable settlement conditions, marked by low mortality rates and sparse indigenous populations. In colonies with unfavorable settlement conditions, on the other hand, European colonizers would have sought to establish an extractive state to transfer resources from the colony back home. Because institutions are persistent, early institutional differences set the colonies on divergent development paths that largely explain huge contemporary disparities in income per capita levels among the former colonies, reversing the previous relative levels of prosperity (AJR, 2002).

The second line of research follows the contributions of La Porta et.al. , hereafter LSSV, (1997, 1998, 1999), who argue that a country’s legal traditions were largely imparted through the colonization process and that differences in legal origins explain differences in contemporary laws and regulations that have influenced economic outcomes. In particular, countries with English common law tradition tend to have better economic performance relative to those with French civil law tradition (La Porta et.al., 2008). Klerman et.al., hereafter KMSW, (2011) illustrate the imperfect correlation between legal tradition and colonial history in suggesting that the identity of the colonizer is a more important determinant of modern development than legal tradition because the former captures more of the diversity in colonial polices that matter for institutional and economic development.

Thus two institutional theories of comparative post-colonial development exist in the current literature, and they have been treated primarily as substitutes. Both the settlement strategy and the colonizer identity theories have helped shape our understanding of how institutions have exerted an effect on comparative development among former colonies, but we contend that the two theories in isolation are incomplete and attempt to bridge the two into a more cohesive theory that better reflects historical evidence that the British exhibited more liberalized economic and political institutions prior to the colonization period, whereas unconstrained monarchs and nocuous mercantilist institutions remained intact among the other major European colonizers.

The current work offers two major innovations to the institutional theory of comparative development literature. First, we integrate the two lines of research in developing an identification strategy that simultaneously accounts for the impact of settlement conditions and heterogeneous colonial policies among the major European colonizers as a means to better capture variation in the development of early institutions among the colonies. We do so by interacting colonial settlement conditions, as measured by population density in 1500, with the identity of the colonizer to provide an instrument that is a stronger determinant of contemporary institutions than has previously been used, allowing us to more accurately estimate the potential causal impact that institutions exert on modern per-capita income levels. The underlying theory motivating our identification strategy relies on evidence that the British exhibited a less absolutist political environment and less mercantilist institutions and policies than their counterparts in continental Europe prior to and during the colonial era. When settlement conditions were favorable, the Europeans settled in large numbers and established institutions similar to those in the mother country. Home institutions were heterogeneous among the major European colonizers such that when the British settled in large numbers, all else equal, they were more likely to establish institutions more conducive to a market economy relative to the other major colonizers, enabling the former to sustain long-term economic growth. When settlement conditions were poor, regardless of the colonizer, extractive institutions were established, setting the stage for prolonged poor economic performance.

The second innovation is the use of an institutional measure, the Fraser Institute's Economic Freedom of the World Index, hereafter EFW, which has not been previously used in the comparative development literature to study the causal impact of colonial institutional development on long-term economic performance. The EFW index is constructed to provide a comprehensive measure of the degree to which a nation's economic institutions and policies reflect the protection of private property, free trade and market allocation.

The three major theories are not necessarily contradictory, but are more likely to be complementary in gaining a more comprehensive understanding of comparative economic development. The current work attempts to account for the three views in advancing a more comprehensive institutional view of comparative development than exists in the current literature.

For instance, Easterly and Levine (2001) document that factor accumulation is important for growth, but that total factor productivity (TFP) explains most of the observed variation in cross-country income levels. Augmented empirical growth models have typically assumed that other factors influence development through the TFP channel. Most empirical studies in the institutional growth literature have implicitly assumed that institutions exert a direct influence on development through the TFP channel (e.g. Knack and Keefer, 1995; De Haan, Lundström and Sturm, 2006), but these studies typically fail to formally model how institutions enter the growth equation. Institutions are explicitly modeled as an element of TFP in an augmented neoclassical production function. While doing so provides a theoretical framework, resulting estimates will be attenuated downwards due to the indirect impact of institutions on growth through their influence on the level and productivity of investment in both physical and human capital (Dawson, 1998; Gwartney, Holcombe and Lawson, 2006; Hall, Sobel and Crowley, 2010; Mauro, 1995).[3] To alleviate the attenuation problem attributable to the indirect impact of institutions on economic performance, the estimates leave out the two types of capital in order to measure the total impact of institutions on economic performance. The 2SLS estimates suggest that a standard deviation increase in our preferred measures of institutions, EFW, is associated with a three-quarter standard deviation increase in log per capita income.

While the endowment theory of development contends that geography and climate exerts a direct impact on economic development, some researchers have argued that endowments only

[3] The same may be true of empirical models augmented to account for geographic endowments.

influence economic performance indirectly through their influence on institutional development, with the basic premise being that they create a natural environment for the establishment of different types of institutional arrangements (Easterly, 2007; Sokoloff and Engerman, 2000). Sachs (2003) contends, however, that the empirical studies (AJR, 2001; Easterly and Levine, 2003; Hall and Jones, 1999; LSSV 1999; Rodrik, Subramanian and Trebbi, hereafter RST, 2004) purporting to show evidence in support of this view are not robust because they use a singular variable, latitude, as a proxy for both geography and climate. Using malaria ecology as an alternative measure of endowments, Sachs finds that it exerts a direct impact on income per capita, even after controlling for the indirect effect through the institutional channel. Auer (2013), who constructs estimates of the geographic potential for disease in the absence of Western colonization, provides additional evidence that endowments exert a direct impact on economic development beyond their influence on institutions. Auer adds that the settler mortality rate was influenced by a region's natural disease environment and that the British tended to colonize regions remote from international markets, suggesting that by failing to adequately account for the impact of geographic endowment, the settler strategy hypothesis, as tested by AJR (2001), overestimates the impact of institutions on economic performance by 28 percent, and the colonizer identity hypothesis, as tested by LSSV (1999), underestimate it by 63 percent.

Sachs (2001, pp. 4-5) furthermore argues that latitude is a poor proxy for climate, stating "countries at the same latitude will have very different climates because of the influence of land masses, wind patterns, and ocean currents…More useful definitions of the tropics rely on ecological or climatic characteristics as opposed to latitude." Sachs adds that latitude will "affect proximity to markets, and therefore transport costs," but argues distance from major markets provides a better proxy than distance from the equator. While the results below do not follow Auer (2013) in exploring a counterfactual experiment, they do follow the arguments of Sachs (2001, 2003) in attempting to provide better measures of the impact of endowments on the development of institutions and long-run economic performance than has previously been used in this line of work, as well as making use of indigenous population density in lieu of the settler mortality rate to avoid the potential endogeneity problem identified by Auer. In doing so, the attenuation of the estimated effects of institutions on development is reduced. We find some evidence that endowments do exert a direct impact on development after controlling for their influence on institutions.

Next, evidence is presented that EFW is a stronger and more robust institutional determinant of modern development than constraints on the executive, the preferred institutional measure of Acemoglu and his co-authors (AJR, 2001; AJ, 2005). Section 2.3 offers a more comprehensive review of the existing literature in laying out the theory underlying the current identification strategy. Empirical results of the causal impact of institutions on income per capita are presented in section 2.4, followed by a series of robustness checks in the penultimate section to show that institutions continue to exert a strong causal effect on economic performance, even after accounting for alternative theories of development suggested in recent literature. Section 2.6 concludes.

2.2 Institutional Determinants of Economic Development

Empirical analyses of the causal impact that institutions exert on comparative post-colonial development have primarily made use of two measures of institutions: the Polity IV constraints on the executive measure and the International Country Risk Guide's (ICRG) risk of expropriation (AJR, 2001, 2002; AJ, 2005). Both are single-dimensional institutional variables, with the former a measure of checks and balances placed on the authority of the chief government executive(s) to make decisions and the latter a measure of de facto protection of private property. Glaeser et.al., henceforth GLLS (2004), provide two criticism regarding the use of these two measures that have been used to establish evidence of the primacy of institutions in promoting growth.

First, GLLS (2004, p. 272) challenge the "close to an intellectual consensus that the political institutions of limited government cause economic growth" in suggesting that authoritarian political regimes, hardly limited governments, sometimes pursue a development strategy through liberalization of the economy, as has been the case recently in countries such as Chile, China, Taiwan and Singapore. Barro (1996, p. 2) clarifies this apparent dichotomy in suggesting that "dictators come in two types, one whose personal objectives often conflict with growth promotion and another whose interests dictate a preoccupation with economic development." There is a substantial body of literature (e.g. De Haan and Sturm, 2003; Lundström, 2005; Pitlik and Wirth, 2003; Pitlik, 2008; Rode and Gwartney, 2012) suggesting that political democracy lays the foundation for economic liberalization, and studies by Dawson (2003), Vega-Gordillo and Álvarez-Arce (2003), and Aixalá and Fabro (2009) demonstrate that political freedom granger causes economic freedom and that economic freedom granger causes growth. Similarly, Jong-A-Pin and De Haan (2008, 2011) provide evidence that economic liberalization precedes growth acceleration. Related is the Hayek-Friedman hypothesis, which suggests that societies with high levels of political freedom must also have high levels of economic freedom, but the relationship need not work the other way around. Lawson and Clark (2010) present empirical evidence supportive of this hypothesis.

Second, GLLS (2004) argue that the risk of expropriation and constraints on the executive variables reflect policy choices or outcomes rather than measures of permanent and durable institutions, suggesting they are outside the periphery of North's (1981, 1991) widely acknowledge definition of institutions. There is some merit to this criticism in that there is a weak correlation between de jure and de facto property rights protections (Feld and Voigt, 2003), a point that GLLS (2004, p.276) themselves recognize by indicating that the "rules on the books are very different from what actually takes place in a nation." For instance, government officials in some countries such as the Czech Republic refrain from expropriating private property without a constitutional provision requiring them to do so, while the constitutions in other countries such as Russia and Moldova offer property rights protections that are nonetheless often circumvented in practice (Bjørnskov, 2012). Regarding the difference in property rights protections between Russia and China, RST, (2004, p.157) indicate that "Credibly signaling that property rights will be protected is apparently more important than enacting them into law as a formal private property rights regime." This is hardly a contemporary phenomenon. Heckscher (1955), for instance, provides ample evidence of economic policy in practice diverging from that on the books in Europe during the medieval and Renaissance eras, with the former exerting an influence on economic performance rather than the latter. It is important to recall that North's definition of institutions also includes informal customs and norms such that if a government is credibly committed to preserving private property rights without a constitutional or legislative mandate, then such policy would fall under the spectrum of institutions if it were consistently practiced. The same can be said of other persistent economic policies, a point that GLLS (2004) appear to agree given their recommendation to use economic policies and rules that can be manipulated by a policy maker, regardless of whether an authoritarian or democratic regime is in place, to estimate the effect of policies and institutions on economic performance.

We heed to the advice of GLLS (2004) in adopting the EFW index as our measure of economic institutions and policies. While the protection of private property rights may very well be the core institutional characteristic of a healthy market economy that facilitates growth, the comprehensive economic environment exerts an impact on the development path that an economy will follow such that failure to account for additional institutional and policy characteristics may overestimate the impact of any single variable such as property rights protections. Hall and Jones (1999) constructed a "social infrastructure" index that was an early attempt to develop a comprehensive measure of a nation's institutions. Our preferred institutional variable, EFW, captures many of the same elements as the social infrastructure index, but has a greater scope and is a better approximation of the broad cluster of mutually-reinforcing economic, political and legal institutions advocated by Acemoglu (2005). It also provides a much more comprehensive measure of a nation's economic institutions and policies that are likely to exert an impact on a country's development than the single-dimensional risk of expropriation variable (Dawson, 2003; Faria and Montesinos, 2009; De Haan, Lundström and Sturm 2006; Gwartney, Holcombe and Lawson, 2006).

2.2.1 Economic Freedom of the World Index

The EFW data are published annually by a network of "think tanks" in 80 different countries headed by the Canadian Fraser Institute. The EFW index is designed to measure the degree to which a country's institutions and policies are consistent with personal choice, voluntary exchange, open markets, and protection of persons and their property from aggressors. The index incorporates 42 separate components derived from publically available sources such as the World Bank, International Monetary Fund, and the Global Competitiveness Report. The original data are transformed to a zero to ten scale, with higher values reflecting more economic freedom. The components are used to derive both a summary rating for each country and ratings in five areas: size of government, legal system and property rights, sound money, freedom to trade internationally and regulation of credit, labor and business. The methodology of the index is highly transparent and the component and area data for each country, as well as the summary ratings, are publicly available on the Fraser Institute website (Gwartney, Lawson and Hall, 2013).

The EFW data provide a broad measure of economic institutions and the policy environment for more than 100 countries back to 1980. The comprehensiveness of EFW captures a “broad cluster of institutions” that are mutually reinforcing in the development process, a desirable feature for measures of institutions (AJR, 2001; Acemoglu, 2005). In order to achieve a high EFW rating, a country must provide secure protection of privately owned property, evenhanded enforcement of contracts, and a stable monetary environment. It also must keep taxes low, refrain from creating barriers to both domestic and international trade, and rely primarily on markets rather than the political process to allocate goods and resources. In many respects, the EFW rating is a measure of how closely the institutions and policies of a country compare with the idealized structure implied by standard textbook analysis of microeconomics.

2.2.2 Institutions as an Input in the Production Function

As described above, most empirical studies in the institutional growth literature have implicitly assumed that institutions exert a direct influence on development through the TFP channel. They have typically done so using an augmented neoclassical growth model, but often without formally specifying how institutions enter the growth equation. We adopt a human-capital augmented neoclassical production function with constant returns to scale (Lucas, 1988; Mankiw, Romer and Weil, 1992; Romer, 1990), given by equation 2.1, where A_i, K_i, H_i and L_i represent TFP, the capital stock, level of human capital and population for country i, respectively.[4]

$$Y_i = A_i K_i^{\alpha_1} H_i^{\alpha_2} L_i^{\alpha_3} \qquad (2.1)$$

TFP is heterogenous across economies and is modeled as $A_i = e^{X_i'\gamma} e^{\beta(I_i - I^*)} A_0$. As such, country i’s TFP is a function of its distance from the ideal institutional environment, $I_i - I^*$, a vector of additional covariates that influence development through TFP, X_i', and a homogenous level of productivity, A_0, that can be thought of as the production possibilities frontier (PPF).[5]

[4] At a theoretical level the issue of institutions is complex. Jones and Romer (2010) claim that a major challenge of the new growth theory is to endogenize in parsimonious models variables accounting for ideas, population, human capital and institutions. The unified growth theory is an attempt to endogenize human capital, technological advancement and population (Galor, 2005), but little progress has been made thus far endogenizing institutions in theoretical growth models. In the model described here, institutions are assumed to be exogenous, as are the other factors of production.

[5] The framework assumes that institutions are measured on a scale that is increasing in the quality of institutions. The EFW index satisfies this condition.

With an ideal institutional environment, productive entrepreneurship, investments in human and physical capital and the division of labor are incentivized in a manner necessary to foster innovation and economic growth (Baumol, 1990; Holcombe 1998) such that a country is operating on the PPF. TFP is here structured to serve as a production deflator for a country whose institutions are less than ideal, $I_i < I^*$, which can be thought of as operating at a point inside the PPF. Within this framework, institutions exert a homogenous influence on the productivity of human and physical capital across economies.

$$\ln y_i = \alpha_0 + \beta I_i + X_i'\gamma + \alpha_1 \ln k_i + \alpha_2 \ln h_i \quad (2.2)$$

Substituting the TFP term into equation 2.1, dividing by population, L_i, normalizing to per-capita terms such that $x_i = X_i/L_i$, and logging the equation yields equation 2.2, where $\alpha_0 = \ln A_0 - \beta I^*$ is a constant and reflects the productivity level of a country with the worst possible institutions. This equation can be used to estimate the direct effect of institutions on the level of income per capita, and differenced to examine how institutional change affects economic growth. This equation likely understates the total effect of institutions on the level of income per capita, as institutions also exert an indirect effect on development through their influence on the level and productivity of human and physical capital (Dawson, 1998; Gwartney, Holcombe and Lawson, 2006; Hall, Sobel and Crowley, 2010).[6] Given this limitation of the model, we initially estimate the effect of institutions on the level of per capita income by equation 3.3, which omits the human and physical capital variables from the regression and includes an idiosyncratic error term. Doing so allows us to estimate the total effect of institutions on the level of development.

$$\ln y_i = \alpha_0 + \beta I_i + X_i'\gamma + \epsilon_i \quad (2.3)$$

2.2.3 OLS Results

Table 2.1 reports the standardized coefficients, with t-statistics pertaining to heteroskedastic-robust standard errors given in parentheses, from OLS estimates of equation 2.3 using the three different measures of institutions discussed above. The income per capita data are from the Penn World Tables (PWT), version 7.1. The results indicate that our preferred and comprehensive measure of economic institutions, economic freedom (EFW), exerts an effect on per-capita

[6] The TFP term in the model can be manipulated to allow for a differential impact of institutions on human and physical capita, as illustrated by Hall, Sobel and Crowley (2010).

income levels that is similar to that of the risk of expropriation (ROE) measure, and a larger impact than constraints on the executive (XCON). These results are robust to the selection of year and measurement of income per-capita, as well as the timing of institutional measures.

Columns 1, 4, 7 and 10 of Table 2.1 use XCON as the measure of institutions, while columns 2, 5, 8 and 11, and 3, 6, 9 and 12 use the ROE and EFW institutional measures, respectively. Columns 1-3 provide estimates for all countries for which the respective data are available for each institutional measure. Columns 4-6 provide estimates for all former colonies in which data for the respective institutional measures are available. The results reported in columns 7-9 pertain to the sample of former colonies for which population density in 1500 (PD1500) data are available. The results reported in columns 10-12 refer to the base sample of former colonies for which data for all three measures of institutions and PD1500 are available.

In panel A, PPP-adjusted log GPD per capita in 1995 is regressed separately on the three institutional measures. AJR (2001, 2002) and AJ (2005) use the average XCON over the period 1990-1999 and average ROE over the period 1985-1995, respectively. We adopt the latter measure, but alter the period of the former to the average over the period 1985-1995. Doing so makes it consistent with the other institutional measures as well as theory, which suggests that institutions exert an influence on economic performance over time (North, 1990, 1991).[7] Our preferred measure of institutions, EFW, also reflects the average over the period 1985-1995.[8]

All three measures are statistically significant at 1 percent for each sample. The estimates from columns 1-3 for the all countries sample indicate that a one standard deviation increase in the XCON, ROE and EFW measures is associated with a 0.57, 0.79 and 0.75 standard deviation increase in log GDP per capita, respectively. This suggests that the latter two measures of economic institutions exert a larger effect than the former, a measure of political institutions. The respective adjusted R^2 values for these regressions are 0.32, 0.62, and 0.56, indicating that ROE and EFW have considerably more explanatory power than XCON. The estimates for the sample

[7] One would not expect institutions in 1999 to exert an influence on income per capita in 1995. At best, measuring institutions at a date in the future may act as a proxy for current or past institutions. Point estimates and explanatory power in regressions using the average over the period 1990-1999 are smaller in magnitude than those using the average over the period 1985-1995, a result that is encouraging with respect to the institutional theory of development.

[8] EFW data is available in five-year intervals over the period 1970-2000 and annually after 2000. Country coverage is limited prior to 1985, with much more comprehensive coverage of countries beginning in 1990. As such, the average over the period 1985-1995 is used here with the stipulation that a country have data for at least two of the three five-year periods. The chain-linked index is used.

of former European colonies in columns 4-6 reiterate these findings, although the performance gap between XCON and the two measures of economic institutions narrows. The standardized coefficient increases from 0.57 to 0.71 for XCON, remains unchanged at 0.79 for ROE, and drops slightly for EFW from 0.75 to 0.73. A similar pattern emerges for the explanatory power of the respective regressions, as the R^2 value in column 4 increases from 0.32 to 0.50, remains unchanged at 0.62 in column 5, and declines slightly from 0.56 to 0.53 in column 6.

The magnitude of the standardized coefficients declines for all three institutional measures when the sample of former European colonies is restricted to those for which PD1500 data are available relative to the estimates obtained without this restriction. In column 7, XCON has a coefficient of 0.65, smaller than the 0.71 estimate from column 4 but still larger than the 0.57 estimate from column 1. Similarly, the R^2 value in column 7 of 0.42 is smaller than the 0.50 value from column 4 but larger than the 0.32 value in column 1. In column 8, the coefficient for ROE is 0.70 and the R^2 value is 0.48, representing declines from the 0.79 coefficient and 0.62 R^2 values obtained in columns 2 and 5. The coefficient and R^2 values of 0.73 and 0.53, respectively, in column 9 for which EFW is the institutional measure, are identical to column 6. Columns 10-12 provide the most comparable estimates for the three institutional measures as the sample for all three regressions include the same countries. The R^2 values for these three regressions indicate that variations in XCON, ROE, and EFW explain 36, 51 and 49 percent, respectively, of the variation in log per-capita incomes among the base sample of former colonies. Coefficient values of 0.61, 0.72 and 0.71 for XCON, ROE and EFW, respectively, suggest that the two measures of economic institutions, ROE and EFW, exert a very similar impact on income per capita, with both a considerably stronger determinant than XCON.

The dependent variable in panel B of Table 2.2 is PPP-adjusted log GDP per capita in 2000. For this set of regressions, the XCON and EFW measures used in panel A are updated to reflect the average over the period 1985-2000, while the ROE measure continues to reflect the average over the period 1985-1995 because we do not have access to more recent data.[9] The results are very similar to those obtained in panel A, with the institutional measures remaining statistically significant at 1 percent in all specifications. For the regressions using XCON and ROE as the measure of institutions, the standardized point estimates are nearly identical as those

[9] The chain-link EFW index scores are used. A country must have data for at least 2 of the 4 five-year periods for inclusion in the sample.

in panel A. The magnitude of the standardized point estimates and explanatory power increases for all of the regressions using EFW as the institutional measure in panel B. The most noticeable increase is exhibited in column 12 for the base sample. Here, the standardized coefficient on EFW rises from 0.71 to 0.77 and the R^2 value from 0.49 to 0.59 relative to panel A. EFW has a slightly higher standardized coefficient than ROE for the base sample, with both measures again considerably larger than XCON.

In panel C of Table 2.2, PPP-adjusted income per capita in 2010 is the dependent variable. The XCON and EFW institutional measures from panel B are updated accordingly to reflect the long-run averages through 2010, providing a long-run average measure of institutions over the period 1985-2010.[10] Using the more recent data, the results are very similar as those obtained in panel B; suggesting that they are relatively robust to the timing of the institutional measures and the period in which income per capita is measured. The standardized point estimates and explanatory power for the regressions employing ROE are virtually unchanged in all three panels. The magnitude of the coefficients for XCON and R^2 values in panel C are lower than those obtained in panels A and B. For instance the standardized coefficient declines from 0.56 in panel B to 0.50, and the R^2 value from 0.31 to 0.24. The results for the specifications using EFW are nearly identical as those obtained in panel B, but have modestly larger standardized coefficients and explanatory power relative to panel A. As with panel B, EFW has the largest impact on income per capita for the base sample in column 12 of panel C. It has a standardized coefficient of 0.75, while ROE's coefficient is moderately smaller at 0.71 and XCON's is considerably lower at 0.60.

Although the PWT income per capita data have been widely employed in the academic literature, the dataset has not been without its critics. Johnson et.al. (2013) provide the most scathing indictment, identifying problems of variability and valuation with earlier versions of the PWT income-per capita measures. The issue of variability is not pertinent to the current study given that it only uses the level of income per capita for a single given year.

[10] Again, the chain-link EFW scores are used. A country must have data for at least 4 of the 6 five-year periods for inclusion in the sample.

Table 2.1: OLS Estimates of the Impact of Institutions on PWT GDP Per Capita

	All Countries (1)	All Countries (2)	All Countries (3)	Former Colonies (4)	Former Colonies (5)	Former Colonies (6)	Colonies w/ PD1500 (7)	Colonies w/ PD1500 (8)	Colonies w/ PD1500 (9)	Base Sample (10)	Base Sample (11)	Base Sample (12)
	Panel A: Dependent variable is PWT log GDP per capita in 1995, PPP											
XCON (85-95)	0.57***			0.71***			0.65***			0.61***		
	(7.11)			(9.03)			(7.10)			(5.69)		
ROE (85-95)		0.79***			0.79***			0.70***			0.72***	
		(18.80)			(15.36)			(10.21)			(9.78)	
EFW (85-95)			0.75***			0.73***			0.73***			0.71***
			(13.23)			(11.31)			(10.82)			(9.54)
Adj. R^2	0.32	0.62	0.56	0.50	0.62	0.53	0.42	0.48	0.53	0.36	0.51	0.49
N	133	108	112	78	73	78	65	61	63	55	55	55
	Panel B: Dependent variable is PWT log GDP per capita in 2000, PPP											
XCON (85-00)	0.56***			0.72***			0.66***			0.61***		
	(6.58)			(8.60)			(6.86)			(5.47)		
ROE (85-95)		0.79***			0.79***			0.70***			0.71***	
		(18.12)			(15.41)			(10.24)			(9.83)	
EFW (85-00)			0.77***			0.77***			0.78***			0.77***
			(13.51)			(11.69)			(11.51)			(10.71)
Adj. R^2	0.31	0.62	0.59	0.51	0.62	0.60	0.42	0.49	0.60	0.36	0.50	0.59
N	133	108	122	78	73	79	65	61	64	56	56	56
	Panel C: Dependent variable is PWT log GDP per capita in 2010, PPP											
XCON (85-10)	0.50***			0.68***			0.61***			0.60***		
	(5.20)			(7.91)			(6.12)			(5.06)		
ROE (85-95)		0.79***			0.78***			0.70***			0.71***	
		(17.99)			(15.38)			(10.60)			(10.43)	
EFW (85-10)			0.78***			0.78***			0.77***			0.75***
			(13.72)			(11.36)			(10.66)			(9.24)
Adj. R^2	0.24	0.62	0.61	0.46	0.61	0.60	0.37	0.48	0.59	0.35	0.50	0.56
N	134	108	122	78	73	79	65	61	64	56	56	56

Standardized coefficients reported.T-Stats pertaining to standard errors robust to heteroskedasticity in parentheses. Constant terms are omitted for space. The base sample includes former colonies for which population density in 1500 data and all three institutional measures are available. The GDP per capita figures are from the Penn World Tables, version 7.1, and are in constant 2005 USD, adjusted for PPP. See appendix A for description of institutional variables. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < .01$.

Table 2.2: OLS Estimates of the Impact of Institutions on WDI GDP Per Capita

	All Countries (1)	All Countries (2)	All Countries (3)	Former Colonies (4)	Former Colonies (5)	Former Colonies (6)	Colonies w/ PD1500 (7)	Colonies w/ PD1500 (8)	Colonies w/ PD1500 (9)	Base Sample (10)	Base Sample (11)	Base Sample (12)
	Panel A: Dependent variable is WDI log GDP per capita in 1995, PPP											
XCON (85-95)	0.62***			0.71***			0.65***			0.59***		
	(8.89)			(8.94)			(6.89)			(5.19)		
ROE (85-95)		0.79***			0.79***			0.71***			0.73***	
		(17.60)			(16.59)			(10.77)			(10.47)	
EFW (85-95)			0.74***			0.72***			0.72***			0.70***
			(12.60)			(10.66)			(10.10)			(8.70)
Adj. R^2	0.38	0.61	0.54	0.50	0.62	0.51	0.42	0.49	0.52	0.34	0.53	0.47
N	145	110	109	79	72	76	65	60	61	53	53	53
	Panel B: Dependent variable is WDI log GDP per capita in 2000, PPP											
XCON (85-00)	0.55***			0.69***			0.65***			0.59***		
	(7.15)			(7.96)			(6.69)			(5.03)		
ROE (85-95)		0.75***			0.80***			0.72***			0.74***	
		(10.57)			(16.94)			(10.97)			(10.71)	
EFW (85-00)			0.75***			0.76***			0.77***			0.75***
			(13.32)			(11.39)			(11.14)			(9.86)
Adj. R^2	0.29	0.56	0.56	0.48	0.63	0.57	0.42	0.50	0.58	0.34	0.54	0.55
N	148	113	119	79	72	77	65	60	62	54	54	54
	Panel C: Dependent variable is WDI log GDP per capita in 2010, PPP											
XCON (85-10)	0.50***			0.62***			0.60***			0.56***		
	(6.20)			(6.26)			(5.91)			(4.50)		
ROE (85-95)		0.78***			0.80***			0.72***			0.75***	
		(12.42)			(17.35)			(11.70)			(11.84)	
EFW (85-10)			0.76***			0.76***			0.75***			0.71***
			(13.09)			(10.56)			(9.81)			(7.97)
Adj. R^2	0.24	0.61	0.58	0.38	0.63	0.57	0.35	0.52	0.56	0.30	0.55	0.50
N	145	110	116	78	71	75	64	59	60	53	53	53

Standardized coefficients reported.T-Stats pertaining to standard errors robust to heteroskedasticity in parentheses. Constant terms are omitted for space. The base sample includes former colonies for which population density in 1500 data and all three institutional measures are available. The GDP per capita figures are from the World Bank World Development Indicators, and are in constant 2005 USD, adjusted for PPP. See appendix A for description of institutional variables. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < .01$.

As indicated by Heston, Summers and Aten (2012), improvements were made for PWT version 7.1 to provide better information about prices and validation, reducing the problem of valuation. Nonetheless, we heed the advice of Ram and Ural (2014) who caution researchers in drawing strong conclusions from empirical results using only PWT income per capita data and advise them to test the robustness of their results with the World Bank's World Development Indicators (WDI) income per capita data due to differences in the two datasets.

Table 2.2 repeats the regression results from Table 1 using the WDI income per capita data in lieu of the PWT data. The sample size for each regression differs slightly due to modest differences in the countries covered by each dataset. Although there are minor differences in the point estimates and explanatory power of the regressions relative to Table 2.1, the results are very similar when using WDI log income per capita measures. Similar patterns observed in Table 2.1 emerge in Table 2.2. The standardized coefficients and explanatory power weakens for XCON in moving from panel A to panels B and C. These values remain relatively stable for both EFW and ROE.

Taken as a whole, the results from Tables 2.1 and 2.2 indicate that measures of economic institutions, ROE and EFW, exert a similar impact on income per capita, with both proving to be a stronger determinant of development than XCON, a measure of political institutions. The regressions using either the ROE or EFW measures always have greater explanatory power and exert a larger effect on log income per capita than those using XCON, the preferred institutional measure of Acemoglu and his co-authors (AJR, 2001; AJ, 2005). The standardized coefficient on ROE ranges from 0.70 to 0.80, while that of EFW ranges from 0.71 to 0.78. Meanwhile the standardized coefficient for XCON ranges from 0.50 to 0.71. The larger range of the estimates for XCON relative to ROE and EFW suggests that the results for the former are more sensitive to the sample of countries than the latter two institutional measures.

The regressions using ROE and EFW also have greater explanatory power than those using XCON as the measure of institutions. The range of R^2 values over the two tables is 0.48 to 0.63 and 0.47 to 0.61 for regressions using ROE and EFW, respectively. This suggests that differences in economic institutions explain 50 to 60 percent of the variation in the income per capita levels across countries. Meanwhile, the range of R^2 values is 0.24 to 0.51 for the regressions using XCON, with the least explanatory power arising in the estimates including the largest number of countries in column 1. The range of R^2 statistics reiterates the finding that the influence of XCON on development is more sensitive to the sample of countries than is ROE or EFW. Although the results suggest that EFW and ROE exert a similar impact on the level of development, as argued above EFW provides a much more comprehensive assessment of a nation's economic institutions and policies than the single-dimensional ROE measure, making it a more suitable measure of economic institutions for the current study.

As an illustration of the estimated impact of economic freedom on the level of per-capita income, the standardized coefficient of 0.78 reported in column 3 of panel C in Table 2.1 is equivalent to a partial effect of 1.06 and suggests that the difference in economic freedom between Costa Rica and Ghana, which are approximately in the 75th and 25th percentile of nations with economic freedom values of 6.9 and 5.5, respectively, should translate into a 1.48 log-point difference (or approximately a 3.4-fold difference: $e^{1.48} - 1 \approx 3.4$) . The actual income per capita difference between the two countries is 1.70 log–points (a 4.5-fold difference), suggesting that differences in economic freedom, if causal, account for nearly 87 percent of the output gap between the two nations. Using the WDI data in lieu of the PWT data, the actual difference in the income per capita levels between Costa Rica and Ghana is 1.96 log points (a 6.1-fold difference). The standardized coefficient of 0.76 reported in column 3 in panel C of Table 2.2 translates to a partial effect of 0.99 and predicts there to be a 1.38 log points (a 3-fold) difference, between the two nations. This estimate suggests that the difference in economic freedom between Costa Rica and Ghana explains about 70 percent of the difference in the level of income per capita.

2.3 European Colonization & Institutional Development

The OLS results suggest that contemporary institutions are highly correlated with modern levels of log income per capita. The two measures of economic institutions, ROE and EFW, are shown to be stronger determinants than XCON, a measure of political institutions. The estimates are derived however from equation 2.3 and the grand transition view of institutions and development suggests that institutions and per-capita income may evolve simultaneously (Paldam and Gundlach, 2008). This would indicate that institutions are endogenous to the equation, violating the exogeneity assumption, $[I_i{}'\epsilon_t] = 0$, necessary for the estimates to be consistent. If contemporary institutions are endogenous, then we need an instrumental variable, Z_i, that is correlated with I_i , but not with ϵ_i, in order to consistently estimate the causal impact that institutions exert on the level of development.

2.3.1. A Brief Literature Review

Hall and Jones (1999) recognized the potential endogeneity of institutions and used latitude and the share of the population speaking a European language as instruments for their index of social infrastructure. The theory underlying their identification strategy is that a country's institutions are largely a function of the extent to which it was influenced by Western Europe. The identification strategy used by Hall and Jones has been criticized for not distinguishing between good and pernicious Western European influence, as well as having weak theoretical foundations for exclusion of the endowment and linguistic diversity variables from estimates that are derived using a sample of countries that is not limited to former colonies (AJR, 2001, 2011; Acemoglu, 2005).

AJR (2001, 2002, 2011) exploit European colonization as a natural experiment in history in developing an identification strategy that allows European influence to be either beneficial or harmful for institutional development, depending on the colonization strategy pursued by the colonizer. The colonization strategy in turn depended on the feasibility of permanent settlement, as determined by the settlement conditions in the colony. AJR contend that two types of settlement strategies were pursued. Colonies in which settlers experienced high mortality rates and/or were densely populated by indigenous persons provided unfavorable settlement conditions. When settlement conditions were poor, AJR allege that the Europeans pursued an extractive strategy that involved mass expropriation of resources from the colony, often through coercion of the native populations, to be shipped home and enrich the kingdom. On the other hand, when settlement conditions were favorable, as indicated by low settler mortality rates and/or sparse indigenous population, the European colonizers were more likely to settle permanently and invest in the establishment of inclusive institutions similar to those existing back in Europe. Because institutions are durable and history is path dependent, AJR argue that the divergent development paths experienced by the former colonies is largely a function of the type of institutions that emerged during the colonization process, with large settlements resulting in the development of growth-promoting institutions protective of property rights and limiting the power of political leaders, and extractive colonies resulting in growth-retarding institutions that protect the power and wealth of the political elite at the peril of the remaining population.

A related line of research argues that a nation's colonizer is intrinsically linked to the development of a wide range of institutions. The contributions of LSSV (1997, 1998, 1999) link English common law tradition to the development of institutions protective of financial investors, and hence greater financial development, relative to rules emanating in countries with civil law tradition inherited from France and other continental European nations. La Porta et.al. (2008, p.286) indicate that subsequent research suggests that "civil law is associated with a heavier hand of government ownership and regulation than common law," more formalism of judicial procedures and less judicial independence, which are in turn linked to less secure property rights and weaker enforcement of contracts. They also contend that legal tradition represents a "style of social control of economic life," and argue that "common law stands for the strategy of social control that seeks to support private market outcomes, whereas civil law seeks to replace such outcomes with state-desired allocations" (p.286).[11] Common law is thus more consistent with the EFW measure of institutions.

Because legal systems were transplanted throughout the world through the colonization efforts of a small number of Western European nations, legal tradition has been used as an instrument for institutions by researchers (e.g. Berggren and Jordahl, 2006; Faria and Mentesinos, 2009).[12] KMSW (2011) argue that it is a valid exogenous instrument for institutions so long as only former colonies that inherited a legal system from their colonizer are included in the sample, but they contend that the identity of the colonizer is a better instrument than legal tradition despite the high correlation between the two because the colonial powers transplanted not only legal systems, but also differences in policies related to "education, public health, infrastructure, European immigration, and local governance" (p. 380)[13] A similar view was espoused much earlier by Adam Smith (1981), who wrote in 1776 that colonists carry with them "the habit of subordination, some notion of the regular government which takes place in their own country, of the system of laws which support it, and the regular administration of justice;

[11] Mahoney (2001, p. 505) makes a similar distinction in noting that legal tradition reflects "different views about the relative role of the private sector and the state."
[12] Berggren and Jordahl (2006) and Faria and Montesinos (2009) use legal origins as an instrumental variable for economic freedom in studies of trust and growth, respectively.
[13] KMSW (2011) indicate that French civil law was transplanted by not only the French, but also the Belgians, Dutch, Portuguese and Spanish, noting institutional and developmental differences between former colonies of the respective colonizers. They also point out that several British colonies have mixed legal systems today.

and they naturally establish something of the same kind in the new settlement" (p. 25). Studies by Bertocchi and Canova (2002), Grier (1999) and Rostowski and Stacescu (2006) find that the former British colonies exhibited higher growth rates than French colonies. KMSW provide additional evidence that British colonies experienced greater growth than French and other continental European colonies, but also find evidence that the identity of the colonizer is a "better predictor of post-colonial growth rates than legal" tradition (p. 405). Landes (1998) and North, Summerhill, and Weingast (2000) similarly argue that former British colonies prospered relative to the colonies of the other major colonizers because British colonies inherited better economic and political institutions from Britain.

Two institutional theories of comparative post-colonial development –settlement strategy and colonizer identity –therefore exist in the current literature. The literature has treated the two views as substitutes. For instance, AJR (2001) state that "British colonies are found to perform substantially better in other studies in large part because Britain colonized places where settlement was possible, and this made British colonies inherit better institutions…identity of the colonizer is not an important determinant of colonization patterns and subsequent institutional development" (p.1388). Auer (2013) points to the fact that British tended to colonize regions located remotely from Europe, perhaps providing better settlement conditions, which would suggest that the settlement conditions may be a proxy for the identity of the colonizer.[14] KMSW (2011) concede that settlement selection may explain some of the observed differences in economic performance among the colonizers, but argue that this does not encompass the entire story because colonizers from the various European nations brought with them a diverse set of institutions and policies from home. While sympathetic to both views, we believe that in isolation each is incomplete and attempt to bridge the two into a more comprehensive theory that better reflects historical evidence.

Rather than treat the two views as substitutes, the institutional view of comparative development advanced here accounts simultaneously for the effects that settlement conditions and the identity of the colonizer exerted on the development of institutions in the colonies. When settlement conditions were poor, on the one hand, extractive institutions were established, regardless of the identity of the colonizer. On the other hand, when settlement conditions were

[14] Auer (2013) argues that by failing to account for the influence that endowments may have exerted on colonization strategy, AJR (2001) overestimate the influence of institutions on economic growth, while LSSV (1999) underestimate the importance of colonial-transplanted legal origins on the development of institutions.

favorable and large-scale settlement occurred, institutions similar to those that had developed in the mother country up to and throughout the colonial era would have been adopted in their colonies. British institutions in particular had become more liberal than institutions on the continent such that its colonies inherited economic, legal and political institutions that were more conducive to the development of a market-based economy and long-term economic growth when large-scale settlement occurred, relative to the colonies of the other major European colonizers. When the British settled in large numbers, they brought with them a bundle of institutions including a constrained government, a common law system, limited regulations of product and labor markets, and openness to trade, paving the way for the development of a market-based economy and sustained economic development.

2.3.2 Settlement Conditions and Colonizer Identity as Determinants of Early Institutions

Although the selection of target colonies by the various European powers for settlement may not have been random and instead based on factors such as climate, geography, or the presence of native populations (Auer, 2013; KMSW, 2011), European colonization nonetheless provides a natural experiment for the exogenous imposition of institutional arrangements in the colonies by the Europeans. As such, contemporary institutions are modeled as a linear function of initial institutions, C_i, and other factors, X_i, that may have exerted an influence on the development of institutions such as endowments and population heterogeneity, and is described by equation 2.4. Because institutions are durable and path dependent, the institutional shock corresponding to European colonization would have altered the trajectory of institutions and hence economic development in the colonies, depending on the type of institutions implanted.

$$I_i = \alpha_0 + \alpha_1 C_i + X_i'\theta + \nu \qquad (2.4)$$

The establishment of highly extractive institutions would have led to a poor institutional environment and stagnant if not counterproductive growth prospects going forward, while the transplantation of continental mercantilist institutions such as adopted by the French or Spanish, would have likely laid the foundation for a similar form of mercantilism in the future and modest, albeit inefficient, growth opportunities. Meanwhile, the imposition of more inclusive, milder forms of mercantilism that provided greater economic freedom, such as that practiced by the British, would likely have fostered an environment incentivizing market competition, entrepreneurship, and innovation, and hence one conducive to persistent economic growth (e.g. Baumol, 1990; Holcombe, 1998; Kirzner, 1973, 1985). Thus, using initial colonial institutions as an instrument for contemporary institutions would provide a theoretically sound exogenous source of variation and allow consistent estimation of the causal impact that institutions exert on the level of development.

Unfortunately, adequate measures of early economic institutions for the colonies are unavailable.[15] Following AJR (2001, 2002) and Acemogu and Johnson (2005), we postulate that settlement conditions faced by colonizer i in region j, SC_j, influenced the settlement strategy and the development of early institutions by the European colonizers. They use two variables to proxy for settlement conditions: log of population density in 1500 and log of settler mortality rates. This line of reasoning suggests that Europeans would have been deterred from permanent colonial settlement and the establishment of institutions similar to those back in Europe in regions with high indigenous population densities and where settlers experienced high mortality rates. Instead, they would have sought to extract the local resources through coercion of the indigenous populations. In regions with low population densities and settler mortality rates on the other hand, the European colonizers would have been much more likely to establish permanent settlements and expend effort to establish institutions resembling those from home such as widespread property rights protections and restraints on the power of political leaders. Indeed, risk of expropriation and constraints on the executive are the two measures that have been used by Acemoglu and his co-authors, although they profess the latter to be their preferred institutional measure. The theory advanced here is consistent with that of Acemoglu and his co-authors in that European colonizers followed a similar settlement strategy such that they would have chosen to establish highly extractive colonies in regions with high indigenous population densities and/or settler mortality rates, but settled permanently and established institutions and policies similar to those in existence in Europe in regions with low indigenous population densities and/or settler mortality rates. It differs however in two respects.

First, it is not challenged that settler mortality rates would have influenced the decision whether to establish permanent settlements and implement inclusive or extractive institutions,

[15] KMSW (2011) use levels of school and life expectancy in 1960 as proxies for colonial policies. In our view, these two variables are development outcomes that may be correlated with early institutions and policies, but are not per se a good measure of them.

but it is argued that indigenous population density is a better proxy for settlement conditions.[16] Olson (1996) suggests that the presence of large native populations would have limited the ability of the colonizers to adopt institutions and policies resembling those in their home country if the natives comprised a significant proportion of the total population and had previously established their own set of institutions and policies. In such circumstance, the colonizers would represent a weak minority, limiting their ability to implement radical institutional change peacefully. This would have been the case even in regions in which colonizers experienced low mortality rates. The mixed legal systems present in former British colonies in Africa provide an example of the difficulty in fully transplanting home institutions in colonies with more dense native populations (KMSW, 2011). Furthermore, Easterly and Levine (2012) provide empirical evidence that population density in 1500 is a robust determinant of European settlement, suggesting that regions with high indigenous populations could supply resistance to European settlement. As such, indigenous population density is a more appropriate proxy for colonial settlement conditions than is the settler mortality rate. This rationale, combined with recent controversy surrounding the settler mortality rate data (c.f. Albouy, 2012 and AJR 2011), is the basis for using population density in 1500 (PD1500) as the main proxy for settlement conditions in the analysis to follow, although analogous results using the settler mortality rates are reported in appendix Table C.2.

Next, the settlement strategy theory advanced by Acemoglu and his co-authors assumes that mother country institutions and policies were homogenous across Europe during the colonial era. This was not the case as the British exhibited mercantilist economic institutions supportive of market allocation and free enterprise, legal institutions based on common law, and political institutions that constrained the powers of the monarch. Meanwhile the other major European colonizers (France, Portugal, and Spain) exhibited highly centralized economic institutions characterized by a large degree of state allocation and regulation, and unconstrained executives whose power was reinforced by a civil law system in which the judges were subject to the discretion of the central administration (e.g. Heckscher, 1955; Landes, 1998; La Porta et.al., 2008; North, Summerhill, and Weingast, 2000). Given the vastly different institutional arrangements between the English and continental colonizers, it should not be expected that

[16] Easterly and Levine (2012) provide evidence that settler mortality rates did not influence settlement strategy, and Auer (2013) argues that European colonization influenced settler mortality rates such that using it as an instrument results in an overestimation of the impact of institutions on long-run growth.

large-scale colonial settlements result in the development of similar institutions irrespective of the colonizer. Initial constraints on the executive measures among the colonies of the major colonizers provide some evidence of this. The average initial constraint on the executive score among former British colonies is 5.4, while that of French, Spanish and Portuguese colonies is 2.3, 2.1 and 2.0, respectively.[17]

The identification strategy used here allows for a differential impact on the development of institutions in British colonies and is given by equation 2.5, for which the initial post-colonial institutional environment is a linear function of settlement conditions and settlement conditions interacted with a dummy variable equal to one if the colonizer was England, UK_i. The colonial identification classifications of KMSW (2011) are used. Following the line of reasoning described above, the main results reported below use PD1500 as the proxy for settlement conditions.

$$C_i = \delta_0 + \delta_1 SC_{ij} + \delta_2 (SC_{ij} \times UK_i) + \mu \qquad (2.5)$$

One of Albouy's (2012) criticisms of the settler mortality rate data used by Acemoglu and his co-authors, who used a log transformation of the variable, is that outliers were driving the result that institutions are a strong and robust causal determinant of economic performance.[18] Even though the PD1500 data are used as the proxy for colonial settlement condition, the variable does nonetheless have a large standard deviation due to the presence of several right-skewed outliers. In an effort to mitigate the potential for a similar condition, along with a reasonable theoretical conjecture, a different transformation metric is adopted that rescales PD1500 to a 0-1 scale that is decreasing using the formula $x'_j = 1 - (x_j / x_{max})$, where x'_j and x_j are the adjusted and nominal population densities in 1500 for colony j, respectively, and $x_{max} = \bar{x} + 0.25\sigma_x$.[19] This transformation rescales the variable in a relative sense such that sparsely populated regions have values approaching one, while the most densely populated areas receive a value approaching zero. This has the benefit of simplifying both the theory and the interpretation of point estimates. A one unit increase in PD1500 is equivalent to the difference between an uninhabited and the

[17] On a 1-7 scale that is increasing in constraints. Initial constraint is the average XCON score over the first 10 years for which data is available from Polity IV, which serves as a proxy for the first decade of independence.

[18] Acemoglu, Johnson and Robinson (2011) replied to Albouy's (2012) criticism, suggesting that limiting the effect of outliers actually strengthens their results rather than weakening them.

[19] Using alternative transformations that set x_{max} equal to 0.5, 0.75 or 1 standard deviations above the mean does not change the main results. See appendix B for additional details and results.

most densely populated region. The rescaled metric assumes that the negative effect of indigenous population density on institutional development fails to exert a differential impact beyond a certain density level, or the marginal effect of indigenous population density on institutional development is zero above x_{max}. Appendix B provides further details on the transformation of the PD1500 variable.

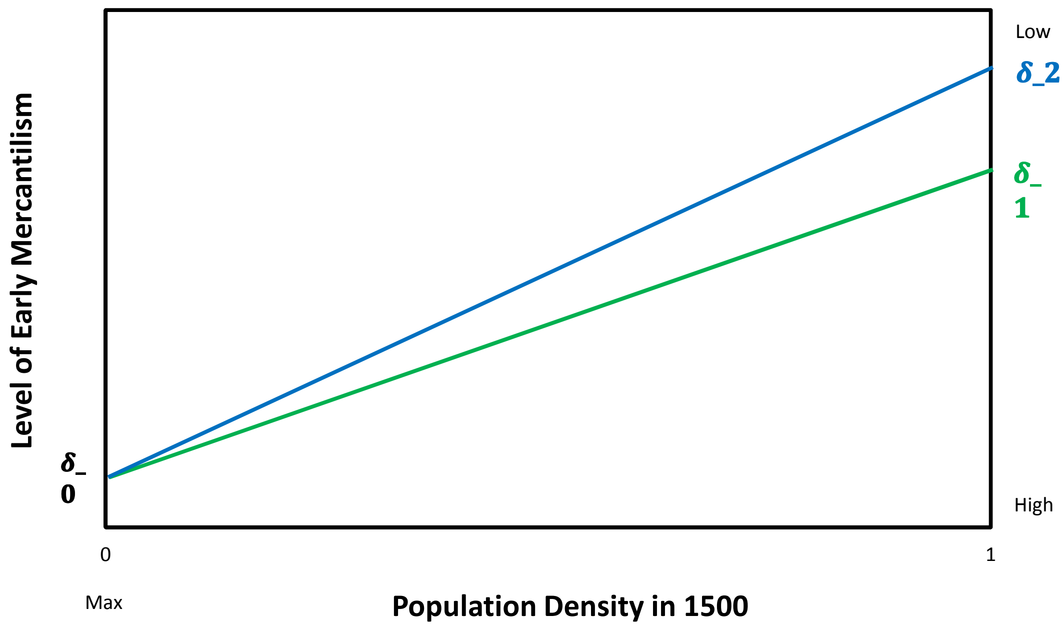

Figure 2.1: Early Mercantilism vs. Settlement Conditions

It is anticipated that a positive relationship exist between the rescaled PD1500 and contemporary institutional variables, and the effect to be greater among colonies settled by the British. Figure 2.1 illustrates this relationship by plotting initial mercantilist institutions and policies against PD1500. Regardless of the identity of the colonizer, it is postulated that the colonizers would have attempted to establish highly mercantilist (purely extractive) institutions and policies in regions with the highest indigenous population densities. As settlement conditions improved (i.e. population density decreased), the opportunity to establish permanent institutions resembling those back home increased. In less populated regions, early institutions and policies are predicted to be less mercantilist among British than other European colonies, represented by the larger slope of the blue line relative to the green one.

2.4 Empirical Results

2.4.1 Determinants of Current Institutions: OLS Results

Substituting equation 2.5 into equation 2.4 yields the instrument, Z_i , given by equation 2.6 where $\gamma_k = \alpha_1\delta_k$, $\zeta = \nu + \alpha_1\mu$ and $\lambda = \alpha_0 + \gamma_0$ are the composite coefficient, error and intercept terms, respectively. OLS estimates of equation 2.6 using PD1500 as the proxy for settlement conditions are given in Table 2.3. Panels A, B and C report the results using three different measures of contemporary institutions: average XCON over the period 1985-2010, average ROE over the period 1985-1995, and average EFW over the period 1985-2010, respectively.

$$Z_i = I_i = \lambda + \gamma_1 PD1500_j + \gamma_2\left(PD1500_j \times UK_i\right) + X_i'\theta + \zeta \qquad (6)$$

Columns 1 and 2 of Table 2.3 deviate from equation 2.6 by including UK and PD1500, respectively, as the sole independent variables, providing a means to compare the results of unified view of post-colonial institutional development to the identity of the colonizer and settlement conditions views, respectively. UK is insignificant in panels A and B of column 1, and only significant at 10 percent in panel C. The R^2 values of column 1 suggest that British colonization explains less than five percent of the variation in contemporary institutions. The results are stronger in column 2, as PD1500 is significant at 1 percent in panels A and C, and 10 percent in panel B. The R^2 values indicate that pre-colonial population density explains 14, 4 and 16 percent of the variation in contemporary XCON, ROE and EFW, respectively.

Column 3 provides an alternative specification that includes both UK and PD1500 separately as contemporary institutional determinants, but not the two interacted. Both UK and PD1500 are significant at 10 percent or more in panels B and C, but the former is insignificant in panel A. The R^2 values indicate that these two variables explain 17, 15 and 25 percent of the variation in contemporary XCON, ROE and EFW, respectively, suggesting that both the identity of the colonizer and settlement conditions were important for the development of institutions. The specification used in column 3 amounts to an upward shift in the intercept for British colonization, suggesting that colonization by the British led to the development of better institutions vis-à-vis the other European colonizers even in the face of the worst possible settlement conditions. It also suggests that the marginal effect of settlement conditions on institutional development in the colonies was homogenous for all colonizers, analogous to the model employed by AJR (2001). While the results obtained are an improvement over those of columns 1 and 2, which only account for the identity of the colonizer and settlement conditions hypotheses in isolation, respectively; the specification used in column 3 does not accurately reflect the theory outlined above. Highly extractive mercantilist institutions were established in very densely populated regions, regardless of the identity of the colonizer. As settlement conditions improved, the opportunity to establish institutions similar to those at home improved, with large-scale settlement by the British exerting a positive differential impact on the quality of early institutions.

Column 4 reports the results pertaining to equation 2.6 in which PD1500 and PD1500×UK are included as regressors. The interactive terms suggests that the marginal effect of settlement conditions on institutional development in British colonies was different than that of the other European colonizers, with a positive coefficient expected. PD1500 remains significant at 1 percent, while PD1500×UK is insignificant in panel A when XCON is the institutional measure. The opposite is true in panel B when ROE is the dependent variable. Meanwhile, consistent with the hypothesis that the English transplanted a broad cluster of market-based institutions in their colonies when large-scale settlement occurred, both terms are significant at 1 percent in panel C when EFW is the measure of contemporary institutions. These two terms jointly explain 28 percent of the variation in contemporary EFW, while explaining 24 and 13 percent of the variation in ROE and XCON, respectively. The weaker results for XCON relative to ROE and EFW provide additional evidence that colonizers brought with them more than just political institutions that restrained the power of the executive. They also brought with them conceptions concerning organization and regulation of the economy from their home country, with liberal British institutions more reliant on market allocation, free trade and protection of persons and their property than the other major European colonizers.

The point estimates in panel C of column 4 suggest that British colonization exerted a significant differential impact on the development of EFW, as a unit increase in PD1500 (change from the most to least densely population region) is associated with a 1.72 point increase in modern EFW among former British colonies, but only a 0.80 rise among non-British colonies.

Table 2.3: Determinants of Institutions - 1st Stage OLS Results

	Former European Colonies							w/o Neo-UK	w/o Africa	Base
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Average Constraints on the Executive (XCON), 1985-2010, is Dependent Variable										
UK	0.54		0.62							
	(0.39)		(0.39)							
PD1500		1.94***	1.95***	1.79***	1.78***	1.57**	1.65***	1.49**	0.92	1.46*
		(0.59)	(0.54)	(0.63)	(0.61)	(0.67)	(0.61)	(0.60)	(0.94)	(0.75)
PD1500×UK				0.32	0.10	0.58	0.32	0.12	0.49	0.29
				(0.53)	(0.44)	(0.48)	(0.46)	(0.61)	(1.01)	(0.51)
COAST					1.40***		0.98**	1.21**	-0.64	0.39
					(0.49)		(0.48)	(0.55)	(0.74)	(0.51)
TROPICS					-1.81***		-1.43***	-1.17**	-0.48	-1.22**
					(0.39)		(0.48)	(0.55)	(0.85)	(0.51)
DMM					-0.03		-0.00	0.09	0.01	0.02
					(0.06)		(0.06)	(0.09)	(0.08)	(0.06)
ELF						-2.16***	-1.30**	-1.33**	-0.52	-1.83**
						(0.52)	(0.55)	(0.58)	(1.30)	(0.71)
Adj. R2	0.01	0.14	0.17	0.13	0.37	0.30	0.41	0.31	0.04	0.39
N	78	65	65	65	64	65	64	60	33	55
F	1.89	10.88	9.10	5.50	22.79	8.19	18.02	13.11	2.69	15.57
p(F)	0.17	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.00
Panel B: Average Risk of Expropriation (ROE), 1985-1995, is Dependent Variable										
UK	0.47		0.99***							
	(0.38)		(0.34)							
PD1500		1.01*	1.12*	0.17	0.34	-0.05	0.29	0.02	0.10	0.40
		(0.54)	(0.57)	(0.52)	(0.53)	(0.50)	(0.56)	(0.56)	(0.71)	(0.61)
PD1500×UK				1.68***	1.51***	1.80***	1.54***	1.17***	2.90***	1.61***
				(0.43)	(0.33)	(0.42)	(0.35)	(0.38)	(0.58)	(0.37)
COAST					0.62		0.55	0.70	-0.84	0.65
					(0.40)		(0.51)	(0.57)	(0.83)	(0.54)
TROPICS					-1.41***		-1.36***	-0.87**	-0.26	-1.50***
					(0.32)		(0.37)	(0.36)	(0.56)	(0.40)
DMM					-0.05		-0.04	0.05	0.11	-0.06
					(0.06)		(0.07)	(0.10)	(0.08)	(0.06)
ELF						-1.02**	-0.18	-0.21	-0.00	-0.06
						(0.48)	(0.71)	(0.70)	(1.30)	(0.81)
Adj. R^2	0.01	0.04	0.15	0.24	0.42	0.28	0.41	0.16	0.57	0.40
N	73	61	61	61	59	61	59	55	34	55
F	1.50	3.49	5.51	8.81	9.28	7.21	7.83	3.36	13.46	8.75
p(F)	0.22	0.07	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Panel C: Average Economic Freedom (EFW),1985-2010, is Dependent Variable										
UK	0.46*		0.60**							
	(0.24)		(0.23)							
PD1500		1.27***	1.27***	0.80***	0.76**	0.65**	0.73**	0.64**	0.95***	0.87**
		(0.33)	(0.30)	(0.27)	(0.29)	(0.28)	(0.28)	(0.26)	(0.21)	(0.34)
PD1500×UK				0.92***	0.84***	1.03***	0.89***	0.69**	1.05***	0.80***
				(0.32)	(0.25)	(0.30)	(0.27)	(0.34)	(0.38)	(0.28)
COAST					1.01***		0.93***	1.08***	1.33***	1.01***
					(0.23)		(0.28)	(0.31)	(0.27)	(0.35)
TROPICS					-0.95***		-0.89***	-0.68**	-1.07***	-0.92***
					(0.22)		(0.24)	(0.28)	(0.32)	(0.27)
DMM					-0.07*		-0.07	-0.01	-0.07*	-0.07
					(0.04)		(0.04)	(0.06)	(0.04)	(0.04)
ELF						-1.00***	-0.23	-0.19	1.30***	-0.06
						(0.28)	(0.34)	(0.34)	(0.35)	(0.43)
Adj. R^2	0.04	0.16	0.25	0.28	0.57	0.37	0.56	0.40	0.75	0.49
N	79	64	64	64	60	64	60	56	33	55
F	3.59	15.10	9.00	10.17	20.57	10.83	17.91	5.66	80.46	11.55
p(F)	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors robust to heteroskedasticity in parentheses. Constant terms omitted for space. See appendix A for details about variables.
*p < 0.10,** p < 0.05,*** p < .01.

Columns 2 and 3 include PD1500 but omit the PD1500×UK term and thus, do not allow for settlement conditions to exert a differential impact on the development of institutions in former British colonies. The theory outlined above suggests that this will result in an overestimation of the effect that PD1500 exerts on contemporary EFW in non-British colonies, and underestimate the effect in British colonies. The estimated coefficient on PD1500 is 1.27 in columns 2 and 3 of panel C, higher than that for non-British colonies and lower than that of British colonies in column 4.

Some researchers have argued that endowments only affect development indirectly through their influence on the development of institutions, with the basic premise being that geography and climate influence the type of institutions adopted (AJR, 2001; Easterly and Levine, 2003; Easterly, 2007; RST, 2004; Sokoloff and Engerman, 2000). Sachs (2003) argues that the studies purporting to show evidence of this view are not robust as they have typically only employed latitude as their singular measure for both geographic and climatic endowments, suggesting that using variables that directly measure the different types of endowments is more appropriate. Auer (2013) adds that endowments may have influenced colonization strategies, which would influence the development of institutions in the colonies.

Following these arguments, column 5 introduces three endowment variables: the share of the population living within 100 kilometers of the coast (COAST), the proportion of land located in the tropics (TROPICS) and the shortest distance from one of the three major world markets (DMM). All three variables have the expected sign in all three panels, with TROPICS and DMM negative and COAST positive. Of the three variables, only TROPICS is significant in all three panels (at 1 percent). Meanwhile, COAST is significant at 1 percent in panels A and C, while DMM is significant (at 10 percent) in panel C. The partial effects for PD1500 and PD1500×UK are very similar to those reported in column 4. Controlling for the impact of endowments on the development of institutions, a unit increase in PD1500 is associated with a 0.76 and 1.60 point increase in contemporary EFW for former non-British and British colonies, respectively.[20] The regressors jointly explain 57 percent of the variation in contemporary EFW, but only 37 and 42 percent of the variation in XCON and ROE, respectively.

[20] The standard deviation of EFW for the sample is 0.989, so a point increase is approximately a 1 standard deviation increase.

Population heterogeneity has often been associated with geopolitical conflict that "leads to political instability, poor quality of institutions, badly designed economic policy, and disappointing economic performance" (Alesina et.al. 2003, p. 155). Huntington (1968) argues that governments in countries with a more fractionalized population tend to implement policies that benefit the winning minority at the expense of groups not represented in government. Mauro (1995) adds that divided countries are prone to greater political instability and are associated with more corruption and lower growth because bureaucrats engage in ethnocentric behavior favoring members of their own group and attempt to take as many bribes as possible given the uncertainty about their tenure in office. Azzimonti (2011) shows theoretically how polarized societies can retard growth. Population heterogeneity has thus become identified as a common determinant of both institutional quality and economic performance. Following Easterly and Levine (1997), many empirical studies use ethno-linguistic fractionalization (ELF) as a measure of population heterogeneity, with most finding fractionalization to be negatively associated with institutional quality and/or economic performance (Brock and Durlauf, 2001; Faria and Montesinos 2009; Hall and Jones, 1999; LSSV 1999; Mauro, 1995; Roe and Siegel, 2011; Sala-i-Martin et.al., 2004).[21]

Column 6 controls for the potential negative impact of population heterogeneity on institutional development by introducing ELF to the regression. As anticipated, ELF is negative and significant in all three panels at the 5 percent level. The pattern of coefficients on PD1500 and $\mathrm{PD1500} \times \mathrm{UK}$ are similar to those obtained earlier, with the former significant in panel A, the latter significant in panel B, and both significant in panel C. Controlling for ELF, a one unit change in PD1500 is associated with an increase in EFW of 0.65 and 1.68 points in former non-British and British colonies, respectively.

Column 7 controls for both the endowments and population heterogeneity variables. ELF is only significant in panel A, a finding that is likely attributable to the high correlation (0.53) with COAST, which is also included as a covariate. As with the results from column 5, TROPICS is negative and significant in all three panels, and COAST is positive and significant in panels A and C (at 5 and 1 percent, respectively). A similar pattern emerges for the partial effects of PD1500 and PD1500×UK. Both are significant at 5 percent or higher in panel C,

[21] ELF is an index that measures the probability that two randomly selected individuals from a country are from different ethno-linguistic groups.

indicating that a unit increase in PD1500 is associated with a 0.73 and 1.62 point increase in EFW in former non-British and British colonies, respectively, holding endowments and fractionalization constant.

Following AJR (2001, Table 4), column 8 excludes from the sample the four nations described by AJR as the "Neo-European" countries: Australia, Canada, New Zealand and the United States. This exercise has the benefit of checking sensitivity of the estimates to the inclusion of these four former British colonies, which are referred to as the "Neo-UK" nations, that all belong to the OECD and are among the most economically free and developed countries in the world today. Although the estimated effects of PD1500 and PD1500×UK on institutional development are slightly lower when excluding the Neo-UK nations, the results are robust to this subsample of former colonies. An increase from the most to the least densely populated region in 1500 is associated with a 0.64 and 1.33 point increase in EFW in former non-British and British colonies, respectively.[22]

Congruent with AJR (2001, Table 4), column 9 excludes the African nations from the sample. This reduces the sample size to 34 countries in panels A and B, and 33 countries in panel C. Neither PD1500 nor PD1500×UK are significant in panel A and the R^2 value is only 0.04, indicating that the impact of settlement conditions on XCON is driven largely by low scores in the African nations, many of which remain politically unstable today. PD1500×UK is the only variable that is statistically significant in panel B, suggesting that large scale British settlements exerted a strong positive influence on the protection of property rights in colonies outside of Africa. All of the independent variables are significant at 10 percent or higher in panel C, and jointly explain 75 percent of the variation in EFW. The estimates suggest that, outside of Africa, a unit increase in PD1500 is associated with a 0.95 and 2 point increase in contemporary EFW among former British and non-British colonies, respectively. This suggests that huge disparities in the level of development between Africa and the rest of the world are not driving the results.

Finally column 10 reports the results for the base sample of countries that have data available for all three institutional measures. These results are nearly identical to those in column 7, with a unit increase in PD1500 associated with a 0.87 point increase in contemporary EFW for former non-British colonies, and a 1.67 point increase for British ones, holding endowments and

[22] The standard deviation of EFW for the subsample of colonies excluding the Neo-UK countries is 0.94, suggesting that a unit increase in PD1500 is associated with a 0.68 and 1.41 standard deviation increase in EFW in former non-British and British colonies, respectively.

ELF constant. The regressors jointly explain 49 percent of the variation in EFW, but only 39 and 40 percent of the variation in XCON and ROE, respectively.

The results from Table 2.3 provide evidence that the instruments, PD1500 and PD1500×UK, are good predictors of contemporary economic institutions as measured by EFW, even after controlling for the effect that endowments and population heterogeneity may exert on institutional development. They are not very good predictors of the other two measures of institutions, XCON and ROE. These results support the hypothesis underlying the identification strategy, namely that both the settlement conditions and identity of the colonizer are important determinants for the development of a broad cluster of market-based economic institutions.

2.4.2 Institutions and Economic Performance: 2SLS Results

Instrumenting I_i with Z_i, two-stage least squares (2SLS) estimates of equation 2.3 are presented in Table 2.4. The dependent variable in all columns is the PWT measures of 2010 log GDP per capita. Panel A, B and C use the average XCON over the period 1985-2010, average ROE over the period 1985-1995, and average EFW over the period 1985-2010, respectively, as the measure of institutions. The first stage results for each column are given in the corresponding columns of Table 2.3.

The OLS results reported in Table 2.3 suggest that the identification strategy that uses PD1500 and PD1500×UK as instruments for institutions performs best when EFW is used as the measure of institutions. Tests for over-identification, under-identification, and weak instruments reinforce these results. The results discussed below pertain mainly to columns 4-10 of Table 2.4, as the first three columns utilize identification strategies that deviate from the theory described above.

The Hansen-Sargan test for over-identification has a joint null hypothesis that the instruments are uncorrelated with the error term and that the excluded instruments are correctly excluded. Because standard errors are robust to heteroskedasticity, the Hansen J-statistic is used, obtained by regressing the residuals from the second stage on the full set of instruments. Under the null, the test statistic is distributed as χ^2_{L-K}. A rejection of the null casts doubt on the validity of the instruments, suggesting that they do not satisfy the orthogonality conditions because they are either not truly exogenous or are incorrectly excluded from the second stage regression (Hayashi, 2000). The p-value from the test is reported as p(OID) for each regression. The null is not rejected for all regressions in panel A, and is only rejected at 10 percent in column 5 of panel C. The null is rejected at 1 percent in all but column 6 of panel B, which is rejected at 5 percent. These results strongly suggest that the instruments may be invalid for ROE.

The p-value of the Kleibergen-Paap rk statistic is reported as p(UID).[23] Under the null hypothesis, the equation is under-identified such that the matrix of L1 reduced form coefficients of the excluded instruments has rank K1-1, where K1 is the number of endogenous regressors. The test statistic is distributed as $\chi^2_{L1-K1+1}$ and a rejection indicates that the matrix has full column rank and is thus identified (Kleibergen and Papp, 2006). With the exception of column 1 in both panels A and B and columns 9 and 10 of panel A, the null is rejected in all remaining regressions in Table 4. Failure to reject the null in column 10 of panel A in particular casts doubt on the relevancy of the excluded instruments as determinants of XCON.

Finally, the Kleibergen-Paap Wald first-stage F-statistics and Stock-Yogo maximal Wald test size distortion critical values are reported as F(WID) and SY size, respectively. If the F(WID) is less than the critical value, then the size distortion of the Wald test suggests that the instruments are weak. Maximal bias critical values are not reported because the number of instruments is sufficiently small such that that Staiger and Stock (1997) rule of thumb that instruments be deemed weak if the first-stage F-statistic is less than ten reasonably approximates a 5 percent test that the worst relative bias is 10 percent or less (Stock and Yogo, 2002). The results are highly suggestive that PD1500 and PD1500×UK are weak instruments for XCON, as the highest F(WID) in panel A, beginning in column 4, is 5.5, which is well below both the critical value of 8.75 (for a desired maximal size of 0.2 for a 5 percent Wald test) and the rule-of-thumb critical value of 10. There is also some evidence of weak instruments in panel B as column 4 has a F(WID) of 8.8, which is less than the rule-of-thumb critical bias value of 10, and only slightly above the critical size value of 8.75. The results suggest the presence of weak instruments for all three institutional measures in column 8, which excludes the four Neo-UK nations from the sample. Other than column 8, there are no other signs of weak instruments in panel C, suggesting that PD1500 and PD1500×UK are strong instruments for EFW.

[23] The Kleibergen-Paap rk statistic is used in lieu of the Craig-Donald statistic because standard errors are robust to heteroskedasticity.

Table 2.4: 2SLS Estimates - Impact of Institutions on PWT GDP Per Capita

	Former European Colonies							w/o Neo-UK	w/o Africa	Base
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: Average constraints on executive (XCON), 1985-2010, as instrumented institutional measure									
XCON (85-10)	0.27	0.70***	0.67***	0.73***	0.77***	0.75***	0.80***	0.78***	1.78	0.92**
	(0.47)	(0.21)	(0.21)	(0.22)	(0.22)	(0.23)	(0.24)	(0.29)	(1.14)	(0.36)
COAST					0.49		0.63	0.51	1.82	1.02**
					(0.42)		(0.40)	(0.56)	(1.31)	(0.49)
TROPICS					-0.08		-0.18	-0.17	0.16	-0.32
					(0.57)		(0.53)	(0.49)	(1.24)	(0.57)
DMM					-0.12***		-0.13***	-0.16*	-0.05	-0.13***
					(0.04)		(0.04)	(0.09)	(0.09)	(0.04)
ELF						-0.11	0.55	0.55	1.44	1.16
						(0.65)	(0.61)	(0.69)	(1.81)	(1.13)
R^2	0.36	0.29	0.31	0.27	0.31	0.25	0.30	0.11	-2.63	0.17
p(OID)			0.68	0.53	0.42	0.51	0.56	0.63	0.69	0.54
p(UID)	0.17	0.00	0.01	0.01	0.01	0.03	0.02	0.06	0.39	0.11
F(WID)	1.9	10.9	9.1	5.5	4.8	4.4	4.3	3.2	1.0	2.6
N	78	65	65	65	64	65	64	60	33	55
$XCON_{OLS}$	0.52	0.47	0.47	0.47	0.31	0.40	0.30	0.25	0.31	0.29
	Panel B: Average Risk of Expropriation (ROE), 1985-1995, as instrumented institutional measure									
ROE (85-95)	0.01	1.34***	0.68***	0.60***	0.57***	0.63***	0.62***	0.63**	0.69***	0.61***
	(0.73)	(0.49)	(0.20)	(0.18)	(0.14)	(0.14)	(0.15)	(0.25)	(0.10)	(0.13)
COAST					1.22***		0.75**	0.82**	0.47	0.79**
					(0.26)		(0.32)	(0.41)	(0.38)	(0.33)
TROPICS					-0.57		-0.21	-0.32	0.22	-0.23
					(0.38)		(0.40)	(0.39)	(0.33)	(0.40)
DMM					-0.08**		-0.05	-0.05	-0.03	-0.05
					(0.04)		(0.04)	(0.06)	(0.04)	(0.04)
ELF						-1.68***	-1.01***	-1.00***	-0.84	-1.08***
						(0.30)	(0.33)	(0.33)	(0.69)	(0.33)
R^2	0.03	-0.09	0.49	0.49	0.67	0.67	0.71	0.63	0.67	0.74
p(OID)			0.01	0.00	0.00	0.05	0.00	0.00	0.01	0.01
p(UID)	0.22	0.06	0.01	0.01	0.00	0.00	0.00	0.04	0.00	0.00
F(WID)	1.5	3.5	5.5	8.8	12.3	10.3	12.4	5.0	15.6	13.1
N	73	61	61	61	59	61	59	55	34	55
ROE_{OLS}	0.67	0.64	0.64	0.64	0.50	0.57	0.51	0.51	0.52	0.52
	Panel C: Average Economic Freedom (EFW), 1985-2010, as instrumented institutional measure									
EFW (85-10)	0.47	1.29***	1.15***	1.11***	0.93***	1.10***	0.97***	1.13***	1.30***	0.97***
	(0.52)	(0.24)	(0.20)	(0.17)	(0.16)	(0.16)	(0.16)	(0.30)	(0.19)	(0.16)
COAST					0.65**		0.40	0.20	-1.42**	0.29
					(0.26)		(0.27)	(0.43)	(0.55)	(0.30)
TROPICS					-0.54*		-0.36	-0.40	1.07**	-0.36
					(0.32)		(0.32)	(0.35)	(0.48)	(0.33)
DMM					-0.04		-0.03	-0.05	0.10*	-0.04
					(0.04)		(0.05)	(0.08)	(0.05)	(0.05)
ELF						-0.98***	-0.60*	-0.59	-1.69***	-0.80**
						(0.37)	(0.36)	(0.37)	(0.46)	(0.40)
R^2	0.42	0.55	0.58	0.59	0.68	0.64	0.69	0.56	0.54	0.66
p(OID)			0.30	0.27	0.08	0.50	0.15	0.22	0.79	0.40
p(UID)	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01
F(WID)	3.6	15.1	9.0	10.2	12.3	10.4	12.0	5.8	27.7	11.1
N	79	64	64	64	60	64	60	56	33	55
EFW_{OLS}	1.04	1.01	1.01	1.01	0.70	0.90	0.70	0.68	0.85	0.71
SY size 0.10	16.38	16.38	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93
SY size 0.15	8.96	8.96	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59
SY size 0.20	6.66	6.66	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75

Standard errors robust to heteroskedasticity in parentheses. First stage results given by the corresponding equations in Table 2.3. p(OID) is the p-value of the Sargan-Hansen test for overidentifying restrictions whose joint null hypothesis is that the instruments are uncorrelated with the error terms and the excluded instruments are correctly excluded. p(UID) is the p-value of the Kleibergen- Papp rk underidentification test whose null hypothesis is that the equation is underidentified. F(WID) is the Kleibergen-Papp rk Wald F-statistics that should be compared to the Stock-Yogo max size and bias critical values, which are reported above, as a test for weak identification. Constant terms omitted for space. See appendix A for details about variables. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < .01$.

Table 2.5: 2SLS Estimates - Impact of Institutions on WDI GDP Per Capita

	Former European Colonies							w/o Neo-UK	w/o Africa	Base
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: Average constraints on executive (XCON), 1985-2010, as instrumented institutional measure									
XCON (85-10)	0.28	0.67***	0.64***	0.70***	0.71***	0.72***	0.75***	0.71***	1.15***	0.81***
	(0.36)	(0.20)	(0.18)	(0.20)	(0.19)	(0.21)	(0.21)	(0.25)	(0.44)	(0.30)
COAST					0.48		0.56	0.50	0.98	1.00**
					(0.38)		(0.38)	(0.50)	(0.82)	(0.50)
TROPICS					-0.04		-0.07	-0.07	0.24	-0.29
					(0.55)		(0.53)	(0.47)	(0.78)	(0.51)
DMM					-0.12***		-0.13***	-0.15	-0.06	-0.13***
					(0.04)		(0.04)	(0.09)	(0.05)	(0.04)
ELF						-0.10	0.39	0.36	0.41	0.90
						(0.58)	(0.53)	(0.58)	(1.08)	(0.98)
R^2	0.33	0.26	0.28	0.23	0.30	0.21	0.27	0.10	-0.65	0.17
p(OID)			0.71	0.47	0.28	0.46	0.37	0.44	0.20	0.35
p(UID)	0.08	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.26	0.07
F(WID)	3.2	12.0	11.6	6.5	5.5	5.5	5.0	3.8	2.2	3.3
N	78	64	64	64	63	64	63	59	32	52
$XCON_{OLS}$	0.45	0.44	0.44	0.44	0.30	0.38	0.29	0.24	.31	0.26
	Panel B: Average Risk of Expropriation (ROE), 1985-1995, as instrumented institutional measure									
ROE (85-95)	0.18	1.33***	0.74***	0.66***	0.66***	0.66***	0.72***	0.82***	0.73***	0.66***
	(0.54)	(0.47)	(0.17)	(0.14)	(0.13)	(0.12)	(0.14)	(0.24)	(0.10)	(0.12)
COAST					1.06***		0.55*	0.56	0.40	0.57*
					(0.27)		(0.32)	(0.42)	(0.40)	(0.31)
TROPICS					-0.25		0.13	0.02	0.46	0.10
					(0.32)		(0.35)	(0.36)	(0.37)	(0.34)
DMM					-0.07*		-0.04	-0.05	-0.04	-0.04
					(0.04)		(0.04)	(0.06)	(0.04)	(0.03)
ELF						-1.51***	-1.07***	-1.08***	-0.96	-1.11***
						(0.28)	(0.33)	(0.35)	(0.70)	(0.33)
R^2	0.31	-0.14	0.51	0.52	0.65	0.68	0.68	0.57	0.70	0.74
p(OID)			0.01	0.00	0.00	0.05	0.01	0.01	0.03	0.02
p(UID)	0.19	0.05	0.01	0.01	0.01	0.00	0.01	0.07	0.01	0.01
F(WID)	1.7	3.9	6.0	9.9	11.5	11.3	11.9	4.6	14.5	12.3
N	71	59	59	59	57	59	57	53	32	52
ROE_{OLS}	0.65	0.63	0.63	0.63	0.52	0.56	0.53	0.53	0.56	0.54
	Panel C: Average Economic Freedom (EFW), 1985-2010, as instrumented institutional measure									
EFW	0.39	1.16***	1.02***	1.00***	0.93***	0.99***	0.96***	1.10***	1.27***	0.95***
	(0.46)	(0.22)	(0.17)	(0.14)	(0.15)	(0.14)	(0.15)	(0.26)	(0.18)	(0.15)
COAST					0.54*		0.32	0.18	-1.46***	0.20
					(0.28)		(0.29)	(0.41)	(0.55)	(0.32)
TROPICS					-0.39		-0.24	-0.30	1.15**	-0.23
					(0.29)		(0.31)	(0.34)	(0.45)	(0.32)
DMM					-0.04		-0.03	-0.05	0.09*	-0.03
					(0.05)		(0.05)	(0.08)	(0.05)	(0.05)
ELF						-0.83**	-0.54	-0.53	-1.68***	-0.75*
						(0.38)	(0.38)	(0.39)	(0.51)	(0.44)
R^2	0.37	0.52	0.56	0.56	0.62	0.60	0.63	0.49	0.54	0.59
p(OID)			0.22	0.28	0.16	0.50	0.26	0.36	0.47	0.62
p(UID)	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01
F(WID)	4.3	17.5	11.0	13.4	15.1	14.7	15.3	7.5	29.2	13.1
N	75	60	60	60	57	60	57	53	31	52
EFW_{OLS}	0.96	0.92	0.92	0.92	0.65	0.83	0.65	0.62	0.87	0.65
SY size 0.10	16.38	16.38	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93
SY size 0.15	8.96	8.96	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59
SY size 0.20	6.66	6.66	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
SY size 0.25	5.53	5.53	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25

Standard errors robust to heteroskedasticity in parentheses. First stage results given by the corresponding equations in table 2.3. See notes to Table 2.4 for information on p(OID), p(UID), and F(WID). See appendix A for details about variables. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < .01$.

The above statistical tests strongly suggest that the identification strategy is valid when EFW is the institutional measure. Meanwhile, they point to issues of under-identification and weak instruments when XCON is the institutional measure, and invalid and weak instruments are suspect when ROE is the institutional measure. Given these results, the remaining discussion will focus predominantly on the results reported in panel C that use EFW as the measure of institutions. As before, the focus will be mainly on the results beginning in column 4 given that the first three columns pertain to alternative identification strategies.

The 2SLS estimate of the causal impact of economic freedom in column 4 of panel C is 1.11, and is highly significant with a robust standard error of 0.17. The point estimate serves as the baseline and is 10 percent higher than the corresponding OLS estimate of 1.01, reported as EFW_{OLS} in panel C. As a comparison, in column 2 of panel C, which only accounts for the settlement conditions hypothesis, EFW has a coefficient of 1.29 and is 27.7 percent higher than the corresponding OLS estimate of 1.01. Although at first it may be tempting to conclude that the latter identification strategy produces better results because the 2SLS estimate of the impact of institutions on log income per capita is higher, this would be naïve since the latter suffers from greater upward bias attributable to its first stage estimation being less precise.

Recall the 1.4 point difference in EFW measures between Costa Rica and Ghana. The earlier OLS estimates suggest that differences in EFW between these two nations accounts for 87 percent of the observed difference in the level of log income per capita of the two nations. The 2SLS estimate of 1.11 (column 4, panel C) suggests that there should be a 1.55 log point (3.75-fold) difference in the income levels of the two countries, less than the 1.70 log point (approximately 5-fold) difference observed in practice. Thus, the 2SLS estimate suggests that differences in EFW between these two nations explain nearly 91 percent of the observed difference in log income per capita.

Column 5 includes three endowment variables to the model. Recall that COAST, TROPICS, and DMM were all three statistically significant in the corresponding first stage regression in panel C of Table 2.3. This suggests that access to the sea for trade exerts a positive impact on institutional development, a finding consistent with evidence presented by AJR (2005), but that tropical climates and distance from major trading markets are negative determinants of institutions. COAST is positive and significant at 5 percent in the second stage results, while both TROPICS and DMM are negative, but only the former is significant, albeit at

10 percent. These results provide evidence in favor of the view that endowments exert a direct influence on the level of economic development beyond their indirect influence on institutions, the total effects are sizeable. The estimates predict that, all else equal, the difference in the level of income per capita between a country in which the entire population lives within 100km of the coast and one without a coastal shoreline is 1.59 (1.01*0.93+0.65) log points (1.23 standard deviations of the same sample), after accounting for the indirect impact that coastal access exerts on institutions. Meanwhile, a total estimated effect of TROPICS suggests that a country with all of its land located in the tropics should have an income per capita level that is 1.42 (1.10 standard deviations) log points lower than a country with no land located in the tropics, ceteris paribus. Accounting for the impact of these variables on institutional development, the 2SLS estimate of EFW is 0.93 and highly significant with a robust standard error of 0.16 in column 5. The 2SLS estimate represents a reduction relative to the baseline estimate, but an increase of nearly a third relative to the OLS estimate for the same sample of countries and set of control variables.

Column 6 adds ELF to the regression from column 4, providing a control for the impact that population heterogeneity exerts on economic performance, both directly and indirectly through its impact on institutions. The -0.98 coefficient is significant at 1 percent, suggesting that it exerts a direct impact, in addition to an indirect impact through the institutional channel, on the level of per capita income. The total effect of an increase from zero to complete ethno-linguistic fractionalization is associated with a reduction in income per capita of 2.08 log points. The significant direct impact of ELF contradicts both the empirical result of Auer (2013) and identification strategy employed by Mauro (1995), who argue that ELF influences growth primarily through its effect on the development of institutions. Both Auer and Mauro use measures for quality of governance, whereas the results reported here use a measure of economic institutions. While the institutional measures are likely correlated, they also differ sufficiently such that this difference is not of grave concern. As demonstrated by AJR (2001, appendix A), if ethno-linguistic fractionalization is endogenous to the system then the coefficient on EFW is biased downwards. The 2SLS estimate of 1.10 for EFW is nearly identical as the baseline in column 4, but is 22.2 percent higher than the OLS estimate of 0.90. Given this result, combined with the time lag involved with the measurement of ELF, any bias attributable to possible endogeneity of ELF is relatively small.

Column 7 includes the three endowments variables as well as ELF. None of the endowment variables are significant at 10 percent in the second stage, but both COAST and TROPICS are significant at 1 percent in the first stage. Meanwhile, ELF is insignificant in the first stage but significant at 10 percent in the second stage. The partial effect of EFW remains positive and highly significant, with a 2SLS estimate of 0.97 and robust standard error of 0.16. Similar results are obtained in column 8, which excludes the four Neo-UK countries, although the magnitude of the partial effect for EFW increases to 1.13 and ELF becomes insignificant. The results from columns 7 and 8 suggest that endowments only exert an indirect influence on economic development through their impact on institutions; while ELF influences economic development directly but not indirectly through the institutional channel. Caution should be taken however in reaching such a strong conclusion. This issue will be further explored below.

African nations are excluded from the sample in column 9. The magnitude of the partial effect of EFW rises to 1.30 in this specification and is highly significant with a robust standard error of 0.19. This suggests that the result that institutions exert a strong causal impact on the level of income per capita are not being driven by vast disparities in economic development between Africa and the rest of the world. Interestingly, by excluding Africa, ELF exerts a positive and significant impact on institutional development, but a negative and significant direct impact on income per capita. The estimates suggest that the direct and indirect effects are offsetting for the small sample of countries, as the total effect of ELF is null. Both COAST and TROPICS have the expected sign in the first stage regressions, but the opposite signs in the second stage. The total estimated effects are 0.31 and -0.32 for COAST and TROPICS, respectively, the anticipated signs, but much smaller than the total estimated effects derived in preceding regressions. This suggests that endowments do exert an impact on the development process both directly and indirectly through institutions, but the large total effects discussed previously may be driven largely by underdevelopment in Africa.

Finally, column 10 restricts the sample to countries for which data for all three institutional measures is available. This reduces the sample to 55 countries. The coefficients on XCON, ROE and EFW are 0.92, 0.61 and 0.97, respectively, with the latter two significant at 1 percent and the former at 5 percent. These coefficients are not directly comparable to one another given that the institutional measures are not scaled in the same manner.[24]

Overall, the results in Table 2.4 suggest that institutions associated with economic freedom exert a large and significant effect on economic performance. They also indicate that the identification strategy that allows settlement conditions to exert a differential impact in British colonies on the development of institutions is valid when EFW is used as the measure of institutions, but that issues of weak and invalid instruments arise when XCON and ROE, respectively, are the institutional measures. The results stand when controlling for the exogenous influence of endowments and population heterogeneity on institutional development and economic performance, and are robust to subsamples that exclude the four Neo-UK nations and Africa. The 2SLS results, reported in Table 2.5, are nearly identical when the WDI 2010 income per capita data are used in lieu of the PWT measures, providing further confidence that the identification strategy is valid and that EFW exerts a strong and causal impact on the level of income per capita.[25]

2.5 Robustness of 2SLS Results

First an alternative classification of colonizer identities than was used in the analysis above, which used the classification system KMSW (2011), is employed. The results reported in Table 2.6 use the colonizer identity classification of AJR (2001). Of the 90 former colonies that were coded in both the KMSW and AJR datasets, there are six discrepancies in the classification of former British colonies. The AJR dataset codes Egypt, Israel, Jordan, Namibia, and Papua New

[24] Standardized the coefficients by multiplying them by σ_I/σ_Y would provide one means of comparing the results, although bias of the 2SLS coefficients obscures the comparison. Standardizing the coefficients yields estimates of 1.17, 0.69 and 0.75 for XCON, ROE and EFW, respectively. The three standardized coefficients suffer from varying degrees of bias and is likely highest for XCON because weak instruments are present and the goodness of fit of the first stage regression is the weakest of the three institutional measures.

[25] Appendix Table C.1 repeats the estimates from column 7 of Table 2.4 using Alternative identification strategies that add additional colonizer-PD1500 interactive terms to equation 2.6 provide some additional insights on how the identity of the colonizer and settlement conditions influenced the development of contemporary institutions, but the results overall are not very robust and should be interpreted with caution. Furthermore, the theory advanced above suggests that the British exhibited better institutions at the time of colonization relative to the other European colonizers such that better institutions were transplanted to their colonies when large-scale settlement occurred. Although historical evidence leads us to the conclusion that the British had more liberal institutions than the other major European colonizers, it does not necessarily allow us to make similar comparisons among the other colonizers. This suggests that the identification strategy outlined above that uses PD1500 and PD1500×UK as instruments for contemporary economic institutions better reflects the view advanced here than including additional colonizer-adjusted terms. Appendix Table C.2 substitutes the settler mortality rate for PD1500.

Guinea as British colonies, whereas the KMSW dataset does not. In addition, the latter codes Tanzania as a British colony, while the former does not.[26]

Panels A and B of Table 2.6 report the second and first stage estimates, respectively. Panel C reports the OLS estimates of the impact of the respective institutional measures on log income per capita for comparison to the 2SLS estimate. Columns 1, 4, 7 and 10 use XCON as the institutional measure. Columns 2, 5, 8 and 10 use ROE, while 3, 6, 9 and 12 use EFW. The first six columns use the sample of former European colonies, with columns 4-6 introducing additional exogenous variables. The results reported in columns 1-3 and 4-6 are comparable to the results from columns 4 and 7 of Table 2.4, respectively. Columns 7-9 exclude the four Neo-UK nations from the sample, and columns 10-12 use the base sample of nations for which data for all three institutional measures are available. Results from the former three are comparable to column 8 of Table 2.4, while latter three columns are comparable to column 10.

The alternative colonizer identity classification does not change the results, as the 2SLS estimates are nearly identical to those obtained in Table 2.4. The regressions using XCON suffer from weak instruments and the instruments appear to be invalid for ROE. Meanwhile, statistical tests suggest that the instruments are valid when EFW is the institutional measure employed. As with earlier results, both PD1500 and PD1500×UK are statistically significant in the first stage regressions when EFW is the dependent variable, with only the former and latter significant when XCON and ROE are the dependent variable, respectively.

Table 2.7 provides 2SLS estimates of the impact of EFW on 2010 PWT log income per capita using the original colonial origins classification scheme of KMSW (2011) and introducing additional control variables. Panels A and B provide the second and first stage estimates, while panel C gives the OLS estimates of the impact of EFW on 2010 PWT log income per capita using the same set of exogenous variables. Column 1 reproduces the first and second stage results obtained in column 4 of Tables 2.3 and 2.4, respectively.

Column 2 includes continent dummy variables for Africa and Asia, coded in accordance with the World Bank classifications, to account for potential continent fixed effects.[27] The p-

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[26] KMSW (2011) code Egypt, Israel and Jordan as former Ottoman colonies. They code Namibia and Papua New Guinea as colonies of South African and Australia, respectively. It is not clear from the AJR (2001) dataset which country is coded as Tanzania's colonizer, although it is neither Britain nor France. AJR cite LSSV (1999) as their source, but the latter do not include colonizer identity data in their paper or online dataset. Thus it is likely that AJR controlled for legal tradition rather than identity of the colonizer. KMSW contrast the two concepts.

value, p(Continents), from the F-test of joint significance is reported for the first stage. Africa and Asia are jointly significant at 1 percent in the first stage, although only the former is individually significant.[28] The two excluded instruments are nonetheless jointly significant at 1 percent, and a F(WID) of 10.7 suggests that the instruments are strong.

Controlling for continent fixed effects, a unit increase in PD1500 is associated with a 0.55 and 1.50 point increase in EFW in non-British and British colonies, respectively. Including continent fixed effects reduces the impact of EFW on log income per capita from 1.11 to 0.94, but it remains highly significant with a robust standard error of 0.16. The corresponding OLS estimate of the impact of EFW on development, given in panel C, is 0.78.

Column 3 includes a full set of region dummy variables from the World Bank, where South Asia is the omitted group.[29] The set of regional dummies are jointly significant in both the first and second stage estimates, with the p-value of the F-test for joint significance reported in brackets as p(Regions).[30] PD1500 is insignificant in the first stage regression, while PD1500×UK is significant at 5 percent. Nonetheless, these first stage estimates remain economically significant. Controlling for a full set of regional fixed effects, a unit increase in PD1500 is associated with a 0.33 and 0.78 point increase in EFW in non-British and British colonies, respectively. The 2SLS estimate of the impact of EFW on per capita income is 1.70 and is highly significant with a robust standard error of 0.38. This is two-thirds larger than the OLS estimate of 1.02. This 2SLS estimate should be taken with caution as the excluded instruments are jointly significant at 10 percent, but a F(WID) value of only 2.9 suggests that they are weak. This is likely attributable to the regional dummy variables being fairly well correlated with PD1500 such that the latter may be serving as a proxy for the former.[31]

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[27] The former includes all countries located on the African continent, including Northern African nations such as Egypt and Morocco. The latter includes countries classified as either Asian Pacific or South Asian, but excludes central Asian nations such as Bahrain and Turkey.

[28] Asia has a coefficient of 0.46 and robust standard error of 0.35, while Africa has a coefficient of -0.84 and robust standard error of 0.19.

[29] East Asia & Pacific (EAP), Europe & Central Asia (ECA), Latin America & Caribbean (LAC), Middle East & North Africa (MENA), North America (NA), South Asia (SAS), Sub-Saharan Africa (SSA).

[30] SSA is negative and significant in the first stage, but negative and insignificant in the second stage. EAP and NA are significant in both stages, but positive in the first and negative in the second. The MENA and LAC regions are insignificant in both stages. The total estimated fixed effects are -1.29 for SSA, 0.59 for MENA, 1.05 for EAP, 1.41 for NA, and 0.53 for LAC.

[31] The simple correlation coefficients between PD1500 and the regional dummies are: $\rho(\mathrm{PD1500, SSA}) = -0.07$, $\rho(\mathrm{PD1500, MENA}) = -0.42$, $\rho(\mathrm{PD1500, SAS}) = -0.53$, $\rho(\mathrm{PD1500, EAP}) = 0.13$, $\rho(\mathrm{PD1500, NA}) = 0.16$, $\rho(\mathrm{PD1500, LAC}) = 0.35$. SAS refers to South Asia, the omitted group.

Table 2.6: 2SLS Estimates Using AJR (2001) Colonizer Identity Classifications

	Former European Colonies						w/o Neo-Englands			Base Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: 2SLS Results, PWT 2010 Log Income Per Capita is Dependent Variable											
XCON (85-10)	0.74***			0.80***			0.79***			0.92***		
	(0.22)			(0.24)			(0.30)			(0.36)		
ROE (85-95)		0.66***			0.65***			0.68***			0.63***	
		(0.17)			(0.15)			(0.26)			(0.14)	
EFW (85-10)			1.12***			0.97***			1.12***			0.97***
			(0.16)			(0.16)			(0.29)			(0.16)
COAST				0.63	0.73**	0.40	0.50	0.77*	0.22	1.02**	0.77**	0.30
				(0.40)	(0.33)	(0.27)	(0.55)	(0.43)	(0.42)	(0.49)	(0.33)	(0.30)
TROPICS				-0.18	-0.16	-0.36	-0.16	-0.27	-0.41	-0.31	-0.17	-0.36
				(0.53)	(0.41)	(0.33)	(0.50)	(0.40)	(0.35)	(0.57)	(0.40)	(0.33)
DMM				-0.13***	-0.05	-0.03	-0.16*	-0.06	-0.05	-0.13***	-0.05	-0.04
				(0.04)	(0.04)	(0.05)	(0.09)	(0.06)	(0.08)	(0.04)	(0.04)	(0.05)
ELF				0.55	-1.02***	-0.60*	0.56	-1.01***	-0.59	1.16	-1.09***	-0.80**
				(0.61)	(0.33)	(0.36)	(0.70)	(0.33)	(0.37)	(1.13)	(0.33)	(0.40)
p(OID)	0.53	0.00	0.32	0.60	0.01	0.14	0.69	0.00	0.20	0.61	0.01	0.38
p(UID)	0.01	0.01	0.00	0.02	0.00	0.00	0.05	0.05	0.02	0.10	0.01	0.01
F(WID)	5.7	8.9	10.7	4.4	11.7	12.0	3.2	4.6	5.9	2.7	12.4	11.2
N	65	61	64	64	59	60	60	55	56	55	55	55
	Panel B: First Stage OLS - Corresponding Institutional Measures as Dependent Variable											
PD1500	1.71***	0.17	0.77***	1.63***	0.33	0.73**	1.48**	0.04	0.63**	1.42*	0.46	0.87**
	(0.63)	(0.52)	(0.27)	(0.61)	(0.56)	(0.28)	(0.60)	(0.56)	(0.26)	(0.74)	(0.61)	(0.33)
PD1500×UK (ARJ)	0.48	1.70***	1.00***	0.38	1.50***	0.91***	0.20	1.11***	0.71**	0.38	1.55***	0.82***
	(0.53)	(0.44)	(0.33)	(0.46)	(0.35)	(0.28)	(0.60)	(0.38)	(0.34)	(0.50)	(0.37)	(0.29)
COAST				0.97**	0.54	0.92***	1.20**	0.70	1.08***	0.38	0.65	1.00***
				(0.48)	(0.52)	(0.28)	(0.55)	(0.57)	(0.31)	(0.52)	(0.55)	(0.35)
TROPICS				-1.41***	-1.35***	-0.87***	-1.17**	-0.85**	-0.66**	-1.19**	-1.49***	-0.90***
				(0.48)	(0.37)	(0.25)	(0.55)	(0.37)	(0.28)	(0.51)	(0.41)	(0.28)
DMM				0.00	-0.04	-0.06	0.08	0.06	-0.01	0.02	-0.05	-0.07
				(0.06)	(0.07)	(0.04)	(0.09)	(0.10)	(0.06)	(0.06)	(0.06)	(0.04)
ELF				-1.30**	-0.09	-0.19	-1.34**	-0.14	-0.16	-1.85**	0.05	-0.02
				(0.54)	(0.71)	(0.34)	(0.56)	(0.69)	(0.33)	(0.69)	(0.81)	(0.43)
R2	0.14	0.25	0.30	0.41	0.40	0.57	0.32	0.15	0.41	0.40	0.39	0.49
N	65	61	64	64	59	60	60	55	56	55	55	55
	Panel C: OLS Impact of Institutions on 2010 PWT Income Per Capita											
XCON (85-10)	0.47***			0.30***			0.25***			0.29**		
	(0.08)			(0.09)			(0.09)			(0.11)		
ROE (85-95)		0.64***			0.51***			0.51***			0.52***	
		(0.06)			(0.07)			(0.09)			(0.07)	
EFW (85-10)			1.02***			0.70***			0.68***			0.71***
			(0.10)			(0.12)			(0.14)			(0.12)

Standard errors robust to heteroskedasticity in parentheses. Panel C controls for the exogenous variables used in panel A. These results and constant terms are omitted for space. See appendix A for details on variables. See Table 2.4 for Stock-Yogo critical values and details on second-stage statistics reported above. *p < 0.10, ** p < 0.05, *** p < .01.

Following AJR (2001, Table 5), column 4 controls for the potential impact of religion on economic performance by including the share of the population that is Catholic, Muslim and Protestant, with other religion as the omitted group. The joint significant level of the corresponding F-statistic is reported as p(Religion) in both panels A and B. The religion variables are jointly insignificant in the first stage, but are significant at 5 percent in the second, suggesting that religion exerts a direct impact on economic performance.[32] AJR also report joint significance of the religion variables in their 2SLS estimates. The 2SLS estimate of EFW is 1.23 and it is highly significant with a robust standard error of 0.20.

AJR (2001) indicated that there may be some concern "that in colonies where Europeans settled, the current population consists of a higher fraction of Europeans" such that the identification strategy employed is "capturing the direct effect of having more Europeans" who brought with them better culture, human capital or other characteristics than exists among the native populations (p. 1390). AJR controlled for the exogenous effect of the share of European population in 1975, finding that it did not exert a significant direct impact on development. The instrument used here, PD1500, should in theory be correlated with European descent given that the identification strategy rests on the assumption that regions with low indigenous population densities were more likely to be permanently settled by Europeans. If PD1500 is correlated with European descent, then the identification strategy may be invalid if the latter impacts economic development directly. The identification strategy also assumes that the major European colonizers brought with them heterogeneous characteristics. By netting out the share of the population with ancestry linked to the colonizer from the share of total European descendants, the correlation between European descent and PD1500 should in theory be reduced, and allow for the impact of European immigration that occurred in the post-colonial era on development to be isolated.

Column 5 includes the share of the population in 2000 of European descent, net the share of the population whose ancestors lived in the home colony in 1500.[33] This measure was derived from the Putterman and Weil (2010) world migration matrix, 1500-2000. The 28 current members of the European Union in addition to Iceland, Norway and Switzerland were counted as

[32] Catholic is significant at 1 percent in the second stage, while Muslim and Protestant are insignificant. None of the three are significant in the first stage regression.
[33] The share of population whose ancestry lived in England, France, Portugal and Spain is netted out for these four nation's former colonies.

European in constructing the measure.[34] Net European descent is positive and significant at 10 percent in both the first and second stages. Both of the excluded instruments are positive and significant at 5 percent, suggesting that the potential endogeneity issue was alleviated by adopting the net European descendent measure.[35] The 2SLS estimate for EFW is 0.98 and it remains highly significant with a robust standard error of 0.21.

The "Out of Africa Hypothesis" advanced by Ashraf and Galor (2013a) argues that genetic diversity of the contemporary population, which was shaped predominantly by human migration out of the "cradle of humankind in East Africa" tens of thousands of years ago, has both beneficial and detrimental effects on productivity (p. 2). Their analysis suggests that the beneficial effects dominate at low levels of diversity where the role of heterogeneity contributes to a division of labor that expands society's production possibility frontier, but that their exists an optimal level of diversity, beyond which additional diversity leads to mistrust, reduced cooperation, and social disorder that lower productivity and inhibit the productive capacity of the economy. They conclude that there is a "long-lasting hump-shaped effect on the pattern of comparative economic development that is not captured by geographical, institutional, and cultural factors" (p.2). Ashraf and Galor (2103b) provide additional evidence that genetic diversity is a "fundamental determinant of observed ethnic and cultural heterogeneity" (p.1) As discussed above, population heterogeneity exerts an influence on the development of institutions.

Columns 6 and 7 further test the "Out of Africa" hypothesis by including genetic diversity and its square as exogenous variables. The former uses estimates of genetic diversity that are not adjusted for ancestry, while the latter employs the ancestry-adjusted measure that "accounts for the diversity arising from differences between subnational ethnic groups" (Ashraf and Galor, 2013a, p. 32). There is theoretical reason to suspect that genetic diversity is correlated with PD1500, which could possibly invalidate the identification strategy. Given that populations in 1500 in the former colonies were largely comprised of indigenous persons who settled there

[34] Ashraf and Galor (2013a) also use a measure of European descent that is derived the world migration matrix, but they do not specify which countries are counted as European in its construction. Their measure likely includes Russia and many of the former Soviet nations. Only those which are members of the EU today, such as the Czech Republic and Poland, are included in our measure. After netting out the share of the population whose ancestors lived in the home colonizer country in 1500, their measure is almost perfectly correlated with ours for the subset of former European colonies for which EFW and PD1500 data are available. For the entire dataset, the two measures have a simple correlation of 0.867.

[35] The same model using European descent not adjusted for colonizer ancestry results in it being highly significant and PD1500 insignificant in the first stage regression. Results not reported but available upon request.

prior to the colonization era and the "reversal of fortunes" that occurred following it (AJR, 2002), adjusting for the genetic diversity of post-colonization ancestry should reduce the correlation between it and PD1500. Indeed, the correlation between ancestry-adjusted diversity and PD1500 is lower than that between it and unadjusted diversity.[36] Nonetheless, both measures are tested.

In column 6, unadjusted genetic diversity and its square are positive and negative, respectively, and both are significant at 1 percent in the first stage regression. This suggests that there is an optimal level of diversity for achieving institutions consistent with economic freedom. The estimates suggest that the optimal level of genetic diversity is 0.65, slightly below the sample mean and close to the levels of diversity in Australia and Canada. Neither unadjusted genetic diversity nor its square are significant in the second stage estimates, perhaps suggesting that genetic diversity may influence economic performance primarily through its influence on institutions, a result contradictory to the findings of Ashraf and Galor (2013a), who used the social infrastructure measure of Hall and Jones (1999).

A different result is obtained in column 7 when using ancestry-adjusted genetic diversity. As before, both diversity and its square are significant at 1 percent in the first stage regression, suggesting that EFW is optimal when genetic diversity is around 0.68, the sample mean and close to the levels of diversity in Singapore and Malaysia. The second stage estimates are both significant at 1 percent, indicating that controlling for its impact on institutions, ancestry-adjusted genetic diversity has a hump-shaped relationship with log income per capita. The level of genetic diversity that maximizes the level of development is 0.68, nearly identical to the one that maximizes EFW. The 2SLS estimates for EFW in columns 6 and 7 are 0.98 and 0.92, both of which are highly significant with robust standard errors of 0.19 and 0.16, respectively. F(WID) values of 9.5 and 10.8 in columns 6 and 7, respectively, suggest that the instruments are moderately strong, although PD1500 is insignificant in both first stage regressions, a finding that is perhaps attributable to the correlation between genetic diversity and PD1500. PD1500×UK is however significant at 1 percent in both regressions.

While the result obtained using the ancestry-adjusted measure is consistent with the findings of Ashraf and Galor (2013a), namely that is genetic diversity exerts a direct impact on

[36] The correlation between ancestry-adjusted genetic diversity and PD1500 is 0.21 for the sample of former colonies, while that between unadjusted diversity and PD1500 is 0.27. For the subsample of 62 countries for which EFW data are available, the correlations are 0.23 and 0.30 for the former and latter, respectively.

economic performance above its influence on institutions, the estimates in column 8 indicate that this result is not robust when controlling for the exogenous influence of endowments on economic development. Three measures of endowments –TROPICS, COAST, and DMM –are included in column 8, all three of which are statistically significant with the expected sign in the first stage regression. The p-value of the three endowment variables, reported as p(Geo-Clim), of 0.63 indicates that they are jointly insignificant in the second stage estimates, with none individually significant. Meanwhile, neither ancestry-adjusted genetic diversity nor its square is significant in the first or second stage regressions. This result again contradicts the findings of Ashraf and Galor. Both PD1500 and PD1500×UK are significant at 5 percent in the first stage regression, and the 2SLS estimate for EFW of 0.91 remains highly significant with a robust standard error of 0.16. The F(WID) statistics of 13.3 is suggestive of strong instruments.

Column 9 replaces the genetic diversity variables with the net colonizer European descent measure, while maintaining the three endowment variables. European descent is positive but insignificant in the first stage, but is positive and significant at 1 percent in the second-stage. The three endowment variables have the expect sign in the first stage, but only TROPICS and COAST are significant, both at 1 percent. The p(Geo-Clim) value of 0.03 indicates that the three variables are jointly significant at 5 percent in the second stage estimates, but only COAST is individually significant (at 1 percent). Both of the excluded instruments are significant at 5 percent or more, and the 2SLS estimate for EFW of 0.83 is highly significant with a robust standard error of 0.17. An F(WID) value of 11.2 again suggests that the instruments are strong.

Finally, column 10 of Table 2.7 includes the three religion variables, net European descent and the three endowment variables simultaneously. The three religious variables are jointly significant at 5 percent in both stages, although only Muslim is individually significant (and negative) in the first stage and Catholic significant (and positive) in the second stage. European descent is insignificant in both stages, perhaps indicative of the cultural influence of European ancestry working through religion. The three endowment variables are all individually significant (with the expected signs) at 1 percent in the first stage, but jointly insignificant with a p-value of 0.32 in the second stage.[37] Both excluded instruments are significant in the first stage, PD1500 at 5 percent and PD1500×UK at 10 percent. This suggests that controlling for the

[37] COAST is positive and significant at 10 percent in the second stage result. The other two endowment variables are insignificant.

impact of endowments, religion, and post-colonization European influence, a unit increase in PD1500 is associated with a 0.70 and 1.41 unit increases in EFW in former non-British and British colonies, respectively. The 2SLS estimate for EFW is 1.08 and it is highly significant with a robust standard error of 0.23. This estimate is just slightly lower than the 1.11 point estimate from column 1 when no exogenous control variables are included. The F(WID) value of 7.2 in column 10 raises concerns that the instruments are moderately weak, but this is likely attributable to the inclusion of 7 exogenous variables in the model.

As described above, colonization strategies by the various European nations may have been influenced by climate and geography factors such that the instruments may be picking up the effects that endowments exerted on institutional development. The results above were robust to the inclusion of endowments variables such as COAST, TROPICS, and DMM. Table 2.8 further explores the robustness of the results to additional endowment variables. Column 1 includes a set of 5 temperature variables to control for the potential effects that temperature exerts on the development of institutions and economic performance. The joint significance level for the set of temperature variables is reported for both the first and second stage regressions as p(Temperature), which is significant at the 1 and 5 percent levels, respectively.[38] These results suggest that temperature influences economic performance both directly and indirectly through the institutional channel. The 2SLS estimate for EFW of 1.04 is highly significant with a robust standard error of 0.15, and is only slightly lower than the baseline estimate of 1.11.

Column 2 includes a set of 4 humidity variables, which are jointly insignificant in the first stage regression, but significant at 5 percent in the second stage. This suggests that humidity does not influence the development of economic institutions, but it does exert a direct effect on economic performance. The 2SLS estimate for EFW is 1.09 and it is highly significant with a robust standard error of 0.16. Column 3 includes simultaneously the sets of temperature and humidity variables. Both sets of variables are jointly significant at 10 percent or higher in both stages of the estimation. The 2SLS estimate for EFW remains little changed at 1.03. P(OID) values of 0.03 and 0.02 in columns 2 and 3, respectively, suggest that the instruments may be invalid in both models; however, both of the excluded instruments are significant in both

[38] Only the minimum monthly high temperature is individually significant (at 5%) and negative in the first stage, while the maximum monthly low (negative) and average temperature (positive) are significant and 1 and 10 percent, respectively, in the second stage..

columns; and the F(WID) values suggest that the instruments are fairly strong. In addition, over-identification does not appear to be an issue in any of the other specifications.

Column 4 introduces three additional endowment variables –COAST, DMM and malaria ecology –along with the sets of temperature and humidity variables.[39] All three sets of variables are jointly significant at 10 percent or higher in the second stage regression, and the sets of temperature and endowment variables, reported as p(Geo-Clim), are jointly significant at 5 percent or higher in the first stage. While COAST, DMM and malaria ecology are individually insignificant in the first stage, DMM and malaria ecology are both negative and significant at 10 percent or more in the second stage. The 2SLS estimates for EFW is 0.99 and it remains highly significant with a robust standard error of 0.13.

Given the importance of agriculture during the period of colonization, the colonizers may have searched for regions to colonize with favorable soil conditions. It is thus possible that the excluded instruments are picking up the effects of soil quality. A set of 7 dummy variables for soil quality are introduced in column 5. They are jointly insignificant in both stages of the model. Column 6 adds a set of natural resource variables to control for the potential impact that resource endowments exert on economic performance. The set of natural resource variables are jointly significant at 1 percent in both stages of the model, but oil reserves (OIL) is the only variable that is individually significant in both stages. The estimates suggest that countries with more oil reserves per capita tend to have less economic freedom, but having large oil reserves exerts a highly significant positive direct influence on the level of per capita income. This result is supportive of the natural resource curse theory.[40] Controlling for the negative influence on institutions, the total effect of having large oil reserves also remains positive. The 2SLS estimates for EFW of 1.06 and 1.10 in columns 5 and 6, respectively, are both highly significant.[41] Column 7 includes both the soil quality and natural resource sets of variables, with the former insignificant in both stages and the latter insignificant in the first but significant at 5 percent in the second stage regression. The 2SLS estimate of 1.01 for EFW remains highly significant with a standard error of 0.23.

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[39] Malaria ecology was included instead of TROPICS because the temperature and humidity variables provide a more direct measure of the conditions of the tropics that have been argued to be unfavorable for development.
[40] See Frankel (2012) for a survey of literature related to the resource curse
[41] Unadjusted standard errors are reported for the estimates in column 5 because the set of dummy variables results in a near singular covariance matrix. Heteroskedastic-robust standard errors are reported for column 6.

It may be of concern that since the colonization period was heterogeneous across the globe, that nations which were colonized earlier and hence gained independence sooner, have had more time to develop their institutions and grow their economy, while those gaining independence later have not had sufficient time to establish sound, growth-promoting institutions. Column 8 introduces the number of years elapsed since independence (YSI) as well as the initial constraints on the executive after gaining independence (XCON Initial) to account for the time elapsed since a nation gained independence from its colonizer and it initial political institutions.[42] Both variables are positive and significant at 1 percent in the first stage, but only YSI remains significant in the second stage. EFW remains highly significant with a 2SLS estimate of 0.87 and robust standard error of 0.23, although the F(WID) value of 5.1 suggests that the instrument are weak. This is likely driven by inclusion of XCON Initial as an exogenous variable. The Europeans tended to settle permanently in less populated regions, resulting in independence being gained sooner and better institutions arising. Additionally, as mentioned above, former British colonies set greater constraints on the executive upon gaining independence than did other European colonizers. As such, PD1500 and PD1500×UK may be determinants of XCON Initial and YSI.

Column 9 drops XCON Initial from the model used in column 8 and replaces it with OIL and a set of three endowment variables: COAST, DMM and TROPICS. The set of endowment variables are jointly significant in the first stage and insignificant in the second stage. COAST is individually significant at 5 percent or more in both stages. OIL is negative and significant in the first and second stages, respectively, and is highly significant in both. YSI is insignificant in both stages, perhaps suggestive that the significant results obtained in column 8 may have been driven by the short duration of independence associated with regions with unfavorable endowments such as the Sub-Saharan Africa countries, many of which did not gain independence until the middle of the 20th century. The 0.95 2SLS estimate for EFW remains highly significant with a robust standard error of 0.15.

Finally, column 10 provides the strongest test for the robustness of the results to the endowment hypothesis by including simultaneously the sets of temperature, humidity, soil quality, and natural resource variables, as well as three endowment variables (COAST, DMM,

[42] YSI is the difference between 2010 and year of independence, which is measured as the first year for which Polity IV reports an XCON score for a nation. XCON Initial is the average XCON for the first ten years after a nation became independent.

malaria ecology) and YSI. The results remain robust to inclusion of all of these variables. The 2SLS estimate of 0.93 is highly significant with a standard error of 0.21, and is not much lower than the baseline estimate of 1.11. The F(WID) value of 5.7 indicates that the instruments may be weak; however the inclusion of 26 instruments dramatically reduces the numerator of the test statistic, given that the regression only includes 59 countries, almost guaranteeing this result.[43]

Overall, the results reported in Tables 2.7 and 2.8 indicate that EFW exerts a strong and significant causal impact on the level of income per capita. This result is robust even after controlling for a variety of variables related to culture, genetic diversity, geography, climate, natural resources, soil quality and duration of independence that have been suggested as determinants of economic development in the literature. The results provide some evidence that endowments do, consistent with the arguments of Sachs (2003) and contrary those of AJR (2001), Easterly and Levine (2003) and RST (2004), exert a direct impact on economic performance that is independent of their influence on the development of institutions.

2.6 Summary

The two major institutional theories of comparative development, settlement strategy (Acemoglu et.al. 2001, 2002, 2005) and colonizer identity (La Porta et.al., 1999, 2008; KMSW, 2011), are integrated to form a more comprehensive institutional view of post-colonial comparative development. This view accounts simultaneously for the effects of settlement conditions and institutional heterogeneity among the European colonizers as sources of variation in contemporary institutional development, and their potential causal impact on modern levels of development. An identification strategy is advanced that allows for a differential impact of settlement strategy on the development of institutions in former British colonies that uses population density in 1500 and it adjusted for British colonization as instruments. Using PD1500 and $\mathrm{PD1500} \times \mathrm{UK}$ in lieu of the settler mortality rate as instruments, as well as controlling for the effects of endowments directly, reduces the upward bias of the impact of institutions on economic performance attributable to the influence of colonization on the disease environment and the downward bias attributable to the location preferences of British colonies (Auer, 2013).

[43] The test statistic is an F version of the Craig-Donaldson Wald statistics, $(\mathrm{N} - \mathrm{L})/(\mathrm{L1} * \mathrm{CDEV})$, where N is the number of observations, L is the total number of instruments, L1 is the number of excluded instruments, and CDEV is the minimum eigenvalue of the Craig-Donaldson statistic.

Because the British began to liberalize their political and economic institutions at a much earlier date than the other major European colonizers, their colonies, when settled, established institutions similar to those evolving at home towards limited government, free trade, property rights protections, and a common law legal system. Such institutional arrangements have been linked positively to macroeconomic performance in a growing body of literature, and are manifest in the measure of economic freedom used in this paper. The home institutions of the other major colonizers –France, Portugal, and Spain –during the colonial era remained far more mercantilist under the direction of highly centralized and absolutist political regimes. Their colonies therefore received similar institutions. Permanent mass settlement by the British thus exerted a substantial positive differential impact on the quality of economic institutions, promoting stronger long-run economic growth, relative to settlements by the other European colonizers. Permanent mass settlement by the other major colonizers did nonetheless lead to better institutions and a higher level of contemporary economic development than colonies that were purely extractive.

The empirical results obtained here are supportive of this view, indicating that: (1) PD1500 and PD1500×UK are a better predictor of the broad cluster of institutions measured by EFW than PD1500 alone, but are not very good instruments for either XCON or ROE, both of which represent a singular institutional measure; (2) British influence exerted a more favorable impact on institutional development than other European colonizers, ceteris paribus, leading to stronger long-run growth among its colonies; and (3) the Fraser measure of economic institutions exerts a stronger impact on income per capita than constraints on the executive, the preferred institutional measure of Acemoglu and his co-authors (2001, 2005).

The baseline 2SLS estimate (Table 2.4, column 4, panel C) of the causal impact of EFW on log income per capita is 1.11, suggesting that a single point increase (1.01 standard deviations) in the former is associated with an increase in the latter of 1.11 log points (0.85 standard deviations). The results are robust to inclusion of a variety geography and climate (e.g. tropical location, access to the coast, distance to major markets, regional fixed effects, natural resources, soil quality, temperature, and humidity) and population heterogeneity (e.g. ethno-linguistic fractionalization, religion, European ancestry and genetic diversity) variables. The causal impact that EFW exerts on long-run economic performance declines modestly, depending on the specification, but always remains strong and highly significant. Additionally, the results provide evidence that endowments exert a direct effect on development beyond their influence on institutions, depending on the measure used. This contradicts earlier results in the comparative development literature (AJR, 2001; RST, 2004) suggesting that endowments only exert an indirect effect on economic performance via its impact on the development of institutions. Lastly, the results provide some evidence that genetic diversity may only influence economic performance indirectly through its effect on the formation of institutions, contrary to the results of Ashraf and Galor (2013a).

Table 2.7: 2SLS Estimates - Impact of Institutions on PWT GDP Per Capita, Robustness 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: 2SLS Results, PWT 2010 Log Income Per Capita is Dependent Variable									
EFW (85-10)	1.11***	0.94***	1.70***	1.23***	0.98***	0.98***	0.92***	0.91***	0.83***	1.08***
	(0.17)	(0.16)	(0.38)	(0.20)	(0.21)	(0.19)	(0.16)	(0.16)	(0.17)	(0.23)
Africa		-0.93***								
		(0.24)								
Asia		-0.63***								
		(0.17)								
p(Regions)			[0.00]							
p(Religion)				[0.04]						[0.01]
Euro Descent Net Colonizer					1.50*				1.59*	1.00
					(0.89)				(0.91)	(0.82)
GenDiv (Unadjusted)						4.65				
						(58.36)				
GenDiv^2 (Unadjusted)						-8.32				
						(43.73)				
GenDiv (Adjusted)							253.09***	83.88		
							(97.63)	(140.33)		
GenDiv^2 (Adjusted)							-185.40***	-64.10		
							(69.90)	(100.78)		
p(Geo-Clim)								[0.63]	[0.03]	[0.32]
p(OID)	0.27	0.32	0.95	0.52	0.33	0.14	0.75	0.43	0.12	0.29
p(UID)	0.00	0.00	0.11	0.03	0.01	0.00	0.00	0.00	0.00	0.02
F(WID)	10.2	10.7	2.9	6.0	6.1	9.5	10.8	13.3	11.2	7.2
N	64	64	64	64	64	64	62	60	60	60
	Panel B: First Stage OLS – EFW (85-10) is Dependent Variable									
PD1500	0.80***	0.55	0.33	0.60*	0.60**	0.29	0.24	0.54**	0.75**	0.70**
	(0.27)	(0.35)	(0.33)	(0.32)	(0.28)	(0.30)	(0.28)	(0.26)	(0.30)	(0.30)
PD1500×UK	0.92***	0.95***	0.45**	1.07**	0.85**	0.94***	1.23***	1.04***	0.84***	0.71*
	(0.32)	(0.25)	(0.21)	(0.43)	(0.33)	(0.24)	(0.30)	(0.27)	(0.26)	(0.35)
p(Continents)		[0.00]								
p(Regions)			[0.00]							
p(Religion)				[0.35]						[0.03]
Euro Descent Net Colonizer					1.82*				0.09	-0.26
					(0.92)				(0.81)	(0.71)
GenDiv (Unadjusted)						164.36***				
						(58.50)				
GenDiv^2 (Unadjusted)						-125.89***				
						(43.05)				
GenDiv (Adjusted)							258.73***	-145.36		
							(92.05)	(119.77)		

Table 2.7 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GenDiv^2 (Adjusted)							-191.31***	99.40		
							(66.03)	(85.96)		
TROPICS								-1.01***	-0.93***	-1.13***
								(0.28)	(0.30)	(0.26)
COAST								1.04***	1.01***	0.80***
								(0.24)	(0.23)	(0.24)
DMM								-0.07*	-0.07	-0.12***
								(0.04)	(0.04)	(0.03)
R^2	0.28	0.51	0.65	0.26	0.32	0.48	0.43	0.59	0.56	0.59
N	64	64	64	64	64	64	62	60	60	60
	Panel C: OLS Impact of EFW on 2010 PWT Income Per Capita									
EFW (85-10)	1.02***	0.76***	0.70***	1.02***	0.93***	0.75***	0.82***	0.65***	0.65***	0.66***
	(0.10)	(0.10)	(0.16)	(0.09)	(0.10)	(0.11)	(0.10)	(0.13)	(0.13)	(0.15)

Standard errors robust to heteroskedasticity in parentheses. P-values from joint tests of significance for subset of variables given in brackets. These results and constant terms are omitted for space. See appendix A for details about variables. See Table 2.4 for details on second-stage statistics reported above. *p < 0.10,** p < 0.05,*** p < .01

Table 2.8: 2SLS Estimates - Impact of Institutions on PWT GDP Per Capita, Robustness 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel A: 2SLS Results, PWT 2010 Log Income Per Capita is Dependent Variable									
EFW (85-10)	1.04***	1.09***	1.03***	0.99 ***	1.06 ***	1.10 ***	1.01 ***	0.87***	0.95***	0.93***
	(0.15)	(0.16)	(0.15)	(0.13)	(0.19)	(0.20)	(0.23)	(0.23)	(0.15)	(0.21)
p(Temperature)	[0.03]		[0.01]	[0.00]						[0.02]
p(Humidity)		[0.02]	[0.00]	[0.08]						[0.13]
p(Geo-Clim)				[0.02]					[0.15]	[0.70]
COAST				0.04					0.56**	0.22
				(0.33)					(0.25)	(0.44)
DMM				-0.10**					-0.01	-0.03
				(0.04)					(0.05)	(0.05)
Malaria Ecology				-0.03*						-0.01
				(0.02)						(0.02)
Tropics									-0.48	
									(0.31)	
p(Soil Quality)					[0.24]		[0.20]			[0.26]
p(Natural Resources)						[0.00]	[0.02]			[0.03]
Oil Reserves						0.00***	0.00***		0.00***	0.00***
						(0.00)	(0.00)		(0.00)	(0.00)
YSI								0.01***	0.00	0.00
								(0.00)	(0.00)	(0.00)

Table 2.8 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
XCON Initial								0.07		
								(0.06)		
p(OID)	0.23	0.03	0.02	0.11	0.60	0.57	0.99	0.84	0.78	0.33
p(UID)	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.03	0.01	0.00
F(WID)	10.1	10.0	8.2	7.8	11.5	7.0	7.3	5.1	11.1	5.7
	Panel B: First Stage OLS – EFW (85-10) is Dependent Variable									
PD1500	1.23***	0.99***	1.20***	0.97**	0.67*	0.84***	0.74*	0.37	0.58*	0.18
	(0.35)	(0.37)	(0.33)	(0.29)	(0.30)	(0.37)	(0.31)	(0.29)	(0.30)	(0.47)
PD1500×UK	0.66***	0.82***	0.60*	0.82***	0.99***	0.68*	0.70**	0.63**	0.95***	1.27**
	(0.35)	(0.32)	(0.33)	(0.29)	(0.30)	(0.37)	(0.31)	(0.29)	(0.30)	(0.47)
p(Temperature)	[0.01]		[0.03]	[0.02]						[0.71]
p(Humidity)		[0.16]	[0.07]	[0.62]						[0.50]
p(Geo-Clim)				[0.00]					[0.00]	[0.32]
p(Soil Quality)					[0.50]		[0.52]			[0.54]
p(Natural Resources)						[0.00]	[0.13]			[0.41]
Oil Reserves						-0.00***	-0.00		-0.00**	-0.00
						(0.00)	(0.00)		(0.00)	(0.00)
YSI								0.01***	0.00	0.00
								(0.00)	(0.00)	(0.00)
XCON Initial								0.18***		
								(0.04)		
R^2	0.33	0.29	0.35	0.48	0.27	0.33	0.32	0.46	0.53	0.42
N	64	64	64	60	64	64	64	60	59	59
	Panel C: OLS Impact of EFW on 2010 PWT Income Per Capita									
EFW (85-10)	0.99***	0.95***	0.88***	0.76***	0.97***	1.02***	0.96***	0.77***	0.76***	0.75***
	(0.09))	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)	(0.12)	(0.14)	(0.13)	(0.13)

Standard errors robust to heteroskedasticity in parentheses. P-values from joint tests of significance for subset of variables given in brackets. These results and constant terms are omitted for space. See appendix A for details about variables. See Table 2.4 for details on second-stage statistics reported above. *p < 0.10,** p < 0.05,*** p < .01.

CHAPTER THREE

THE CONCEPT & MEASUREMENT OF ECONOMIC INEQUALITY

3.1 Introduction

The analysis in chapter two indicates the importance of a nation's economic institutions and policies in facilitating long-run economic development. Countries that have adopted market-based, capitalistic institutions and policies have achieved higher average levels of income than those in which the market process has been hampered. While a large body of literature supports this finding, there is much less agreement concerning how market-based capitalism shapes the distribution of income and other measures of economic welfare. There are two major challenges to advancing our understanding of how economic institutions influence the formation and changes in economic inequality. First is the lack of cohesive economic theory. This issue will be discussed in the next two chapters. Second is the scarcity of quality data to test hypotheses. This chapter will address the data issue and describe the measures of inequality to be used in the analysis of chapters four and five.

The remainder of the chapter is organized as follows. Next is a discussion of the concept of economic inequality. Section 3.3 describes the measurement of economic inequality. Section 3.4 describes the inequality database used for the analysis of chapters four and five. The last section offers concluding remarks.

3.2 The Concept of Economic Inequality

There are two notions of economic inequality that distinguish between outcome and opportunity. The difference between the two ideas might be thought of as the difference between a stock variable and a process. Inequality of outcome refers to disparity in the actual distribution of economic resources among a population. Outcome-based measures entail inequality among a group for induced economic variables such as consumption, expenditure, income, and wealth. Because they are normally recorded and calculated at a given point in time, inequality of outcome can be regarded as a stock variable.

Inequality of outcome results from the decisions made by individuals, responding to the incentives and opportunities available to them, within an underlying economic, political, and social structure. Measures of outcome inequality typically do not take account of the framework or process of the economic system, but rather only the resulting distributional outcomes. The second concept, inequality of opportunity, refers to inequalities in the economic opportunities available to the members of society. Thus it relates to the underlying process of an economic environment rather than the outcomes of it. Because inequality of opportunity is a mechanism that acts to direct resources, it can be thought of as a process.

Because individuals are heterogeneous in many aspects including their resource endowments, motivation, network, preferences, and skills it is expected that economic outcomes will differ among individuals and result in some degree of inequality of economic outcome. Measures of inequality of outcome reflect the actual distributional outcomes and ignore the underlying process that serves as a mechanism to direct the distribution of economic resources in an economy. Meanwhile, inequality of opportunity reflects inequality in the opportunities available to agents in an economy and is thus related to the structure of the economy, including its institutions and policies.

It has often been suggested that the two concepts of inequality are complementary such that more equitable processes are associated with more equitable outcomes (see e.g. Okun, 1975; Friedman, 1980). While promoting greater equality of opportunity is a widely shared objective among policymakers and scholars as a means to enhance economic opportunities and promote greater equality of outcome (e.g. Azerrad and Hederman, 2012; Friedman and Friedman, 1980; Okun, 1975), it is unfortunately not a well-defined concept and is thus difficult to measure. Confounding this issue is the lack of consensus regarding how to define equality of opportunity, as two primary strains of thought exist that are somewhat at odds with one another.

The first concept has been described as formal equality of opportunity and is based on the principles of nondiscrimination, merit, and equality before the law. This is the concept that Milton and Rose Friedman (1980) had in mind in suggesting that equality of opportunity implies that there not exist arbitrary obstacles that prevent an individual from utilizing "his capacity to pursue his own objectives," and describing it as an essential component of liberty (p. 128). Reisman (1996) shares a similar sentiment in describing "the ability to exploit the opportunities afforded by reality, without being stopped by the initiation of physical force" as constituting equality of opportunity (p. 339). The concept of economic freedom might be considered a proxy for formal equality of opportunity.

The Friedmans (1980) offer a race analogy to distinguish between formal equality of opportunity and equality of outcome: the former requires that everyone start the race at the same time and face the same rules, while the latter requires that everyone cross the finish line at the same time. Under formal equality of opportunity, the most competitive players will always end up in the winner's circle, a highly efficient outcome. Critics of this view contend that it is justification for the inevitable inequality of outcomes that will arise in the market due to advantages inherently conferred to persons born into favorable conditions.

The second strain of thought has been referred to as substantive or fair equality of opportunity. Proponents of this line of reasoning such as John Rawls (1971) and Arthur Okun (1975) argue that perfect equality of opportunity is not a realistic possibility given that individuals are endowed with heterogeneous characteristics and circumstances that provide some an advantage over others in competing for economic resources. As such they advocate for interventionist policies to compensate for natural differences. Affirmative action employment, preferential college admissions, and progressive income taxation provide examples of policies designed to mitigate substantive inequality of opportunity. Returning to the Friedmans' race analogy, policies designed to promote substantive equality of opportunity are analogous to providing slower runners with a head start. The head start does not necessarily change the final standings of the race, but it does alter the margins of victory. Critics of substantive equality of opportunity argue that policies intended to promote greater equality of outcome do so by reducing equality before the law. Milton Friedman (1980) for instance famously suggested that "A society that puts equality before freedom will get neither. A society that puts freedom before equality will get a high degree of both."

The analyses in chapters four and five examine how differences in economic institutions impact inequality of outcome across countries. Given that measures of economic freedom are utilized as proxies for institutions, the analyses could be thought of as testing the hypothesis that greater equality of formal equality of opportunity produces greater equality of outcome. In addition, some components of economic freedom account for the level of government intervention in the economy, providing a proxy for institutions designed to pursue substantive equality of opportunity such that it is also possible to test the hypothesis that greater substantive equality of opportunity is associated with greater equality of outcome.

3.3 Measuring Inequality of Outcome

Inequality of outcome, henceforth inequality, may relate to disparities in the distribution for a number of economic variables such as consumption, expenditures, income, and wealth. As previously indicated, one of the two major challenges constraining achievement of a better understanding of economic inequality has been data limitations. It is only over the past half century that data has begun to become available to enable the measurement of economic inequality.

The design of modern national economic accounts associated with Simon Kuznets, Colin Clark, and Richard Stone, as well as the growing number of micro-datasets compiled using household or family surveys, have been important developments towards gaining a better understanding of the distribution of economic resources both between and within nations. Armed with these data, researchers have estimated thousands of measures of economic inequality for most countries and regions in the world at various points in time. Early attempts to consolidate the myriad of inequality measures into a secondary dataset for use in comparative research were made by Paukert (1973), Jain (1975), and Fields (1989), among others. As Deininger and Squire (1996) note, these efforts were limited in their coverage of countries and suffered from a number of methodological issues such as inconsistency in the unit of analysis and economic variable measured that have rendered much of the data of dubious quality and hence incomparable over time and across countries.

Deininger and Squire (1996) compiled a higher quality dataset of income inequality measures that greatly expanded the number of nations covered and enhanced the comparability of measures across nations and over time. They did so by screening measures to ensure that the underlying data are based on household surveys and include comprehensive coverage of the population and income sources. In 2000, United Nations University –World Institute for Development Economics Research (UNU-WIDER) released the World Income Inequality Database (WIID) that would later supplant the Deininger and Squire secondary dataset. The WIID continues to be updated as data become available and the latest version, WIID2C, is utilized in the current research.[44]

[44] See Atkinson and Brandolini (2001), Pyatt (2003), and Atkinson and Brandolini (2009) for a more comprehensive review of the growth in survey activity and secondary inequality dataset compilations.

More recently, a number of micro databases have emerged that allow for the computation of relatively homogenous measures of inequality across countries and time for various subsets of countries. The two most prominent such databases are the Luxembourg Income Study (LIS) and the Socio-Economic Database for Latin America and the Caribbean (SEDLAC). Milanovic's (2012) *All the Ginis* dataset is the latest effort to assemble a comprehensive secondary inequality database from the available inequality measures, including the LIS and SEDLAC measures. These data sources are utilized in the current research and are discussed in more detail in section 3.4.

Despite the rise in availability of inequality data, a number of conceptual, methodological, and statistical issues remain that hamper the ability of researchers to use inequality data for empirical analyses. A discussion of these issues is provided next.

3.3.1 Properties of Inequality Measures

A variety of methods have been developed to measure inequality, each of which embodies a number of characteristics and properties. One major distinguishing characteristic between measures of inequality is whether they are relative or absolute measures. Relative measures of inequality are scale invariant, meaning that for any given distribution of resources, inequality remains unchanged if the resources of every economic unit experience an equivalent proportional change (Jenkins and Van Kerm, 2008). Absolute measures of inequality on the other hand satisfy the translation invariance property, which specifies that for any resource distribution, inequality remains unchanged if the resources of every economic unit changes by an equal amount (Blackorby and Donaldson, 1980; Bosmans and Cowell, 2010).

Sen and Foster (1997) distinguish between positive and normative measures of inequality. Positive inequality measures are not based on a concept of social welfare while normative ones are derived using a subjective social welfare concept to account for losses incurred from an unequal distribution. Positive measures of inequality include the coefficient of variation, Gini coefficient, percentile ratios, relative mean deviation, standard deviation of logarithms, and Theil entropy index. All of the positive measures of inequality with the exception of variance also satisfy the scale invariance property, meaning that positive measures of inequality are for the most part also relative measures. Normative measures of inequality include the Dalton and Atkinson measures.

There are a number of other properties and characteristics common to inequality measures. The Pigou-Dalton or weak transfer principle requires that a transfer from a relatively rich to poorer economic unit reduce inequality, ceteris paribus. The population independence principle requires that an inequality measures is not dependent on the size of the population. Decomposable measures of inequality can be expressed as a function of inequality both between and within subgroups of the population. Sen and Foster (1997), Jenkins and Van Kerm (2008), and Cowell (2011) provide a more detailed discussion of the various measures of inequality and their properties.

There are advantages and disadvantages to using each type of inequality measure. For example, the Theil index is decomposable into between-group and within-group components but is difficult to interpret due to it being based on the concept of entropy. Absolute measures of inequality satisfy many desirable properties but require a normative judgment concerning societal aversion to inequality. Meanwhile the Gini coefficient is easily interpretable, but there is no unique mapping from the income distribution to the Gini measure and it is not decomposable (Haughton and Shahidur, 2009; Jenkins and Van Kerm, 2009; Deininger and Squire, 1996). Percentile ratios (e.g. 90/10, 80/20), while easily interpretable, ignore significant portions of the distribution. One drawback that is common to nearly all measures of inequality is that they are typically a stock variable and as such only provide a snapshot of the distribution for a given population at a single point in time. As a result, comparing changes in such measures over time does not account for economic mobility afforded to individuals by the underlying process (Garrett, 2010).[45]

The current research will only make use of measures of inequality that are both positive and relative. Specifically, Gini coefficients and percentile ratios will be utilized for the analysis in the next two chapters. The Gini coefficient ranges from zero to one and is increasing in inequality such that a measure of zero represents perfect equality and a measure of one represents perfect inequality. With perfect equality, a population of N individuals each has a 1/N share of economic resources, while a population characterized by perfect inequality indicates that one individual has control over all of the resources. Percentile ratios are the ratio of resources controlled by two given percentile groups and are expressed with the greater percentile in the

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[45] Lifetime inequality would provide a better measure of distributional differences. Unfortunately, such measures are few and far between.

numerator such that inequality is increasing in the ratio. In addition to satisfying scale invariance properties, both of these measures also satisfy the Pigou-Dalton and population independence principles. They do not however satisfy the decomposability principle. The choice to use these two measures is based on the availability of data, ease of interpretability, desirable characteristics of the measures, and general acceptability as measures of inequality in the literature.

3.3.2 Methodological Issues

Methodological issues for the measurement of economic inequality have long been acknowledged. In his paper, "Economic Growth and Income Inequality," Simon Kuznets (1955), one of the early innovators in the production of inequality data, identified five measurement specifications that economists should concern themselves. First, the family, adjusted for size, should be the unit of analysis. Second, the distribution should be complete in that it covers all units of a given population. Third, the definition of income should be comprehensive, including in-kind post-tax income, but excluding capital gains. Fourth, the distribution should only include units engaged in full-time economic activity, excluding students and retirees. Finally, it should be grouped by secular income levels that are free of cyclical and other transient disturbances.

Although the quality of data available to compute measure economic inequality has improved tremendously over the past few decades, many of the data issues discussed by Kuznets remain problematic for statistical analysis. These issues will be discussed in more detail below. In particular, the first three specifications mentioned above will be addressed, in addition to some issues not raised by Kuznets.[46]

As previously mentioned, Deininger and Squire (1996) identified problems of comparability, coverage, and quality with earlier inequality data in constructing their secondary dataset intended to overcome some of these issues. While their contribution provided greater coverage and was an improvement over earlier datasets, the use of such secondary data for

[46] Kuznets was primarily concerned with the distribution of income while the current research is concerned with economic inequality, of which income is only one aspect. Because individuals consumption smooth such that they defer income for retirement, excluding retirees from inequality calculations ignores important information. In addition, Kuznets argued that only full-time workers should be included in measurements of inequality. Following this advice would ignore important structural changes to the economy such as the growth of part-time employment, changes in the family structure, and the growth of social welfare programs that allow some individuals to rely on social transfers as their primary means of income. For these reasons, the fourth specification is not discussed further. Kuznets' last specification is concerned with income mobility that is obscured from many aggregate measures of relative inequality. While economic mobility is recognized as an important issue by economists, the current research is focused on economic inequality, a related but distinct issue.

empirical research has been met with criticism by a number of scholars. Indeed, the criticisms have been taken seriously as subsequent revisions of the Deininger and Squire dataset, as well as other inequality sources such as the LIS, SEDLAC, and Milanovic datasets, have incorporated many of the suggestions for improved comparability of measures.

Székely and Hilgert (1999) analyzed inequality measures based on household surveys in 18 Latin American and Caribbean (LAC) countries, finding that differences in inequality across the LAC countries may be at least partially attributable to disparities in the methods used to collect and compute inequality rather than genuine distributional differences. They cite inconsistency in the collection and calculation methods employed by the LAC countries as contributing to the misleading inequality measures. In particular, they consider differences in characteristics of the sample, survey quality, and coverage of population groups, income sources, and geographic areas as effecting the measurement of inequality. Pyatt (2003) points out many of the same issues in suggesting that inequality measures based on surveys may be systematically biased by non-sampling errors. Deaton (1997) and Atkinson and Mickelwright (1992) provide additional information regarding issues with survey data.

Analyzing inequality measures from the Deininger and Squire and LIS datasets for the OECD countries, Atkinson and Brandolini (2001) identify a number of issues that potentially compromise the comparability and consistency of inequality measures across countries and time. They warn against the mechanical use of inequality measures from secondary datasets, advising researchers to pay careful attention to definitional, source, and processing factors when constructing a dataset for empirical analyses. Pyatt (2003) and Atkinson and Brandolini (2009) echo this warning. These factors are discussed in greater detail below, along with guidance provided for researchers using inequality data from secondary sources to minimize the problems highlighted above and enhance the comparability of inequality measures across countries and time.

3.3.2.1 Sources of Data. The source of the data is one important factor to consider in deriving a measure of inequality. The most common sources of data used to derive inequality measures are administrative records (e.g. tax filings), household surveys, and national accounts. Inequality measures derived using random, nationally representative, and comprehensive household surveys are generally preferred to those calculated using national income accounts or administrative records for a number of reasons (Deininger and Squire, 1996; Székely and

Hilgert, 1999). Several scholars argue however that greater integration of data derived from national accounts and/or tax records is desirable to improve inequality data (Atkinson and Brandolini, 2001; Pyatt, 2003). The inequality measures described in section 4.4 are based on random household surveys with comprehensive population and income coverage.[47]

There are several other issues to consider when using household survey data to compute inequality measures. First, inequality measures may be sensitive to the weighting of households. Households are normally weighted in surveys using census data from previous years as a means to reduce sampling error and make the sample more representative of the actual population. Atkinson and Brandolini (2001) discuss the potential problems with sample weighting. Because the inequality data used for the current research are drawn from secondary sources, the household weights assigned by the various datasets are taken as given.

Next, the methods utilized for processing the data can also influence the measurement of inequality. Many survey databases top and/or bottom code income data in an effort to prevent the identification of individual survey respondents. While some researchers prefer to trim survey data in this manner to reduce noise in the tails of the distribution (see e.g. Cowell and Victoria-Feser, 1996), others have found that doing so significantly impacts the measurement of inequality (see e.g. Ryscavage, 1995). Trimming can also affect income groupings (e.g. quintiles, deciles), but since the inequality measures used in the current research are derived using household survey data rather than income quintiles, this issue is not applicable. Inequality measures from the LIS and SEDLAC databases are derived without trimming methods, but it is not known whether the inequality measures taken from the other sources were trimmed or not due to a lack of documentation on the matter.

3.3.2.2 Demographic Unit and Adjustments. The use of household survey data to calculate inequality measures necessitates that certain definitional assumptions in relation to the data be made. To the extent that the primary data is available for computation, Atkinson and Brandolini (2009) advise that researchers consider the particular economic analysis to be undertaken in making choices regarding the definition of inequality to be used. The demographic unit of analysis (family, household, individual, etc.) is often not a choice when using data that has already been collected, but most reputable contemporary surveys use the household as the

[47] A few exceptions exist. All of the surveys for Argentina and those for Uruguay before 2006 only cover urban areas. Urban areas account for 60% of the population in Argentina and 80% in Uruguay.

primary unit of analysis. Consistent with the arguments for the proper measure of income inequality advanced by Kuznets (1955), using the household as the demographic unit of analysis has become relatively standard in the literature for calculating inequality measures from survey data.

A related definitional issue is the adjustment for the size and composition of the demographic unit. A variety of adjustment methods are used in the literature to deflate household economic resources. The two most common are a per-capita adjustment and various equivalence scale adjustments. The per-capita adjustment simply adjusts the economic resources reported by a household, x, by the household size, n, resulting in the household per-capita measure x/n. Many published inequality measures, such as those from LIS and SEDLAC, use the income-per-capita adjustment method because it is a widely used metric. Indeed, Székely and Hilgert (1999) refer to this as the conventional adjustment method. The per-capita adjustment implicitly assumes that there are no economies of scale in the household and that the economic needs of all household members are equivalent.

To allow for differentiated needs among family members and economies of scale in the household, a variety of equivalence scale adjustments have been developed that specify a function such as $f(n, \theta, \gamma) = n^{\theta}$, where $n = \sum A + \sum K$ is the household composition, A and K represent adults and children, respectively, and θ and γ are the economies of scale of the household and welfare weights assigned to individual household members, respectively (McClements, 1977). While such adjustment equivalence scale methods allow for the differentiation of needs among various household members as well as the ability to control for economies of scale in the household, they too require that researchers make assumptions concerning the welfare needs and behavior of households in choosing a functional form. As such, equivalence scale adjustments inject normative assumptions into the measurement of inequality. Buhmann et.al. (1988), Glewwe (1991), Coulter, Cowell, and Jenkins (1992), and Deaton and Zaidi (2002) offer more detailed information on the various equivalence scales, including analyses of the sensitivity of inequality measures to them.

All of the outcome inequality measures described in section 3.4 reflect household income or consumption, and are adjusted for household size. This is primarily attributable to data availability and the fact that this adjustment method is widely considered to be an appropriate measure of economic inequality, as originally proposed by Kuznets (1955).

3.3.2.3 Concept of Economic Resource. The above discussion indicated that inequality measures depend on the level of an economic resource, x, controlled at the household level, but did not specify the concept of this variable or the time period of measurement. Inequality can be measured for many economic variables such as consumption, education, consumption, income, and wealth, and may represent inequality for an arbitrary point in time such as a year or over a longer period such as one's lifetime (Cowell, 2011). While command over economic resources over a lifetime is likely a better indication of well-being than command at an arbitrary point in time, data limitations often restrict analysis to the latter. In addition, Jenkins and Van Kerm (2009) point out that the longer the reference period survey respondents are asked to report economic activity, the greater the likelihood of inaccurate reporting attributable to recall and/or changes in household composition over the interval (see also SEDLAC, 2012). Most household surveys capture economic activity for a specific time interval, often annually, and there is general agreement that a year is an appropriate interval to measure inequality (Deaton and Zaidi, 2002).

The two most common economic variables used to compute inequality are consumption (or expenditure) and income. The traditional approach to welfare economics suggests that consumption is a better concept than income to measure inequality since consumption enters the utility function and measures the actual use of as opposed to command over economic resources (Jenkins and Van Kerm, 2009). Three additional reasons have been offered as to why consumption is a better measure than income inequality (SEDLAC, 2012; Deininger and Squire, 1996; Deaton and Zaidi, 2002). First, because people can consumption smooth when they have access to saving and borrowing facilities, consumption is less volatile than income over a short period of time such that the former is a better indication of permanent economic well-being than the latter.[48]

Second, household consumption data is less likely to suffer from problems of misreporting and underrepresentation of certain groups that result in biased estimates of inequality. In countries with high rates of self-employment and home production, accurate income information is notoriously difficult to gather because business and personal finances are often intermingled and the definition of income may not be as clear as consumption (Deaton and

[48] Consumption inequality also tends to be lower than income inequality for this reason. Deininger and Squire (1996) report the mean difference between income-based and expenditure-based Gini coefficients as 6.6 points for the 47 observations for which both measures are available. If inequality is measured over a lifetime, economic theory would suggest that consumption and income inequality are approximately equal since individuals tend to consumption smooth over their lifetime (Deaton and Zaidi, 2003).

Zaidi, 2002).[49] Survey respondents also have a greater incentive to mask income and/or avoid participation for tax purposes when the survey asks for income information. This may be especially true in countries with weak tax compliance mechanisms. The underrepresentation of high income individuals in household surveys may also be attributable to the low probability of being sampled (Székely and Hilgert, 1999; SEDLAS, 2012) and/or the high opportunity cost of time for survey response. These reasons weaken the intentional misrepresentation of income by the rich argument and suggest that high income individuals may be no better represented in consumption relative to income surveys. The poorest individuals in society are also often underrepresented in survey data, a phenomenon that is attributable to a variety of factors, including low probability of being sampled, unstable home dwellings, and avoidance of official activity (Pyatt, 2003). Thus, both tails of the income distribution are often underrepresented in household survey data.

Finally, consumption is perceived as a better measure of inequality than income because it is a comprehensive measure of economic activity that is by definition net of taxation and transfers. Cowell (2011) suggests, however, that a comprehensive measure of income that includes labor market earnings, capital gains, transfers, and other forms of income may also serve as a good barometer of a person's economic well-being at a given point in time. This may be particularly true if the income measure is net of taxes and transfers, especially for developed countries with progressive income tax systems and/or significant social welfare programs. For countries with relatively flat tax rates and/or minimal social welfare programs, gross income inequality may be an adequate measure of well-being. The purpose of the current research is to analyze the effect that economic institutions and policies exert on economic inequality and as such, income net of taxes and transfers is the preferred concept since most economies redistribute income through the tax system. With that being said, only gross income inequality measures are available for a number of countries, predominantly less developed ones.

A related issue is the comprehensiveness of the economic resource being measured. While consumption bundles and the importance of home-produced consumption goods certainly differ across population groups and countries, the issue of comprehensiveness mainly pertains to income. Sources of income include labor market earnings, retirement income, self-employment

[49] Deaton and Zaidi (2002) suggest that in less developed countries, the measurement of household consumption is often more prevalent than household income because the "concepts are clearer, the protocols are well-understood, and less imputation is required."

income, capital gains, cash and in-kind compensation, and a variety of imputed rents such as owner-occupied housing. While wage income is the largest source of income in most economies, the prevalence of other sources of income varies across countries and inequality measures are sensitive to the definition of income used (Atkinson, Rainwater, and Smeeding, 1995). Reliable information from some income sources may be easier to collect and more accessible than others. For instance, information on income earned in the formal sector is often more reliable than that from the informal economy because administrative records are generally mandated by law for tax purposes. Of course the institutional environment may influence the size of the formal sector as onerous regulatory and tax regimes often provide disincentives for formal economic activity.[50] Additionally, income from cash transfers (governmental, private charity, or inter-family) is likely to be more reliable than income from in-kind compensation (e.g. fringe benefits, food, healthcare and housing subsidies) on account of better administrative records typically being kept for the former. Because the institutional and policy structure of an economy will influence the ability of individuals to earn income from various sources, measures that are as comprehensive as possible are desirable for the current research.

Despite the many benefits of consumption as a measure of welfare, it also has several drawbacks. First, the costs of collecting consumption data are higher relative to collecting income information. Because income surveys are less expensive to conduct, more households can be surveyed such that the sample size is larger and the data more representative of the population, reducing potential sampling bias (Deaton and Zaidi, 2002). Next, individuals generally keep better income records as compared to consumption such that recall problems are likely more severe when collecting consumption information. Additionally, consumption is generally measured in one of two ways: expenditure and the difference between income and savings (Deininger and Squire, 1996; Jenkins and Van Kerm, 2009). If consumption is derived from income, then the problems associated with collecting income information remain in tack for collecting consumption information. In less developed countries, a nontrivial portion of economic activity may not involve the exchange of financial assets (e.g. barter, home production) such that expenditure information excludes valuable consumption commodities whose value may be indeterminate. Atikinson and Bourguinon (2000) point out that the

[50] Income earned in the informal economy is likely a source of major underreporting.

treatment of durable goods requires the imputation of values for their services and that it is not clear that there is a uniform method for doing so. As such, there are challenges to collecting consumption as well as income information to compute measures of inequality.

Clearly, there are advantages as well as disadvantages to collecting consumption and income information from households. Cowell (2009) points out that personal income data is widely available and readily interpretable in defending its use as a measure of well-being. Most developed countries and an increasing share of less developed ones, particularly the Latin American nations, conduct regular household income surveys. Jenkins and Van Kerm (2009) make a normative argument that income is preferable to consumption as a measure of inequality because economic inequality is concerned with "access or control over economic resources rather than the actual exercise of that power" (p. 2). The preceding arguments illustrate that both consumption and income are generally accepted as a measure of individual welfare. While both concepts have their merits, nearly seventy percent of inequality measures in the dataset described in section 3.4 reflect income inequality, while the remainder represent mostly underdeveloped countries for which consumption inequality may be a more appropriate measure. This is largely attributable to data availability and the desire to have comprehensive measures that are as comparable across countries and time as possible, as originally suggested by Kuznets (1955).

3.4 Construction of a Custom Inequality Database

In this section, details are provided for the construction of an inequality database that is used for the analyses in chapters four and five. Custom datasets that contains highly comparable measures of net income, gross income, and consumption inequality measures are described in sections 3.4.1 and 3.4.2. Additional measures of inequality that are used for the analyses in subsequent chapters are described in section 3.4.3.

3.4.1 Data Sources

The inequality measures used in the construction of the custom database follow what is considered convention in the literature in that they are derived from nationally-representative household surveys. Four secondary inequality datasets were utilized in its construction: Milanovic's All the Ginis (ATG) database, LIS, SEDLAC, and WIID2C. Each is discussed below.

3.4.1.1 Milanovic. The Milanovic (2005) secondary database of inequality measures, ATG, expands coverage of relatively comparable inequality measures in an effort to circumvent some of the issues discussed above. The Milanovic dataset includes Gini coefficients retrieved from seven databases: (1) LIS, which covers 38 countries over the period 1967-2010; (2) SEDLAC, which covers 20 countries over the period 1981-2006; (3) Eurostat's Survey of Income and Living Conditions (SILC), which provides inequality measures for 28 countries for 2008; (4) World Bank's Eastern Europe and Central Asia (ECA) dataset, which covers 28 countries from 1990-2009; (5) the World Income Distribution (WYD) dataset, which covers 151 countries from 1980-2010; (6) World Bank's POVCAL dataset, which include 124 countries and spans the period 1978-2011; and (7) the UNU-WIDER WIID1 dataset that covers 119 countries over the period 1950-1998 and supersedes the Deininger and Squire (1996) dataset.

As mentioned above, Milanovic's database includes inequality measures from the LIS, SEDLAC and UNU-WIDER datasets; however, the measures used in the current research were obtained directly from these three sources rather than taken from Milanovic's dataset. This was done for several reasons. First, at the time the dataset was compiled (October 2012), both SEDLAC and LIS had released additional inequality measures since the Milanovic dataset had last been updated (summer 2010).[51] As such, to include these recent measures in the current study necessitated obtaining them directly. Second, because consistency in the inequality computation method is highly desirable, all of the inequality measures were obtained from the LIS and SEDLAC databases directly rather than from Milanovic's database. Milanovic's documentation of how the inequality measures from SEDLAC and LIS were derived is incomplete.[52] For instance, it was not clear how zero and blank income survey responses were treated, nor was it clear whether data trimming was implemented in calculating Gini coefficients. Lastly, Milanovic's dataset includes UNU-WIDER WIID1 inequality measures, which only provides coverage through 1998. The latest version is WIID2C and it includes coverage through 2006. Because the LIS, SEDLAC, and WIID2C databases provided multiple inequality measures and/or allow users to define their own criterion to compute inequality, obtaining the data directly rather than taking it as given by Milanovic allows a more selective screening of the data for comparability.

[51] Milaovic updated the ATG dataset in October 2012, adding the SILC and POVCAL measures to the database.
[52] An email was sent to Milanovic inquiring about these specific issues on September 18, 2012. No response has been received as of March 19, 2014.

In addition to the LIS, SEDLAC and UNU-WIDER inequality measures, the World Bank POVCAL measures were also not included in the current study. The primary reason for excluding the latter is the lack of sufficient documentation on how the measures were derived. As such, the ECA, WYD, and SILC inequality measures were taken from the Milanovic ATG dataset. In total, 546 inequality measures from Milanovic are included in the dataset used for this research. Of this, the majority (313) measure consumption inequality, while 145 and 88 measure gross and net income inequality, respectively. Of the 546 inequality measures, 363, 155 and 28 are from the WYD, ECA, and SILC datasets, respectively.

3.4.1.2 LIS. The Luxembourg Income Study (LIS) is a secure database that provides harmonized micro data for high- and medium-income countries periodically over the period 1967-2010. Most of the datasets reflect data obtained from random, nationally-representative household surveys. LIS provides ready-computed inequality measures on its website for download, but these figures are computed using top- and bottom-coding techniques that are undesirable for the current research. LIS does not trim its micro data and provides access to researchers to generate data such that inequality measures can be derived in the manner desired. Each dataset contained in the LIS database contains a wealth of household-level data including disposable household income, the number of persons residing in each home, and the household sample weight. This information was used to calculate income Gini coefficients based on disposable per capita household income for each country and year available in the database.[53] The LIS database provides 157 disposable income Gini measures for 37 countries.[54] Because the datasets are harmonized, these measures of inequality are highly comparable across countries and over time.

3.4.1.3 SEDLAC. The Socio-Economic Database for Latin America and the Caribbean (SEDLAC) database is a joint project of the CEDLAS at Universidad Nacional de La Plata and the World Bank. It provides socio-economic statistics for Latin American and Caribbean countries. The statistics are derived from random household surveys. Most of the surveys are

[53] Disposable household income is defined as total monetary and non-monetary current income net of income taxes and social security contributions. Households with zero, missing or negative disposable household income were excluded from the calculations. For more information, see <http://www.lisdatacenter.org/wp-content/uploads/our-lis-documentation-variables-definition.xlsx>.

[54] A few datasets were comprised of data from administrative tax records (e.g. France 1984). These data were excluded.

nationally representative with a few exceptions. SEDLAC publishes a number of inequality and poverty measures, including income Gini coefficients that are based on gross total current per capita household income. The measures are not net of taxes but do include both non-monetary labor income and transfers. As with the inequality measures derived using the LIS database, households reporting zero, missing, and negative income were excluded from the calculations. The SEDLAC database provides 195 gross income Gini coefficients for 22 different countries.

3.4.1.4 WIID2C. The United Nations University Worldwide Institute for Development Economics Research (UNU-WIDER) produces the WIID secondary database. WIID supersedes the Deininger and Squire database and is updated as new inequality measures become available. The latest version of the database as of this writing, WIID2C, contains more than 5,300 Gini coefficients that measure inequality for a variety of income and consumption concepts over the period 1867-2006.

Each Gini coefficient is assigned a quality rating on a scale of one to four. Observations receive a quality rating of one if the underlying concepts are known and the quality of the income concept and survey are judged to be sufficient. If the quality of either the income concept or survey is problematic or unknown, or the underlying sources were unverifiable, then an observation is assigned a quality rating of two. Observations are assigned a quality rating of three if both the income concept and survey are problematic or unknown. Observations assigned a quality rating of four are considered unreliable.

The WIID2C measures were carefully screened for inclusion in the current database in order to obtain relatively consistent net income, gross income, and consumption Gini coefficients. Several criteria were applied to filter the Gini coefficients. First, measures must have a quality rating of one or two. Second, the survey must cover all areas within a country and at least 90 percent of the population. Third, the survey should be conducted at the household level and include all individuals in the house, with the Gini coefficient computed using household per capita measures. Consumption Gini coefficients can include either consumption or expenditure data. Net income Gini coefficients can be based on net earnings, disposable income, or disposable monetary income. Gross income Gini coefficients can include gross earnings, income, or monetary income. After screening the data, 324 Gini coefficients from WIID2C remained. Of these, 206 and 52 measure net and gross income inequality, respectively, and 66 reflect consumption inequality. WIID2C consists of Gini measures originating from many different sources. Two of the most common sources are measures from Deininger and Squire (DS04) and Transmonee. The former measures were computed exclusively for inclusion in WIID2C. The latter measures are from various years.

Table 3.1 Descriptive Statistics for Inequality Datasets

	(1) Net Income	(2) Gross Income	(3) Consumption
# Observations (N)	322	305	295
# Countries (I)	68	71	79
Mean (N/I)	4.7	4.3	3.7
# Countries with:			
1 Observation	14	22	12
3+ Observations	44	32	53
6+ Observations	28	18	13
8+ Observations	13	16	6
10+ Observations	5	13	2
Gini Summary Statistics			
Minimum	0.175	0.233	0.186
Maximum	0.698	0.676	0.697
Mean	0.340	0.482	0.374
Standard Deviation	0.091	0.091	0.081

3.4.2 The Custom Datasets

Gini coefficients from the LIS, SEDLAC, WIID2C and Milanovic databases were carefully screened to form custom inequality datasets for use in the analysis of chapters four and five. All of the inequality measures are based on nationally representative household survey data. The household measures of economic resources used to compute the Gini coefficients are comprehensive and adjusted for household size. The database consists of 1,231 total Gini coefficients, covering 129 countries over the period 1967-2010.

Datasets comprised of Gini measures of net and gross income inequality, and consumption inequality are compiled. Household income per capita is the measure of welfare for 852 (69.2%) of the Gini coefficients. Of the income Gini coefficients, 460 (37.4%) represent net income per capita and 392 (31.8%) represent gross income per capita. The remaining 379 (30.8%) Gini coefficients are measures of household consumption or expenditure per capita. Nearly all of the consumption Gini coefficients represent developing countries and may be the appropriate measure of welfare for these nations due to the presence of large informal and home production sectors.

3.4.2.1 Net Income Inequality Dataset. There are 467 net income Gini coefficients in the database, 173 of which are drawn from the LIS database. Meanwhile, 206 of the measures are taken from WIID2C and 88 from the Milanovic ATG database. Gini coefficients are often available from more than one of the sources for a given country and year. In fact, 145 of the net income Gini coefficient observations are duplicates, but the overlapping measures arenot necessarily equivalent because they may have been calculated using slightly different survey methodologies or income concepts. In forming a single net income Gini dataset, all of the years for a given country are considered in selecting the source. In the event that multiple sources were available for a given country, the following order of preference is used to select the primary source for that country:

$$\text{LIS} \succ \text{SEDLAC} \succ \text{DS04} \succ \text{Transmonee} \succ \text{Other WIID2C} \succ \text{SILC} \succ \text{ECA} \succ \text{WYD}$$

A few exceptions to the above preference ordering are made in selecting a primary source for a country, all of which involved a less preferred source having a greater number of observations for that country. In general the source providing the greatest number of observations for a given country is selected as the primary source, but having more observations was not sufficient for a less preferred source to be selected. Each country was considered on a case-by-case basis, considering the trend and volatility of the measures from a less preferred source relative to the more preferred source(s). For some countries, secondary and tertiary sources are utilized to add additional observations if the data were available for a year(s) not covered by the primary source. The same preference ranking and methodology is used in selecting secondary and tertiary sources.

The resulting dataset consists of 322 net income Gini coefficients representing 68 countries. Thirty-nine of the countries utilize a single source, while sixteen and thirteen use secondary and tertiary sources, respectively. The mean number of net income Gini coefficients per country is 4.7, but fourteen of the countries have only a single observation. Meanwhile, forty-four countries have three or more and twenty-eight countries have six or more net income Gini coefficients. Column 1 of Table 3.1 provides descriptive statistics related to the net income

Gini dataset. Appendix Table D.1 provides summary statistics by country, including the data sources and years available, for the net income Gini coefficient dataset.

3.4.2.2 Gross Income Inequality Dataset. There are 395 gross income Gini coefficients in the database, approximately half (195) of which are from SEDLAC. Meanwhile, 145 are from the Milanovic ATG database and 52 from WIID2C. Similar to the net income dataset, multiple sources were available for some countries. In constructing a single gross income inequality dataset, the same method as described above is used. The resulting dataset contains 305 gross income Gini coefficients, representing 71 countries. Fifty-three of the nations have data from a single source, while the remaining fourteen utilize two sources. The mean number of gross income Gini coefficients per country is 4.3, but twenty-two countries have only a single observation. Thirty-two countries have three or more observations, while sixteen countries have eight or more observations.[55] Column 3 of Table 3.1 provides descriptive statistics related to the gross income Gini dataset. Appendix Table D.2 provides summary statistics by country, including the data sources and years available, for the gross income Gini coefficient dataset.

3.4.2.3 Consumption Inequality Dataset. There are 379 consumption Gini coefficients in the database. Most (313) of the measures are drawn from the Milanovic ATG database. The remaining 66 measures are from WIID2C. Again, multiple sources are available for some countries. The same methodology described above is used to construct a single consumption Gini dataset, resulting in 295 observations for 79 countries. Fifty-six of the countries have data from a single source, while the remaining twenty-two consist of two sources. The mean number of consumption Gini coefficients per country is 3.7, lower than that of either the net or gross income Gini datasets, a factor that is likely attributable to the consumption inequality measures largely representing developing countries. A smaller share of countries contain only a single consumption Gini coefficient compared to the other two inequality concepts, as twelve countries (15.2%) fall into this category.[56] Two-thirds of the countries (32) have three or more observations, while eighteen have six or more observations.[57] Column 3 of Table 3.1 provides descriptive statistics related to the consumption Gini dataset. Appendix Table D.3 provides

[55] SEDLAC provides a relatively high number of observations per country.
[56] In contrast, 20.6% of net income Gini and 31% of gross income Gini countries contain only a single observation.
[57] In contrast, 65% of net income Gini and 45% of gross income Gini countries contain three or more observations.

summary statistics by country, including the data sources and years available, for the consumption Gini coefficients dataset.

3.4.2.4 Technical Note. Chapter four analyzes the relationship between economic institutions and inequality. Because the Fraser Institute's Economic Freedom of the World (EFW) data are used as the measures of a country's economic institutions, annual data are not available for the entire 1970 to 2010 period. Annual EFW data are available beginning in 2000, but data are only available every five years over the period 1970-2000.

It is also the case the inequality measures are generally not available on an annual basis for any given country due primarily to the high cost of conducting household surveys. This is particularly true for many developing countries, but also for most developed ones. In addition, household surveys that can be used to derive Gini coefficients are often conducted in different years and with varying frequencies for different countries. For instance, the primary source of net income Gini coefficients for both Italy and the Netherlands, two advanced economies, is LIS. Gini measures for the former are reported for 1986, 1991, 1995, 2000, and 2004. Meanwhile, they are reported for the years 1987, 1990, 1993, 1999, and 2004 for the latter.

Table 3.2: Assignment Metric for Inequality Measures

Beginning (X)	End (Y)	Base (Z)
1967	1972	1970
1973	1977	1975
1978	1982	1980
1983	1987	1985
1988	1992	1990
1993	1997	1995
1998	2002	2000
2003	2007	2005
2008	2012	2010

Observations between X and Y assigned to base year Z

The discrepancy in time availability of Gini coefficients presents a minor challenge for constructing a panel dataset to match EFW data that is provided at quinquennial intervals prior to 2000. To deal with this issue, an assignment metric is implemented for the Gini coefficients. Observations reported for years ending in the closed interval from eight to two are assigned to the closest year ending in zero. For example, observations occurring over the interval 1988 to 1992 are assigned to 1990. Gini coefficients reported for years ending in the closed interval from three to seven are assigned to the nearest year ending in five. For instance, observations occurring over the interval 1993 to 1997 are assigned to 1995.

In the event that multiple Gini coefficients for a given country are available for a single five-year interval prior to 2000, the one closest to the base year (years ending in zero or five) is selected.[58] If two measures within the same interval are equidistance from the base year, then the post-assignment year observation is selected in most instances.[59] When multiple observations are available for a quinquennial interval for a given country in the post-2000 period, all of the measures are retained and the observation closest to 2005 (or 2010) is assigned to the base year. Again, if two measures within the five-year interval are equidistance from 2005 then the post-2005 observation is selected. Table 3.2 summarizes the assignment metric. Because EFW measures are available annually beginning in 2000, readers may wonder why the assignment metric is followed for Gini coefficients reported for the post-2000 period. The analysis in chapters four and five only makes use of the quinquennial observations, including those occurring after 2000 when annual data are available. The rational for this is to avoid overweighting recent observations in panel data econometric estimates.

3.4.3 Additional Datasets

Several other inequality datasets are used for the analysis in chapters four and five. These include Gini measures from the Standardized World Income Inequality Database (SWIID) and the University of Texas Inequality Project (UTIP). Two income ratio inequality measures are also utilized. Each is discussed separately below.

3.4.3.1 SWIID. Solt (2009) developed a custom missing-data algorithm to standardize Gini coefficient measures from a number of number of sources, including WIID, SEDLAC, the OECD Distribution Database, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Carribean, the World Top Incomes Database, and national statistical offices. Gini measures from LIS are used as the benchmark standard. The goal of SWIID is to provide a dataset of comparable net and gross income Gini coefficients for as

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[58] For instance, if a Gini coefficient is available for a country for 1988 and 1991, which would both be assigned to 1990, the measure representing 1991 is assigned to 1990 because it is closer.

[59] As an illustration, if a Gini coefficient is available for a country for 1989 and 1991, which would both be assigned to 1990 and are equidistance from it, the measure representing 1991 is assigned to 1990 because it is occurs after the assignment year.

many countries and years as possible. The dataset is updated as new data become available. The most recent version at the time of writing is version 4.0 and it includes Gini measures for 173 countries for as many years as possible from 1960 to present.[60] The same criteria discussed in section 3.4.2.4 was applied to the SWIID net and gross Gini dataset to assign the measures to quinquennial periods for the analysis in chapters four and five.

It should be noted that although the SWIID dataset expands country and period coverage relative to other datasets, it does so by compromising data quality. The measures provided in the SWIID dataset, with the exception of those from LIS, are estimates derived using an algorithm and are therefore not computed from micro data. As the analysis in chapter four will indicate, this can reduce the accuracy of the inequality measures.

3.4.3.2 UTIP. Galbraith and Kum (2005) estimate Gini measures of gross household income inequality using measures of manufacturing pay inequality, Gini coefficients from the Deininger and Squire dataset, and other information with multivariate regression analysis. At the time of data collection, the UTIP dataset included Gini measures for 154 countries spanning the period 1963-2002. The metric described in section 3.4.2.4 was used to assign the measures to quinquennial periods for the present research. As with the SWIID measures, the UTIP Gini coefficients are not based on household micro data but are estimated from other data using statistical procedures.

3.4.3.3 Income Ratios. The World Bank World Development Indicators and WIID2C both provide measures of the share of income held by the top and bottom deciles and quintiles. These figures were used to compute 80/20 and 90/10 income inequality ratios, which measure the ratios of the share of income held by the top 20 to bottom 20 percent and top 10 to bottom 10 percent of the distribution, respectively. Measures from the two sources are combined using a similar methodology as described above. Preference is given to measures from the WIID2C due to it providing better documentation of the data than the World Bank measures. Income ratios are available for up to 129 countries spanning the period 1980-2010. The quality of these measures is highly suspect, but they are included in the database nonetheless to provide another alternative measure of inequality for a large number of countries.

[60]Data retrieved on December 31, 2013 from <http://myweb.uiowa.edu/fsolt/swiid/swiid.html>.

3.5 Summary

This chapter discusses the concept and measurement of economic inequality, including many of the methodological issues associated with the use of inequality data for comparative analysis. One of main problems is comparability of inequality measures across countries and over time. A custom dataset is constructed that includes highly comparable measures of net income, gross income, and consumption Gini coefficients. These datasets, along with several other existing datasets such as SWIID and UTIP, are included in an inequality database that is used for the empirical analyses in the next two chapters. The database also includes two income ratio measures of inequality. All of the measures included in the database are relative measures of inequality.

CHAPTER FOUR

ON THE AMBIGUOUS ECONOMIC FREEDOM-INEQUALITY RELATIONSHIP

4.1 Introduction

The findings in chapter two indicate that countries which adopted a broad cluster of institutions and policies supportive of economic freedom following European colonization have experienced sustainable long-run economic growth, while those which developed institutions more reliant on state allocation and control of the economy have lagged behind. Although the analysis from chapter two is focused on the historical development of contemporary institutions that have impacted economic development, Shleifer (2009) describes the period starting around 1980 as the "Age of Milton Friedman" due to the adoption of more market-based institutions and policies in many less developed countries such as China, India, and Indonesia. Numerous studies have found contemporary economic liberalization to be a robust positive determinant of economic growth. The results from chapter two therefore contribute to the growing body of literature that has reached a near intellectual consensus that economic freedom and economic liberalization are robust and positive determinants of economic growth and development (Berggren 2003; De Haan, Lundström, and Sturm, 2006; Doucouliagos, 2005; Montesinos and Faria, 2009; Rode and Coll, 2012)..

Coinciding with the liberalization of the economy and subsequent economic growth in many developing countries over the past several decades has been a dramatic decline in poverty rates (Pinkovsky and Sala-i-Martin, 2009; Sala-i-Martin, 2006). Studies by Dollar and Kraay (2002), Norton (2002), Ravalllion (2001), and Roemer and Gugerty (1997) find that economic growth exerts a strong and negative influence on poverty. As mentioned above, economic liberalization has consistently been found to be a positive determinant of economic growth, so it follows that if growth reduces poverty, that economic liberalization ought to be linked to poverty alleviation. Indeed, several recent studies have found that economic liberalization is associated with poverty reductions (Chansukree, 2012; Connors, 2012; Hasan, Mitra, and Ulubasoglu, 2007).

A related but much less studied topic is how differences in economic freedom between countries have contributed to heterogeneous levels of income inequality. Just as institutional differences have contributed to huge disparities in the average living standards across countries, one might also expect that the distribution of income within nations to vary depending on the mixture of institutions and policies –they do after all create the incentive structure faced by agents in the economy as well as determine the mechanism(s) by which resources are allocated. This begs the question: do some institutional structures produce more equitable distributions than others? It has commonly been asserted that market economies are more efficient than other types of economic systems, but inevitably lead to greater levels of economic inequality. The institutions of a market economy, particularly private property rights, enable supply and demand conditions to determine prices, a mechanism that, when unhindered by high transactions costs and asymmetric information, efficiently acts to allocate resources to their highest valued use. Easterly (2007) suggests that market economies produce a natural level of inequality due to the unequal rewards of success across individuals, industries, and regions.

In the opening page of *Efficiency and Equality: The Big Tradeoff*, Arthur Okun (1975, 1) suggests that "the pursuit of efficiency necessarily creates inequalities." This mantra has oft been repeated by academics, politicians, and other public intellectuals in the form of a common idiom –the rich are getting richer while the poor poorer –as justification for government interventions in the marketplace. For instance, in an early December 2013 speech, U.S. President Barack Obama (2013) implied that the institutions underlying market economies are responsible for creating economic inequality, stating that "the trend towards growing inequality is not unique to America's economy. Across the developed world, inequality has increased." Economist Paul Krugman (2013) agreed with the President in his *New York Times* column, suggesting that inequality is "the defining challenge of our time." Even the head of the Catholic Church, Pope Francis (2013), recently criticized market-based capitalism as a system of exclusion and inequality that is "unjust at its roots" and "devour[s] everything which stands in the way of increased profits," creating a "new tyranny…which unilaterally and relentlessly imposes its own laws and rules" (p.48).

But are such criticisms of market economies justified? Is it the case that countries adopting institutions and policies consistent with market capitalism generate greater distributional disparities than countries in which the state plays a greater role in the economy? Rapid economic growth in less developed countries that have liberalized their economies over the past several decades has not only drastically improved the living standards for millions of previously impoverished persons around the world, but it has also acted to reduce global economic inequality as the disparity in average living standards between many developed and developing countries has diminished (Pinkovsky and Sala-i-Martin, 2009). Partially offsetting the decline in global inequality has been the rise of within-country inequality in some nations over the same time period (Goesling, 2001). If economic liberalization both enhances growth and diminishes poverty, then in order for it to increase income inequality, it must be the case that the economic benefits of growth-promoting liberalization of the economy accrue disproportionately to the upper parts of the income distribution.

Unfortunately neither economic theory nor existing empirical evidence provides clear guidance on the matter. Only a few studies have examined how economic freedom impacts inequality. Berggren (1999) was the first to explicitly study the relationship between the two concepts. Using a simple theoretical framework, Berggren shows that other than income redistribution through a tax-and-transfer system, which reduces both economic freedom and inequality, the relationship between economic freedom and inequality is theoretically ambiguous due to the expected differential effect that various components of a measure of economic freedom exert on the distribution of income. Concluding that the theoretical relationship between the two concepts is ambiguous, Berggren employs an empirical analysis to try and bring clarity to the matter. Subsequent analyses (Apergis, Dincer and Payne, 2013; Ashby and Sobel, 2008; Bennett and Vedder, 2013; Bergh and Nilsson, 2010; Carter 2006; Clark and Lawson, 2008; Compton, Giedeman, and Hoover, 2014; Scully, 2002) have followed Berggren in examining how economic freedom impacts inequality empirically. The relationship between the two concepts is very complex, so it is understandable that most authors have passed the torch of developing a theoretical foundation and instead jumped to the data in an effort to shine light on the issue. This would be more comforting if the empirical results were robust to a number of different econometric specifications and measures of inequality, but this has not been the case.

Section 4.2 develops a simple theoretical framework, building on the work of Berggren (1999) and Scully (2002), to further illustrate the theoretical ambiguity of the economic freedom-inequality relationship. As demonstrated, even the conclusion that redistribution reduces inequality is not generalizable unless it is assumed that (i) redistribution is top-down and (ii) redistribution involves zero economic cost. A correlation analysis is presented in section 4.3 using several measures of both inequality and economic freedom. A casual examination of the data suggests that there is a negative correlation between the two variables, although the magnitude and sign of the correlation varies by area of economic freedom, year of observation, and measure of inequality. The non-robust results of various empirical studies on the economic freedom-inequality relationship are discussed in section 4.4. In addition to concerns over the quality and comparability of inequality data, as discussed in chapter three, other potential factors that have contributed to the inconsistent results include the use of different datasets and econometric techniques.

The penultimate section provides new empirical results for each of the main econometric models employed in the literature using several alternative measures of both inequality and economic freedom. The results indicate that the empirical economic freedom-inequality relationship is sensitive to the economic specification, measure of inequality, sample of countries, and time period examined. Section 4.6 offers concluding remarks. Despite many unanswered questions concerning the interaction between market capitalism and inequality, many continue to treat the so-called equality-efficiency tradeoff as if it were a stylized fact. The analysis in this chapter suggests that both the theoretical and empirical relationship between economic freedom and inequality are ambiguous, and in need of further study.

4.2 A Simple Theoretical Framework

Previous studies on economic freedom and inequality suggest that the relationship between the two is theoretically ambiguous. Part of the reason is that economic freedom is a complex concept that covers many related institutional and policy arrangements, as indicated by equation 4.1 where EFI is an index of economic freedom comprised of K components. The Economic Freedom of the World Index (EFW) for instance is based on five broad areas, each of which is comprised of a number of underlying components. While all of the areas and their components are consistent in measuring the extent to which the principles of personal choice, voluntary exchange, open markets, and protection of persons and their property from aggressors are practiced, the particular mix of institutions and policies within a country do involve trade-offs such that some areas of economic freedom are compromised in order to achieve greater economic freedom in other areas. Bergh and Henriksen (2011) refer to this as the compensation effect.

$$\mathrm{EFI_t} = \mathrm{f(EF_{1t}, EF_{2t}, \dots, EF_{Kt})} \qquad (4.1)$$

To provide an illustration, for a government to protect property rights and make available an equitable rule of law, it must raise revenues that in many instances are generated through taxation to support the underlying institutions. In this example the former enhances economic freedom, while the latter reduces it, although it should be noted that the EFW methodology scores countries in a relative sense such that establishing government institutions and policies that support economic freedom does not necessarily punish a nation in terms of its rating, particularly if it does so in an efficient manner. This is an important consideration because a composite economic freedom measure accounts for a particular institutional and policy mix, but the individual areas and components of the index are likely heterogeneous across economies, reflecting different histories and institutional development, and may individually exert a differential impact on economic inequality.

Most scholars who have studied economic freedom and inequality have recognized that the individual areas of an economic freedom index may exert a heterogeneous effect on inequality. Berggren (1999) advanced a framework consisting of two representative agents, rich and poor, as a means to theoretically examine how various components of economic freedom affect income inequality, concluding that with the exception of income redistribution, which reduces economic freedom and inequality, the relationship between the two variables is theoretically ambiguous. Scully (2002) structured an econometric model in which inequality is a function of both economic growth and economic freedom, and economic growth is a function of economic freedom. Scully's specification assumes that economic freedom exerts both a direct effect and indirect effect via growth on inequality. Building on these two frameworks, as well as the institutions-augmented neoclassical production function specified in chapter 2, an N-person framework is considered below as a means to examine the relationship between the various components of economic freedom and their impact on the distribution of income.

The framework described here differs from that of Berggren (1999) and Scully (2002) in several ways. First, it is more general in that it consists of a discrete number of N households whose incomes are distributed uniformly; whereas Berggren's framework consisted of two representative agents –rich and poor. Second, Berggren assumes that government redistribution policies are costless. Okun (1975) described redistribution, whether through tax and transfer or regulatory policies, as a "leaky bucket," meaning that there is an efficiency loss in terms of reduced aggregate output when income is redistributed. There are several mechanisms that could result in the bucket leaking, including not only the imposition of information and transactions costs, but also efficiency-reducing market distortions. This will be discussed more below, but the framework presented here accounts for the leaky bucket of redistribution. Next, Scully models growth as a function of the level of economic freedom. The framework below, which is based on an institutions-augmented neoclassical production function, suggests that growth is a function of the change in economic freedom.[61] Finally, Kuznets (1955) and many subsequent researchers (e.g. Barro, 2000; Brenner, Kaelble and Thomas, 1991) have assumed that inequality is a non-linear function of the level of development, whereas Berggren and Scully model inequality as a linear function of the level of development and growth rate, respectively. The framework presented here models inequality as a function of individual incomes, which can be rewritten in terms of individual income growth rates.[62]

4.2.1 Institutions-Augmented Production Function

Economic freedom is modeled as a linear combination of K institutional and policy components. The institution and policy mix determines the rules and incentives faced by agents in an economy (North, 1980, 1991) such that a given level of economic freedom allocates resources in a manner that generates some distribution of income in period t. Easterly (2007) refers to this as natural inequality. Aggregate income, Y_t, is defined by the institutions-augmented neoclassical production function given by equation 4.2, which is characterized by constant returns to scale. Total factor productivity (TFP) is a function of K components of economic freedom and a vector of other explanatory variables, X_t', as given by $A_t = A_0 e^{\sum_{k=1}^{K} \beta_k (EF_{k,t} - EF_k^*)} e^{X_t' \gamma}$. The distance between the observed level of each component of economic freedom and ideal economic freedom, $EF_{k,t} - EF_k^*$, serves as a productivity deflator, assuming that economic freedom is measured on a normalized scale that is increasing in economic freedom.[63] The further component k is from the ideal level, all else equal, the further the economy is operating inside the production possibilities frontier. Equation 4.2 also indicates that aggregate income in period t can be

[61] In their review of the literature, De Haan, Lundström and Sturm (2006) argue that growth should be modeled as a function of change in economic freedom rather than the level.
[62] Cross-sectional results tend to support the Kuznets Hypothesis, but panel and time series results do not (see e.g. Ahluwalia 1976a, 1976b; Anand and Kanbur 1993; Li, Squire, and Zou 1998).
[63] The EFW index is measured on a 0-10 scale that is increasing in economic freedom.

expressed in terms of aggregate income in period t-1 and the growth rate of aggregate income, $\dot{Y}_t$, in period t.

$$Y_t = A_t K_t^{\alpha_1} H_t^{\alpha_2} L_t^{\alpha_3} = Y_{t-1}(1 + \dot{Y}_t) \tag{4.2}$$

$$\ln y_t = \alpha_0 + \sum_{k=1}^{K} \beta_k EF_{k,t} + X_t'\gamma + \alpha_1 \ln k_t + \alpha_2 \ln h_t \tag{4.3}$$

$$\dot{y}_t = \sum_{k=1}^{K} \beta_k \dot{EF}_{k,t} + \alpha_1 \dot{k}_t + \alpha_2 \dot{h}_t \tag{4.4}$$

Dividing equation 4.2 by population, L_t, normalizing it to per-capita terms such that $w_t = W_t/L_t$, and taking the natural log yields equation 4.3, where $\alpha_0 = \ln A_0 - \sum_{k=1}^{K} \beta_k EF_k^*$ is a constant that reflects the productivity level of an economy with absolutely no economic freedom.[64] Letting $\dot{w}_t = \ln w_t - \ln w_{t-1}$ denote the growth rate of variable w_t, the growth rate of aggregate income can be obtained by differencing equation 4.3 and is given by equation 4.4, which indicates that growth of per capita income is a function of changes in the K components of economic freedom.

4.2.2 An N-Agent Framework with Redistribution

The setup here differs from that of Berggren (1999) in several ways. First, Berggren's framework consisted of 2 agents – rich and poor. The framework here is generalizable to N agents. Next, Berggren modeled government redistribution policy as a costless system that taxed the income of the rich at proportion rate τ_t and transferred the revenues to the poor as a lump-sum payment T_t. Such a framework assumes that redistribution is top-down such that high income households are taxed with the proceeds paid to low income households, and occurs with no economic cost. Neither of these assumptions may hold in practice. For instance, Olson (1982) argues that government redistribution is often not motivated by egalitarian reasons and that income is often redistributed from lower to higher income people, citing subsidies for private airplanes and jets in the United States as an illustration. Rent-seeking theory is based on non-egalitarian redistribution, and Tullock (1967) and Krueger (1974) shows that rent-seeking can result in a large welfare losses. In addition, Berggren's analysis assumes that transfers payments do not distort the labor-leisure decision of recipients. The standard labor-leisure model suggests that transfer payments are unearned income that will result in a pure income effect such that

[64] Given that the components of the EFW index are measured on a scale of 0-10, the intercept can be rewritten as $\alpha_0 = \ln A_0 - 10K \sum_{k=1}^{K} \beta_k$ if we assume that an EF score of 10 is ideal.

recipients can increase their utility by reducing the amount of time that they allocate to labor, and therefore reduce their gross market income.

The framework advanced here is general enough to allow for horizontal or regressive redistribution that may result from a political environment in which rent-seeking, crony capitalism, and/or corruption plague government policy (Barro, 2000; Olson, 1982; Stiglitz, 2013). It also allows for government redistribution to impose an economic cost on the economy and for transfers payments to reduce the gross income of recipients. The implications of the framework suggest that Berggren's conclusion that government redistribution lowers inequality is not generalizable to all economies.

Consider an economy consisting of N-agents operating within a given set of institutions and policies that result in a uniform distribution of gross incomes. Let y_t^i denote the gross income of agent i in period t. If the government redistributes income, then assume that it does so through a tax-and-transfer system and runs a balanced budget.[65] The production function specified above suggests that redistribution, which reduces economic freedom, will result in a reduction in the level of productivity in an economy and a loss of aggregate income. Okun (1975) refers to the loss of economic efficiency when incentives to earn income are distorted by redistribution policies as a "leaky bucket." Accounting for this phenomenon, agent i's net income in period t, $\bar{y}_t^i$, is a function of his tax rate τ_t^i and lump-sum transfer T_t^i as given by equation 4.5. Note that agent i's income in period t can be expressed as a function of her tax rate, transfer, income in the previous period, and the growth rate of her gross income $\dot{y}_t^i$.

$$\bar{y}_t^i = y_t^i(1-\tau_t^i) + T_t^i = [y_{t-1}^i(1+\dot{y}_t^i)](1-\tau_t^i) + T_t^i \tag{4.5}$$

$$\sum_{i=1}^N \tau_t^i y_t^i = (1-\lambda)\sum_{i=1}^N T_t^i \tag{4.6}$$

$$Y_t = Y_{t-1}(1+\dot{Y}_t) = \sum_{i=1}^N y_t^i - \lambda\sum_{i=1}^N T_t^i = \sum_{i=1}^N y_{t-1}^i(1+\dot{y}_t^i) - \mu_t \tag{4.7}$$

The government budget constraint, given by equation 4.6, reveals the mechanism by which the efficiency tax imposed on the economy to redistribute income works. Aggregate tax revenues are greater than or equal to aggregate transfers, with the difference $\mu_t = \lambda\sum_{i=1}^N T_t^i$ not making its way back into economic production. The "efficiency tax" on the economy from government engaging in redistribution is represented by $\lambda \in [0,1]$. Berggren's (1999) framework

[65] Empirical evidence indicates that the balanced budget assumption is violated in most countries, but for simplicity it is assumed that governments face this constraint.

represents a special case where $\lambda = 0$. This loss of income could be thought of as the transaction cost of government redistribution that manifests itself in reduced incentives to invest, save, and/or work (Barro, 2000). This government framework likewise applies to government regulations that result in a redistribution of income such as minimum wage laws that raise the wages of those who maintain their jobs in low wage occupations but result in a loss of opportunities for others to supply their desired quantity of labor (e.g. Olson, 1982, p. 174).

Given the efficiency loss involved with government redistribution policies, aggregate income in period t is the sum of gross incomes net of μ, as given by equation 4.7, which can also be rewritten as a function of all individual incomes in the previous period, individual gross income growth rates, and μ_t. Agent i's share of gross and net income are given by $\theta_t^i = y_t^i / Y_t$ and $\bar{\theta}_t^i = \bar{y}_t^i / Y_t$, respectively. $\bar{\theta}_t^i > \theta_t^i$ for a net beneficiary of redistribution, while the opposite is true for a net tax payer. Gross and net income shares are equivalent for all agents ($\bar{\theta}_t^i = \theta_t^i, \forall i$) when there is no redistribution. Complete equality of income is achieved when net income shares are equalized across all agents ($\bar{\theta}_t^i = \bar{\theta}_t^{-i}, \forall i$).

4.2.3 Redistribution and Inequality

Given the very low likelihood that an unhindered market achieves complete equality or the magnitude of redistribution is sufficient to do so, a measure of relative income inequality that accounts for all N agents is needed to determine whether inequality has increased, decreased or remained unchanged after redistribution. The Gini coefficient satisfies this property. For incomes that are uniformly distributed among the population, indexed in non-decreasing order, the net income Gini coefficient $\overline{Gini}_t$ is computed using equation 4.8. The gross income Gini coefficient $Gini_t$ is computed using the same algorithm but replacing net individual incomes with gross incomes (y_t^i for $\bar{y}_t^i, \forall i$). If $\overline{Gini}_t > \overline{Gini}_{t-1}$ then net inequality increased between the two periods, and if $\overline{Gini}_t < Gini_t$, then redistribution lowered inequality in period t.

$$\overline{Gini}_t = \frac{1}{N}\left[N + 1 - 2\left(\frac{\sum_{i=1}^{N}(N+1-i)\bar{y}_t^i}{\sum_{i=1}^{N}\bar{y}_t^i}\right)\right] \qquad (4.8)$$

Substituting equation 4.5 into equation 4.8, we observe that net inequality in period t is a function of $y_{t-1}^i, \dot{y}_t^i, \tau_t^i$ and $T_t^i, \forall i$. The redistribution policy variables τ_t^i and $T_t^i, i \in [1, \ldots, N]$ are negatively related to economic freedom such that $\frac{\partial EFI_t}{\partial \tau_t^i} < 0$ *and* $\frac{\partial EFI_t}{\partial T_t^i} < 0, \forall i$. Equation 4.4

suggests that an increase in redistribution, which reduces economic freedom, acts to reduce the aggregate growth rate. Given that this framework necessitates that an increase in government redistribution reduces the aggregate growth rate when $\lambda > 0$, it follows that redistribution may exert a heterogeneous impact on the growth rate of individual gross incomes. How this impacts income inequality depends on the relative effects on individual growth rates. If the growth-reducing effects of redistribution disproportionately impact upper income agents, then inequality will be reduced. If on the other hand it exerts a relatively greater downward effect on lower income agents, then inequality may rise if transfer payments are not sufficient to overcome the reduction in gross income attributable to the loss of economic efficiency.

Because it is trivially obvious that regressive redistribution results in more inequality, assume redistribution policy is progressive such that income is redistributed from high earners to low earners. Equation 4.5 models income transfers as a non-distortionary lump-sum payment that does not affect a recipient's labor-leisure decision, assuming that gross income is earned by selling one's labor and that leisure is the opportunity cost of working. In this case it is trivially clear that progressive redistribution reduces inequality, as suggested by Berggren (1999). As mentioned above, the standard labor-leisure model suggests that unearned income will exert a pure income effect such that transfer recipients will reduce the amount of time allocated to labor and increase the amount allocated to leisure. Given this result, an individual's growth rate of gross income will be reduced the period in which he becomes eligible for a transfer. Transfers could alternatively be modeled in the form of a negative income tax rate such that they are explicitly distortionary. Many practical transfer policies have phase out provisions such that they do exert an impact on individual's marginal labor-leisure decisions. In this case, individuals with a dominant income effect will respond by reducing labor effort, while those with a dominant substitution effect will work more. Unless transfers are distortionary and an individual has a dominant substitution effect, economic theory suggests that transfer payments will result in a reduction in an individual's gross income and hence, individual growth rate of gross income, $\frac{\partial \dot{y}_t^i}{\partial T_t^i} \leq 0$, ceteris paribus. If these individuals do not receive a transfer payment that is sufficient to compensate for the loss of gross income, inequality could rise depending on how the policy impacts the gross income of higher income individuals.

Now consider a high income individual who is a net tax payer. The income tax is modeled as distortionary. If the tax rate is sufficiently high and the individual has a dominant substitution effect, it will result in this individual substituting away from earning income to taking more leisure since the opportunity cost of leisure is reduced with an increase in his marginal tax rate. An increase in the tax rate for an individual with a dominant substitution effect will therefore result in a reduction in his gross income and growth rate. Another high income individual with a dominant income effect may however increase her time allocated to market production to compensate for the loss of income from taxation. Thus the effect of an increase in taxes on the growth rate of personal gross income for high income earners is theoretically ambiguous.

While transfer payments to low-income individuals may act to reduce inequality when non-distortive, they may distort the labor-leisure decisions of beneficiaries and exert an offsetting effect. If transfer recipients reduce their allocation to work to enjoy more leisure, which is typically considered a normal good; their gross income is reduced as well as the growth rate of their gross income. If transfer payments are not of sufficient magnitude to compensate for the reduction in gross income and/or net tax payers with a dominant income effect increase their gross income to compensate for taxes paid, inequality could rise within a redistribution system. The distortions created by redistribution could also exacerbate inequality over time if the work disincentives are large enough for individuals to develop a dependency on transfers for their economic livelihood. Such individuals are likely to experience stagnation in their incomes over time, while those remaining in the labor force acquire additional human capital and likely experience real gains in their income as time passes when the disincentives from taxation are not too high (Bennett and Vedder, 2014). Thus it is not clear a prioi that progressive redistribution will reduce inequality if transfers distort market allocation decisions. Letting $T_t = \frac{\lambda \sum_{i=1}^{N} y_t^i \tau_t^i}{Y_t}$ represent the extent of income redistribution in an economy, Equations 4.9a to 4.9c summarize the theoretical implications of an increase in redistribution on net income inequality, depending on the nature of the redistribution and the distortionary effects of transfers on the individual income growth rates of beneficiaries.

$$\frac{\partial \overline{Gini}_t}{\partial T_t} > 0 \; if\ redistribution\ is\ regressive \qquad (4.9a)$$

$$\frac{\partial \overline{Gini}_t}{\partial T_t} < 0 \; if\ redistribution\ is\ progressive\ and \frac{\partial \dot{y}_t^i}{\partial \tau_t^i} = 0, \forall i \qquad (4.9b)$$

$\frac{\partial \overline{\text{Gini}}_t}{\partial T_t}$ ambiguous if redistribution is progressive and $\frac{\partial \dot{y}_t^i}{\partial \tau_t^i} < 0, \frac{\partial \dot{y}_t^j}{\partial \tau_t^j} \geq 0$ for some i, j (4.9c)

Equations 4.9a and 4.9b indicate that regressive redistribution and progressive redistribution that does not distort the labor-leisure decision of recipients unambiguously leads to increases and decreases in net inequality, respectively. Equation 4.9c meanwhile indicates that distortionary progressive redistribution has an ambiguous impact on net inequality. Most redistribution policies in practice are progressive and distortionary to some extent such that the latter environment likely prevails, and the theoretical impact of progressive redistribution on inequality depends on the extent and distribution of the distortions created by the redistribution policies, as well as the magnitude and allocation of the transfer payments.[66]

The above framework assumes that the state engages in redistribution. Progressive taxation and welfare spending are predominantly practiced in Western Democracies, whereas less developed countries typically have very small transfer sectors. For instance, the average transfer sector of the 24 Latin American and Caribbean (LAC) and 29 African nations amounted to 5.1 and 2.7 of GDP in 2005, respectively.[67] Meanwhile the average transfer sector of the 30 OECD nations (excluding Chile, which is included in the LAC group) comprised 18 percent of GDP. Because redistribution comprises such a small share of economic activity in less developed countries, measures of gross income inequality are likely to be similar to measures of net income inequality such that the former provide a good proxy for the degree of inequality in society. Redistribution in advanced economies is more pronounced such that measures of net and gross income inequality likely reflect substantial differences in inequality. For advanced economies that engage in significant redistribution, a net measure of inequality is appropriate.

[66] Åberg (1989) constructs a model which shows that welfare states on net reduce inequality. Bergh (2007) and Le Grand and Winter (1986) find evidence that the inequality-reducing effects of the welfare state are attributable to benefits derived primarily by the middle class, a result predicted by the median voter theorem (see e.g. Persson and Tabellini, 1992; Perotti, 1996). Clark and Lawson (2008) and Scully (2002) find that countries with high top marginal tax rates have less inequality. Roine, Vlachos and Waldenström, hereafter RVW (2009), find evidence that top marginal tax rates reduce the income share of the top 10 percent of the distribution and increase it for the bottom 90 percent, but indicate that the effects are small for a panel of 16 mostly advanced economies over the twentieth century. Mehlkop (2002) provides a survey of the empirical literature related to the government transfer sector and inequality.

[67] Only countries included in the Economic Freedom of the World are included in these figures. Excluding Venezuela, for which transfers and subsidies comprised 16% of GDP, the average over the LAC countries drops to 4.6%.

4.2.4 Liberalization, Growth, and Inequality

The above framework provides guidance on how the government transfer sector influences inequality. Now assume that there is no redistribution so that we can examine how liberalization of the economy impacts inequality. This can easily be done by setting $T_t^i = \tau_t^i = 0,\ \forall i, t$, and is equivalent to holding redistribution constant. Now equation 4.8 reflects the gross income Gini coefficient and is a function of all individual gross incomes in the previous period and their growth rates. To understand how liberalization of the various components of economic freedom will impact inequality, first recall from equation 4.7 that we can rewrite the aggregate growth rate of the economy as $\dot{Y}_t = (Y_t - Y_{t-1})/Y_{t-1}$. Next, recall that $\theta_i = \frac{y_t^i}{Y_t}$ denotes individual i's gross share of aggregate income. We can rewrite aggregate income as $Y_t = y_{t-1}^i(1 + \dot{y}_t)/\theta_i$. Now the aggregate growth rate can be expressed as a function of individual i's share of gross income in periods t and t-1, and his gross income growth rate, or $\dot{Y}_t = \frac{[\theta_{t-1}^i(1+\dot{y}_t^i)-\theta_t^i]}{\theta_t^i}$. Next, this aggregate growth rate can be equated to equation 4.4 and solve for individual i's growth rate as given by equation 4.10, where $\phi_t = \sum_{k=1}^{K} \beta_k \dot{EF}_{k,t} + \alpha_1 \dot{k}_t + \alpha_2 \dot{h}_t$.

$$\dot{y}_t^i = (\phi_t - 1)\left(\frac{\theta_t^i}{\theta_{t-1}^i}\right) - 1 \qquad (4.9c)$$

Within this framework we see that the partial derivative $\frac{\partial \dot{y}_t^i}{\partial \dot{EF}_{k,t}} = \beta_k(\frac{\theta_t^i}{\theta_{t-1}^i})$ suggests that individual i's gross income growth rate is affected by liberalization of economic freedom component k and is a function of the marginal impact of liberalization on the aggregate growth rate of the economy as well as the ratio of the individual’s share of income in period t to period t-1, $\nu_t^i = \frac{\theta_t^i}{\theta_{t-1}^i}$. While theory indicates that the aggregate growth rate of the economy is a positive function of changes in economic freedom, it does not tell us how this growth will be allocated among an economy’s agents. If $\nu_t^i = 1, \forall i$ then all individuals realize the same rate of income growth and inequality remains unchanged. This is likely not to be the case in most economies in practice, as economic growth often exerts a stronger impact on some sectors than it does others. Depending on the composition of an economy’s sectors and the allocation of individuals’ resources among its sectors, the impact of economic liberalization is likely to exhibit a heterogeneous impact on individual income growth rates. As such an individual whose resources are allocated to a sector that benefits relatively more from growth-enhancing liberalization k is likely to experience greater income growth than someone whose resources are allocated to a sector less impact by the liberalization. Because economic liberalization is likely to exert a heterogeneous impact on individual income growth rates, the affect that economic liberalization exerts on inequality will depend on how the gains from economic growth are distributed among a population. Thus we need to discern how changes in economic freedom and its various components differentially influence the growth rates of gross individual incomes in order to understand how changes in economic freedom influence income inequality indirectly through the growth channel. It is probable that conditions 4.11a-4.11c are satisfied for an economy comprised of N agents.

$$\frac{\partial \dot{y}_t^i}{\partial \dot{EFI}} \neq \frac{\partial \dot{y}_t^j}{\partial \dot{EFI}} \text{ for at least some } i \neq j \tag{4.11a}$$

$$\frac{\partial \dot{y}_t^i}{\partial \dot{EF}_{k,t}} \neq \frac{\partial \dot{y}_t^j}{\partial \dot{EF}_{k,t}} \text{ for at least some } i \neq j \text{ and some } k \in [1, \dots, K] \tag{4.11b}$$

$$\frac{\partial \dot{y}_t^i}{\partial \dot{EF}_{k,t}} \neq \frac{\partial \dot{y}_t^i}{\partial \dot{EF}_{h,t}} \text{ for at least some } k \neq h \in [1, \dots, K] \text{ and some } i \tag{4.11c}$$

Conditions 4.11a and 4.11b suggest that changes in overall economic freedom and some component k of economic freedom will exert a differential impact on the gross income growth rate of at least some agents i ≠ j, respectively. This follows from the idea that changes to institutions and policies will impact different sectors of the economy heterogeneously such that individuals whose resources are employed in a sector that exhibits high growth from an institutional change will likely experience greater personal income growth than individuals whose resources are employed in a relatively lower growth sector. For instance financial deregulation will improve economic freedom and promote growth in the financial sector, likely increasing the incomes of those employed in it. While both economic freedom and overall growth increase as a result of the deregulation, those employed in sectors not directly impacted by the deregulation will likely benefit from the uptick in economic activity, but probably to a lesser extent than those employed in the financial sector (Greenwood and Jovanovic 1990; RVW 2009). Condition 4.11c suggests that changes in at least some components of economic freedom $\dot{EF}_k \neq \dot{EF}_h$ will exert a differential impact on the gross income growth rate of at least some agents. For instance, persons employed in the import sector will likely benefit from both reductions in trade barriers and an improvement in monetary policy, but they are likely to experience a greater income gain from liberalization of the former than the latter.

The few examples discussed above are illustrative of the theoretical ambiguity surrounding the many channels through which economic freedom influences inequality, both directly through redistribution and indirectly through the growth channel. Because the indirect effects of changes in economic freedom on inequality work through the growth channel, these effects largely depend on the existing institutional and policy structure of an economy, as well as the composition of its workforce and resource allocations. Examining all of the possible permutations is beyond the scope of this chapter. It can be said with certainty that if the relative gains from growth are distributed such that individual growth rates are a positive linear function of previous income, then inequality unambiguously rises with economic liberalization. It can also be said that if the opposite holds, that is individual gross rates are a negative linear function of personal income, then inequality unambiguously falls with economic liberalization. Unfortunately no other unambiguous claims can be made. While the framework described here provides more clarity on the various channels through which economic freedom impacts inequality than previous research, it unfortunately leaves us with theoretical ambiguity. This would perhaps be more satisfying if the empirical evidence provided some clarity, but as will be discussed in the remainder of this chapter, the empirical evidence is also mixed.

4.3 Data & Correlation Analysis

In this section, the cross-country correlations between eight different measures of inequality and the Economic Freedom of the World (EFW) index and its five individual areas are examined as a first step to understand how inequality and economic freedom might be related. The eight measures of inequality are the (1) net and (2) gross income Gini coefficients from Solt's (2009) Standardized World Income Inequality Database version 4.0 (SWIID); (3) gross household income Gini coefficients from the University of Texas Inequality Project (UTIP); the (4) net income, (5) gross income, and (6) consumption Gini coefficients from the custom dataset described in chapter three; and the ratios of income earned by the (7) top 10 percent to the bottom 10 percent of the distribution (90/10), and (8) top 20 percent to bottom 20 percent of the distribution (80/20). Data for the latter two income ratio inequality measures are from the World

Bank World Development Indicators (WDI) and UNU/WIDER World Income Inequality Database (WIID).[68]

The EFW data represent the chain linked composite index and five area sub-indices from the EFW dataset. The composite EFW index is the simple average of each of the five main area indices. Area 1 (EF1) is an index consisting of components measuring the size of government. More government is associated with less economic freedom such that higher EF1 scores represent less government involvement in the economy. Area 2 (EF2) is an index consisting of components that measure the rule of law and protection of property rights. Countries with an independent judicial system that practice the even-handed enforcement of contracts and protect private property receive high scores in this area. Area 3 (EF3) is an index comprised of components that measure the soundness of monetary policy. Countries that limit the growth rate of money and inflation, and allow citizens to own foreign bank accounts receive score highly in this area. Area 4 (EF4) is an index comprised of components that measure the freedom to trade internationally. Area 5 (EF5) is an index comprised of components that measure freedom from onerous regulation of business, credit, and labor markets (Gwartney, Lawson and Hall 2013). Summary statistics and descriptions of all the variables used in this chapter are provided in appendix Table E.1.

A casual examination of the data suggests that countries with more economic freedom generally exhibit lower levels of income inequality than do less free countries. Figure 4.1 plots the average SWIID net income inequality Gini over the period 1990-2010 against the average EFW measure over the period 1985-2010 for a sample of 108 countries. The simple correlation between the two variables is moderately negative at -0.37, although there are some countries that exhibit both high levels of economic freedom and income inequality, as well as countries that have both low levels of economic freedom and income inequality. For instance, Chile and Panama, two Latin American nations, are each among the top quartile of countries in terms of both economic freedom and income inequality. Four former Soviet-bloc countries (Bulgaria, Poland, Romania, and Ukraine) are among the bottom quartile of nations in terms of both economic freedom and income inequality.

[68] See chapter three for more information on these measures.

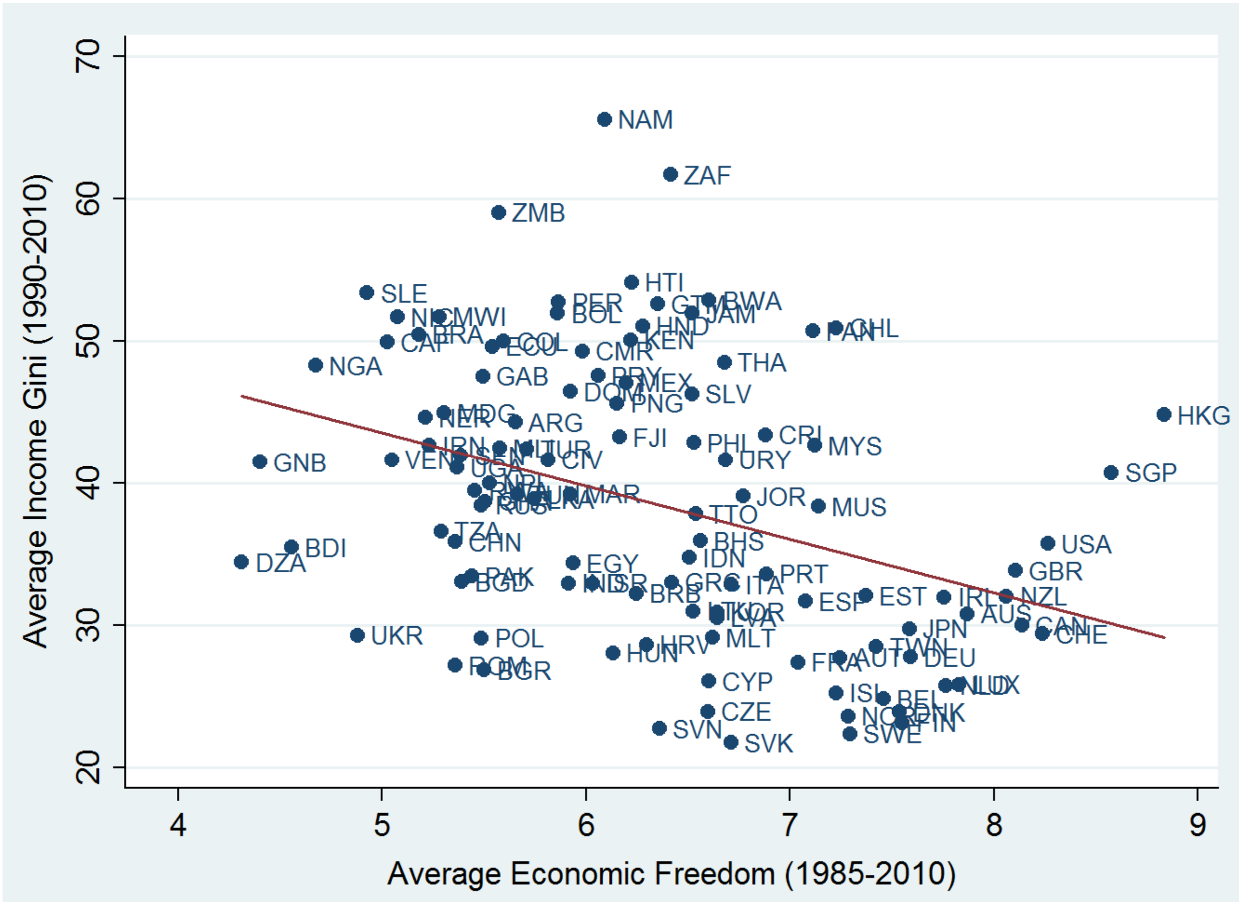

Figure 4.1: Income Inequality vs. Economic Freedom

Appendix Table E.2 provides the simple contemporaneous pairwise correlations between each inequality measure and the various economic freedom indices. The correlations for each five-year period spanning the period 1970-2010 are given in panels A to I. The mean pairwise correlations over all time periods are given in panel J. Panels K and L indicate the share of pairwise correlations over the time period that are of moderate ($0.3 \leq |\rho| < 0.5$) and strong ($|\rho| \geq 0.5$) strength, respectively. Panel M gives the share of pairwise correlations that are negative. Panel N and O provide the share of pairwise correlations that are both negative and of at least moderate strength ($\rho \leq -0.3$) and positive and of at least moderate strength ($\rho \geq 0.3$), respectively.

Table 4.1 provides a summary of the pairwise correlations over all of the years and measures of inequality. There are 56 correlations between inequality and each measure of economic freedom. EFW is negatively correlated with inequality in 85.7 percent of the pairwise correlations. When positive, the correlation is always weak ($|\rho| < 0.3$). The correlation is negative and at least of moderate strength for slightly more than a third (35.7 percent) of the pairwise correlations, but there are very few (3 of 56) instances of a strong negative correlation between EFW and inequality. These simple pairwise correlations suggest that more free economies in general exhibit lower levels of inequality, but the correlations are in general not very strong.

Table 4.1: Summary of Pairwise Correlations between Economic Freedom and Inequality

	(A) % Moderate $0.3 \leq \lvert\rho\rvert \leq 0.5$	(B) % Strong $\lvert\rho\rvert \geq 0.5$	(C) % Negative $\rho < 0$	(D) % $\rho \leq -0.30$	(E) % $\rho \geq 0.30$	(F) # Correlations
EFW	30.4	5.4	85.7	35.7	0.0	56
EF1	32.1	19.6	7.1	0.0	51.8	56
EF2	32.1	39.3	98.2	71.4	0.0	56
EF3	35.7	1.8	76.8	37.5	0.0	56
EF4	32.1	8.9	82.1	41.1	0.0	56
EF5	8.9	1.8	67.9	8.9	1.8	56

Pairwise correlations by year provided in appendix Table E.2

The pairwise correlations between EF1 and inequality are mostly positive (92.9 percent), with most exceptions found in column 6 of appendix Table E.2, for which consumption Gini is the measure of inequality used. Most of the correlations are of at least moderate strength in columns 1, 3 and 4, and more than half (51.8 percent) of all of the pairwise correlations are both positive and of moderate strength or higher. There are no instances of moderate negative correlation between EF1 and inequality. These simple pairwise correlations suggest that countries with relatively larger government sectors (less free economically) in general exhibit lower levels of inequality.

The mean correlation between EF2 and each measure of inequality is negative, and all but one (98.2 percent) of the pairwise correlations is negative. The sole exception occurs when gross income Gini is used as the measure of inequality for the year 2010 (appendix Table E.2, panel A, column 5) when there are only 19 countries in the sample. More than 71 percent of all of the pairwise correlations are negative and at least moderate in strength, including all of the correlations in columns 1, 3, and 4 of appendix Table E.2. The majority are both of moderate strength and negative in all but column 6, which uses consumption Gini as the inequality measure. None of the pairwise correlations are moderately positive. The correlations between

EF2 and inequality are the strongest and most consistent among the economic freedom variables, and strongly suggest that countries that provide a more equitable rule of law and protection of property rights also exhibit less economic inequality.

More than three-fourths (76.8 percent) of the correlations between EF3 and inequality are negative, although the means are weakly positive and zero in columns 5 and 6 of appendix Table E.2, respectively. In columns 1, 2, 3, and 4, the share of pairwise correlations of at least moderate strength and negative are 78, 33, 63, and 50 percent, respectively. The respective shares are 14 and 29 percent in columns 7 and 8 of appendix Table E.2. None of the pairwise correlations between EF3 and inequality in columns 5 and 6 are of moderate strength or better. Overall, 37.5 percent of all of the correlations are negative and of at least moderate strength. These correlations suggest that countries with more sound monetary policy also tend to exhibit less economic inequality.

EF4 and inequality are typically negatively correlated. The mean pairwise correlation is negative in each of the eight columns of appendix Table E.2, with all correlations negative in columns 1, 4, and 5. The majority are negative in the remaining columns. Overall, 82.1 percent of the pairwise correlations are negative. When the UTIP gross income Gini is the measure of inequality (appendix Table E.2, column 3), all of the correlations are both negative and at least moderate strength. Approximately four-fifths of the correlations in columns 1 (78 percent) and 4 (83 percent) of appendix Table E.1are both negative and of at least moderate strength. Overall, 41.1 percent of the correlations are at least moderately negative and none are moderately positive, suggesting that countries that offer greater freedom to trade internationally also tend to have less inequality.

More than two-thirds (67.9 percent) of the pairwise correlations between EF5 and inequality are negative. The majority of the correlations are negative in columns 1 and 3 to 8 of appendix Table E.2. Only one-third are negative in column 2. Only 8.9 percent of all the correlations are of moderate strength or better. In columns 3, 4, and 6 of appendix Table E.1, the shares of correlations that are both negative and moderate strength or above are 38, 17, and 20 percent, respectively. Twenty percent have a moderate positive correlation in column 5, and there is one correlation that is moderately positive (appendix Table E.1, column 6, panel C). EF5 and inequality are generally negatively correlated, suggesting that less regulated economies have less inequality; although the correlations are the weakest of any of the areas of economic freedom however.

The cross-sectional correlation between economic freedom and inequality is in general negative, but this does not hold across all five areas of the EFW index. The strength of the correlation and consistency across time periods also varies by freedom area. The correlation between EF1 and inequality suggests that countries with more limited government also tend to have greater inequality. The remaining areas exhibit a negative correlation with inequality. EF2 has the most robust and strongest correlation across measures of inequality and time periods, indicating that countries with a better rule of law and property rights protections tend to have less inequality. Sound money and freedom to trade internationally are also generally negatively correlated with inequality. Although the pattern of the correlations between EF5 and inequality is generally negative, the correlations between regulatory burden and inequality are the weakest and least robust among the economic freedom areas.

4.4 Literature Review: Non-Robustness of Empirical Evidence

A few studies have explicitly examined the relationship between economic freedom and inequality across countries empirically, but have produced relatively inconsistent results. As Hall and Lawson (2013) note, "the evidence…indicates that more economic freedom may come at the price of a very slight increase in income inequality. We hasten to add that this strain of literature is quite small, and the international data on income inequality are so questionable that caution is still warranted in drawing any conclusion" (p. 8). In addition to concerns over the quality and comparability of inequality data discussed in chapter three, other potential factors that have contributed to the non-robustness of results include the use of different datasets and econometric techniques in the various studies on economic freedom and inequality. As the correlation analysis in section 4.3 indicates, the relationship between economic freedom and inequality is very complex. The different areas of freedom correlate in different magnitudes (in the case of EF1 a different direction) with inequality. These correlations are often inconsistent for different measures of inequality, periods of observation, and country samples.

Several scholars have made us of cross-sectional data to explore the empirical relationship between economic freedom and inequality, generally finding that economic freedom is associated with less income inequality – consistent with the correlations discussed above

(Berggren, 1999; Clark and Lawson, 2008; Scully, 2002). Others however have utilized panel data methods to explore the time series variation within nations, generally finding that economic freedom is weakly associated with more inequality (Carter, 2006; Bergh and Nilsson, 2010). That the two methods of examining how economic freedom affects inequality have resulted in quite different results is not surprising given that (1) economic freedom is a robust determinant of economic development, and (2) empirical evidence often supports the inverted U-shaped Kuznets' curve between economic development and inequality when cross-sectional data are used, but generally not when panel or time series data are utilized.[69] Thus it is not surprising that an examination of the cross-sectional data suggest that countries with more economic freedom have less inequality, particularly when the sample of countries contains a disproportionate number of developed countries, but an examination of the time series variation within countries using panel data suggest a much weaker statistical relationship.[70]

Still another factor is that the various authors have made use of different datasets and examined the relationship between economic freedom and inequality over different periods of time for different samples of countries. Berggren (1999) uses the Deininger and Squire (1996) inequality dataset and an earlier version of the EFW index to analyze the relationship between the two variables for up to 102 countries, finding that increases in EFW from 1975-1985 and the level of EFW in 1985 are associated with less and more income inequality in 1985, respectively. Scully (2002) uses inequality data (Gini coefficients and income quartile ratios) from the Deininger and Squire dataset and an economic freedom index consisting of nine "policy" variables for a sample of 26 mostly advanced economies over the period 1975-1990. He finds that economic freedom is associated with more economic growth and less income inequality, but that growth exerts a small but positive effect on income inequality. The result that the level of economic freedom is associated with more income equality is opposite the findings reported by Berggren.[71]

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[69] This result may be attributable to the relatively short duration of time-series data available relative to the length development process for a given country, whereas cross-sectional studies include countries at various stages of development.

[70] Like the development process, institutional changes tends to be slow such that economic freedom time series may not be long enough in duration to reflect major institutional changes. Inequality also tends to be highly persistent over time.

[71] Scully attributes the differences between his findings and those of Berggren to the latter's failure to account for definitional differences in the measures of inequality contained in the Deininger and Squire dataset, which Scully attempted to control for by using a series of dummy variables for different inequality concepts, an approach that is common in the literature (e.g. De Gregorio and Lee 2002), but has been subject to criticism as discussed in chapter

Clark and Lawson (2008) likewise model inequality as a function of both growth and economic freedom. Using inequality measures from the World Bank World Development Indicators, they find that both growth and economic freedom are negatively associated with income inequality for a sample of 66 countries. The finding that the level of economic freedom is associated with more equality is consistent with Scully's (2002) findings, but the result that growth is associated with less inequality is not. Clark and Lawson also run a regression with both the level and change in EFW over 1980-2002 included as regressors, both of which are negatively correlated with income inequality. The latter result is consistent with the results obtained by Berggren (1999), but the former is not. Carter (2006) argues that Berggren interpreted his results incorrectly, indicating that inclusion of both the level and change of EFW as independent variables is algebraically analogous to estimating a distributed lag model and as such, increases in EFW are associated with more (less) income equality in the short (long) run.[72] Applying the same logic to a similar regression of Clark and Lawson yields a negative relationship between economic freedom and income inequality in both the short- and long-run. The finding that the level of economic freedom is negatively associated with income inequality is consistent with Carter's interpretation of Berggren's (1999) results.

Bergh and Nilsson (2010) use the SWIID Gini measures to examine the relationship between EFW and income inequality using a fixed effects model for a panel of 78 mostly middle and high income countries over the period 1970-2005. They find a positive relationship between the level of EFW and income inequality, noting that this result may be driven by the over-representation of developed countries in their sample. This result is inconsistent with the findings of Scully (2002), whose sample also consisted of an over-representation of developed countries, and is also inconsistent with the short-run effect if Berggren's (1999) results are interpreted as a distributed-lag model. Berggren's original interpretation of his results are however consistent with the findings of Bergh and Nilsson.

Using relatively consistent inequality measures from the World Institute for Development Economics Research WIID1a dataset to construct an unbalanced panel of 39 developed nations,

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three (Atkinson and Brandilini 2001, 2009; Pyatt 2003). As suggested above, differences in the sample of countries used, time period examined, and econometric specification likely also have contributed to differences in the results of the two studies.

[72] An exchange between Cole and Lawson (2007) and De Haan and Sturm (2007) considers the theoretical and statistical issues of including both the level and change of economic freedom as an independent variable in growth regressions. Similar arguments apply to the relationship between economic freedom and inequality.

Carter (2006) examines the possibility of a parabolic relationship between EFW and inequality over the period 1980-2000. Carter finds evidence of a U-shaped curve that he describes as a policy trade-off between the two variables, suggesting that the relationship is relatively inelastic over a broad range of economic freedom. At relatively high levels of economic freedom, Carter finds a positive relationship between it and inequality, consistent with the findings of Bergh and Nillson (2010).

Another econometric factor that has potentially contributed to the inconclusive results is the use of different model specifications. Berggren (1999) for instance models the level of inequality as a function of the current level of economic freedom and the change in economic freedom over the previous decade. Scully (2002) specifies a system of equations in which the level of inequality is a function of economic freedom both directly and indirectly through growth. Carter (2006) specifies inequality as a quadratic function of economic freedom. Bergh and Nilsson (2010) model the level of inequality as a function of the level of economic freedom for their panel estimates, but they also model the long-run change in inequality as a function of the change in economic freedom. The use of quite different econometric models by the various authors who have examined the issue is at least partially attributable to the fact that the theory that has been advanced thus far has largely concluded that the a priori effect of economic freedom on inequality is ambiguous. Berggren (1999) for instance concluded that "we can say that economic freedom and changes thereof affect the equality level, and we can specify through the channels it does so, but we cannot say in what direction the equality level goes, on net" (p. 208). Although the theoretical framework developed in section 4.2 reaches the same result, it provides some insights on how to model inequality and economic freedom econometrically.

The four main econometric specifications that have been used in this literature are further examined in section 4.5 to explore the robustness of each model to different measures of inequality and expanded country and period coverage. The results highlight that not only have the different econometric specifications used in previous studies sometimes produced contrasting results, but also that the same econometric specification can produce contrasting results when alternative measures of inequality are used, different periods of time are examined, and/or different samples of countries are included. While these new results do not provide a definitive empirical answer on how economic freedom impacts economic inequality, they call into question the findings from previous studies by showing that earlier results are not robust and should therefore not be given much credence by policymakers and others who might wish to use them as a means to advocate for policy changes.

4.5 Further Evidence of the Ambiguous Empirical Relationship

Section 4.4 discusses the non-robustness of cross-country econometric evidence concerning the relationship between economic freedom and inequality. In this section, each of the four main econometric models that have been used in the literature are further tested using comparable measures of economic freedom and inequality that cover longer durations of time and in many instances provide greater country coverage than the original studies. The analysis to follow further complicates the state of knowledge regarding the relationship between these two variables, as it indicates that not only are the results not robust across different econometric specifications, but they are also sensitive to alternative measures of inequality and samples using the same econometric model.

4.5.1 Berggren Cross-Sectional Specification

Berggren (1999) models the level of inequality in 1985 as a function of both the level of economic freedom in 1985 and change in it over the period 1975-1985, as given by equation 4.12, where $\mathrm{EF_t}, \Delta_{10}\mathrm{EF_t},$ and $\mathrm{X_t}$ represent economic freedom in period t, the change in economic freedom between period t and t-10, and a vector of control variables, respectively. His main findings indicate that the level of economic freedom and the change in it are positively and negatively correlated with the level of inequality ($\widehat{\alpha_1} > 0$ *and* $\widehat{\alpha_2} < 0$), respectively.[73] As mentioned above, two criticisms of Berggren's findings have been raised in the literature. First, Scully (2002) points out that the measures of inequality used by Berggren, which were drawn from the Deininger and Squire (1996) dataset, were based on different concepts of income and thus not comparable across countries. The implication of Scully's criticism is that some of the observed variation in the inequality measures across countries is attributable to systematic differences in the various concepts and not actual differences in inequality, thus distorting the regression estimates. The results reported below make use of relatively comparable measures of inequality, significantly reducing any such bias.

[73] Ashby and Sobel (2008) use a similar specification to estimate the impact of economic freedom on inequality in the U.S. states, finding the both the level and change in the form is negatively associated with the latter.

$$\text{Ineq}_t = \alpha_0 + \alpha_1 \text{EF}_t + \alpha_2 \Delta_{10} \text{EF}_t + \beta X_t + u_t \quad (4.12)$$

Next, Carter (2006) argues that the econometric specification employed by Berggren (1999) is algebraically equivalent to a distributed lag model, and that Berggren misinterprets the results. Carter contends that equation 4.12 can be rewritten as equation 4.13, where $\delta_1 = \alpha_1 + \alpha_2$ and $\delta_2 = -\alpha_2$, and that Berggren's findings suggest that the short run effect of economic freedom on inequality is negative, $\widehat{\delta_1} < 0\ since\ |\widehat{\alpha_2}| > |\widehat{\alpha_1}|$, but the long-run effect is positive, $\widehat{\delta_1} + \widehat{\delta_2} = \widehat{\alpha_1} > 0$.[74] While the results reported below pertain to equation 4.12, the distributed lag critique is also addressed in the analysis to follow.

$$\text{Ineq}_t = \alpha_0 + \delta_1 \text{EF}_t + \delta_2 \text{EF}_{t-10} + \beta X_t + u_t \quad (4.13)$$

Ignoring additional control variables, appendix Table E.3 estimates equation 4.12 for each of the eight different inequality measures and each of the economic freedom indices described in section 4.3.[75] Columns 1 and 2 use the SWIID version 4.0 net and gross income Gini measures, respectively. Column 3 uses the UTIP gross household income Gini measures. Columns 4, 5 and 6 use the net income, gross income and consumption Gini coefficients from the custom inequality dataset described in chapter three, respectively. Columns 7 and 8 use the 90/10 and 80/20 income ratios, respectively.[76] Panels A to G of appendix Table E.3 report the cross-sectional OLS estimates for each five-year period over 1980-2010, and panel H reports fixed effects estimates for the same specification over the entire period. Results are only given when the number of countries available is at least 30.[77] Table 4.2 provides a summary of the results.

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[74] An exchange between Cole and Lawson (2007) and De Haan and Sturm (2007) examines the theoretical and statistical issues of including both the level and change of economic freedom as independent variables in growth regressions. Similar arguments apply to the relationship between economic freedom and inequality.

[75] Berggren's main model controlled for both GDP per capita and the adult illiteracy rate. Countries with greater economic freedom tend to achieve greater levels of economic development and their populations tend to have higher literacy rates. Institutional theory of development suggests that both of these variables are (at least partially) causally determined by a nation's institutions such that any observable effect that either variable exerts on inequality may reflect a partial indirect effect of the institutional environment. In addition, including them in the model may introduce partial collinearity and result in a downwards bias of the total impact of institutions on inequality. The illiteracy data also covers a limited number of countries and time periods such that included it as an independent variable will reduce the sample size considerably. For these reasons, GDP per capita and illiteracy are not omitted.

[76] Note that many of the income share observations are based on different income concepts such that issues of comparability arise. These data are nonetheless available for a fairly large number of countries for each period observed. Because they are included mainly as a robustness check, the benefit of the coverage outweighs the cost arising from the comparability issue.

[77] The number of countries for each sample was examined using only the inequality and EFW measures for each period. In a few instances, $N < 30$ for regressions using one or more of the EF areas.

When the summary index EFW is used as the measure of economic freedom, the level is statistically significant (at 10% or better) in 57.8 percent of the 45 OLS regressions, and the change significant in 53.3 percent. The level of EFW has a negative sign in 86.7 percent of the regressions, but conditional on being significant, it is negative 96.2 percent of the time. The only instance of the level of EFW being positive and significant is column 6 of panel C in appendix Table E.3, which uses the consumption Gini data as the measure of inequality for t=2000. Meanwhile, the change in EFW has a negative sign in 51.1 percent of the estimates. When significant, it is negative 54.2 percent of the time. When $t = 1995$ or 2000, the coefficient on the change in EFW, when significant, is always positive. Interpreting the regression equation as a distributed lag model indicates that the short- and long-run effects of EFW on inequality are negative in 77.8 and 86.7 percent of the OLS regressions, respectively. Overall, the OLS estimates of equation 4.12 suggest that the EFW summary index is in general, negatively associated with inequality, although this result is not robust to all of the various measures of inequality or time periods. These results are often opposite those obtained by Berggren. When a fixed effects specification is used in lieu of cross-sectional OLS (panel H, appendix Table E.3), the level of EFW, when significant, is positively related to inequality. Meanwhile, the change in EFW is significant in three of the eight regressions, and has a negative sign for two of the three significant estimates.

Table 4.2: Summary of OLS Regressions – Berggren Specification

	(A) % Negative	(B) % Positive	(C) % Significant (*)	(D) % Negative | *	(E) % Positive | *
EFW	86.7	13.3	57.8	96.2	3.8
ΔEFW	51.1	48.9	53.3	54.2	45.8
EF1	0.0	100.0	75.6	0.0	100.0
ΔEF1	22.2	77.8	44.4	5.0	95.0
EF2	100.0	0.0	88.9	100.0	0.0
ΔEF2	22.2	77.8	44.4	5.0	95.0
EF3	88.9	11.1	68.9	93.5	6.5
ΔEF3	28.9	71.1	20.0	0.0	100.0
EF4	84.4	15.6	66.7	93.3	6.7
ΔEF4	31.1	68.9	40.0	38.9	61.1
EF5	53.3	46.7	24.4	90.9	9.1
ΔEF5	64.4	35.6	46.7	81.0	19.0

45 OLS Regression were run for each measure of economic freedom. Full results provided in appendix Table E.3

The level of EF1 always has a positive sign and is significant in 75.6 percent of the specifications. The change in EF1 is negative in 77.8 percent of the specifications, but when significant (only 28.9 percent of regressions), it is always negative. It is not significant in any of the OLS specifications in columns 3 or 5 of appendix Table E.3. Interpreting the coefficients as a distributed lag model suggests that the short- and long-run effects of smaller government are both associated with more inequality in most specifications. In general, the OLS estimates of equation 4.12 indicate that larger government is associated with less inequality, although the general insignificance of the change in EF1 variable raises concerns about the robustness of these results. The level of EF1 has a positive coefficient in five of the eight fixed effects specifications in panel H of appendix Table E.3, and is always positive when significant. The change in EF1 is negative in 4 of the 8 fixed effects specifications in panel H, including 2 of the 3 significant estimates.

The level of EF2 has a negative coefficient in all 45 OLS regressions of appendix Table E.3, and is significant at 10 percent or better in 88.9 percent of them. The change in EF2 has a positive sign in 77.8 percent of the regressions, but is only significant 44.4 percent of the time. Conditional on being significant, the change in EF2 is positive 95 percent of the time.[78] The absolute value of the magnitude of the coefficient on the change in EF2 is generally less than that of the coefficient for the level of EF2 such that the short- and long-run effects of legal institutions are negative in 93.3 and 100 percent of the regressions, respectively. The OLS estimates indicate that countries with more equality before the law also tend to have more economic equality. When both the level and change in EF2 are significant in the fixed effects estimate of panel H of appendix Table E.3 (columns 3, 4, and 6), the former has a positive and the latter a negative coefficient.

The level of EF3 is negative in 88.9 percent of the OLS estimates. When significant (68.9 percent) it is negative 93.8 percent of the time. The change in EF3 is positive in 71.1 percent of the OLS regressions, but is only significant in a fifth of them. When significant, the change in EF3 always has a positive coefficient. Both the short and long-run effects of sound money on inequality are negative in more than 80 percent of the estimates. The OLS estimates of equation 4.12 suggest that sound monetary policy is associated with more equality, but are sensitive to some measures of inequality and time periods. The fixed effects estimates (panel H, appendix

[78] Column 4 of panel E in appendix Table E.3 is the exception

Table E.3) are mostly insignificant, as the level of EF3 is only significant in 3 of the 8 columns (positive in 2 of the 3), while the change in EF3 is only significant (and positive) in column 5.

Coefficients on the level and change in EF4 are negative in 84.4 and 31.1 percent of the OLS regressions, respectively. When significant (two-thirds of the regressions), the level of EF4 is negative 93.3 percent of the time. The change in EF4 is only significant in 40 percent of the regressions, and when significant, it is positive 61.1 percent of the time. The short- and long-run effects of EF4 on inequality are negative in 75.6 and 84.4 percent of the specifications, respectively. The OLS estimates in general indicate that freedom to trade internationally is associated with less inequality, but the results are once again not robust to the time period or measure of inequality. The fixed effects estimates in panel H of appendix Table E.3 indicate that the level and change in EF4 is, in most instances, insignificant. When significant (3 of 8 regressions), the level of EF4 has a positive sign. In the only fixed effects regression in which the change in EF4 is significant (column 5), it also has a positive sign.

The level and change in EF5 have negative coefficients in 53.3 and 64.4 percent of the OLS regressions, respectively. The level of EF5 is significant in only 24.4 percent of the regressions, and when significant, it is negative in 90.9 percent of the specifications. The change in EF5 is significant in 46.7 percent of the regressions, and is negative in 81.0 percent of these estimates. The short-run impact of EF5 on inequality is negative in 75.6 percent of the estimates, while the long-run effect is negative in 53.3 percent. The OLS estimates are generally insignificant when EF5 is used as the measure of economic freedom. When the estimates are significant, they are mostly negative, suggesting that freedom from regulation is associated with more equality, but this relationship is clearly not robust. The level of EF5 is significant in 5 of the 8 fixed effects estimates from panel H of appendix Table E.3, and is always positive when significant. The change in EF5 is meanwhile significant in 3 of the 8 fixed effects estimates, and is always negative when significant.

As the analysis above indicates, the econometric specification used by Berggren (1999) to examine the empirical relationship between economic freedom and inequality does not produce robust results. The coefficient estimates are often insignificant, and when significant, sometimes have different signs for the same measure of economic freedom when different measures of inequality or time periods are used. The issue of inconsistent coefficient signs is most troubling for the change in EFW and change in EF4 measures. This issue could be attributable to a number of econometric issues, including measurement error in the inequality and/or economic freedom variables, and omitted variable bias. The inconsistency of coefficient signs is least problematic for the specifications using EF1, EF2, and EF3 as the measure of economic freedom, perhaps suggesting that government size, legal institutions, and monetary policy exert a more consistent effect on the level of inequality in an economy, or perhaps are measured with less error. These results are particularly robust for the levels of EF1 and EF2, as more than three quarters of the specifications for the former are significant and positive, while nearly 90 percent of the specifications for the latter are significant and negative.

4.5.2 Carter Non-Linear Specification

Carter (2006) hypothesized the existence of a U-shaped relationship between economic freedom and inequality. Using relatively consistent inequality measures from the UNU-WIDER WIID1a dataset and the 2005 EFW dataset, Carter constructs an unbalanced panel for 39 countries over the period 1980-2000.[79] He models the level of inequality as a non-linear function of economic freedom and a number of additional variables, as given by equation 4.14 where $\mathrm{EF}_{i,t}$, $\mathrm{EF}_{i,t}^2$, $X_{i,t}$ and c_i represent economic freedom, economic freedom squared, a vector of control variables, and an unobserved country fixed effect, respectively.[80] Controlling for variables such as real GDP per capita (RGDPL), political rights (POLRIGHTS), civil liberties (CIVLIB), average years of schooling of the adult population (AYS25), the shares of the population under 15 (UNDER15) and over 65 (OVER65), urban population (URBAN), and the shares of the labor force employed in the industrial (INDUSTRY) and service sectors (SERVICE), Carter's main findings (Table 3, page 170) support his hypothesis of the existence of a U-shaped inequality-economic freedom curve ($\widehat{\alpha_1} < 0 \; and \; \widehat{\alpha_2} > 0$).[81]

$$\mathrm{Ineq}_{i,t} = \alpha_0 + \alpha_1 \mathrm{EF}_{i,t} + \alpha_2 \mathrm{EF}_{i,t}^2 + X_{i,t}\beta + c_i + e_{i,t} \qquad (4.14)$$

[79] The 2005 EFW dataset organizes the variables into the same 5 major areas as the current version of the index. The 39 countries in Carter's analysis are Australia, Austria, Bangladesh, Bolivia, Bulgaria, Canada, Chile, China, Denmark, Ecuador, Egypt, El Salvador, Finland, France, Germany, Greece, Indonesia, Ireland, Israel, Italy, Mexico, Netherlands, New Zealand, Norway, Panama, Peru, Philippines, Poland, Portugal, Slovak Republic, Slovenia, South Korea, Spain, Sweden, Thailand, Turkey, United Kingdom, United States, and Venezuela.

[80] The very high R^2 values reported by Carter (2006) suggest that he reported the between rather than within country R^2 values. The latter are reported here.

[81] Examining the relationship between economic freedom and inequality among the 50 U.S. states, Bennett and Vedder (2013) find evidence of an inverted U-shaped relationship between economic freedom and inequality, opposite that of Carter.

Using alternative measures of inequality and an expanded sample of countries for a longer duration of time, the current analysis indicates that Carter's findings are not very robust, as the linear and/or quadratic terms are often insignificant, and in some instances the curve is inverted. Carter's evidence of a U-shaped inequality-economic freedom curve appears to be a finding that is specific to the sample of countries, time period and measure of inequality used in his analysis.

Ignoring the vector of control variables for a moment, Table 4.3 estimates equation 4.14, using each of the eight different inequality measures. The panel includes observations for five-year periods spanning 1970-2010 for all countries for which data are available for both inequality and economic freedom. The estimates thus provide greater country coverage and time coverage than Carter's analysis. Panel A provides the results using the composite EFW index. Evidence of the U-shaped economic freedom-inequality curve is present in columns 1,2, and 6-8 as the linear and quadratic terms are positive and negative, respectively, and are both significant at 10 percent or better. The estimated inflection point at which the partial effect of EFW on inequality changes from negative to positive is given for each of the columns in which both the linear and quadratic terms are significant as EFW^*. This ranges from 5.36 to 6.23. Both the mean and median of EFW for the entire dataset fall within this range, suggesting that economic liberalization may be associated with greater equality over a broad base of countries with low levels of economic freedom. The coefficient estimates form an inverted U-shaped curve in columns 3, 4, and 5, although none of the EFW terms are statistically significant.

Panel B of Table 4.3 reports the results using EF1 as the measure of economic freedom. Neither the linear or quadratic terms are significant in columns 1, 2, 4, 5, 7 or 8. In column 3, which uses the UTIP gross income Gini as the measure of inequality, both the linear and quadratic terms are significant at 5 percent or better, but the curve represents an inverted U, opposite the anticipated shape. $EF1^*$ in column 3 is estimated at 8.10, suggesting that decreases in the size of government are associated with more and less gross income inequality when the initial level of EF1 is below and above this point, respectively. The coefficients in columns 1 and 2 form inverted U-shapes, but none of them are significant. The opposite is true in column 6, which uses consumption Gini as the measure of inequality. An estimated $EF1^*$ of 5.70 in column 6 suggests that decreases in the size of government are associated with less and more consumption inequality when the initial level of EF1 is below and above this point, respectively.

The coefficients in columns 4, 7, and 8 form U-shaped curves, but none of the EF1 terms are significant in these specifications. Both the linear and quadratic terms are positive in column 4, but neither is significant. The results from panel B are very inconsistent using the various measures of inequality and underlying samples of countries, providing little evidence of a parabolic relationship between government size and inequality.

Panel C of Table 4.3 uses EF2 as the measure of economic freedom. All of the EF2 terms are statistically insignificant at traditionally accepted levels with the exception of column 2 for which the SWIID gross income Gini is the measure of inequality. Both terms are significant at 5 percent or better, with the linear term negative and the quadratic term positive, forming a U-shaped curve. The estimated inflection point in column 2 at which the marginal effect of EF2 on gross income inequality changes from negative to positive is 5.34, slightly less than the median of the entire dataset. The coefficients in columns 1, 3, and 4 also form a U-shaped curve, but none of the terms are significant. The coefficients in columns 5 and 6 form an inverted U-shaped curve and both the linear and quadratic terms are negative in columns 7 and 8, although none of these terms are statistically significant. Overall, there is little evidence of a parabolic relationship between the rule of law (EF2) and inequality.

Panel D of Table 4.3 uses EF3 as the measure of economic freedom. The linear and quadratic terms are negative and positive, respectively, in seven of the eight columns. Both terms are significant at 10 percent or better in columns 1, 2, and 6-8, and the quadratic term is significant at 5 percent in column 4. These results provide some evidence of a U-shaped curve. The estimated inflection points for the columns in which both the linear and quadratic terms are significant is given as $EF3^*$, and range from 5.03 in column 6 to 6.37 in column 1. The first and second quartile EF3 measures for the entire dataset are 5.82 and 6.89, respectively, suggesting that sound monetary policy may exert a negative impact on inequality over a broad range of countries in the dataset.

EF4 is the measure of economic freedom used in panel E of Table 4.3. Both the linear and quadratic terms are significant at 5 percent in columns 1 and 2, and form a U-shaped curve. The coefficients also form a U-shaped curve in columns 7 and 8, but neither EF4 term is significant. The coefficients form an inverted U-shaped curve in columns 4-6, but only the linear terms in columns 4 and 5 and the quadratic term in column 5 are significant at 10 percent or better. The estimated inflection point is given for columns 1 and 2 (5.87 and 5.69, respectively) and represents the level of EF4 at which the effect on inequality of a marginal increase in EF4 changes from negative to positive. The inflection point for column 5 is 6.37 and refers to the level of EF4 at which the effect on inequality of a marginal increase in EF4 changes from positive to negative. The mean and medium EF4 measures are 5.94 and 6.28, respectively. The estimates provide some evidence of a non-linear relationship between freedom to trade internationally and inequality, but the shape of the curve is not consistent for various measures of inequality.

Panel F in Table 4.3 uses EF5 as the measure of economic freedom. The coefficients form an inverted U-shaped curve in all but column 6, with both terms statistically significant at 5 percent or better in columns 3, 7 and 8. The estimated inflection points for these three specifications are 7.86, 4.72, and 4.60, respectively. With the exception of the coefficient estimates from column 6 forming a U-shaped curve, the results from panel F contradict the findings of Hopkin and Blythe (2012) and Blythe, Hopkin, and Werfel (2012), who argue that freedom from regulation is a proxy for economy efficiency and low and high levels of efficiency are associated with greater inequality, but intermediate levels of efficiency are associated with more equality.

The results from Table 4.3 provide some additional support for Carter's hypothesis of a U-shaped relationship between economic freedom and inequality when EFW or EF3 are used as the measure of economic freedom. The results are not however robust to the measure of inequality nor to the measure of economic freedom, as discussed above. EF5 in particular exhibits an inverted U-shaped curve with inequality. They also do not control for any additional covariates and explain very little of the variation in inequality within countries over time.

Table 4.4 estimates the impact of EFW on the eight measures of inequality using a fixed effects model that includes the full set of control variables employed by Carter in his main results (2006, Table 3). The estimates differ from those of Carter in three ways. First, Carter made use of inequality measures from the UNU/WIDER WIID2a dataset. The eight inequality measures used in the current analysis are from alternative datasets, although the net income, gross income, and consumption Gini datasets from chapter three do contain a limited number of inequality measures from the WIID2c dataset. Next, the dataset used for the estimates here spans the period 1970-2010, while Carter's analysis spans the period 1980-2000. Lastly, Carter's analysis consisted of a sample of 39 nations, of which 23 belong to the OECD. The samples of countries used here vary by the measure of inequality, but range from 57 to 107 countries. Thus the estimates in the current analysis make use of alternative measures of inequality, and provide greater country and time coverage than Carter's analysis.

The U-shaped inequality-economic freedom curve is present in columns 1, 2, 4, and 6-8, but the linear and quadratic economic freedom terms are significant at 10 percent or better only in columns 1, 7 and 8. An inverted U-shaped curve is present in columns 3 and 5, although none of the EFW terms are significant in these regressions. For the estimates in which the U-shaped curve is present and the EFW terms are both significant, the estimated inflection point at which the partial effect of economic freedom on inequality turns from negative to positive ranges from 4.47 to 5.62, all of which are greater than the inflection point of 4.03 estimated by Carter (2006). The upper bound of the first quartile of EFW measures over the sample is 5.15, suggesting that EFW is positively associated with inequality for most countries. The R^2 values in Table 4.4 range from 0.10 in column 7 to 0.46 in columns 3 and 6, and are noticeably larger than those obtained in Table 4.3 when no additional control variables were included in the model. Analogous results for each of the area measures of economic freedom with the full set of control variables are given in appendix Table D.4, although the coefficients estimates for the control variables are omitted for space. The results are similar to those reported in Table 4.3 when no controls are included, namely that there is some evidence that there exists a U-shaped curve between EF3 and inequality but the evidence is much more mixed concerning the existence of a curvilinear relationship between inequality and the remaining economic freedom indices.

The results obtained thus far suggest that Carter's finding of a U-shaped inequality-economic freedom curve is not very robust, as alternative measures of inequality and economic freedom sometimes produce contrasting results. One possibility is that Carter's results were specific to the sample of countries used in his study. As mentioned above, the samples of countries used in the present analysis vary by the measure of inequality used, but in all cases provide greater country coverage than Carter's analysis. The odd-numbered columns in Table 4.5 re-estimate the non-linear model for the sample of 39 countries used in Carter's analysis. It is also possible that Carter's results were specific to his sample period, 1980-2000. The present analysis examines a longer duration of time than Carter, covering the period 1970-2010. The even-numbered columns of Table 4.5 re-estimate the non-linear model for the sample of 39 countries over the period examined by Carter, 1980-2000. Columns 1-2 and 3-4 use the SWIID net and gross income Gini measures as the dependent variable, respectively. Columns 5 and 6 use the UTIP gross income Gini, while columns 7-8 and 9-10 use the 90/10 and 80/20 ratios, respectively. The remaining three measures of inequality are omitted because the inequality data are incomplete for Carter's sample of countries.

The U-shaped inequality-economic freedom curve is present in all ten specifications of Table 4.5, including those in columns 5 and 6 for which the UTIP gross income Gini measures are used as the dependent variable. Recall from Tables 4.3 and 4.4 that the curve is inverted for this measure of inequality (column 3). Both the linear and quadratic EFW terms are statistically significant in columns 1 and 2 when the SWIID net Gini measures are the dependent variable, and the estimated inflection points at which the partial effect of additional increases in economic freedom turn from negative to positive are 5.03 and 5.66 for the 1970-2010 and 1980-2000 periods, respectively. Both the linear and quadratic economic freedom terms are also statistically significant at 5 percent or better in columns 8 and 10, both of which are constrained to the period 1980-2000. Neither EFW term is significant in the estimates using the corresponding inequality measures for the period 1970-2010 in columns 7 and 9. The quadratic EFW term is positive and significant at 10 percent in columns 3 and 4, but the linear terms, while negative, are insignificant. Neither EFW term is statistically significant (at 10 percent) in either column 5 or 6.

The results from Table 4.5 further suggest that Carter's findings of a U-shaped inequality-economic freedom curve are not robust, but may instead be specific to the sample of countries and time period examined. The U-shaped inequality-economic freedom curve is present when the sample of countries is restricted to the 39 used by Carter, but the EFW terms are not always significant for alternative measures of inequality. They are never significant when the UTIP gross income Gini measures are used, as well as when the time period is extended from 1980-2000 to 1970-2010 for three of the four other inequality measures. The results obtained here strongly suggest that Carter's finding of a U-shaped economic freedom-inequality curve is not a generalizable result, but rather an empirical irregularity.

Table 4.3 Non-Linear Fixed Effects Regressions – Carter Specification I

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt 3 Net Gini (4)	Chpt 3 Gross Gini (5)	Chpt 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A							
EFW	-6.637***	-7.294***	1.241	1.443	3.521	-7.308**	-10.023*	-5.135**
	(2.01)	(1.95)	(1.70)	(1.71)	(2.14)	(3.54)	(5.41)	(2.47)
EFW^2	0.545***	0.632***	-0.005	-0.009	-0.274	0.682**	0.828*	0.412**
	(0.16)	(0.16)	(0.14)	(0.14)	(0.19)	(0.29)	(0.44)	(0.19)
R^2	0.04	0.04	0.11	0.20	0.03	0.04	0.01	0.03
N	761	761	596	240	180	178	490	490
Countries	118	118	115	57	64	61	113	113
EFW*	6.09	5.77				5.36	6.05	6.23
	Panel B							
EF1	0.886	2.319	2.965***	0.457	-0.081	-3.738**	-1.196	-0.272
	(1.55)	(1.64)	(0.97)	(0.91)	(1.37)	(1.63)	(2.19)	(0.82)
$EF1^2$	-0.088	-0.204	-0.183**	0.054	0.064	0.328**	0.054	0.001
	(0.13)	(0.14)	(0.08)	(0.09)	(0.12)	(0.13)	(0.20)	(0.08)
R^2	0.00	0.01	0.14	0.15	0.04	0.04	0.00	0.00
N	789	789	650	243	182	177	491	491
Countries	118	118	115	56	65	61	113	113
EF1*			8.10			5.70		
	Panel C							
EF2	-1.172	-2.295***	-0.195	-0.036	1.145	1.828	-0.513	-0.041
	(0.80)	(0.85)	(0.51)	(1.27)	(1.37)	(2.21)	(1.59)	(0.55)
$EF2^2$	0.087	0.215***	0.065	0.034	-0.096	-0.162	-0.014	-0.014
	(0.06)	(0.07)	(0.04)	(0.09)	(0.15)	(0.24)	(0.13)	(0.04)
R^2	0.01	0.02	0.04	0.03	0.01	0.01	0.00	0.00
N	730	730	559	240	176	176	477	477
Countries	118	118	111	57	61	61	111	111
EF2*		5.34						
	Panel D							
EF3	-1.568***	-2.265***	-0.558	-0.559	-0.056	-1.759***	-5.543***	-2.732**
	(0.43)	(0.51)	(0.49)	(0.53)	(0.58)	(0.57)	(1.92)	(1.10)
$EF3^2$	0.123***	0.195***	0.056	0.080*	-0.001	0.175***	0.484***	0.227***
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.16)	(0.08)
R^2	0.02	0.04	0.01	0.11	0.00	0.05	0.06	0.10
N	805	805	666	248	183	181	498	498
Countries	118	118	115	57	66	61	113	113
EF3*	6.37	5.81				5.03	5.73	6.02
	Panel E							
EF4	-1.503*	-1.594***	0.609	1.994***	2.637**	1.168	-1.040	-0.542
	(0.76)	(0.60)	(0.39)	(0.70)	(1.20)	(0.91)	(1.02)	(0.34)
$EF4^2$	0.128**	0.140**	0.001	-0.084	-0.207**	-0.090	0.110	0.041
	(0.06)	(0.05)	(0.03)	(0.06)	(0.10)	(0.10)	(0.11)	(0.04)
R^2	0.02	0.02	0.10	0.16	0.08	0.02	0.00	0.00
N	760	760	602	240	178	174	481	481
Countries	117	117	109	57	63	60	112	112
EF4*	5.87	5.69			6.37			
	Panel F							
EF5	3.469	3.807	6.884***	1.231*	3.946	-8.080	4.680**	2.062**
	(2.35)	(2.51)	(1.26)	(0.73)	(2.67)	(4.92)	(2.12)	(0.97)
$EF5^2$	-0.268	-0.256	-0.438***	-0.001	-0.350	0.707*	-0.496***	-0.224**
	(0.19)	(0.21)	(0.11)	(0.07)	(0.24)	(0.41)	(0.19)	(0.09)
R^2	0.02	0.04	0.29	0.20	0.03	0.03	0.01	0.01
N	751	751	586	242	181	176	492	492
Countries	118	118	115	57	65	61	113	113
EF5*			7.86				4.72	4.60

Standard errors robust to heteroskedasticity and autocorrelation reported in parentheses. Appendix Tables E.1 provides information on variables.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < .01$.

Table 4.4 Non-Linear Fixed Effects Regressions – Carter Specification II

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt 3 Net Gini (4)	Chpt 3 Gross Gini (5)	Chpt 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
EFW	-3.431**	-2.943	1.976	-1.329	2.049	-4.876	-9.998*	-3.672*
	(1.73)	(2.21)	(1.57)	(1.37)	(2.23)	(4.33)	(5.92)	(2.00)
EFW^2	0.305**	0.314	-0.127	0.193*	-0.129	0.472	1.048**	0.381**
	(0.15)	(0.20)	(0.13)	(0.10)	(0.21)	(0.39)	(0.52)	(0.17)
RGDPL	-0.000	-0.000	-0.000	-0.000	0.000	-0.002	-0.001	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$RGDPL^2$	0.000	0.000	0.000	0.000	-0.000	0.000***	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
POLRIGHTS	0.661	-0.611	-0.580	-0.154	0.821	0.682	-0.699	0.004
	(0.65)	(1.23)	(0.59)	(0.87)	(1.07)	(0.85)	(1.70)	(0.45)
$(POLRIGHTS)^2$	-0.020	0.052	0.048	0.005	-0.043	-0.093	0.019	-0.003
	(0.05)	(0.08)	(0.05)	(0.07)	(0.08)	(0.09)	(0.19)	(0.05)
CIVLIB	-0.169	0.394	1.449**	3.731***	0.886	-0.324	3.512	0.743
	(0.78)	(1.00)	(0.67)	(1.28)	(1.91)	(1.76)	(3.69)	(0.90)
$(CIVLIB)^2$	-0.011	-0.026	-0.073	-0.254***	-0.095	0.055	-0.266	-0.068
	(0.05)	(0.06)	(0.05)	(0.08)	(0.14)	(0.13)	(0.21)	(0.06)
AYS25	-1.150	-1.833	-0.447	-0.741	0.819	-6.888**	-4.346	-2.796**
	(1.09)	(1.41)	(1.12)	(1.43)	(2.90)	(2.79)	(3.30)	(1.29)
$AYS25^2$	0.064	0.105	0.011	0.076	-0.234	0.400**	0.215	0.153**
	(0.06)	(0.08)	(0.07)	(0.07)	(0.27)	(0.17)	(0.17)	(0.06)
UNDER15	0.230	0.319	0.511	0.621	-0.444	3.519**	1.288	0.527
	(0.48)	(0.60)	(0.40)	(0.46)	(0.88)	(1.75)	(1.30)	(0.48)
$UNDER15^2$	-0.003	-0.000	-0.014*	-0.004	-0.002	-0.060***	-0.021	-0.009
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.01)
OVER65	0.509	0.339	-0.951	2.581	-2.427	3.685	-1.156	-0.670
	(0.96)	(0.89)	(0.90)	(1.72)	(2.18)	(2.72)	(2.77)	(1.00)
$OVER65^2$	0.005	0.021	0.056*	-0.068	0.087	-0.130	0.053	0.030
	(0.03)	(0.03)	(0.03)	(0.05)	(0.08)	(0.08)	(0.09)	(0.03)
URBAN	1.000***	0.936***	-0.053	0.376	0.035	0.888**	-0.622	-0.047
	(0.26)	(0.23)	(0.21)	(0.46)	(0.70)	(0.43)	(0.75)	(0.30)
$URBAN^2$	-0.009***	-0.008***	-0.001	-0.003	-0.001	-0.007*	0.006	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
INDUSTRY	-0.473	-0.606	-0.006	-0.848**	-0.637	-0.671	-1.804	-0.593
	(0.47)	(0.49)	(0.31)	(0.39)	(0.55)	(0.55)	(1.56)	(0.45)
$INDUSTRY^2$	0.006	0.007	-0.006	0.011*	0.012	0.013	0.021	0.007
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)
SERVICE	0.446	0.487*	0.318*	0.533	1.331**	0.255	2.572**	0.934**
	(0.28)	(0.27)	(0.19)	(0.33)	(0.51)	(0.28)	(1.07)	(0.38)
$SERVICE^2$	-0.003	-0.004	-0.003	-0.005*	-0.011**	-0.003	-0.025**	-0.009**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
R^2	0.26	0.30	0.46	0.45	0.33	0.46	0.10	0.12
N	514	514	345	216	157	127	387	387
Countries	107	107	96	56	52	52	100	100
EFW^*	5.62						4.77	4.82

Standard errors robust to heteroskedasticity and autocorrelation reported in parentheses. $^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<.01$. Analogous results for the individual economic freedom areas are provided in appendix Table E.4. Appendix Tables E.1 provides information on variables.

Table 4.5: Non-Linear Fixed Effects Regressions – Carter Specification III

	Measure of Inequality									
	SWIID Net Gini (1)	SWIID Net Gini (2)	SWIID Gross Gini (3)	SWIID Gross Gini (4)	UTIP Gross Gini (5)	UTIP Gross Gini (6)	90/10 Ratio (7)	90/10 Ratio (8)	80/20 Ratio (9)	80/20 Ratio (10)
EFW	-4.530*	-5.984**	-4.609	-5.713	-0.936	-0.764	-11.669	-18.76**	-3.356	-5.214*
	(2.32)	(2.45)	(3.41)	(3.52)	(1.50)	(1.55)	(8.14)	(8.71)	(2.55)	(2.59)
EFW^2	0.450**	0.529**	0.536*	0.553*	0.154	0.141	1.244	1.757**	0.390	0.516*
	(0.20)	(0.23)	(0.27)	(0.29)	(0.12)	(0.12)	(0.81)	(0.86)	(0.25)	(0.26)
RGDPL	-0.000	-0.000	-0.001*	-0.001	-0.000	-0.000	-0.003	-0.003	-0.001	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$RGDPL^2$	0.000	0.000	0.000**	0.000	0.000**	0.000*	0.000	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
POLRIGHTS	0.186	0.330	-3.137	-2.655**	0.321	0.533	-6.041	-11.325*	-1.290	-2.872*
	(0.76)	(1.68)	(2.19)	(1.16)	(0.57)	(0.49)	(4.65)	(6.01)	(1.12)	(1.49)
$(POLRIGHTS)^2$	-0.009	-0.032	0.191	0.157*	-0.010	-0.026	0.426	0.825*	0.093	0.224*
	(0.06)	(0.13)	(0.14)	(0.09)	(0.05)	(0.04)	(0.40)	(0.44)	(0.10)	(0.12)
CIVLIB	0.243	0.508	2.032	1.587	0.974	0.523	11.159	14.257	2.660	3.358
	(0.70)	(1.07)	(1.58)	(1.27)	(0.77)	(0.71)	(8.08)	(9.21)	(1.87)	(2.14)
$(CIVLIB)^2$	-0.023	-0.038	-0.102	-0.035	-0.083	-0.052	-0.729	-0.891	-0.180	-0.220
	(0.05)	(0.08)	(0.10)	(0.10)	(0.06)	(0.05)	(0.46)	(0.54)	(0.11)	(0.14)
AYS25	-2.665	-1.006	-2.763	-3.534	2.204	1.759	-4.212	-4.774	-2.450*	-2.264
	(1.91)	(3.28)	(2.76)	(2.43)	(1.47)	(1.33)	(3.86)	(6.84)	(1.23)	(2.04)
$AYS25^2$	0.110	0.046	0.112	0.228	-0.175**	-0.149*	0.207	0.459	0.145*	0.181
	(0.10)	(0.19)	(0.14)	(0.15)	(0.08)	(0.07)	(0.24)	(0.44)	(0.08)	(0.13)
UNDER15	0.306	1.082	0.087	2.027*	0.231	0.257	0.871	4.829	0.183	1.245
	(0.58)	(1.38)	(0.77)	(1.13)	(0.50)	(0.51)	(2.43)	(4.53)	(0.60)	(1.06)
$UNDER15^2$	-0.004	-0.016	0.005	-0.024	-0.008	-0.008	-0.020	-0.091	-0.003	-0.021
	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.05)	(0.09)	(0.01)	(0.02)
OVER65	0.261	3.415	0.502	2.671	-0.402	-0.190	5.476	8.361	1.152	3.134
	(1.98)	(3.79)	(1.85)	(3.94)	(1.06)	(1.41)	(4.83)	(9.05)	(1.46)	(2.60)
$OVER65^2$	0.017	-0.066	0.029	0.010	0.018	0.011	-0.111	-0.166	-0.023	-0.073
	(0.06)	(0.14)	(0.06)	(0.13)	(0.03)	(0.04)	(0.16)	(0.33)	(0.05)	(0.09)
URBAN	1.487***	1.651***	1.174***	2.171***	-0.372	-0.357	0.602	-1.400	0.343	-0.189
	(0.26)	(0.40)	(0.27)	(0.70)	(0.29)	(0.27)	(1.05)	(1.33)	(0.30)	(0.38)
$URBAN^2$	-0.012***	-0.015***	-0.009***	-0.018***	0.003	0.003	-0.011	0.005	-0.004	-0.000
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)

Table 4.5 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
INDUSTRY	-0.374	0.004	-0.517	-0.636	0.178	0.166	-5.531*	-6.521*	-1.561*	-1.789**
	(0.62)	(0.69)	(0.56)	(0.60)	(0.42)	(0.40)	(3.21)	(3.44)	(0.80)	(0.79)
$INDUSTRY^2$	0.006	0.001	0.007	0.011	-0.009	-0.009	0.087	0.103*	0.025*	0.029**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.05)	(0.05)	(0.01)	(0.01)
SERVICE	0.332	0.458	0.222	-0.041	0.271	0.238	1.047	1.970	0.482*	0.570
	(0.37)	(0.37)	(0.43)	(0.44)	(0.18)	(0.19)	(0.70)	(1.47)	(0.26)	(0.40)
$SERVICE^2$	-0.002	-0.003	-0.001	0.002	-0.002	-0.002	-0.012	-0.024	-0.005	-0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
R^2	0.35	0.45	0.44	0.56	0.64	0.61	0.18	0.30	0.22	0.32
N	251	174	251	174	182	171	195	157	195	157
Countries	39	39	39	39	39	39	39	39	39	39
Period	1	2	1	2	1	2	1	2	1	2
EFW*	5.03	5.66						5.34		5.05

Standard errors robust to heteroskedasticity and autocorrelation reported in parentheses. Periods 1 and 2 refer to 1970-2010 and 1980-2000, respectively. Appendix Table E.1 provides information on variables. *$p < 0.10$,** $p < 0.05$,*** $p < .01$.

4.5.3 Scully Structural Model

Scully (2002) models inequality as a function of both economic growth and economic freedom, and growth as a function of economic freedom and the growth rates of capital and government consumption, as given by equations 4.15 and 4.16, where GROWTH, KDOT, and GDOT represent the growth rates of GDP and capital and government consumption per capita, respectively. Using quinquennial data spanning the period 1975-1990 for a sample of 26 advanced economies, Scully finds that economic freedom exerts a negative direct impact on inequality but a small positive indirect impact through its positive effect on growth.[82] Carter (2006) suggests that Scully misreports the significance of his regression results. The coefficients reported by Scully are given in scientific notation. Although not indicated in the regression tables, if the standard errors are also in scientific notation, then this amounts to an editorial error rather than invalidation of the significance of the results, as suggested by Carter.

$$\mathrm{Ineq}_{i,t} = \alpha_0 + \alpha_1 \mathrm{EF}_{i,t} + \alpha_2 \mathrm{GROWTH}_{i,t} + e_{i,t} \quad (4.15)$$

$$\mathrm{GROWTH}_{i,t} = \delta_0 + \delta_1 \mathrm{EF}_{i,t} + \delta_2 \mathrm{KDOT}_{i,t} + \delta_3 \mathrm{GDOT}_{i,t} + u_{i,t} \quad (4.16)$$

There are however several potential issues with Scully's framework. First, Scully appears to use contemporary values for each variable in his model. Economic theory and empirical evidence suggest that institutions exert an impact on subsequent economic performance such that institutions in period t would affect growth in per capita income in period t+1 and beyond. Economic freedom should therefore be lagged by at least one period to appropriately estimate its impact on growth, although this timing issue likely does not affect the results much given that economic freedom changes relatively slowly and its values in adjacent periods are highly correlated.[83]

Table 4.6 reports the 2SLS estimates of Scully's model using the 5-year lag of EFW for the full sample of countries for which data are available for each of the eight inequality measures.[84] Panels A1 and A2 give the second and first stage estimates for each measure of

[82] The 26 countries in Scully's analysis are: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, South Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Taiwan, Thailand, United Kingdom, and the United States.

[83] The correlation between EFW_t and EFW_{t-5} is 0.892 for the entire dataset.

[84] Scully uses the log odds ratios of the Gini coefficient and economic freedom variables in his analysis because each variable is bound between zero and one. Being bound along the unit interval does not necessarily exclude normality. Because Scully pooled his data and both inequality and institutions tend to change slowly over time, his dataset contains information for only a limited number of mostly advanced economies such that one might not

inequality, respectively, and panel A3 indicates the direct, indirect, and total estimated effects of EFW on inequality. EFW has a positive and statistically significant (at 10 percent or better) effect on the GDP growth rate in each of the first-stage regressions. Similarly, KDOT and GDOT are both positive and highly significant in all eight specifications. The first stage estimates are qualitatively similar to those obtained by Scully. EFW has a negative coefficient in six of the eight second stage regressions, and is statistically significant at 1 percent in four of these (columns 1-4); however, EFW has a positive but insignificant coefficient in the second stage regressions of columns 5 and 6. Although not completely robust to the measure of inequality (and hence sample of countries), the generally negative direct impact of economic freedom on inequality is consistent with Scully's findings. Inconsistent with the findings of Scully is the negative coefficient on GROWTH in the second stage regression in all but column 4, implying that EFW also has a negative indirect effect on inequality in seven of the eight estimates. The total estimated effect of EFW on inequality is negative in all but columns 5 and 6 for which the gross income and consumption Gini measures are the measure of inequality, respectively. These two measures contain mostly less developed countries in their samples, so it may be the case the economic freedom exerts a differential effect on inequality depending on the level of development.

While the lag issue is easily overcome, Scully's functional form may be misspecified. He models economic growth as a function of both the growth in per capita government consumption and the level of economic freedom. The level of government consumption is a component of EFW. This suggests that both the level and growth of government consumption influence inequality, albeit indirectly through their influence on economic freedom and economic growth, respectively.[85] Meanwhile, Scully's model implicitly assumes that the levels of (and not changes in) the other economic freedom components impact the level of inequality. There has been some discussion in the literature that it is not the level of economic freedom that impacts economic growth, but the change in economic freedom (cf. Cole and Lawson, 2007; De Haan and Sturm,

expect the variables to exhibit a normal distribution. As the number of countries included in the sample increases, one might anticipate that the distributions approach normal, particularly if the variables are observed at a given point in time. The results presented here use the observed values of each variable. Using the log-odds ratios of EFW and inequality does not qualitatively change the results – only the interpretation.

[85] To the extent that government consumption redistributes incomes, there is good reason to believe that the level of government consumption impacts inequality directly in a static sense and that changes in government consumption will influence changes in inequality directly, and potentially indirectly by reducing economic growth. See the theoretical framework provided in section 2.2 for more information.

2007). The augmented neoclassical production function specified by equation 4.2 above suggests that the level of economic development is a function of the level of economic freedom, and by extension, growth is a function of changes in economic freedom. A similar case can be made that inequality is a function of the level of development and not the growth rate, and that changes in inequality are a function of economic growth. This is implied by the Kuznets curve.

The potential model misspecification is addressed in the results presented in Panel B of Table 4.6, which provides the 2SLS estimates using the levels of log per capita GDP (LRGDPL), capital (LKL), and government consumption (LGL) in lieu of the growth rates. In the first stage (panel B2), EFW has a positive coefficient in all but column 6 (negative and insignificant), and is significant (at 10 percent or better) in six of the seven regressions for which the sign is positive. LKL and LGL are both positive and significant (at 1 percent) in the first stage. The level of development is negative and highly significant in all eight second stage estimates. Meanwhile, EFW is always positive in the second stage estimates, and is significant (at 10 percent or better) in half of them. The specification that uses the levels of all variables suggests that EFW, in general, exerts a positive direct, negative indirect, and positive net impact on inequality.[86]

Economic theory suggests that institutions affect economic growth both directly through greater total factor productivity and indirectly by incentivizing capital investment.[87] Including both net investment and economic freedom in the growth equation will underestimate the effect of freedom on growth and hence the indirect impact that freedom exerts on inequality through economic growth. Table 4.7 repeats the 2SLS estimates from Table 4.6 excluding KDOT as an exogenous source of variation in growth. The coefficients for EFW in the first stage regressions are indeed higher in panel A2 of Table 4.7 than the corresponding coefficients in Table 4.6, with the exception of column 4 in which EFW is insignificant in the former. With the exception of column 4 in Panel A1 of Table 4.6, economic growth has a negative coefficient in all of the second stage regressions. Given that EFW exerts a positive impact on GROWTH, the negative indirect effect of EFW on inequality is underestimated when capital is included in the model. The indirect effects reported in panel C are indeed less negative in Table 4.6 than in Table 4.7.

[86] The indirect effect is positive in column 6.

[87] Institutions create the environment by which exchange takes place. When an economy is characterized by high levels of economic freedom, the market process is less constrained, providing greater opportunity for economic actors to engage in mutually-beneficial exchange and entrepreneurs to develop technological innovation, thus enabling a more efficient exchange of resources and productivity enhancements that result in economic development. Studies by Dawson (1999), Gwartney, Holcombe, and Lawson (2006), and Hall, Sobel and Crowly (2010) provide empirical evidence of the indirect effect.

Excluding capital from the model increases (in absolute value) the estimated indirect impact of EFW on inequality, but it also reduces (in absolute value) the estimated direct impact of EFW on inequality, presumably because more of the indirect effect is being picked up. Excluding capital from the model nonetheless results in a greater, although only trivially so in most specifications, estimated negative total effect of EFW on inequality.

As an illustration, the coefficient on EFW in the first stage regression is 0.016 when capital is included in column 2 of Table 4.6, and the coefficient on GROWTH is -5.398 in the second stage such that the indirect effect of EFW on inequality is -0.086 (0.016*-5.398). The estimated direct effect of EFW on inequality is -0.672 in Table 4.6 such that the total estimated effect is -0.758. The corresponding effect of EFW on growth is 0.020 and the coefficient for GROWTH in the second-stage is -9.876 in column 2 of panels A2 and A1 of Table 4.7, respectively. The indirect effect of EFW on inequality is -0.198, or more than double the magnitude of the indirect effect from Table 4.6. The direct effect of EFW on gross income inequality in column 2 of Panel A1 in Table 4.7 is -0.565, slightly less in absolute value than the corresponding estimate of -0.672 in Table 4.6. The total effect of EFW on inequality in column 2 of Table 4.7 is -0.763, slightly greater in absolute value than the total estimated effect of -0.758 from Table 4.6. Similarly for the alternative specification that uses level values in lieu of growth rates, the inclusion of investment in the first stage results in underestimation of the impact of EFW on the level of development, as well as the indirect and total effects of EFW on inequality. Comparing the results in panel B of Table 4.6 to those of Table 4.7 provides supporting evidence of this.

It is possible that in an increasingly global economy business cycles are relatively synchronized across countries such that growth and/or inequality are affected by global economic trends in a homogenous manner. If this were the case, then one might expect that the statistical relationship between economic freedom and (i) economic growth and (ii) inequality to vary by time period. Table 4.8 adds a set of fixed time effects to the 2SLS model as a means to test this proposition. The p-value for the joint significance of the fixed time effects is reported as p(Time). In panel A, the direct effect of EFW on inequality is negative in all but columns 5 and 6, and when statistically significant, it is always negative. The indirect effect of EFW is always negative, and the total effect is negative in all but columns 5 and 6. The direct and total effects of EFW on inequality are more negative than the corresponding effects from panel A of Table 4.6.

The fixed time effects are jointly significant at 10 percent or better in columns 3, 4, 7, and 8 of panel A1, and in columns 1, 2, and 6 of panel A2. In panel B, which uses the levels of all variables, the direct effect of EFW on inequality is positive in all but column 3, and is significant at ten percent or better in columns 1, 2, 4, 5, and 6. The indirect effect is negative in all columns except 6 for which EFW has a negative but insignificant coefficient in the first stage. The direct and total effects of EFW on inequality are in general more positive than the corresponding estimates from panel B of Table 4.6. The fixed time effects are only jointly significant at ten percent of better in column 4 of panel B1, and columns 4 and 5 of panel B2.

An alternative to including fixed time effects is to estimate the model using cross-sectional data by observation period. The dataset used in this chapter contains enough data to estimate the 2SLS model using cross-sectional data for up to eight different quinquennial periods spanning 1975-2010. Table 4.9 summarizes the results for the cross-sectional 2SLS estimates. The results for each period are given in appendix Table E.5. Panel A of Table 4.9 provides the mean direct, indirect and total effects of EFW on inequality over each of the single year model estimates for each measure of inequality. Panels B, C, and D give the corresponding minimum, maximum, and standard deviation for each effect, respectively. Panels E and F summarize the qualitative effects of EFW in both stages, as well as those for GROWTH in the second stage, by measure of inequality and over all specification, respectively.

The direct effect of EFW on inequality is negative in 35 of the 49 second stage estimates, and when statistically significant at 10 percent or better (24/49), EFW is negative 92 percent of the time.[88] EFW is significant at 10 percent or better in seven of eight, four of eight, and six of seven second stage estimates when SWIID net income Gini, SWIID gross income Gini, and UTIP gross income Gini are used as the measure of inequality, respectively. When EFW is significant in these second stage estimates, it always has a negative sign. EFW is only significant in two of the five second stage estimates when the custom net income Gini data are used as the measure of inequality, but is negative in both instances. When the remaining measures of inequality are used, EFW is insignificant in the majority of the second stage estimates, and its sign is negative in only one of the five instances in which EFW is significant in the second stage.

[88] Column 7 in panel B of Table E.5 is the sole exception for which EFW is positive and significant in the second stage regression. The 90/10 ratio is the measure of inequality and the estimates pertain to t=2005 for this specification.

Table 4.6: 2SLS Regression – Scully Specification I

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	-2.359***	-0.672***	-1.481***	-1.692***	0.850	0.476	-0.469	-0.427
	(0.285)	(0.225)	(0.195)	(0.446)	(0.584)	(0.624)	(0.657)	(0.271)
GROWTH	-1.442	-5.398*	-5.832**	3.376	-14.334**	-9.028	-19.092**	-8.226***
	(3.708)	(3.147)	(2.347)	(6.842)	(6.055)	(6.078)	(7.477)	(2.837)
p(OID)	0.33	0.25	0.00	0.10	0.01	0.35	0.11	0.12
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	129.8	129.8	106.9	184.6	152.8	26.4	84.8	84.8
	Panel A2: First Stage Estimates – GROWTH is Dependent Variable							
EFW	0.016***	0.016***	0.016***	0.007*	0.017***	0.020***	0.018***	0.018***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.007)	(0.003)	(0.003)
KDOT	0.211***	0.211***	0.216***	0.279***	0.264***	0.165***	0.207***	0.207***
	(0.019)	(0.019)	(0.022)	(0.016)	(0.018)	(0.034)	(0.022)	(0.022)
GDOT	0.176***	0.176***	0.212***	0.249***	0.262***	0.123***	0.175***	0.175***
	(0.027)	(0.027)	(0.034)	(0.039)	(0.034)	(0.047)	(0.032)	(0.032)
R^2	0.54	0.54	0.57	0.69	0.72	0.43	0.56	0.56
N	686	686	496	226	172	172	470	470
	Panel A3: Effects of EFW on Inequality							
Direct	-2.359	-0.672	-1.481	-1.692	0.850	0.476	-0.469	-0.427
Indirect	-0.023	-0.086	-0.093	0.024	-0.244	-0.181	-0.344	-0.148
Total	-2.382	-0.758	-1.574	-1.668	0.606	0.295	-0.813	-0.575
	Panel B1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	0.558	0.746**	0.246	3.378***	2.282***	1.642**	0.728	0.135
	(0.374)	(0.319)	(0.255)	(0.552)	(0.623)	(0.660)	(0.801)	(0.306)
LRGDPL	-4.801***	-2.517***	-3.185***	-12.884***	-5.532***	-3.330***	-3.384***	-1.546***
	(0.369)	(0.326)	(0.275)	(0.979)	(1.139)	(0.549)	(0.830)	(0.346)
p(OID)	0.00	0.17	1.00	0.00	0.32	0.41	0.04	0.13
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	2530.4	2530.4	1673.8	531.7	795.1	729.1	1819.8	1819.8
	Panel B2: First Stage Estimates – LRGDPL is Dependent Variable							
EFW	0.040***	0.040***	0.043***	0.030**	0.024	-0.012	0.023*	0.023*
	(0.011)	(0.011)	(0.013)	(0.013)	(0.017)	(0.028)	(0.014)	(0.014)
LKL	0.567***	0.567***	0.540***	0.666***	0.636***	0.477***	0.582***	0.582***
	(0.025)	(0.025)	(0.027)	(0.034)	(0.033)	(0.052)	(0.032)	(0.032)
LGL	0.318***	0.318***	0.332***	0.240***	0.184***	0.386***	0.308***	0.308***
	(0.024)	(0.024)	(0.027)	(0.032)	(0.034)	(0.053)	(0.030)	(0.030)
R^2	0.95	0.95	0.95	0.93	0.92	0.92	0.94	0.94
N	686	686	497	226	172	172	470	470
	Panel B3: Panel A3: Effects of EFW on Inequality							
Direct	0.558	0.746	0.246	3.378	2.282	1.642	0.728	0.135
Indirect	-0.192	-0.101	-0.137	-0.387	-0.133	0.040	-0.078	-0.036
Total	0.366	0.645	0.109	2.991	2.149	1.682	0.650	0.099

Standard errors robust to heteroskedasticity reported in parentheses. F(WID) represents the Kleibergen-Papp rk Wald F statistic and should be compared to the Stock-Yogo critical values as a test for weak instruments. p(OID) is the p-value from the over-identification test that uses Hansen's J statistics. p(UID) is the p-value from the under-identification test that uses the Kleibergen-Papp rk LM statistic. Appendix Table E.1 provides details on the variables. *p < 0.10,** p < 0.05,*** p < .01.

Table 4.7: 2SLS Regression – Scully Specification II (No Capital)

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	-2.250***	-0.565**	-1.255***	-1.795***	1.799**	0.796	0.141	-0.212
	(0.313)	(0.254)	(0.218)	(0.489)	(0.751)	(0.713)	(0.800)	(0.308)
GROWTH	-5.986	-9.876*	-13.690***	-20.064	-39.548***	-18.628	-38.919***	-15.204***
	(5.936)	(5.068)	(3.578)	(16.006)	(10.615)	(13.094)	(14.229)	(5.236)
p(OID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p(UID)	66.5	66.5	83.6	7.5	17.5	9.1	34.8	34.8
F(WID)	-2.250***	-0.565**	-1.255***	-1.795***	1.799**	0.796	0.141	-0.212
	Panel A2: First Stage Estimates – GROWTH is Dependent Variable							
EFW	0.020***	0.020***	0.025***	0.001	0.030***	0.029***	0.027***	0.027***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)	(0.011)	(0.005)	(0.005)
GDOT	0.275***	0.275***	0.333***	0.299***	0.308***	0.170***	0.248***	0.248***
	(0.034)	(0.034)	(0.036)	(0.109)	(0.074)	(0.056)	(0.042)	(0.042)
R^2	0.24	0.24	0.30	0.14	0.31	0.17	0.25	0.25
N	686	686	496	226	172	172	470	470
	Panel A3: Effects of EFW on Inequality							
Direct	-2.250	-0.565	-1.255	-1.795	1.799	0.796	0.141	-0.212
Indirect	-0.120	-0.198	-0.342	-0.020	-1.186	-0.540	-1.051	-0.411
Total	-2.370	-0.763	-1.597	-1.815	0.613	0.256	-0.910	-0.623
	Panel B1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	0.851**	0.857***	0.246	4.128***	2.064***	1.556**	0.310	0.021
	(0.389)	(0.332)	(0.275)	(0.696)	(0.647)	(0.679)	(0.806)	(0.311)
LRGDPL	-5.278***	-2.698***	-3.186***	-14.784***	-4.921***	-3.136***	-2.592***	-1.330***
	(0.402)	(0.359)	(0.318)	(1.338)	(1.435)	(0.615)	(0.832)	(0.335)
p(OID)	2256.7	2256.7	1308.1	291.9	403.6	680.7	1656.1	1656.1
p(UID)	0.851**	0.857***	0.246	4.128***	2.064***	1.556**	0.310	0.021
F(WID)	(0.389)	(0.332)	(0.275)	(0.696)	(0.647)	(0.679)	(0.806)	(0.311)
	Panel B2: First Stage Estimates – LRGDPL is Dependent Variable							
EFW	0.148***	0.148***	0.155***	0.151***	0.175***	0.080**	0.112***	0.112***
	(0.016)	(0.016)	(0.017)	(0.022)	(0.029)	(0.039)	(0.019)	(0.019)
LGL	0.863***	0.863***	0.824***	0.755***	0.703***	0.865***	0.871***	0.871***
	(0.018)	(0.018)	(0.023)	(0.044)	(0.035)	(0.033)	(0.021)	(0.021)
R^2	0.87	0.87	0.87	0.79	0.75	0.83	0.85	0.85
N	686	686	497	226	172	172	470	470
	Panel B3: Panel A3: Effects of EFW on Inequality							
Direct	0.851	0.857	0.246	4.128	2.064	1.556	0.310	0.021
Indirect	-0.781	-0.399	-0.494	-2.232	-0.861	-0.251	-0.290	-0.149
Total	0.070	0.458	-0.248	1.896	1.203	1.305	0.020	-0.128

Standard errors robust to heteroskedasticity reported in parentheses. See notes to Table 4.7 for information on F(WID), p(UID), and p(OID). Appendix Table E.1 provides details on the variables. *p < 0.10,** p < 0.05,*** p < .01.

Table 4.8: 2SLS Regression – Scully Specification III (Fixed Time Effects)

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	-2.668***	-0.798***	-2.061***	-1.966***	0.445	0.733	-0.598	-0.467*
	(0.310)	(0.238)	(0.198)	(0.474)	(0.656)	(0.643)	(0.646)	(0.256)
GROWTH	-2.529	-6.728**	-5.947**	-0.613	-16.362***	-11.109*	-25.814***	-11.273***
	(4.001)	(3.328)	(2.527)	(8.010)	(6.290)	(6.640)	(8.045)	(3.055)
p(Time))	[0.176]	[0.516]	[0.000]	[0.004]	[0.185]	[0.286]	[0.002]	[0.010]
p(OID	0.43	0.31	0.14	0.18	0.00		0.18	0.18
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	117.0	117.0	89.8	151.0	138.6	22.3	72.4	72.4
	Panel A2: First Stage Estimates – GROWTH is Dependent Variable							
EFW	0.019***	0.019***	0.016***	0.006	0.020***	0.020**	0.019***	0.019***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.009)	(0.004)	(0.004)
KDOT	0.212***	0.212***	0.214***	0.273***	0.266***	0.161***	0.207***	0.207***
	(0.020)	(0.020)	(0.023)	(0.018)	(0.018)	(0.036)	(0.023)	(0.023)
GDOT	0.169***	0.169***	0.202***	0.246***	0.267***	0.121**	0.174***	0.174***
	(0.027)	(0.027)	(0.036)	(0.039)	(0.036)	(0.048)	(0.032)	(0.032)
p(Time)	[0.020]	[0.020]	[0.276]	[0.364]	[0.102]	[0.000]	[0.895]	[0.895]
R^2	0.54	0.54	0.57	0.69	0.72	0.41	0.56	0.56
N	686	686	496	226	172	172	470	470
	Panel A3: Effects of EFW on Inequality							
Direct	-2.668	-0.798	-2.061	-1.966	0.445	0.733	-0.598	-0.467
Indirect	-0.048	-0.128	-0.095	-0.004	-0.327	-0.222	-0.490	-0.214
Total	-2.716	-0.926	-2.156	-1.970	0.118	0.511	-1.088	-0.681
	Panel B1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	0.691*	0.861**	-0.384	3.344***	1.764***	2.149***	1.102	0.323
	(0.408)	(0.350)	(0.264)	(0.565)	(0.669)	(0.683)	(0.896)	(0.323)
LRGDPL	-4.863***	-2.578***	-2.896***	-12.709***	-5.492***	-3.541***	-3.757***	-1.715***
	(0.373)	(0.336)	(0.270)	(0.956)	(1.102)	(0.580)	(0.941)	(0.388)
p(Time)	[0.936]	[0.918]	[0.813]	[0.007]	[0.205]	[0.200]	[0.109]	[0.225]
p(OID)	0.00	0.18	0.60	0.00	0.45		0.03	0.09
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	2307.3	2307.3	1726.5	545.6	764.4	606.0	1436.8	1436.8
	Panel B2: First Stage Estimates – LRGDPL is Dependent Variable							
EFW	0.047***	0.047***	0.037***	0.030**	0.010	-0.010	0.039**	0.039**
	(0.013)	(0.013)	(0.013)	(0.014)	(0.019)	(0.035)	(0.016)	(0.016)
LKL	0.570***	0.570***	0.551***	0.675***	0.649***	0.477***	0.578***	0.578***
	(0.026)	(0.026)	(0.028)	(0.035)	(0.033)	(0.054)	(0.032)	(0.032)
LGL	0.312***	0.312***	0.324***	0.226***	0.170***	0.374***	0.300***	0.300***
	(0.025)	(0.025)	(0.028)	(0.034)	(0.034)	(0.053)	(0.030)	(0.030)
p(Time)	[0.336]	[0.336]	[0.134]	[0.085]	[0.10]	[0.575]	[0.176]	[0.176]
R^2	0.95	0.95	0.95	0.94	0.92	0.92	0.94	0.94
N	686	686	497	226	172	172	470	470
	Panel B3: Panel A3: Effects of EFW on Inequality							
Direct	0.691	0.861	-0.384	3.344	1.764	2.149	1.102	0.323
Indirect	-0.229	-0.121	-0.107	-0.381	-0.055	0.035	-0.147	-0.067
Total	0.462	0.740	-0.491	2.963	1.709	2.184	0.955	0.256

Standard errors robust to heteroskedasticity reported in parentheses. See notes to Table 4.7 for information on F(WID), p(UID), and p(OID). P-value for test of joint significance of fixed time effects reported in brackets. Appendix Table E.1 provides details on the variables. *p < 0.10,** p < 0.05,*** p < .01.

Table 4.9: Summary of Effects of EFW on Inequality from 2SLS Cross-Sectional Estimates

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A: Mean Effects of EFW on Inequality, All Single Year Estimates							
Direct	-2.405	-0.619	-1.908	-2.044	-0.166	0.684	0.422	-0.069
Indirect	-0.060	-0.085	-0.098	-0.144	-0.126	-0.544	-0.222	-0.097
Total	-2.465	-0.704	-2.005	-2.188	-0.292	0.140	0.200	-0.166
	Panel B: Min Effects of EFW on Inequality, All Single Year Estimates							
Direct	-4.751	-2.845	-2.602	-3.731	-0.830	-0.457	-3.079	-1.784
Indirect	-1.153	-0.669	-0.316	-1.154	-0.347	-0.992	-1.431	-0.481
Total	-4.283	-2.608	-2.569	-3.377	-1.177	-1.449	-3.756	-2.041
	Panel C: Max Effects of EFW on Inequality, All Single Year Estimates							
Direct	0.272	1.008	-1.580	-0.372	0.812	1.702	3.284	1.250
Indirect	0.468	0.237	0.090	0.409	0.041	-0.269	1.449	0.454
Total	-0.881	0.495	-1.696	-0.656	0.741	1.433	4.398	1.292
	Panel D: Standard Deviation of Effects of EFW on Inequality, All Single Year Estimates							
Direct	1.465	1.344	0.427	1.297	0.865	0.949	2.659	1.117
Indirect	0.544	0.306	0.128	0.633	0.200	0.332	0.945	0.312
Total	1.061	1.197	0.329	1.009	0.968	1.274	2.889	1.191
	Panel E: Summary Statistics							
#Time Periods	8	8	7	5	3	4	7	7
EFW								
2nd Stage (#*)	7	4	6	2	0	1	2	2
% Negative|*	100%	100%	100%	100%		0%	50%	0%
1st Stage (#*)	4	4	4	5	2	0	4	4
% Negative|*	0%	0%	0%	40%	0%		0%	0%
GROWTH								
2nd Stage (#*)	5	4	2	0	1	1	3	3
% Negative|*	40%	75%	100%	0%	100%	100%	100%	100%
	Panel F: Aggregate Summary Statistics for All Measures of Inequality							
		# Time Periods	EFW (#*) 2nd Stage	EFW % (-|*) 2nd Stage	EFW (#*) 1st Stage	EFW % (-|*) 1st Stage	GROWTH (#*) 2nd Stage	GROWTH % (-|*) 2nd Stage
		49	24	92%	27	7%	19	79%

(#*) indicates the number of cross-sectional estimates that are statistically significant at 10% or better. (x|*) is the probability of event x, conditional on the coefficient being significant at 10% or better. The summary statistics presented in panels A to D are based on all single observation period 2SLS estimates, regardless of statistical significance. Full results by observation period are given in appendix Table E.4.

Table 4.10: FE 2SLS Regression – Scully Specification IV (Fixed Country Effects)

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	0.189	0.598***	1.016***	1.166***	-0.007	0.807*	-0.043	-0.121
	(0.204)	(0.224)	(0.188)	(0.198)	(0.310)	(0.453)	(0.699)	(0.258)
GROWTH	-5.242*	-6.029**	1.013	2.612	-1.772	3.827	-11.599	-6.607
	(2.776)	(2.849)	(1.506)	(2.072)	(2.818)	(7.171)	(8.825)	(4.570)
p(OID)	0.11	0.10	0.06	0.57	0.10	0.87	0.58	0.90
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	86.7	86.7	88.0	226.3	129.0	9.1	50.9	50.9
	Panel A2: First Stage Estimates – GROWTH is Dependent Variable							
EFW	0.012***	0.012***	0.005	0.011**	0.020***	0.012	0.017***	0.017***
	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.009)	(0.004)	(0.004)
KDOT	0.195***	0.195***	0.201***	0.275***	0.236***	0.114**	0.181***	0.181***
	(0.021)	(0.021)	(0.026)	(0.015)	(0.017)	(0.050)	(0.027)	(0.027)
GDOT	0.134***	0.134***	0.170***	0.180***	0.216***	0.112**	0.140***	0.140***
	(0.026)	(0.026)	(0.033)	(0.038)	(0.029)	(0.049)	(0.034)	(0.034)
R^2	0.42	0.42	0.39	0.66	0.64	0.02	0.42	0.42
N	681	681	485	216	153	159	459	459
	Panel A3: Effects of EFW on Inequality							
Direct	0.189	0.598	1.016	1.166	-0.007	0.807	-0.043	-0.121
Indirect	-0.063	-0.072	0.005	0.029	-0.035	0.046	-0.197	-0.112
Total	0.126	0.526	1.021	1.195	-0.042	0.853	-0.240	-0.233
	Panel B1: Second Stage Estimates – Inequality is Dependent Variable							
EFW	-0.157	-0.029	1.194***	0.767***	-0.365	0.623	0.246	-0.002
	(0.292)	(0.323)	(0.244)	(0.295)	(0.391)	(0.717)	(1.166)	(0.473)
LRGDPL	1.202	2.616*	-0.948	1.881	2.278	1.997	-3.978	-1.988
	(1.320)	(1.353)	(0.868)	(1.227)	(2.173)	(3.429)	(4.881)	(2.618)
p(OID)	0.27	0.22	0.08	0.82	0.54	0.30	0.40	0.50
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	144.6	144.6	173.6	150.0	133.3	16.0	68.0	68.0
	Panel B2: First Stage Estimates – LRGDPL is Dependent Variable							
EFW	0.055**	0.055***	0.060***	0.051***	0.033***	0.050***	0.055***	0.055**
	(0.008)	(0.008)	(0.010)	(0.011)	(0.009)	(0.019)	(0.009)	(0.009)
LKL	0.334***	0.334***	0.314***	0.480***	0.361***	0.245***	0.311***	0.311***
	(0.036)	(0.036)	(0.029)	(0.038)	(0.032)	(0.066)	(0.038)	(0.038)
LGL	0.360***	0.360***	0.396***	0.322***	0.412***	0.253***	0.284***	0.284***
	(0.043)	(0.043)	(0.038)	(0.046)	(0.065)	(0.082)	(0.048)	(0.048)
R^2	0.74	0.74	0.72	0.86	0.83	0.51	0.69	0.69
N	681	681	486	216	153	159	459	459
	Panel B3: Panel A3: Effects of EFW on Inequality							
Direct	-0.157	-0.029	1.194	0.767	-0.365	0.623	0.246	-0.002
Indirect	0.066	0.144	-0.057	0.061	0.075	0.100	-0.219	-0.109
Total	-0.091	0.115	1.137	0.828	-0.290	0.723	0.027	-0.111

Standard errors robust to heteroskedasticity reported in parentheses. See notes to Table 4.7 for information on F(WID), p(UID), and p(OID). Appendix Table E.1 provides details on the variables. *$p < 0.10$,** $p < 0.05$,*** $p < .01$.

The growth rate is significant at 10 percent or better in only 19 of 49 of the second stage regressions, and has a negative coefficient in 79 percent of the estimates for which GROWTH is a significant determinant of inequality. Three of the four instances in which GROWTH is positive and significant occur when the SWIID net income Gini is the measure of inequality, with the other occurs when the SWIID gross income Gini is used. EFW is significant in 27 of the 49 first stage specifications and has a positive coefficient in 93 percent of the significant estimates. The only instances of EFW being negative and significant in the first stage occur when the custom net income Gini is the measure of inequality (three of five significant coefficients are positive). These findings suggest that in general EFW exerts a negative direct as well as indirect impact on inequality, although as before, caution should be taken when interpreting these results due to the inconsistency in the qualitative effects and statistical insignificance for many specifications. The mean indirect effect of EFW on inequality is negative for each of the eight measures of inequality used, while the mean direct effect is negative for six of the eight measures of inequality. The mean total effect is also negative for six of the eight measures. The mean total estimated effects of EFW on inequality are: -2.465, -0.704, -2.005, and -2.188 in columns 1 to 4 in panel A of Table 4.9. To put these estimates in perspective, a standard deviation increase in EFW is associated with, on average, a 0.296, 0.106, 0.422, and 0.267 standard deviation decrease in SWIID net income, SWIID gross income, UTIP gross income, and the custom net income inequality measures, respectively.[89]

Because the levels of economic freedom and inequality are highly correlated over time within a country and the growth rate of the economy is more cyclical, the relationship between economic freedom and inequality is likely to be more stable for a given country over multiple periods, while the relationships between the growth rate of the economy and (i) inequality and (ii) economic freedom likely exhibit greater variation for a given country over time.[90] Scully pools his data and does not control for fixed country effects such that data for a given country for different time periods are treated as a random observations, but likely exhibit very similar levels of economic freedom and inequality, and potentially very different growth rates. This potentially

[89] The point estimates for the remaining measures of inequality are more often than not statistically insignificant, so standardized estimates are omitted here.
[90] Capital and government consumption are components of GDP, so the relationship between the growth rates of these measures is of less concern as they are expected to move together.

introduces somewhat artificial variation to the resulting statistical estimates when the data are pooled. Table 4.10 provides estimates for the model using a fixed effects 2SLS specification.

As with Tables 4.6, 4.7, and 4.8, panels A and B of Table 4.10 provide the results for the specifications that use the growth and levels of log GDP, capital, and government consumption per capita, respectively. The estimated direct effect of EFW on inequality is positive in five of the eight columns in panel A1 of Table 4.10, and when statistically significant, it is always positive. EFW is always positively associated with GDP per capita growth in panel A2, and is significant at 5 percent or better in six of eight columns. Growth is a negative determinant of inequality in five of the eight second-stage estimates, but is only significant in columns 1 and 2. The results in panel A suggest that in general, EFW exerts positive direct and total impacts on inequality. Because GROWTH is only significant (and negative) in the second stage in columns 1 and 2, the indirect (and hence total) effect of EFW on inequality cannot be discerned with much confidence, although the estimates do suggest that when a large number of countries is included in the sample, the estimated indirect impact tends to be negative. These results are reported in panel A3. The story is much the same in panel B, where EFW is always a positive and highly significant determinant of the level of log GDP per capita, and a positive determinant of inequality when significant in the second stage (columns 2 and 3). The level of output is only significant (and positive) in column 2 of the second stage regression. The results from panel B point to EFW exerting a positive overall effect on inequality when controlling for country fixed effects, but as with the results from panel A, caution should be taken interpreting these results due to the general insignificance and non-robustness of the estimates.

Scully (2002) finds economic freedom to exert a negative direct effect on inequality and a small but positive indirect effect on inequality through its positive impact on growth for a small sample of mostly developed economies. The above analysis suggests a number of potential specification issues with Scully's model and shows that his results are sensitive to the measure of inequality used, the time period and sample of countries observed, and the type of estimation method used. The results presented here suggest that in most instances, EFW exerts both a negative direct and indirect effect on inequality when inequality is modeled as a function of growth, but the opposite is true when inequality is instead modeled as a function of the level of output. The results are more mixed for the fixed country effects specification in Table 4.10, and although EFW is found to exert a positive effect on inequality in the majority of regressions, it is often insignificant.

4.5.4 Bergh and Nilsson Panel Specification

Using an earlier version of the SWIID net income Gini coefficients as their primary measure of inequality, Bergh and Nilsson, hereafter BN (2010), provide the most recent cross-country analysis of the relationship between economic freedom and inequality using panel data methods. Their baseline estimates (Table 2, p. 496) are derived from a fixed effects specification, given by equation 4.17 where $X_{i,t}$ is a vector of control variables for country i at time t, c_i is a fixed country effect, and $dt, t \in [1, \dots, T]$ represent a set of fixed time effects. Their main specification includes as control variables: log of real GDP per capita (LRGDPL), the share of the adult population that has completed a tertiary education (HUMCAP) and the ratio of the dependent (under 15 and over 65 years of age) to working age (15-64 years of age) populations (DEP2LABOR).

$$\mathrm{Ineq}_{i,t} = \alpha_0 + \alpha_1 \mathrm{EF}_{i,t} + X'_{i,t}\beta + \sum_{t=1}^{T} \gamma_t dt + c_i + e_{i,t} \qquad (4.17)$$

BN (2010) estimate equation 4.17 using the aggregate EFW index as well as each of the five area sub-indices separately, finding that the EFW as well as both freedom to trade internationally (EF4) and freedom from regulation of business, credit, and labor (EF5) are positive and statistically significant (at 5 percent or better) determinants of inequality. BN also perform a number of additional robustness checks, concluding that EF4 and EF5 are the most robust (and positive) determinants of inequality. Column 1 of Table 4.11 reproduces BN's baseline results using their dataset, which includes data for a sample of 78 countries over the period 1970-2005.[91] Panel A gives the results using the aggregate EFW index, while subsequent panels provide the results for each of the five economic freedom areas.

The SWIID dataset is updated periodically and version 4.0 was released in September 2013, providing expanded country and time coverage. Using the net income Gini measures from SWIID 4.0 in lieu of the earlier SWIID net income Gini measures used by BN, column 2 of Table 4.11 repeats the estimates from column 1 for the same sample of countries and time period

[91] BN paper dataset available from Andreas Bergh's website at <http://www.andreasbergh.se/papers/do-liberalization-and-globalization-increase-income-inequality.html>.

using the same dataset of independent variables as BN (2010).[92] Using the SWIID 4.0 net income Gini measures in column 2 adds no more than 20 total country-year observations to each specification relative to column1, but is otherwise identical in terms of country coverage and time periods examined such that one would expect the results to be very similar.[93] The results are very surprising, as none of the economic freedom measures are statistically significant in column 2. In addition EF2, EF3 and EF5 have the opposite sign as that reported in column 1. The partial effects for the control variables are qualitatively and statistically similar in columns 1 and 2, as is the explanatory power of the two specifications.

These results call into question the robustness of BN's (2010) findings. One possible explanation for the dramatic difference is inconsistency in country-year observations between SWIID versions. Although the correlation between the SWIID net income Gini measures used by BN and the version 4.0 measures used in the current study is quite high at 0.858, there is a difference of at least five Gini points (roughly a half standard deviation) between the two datasets for more than a quarter of the 645 overlapping country-year observations. There is at least a ten Gini point difference (approximately a full standard deviation) between the two datasets for nearly one in ten overlapping country-year observations.[94] The mean difference between the two datasets is 3.90 Gini points, the standard deviation of differences is 4.51 Gini points, and the minimum and maximum differences are 0.02 and 29.08, respectively. The disparity in inequality measures between the two versions is likely attributable to the fact that the SWIID Gini measures are derived using an estimation algorithm rather than actual household micro-data.

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[92] Although updated versions of all independent variables are available, the variables as used by BN are used here as a means to make the estimates as comparable as possible.

[93] Both the SWIID measures used by BN (2010) and the current SWIID 4.0 inequality measures represent the average over a five-year period, although the former assigns the average over the previous five years to years ending in five or zero, while the current method assigns to each year ending in five or zero the average over the two years before through the two years after it. On theoretical grounds, the current method is preferable to that of BN because the former provides a better approximation of contemporaneous inequality, which is desirable because contemporaneous measures of the other variables are used, when available. When unavailable, a similar method as that used here is employed. The correlations between the two methods are 0.986 and 0.975 for the SWIID 4.0 net and gross income Gini measures, respectively. Using the BN averaging method in lieu of the one used here does not alter the results in a substantive way. Results omitted here but available upon request.

[94] 167 of the 645 country-year observations that appear in both datasets have a five Gini point difference or more (on scale of 0-100), and 59 have a difference of 10 points or more. For this exercise, the averaging method of BN is applied to the SWIID version 4.0 data to maximize comparability between the two datasets. See previous footnote for more information.

Column 3 of Table 4.11 uses the SWIID 4.0 gross income Gini measures as the dependent variable, preserving the same country sample, period, and BN (2010) dataset from columns 1 and 2. BN (2010) find EFW and EF4 to be positive and significant determinants of gross income inequality, with partial effects of 1.029 and 0.799, respectively. Using the SWIID 4.0 gross income Gini data, EFW has a positive but insignificant partial effect of 0.269, while EF4 has a negative but insignificant partial effect of -0.170. Although BN do not find EF5 to be a statistically significant determinant of gross income inequality, EF5 has a significant (at 5 percent) and positive partial effect of 1.685 in column 3 of Table 4.11.

The remaining regressions of Table 4.11 use updated data for the independent variables and do not restrict the country sample or time period. Column 4 uses the SWIID net income Gini measures from BN (2010) as the dependent variable. Removing the sample restrictions increases the number of countries from 78 to 93 relative to column 1, and the number of total observations increases by an average of 76.17 over panels A to F. EF1 and EF5 are both significant at 5 percent in column 4 and have positive partial effects of 0.578 and 1.218, respectively. The remaining economic freedom components are insignificant. Columns 5 and 6 use the SWIID 4.0 net and gross income Gini data, respectively, for the unrestricted sample. The number of countries used in the estimations rises from 78 to 112, and the average number of country-years observations over panels A to F increases by 232.5 when the unrestricted samples are used.[95] EF2 has a significant and negative (at 10 percent) coefficient of -0.455 in column 5, while EF5 is statistically significant (at 5 percent or better) in both columns 5 and 6, with positive coefficients of 0.909 and 1.252, respectively. The remaining economic freedom measures are statistically insignificant across columns 5 and 6.

Column 7 uses the UTIP gross income Gini measures as the dependent variable. Up to 109 countries and 635 observations are used in the estimates in column 7. EF1, EF4, and EF5 are all positive and significant (at 10 percent or better), with coefficients of 0.461, 0.297, and 1.417, respectively. Column 8 uses the custom net income Gini dataset, providing estimates based on a sample of 57 mostly developed countries and up to 245 country-year observations. EFW, EF1, EF4, and EF5 are all positive and significant (at 5 percent or better) in column 8, suggesting that marginal increases in these measures of economic freedom are positively correlated with increases in within-country net income inequality in advanced economies. Columns 9 and 10 use

[95] Only 111 countries are used in the estimations for panel E of columns 4 and 5.

the custom gross income and consumption Gini datasets, respectively. None of the economic freedom indices are significant in either column. Because most of the countries included in these two samples are low or middle income, this suggests that economic freedom may exert a differential impact on inequality depending on the level of development. The results from columns 7-9 are qualitatively similar to the results that BN (2010, Table 7) report by development level. Finally, the 90/10 and 80/20 income ratios are used as the measure of inequality in columns 11 and 12, respectively. Nearly all of the economic freedom variables are statistically insignificant in these two columns. EF2 is the lone exception, as it has a negative and significant (at 10 percent) coefficient of -1.034 in column 11.

BN (2010) employed a large number of sensitivity tests in their analysis, finding EF4 and EF5 to be relatively robust and positive determinants of inequality. The estimates from Table 4.11 constitute an additional test of sensitivity of their results by employing more recent data that allow for expanded country and time coverage, as well as alternative measures of inequality. The results largely suggest that freedom to trade international (EF4) is in general not a significant determinant of inequality, as three quarters of the estimates are statistically insignificant. When significant (columns 1, 7, and 8), EF4 is positive. The results in panel F suggest that freedom from regulation (EF5) is the more robust determinant of inequality, as it has a positive coefficient in all but columns 9 and 10 (neither is significant), which both use samples of mostly less developed countries. EF5 is positive and significant in two-thirds of the estimates, suggesting that economic regulations may play a role in promoting greater economic equality over time within an economy.

4.6 Summary

Despite many unanswered questions concerning the relationship between market capitalism and inequality, many continue to treat the so-called equality-efficiency tradeoff as if it were a stylized fact. As the framework advanced in section 4.2 indicates, the relationship between economic freedom and inequality is theoretically ambiguous. Several studies have examined the empirical relationship between economic freedom and inequality and have found somewhat contrasting results. Above it was indicated that these studies have employed different econometric specifications as well as made use of different measures of inequality and economic freedom. Previous problems of data availability and quality have been reduced in recent years as several relatively comparable inequality datasets are now available and the Economic Freedom of the World dataset, which has been used in more than 400 scholarly articles (Hall and Lawson, 2013), has been validated as the standard quantitative measure of economic freedom.

Making use of these data, each of the four main econometric specifications that have been used in the literature to study the empirical relationship between economic freedom and inequality are re-examined using eight alternative measures of inequality. The results suggest that not only do different econometric specifications often generate different results, but that for a given econometric model the results are often sensitive to the measures of inequality, time period, and country sample. While the analysis here further complicates an already limited understanding of how economic freedom impacts economic inequality, it should serve as a cautionary warning to policymakers desiring to alter the distribution of income by adopting policy and/or institutional changes that will reduce economic freedom. It can be said with relatively high confidence that reducing economic freedom will have an adverse impact on economic growth, but additional evidence is needed to determine how reducing economic freedom will impact economic inequality. Chapter five explores in more detail one channel, the rule of law, through which institutions potentially impact economic inequality.

Table 4.11: Fixed Effects Regression – Bergh & Nilsson Specification

	Measure of Inequality											
	SWIID	SWIID	SWIID	SWIID	SWIID	SWIID	UTIP	Chpt. 3	Chpt. 3	Chpt. 3	WDI/WIID	WDI/WIID
	Net	Net	Gross	Net	Net	Gross	Gross	Net	Gross	Consumption	90/10	80/20
	Gini[a]	Gini[b]	Gini[b]	Gini[a]	Gini[b]	Gini[b]	Gini	Gini	Gini	Gini	Ratio	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Aggregate EFW Index											
EFW	0.949**	-0.576	0.269	0.456	-0.520	-0.226	0.404	1.017**	0.162	-0.920	-0.200	-0.329
	(0.384)	(0.695)	(0.609)	(0.331)	(0.463)	(0.457)	(0.353)	(0.387)	(0.385)	(0.725)	(1.303)	(0.598)
LRGDPL	3.304**	5.293**	7.555***	3.910***	5.390***	6.487***	-3.262***	0.528	5.014**	1.357	4.235	3.363**
	(1.570)	(2.173)	(2.200)	(1.482)	(1.739)	(1.620)	(1.198)	(2.451)	(2.317)	(3.186)	(3.050)	(1.686)
HUMCAP	0.373**	0.332	0.302	0.167	0.187	0.202	-0.053	-0.015	-0.121	0.261	-0.161	-0.018
	(0.162)	(0.246)	(0.247)	(0.135)	(0.125)	(0.138)	(0.092)	(0.115)	(0.344)	(0.378)	(0.313)	(0.115)
DEP2LABOR	4.219	10.094*	24.299***	3.966	15.002***	25.914***	2.239	6.012	-9.511	-16.290*	-9.512	-2.451
	(3.490)	(6.018)	(5.056)	(3.569)	(5.141)	(5.093)	(3.416)	(5.174)	(10.175)	(9.508)	(11.923)	(4.608)
R^2	0.14	0.11	0.18	0.13	0.12	0.17	0.26	0.34	0.19	0.11	0.05	0.06
N	479	497	497	555	732	732	573	240	178	164	474	474
Countries	78	78	78	93	112	112	109	57	62	57	108	108
p(Time)	0.00	0.02	0.01	0.06	0.04	0.02	0.00	0.00	0.00	0.96	0.00	0.00
	Panel B: EFW Area 1: Size of Government											
EF1	0.604	-0.059	0.152	0.578**	-0.110	-0.050	0.461**	0.571**	0.293	-0.460	-0.302	-0.013
	(0.368)	(0.498)	(0.521)	(0.266)	(0.348)	(0.374)	(0.207)	(0.238)	(0.342)	(0.728)	(0.707)	(0.230)
LRGDPL	3.849***	4.309**	7.062***	4.193***	4.855***	6.017***	-3.148***	0.550	4.667*	0.587	3.437	2.912*
	(1.242)	(1.917)	(1.926)	(1.348)	(1.680)	(1.537)	(1.010)	(2.328)	(2.469)	(3.027)	(2.952)	(1.584)
HUMCAP	0.366**	0.419*	0.464**	0.207*	0.284**	0.312**	-0.033	-0.100	-0.093	0.509*	-0.118	-0.013
	(0.148)	(0.249)	(0.228)	(0.123)	(0.125)	(0.134)	(0.086)	(0.110)	(0.355)	(0.268)	(0.294)	(0.112)
DEP2LABOR	7.137**	16.987***	30.779***	6.680**	15.423***	25.057***	4.264	6.059	-10.333	-19.409**	-10.448	-2.562
	(3.220)	(6.030)	(5.308)	(3.280)	(4.869)	(5.222)	(2.843)	(4.915)	(11.075)	(9.183)	(12.386)	(4.631)
R^2	0.16	0.13	0.22	0.16	0.14	0.19	0.28	0.32	0.18	0.14	0.05	0.06
N	509	529	529	576	758	758	624	243	180	163	475	475
Countries	78	78	78	94	112	112	109	56	63	57	108	108
p(Time)	0.000	0.001	0.000	0.001	0.004	0.002	0.000	0.001	0.000	0.779	0.000	0.000
	Panel C: EFW Area 2: Rule of Law & Property Rights											
EF2	-0.045	-0.033	0.145	0.004	-0.455*	-0.327	-0.048	-0.257	0.126	0.202	-1.034*	-0.183
	(0.273)	(0.434)	(0.412)	(0.206)	(0.270)	(0.276)	(0.158)	(0.289)	(0.442)	(0.646)	(0.577)	(0.244)
LRGDPL	3.077**	4.429*	7.051***	3.956***	4.980***	6.286***	-2.680**	1.197	4.564*	0.131	3.382	3.137
	(1.328)	(2.228)	(2.422)	(1.368)	(1.763)	(1.738)	(1.310)	(2.550)	(2.448)	(3.008)	(3.345)	(2.024)
HUMCAP	0.240*	0.392	0.330	0.139	0.174	0.188	-0.080	-0.067	-0.116	0.193	-0.083	0.001
	(0.133)	(0.259)	(0.264)	(0.125)	(0.121)	(0.138)	(0.097)	(0.113)	(0.350)	(0.398)	(0.296)	(0.120)
DEP2LABOR	4.477	8.361	21.557***	3.402	14.958***	25.520***	2.756	1.020	-14.020	-19.378**	-11.955	-4.631
	(3.399)	(6.199)	(5.289)	(3.683)	(4.901)	(4.951)	(3.534)	(5.308)	(10.646)	(9.190)	(13.644)	(6.684)
R^2	0.12	0.09	0.16	0.12	0.12	0.17	0.26	0.30	0.17	0.09	0.05	0.06
N	461	480	480	539	703	703	536	240	174	163	463	463
Countries	78	78	78	93	112	112	105	57	59	57	107	107
p(Time)	0.016	0.069	0.024	0.037	0.036	0.014	0.000	0.000	0.001	0.425	0.000	0.001

Table 4.11 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel D: EFW Area 3: Sound Money											
EF3	-0.007	-0.323	-0.130	-0.172	-0.274	-0.226	-0.211	0.060	-0.139	-0.041	0.178	-0.128
	(0.212)	(0.252)	(0.237)	(0.132)	(0.173)	(0.168)	(0.136)	(0.163)	(0.183)	(0.235)	(0.555)	(0.278)
LRGDPL	3.353**	5.420**	7.284***	4.396***	5.299***	6.321***	-2.788***	-0.061	4.536*	-0.345	3.131	3.002*
	(1.506)	(2.211)	(1.949)	(1.412)	(1.769)	(1.564)	(1.034)	(2.420)	(2.411)	(3.495)	(3.343)	(1.793)
HUMCAP	0.308*	0.266	0.338	0.223*	0.253**	0.276**	-0.015	-0.109	-0.091	0.160	-0.146	0.002
	(0.157)	(0.262)	(0.241)	(0.134)	(0.126)	(0.132)	(0.092)	(0.117)	(0.343)	(0.393)	(0.313)	(0.119)
DEP2LABOR	5.437	16.890***	29.686***	4.770	15.287***	24.788***	3.482	1.514	-11.260	-13.121	-9.583	-1.620
	(3.450)	(6.160)	(5.379)	(3.424)	(4.804)	(5.112)	(2.672)	(4.977)	(10.384)	(9.747)	(11.727)	(4.163)
R^2	0.14	0.13	0.21	0.14	0.14	0.19	0.26	0.30	0.18	0.07	0.05	0.06
N	503	522	522	585	769	769	635	245	180	165	479	479
Countries	78	78	78	94	112	112	109	57	63	57	108	108
p(Time)	0.000	0.001	0.000	0.003	0.002	0.000	0.000	0.000	0.000	0.872	0.000	0.000
	Panel E: EFW Area 4: Freedom to Trade Internationally											
EF4	0.662**	-0.588	-0.170	0.237	-0.087	-0.088	0.297*	0.835***	0.278	0.004	0.288	-0.009
	(0.295)	(0.707)	(0.567)	(0.164)	(0.303)	(0.262)	(0.162)	(0.196)	(0.255)	(0.507)	(0.507)	(0.183)
LRGDPL	3.680**	4.751**	7.210***	4.307***	5.044***	6.282***	-3.259***	1.598	4.975**	-0.061	4.376	3.325**
	(1.464)	(2.246)	(2.157)	(1.382)	(1.773)	(1.580)	(0.992)	(2.359)	(2.220)	(3.340)	(3.019)	(1.643)
HUMCAP	0.409***	0.315	0.353	0.241*	0.251**	0.263**	-0.044	0.056	-0.133	0.206	-0.112	-0.010
	(0.147)	(0.259)	(0.238)	(0.125)	(0.123)	(0.133)	(0.088)	(0.116)	(0.345)	(0.387)	(0.297)	(0.113)
DEP2LABOR	3.105	11.719*	25.774***	2.837	16.157***	27.241***	2.460	6.753	-8.997	-17.986*	-8.542	-2.264
	(3.086)	(5.964)	(5.290)	(3.094)	(4.807)	(4.825)	(3.372)	(5.094)	(10.338)	(9.327)	(12.966)	(4.981)
R^2	0.14	0.11	0.18	0.14	0.13	0.19	0.26	0.36	0.20	0.09	0.05	0.06
N	493	511	511	563	732	732	581	240	177	160	467	467
Countries	78	78	78	93	111	111	104	57	62	56	107	107
p(Time)	0.000	0.004	0.001	0.006	0.035	0.006	0.000	0.000	0.000	0.900	0.001	0.002
	Panel F: EFW Area 5: Freedom from Regulation											
EF5	1.260***	0.587	1.685**	1.218***	0.909**	1.252***	1.417***	0.729**	-0.126	-1.795	0.356	0.116
	(0.459)	(0.659)	(0.776)	(0.327)	(0.355)	(0.400)	(0.439)	(0.285)	(0.561)	(1.086)	(0.985)	(0.423)
LRGDPL	4.361**	7.625***	9.458***	3.871**	6.005***	6.863***	-3.432***	0.827	5.081**	1.578	3.632	2.933*
	(1.862)	(2.361)	(2.077)	(1.583)	(1.633)	(1.425)	(1.109)	(2.339)	(2.408)	(3.036)	(3.066)	(1.675)
HUMCAP	0.341*	0.273	0.321	3.871**	6.005***	6.863***	-3.432***	0.827	5.081**	1.578	3.632	2.933*
	(0.177)	(0.263)	(0.262)	(1.583)	(1.633)	(1.425)	(1.109)	(2.339)	(2.408)	(3.036)	(3.066)	(1.675)
DEP2LABOR	3.044	11.024*	25.573***	4.445	15.810***	26.461***	2.153	4.115	-10.114	-15.045*	-8.347	-2.178
	(3.754)	(6.250)	(5.487)	(3.645)	(4.746)	(4.434)	(4.081)	(5.090)	(11.100)	(8.460)	(11.986)	(4.631)
R^2	0.15	0.14	0.21	0.16	0.14	0.19	0.31	0.34	0.19	0.15	0.05	0.06
N	465	481	481	549	721	721	560	242	179	162	476	476
Countries	78	78	78	93	112	112	109	57	63	57	108	108
p(Time)	0.006	0.013	0.006	0.002	0.004	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Dataset	BN	BN	BN	Updated	Updated	Updated	Updated	Updated	Updated	Updated	Updated	Updated

(a) Net income Gini measures used by Bergh and Nilsson (2010) - reflect an earlier version of the SWIID dataset. (b) Gini data from SWIID version 4, released September 2013. Data for independent variables in columns 1-3 from Bergh and Nilsson (2010) dataset. Updated data used in remaining regressions - see appendix Table E.1 for data sources. All regressions include a set of fixed time effects, with the p-value of joint significance reported as p(Time). Standard errors robust to heteroskedasticity and autocorrelation reported in parentheses. p < 0.10,** p < 0.05,*** p < .01.

CHAPTER FIVE

LEGAL ORIGINS & THE DISTRIBUTIONAL CONSEQUENCES OF THE RULE OF LAW

"We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed."
–U.S. Declaration of Independence

5.1 Introduction

As the above quote from the U.S. Declaration of Independence seems to suggest, the intended role of the U.S. government, as envisioned by the nation's founders, is to treat its citizens in an equitable manner so as not to undermine unalienable rights such as life, liberty, and the pursuit of happiness. Many have interpreted this statement to mean that government is intended to create and preserve an equitable rule of law in which all men play by the same rules. Others however have fixated on the word equality from the statement in making arguments that the government should play an active role in promoting equality of economic outcomes. Holding all else constant, greater equality may be preferable to higher inequality, but government policy designed to achieve greater economic equality necessarily involves creating a set of rules that are not applied equally to all citizens, violating equality before the law and the individual economic liberties of those negatively impacted by such policies. Milton Friedman (1980) famously suggested that "A society that puts equality before freedom will get neither. A society that puts freedom before equality will get a high degree of both."

World history has been characterized by societies founded by conquest and plunder, whereby those ascending to political authority have ruled absolutely and arbitrarily over those under their control. In such societies, only those who have manage to find favor with or become the ruling political authorities have been permitted to acquire property (often including humans as slaves or serfs), receive protection under the law, and engage in economic activities. The privileged elite have often accumulate personal wealth, while the remainder and majority of the population were relegated to a life of impoverishment and arbitrarily denied economic opportunities and protections under the law (Acemoglu and Robinson, 2012; Sokoloff and Engerman, 2000; Engerman and Sokoloff, 2006).

Economic inequality has therefore been a mainstay throughout history, particularly since the era of European colonization, and it is only relatively recently that economic inequality has begun to subside. For instance, Bourguignon and Morrison (2002) estimate that global inequality increased almost continuously from the beginning of the 19th century through the first half of the 20th century, but has leveled off since then. Global inequality has declined over the past several decades as some previously underdeveloped nations have experienced economic liberalization, creating an economic environment conducive to rapid growth that has not only reduced some of the disparity in the average living standards between many developed and developing countries (Pinkovsky and Sala-i-Martin 2009), but has also lifted millions of people out of poverty by increasing the economic opportunities available to them in the newly emerging market economies of the world (Chansukree, 2012; Connors, 2012)

Although global inequality has subsided in recent decades, substantial disparities in the level of inequality within nations persist among countries around the world. Inequality tends to be persistent over long periods of time, particularly in societies where a wealthy elite minority segment of the population have managed to "establish a legal framework that insured them disproportionate shares of political power, and to use that greater influence to establish rules, laws, and other government policies that advantaged members of the elite relative to nonmembers" (Sokoloff and Engerman, 2000, p. 223). In such societies, the elite have been able to institutionalize rules and laws to protect their wealth and restrict economic opportunities for the majority of the population, contributing to the relative inelasticity of economic inequality. Acemoglu and Robinson (2012) refer this process as a vicious circle. Easterly (2007) refers to the rigidity of inequality by such non-market mechanisms as structural inequality, which he distinguishes from market inequality that arises naturally in the context of a market economy because success tends to be rewarded very unevenly "across different individuals, cities, regions, firms, and industries" (p. 756).

It has thus been argued that countries with a rule of law characterized by partial courts that fail to offer broad protection of private property rights and enforce contracts in an even-handed manner are more likely to exhibit higher levels of economic inequality than countries whose legal system effectively and impartially protect private property and enforce contracts, characteristics of a market economy that are essential for the price mechanism to efficiently allocate resources. If this is true then it seems to reason that, contrary to critics of market capitalism, the legal institutions underpinning modern market capitalism serve as a mechanism to deter extreme economic inequality, at least relative to countries with legal institutions designed to only serve the interests of the elite.

This chapter presents evidence that the legal apparatus necessary to support a free and capitalistic market economy, which has often been argued to be prerequisite for individual liberty (e.g. Alchian, 2008; Hayek, 1960), is also an effective means of restraining extreme and persistent economic inequality. It does so by developing an identification strategy that simultaneously accounts for the two prevailing views of the origins of legal institutions, legal tradition and factor endowments, (Levine, 2005) as a means to estimate the potential causal impact of legal institutions on economic inequality. It can therefore be construed as en empirical test of the Engerman-Sokoloff Hypothesis that the elite's historical efforts to influence the rule of law, when successful, have perpetuated economic inequality. It might also be considered an empirical test of Friedman's Freedom-Inequality Hypothesis.

The remainder of this chapter is organized as follows. Section 5.2 describes the two views on the origins of legal institutions and argues that both legal tradition and endowments are important determinants of contemporary legal systems. The data and empirical methodology are described in section 5.3. Section 5.4 presents the main results, followed by robustness checks in the penultimate section. Concluding remarks are given in section 5.6.

5.2 Two Views on the Origins of Legal Institutions

The wealthy elite have historically sought to influence the development of legal institutions as a means to protect their economic interests at the expense of denying the same legal rights to the broader population, resulting in inequality before the law when such efforts have been successful. Legal systems that favor one group of people over others provides "highly unbalanced access to property rights and economic opportunities" that favor an elite group relative to the rest of the population, allowing for perpetually high levels of economic inequality when such systems became institutionalized (Engerman and Sokoloff, 2005, p. 41). Easterly (2007) refers to this persistence of economic inequality as structural inequality, while Acemoglu and Robinson (2012) call it as part of a vicious circle.

Given that one group of people yielding political and/or economic power has an incentive to develop legal institutions to preserve their status and perpetuate economic inequality, why is it that legal systems in practice are heterogeneous in the degree to which they offer relatively equal protections to all citizens? As Levine (2005) indicates, there are two prevailing views regarding the origins of legal institutions that "consist of the entire apparatus of courts, procedures and institutions associated with enforcing property rights." First is the "law view [which] stresses that differences in legal traditions formed centuries ago in Europe and spread via conquest, colonization and imitation around the world [that] continue to account for cross-country differences in property rights." This view will henceforth be referred to as the *legal tradition view*. Next is the "*endowment view* [which] argues that differences in natural resources, climate, the indigenous population and the disease environment affected the construction of institutions, and these self-sustaining institutions continue to shape property rights today" (p. 62).

5.2.1 The Legal Tradition View

The legal tradition view of the origins of legal systems typically distinguishes between the traditions of common and civil law heritage. La Porta, Lopez-de-Silanes, and Shleifer, hereafter LSS (2008) depict legal tradition as "central to understanding the varieties of capitalism" (p. 287) and describe it as "a style of social control of economic life…common law stands for the strategy of social control that seeks to support private market outcomes, whereas civil law seeks to replace such outcomes with state-desired allocations" (p. 286).

The common law tradition is typically associated with England and its colonial offshoots, and is characterized by precedents established by appellate judges solving specific legal disputes as new situations arise, adversarial rather than inquisitorial dispute resolution, and a judiciary that is independent from both the executive and legislative branches of government (LSS 2008). Mahoney (2001) indicates that the "English common law developed because landed aristocrats and merchants wanted a system of law that would provide strong property rights protections for property and contract rights, and limit the crown's ability to interfere in markets" (p. 504). Levine (2005) adds that "judges were granted greater discretion and independence after the Glorious Revolution" in England (p. 64).

The civil law tradition is the "oldest, the most influential, and the most widely distributed around the world" (LSS, 2008, p. 289). It originates in Roman law, but was adopted and spread throughout much of Europe by the Catholic Church. The French civil law tradition, which is traditionally identified with the French Revolution and Napoleon's codes, is widespread in practice today.[96] Mahoney (2001) indicates that "French civil law developed as it did because the revolutionary generation, and Napoleon after it, wished to use state power to alter property rights and attempted to ensure that judges did not interfere" (p. 505). Thus the French civil law traditional embodies a centralized and activist role for the government in legal and economic matters (Mahoney, 2001).

Because of the differences in judicial independence, dispute resolution, and jurisprudence, British common law, relative to French civil law, is expected to "be more respectful of private property and contract than civil law," place a greater "emphasis on private contracts and orderings, and less emphasis on government regulation," and be "more adaptable to changing circumstances" (La Porta, Lopez-de-Silanes, and Shleifer, 2008, p. 305). Levine (2005) adds:

> *"Compared with the British common law, the French civil law places comparatively less emphasis on private property rights, less emphasis on judicial independence and discretion, and more emphasis on the rights of the state. Indeed, the civil law can be viewed as a proxy for the intent to build institutions that further the power of the state (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1999). From this perspective, governments in French civil law countries tend to 1) enjoy greater latitude in their abilities to funnel resources toward politically advantageous ends, even if this abrogates private property rights and pre-existing contracts; and 2) have difficulty credibly committing not to interfere in private contracting arrangements. Thus, the law view argues that French civil law countries will have weaker protection of private property rights than common law countries…Furthermore, many influential scholars argue that legal systems that embrace jurisprudence, such as British common law systems, tend to adapt more efficiently to the changing contractual needs of an economy than legal systems that adhere rigidly to formalistic procedures and codified law, such as French civil law countries" (p.65).*

Several criticisms exist concerning the legal traditions view of the origins of legal institutions. Ekelund and Tollison (1981) argue that the common law courts emerged in England by partnering with Parliament to compete with the Crown for monopoly-granting rights, with the implication being that the positive associations between common law tradition and strong property rights protections, private contract enforcement, and free trade may be attributable to historical coincidence rather than a natural predisposition. Levine (2005) summarizes a number

[96] More than half of the 187 countries in the LSS (2008) dataset are coded as having French legal traditions.

of additional criticisms of the legal view which suggest that "simply knowing whether a country has a civil or common law system will not provide much information on the effectiveness of property rights institutions." Alternatives explanations include: (a) strong property rights and private contracting were influenced by England's superior economic and political institutions, and not just its common law system; (b) the manner through which legal systems were obtained, rather through conquest, colonization, or imitation, matters for the development of property rights; and (c) the degree to which private property is protected, the rule of law applied equally to all, and private contracting unhindered by government interference is ultimately determined by political and military institutions.[97]

5.2.2 The Endowment View

The endowment view of legal origins contends that a region's climate, geography, natural resource, and/or population endowments "shaped the initial formation of property rights and the initial systems for defining, defending and interpreting property rights [and] have had long-lasting ramifications on property rights and private contracting today" (Levine, 2005, p. 75-76). Two main theories exist concerning the endowment view of legal origins.

The first is the story shaped by economic historians Stanley Engerman and Kenneth Sokoloff, who stress the influence that natural resource endowments related to mining and agriculture had in shaping the evolution of economic and legal institutions in the Americas following European colonization. Regions endowed with climates and land suitable for the production of cash crops such as sugar and coffee, as well as large populations of unskilled native populations, provided European immigrants with an incentive to establish large slave plantations to take advantage of economies of scale. This resulted in the emergence of an elite class of landowners and initially large degrees of economic and political inequality in these colonies. The elite class had an incentive to protect their positions by institutionalizing a legal code and other policies that served their interests, while systematically denying legal rights and economic opportunities to the rest of the population. Inequality before the law perpetuated economic inequality over time. Meanwhile, regions that were relatively uninhabited by natives and were endowed with climates and land suitable for the production of crops such as wheat and other grains created an economic environment conducive to smaller-scale family farming. Most

[97] See references provided by Levine (2005, pp. 66-67).

adult male immigrants to these regions became land owners and established independent family farms. As a result, the initial distribution of economic and political power was more equal such that more egalitarian legal institutions emerged, promoting greater economic equality.[98] Easterly (2007) establishes statistical evidence that the historical suitability of land endowments for wheat relative to sugar production predicts the share of family farms and is a significant determinant of contemporary income inequality.

Next is the story shaped by Acemoglu, Johnson, and Robinson, hereafter AJR (2001, 2002), who argue that the settlement conditions faced by European colonists influenced the development of property rights institutions. When settlement conditions were favorable, as characterized by low settler mortality rates and indigenous populations, the Europeans had an incentive to settle permanently in large numbers and invest in the development of inclusive institutions to protect private property. On the other hand, when conditions were poor, as characterized by high settler mortality rates and large indigenous populations, the Europeans were more interested in extracting the resources for the colony in pursuit of personal wealth. As a result, extractive institutions emerged that served the economic interests of the elite while denying legal rights and economic opportunities to the rest of the population. As with the Engerman-Sokoloff story, the AJR story suggests that the initial institutions established by the colonizers have largely influenced the evolution of institutions over time such that initially extractive (inclusive) institutions are associated with weak (strong) property rights institutions today.

There has been some debate in the literature over the interaction between the various types of endowments and their importance for the development of institutions. For instance, Easterly (2006) argues that the suitability of land for crops and minerals may have been a more important determinant of European migration because settlers were more willing to risk disease and death for the potential large payoff from establishing a plantation or mine. Auer (2013) argues that geographic endowments such as climate influenced the disease environment faced by European settlers. Easterly and Levine (2012) find that indigenous population densities were higher in regions where the land was conducive to raise domestic animals, cultivate storable plants, and hence to produce food. They also find evidence that the native populations in areas

[98] See e.g. Engerman and Sokoloff (1997, 2002, 2006), and Sokoloff and Engerman (2000). They also provide a similar story regarding mining endowments leading to the developing of heterogeneous legal institutions.

which were isolated from contact with Europeans prior to colonization may have been adversely impacted by the arrival of the Europeans due to their lack of exposure to European-borne diseases, an argument also made by Diamond (1997).

Although there are still some outstanding questions regarding the exact mechanisms through which endowments influenced the development of legal institutions, as Levine (2005) suggests, the various "endowment-based explanations need not be mutually exclusive…colonists established 'extractive colonies' either because the environment was inhospitable to Europeans or because the geography and composition of the indigenous population fostered large plantations and mining operations…Where colonists settled in large numbers and where the geography fostered small-scale farming and a burgeoning middle class, Europeans were much more likely to develop sound property rights institutions." (p. 76).

5.2.3 Interdependence of Legal Traditions and Endowments

Both views of the origins of legal institutions suggest that exogenous factors shaped them, but they differ on the crucial historical conditions responsible for their formation (Levine, 2005). The legal traditions view contends that countries with an English common law tradition, or similarly those colonized by the British, have legal institutions that better protect property rights, enforce private contracting, and offer more equal protection under the law than those with a French civil law tradition, which could have been colonized by the French, Portuguese or Spanish. The endowments view meanwhile contends that a region's climate, geography, natural resource, and/or population endowments influenced the settlement strategy pursued by the Europeans such that better legal institutions emerged when the endowments provided an environment favorable for permanent settlement, irrespective of legal tradition or colonizer.

The literature has often treated the two views of the origins of legal institutions as alternative explanations. Levine (2005) suggests that according to the endowment view, "the identity of the colonizer is irrelevant" and from the law point of view, the legal tradition is the critical factor (p. 82). Berkowitz, Pistor, and Richard (2002), consistent with the settlement strategy theory advanced by AJR (2001, 2002), suggest that it is not legal tradition but the manner through which legal systems were obtained that matters for the effectiveness of the rule of law in protecting property rights. Meanwhile, AJR (2001) indicate that "it is not the identity of the colonizer or legal origin that matters, but whether European colonialists could safely settle in a particular location: where they could not settle, they created worse institutions" (p. 1373). Auer (2013) points out that the British tended to colonize regions more remotely located from Europe that may have provided better settlement conditions, with the potential implication being that settlement conditions may be a proxy for legal origins, or vice versa. Auer also argues that both the settlement conditions and legal origins views fail to adequately account for the influence of geographic endowments on the development of institutions. Klerman, Mahoney, Spamann, and Weinstein (2011) concede that endowments may have influenced the location choices of the various European colonizers, but argue that this story is incomplete and that the identity of the colonizer also influenced the development of institutions.

Levine (2005) suggests however that even though "the two theories are substantially different…they are not contradictory." (p. 82). Chapter two provides evidence that both endowments and the identity of the colonizer influenced the development of a broad measure of economic institutions, with favorable population endowments resulting in a more market-oriented economy, particularly for former British colonies. It the spirit of chapter two, it is contended that both the endowment and legal tradition views of legal origins influenced the development of contemporary legal institutions. Specifically the Engerman and Sokoloff (1997, 2000, 2002) endowment story that the suitability of the land and climate for small-scale family farming relative to large-scale plantation farming influenced the development of legal institutions, is adopted. When endowments were favorable for family farming, legal institutions developed that provided better protections of private property rights, enforcement of private contracting, and more equal protections under the law. The impact of favorable land endowments on the rule of law was partially mitigated when a country received the French civil law tradition such that less equitable legal institutions developed. When endowments favored plantation farming, very weak legal institutions were likely to emerge, regardless of the legal tradition.

When institutions emerged that provided greater equality before the law, the elite were unable to protect their status and deny legal rights and economic opportunities to others. As a result, a more equitable distribution of income resulted. The development of less equitable legal institutions has provided the elite with a means to protect their positions and deny the majority of the population access to property, contracting rights, and legal protections, resulting in a perpetuation of economic inequality over long periods of time. It is therefore contended that the rule of law was influenced by both factor endowments and legal traditions, and that legal institutions are the primary mechanism influencing the degree to which the elite have managed to preserve structural inequality over long periods of time.

Table 5.1: Descriptive Statistics

	Mean	SD	Min	Max	N
SWIID Net	39.52	9.44	21.94	61.19	91
SWIID Gross	44.82	6.47	30.94	63.71	91
UTIP Gross	42.07	6.43	25.99	64.25	84
Net Gini	39.09	11.39	24.25	69.77	50
Gross Gini	45.19	10.76	23.30	63.11	51
Consumption Gini	38.51	7.88	24.00	59.65	47
90/10	19.97	16.50	4.08	86.01	91
80/20	10.04	6.29	3.08	27.67	91
EF2	5.58	1.82	1.38	8.96	92
LWHEATSUGAR	0.18	0.16	0.00	0.58	92
FR	0.50	0.50	0.00	1.00	92
LWHEATSUGAR×FR	0.08	0.13	0.00	0.58	92
AYS15	7.06	2.72	1.09	12.52	89
TROPICS	0.49	0.48	0	1	120
TROPICS×FR	0.30	0.45	0	1	120
ILLITERACY	23.38	21.96	0.25	80.97	71
DEP2LABOR	0.67	0.17	0.43	1.04	92
URBAN	54.74	22.84	7.26	96.70	92
SERVICE	49.51	17.46	5.59	74.75	89
INDUSTRY	21.76	9.29	2.10	40.53	89
GROWTH	7.88	8.95	-10.72	40.80	91
POL RIGHTS	6.64	2.86	0.00	10.00	92
CIVIL LIBERTIES	6.33	2.44	0.07	10.00	92
DEMOCRACY	7.28	2.61	1.30	10.00	92
COAST	0.47	0.36	0.00	1.00	89
DMM	3.85	2.64	0.14	9.28	91
EF1	5.71	1.30	2.93	8.24	92
TRANSFERS	10.50	8.34	0.77	29.63	79

Statistics for all variables but TROPICS limited to sample of countries for which LWHEATSUGAR, FR, and EF2 data available. TROPICS statistics refer to sample of countries for which EF2 and FR data available. See appendix Table F.1 for sources and descriptions of variables.

5.3 Data

The inequality, contemporary legal institutions, and institutional determinants data are discussed in this section. Descriptive statistics for each of these variables, as well as the additional variables introduced in section 5.5, are provided in Table 5.1.

5.3.1 Inequality

The eight alternative measures of economic inequality that were used in chapter four are also used in this chapter to show that the results are not sensitive to the choice of inequality measure. Easterly (2007) argues that economic inequality is fairly persistent over time, a claim with empirical support from Lindert and Williamson (2003) and Lindert (2000). The contemporary measures of inequality used here also reveal relatively strong time dependence, as indicated in Table 5.2, which provides the correlation between each measure and values lagged up to twenty years. All but three of twenty-seven correlations are above 0.5, and more than 70 percent are 0.7 or higher. Because within-nation inequality has been reasonably rigid since 1990, the average of each inequality measure over the period 1990-2010, when available, is used in the empirical analysis.[99]

5.3.2 Contemporary Legal Institutions

Levine (2005) suggests that the "law, property rights and contracting are inseparable…legal systems consist of the entire apparatus of courts, procedures and institutions associated with enforcing property rights" (p.62). Consistent with this view, area 2 of the Economic Freedom of the World index (EF2) is used as the measure of contemporary legal institutions. It provides a broad measure of the degree to which a nation's legal system is consistent with personal choice, voluntary exchange coordinated by markets, freedom to enter and compete in markets, and protection of persons and their property from aggression by others – the pillars of a private free market economy. EF2 is an index comprised of the following nine components: judicial independence; impartial courts; protection of property rights; freedom from military interference in rule of law and politics; integrity of the legal system; legal enforcement of contracts; freedom from regulatory restrictions on the sale of real property; reliability of police; and low business costs of crime. All of the components are normalized to a 0-10 scale that is increasing in the degree to which they are consistent with the pillars of the index. Each component is weighted equally for the composite EF2 index (Gwartney, Hall, and Lawson, 2013).

Table 5.2 also reveals that legal institutions are relatively persistent over time. The correlation between EF2 and its lagged values up to twenty years ranges from 0.671 to 0.936.

[99] Due to data limitations, the UTIP data represent the average over the period 1990-2000, while the consumption Gini and 90/10 and 80/20 income ratios represent the average over the period 1990-2005.

Because legal institutions tend to change very slowly, the average chain-linked EF2 measure over the period 1985-2005 is used. It is purposefully lagged relative to the inequality measures so that observed legal institutions precede distributional outcomes. This weakens the possibility that inequality influences the development of legal institutions.

Table 5.2: Persistence of Inequality & Legal Institutions

	(1) $\rho(X_t, X_{t-5})$	(2) $\rho(X_t, X_{t-10})$	(3) $\rho(X_t, X_{t-15})$	(4) $\rho(X_t, X_{t-20})$
SWIID Net[a]	0.933	0.886	0.837	0.747
N	106	105	103	99
SWIID Gross[a]	0.851	0.700	0.593	0.534
N	106	105	103	99
UTIP Gross[b]	0.813	0.638		
N	94	86		
Net Gini[a]	0.916	0.828	0.797	0.827
N	27	28	28	24
Gross Gini[a]	0.848	0.766	0.682	0.765
N	17	17	16	12
Consumption Gini[c]	0.623	0.430	0.804	
N	43	33	21	
90/10[c]	0.913	0.806	0.446	
N	75	75	64	
80/20[c]	0.896	0.785	0.467	
N	75	75	64	
EF2[b]	0.936	0.885	0.671	0.706
N	123	119	109	108

(a) t = 2010; (b) t = 2000; (c) t = 2005. For inequality measures, t represents the most recent observation year available. Actual observations are assigned to closest quinquennial year ending in 0 or 5 between 1990-2010 (only if within +/ − 2 years of the assignment period). If more than one observation assigned to a quinquennial period, then the closest observation selected, with preference for post-assignment values. Appendix Table F.1 provides details about the variables.

5.3.3 Determinants of Legal Institutions

As indicated in section 5.2, the historical suitability of endowments for small-scale family farming of crops such as wheat and other grains is expected to lead to the development of better legal institutions relative to endowments more suitable for large-scale plantation farming of crops such as sugarcane and tobacco. Easterly (2007) develops a measure of the relative suitability of land for growing wheat relative to sugar based on data from the Food and Agriculture Organization, defined as LWHEATSUGAR = log[(1+share of arable land suitable for wheat)/(1+share of arable land suitable for sugarcane)]. Easterly shows empirically that “a high endowment of wheat land relative to sugarcane land predicts landowning dominated by family farms” (p. 763).

Easterly uses the LWHEATSUGAR variable as an instrument for contemporary levels of income inequality. It is argued here that legal institutions are the mechanism through which factor endowments impact economic inequality. The correlation matrix in Table 5.3 shows that the 0.490 correlation between LWHEATSUGAR and EF2 is greater in absolute value than the correlation between LWHEATSUGAR and all but two of the eight inequality measures, and only nominally smaller than the remaining two which have negative correlations of 0.498 and 0.523. The correlation matrix also reveals that the correlation between EF2 and inequality is stronger for all eight measures of inequality than the corresponding correlations between LWHEATSUGAR and inequality. These simple correlations provide evidence that (1) LWHEATSUGAR is as good and in most cases a better predictor of legal institutions than it is of inequality; and (2) legal institutions are a better predictor of inequality than LWHEATSUGAR.

The legal tradition view of legal origins suggests that the development of contemporary legal institutions were influence by a nation’s legal family. Following a voluminous body of literature (e.g. La Porta, Lopez-de-Silanes, and Shleifer, 2008) the legal traditions classifications of La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) are used. It is anticipated that French legal tradition exerts a negative influence on the development of legal institutions that protect private property and enforce contracts.

Table 5.3: Correlations between EF2, Inequality & LWHEATSUGAR

	LWHEATSUGAR	EF2
EF2	0.490	
SWIID NET	-0.539	-0.628
SWIID GROSS	-0.292	-0.280
UTIP	-0.509	-0.656
NET GINI	-0.541	-0.708
GROSS GINI	-0.466	-0.514
CONSUMPTION GINI	-0.531	-0.451
90/10	-0.309	-0.434
80/20	-0.357	-0.469

5.4 Empirical Results

Figure 5.1 plots the average level of SWIID net income inequality over the period 1990-2010 against the average EF2 chain-linked score over the period 1985-2005, revealing a strong negative relationship between legal institutions and income inequality. Countries with high EF2 ratings tend to exhibit much lower levels of income inequality. EF2 is purposefully lagged relative to the measure of income inequality, providing some evidence in support of the hypothesis that market-enhancing legal institutions are associated with less economic inequality. This relationship, while strong, is not sufficient evidence to establish a causal link from legal institutions to economic inequality.

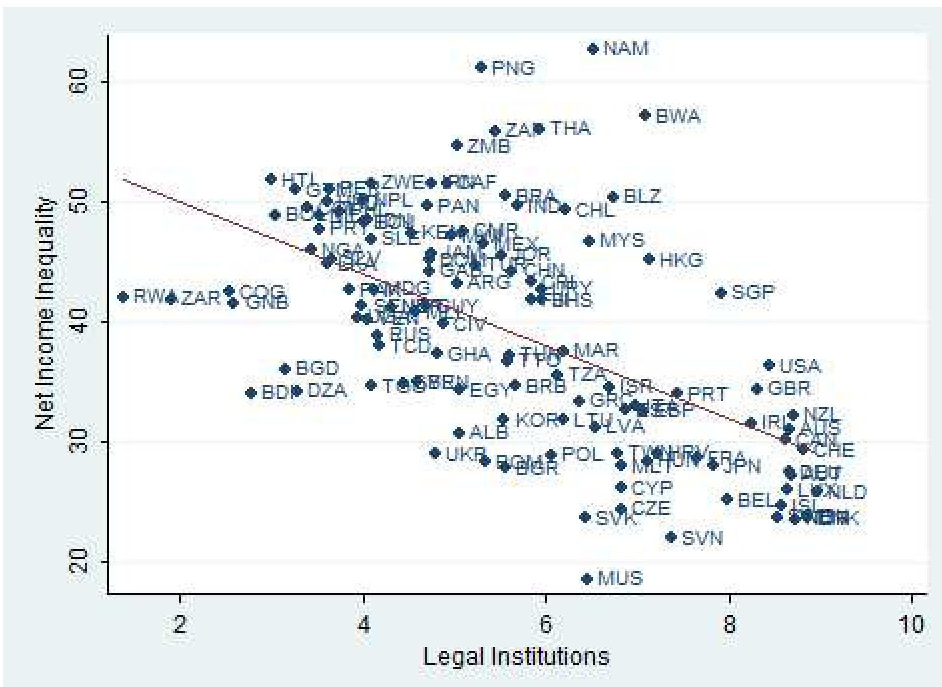

Figure 5.1: Income Inequality vs. Rule of Law

The theory discussed in section 5.2 suggests that endowments and legal tradition may have both exogenously influenced the development of legal institutions. If these factors impacted structural inequality only through their influence on the development of legal institutions, then they make valid instruments for EF2 to estimates its potentially causal impact on economic inequality. Historically, the elite desired to legally preserve their positions in society by influencing the rule of law to deny the remainder of the population equal legal rights and hence economic opportunities. When successful, the elite managed to capture the legal system and perpetuate economic inequality over long periods of time, resulting in what Easterly (2007) refers to as structural inequality and Acemoglu and Johnson call a vicious circle. The elites' efforts to manipulate the legal system in their favor and perpetuate economic inequality were hindered by two factors: (1) land and climate endowments that favored small-scale family farming relative to large-scale plantation farming; and (2) a nation's legal tradition since common law is associated with constraints that limit the power of the elite to rule arbitrarily such as judicial independence and jurisprudence (Hayek, 1960; La Porta, Lopez-de-Silanes, Pop-Eleches, and Shleifer, 2004).

It is therefore hypothesized that: (1) the suitability of land and climate for the production of wheat relative to sugar, as measured by LWHEATSUGAR, predict a more equitable rule of law, as measured by higher EF2 values; and (2) the positive impact of LWHEATSUGAR on EF2 is mitigated when a country inherited French civil law. Thus the first stage regression equation in the 2SLS model is given by equation 5.1, where FR is a dummy variable equal to one if a nation has the French civil law tradition. The hypotheses suggest that $\alpha_1 > 0$ and $\alpha_2 < 0$. This identification strategy simultaneously accounts for both the "legal tradition" and "endowments" views of the development of legal institutions. Assuming that these factors influence inequality only through the institutional channel, the identification strategy provides a means to estimate the potential causal impact of the rule of law on economic inequality,

$$\mathrm{EF2} = \alpha_0 + \alpha_1 \mathrm{LWHEATSUGAR} + \alpha_2 (\mathrm{LWHEATSUGAR} \times \mathrm{FR}) + \mu \qquad (5.1)$$

The first stage estimates are given in panel B of Table 5.4. As predicted $\widehat{\alpha_1} > 0 \; and \; \widehat{\alpha_2} < 0$ in all eight columns, suggesting that historic endowments more suitable for family relative to plantation farming are associated with a more equitable contemporary rule of law, but the effect is partially offset for countries with French civil law tradition. Up to 30 percent of the variation in contemporary values of EF2 is explained by these two factors. LWHEATSUGAR is significant at 1 percent in all eight columns, and the value of $\widehat{\alpha_1}$ ranges from 4.32 to 6.956. This suggests that a one standard deviation increase in LWHEATSUGAR is associated with a 0.391 to 0.614 standard deviation increase in EF2, depending on the sample of countries used. LWHEATSUGAR×FR is significant at 5 percent or better in all but one column, and $\widehat{\alpha_2}$ ranges from -4.466 to -1.204. In countries with French civil law tradition, a standard deviation change in endowment conditions favorable for family relative to plantation farming is only associated with a 0.077 to 0.291 standard deviation increase in EF2. This suggests that countries with land relatively well suited for family farming where hampered in developing the rule of law by the inheritance of the French civil law tradition.

Also provided in panel B are the results from statistical tests of over-identification, under-identification, and weak instruments. The level of significant of the Sargen-Hansen test for over-identification, which has a joint null hypothesis that the instruments are uncorrelated with the error term and that the excluded instruments are correctly excluded, is reported as p(OID). A rejection of the null casts doubt on the validity of the instruments, suggesting that they do not satisfy the orthogonality conditions because they are either not truly exogenous or are incorrectly excluded from the second-stage regression (Hayashi 2000). In all but column 4, which has a p(OID) of 0.03, the null is not rejected. The sample of countries used in column 4 contains fifty mostly economically advanced nations for which the mean LWHEATSUGAR is 0.4 standard deviations higher than the full sample mean, and the mean EF2 score is 0.46 standard deviations higher than the full sample mean. The significance level of the Kleibergen-Papp rk statistic is reported as p(UID). The null hypothesis is that the equation is under-identified (Kleiberben and Papp 2006), and is easily rejected at 1 percent in all eight columns.

F(WID) represents the Kleibergen-Papp Wald first-stage F-statistic and should be compared to the Stock-Yogo maximal Wald test size distortion critical values, which are reported as SY size. If F(WID)<SY size, then the size distortion of the Wald test suggests that the instruments are weak (Stock and Yogo 2002). The results indicate that the maximal test size distortion is less than 10 percent in columns 1, 2, 7 and 8, less than 15 percent in columns 3 and 6, and less than 20 percent in column 4. This suggests that the instruments are relatively strong. Stock and Yogo (2002) also provide critical values for a test of maximal bias of IV estimates that are commonly used to evaluate the strength of instruments. These critical values are not reported because the number of excluded instruments is sufficiently small such that the Staiger and Stock (1997) rule of thumb that instruments should be considered weak if F(WID) is less than 10 “approximates a 5% test that the worst case relative bias is approximately 10% or less” (p.30). The F(WID) values reported in Table 5.4, with the exception of column 4 that has a value of 9.9, are well above the rule of thumb value. These test results reiterate that the instruments are fairly strong.

Panel A in Table 5.4 presents the second stage results in which inequality is the dependent variable. As the results indicate, EF2 is a negative and highly significant determinant of inequality in each of the eight columns. The second stage estimates suggest that a unit increase in EF2 (0.54 to 0.84 standard deviations, depending on the sample) is associated with a 2.295 to 7.427 point (0.355 to 0.776 standard deviations, depending on the sample) decrease in economic inequality. These estimates suggest that a standard deviation increase in the rule of law reduces economic inequality by 0.643 to 1.165 standard deviations. To provide a practical comparative example, consider two Latin American countries – Guyana and Peru. The two countries both have endowments highly suitable for plantation farming (both have a LWHEATSUGAR value of 0.09), but Guyana inherited an English common law tradition while Peru received French civil law. Guyana has a contemporary EF2 score of 4.69, which is more than a full point higher than Peru's EF2 score of 3.62. Although both have relatively weak rule of law, economic inequality differs significantly between the two nations as the SWIID net income Gini measure is 41.3 in Guyana and 51.1 in Peru. The second stage estimate in column 1 of Table 5.4 predicts that the difference in EF2 between the two countries should result in inequality being 5.91 points lower in Guyana. The observed difference is 9.8 points, suggesting that the difference in the rule of law between the two nations explains 60 percent of the observed difference in inequality between the two countries.

Panel C of Table 5.4 reports the OLS results from regressing inequality directly on EF2. The point estimates range from -1.000 to -4.385. Recall that the 2SLS estimates range from -2.295 to -7.427, so the 2SLS estimates of the impact of legal institutions are 54.3 to 129.5 percent higher in absolute value than the corresponding OLS estimates. Accounting for the origins of legal institutions reduces the error associated with the measurement of legal institutions in estimating its impact on economic inequality, thus reducing the attenuation bias.

5.5 Sensitivity Analysis

5.5.1 Robustness to Additional Control Variables

Table 5.5 tests the sensitivity of the 2SLS results to additional control variables that possibly influence the degree of inequality in society. Column 1 reproduces the results from column 1 of Table 5.4, which uses the SWIID net income Gini as the measure of inequality, and serves as the baseline. The second stage estimate of EF2 is -5.53, and the first stage estimates of LWHEATSUGAR and LWHEATSUGAR×FR are 6.96 and -3.72, respectively. The controls (or sets of variables) enter one at time to reduce the risk of multi-collinearity and preserve degrees of freedom, given the relatively small sample size. SWIID net income Gini remains the dependent variable in the second stage for each additional specification because it offers the greatest country coverage.

Many scholars contend that economic inequality is a function of unequal opportunity, and that expanding educational opportunity is a means to reduce inequality of opportunity. Column 2 of Table 5.5 includes the average years of schooling for the population above age 15 (AYS15) to control for educational opportunity. There is no clear a priori expectation for the sign of AYS15 because the theoretical arguments are ambiguous (Bennett and Vedder, 2014) and empirical evidence is mixed (e.g. Ram, 1989; De Gregorio and Lee, 2002) regarding the relationship between educational attainment and inequality. AYS15 is positive but insignificant in both stages of the regression. Column 3 includes the illiteracy rate of the adult population (ILLITERATE) as an alternative measure of educational opportunity. ILLITERATE is negative and significant at 5 percent in both stages, suggesting that illiteracy exerts a small positive overall effect on inequality.[100] The coefficient on EF2 is -5.75 and -10.75 in columns 2 and 3, respectively, and both remain highly significant. The two excluded instruments maintain the appropriate sign and are significant at 5 percent or better when controlling for educational outcomes, although the instruments appear to be a little weak in column 3, as the F(WID) value is only 5.9.[101]

Column 4 includes the ratio of dependents (under age 15 and above age 65) to potential labor force (between ages 15-64), reported as DEP2LABOR. Higgins and Williamson (1999) argue that population distributions with relatively high proportions of dependents relative to working age adults will be associated with more income inequality because of the relatively low economic rewards associated with large population cohorts. As such, it is anticipated that

[100] It has been suggested that low levels of public investment in education may be another channel through which the elite maintained their status and perpetuated economic inequality. A largely uneducated and/or illiterate population will find it difficult to take advantage of economic opportunities. In addition, the uneducated have historically been disenfranchised from the political process. This may potentially result in both inequalities before the law and economic inequality. See Mariscal and Sokoloff (1998) for empirical evidence of the link between factor endowments, schooling institutions, and inequality.

[101] The absolute value of the magnitude of EF2 in column 3 is nearly double that of the baseline. This may be attributable to the much smaller sample size in column 3, as it contains only 70 countries whereas the baseline includes 91 nations.

DEP2LABOR be positively associated with inequality. DEP2LABOR is negative and significant at 1 percent in the first stage, but negative and insignificant in the second stage. The total estimated impact of DEP2LABOR on inequality is positive, with a coefficient of 25.66, as anticipated. EF2 has a coefficient of -6.31 and is highly significant with a robust standard error of 2.14 in the second-stage. A p(OID) value of 0.05 and F(WID) value of 4.5 suggest that the instruments may be invalid and weak in this specification, respectively. The two excluded instruments however preserve the correct sign and are significant at 5 percent or better.

Kuznets (1955) suggests that countries urbanize and industrialize as they continue along the path of economic development. In the early stages of development, inequality tends to be rise but this subsides as the development process continues and urbanization and industrialization expand, providing greater economic opportunities to a wider segment of the population. Column 5 controls for the share of the population living in an urban area (URBAN), which is positive and significant at 1 percent in the first-stage but positive and insignificant in the second-stage. The total estimated effect of URBAN on inequality is negative, with a coefficient of -0.134.

Advanced industrial economies tend to achieve additional growth through greater specialization and development of their financial sectors (e.g. Levine 2002). As such, column 6 controls for the share of the work force employed in both the industrial (INDUSTRY) and service (SERVICE) sectors. SERVICE is positive and significant at 5 percent in both stages, suggesting that a larger service sector is associated with less inequality overall, with an estimated total partial effect of -0.01. INDUSTRY is positive in the first-stage and negative in the second-stage, although neither coefficient is significant at conventionally accepted levels. Although insignificant, the total estimated partial effect of INDUSTRY on inequality is -0.37. EF2 remains a negative and highly significant determinant of inequality in both columns 5 and 6, and the magnitude of the coefficient changes very little relative to the baseline.[102]

Despite the fact that both the direction of causality and the qualitative effect between growth and inequality are ambiguous, column 7 controls for the average 5-year GDP growth rate over the period 1985-2005 (GROWTH). By lagging growth relative to inequality, this at least

[102] Controlling for potential non-linear effects of URBAN does not change the results. The linear and quadratic terms are both insignificant in both stages. INDUSTRY may exert a non-linear direct effect on inequality. Including linear and quadratic INDUSTRY terms suggests that there is an inverted U-shaped relationship between INDUSTRY and inequality in the second-stage regression, consistent with the Kuznets Hypothesis. This reduces the magnitude of EF2 to -3.49, but it remains highly significant with a robust standard error of 1.11. The excluded instruments maintain significance and the expected qualitative effect in the first-stage.

reduces the potential simultaneity issue.[103] GROWTH is positive in both stages, but is only significant (at 1 percent) in the first-stage. While the positive relationship between GROWTH and EF2 is likely a reflection that countries with stronger legal institutions create strong incentives for growth, the estimates nonetheless suggest GROWTH is negatively associated with inequality overall. EF2 has a coefficient of -5.86 and is highly significant with a robust standard error of 1.08. The two excluded instruments maintain a similar qualitative effect and significance level in the first stage relative to the baseline.

Columns 8 and 9 control for the potential impact of greater political rights (POLRIGHTS) and civil liberties (CIVLIB) on inequality, respectively.[104] As suggested above, political inequality is often associated with greater economic inequality such that one might expect countries with greater political and civil liberties to exhibit less inequality. Both POLRIGHTS and CIVLIB are positive and significant at 5 percent or higher in both stages of the model. Column 10 controls for the degree to which a nation is democratized (DEMOCRACY), as measured by the Polity IV composite index. DEMOCRACY is also positive and significant in both stages of the model. As before, EF2 remains negative and highly significant in the second stage and both excluded instruments preserve the right sign and statistical significance in columns 8-10. Interestingly, when holding contemporary political institutions constant, the positive impact of LWHEATSUGAR on EF2 is completely negated for countries with French civil law tradition. The absolute value of EF2 in the second stage regression is also considerable higher than the baseline, as the coefficients range from -7.15 to -7.73. In each of these three columns p(OID)<0.05, suggesting that the null of the Sargen-Hansen test of over-identificatio be rejected. This may be attributable to the fact that countries with greater equality before the law also tend to exhibit greater political and civil liberties.[105]

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[103] The relationship between economic growth and inequality is theoretically ambiguous. Many scholars have suggested that growth may be a function of inequality, and have identified several channels have been identified such as political economy (see Alesina and Perotti, 1994 for a survey) and credit market imperfections that inhibit investments in human capital and/or occupational choice (Aghion and Bolton, 1992; Banerjee and Newman ,1993; Galor and Zeira, 1993). The Kuznets Hypothesis meanwhile contends that the relationship work the other way around, with economic growth impacting changes in the distribution of income. The empirical results regarding the relationship between the two variables is mixed, with some researchers finding a negative relationship (see Benabou, 1996 for a survey) and others finding a positive or insignificant relationship (Barro, 2000; Forbes, 2000; Scully, 2002; Stevans, 2012).

[104] POLRIGHTS and CIVLIB are highly correlated, so they enter one at a time to avoid multi-colinearity.

[105] Strong private property rights and private contracting enforcement are considered hallmark characteristics of economic freedom. The Friedman-Hayek hypothesis suggests that “economic freedom is a necessary condition for political freedom” (Lawson and Clark, 2010, p. 231).

Table 5.4: 2SLS Estimates

	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI\WIID 80/20 Ratio (8)
	Panel A: 2nd Stage Estimates – Inequality is Dependent Variable							
EF2	-5.528***	-2.295***	-4.093***	-6.843***	-7.427***	-6.116***	-6.097***	-2.599***
	(0.851)	(0.692)	(0.671)	(1.419)	(1.319)	(1.117)	(1.279)	(0.497)
Constant	70.509***	57.683***	65.071***	83.178***	82.271***	70.068***	54.146***	24.605***
	(5.097)	(4.023)	(3.895)	(9.337)	(7.098)	(6.259)	(8.188)	(3.139)
	Panel B: 1st Stage Estimates – EF2 is Dependent Variable							
LWHEATSUGAR	6.956***	6.956***	6.805***	5.003***	5.339***	4.432***	6.956***	6.956***
	(0.932)	(0.932)	(1.086)	(1.370)	(0.905)	(0.859)	(0.932)	(0.932)
LWHEATSUGAR×FR	-3.722***	-3.722***	-3.514***	-4.075**	-4.466***	-1.204	-3.722***	-3.722***
	(1.238)	(1.238)	(1.322)	(1.518)	(1.258)	(1.323)	(1.238)	(1.238)
Constant	4.674***	4.674***	4.715***	5.653***	4.419***	4.505***	4.674***	4.674***
	(0.243)	(0.243)	(0.264)	(0.489)	(0.238)	(0.205)	(0.243)	(0.243)
R^2	0.28	0.28	0.24	0.18	0.30	0.27	0.28	0.28
N	91	91	84	50	51	47	91	91
p(OID)	0.46	0.65	0.62	0.03	0.44	0.14	0.60	0.85
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p(FWID)	27.9	27.9	19.6	9.9	18.9	13.8	27.9	27.9
SY Size 10	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93
SY Size 15	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59
SY Size 20	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
	Panel C: OLS Estimates - Inequality is Dependent Variable							
EF2	-3.265***	-1.000***	-2.307***	-4.385***	-4.145***	-2.978***	-3.951***	-1.627***
	(0.367)	(0.309)	(0.273)	(0.448)	(0.940)	(0.779)	(0.789)	(0.283)
Constant	57.823***	50.422***	55.032***	67.342***	65.886***	53.875***	42.113***	19.157***
	(2.262)	(2.007)	(1.761)	(3.526)	(4.698)	(4.240)	(5.605)	(1.985)
R^2	0.39	0.07	0.42	0.49	0.25	0.19	0.18	0.21

Robust standard errors in parentheses. Appendix Table F.1 describes variables. *p < 0.10, ** p < 0.05, ***p < .01.

Table 5.5: Robustness of 2SLS Estimates to Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Panel A: 2nd Stage Estimates – SWIID Net Income Gini is Dependent Variable												
EF2	-5.53***	-5.75***	-10.75***	-6.31***	-5.85***	-5.29***	-5.86***	-7.73***	-7.52***	-7.15***	-3.85***	-5.30***	-3.99**
	(0.85)	(0.92)	(2.79)	(2.14)	(1.16)	(1.12)	(1.08)	(1.74)	(1.95)	(1.46)	(0.95)	(1.20)	(2.01)
AYS15		0.40											
		(0.34)											
ILLITERACY			-0.20**										
			(0.09)										
DEP2LABOR				-14.72									
				(16.55)									
URBAN					0.10								
					(0.07)								
SERVICE						0.20***							
						(0.08)							
INDUSTRY						-0.21							
						(0.13)							
GROWTH							0.13						
							(0.14)						

Table 5.5 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
POLRIGHTS								2.18**					
								(0.92)					
CIVLIB									2.65**				
									(1.32)				
DEMOCRACY										1.87**			
										(0.77)			
COAST											3.62*		
											(1.96)		
DMM											1.18***		
											(0.39)		
EF1												0.54	
												(1.05)	
TRANSFERS													-0.23
													(0.38)
	Panel B: 1st Stage Estimates – EF2 is Dependent Variable												
LWHEATSUGAR	6.96***	6.77***	3.78***	2.46**	4.13***	4.07***	6.15***	3.16***	2.11**	3.96***	5.43***	5.18***	0.31
	(0.93)	(0.97)	(1.15)	(1.13)	(1.10)	(1.32)	(1.00)	(0.98)	(0.81)	(1.07)	(1.36)	(1.15)	(1.31)
LWHEATSUGAR×FR	-3.72***	-3.61***	-2.26**	-3.02***	-4.42***	-3.83***	-3.16**	-3.28***	-2.85***	-3.71***	-3.48***	-2.56**	-2.36**
	(1.24)	(1.27)	(1.08)	(1.08)	(1.16)	(1.10)	(1.25)	(0.92)	(0.77)	(1.06)	(1.30)	(1.15)	(1.06)
AYS15		0.03											
		(0.06)											
ILLITERACY			-0.02**										
			(0.01)										
DEP2LABOR				-6.40***									
				(1.01)									
URBAN					0.04***								
					(0.01)								
SERVICE						0.04***							
						(0.01)							
INDUSTRY						0.03							
						(0.02)							
GROWTH							0.05***						
							(0.02)						
POLRIGHTS								0.39***					
								(0.06)					
CIVLIB									0.56***				
									(0.07)				
DEMOCRACY										0.36***			
										(0.08)			
COAST											0.92*		
											(0.51)		
DMM											-0.16		
											(0.09)		
EF1												-0.55***	
												(0.12)	
TRANSFERS													0.18***
													(0.02)
R^2	0.28	0.26	0.24	0.52	0.47	0.44	0.32	0.54	0.66	0.46	0.35	0.41	0.62
p(OID)	0.46	0.54	0.37	0.05	0.03	0.13	0.53	0.02	0.00	0.03	0.42	0.42	0.40
p(UID)	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
F(WID)	27.9	24.5	5.9	4.5	12.2	8.3	18.9	8.4	7.2	10.1	8.0	10.4	3.6
N	91	88	70	91	91	88	91	91	91	91	89	91	79

Robust standard errors in parentheses. $*p < 0.10$, $**p < 0.05$, $***p < .01$. Constant terms omitted for space. See Table 5.4 for SY size critical values. Appendix Table F.1 describes the variables

Table 5.6: Robustness of 2SLS Estimates to Alternative Measure of Endowments

	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI\WIID 80/20 Ratio (8)
	Panel A: 2nd Stage Estimates – Inequality is Dependent Variable							
EF2	-3.688***	-1.395***	-2.927***	-5.879***	-6.580***	-4.207***	-6.542***	-2.471***
	(0.527)	(0.495)	(0.409)	(0.509)	(1.302)	(1.095)	(1.346)	(0.457)
Constant	59.950***	52.154***	59.167***	76.562***	78.807***	60.079***	56.899***	24.030***
	(3.057)	(2.920)	(2.360)	(2.801)	(6.295)	(5.372)	(8.311)	(2.746)
	Panel B: 1st Stage Estimates – EF2 is Dependent Variable							
TROPICS	-1.550***	-1.550***	-1.477***	-1.087	-0.271	-1.051***	-1.545***	-1.545***
	(0.323)	(0.323)	(0.329)	(0.670)	(0.445)	(0.335)	(0.336)	(0.336)
TROPICS×FR	-1.357***	-1.357***	-1.333***	-2.388***	-1.664***	-0.844**	-1.359***	-1.359***
	(0.303)	(0.303)	(0.337)	(0.619)	(0.401)	(0.332)	(0.302)	(0.302)
Constant	6.789***	6.789***	6.746***	7.250***	5.903***	5.837***	6.768***	6.768***
	(0.206)	(0.206)	(0.203)	(0.214)	(0.257)	(0.230)	(0.214)	(0.214)
R^2	0.46	0.46	0.41	0.54	0.37	0.35	0.46	0.46
N	0.00	0.07	0.03	0.38	0.06	0.12	0.44	0.10
p(OID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p(UID)	53.8	53.8	41.7	82.4	22.3	17.0	56.2	56.2
p(FWID)	116	116	107	55	62	60	110	110
SY Size 10	-1.550***	-1.550***	-1.477***	-1.087	-0.271	-1.051***	-1.545***	-1.545***
SY Size 15	(0.323)	(0.323)	(0.329)	(0.670)	(0.445)	(0.335)	(0.336)	(0.336)
SY Size 20	-1.357***	-1.357***	-1.333***	-2.388***	-1.664***	-0.844**	-1.359***	-1.359***
	Panel C: OLS Estimates - Inequality is Dependent Variable							
EF2	-3.021***	-0.982***	-2.263***	-4.433***	-3.862***	-2.393***	-3.745***	-1.501***
	(0.340)	(0.281)	(0.258)	(0.446)	(0.804)	(0.664)	(0.775)	(0.275)
Constant	56.210***	49.838***	55.349***	67.108***	64.943***	50.978***	41.255***	18.605***
	(2.006)	(1.738)	(1.657)	(3.538)	(4.017)	(3.331)	(5.288)	(1.823)
R^2	0.31	0.05	0.35	0.49	0.24	0.16	0.14	0.15

Robust standard errors in parentheses. Appendix Table F.1 describes variables. *$p < 0.10$, ** $p < 0.05$, ***$p < .01$.

Column 11 controls for two measures of geographic endowments: the share of a nation's population living within 100 kilometers of the coast (COAST), and the shortest distance from one of the three major world markets (DMM).[106] It has been suggested that countries with greater access to the ocean and located within closer proximity to world markets are better situated to capture the benefits of specialization (Gallup, Sachs, and Mellinger 1999; Sachs and Warner 1997). Acemoglu, Johnson, and Robinson (2005) argue that access to the ocean for trade also leads to institutional improvement.

Although there is some debate over how geography impacts development, whether directly or indirectly through institutional development (cf. Sachs 2003; Rodrik, Subramanian, and Trebbi 2004), because geography influences development and underdevelopment is

[106] Empirical researchers often also include the share of a nation's land located in the tropics as a direct measure of geography. This variable may be a proxy for land suitability and is thus excluded here. See section 5.5.2 for more information.

associated with high levels of poverty and inequality, it is anticipated that COAST will be positively and negatively associated with EF2 and inequality, respectively; and the opposite true of DMM. With the exception of COAST having a positive sign in the second stage, the geographic variables perform as expected. EF2 remains negative and highly significant in the second stage with a coefficient of -3.85, which is about 30 percent lower (in absolute) value than the baseline. The excluded instruments maintain significance and the correct qualitative effects in the first stage.

Finally, many believe that the government should play an active role in reducing economic inequality by providing public goods and services and erecting a social safety net. Column 12 includes the size of government sub-index from the Economic Freedom of the World dataset (EF1). The size of government is inversely related to economic freedom because greater government involvement in the economy necessitates less individual choice. EF1 thus decreases in the size of government. EF1 is negative in the first stage and positive in the second stage, although it is only significant in the former.[107] The total estimated effect of EF1 on inequality is 3.46, suggesting that larger government is associated with less income inequality. EF2 remains negative and the coefficient of -5.30 is highly significant with a robust standard error of 1.20 in the second stage. The two excluded instruments preserve the correct sign and are significant at 5 percent or better in the first stage.

Column 13 provides a direct measure of government efforts to reduce inequality by including the government subsidies and transfer payments as a share of GDP (TRANSFERS) in lieu of EF1. TRANSFERS is positive and highly significant in the first stage, and negative but insignificant in the second stage. The overall effect of TRANSFERS on inequality is -0.95, suggesting that a one percent increase in TRANSFERS is associated with a nearly 1 Gini point reduction in net income inequality. Meanwhile, EF2 remains negative and significant in the second stage, although the magnitude of the coefficient (-3.99) is noticeably lower in absolute value than the baseline. Unadjusted LWHEATSUGAR loses significance in the first stage regression and an F(WID) value of 3.6 suggest that the instruments are weak.[108]

[107] Establishing and maintain legal institutions in the public arena requires resources. It is therefore not surprising that there is a negative relationship between EF1 and EF2 in the first-stage.
[108] A strong positive correlation of 0.69 between EF2 and TRANSFERS, and a correlation of 0.67 between TRANSFERS and LWHEATSUGAR likely explains the weakening of the instruments in column 13.

Overall, the results from Table 5.5 suggest that the 2SLS estimates of the potential causal impact of EF2 on income inequality are robust to a number of other potential determinants of inequality. In all specifications, EF2 remains negative and highly significant in the second stage. With the exception of one specification (column 13), LWHEATSUGAR remains a positive and significant instrument for EF2 in the first stage, although its' positive impact on the development of the rule of law is mitigated in countries with French civil law tradition. Statistical tests for validity and weak instruments suggest that, for the most part, the excluded instruments remain strong and valid when controlling for a number of additional potentially exogenous determinants of inequality.

5.5.2 Robustness to Alternative Measure of Factor Endowments

Following Easterly (2007), the share of a country's land located in the tropics (TROPICS) is adopted as an alternative measure of factor endowments. TROPICS is indeed moderately well correlated with LWHEATSUGAR, as the correlation between the two variables is -0.54. This suggests that TROPICS may serve as a proxy for the suitability of endowments for plantation relative to family farming. Table 5.6 repeats the results from Table 5.4 using TROPICS and TROPICS×FR in lieu of LWHEATSUGAR and LWHEATSUGAR×FR as the excluded instruments.

The results in the first-stage regressions suggest that tropical locations exert a negative impact on the rule of law, with the negative impact more pronounced in countries with French legal tradition. The excluded instruments are both significant at 5 percent or better in all specifications, with two exceptions.[109] EF2 is negative and highly significant in all eight second-stage regressions, and the coefficients range from -1.395 to -6.58. There do not appear to be any indications of the instruments being weak, although p(OID) is less than 0.05 in columns 1 and 3, suggesting that the instruments may be invalid. The results are therefore fairly robust to an alternative, although less precise, measure of factor endowments.

[109] TROPICS is insignificant in columns 4 and 5.

5.6 Summary

Using land endowments and legal origins as instruments for contemporary legal institutions, this chapter argues that there are distributional consequences to the rule of law and shows empirically that equality before the law results in greater economic equality. The potential causal impact of a nation's legal institutions, as measured by area 2 of the Economic Freedom of the World index, on income inequality is estimated by developing an identification strategy that simultaneously accounts for the two prevailing views in the literature on the origins of legal institutions – legal tradition and endowments. Because these two historical factors influenced the ability of the elite to successfully shape the law in a manner that preserved their status and perpetuate inequality, they make valid exogenous instruments for the rule of law to estimate its potential causal impact on economic inequality.

Specifically, Engerman and Sokoloff (1997, 2000, 2002) endowment story is adopted. The suitability of the land and climate for small-scale family relative to large-scale plantation farming influenced the development of legal institutions. When endowments were favorable for family farming, legal institutions developed that provided better protections of private property rights, enforcement of private contracting, and more equal protections under the law. The impact of favorable land endowments was partially mitigated when a country received the French civil law tradition such that less equitable legal institutions developed. When endowments favored plantation farming, very weak legal institutions were likely to emerge, regardless of the imparted legal tradition.

When institutions emerged that provided greater equality before the law, the elite were unable to protect their status and deny others economic opportunities. As a result, a more equitable distribution of income resulted. The development of less equitable legal institutions has provided the elite with a means to protect their positions and deny the majority of the population access to economic opportunities, resulting in a perpetuation of economic inequality over long periods of time. The empirical evidence presented here supports the Engerman-Sokoloff Hypothesis that the elite's historical efforts to influence the rule of law, when successful, have perpetuated economic inequality. They also support the Friedman Hypothesis that societies which pursue freedom before equality will achieve higher levels of both, given that equality before the law is considered an essential ingredient for freedom.

One potential limitation of the empirical work presented here is that factor endowments and legal tradition may exert an influence on inequality through channels besides legal institutions. For instance, it has been suggested that economic inequality has historically been perpetuated through political inequality by limiting the voting franchise, as well as by a lack of public investment in schooling institutions, that may have also been influenced by factor endowments and/or colonization policies (Mariscal and Sokoloff 2000; Klerman, Mahoney, Spamann, and Weinsten 2011). It is difficult to disentangle these various channels empirically without additional exogenous instruments due to the high correlation between the various types of institutions. This would be an area fruitful for additional research.

CHAPTER SIX

CONCLUSIONS

The current research contributes to a growing body of literature suggestive that institutions are an important determinant of the development process. Specifically, it examines how economic institutions affect economic inequality, including both comparative economic development among nations and the distribution of income within nations. In doing so, it also constitutes an effort towards the development of a better historical understanding of the origins of economic institutions, and how this has impacted economic outcomes. It provides some evidence in favor of economic freedom being a causal determinant of economic development, and some evidence that a weak rule of law is a causal determinant of economic inequality.

6.1 Summary of Findings

Chapter two examines empirically how European colonization impacted the development of institutions supportive of economic freedom, and how these institutions in turn affected long-run economic development. The theory underlying the empirical strategy combines two institutional views of post-colonial comparative economic development, finding evidence that both settlement conditions (Acemoglu, Johnson, and Robinson, 2001, 2002) and the identity of the colonizer (Klerman et.al. 2011; Landes, 1998; North, Summerhill, and Weingast, 2000) were important determinants of a broad cluster of mutually-reinforcing economic institutions.

When the Europeans colonized a region with a sparse indigenous population, they invested in the development of institutions similar to those existing in the mother country. For the British, this meant inclusive liberal institutions consistent with the principles of limited government, property rights, and markets. Meanwhile, the French, Portuguese, and Spanish exhibited much more mercantilist institutions prior to the French Revolution such that their colonies were unlikely to receive inclusive economic institutions, even if settlement conditions were favorable. For colonies with large indigenous populations capable of supplying resistance to the Europeans, extractive institutions were established, regardless of the colonizer.

The colonization era marked the beginning of long-run divergence among the former colonies as countries that developed liberal economic institutions consistent with economic freedom experienced long-run economic growth, while those that developed more extractive economic institutions have evolved into economically unfree nations today and experienced relative stagnation of their economies. The estimated causal effect of economic freedom on economic development is both economically and statistically significant, explaining a considerable degree of the disparity in the levels of income per capita in existence today. This finding is robust to a number of alternative explanations for economic development such as geography, natural resources, and population heterogeneity, suggesting that a considerable amount of between-nation inequality in the world today is explained by heterogeneous economic institutional arrangements.

Chapter three provides an overview of the concept and measurement of within-nation economic inequality. The historical scarcity of relatively comparable high-quality inequality measures across countries is one reason that a clear understanding concerning how institutions shape economic distributions within an economy has yet to be established. Relatively recent efforts by researchers to develop more comparable estimates of within-nation inequality across countries have partially alleviated this issue. An inequality database is constructed that contains eight alternative measures of relative inequality. Each of the measures is relatively comparable across countries and time, but differs in its country coverage and/or income concept. Gini coefficients representing net income, gross income, and consumption inequality are included in the database, as well as measures of top-to-bottom income shares. The eight alternative measures of inequality are used in the analysis of chapters four and five.

Chapter four provides an analysis of how economic freedom impacts inequality within nations. The literature on this issue is quite sparse and previous researchers have followed Berggren (1999), at least implicitly, in assuming that the relationship is theoretically ambiguous and a matter to be resolved by empirical evidence. Berggren developed a simple theoretical framework to examine how economic freedom affects inequality, concluding that other than redistribution, which reduces both economic freedom and inequality, the relationship between economic freedom and inequality is theoretically ambiguous. Even the result that redistribution lowers inequality is not theoretically generalizable once the framework is altered to allow for regressive, as opposed to progressive redistribution, or for distribution to impose an efficiency cost on the economy.

Several researchers have examined the relationship between economic freedom and inequality empirically, but have reached largely inconsistent results. Berggren (1999) and Scully

(2002) for instance conclude that economic freedom is associated with less inequality, while Bergh and Nilsson (2010) report a positive relationship. Carter (2006) meanwhile contends that the relationship is non-linear, suggesting that low and high levels of economic freedom are associated with more inequality, but intermediate levels are associated with lower inequality. There are several possible explanations for the non-robust findings. First, and perhaps because of the theoretical ambiguity, the various studies have used different econometric models. Second, the studies have used different measures of both inequality and economic freedom. Third, empirical analyses have covered different samples of countries and time periods.

Armed with the eight inequality measures, each of the four major econometric models that have been used in the literature are tested for robustness. The new estimates obtained in chapter four suggest that not only do the different econometric models often produce contrasting results, but also the models themselves are in general not very robust to alternative measures of inequality or economic freedom, country samples, or time periods examined.

The findings in chapter four highlight the ambiguity of the economic freedom-inequality relationship, suggesting that more research on the various mechanisms through which economic intuitions impact inequality is needed. Chapter five addresses one such mechanism – the historical development of legal institutions and the rule of law as a mechanism to either promote or hinder economic opportunity and inequality. Two views exist in the literature on legal origins: endowments and legal tradition (Levine, 2005). The first is commonly associated with economic historians Stanley Engerman and Kenneth Sokoloff, who argue that efforts by the elite class to legally protect their economic interests and perpetuate economic inequality over time were bolstered by factor endowments suitable for plantation farming and/or industrial mining. When the factor endowments were more suitable for smaller scale family farming, a wider segment of the male population became landowners and a more egalitarian rule of law evolved, resulting in a more equitable distribution of economic income.

The second view on the origins of legal and property rights institutions focuses on the tradition of a nation's legal system. The legal traditions of a few European nations have spread throughout the world mainly through colonization and conquest. The French civil law tradition has often been associated with less secure private property rights and contract enforcement than the other major legal traditions (La Porta et.al., 2008). Countries that received the French legal tradition are therefore less likely to exhibit an equitable rule of law and property rights protections than those that received British common law. It has been suggested that the rule of law and property rights are essential for the establishment of liberty (Alchian, 2008; Hayek, 1960), and Milton Friedman (1980) hypothesized that countries that pursue freedom will achieve greater equality.

While the two views of legal origins have often been treated as alternative theories, they are treated as complementary in the current research as a means to establish a potentially causal relationship between the rule of law and economic inequality. Contemporary legal institutions, as measured by area 2 of the EFW index, are instrumented for with a measure of the suitability of endowments for the production of wheat relative to sugar farming (LWHEATSUGAR), and LWHEATSUGAR adjusted for a dummy variable equal to one if a nation received the French legal tradition. Historically the elites sought to influence the development of legal institutions to protect their economic interests while suppressing the legal rights of others. Their efforts were hindered when endowments favored small scale family farming relative to plantation farming. The positive affect of LWHEATSUGAR on the rule of law is partially mitigated when a nation received the French civil law tradition.

With the development of a more equitable rule of law that offered widespread property rights protections, a more equitable distribution of income has resulted over time. When the conditions were favorable for legal capture by the elites, as characterized by endowments suitable for plantation farming and the receipt of French legal tradition, huge income disparities have persisted until today, culminating in what Easterly (2007) refers to as structural inequality and Acemoglu and Robinson (2012) call the vicious circle. These results provide empirical support for both the Engerman-Sokoloff and Friedman Hypotheses.

6.2 Practical Implications

Free market capitalism is often denounced by academics, politicians, and other public intellectuals as the cause of growing economic inequality around the world. The Economic Freedom of the World index provides a good proxy for the degree to which a nation is committed to free market capitalism. As such the current research provides some insights concerning the claims that free market capitalism is the culprit for global economic inequality, which is comprised of two major components: (1) between-nation inequality, and (2) within-nation inequality. It does so by advancing theory concerning the origins of economic institutions, and empirically testing how economic institutions consistent with economic freedom influence comparative economic development and economic inequality.

The evidence suggests that countries which have developed economic institutions that promote market capitalism have achieved greater levels of income per capita than those which have not, suggesting that the continued lack of economic freedom in many countries is culpable for the persistence of huge disparities in the average living standards across the world, or between-nation inequality. Indeed, recent research suggests that economic liberalization in previously impoverished countries such as China, India, and Indonesia over the past several decades has promoted economic growth that has not only lifted millions out of dire poverty, but also narrowed the income gap between the reforming countries and the developed world (Connors, 2012; Sala-i-Martin, 2006). While countries that are moving towards more economic freedom are contributing to the reduction of global inequality, those which remain largely unfree such as most African nations continue to fall further behind economically, offsetting some of the reductions in global inequality achieved by recent development in reformist nations.

While the above evidence is consistent with institutional theory and a large body of empirical literature, how economic freedom impacts within-nation inequality is much less clear. Theory concerning the relationship between the two variables is ambiguous, and the few studies that have examined the issue empirically have often reached different conclusions. The findings of chapter four highlight this ambiguity. Because the effects of economic freedom on inequality are not yet clearly understood, policymakers seeking to promote widespread prosperity should resist pursuing institutional and policy changes that reduce economic freedom in an effort to achieve greater equality. Milton Friedman (1980) suggests that a society that pursues equality before freedom will get neither. A growing body of research suggests that economic freedom promotes economic growth, and that growth reduces poverty. Pursuing equality at the expense of economic freedom, in addition to reducing freedom which might be considered a normal good in itself, could also undermine recent progress towards reducing global poverty. The evidence presented in chapter five provides support for Friedman's Hypothesis that legal institutions consistent with the protection of private property rights and contract enforcement, and hence freedom, are associated with greater economic equality.

6.3 Future Research

The empirical development literature appears headed in two directions, both of which are fruitful for future research on institutions and development. First, while there is widespread agreement that institutions matter for development, the determinants of institutional change are less well understood. Second, the literature is increasingly focused on identifying the so-called deep determinants of development. While the current research constitutes a contribution to both areas of inquiry, there is much more work to be done. Factors such as ancestry, genetic diversity, experienced statehood, and world migration have been identified as possible deep determinants of development. Preliminary evidence suggests that some of these factors may impact economic development through their influence on institutional development. Further exploration of this topic would be a fertile area for additional research on both the origins of institutions and the deep determinants of development.

While there is relatively broad support for the idea that institutions are a causal determinant of economic development, there is a competing hypothesis that human capital is the key driver of economic performance (Glaeser et.al., 2004; Hanushek and Woessmann, 2012). Preliminary evidence suggests existing evidence that human capital is a better predictor of economic development than institutions is sensitive to the measure of human capital and institutions. Further developing this empirical work concerning the relative importance of institutions versus human capital is likely to be another area ripe for future research.

One of the limitations indicated in chapter five is that the development of legal institutions may only be one channel through which the elite class perpetuated economic inequality. It has been suggested that the elite also utilized other channels such a limiting the franchise and access to schooling institutions (Mariscal and Sokoloff ,2000; Klerman, Mahoney, Spamann, and Weinsten, 2011). Estimating the relative importance of multiple channels through which inequality has historically been perpetuated is another potentially rich area for future research.

APPENDIX A

DATA – CHAPTER TWO

Table A.1: Description & Sources, Chapter Two Data

Variable	Description	Source(s)
Log Per Capita GDP Measures		
Log PWT GDP per Capita PWT 95, PWT 00, PWT 10	Log of GDP per capita in 1995, 2000 & 2010 in constant 2005 PPP-adjusted USD.	Heston, Summers and Aten (2012) Penn World Table Version 7.1
Log WDI GDP per Capita WDI 95, WDI 00, WDI 10	Log of GDP per capita in 1995, 2000 & 2010 in constant 2005 PPP-adjusted USD.	World Bank (2013) World Development Indicators
Institutional Measures		
Average Economic Freedom of the World EFW 85-95 EFW 85-00 EFW 85-10	Average chain-linked EFW Index score over quinquennial periods. Country must have score for 2/3 periods for 85-95; 2/4 periods for 85-00; 4/6 periods for 85-10. Otherwise, treated as missing. Comprised of 5 area ratings, each of which is on a 0-10 scale that is increasing in EFW. Index represents an average of each area.	Gwartney, Lawson, and Hall (2012). Economic Freedom of the World Annual Report. www.freethworld.com
Years Since Independence YSI	Number of years passed since a nation became politically independent. Equal to difference between 2010 and year Polity IV data for a nation first available.	Polity IV Dataset. Center for Systemic Peace; Integrated Network for Societal Conflict Research www.systemicpeace.org
Average Constraints on the Executive XCON 85-95 XCON 85-00 XCON 85-10 XCON Initial	A seven-category scale from 1 to 7. Average annual score over each period. Transition scores (-66, -77, -88) treated as missing. Initial is average over first 10 years of available data for a country.	Polity IV Dataset. Center for Systemic Peace; Integrated Network for Societal Conflict Research www.systemicpeace.org
Average Risk of Expropriation ROE 85-95	Risk of expropriation of private foreign investment. 0-10 scale decreasing in risk. Annual mean over 1985-1995.	As used by AJR (2001). Data organized by IRIS Center at University of Maryland. Originally Political Risk Services.
Geography & Climate Measures		
Coastal Population COAST	Share of national population living within 100 km of the coast.	Gallup, Sachs, and Mellinger (1999)
Distance to Major Markets DMM	Nearest distance by air to oneof the three major world markets (New York, Rotterdam or Tokyo).	Gallup, Sachs, and Mellinger (1999)
Tropical Climate TROPICS	Proportion of land area located in tropical climate	Gallup, Sachs, and Mellinger (1999)
Latitude	The absolute value of a country's latitude (distance from equator). Scaled to take values from 0-1, where 0 is equator.	La Porta et.al. (1999)
Risk of Malaria Malaria Ecology	An index comprised of temperature, mosquito species type abundance, and vector type. Measured at subnational level. Index averaged for country	Kiszewski et.al. (2004), as used by Sachs (2003).
Humidity Variables AM Min, AM Max PM Min, PM Max	Set of 4: morning min and max humidity, afternoon min & max humidity	Parker (1997), as used by AJR (2001)
Temperature Variables Mean, Min High, Max High, Min Low, Max Low	Set of 5: average temperature, min & max monthly high temperatures, min & max monthly low temperatures	Parker (1997), as used by AJR (2001)
Soil Quality Steplow, Deslow, Stepmid, Desmid, Drystep, Drywint, Highland	Set of 7 soil quality dummy variables: steppe (low & middle latitudes), desert (low & middle latitudes), dry steppe wasteland, desert dry winter, and highland.	Parker (1997), as used by AJR (2001)

Table A.1 - Continued

Variable	Description	Source(s)
Natural Resources Oil Reserves, Zinc, Gold, Iron, Silver	Set of 5: percentages of world gold, iron, silver and zinc reserves, oil resources (1,000's barrels / capita)	Parker (1997), as used by AJR (2001)
Population Heterogeneity Measures		
Ethno-linguistic Fractionalization ELF	Average value of 5 different indices of national ELF. Values range from 0 to 1. Probability that two randomly selected people: (1) belong to different ethnic group in 1960;(2) speak different language;(3) don't speak same language; (4) % population not speaking official language; and (5) % population speaking most widely used language.	Easterly and Levine (1997), as used in La Porta et.al. (1999). Sources of ELF sub-components: (1) Atlas Narodov Mira (1964); (2) Mueller, 1964; (3) Roberts (1962); (4) and (5) Gunnemark (1991)
Ethnic Fractionalization EF	Probability that 2 randomly selected people are from the same ethnic group.	Alesina et.al. (2003). Original sources: Encyclopedia Brittannica (2001); CIA (2000); Levinson (1998); Minority Rights Group International (1997)
Linguistic Fractionalization LF	Probability that 2 randomly selected people speak the same language	Alesina et.al. (2003). Original source: Encyclopedia Brittannica (2001)
Religion Variables Catholic Protestant Muslim	Shares of population belonging to Roman Catholic, Protestant, Muslim and all other religions in 1980 (1990-1995 for recently formed nations).	La Porta et.al. (1999), as used by AJR (2001).
Genetic Diversity GenDiv $GenDiv^2$	Gentic diversity of contemporary national populations, predicted by pairwise migratory distance from East Africa of the 53 unique ethnic groups identified by HGDP-CEPH.	Ashraf and Galor (2013a).
Genetic Diverstiy, Adjusted GenDiv (Adjusted) $GenDiv^2$(Adjusted)	Genetic diversity of contemporary national populations, adjusted for ancestry to account for diversity arising from differences between subnational ethnic groups.	Ashraf and Galor (2013a). World Migration Matrix, 1500-2000 (Putterman andWeil, 2010) used for adjustment.
European Descent, Net Colonizer	Share of national population in 2000whose ancestors lived in Europe in 1500, net of the share whose ancestors lived in the primary colonizer in 1500. Europe defined as the 28 current members of EU (as of 2013) in addition to Iceland, Norway and, Switzerland.	World Migration Matrix, 1500-2000 (Putterman and Weil, 2010).
Regional Dummy Variables		
Continent Dummies Africa Asia Other	Set of three dummy variables for Africa, Asia, and All Other. Africa includes all countries on continent, including northern African countries (e.g. Egypt, Morocco). Asia includes Asian Pacific and South Asian, but not central Asian countries (e.g. Bahrain, Turkey).	World Bank (2013) World Development Indicators.
Regional Dummies EAP, ECA, LAC MENA, NA, SAS, SSA	Set of 7 regional dummy variables for East Asia & Pacific, Europe & Central Asia, Latin American & Caribbean, Middle East & North Africa, North America, South Asia, and Sub-Saharan Africa	World Bank (2013) World Development Indicators.
Exogenous instruments		
Population Density in 1500 PD1500	Ratio of total population to arable land in A.D. 1500. Transformed to take values between 0 and 1. See Appendix B for details.	McEvedy and Jones (1978), as used in AJR (2001).
Settler Mortality Rate SMR	Mortality rates of European-born soldiers, sailors, and bishops when stationed in colonies. Measures effects of local diseases on people without inherited or acquired immunities. Transformed to take values between 0 and 1. See Appendix B for details.	AJR (2001), based on Curtin (1989) and other sources.
Colonizer Identity UK, Non UK, ESP, POR, Other	The primary colonizer of modern nation. Dummy variable equal to 1 if colonized by England, Spain, France, Portugal. or Other	Klerman et.al. (2011)
Colonizer Identity (AJR) UK (AJR) Other (AJR)	Dummy variable equal to 1 if colonized by England (UK). AJR refer to this as colonizer identity, but it is likely legal origin, given origin source. See Klerman et.al. (2011) for analysis of differences between legal tradition and colonizer identity.	La Porta et.al. (1999), as used in AJR (2001).

Table A.2: Descriptive Statistics, Chapter Two Data

	Full Sample					Former Colonies				
	SD	Min	Max	N	Mean	SD	Min	Max	N	Mean
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log GDP Per Capita Measures										
PWT 10	8.849	1.363	5.483	11.823	141	8.574	1.357	5.765	11.233	84
PWT 00	8.584	1.395	5.193	11.084	141	8.352	1.389	5.965	11.084	84
PWT 95	8.487	1.348	5.612	10.974	141	8.271	1.337	5.786	10.847	84
WDI 10	8.774	1.309	5.757	11.153	151	8.612	1.301	6.261	11.137	83
WDI 00	8.525	1.338	5.561	11.143	156	8.399	1.319	6.207	11.02	85
WDI 95	8.385	1.32	4.614	11.129	153	8.293	1.285	5.989	10.788	85
Institutional Measures										
EFW (85-95)	5.747	1.243	3.306	8.787	112	5.62	1.245	3.335	8.787	78
EFW (85-00)	5.946	1.142	3.442	8.805	122	5.856	1.156	3.708	8.805	79
EFW (85-10)	6.266	1.007	3.84	8.835	122	6.161	1.019	4.312	8.835	79
XCON (85-95)	4.162	2.115	1	7	151	4.207	2.09	1	7	81
XCON (85-00)	4.310	2.033	1	7	151	4.419	1.938	1.125	7	81
XCON (85-10)	4.565	1.934	1	7	152	4.712	1.743	1.692	7	81
XCON Initial	3.338	2.147	1	7	152	3.559	2.161	1	7	81
YSI	106.843	169.035	17	2010	153	96.765	61.332	34	210	81
ROE (85-95)	7.11	1.776	1.636	10	115	6.966	1.571	3.727	10	74
Geography & Climate Measures										
COAST	0.424	0.365	0	1	143	0.488	0.361	0	1	78
DMM	4.085	2.436	0.14	9.59	159	4.784	2.456	0.14	9.59	87
Tropics	0.477	0.476	0	1	152	0.655	0.448	0	1	85
Latitude	0.296	0.191	0	0.722	157	0.228	0.169	0.011	0.722	87
Malaria Ecology	3.803	6.702	0	31.548	155	4.714	7.118	0	30.095	86
Humid, AM Min	67.642	16.39	18	97	151	69.906	17.335	19	97	85
Humid, AM Max	86.311	7.419	54	98	151	86.671	7.513	54	98	85
Humid, PM Min	48.993	15.96	10	86	151	51.176	17.303	10	86	85
Humid, PM Max	73.185	10.323	35	92	151	72.388	10.16	41	92	85
Temp, Mean	18.881	8.140	-4	32	151	21.388	6.295	4	29	85
Temp, Min High	24.166	9.238	-6	40	151	27.471	6.722	7	38	85
Temp, Max High	38.278	5.099	23	49	151	37.506	5.349	23	48	85
Temp, Min Low	-2.748	16.528	-44	20	151	3.635	12.59	-37	20	85
Temp, Max Low	14.066	6.616	1	26	151	14.718	6.528	1	24	85
Soil, Steplow	0.205	0.405	0	1	151	0.247	0.434	0	1	85

Table A.2 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Soil, Deslow	0.185	0.39	0	1	151	0.212	0.411	0	1	85
Soil, Stepmid	0.06	0.238	0	1	151	0.024	0.152	0	1	85
Soil, Desmid	0.026	0.161	0	1	151	0.012	0.108	0	1	85
Soil, Drystep	0.04	0.196	0	1	151	0.059	0.237	0	1	85
Soil, Drywint	0.007	0.081	0	1	151	0.012	0.108	0	1	85
Gold	0.435	3.902	0	47	154	0.788	5.24	0	47	85
Iron	0.324	1.628	0	16	154	0.472	2.09	0	16	85
Silver	0.357	1.983	0	13	154	0.647	2.64	0	13	85
Zinc	0.5	2.052	0	15	154	0.729	2.665	0	15	85
Oil Reserves	295853.351	1531138.14	0	15700000	154	76074.082	343311.071	0	3040000	85
Population Heterogeneity Measures										
ELF	0.355	0.309	0	1	129	0.377	0.304	0	0.89	87
EF	0.452	0.256	0	0.930	158	0.491	0.247	0.045	0.930	87
LF	0.403	0.285	0.002	0.923	155	0.424	0.301	0.019	0.923	84
Catholic	30.015	35.457	0	97.3	154	38.002	36.707	0.1	96.600	85
Muslim	24.818	36.673	0	99.7	154	18.981	31.255	0	99.400	85
Protestant	13.335	22.297	0	100	154	12.534	18.671	0	96.600	85
GenDiv (Unadjusted)	0.711	0.053	0.572	0.774	158	0.693	0.063	0.572	0.765	87
GenDiv2 (Unadjusted)	0.508	0.071	0.327	0.6	158	0.484	0.085	0.327	0.586	87
GenDiv (Adjusted)	0.727	0.027	0.628	0.774	154	0.722	0.031	0.628	0.765	84
GenDiv2 (Adjusted)	0.529	0.038	0.394	0.6	154	0.522	0.044	0.394	0.586	84
Euro Descent Net Colonizer	0.199	0.365	0	1	159	0.144	0.304	0	1	87
Regional Dummy Variables										
Africa	0.308	0.463	0	1	159	0.391	0.491	0	1	87
Asia	0.132	0.34	0	1	159	0.126	0.334	0	1	87
SSA	0.274	0.447	0	1	157	0.356	0.482	0	1	87
MENA	0.121	0.327	0	1	157	0.069	0.255	0	1	87
ECA	0.287	0.454	0	1	157	0.115	0.321	0	1	87
SAS	0.038	0.192	0	1	157	0.046	0.211	0	1	87
EAP	0.108	0.312	0	1	157	0.103	0.306	0	1	87
NA	0.013	0.113	0	1	157	0.023	0.151	0	1	87
LAC	0.159	0.367	0	1	157	0.287	0.455	0	1	87
Exogenous Instruments										
PD1500	0.687	0.314	0	0.997	74	0.680	0.318	0	0.997	71
SMR	0.581	0.328	0	0.975	68	0.582	0.33	0	0.975	67
UK	0.359	0.482	0	1	92	0.379	0.488	0	1	87

Table A.2 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Non UK	0.641	0.482	0	1	92	0.621	0.488	0	1	87
ESP	0.196	0.399	0	1	92	0.207	0.407	0	1	87
FR	0.217	0.415	0	1	92	0.23	0.423	0	1	87
POR	0.033	0.179	0	1	92	0.034	0.184	0	1	87
Other	0.196	0.399	0	1	92	0.149	0.359	0	1	87
UK (AJR)	0.305	0.462	0	1	154	0.4	0.493	0	1	85
Other (AJR)	0.025	0.157	0	1	159	0.034	0.184	0	1	87
PD1500×UK						0.690	0.354	0	0.997	29
PD1500×NonUK						0.686	0.289	0	0.987	45
PD1500×ESP						0.851	0.084	0.680	0.987	17
PD1500×FR						0.6	0.278	0	0.878	17
PD1500×POR						0.771	0.259	0.484	0.986	3
PD1500×Other						0.486	0.426	0	0.983	8
SMR×UK						0.699	0.336	0	0.975	26
SMR×NonUK						0.507	0.304	0	0.804	42
SMR×ESP						0.748	0.092	0.528	0.801	17
SMR×FR						0.287	0.293	0	0.774	17
SMR×POR						0.659	0.191	0.524	0.795	2
SMR×Other						0.399	0.252	0.191	0.804	6

APPENDIX B

PD1500 TRANSFORMATION – CHAPTER TWO

Albouy (2012) criticized the use of settler mortality rates (SMR) as an instrument for contemporary institutions, arguing that several outliers were driving the results obtained by Acemoglu et.al. (2001, 2002, 2005) that institutions exert a strong and significant causal impact on long-run economic performance. Acemoglu and his co-authors use a log transformation of the SMR in their work, which already reduces the relative dispersion of the variable (coefficient of variation) significantly compared to the raw data, mitigating the effect of outliers. For the sample of former European colonies, the coefficients of variation for the raw and log-transformed SMR variables are 1.89 and 0.26, respectively. Acemoglu at.al. (2011) further rebuke the claims of Albouy in showing that their results remain unchanged, and in some cases are stronger, when applying transformations of the data that further reduce the dispersion of SMR.

Although we are not aware of similar criticisms lobbied at the population density in 1500 (PD1500) data, which was our preferred instrument for contemporary institutions in chapter two, the variable does include a number of right-skewed observations. PD1500 ranges from 0.02 to 100.5, with a mean of 5.4 and standard deviation of 12.9. The relative dispersion for PD1500 is greater than it is for SMR, with a coefficient of variation of 2.52. Only 16 of the 87 countries in the dataset have a PD1500 value greater than the mean, and 11 countries have a value in the double digits. Six nations have a PD1500 value above 20, including Egypt with a value of 100.5. In order to reduce the possibility of outliers driving the results, a transformation of the PD1500 is implemented.

Taking the natural log of the PD1500 data actually increases the relative dispersion for the sample of former European colonies, as the coefficient of variation rises from 2.5 to 3.9, so this transformation would enhance the possibility that outliers are driving the results. As previously discussed in chapter two, the transformation $\mathrm{PD1500}' = 1 - \left(\frac{\mathrm{PD1500}}{\mathrm{PD1500}_{\max}}\right)$, where $\mathrm{PD1500}_{\max} = \overline{\mathrm{PD1500}} + \alpha\sigma_{\mathrm{PD1500}}$, rescales the variable to a 0-1 scale that is increasing in population density. The metric assigns regions with raw PD1500 close to zero a value close to one, and countries with raw PD1500 near the maximum a value approaching zero. The transformation can be reconciled with theory, as it suggests that pre-colonial indigenous population density exerts a linear impact on the settlement strategy of the colonizer that influences the development of institutions over a range of values, $\mathrm{PD1500}' \in [0, \mathrm{PD1500}_{\max}]$. As PD1500 approaches $\mathrm{PD1500}_{\max}$, the marginal impact of settlement strategy approaches zero as the colonizers seek to establish purely extractive institutions. Table B.1 reports the summary statistics for α values of 0.25, 0.5, 0.75 and 1, for the sample of former European colonies.

The main results reported in chapter two use $\alpha = 0.25$, which sets PD1500'=0 for nine countries. This is labeled PD1500D in Table B.1. The 2SLS estimates using PD1500D from column 7 of Table 2.4 of chapter two are reproduced in columns 1-3 of panel A in Table B.2 for each of the three institutional measures, controlling for the exogenous impact of three geography-climate variables (COAST, TROPICS and DMM) and ELF. Panel B reports the corresponding first-stage estimates. Columns 4-6 repeat the estimates using PD1500C, while columns 7-9 and 10-12 use PD1500B and PD1500A, respectively. The results are nearly identical using the alternative transformation metrics, indicating the main results are robust to the transformation of the instrument, PD1500.

Table B.1: Summary Statistics for Alternative Transformations of PD1500

Transformation	Min	Max	SD	Mean	Coefficient of Variation	Countries Assigned Zero
PD1500 (Raw)	0.02	100.5	13.03	5.17	2.52	
PD1500A ($\alpha = 1$)	0	1	0.28	0.80	0.35	BDI, BGD, EGY, IND, PAK, RWA
PD1500B ($\alpha = 0.75$)	0	1	0.29	0.78	0.37	BDI, BGD, EGY, IND, PAK, RWA, LKA
PD1500C ($\alpha = 0.5$)	0	1	0.30	0.74	0.40	BDI, BGD, EGY, IND, PAK, RWA, LKA, SDN
PD1500D ($\alpha = 0.25$)	0	1	0.32	0.68	0.47	BDI, BGD, EGY, IND, PAK, RWA, LKA, SDN, MAR
ln(PD1500)	-3.8	4.6	1.62	0.41	3.91	

Table B.2: Robustness of 2SLS Estimates to Alternative PD1500 Transformations

	PD1500D			PD1500C			PD1500B			PD1500A		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Second Stage Estimates: PWT 2010 Log Income Per Capita is Dependent Variable											
XCON (85-10)	0.80***			0.81***			0.83***			0.84***		
	(0.24)			(0.26)			(0.29)			(.30)		
ROE (85-95)		0.62***			0.64***			0.64***			0.64***	
		(0.15)			(0.15)			(0.16)			(0.16)	
EFW (85-10)			0.97***			0.98***			0.98***			0.99***
			(0.16)			(0.17)			(0.17)			(0.18)
COAST	0.63	0.75**	0.40	0.61	0.74**	0.39	0.59	0.74**	0.39	0.59	0.73**	0.38
	(0.40)	(0.32)	(0.27)	(0.41)	(0.33)	(0.28)	(0.43)	(0.33)	(0.28)	(0.44)	(0.33)	(0.29)
TROPICS	-0.18	-0.21	-0.36	-0.15	-0.18	-0.35	-0.12	-0.18	-0.35	-0.11	-0.17	-0.34
	(0.53)	(0.40)	(0.32)	(0.56)	(0.40)	(0.32)	(0.59)	(0.41)	(0.32)	(0.61)	(0.41)	(0.32)
DMM	-0.13***	-0.05	-0.03	-0.13***	-0.05	-0.03	-0.13***	-0.05	-0.03	-0.13***	-0.05	-0.03
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)
ELF	0.55	-1.01***	-0.60*	0.57	-1.02***	-0.60*	0.59	-1.02***	-0.60*	0.60	-1.02***	-0.60*
	(0.61)	(0.33)	(0.36)	(0.61)	(0.33)	(0.36)	(0.63)	(0.33)	(0.36)	(0.63)	(0.33)	(0.36)
p(OID)	0.56	0.00	0.15	0.64	0.01	0.13	0.70	0.01	0.12	0.74	0.01	0.12
p(UID)	0.02	0.00	0.00	0.04	0.00	0.00	0.05	0.00	0.00	0.06	0.00	0.00
F(WID)	4.3	12.4	12.0	3.1	10.6	11.0	2.5	9.6	10.1	2.3	8.8	9.5
SY size 0.10	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93
SY size 0.15	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59	11.59
SY size 0.20	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
SY size 0.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25
	Panel B: First Stage Estimates – Corresponding Institutional Measure is Dependent Variable											
PD1500	1.61***	0.28	0.73**	1.50**	0.38	0.70**	1.37*	0.39	0.65**	1.32*	0.43	0.63**
	(0.60)	(0.56)	(0.28)	(0.69)	(0.64)	(0.28)	(0.73)	(0.68)	(0.27)	(0.76)	(0.73)	(0.28)
PD1500×UK	0.36	1.52***	0.89***	0.45	1.37***	0.86***	0.50	1.29***	0.84***	0.53	1.24***	0.83***
	(0.46)	(0.34)	(0.27)	(0.43)	(0.33)	(0.26)	(0.41)	(0.32)	(0.25)	(0.40)	(0.32)	(0.25)
COAST	1.08**	0.53	0.93***	1.02**	0.55	0.91***	0.99**	0.55	0.90***	0.96*	0.54	0.88***
	(0.46)	(0.52)	(0.28)	(0.48)	(0.52)	(0.28)	(0.49)	(0.52)	(0.29)	(0.50)	(0.52)	(0.29)
TROPICS	-1.47***	-1.35***	-0.89***	-1.48***	-1.44***	-0.93***	-1.47***	-1.48***	-0.95***	-1.47***	-1.52***	-0.96***
	(0.47)	(0.37)	(0.24)	(0.49)	(0.37)	(0.25)	(0.51)	(0.38)	(0.25)	(0.52)	(0.38)	(0.25)
DMM	0.01	-0.04	-0.07	0.02	-0.04	-0.06	0.03	-0.04	-0.05	0.04	-0.04	-0.05
	(0.06)	(0.07)	(0.04)	(0.06)	(0.07)	(0.04)	(0.07)	(0.07)	(0.05)	(0.07)	(0.07)	(0.05)
ELF	-1.27**	-0.14	-0.23	-1.46**	-0.16	-0.34	-1.56**	-0.18	-0.39	-1.62**	-0.19	-0.42
	(0.53)	(0.71)	(0.34)	(0.56)	(0.70)	(0.35)	(0.59)	(0.69)	(0.35)	(0.61)	(0.69)	(0.36)
Adj. R^2	0.42	0.41	0.56	0.40	0.38	0.54	0.39	0.37	0.52	0.38	0.36	0.51
N	66	60	60	66	60	60	66	60	60	66	60	60

Standard errors robust to heteroskedasticity in parentheses. Constant terms are omitted for space. $*p < 0.10$, $** p < 0.05$, $*** p < .01$.

APPENDIX C

ALTERNATIVE IDENTIFICATION STRATEGIES – CHAPTER TWO

PD1500 and PD1500×UK are used as instruments for contemporary institutions in chapter two. Alternative identification strategies are examined in this appendix. First, Table C.1 reports the 2SLS results that include additional PD1500 terms adjusted for the other major colonizers. Columns 1, 2, and 3 use XCON, ROE, and EFW as the institutional measure, respectively, and all three models control for three measures of endowments (COAST, TROPICS, and DMM) and ELF, and instrument PD1500 and PD1500×UK for institutions. Columns 4-6 add PD1500×ESP as an instrument to the baseline, while columns 7-9 add PD1500×FR, where ESP and FR are dummy variables equal to one if the colonizer was Spain and France, respectively. Columns 10-12 add both PD1500×ESP and PD1500×FR as instruments to the baseline. Adding additional PD1500 adjusted for colonizer terms as instruments does not significantly alter the second stages estimates for two measures of economic institutions, ROE and EFW. As the results suggest, the baseline model that uses EFW (column 3) as the institutional measure performs best, as one or more of the excluded instruments are statistically insignificant in the remaining specifications, which also potentially suffer from weak and/or invalid instruments.

Next, Table C.2 substitutes the settler mortality rate (SMR) for PD1500 as the instruments.[110] Columns 1-3 serve as the baseline estimates for each institutional measure as they do not include additional covariates. Both SMR and SMR×UK are significant in the specifications using ROE and EFW as the institutional measures (columns 2 and 3, respectively); however, once controls for endowments and ELF are added, at least one of the two instruments loses significance and the weak instruments become suspect. This result is likely attributable to the influence of endowments on SMR (Auer, 2013), reinforcing our argument that indigenous population density is a more appropriate proxy for settlement conditions.[111]

[110] The same transformation as described in appendix B for PD1500 is applied to the raw SMR data.
[111] The correlation between TROPICS and the transformed SMR variable is -0.53, while that between COAST and SMR is -0.42. The respective correlations are 0.57 and -0.35 when a log transformation of SM is used instead.

Table C.1 2SLS Estimates with Additional Colonizer-Adjusted PD1500 Terms

	Former European Colonies						w/o Neo England's			Base Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Second Stage Estimates: PWT 2010 Log Income Per Capita is Dependent Variable											
XCON (85-10)	0.80***			0.65***			0.70***			0.66***		
	(0.24)			(0.14)			(0.16)			(0.14)		
ROE (85-95)		0.62***			0.63***			0.67***			0.64***	
		(0.15)			(0.15)			(0.14)			(0.14)	
EFW (85-10)			0.97***			1.00***			0.93***			0.90***
			(0.16)			(0.17)			(0.16)			(0.16)
COAST	0.63	0.75**	0.40	0.80**	0.74**	0.36	0.74*	0.71**	0.45*	0.79**	0.74**	0.49*
	(0.40)	(0.32)	(0.27)	(0.38)	(0.32)	(0.28)	(0.39)	(0.33)	(0.26)	(0.39)	(0.32)	(0.26)
TROPICS	-0.18	-0.21	-0.36	-0.41	-0.20	-0.32	-0.32	-0.12	-0.42	-0.39	-0.18	-0.45
	(0.53)	(0.40)	(0.32)	(0.32)	(0.40)	(0.32)	(0.37)	(0.39)	(0.32)	(0.32)	(0.39)	(0.33)
DMM	-0.13***	-0.05	-0.03	-0.12***	-0.05	-0.03	-0.12***	-0.05	-0.03	-0.12***	-0.05	-0.04
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
ELF	0.55	-1.01***	-0.60*	0.36	-1.02***	-0.60*	0.43	-1.03***	-0.60*	0.37	-1.02***	-0.60*
	(0.61)	(0.33)	(0.36)	(0.48)	(0.33)	(0.36)	(0.51)	(0.33)	(0.36)	(0.48)	(0.33)	(0.35)
p(OID)	0.56	0.00	0.15	0.50	0.00	0.07	0.70	0.01	0.02	0.63	0.00	0.05
p(UID)	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.02
F(WID)	4.3	12.4	12.0	9.4	8.4	7.8	7.4	7.9	8.0	7.3	6.2	5.9
SY size 0.15	11.59	11.59	11.59	12.83	12.83	12.83	12.83	12.83	12.83	13.96	13.96	13.96
SY size 0.20	8.75	8.75	8.75	9.54	9.54	9.54	9.54	9.54	9.54	10.26	10.26	10.26
SY size 0.25	7.25	7.25	7.25	7.80	7.80	7.80	7.80	7.80	7.80	8.31	8.31	8.31
	Panel B: First Stage Estimates – Corresponding Institutional Measure is Dependent Variable											
PD1500	1.65***	0.29	0.73**	0.43	0.25	0.64**	2.12***	0.42	0.68**	0.96	0.87	-0.08
	(0.61)	(0.56)	(0.28)	(0.71)	(0.81)	(0.32)	(0.59)	(0.54)	(0.31)	(0.82)	(0.77)	(0.51)
PD1500×UK	0.32	1.54***	0.89***	1.33**	1.58**	0.98***	-0.22	1.40***	0.95***	0.83	0.98	1.67***
	(0.46)	(0.35)	(0.27)	(0.52)	(0.60)	(0.32)	(0.50)	(0.36)	(0.30)	(0.61)	(0.63)	(0.55)
PD1500×ESP				1.91***	0.06	0.14				1.39**	-0.56	0.83
				(0.55)	(0.72)	(0.28)				(0.66)	(0.67)	(0.50)
PD1500×FR							-1.83***	-0.53	0.16	-0.75	-0.95	0.89
							(0.57)	(0.80)	(0.30)	(0.68)	(0.97)	(0.55)
COAST	0.98**	0.55	0.93***	0.92**	0.55	0.93***	0.73	0.52	0.94***	0.84*	0.46	0.99***
	(0.48)	(0.51)	(0.28)	(0.43)	(0.52)	(0.28)	(0.46)	(0.52)	(0.28)	(0.44)	(0.51)	(0.27)
TROPICS	-1.43***	-1.36***	-0.89***	-1.36***	-1.36***	-0.88***	-1.28***	-1.33***	-0.90***	-1.31***	-1.30***	-0.91***
	(0.48)	(0.37)	(0.24)	(0.47)	(0.37)	(0.25)	(0.47)	(0.37)	(0.24)	(0.47)	(0.36)	(0.25)
DMM	-0.00	-0.04	-0.07	0.01	-0.04	-0.07	-0.04	-0.05	-0.06	-0.01	-0.06	-0.05
	(0.06)	(0.07)	(0.04)	(0.06)	(0.07)	(0.04)	(0.06)	(0.06)	(0.04)	(0.07)	(0.06)	(0.04)
ELF	-1.30**	-0.18	-0.23	-0.58	-0.16	-0.18	-0.89	-0.05	-0.29	-0.60	-0.19	-0.22
	(0.55)	(0.71)	(0.34)	(0.60)	(0.82)	(0.35)	(0.57)	(0.73)	(0.37)	(0.60)	(0.77)	(0.34)
Adj. R^2	0.41	0.41	0.56	0.50	0.40	0.56	0.49	0.41	0.56	0.50	0.40	0.57
N	64	59	60	64	59	60	64	59	60	64	59	60

Standard errors robust to heteroskedasticity in parentheses. Constant terms are omitted for space. $*p < 0.10, ** p < 0.05, *** p < .01$.

Table C.2 2SLS Estimates using SMR as Instrument

	Former European Colonies						w/o Neo England's			Base Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Second Stage Estimates: PWT 2010 Log Income Per Capita is Dependent Variable											
XCON (85-10)	0.81***			0.72***			0.74***			0.83***		
	(0.15)			(0.24)			(0.24)			(0.35)		
ROE (85-95)		0.95***			0.81***			1.10***			0.81***	
		(0.15)			(0.17)			(0.36)			(0.17)	
EFW (85-10)			1.32***			0.89***			1.13***			0.93***
			(0.15)			(0.20)			(0.32)			(0.22)
COAST				0.58	0.37	0.47	0.45	0.16	0.16	1.04**	0.33	0.23
				(0.44)	(0.37)	(0.38)	(0.56)	(0.61)	(0.54)	(0.53)	(0.38)	(0.39)
TROPICS				-0.30	0.30	-0.41	-0.20	0.34	-0.34	-0.40	0.38	-0.31
				(0.47)	(0.38)	(0.35)	(0.41)	(0.44)	(0.40)	(0.50)	(0.39)	(0.36)
DMM				-0.12**	-0.01	-0.03	-0.14	-0.03	-0.04	-0.12**	-0.01	-0.03
				(0.05)	(0.04)	(0.04)	(0.10)	(0.07)	(0.08)	(0.05)	(0.04)	(0.05)
ELF				0.40	-1.11***	-0.59	0.45	-1.16**	-0.60	0.97	-1.29***	-0.84**
				(0.55)	(0.37)	(0.36)	(0.59)	(0.48)	(0.38)	(1.03)	(0.38)	(0.42)
p(OID)	0.97	0.00	0.00	0.99	0.05	0.00	0.88	0.21	0.00	0.78	0.03	0.01
p(UID)	0.00	0.00	0.00	0.01	0.03	0.01	0.02	0.13	0.04	0.02	0.03	0.03
F(WID)	21.7	10.9	21.8	6.3	5.5	7.0	6.5	2.7	4.8	4.2	5.3	5.7
SY Size 0.10	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93
SY size 0.15	11.59	11.59	11.59	12.83	12.83	12.83	12.83	12.83	12.83	13.96	13.96	13.96
SY size 0.20	8.75	8.75	8.75	9.54	9.54	9.54	9.54	9.54	9.54	10.26	10.26	10.26
SY size 0.25	7.25	7.25	7.25	7.80	7.80	7.80	7.80	7.80	7.80	8.31	8.31	8.31
	Panel B: First Stage Estimates – Corresponding Institutional Measure is Dependent Variable											
SMR	3.08***	1.25**	1.00***	2.49***	0.80	0.33	2.68***	1.14	0.47	1.83**	0.75	0.34
	(0.57)	(0.51)	(0.25)	(0.81)	(0.72)	(0.35)	(0.80)	(0.73)	(0.38)	(0.79)	(0.73)	(0.39)
SMR×UK	0.21	1.37***	1.00***	0.50	1.21**	1.14***	-0.12	0.49	0.72	0.72	1.23**	1.10**
	(0.53)	(0.48)	(0.31)	(0.69)	(0.56)	(0.40)	(0.80)	(0.62)	(0.45)	(0.70)	(0.58)	(0.44)
COAST				0.33	0.40	0.78**	0.66	0.67	0.99***	-0.47	0.46	0.56
				(0.61)	(0.65)	(0.34)	(0.63)	(0.68)	(0.34)	(0.66)	(0.66)	(0.40)
TROPICS				-0.21	-0.93**	-0.43	0.30	-0.36	-0.12	0.10	-1.01**	-0.25
				(0.73)	(0.43)	(0.35)	(0.64)	(0.45)	(0.42)	(0.77)	(0.48)	(0.38)
DMM				0.12	-0.02	-0.03	0.26***	0.07	0.05	0.12	-0.03	-0.01
				(0.08)	(0.08)	(0.05)	(0.09)	(0.09)	(0.07)	(0.08)	(0.08)	(0.07)
ELF				-0.77	0.22	-0.18	-0.72	0.49	-0.07	-1.93**	0.27	-0.35
				(0.67)	(0.89)	(0.41)	(0.67)	(0.85)	(0.39)	(0.77)	(0.91)	(0.52)
Adj. R^2	0.41	0.32	0.42	0.43	0.33	0.48	0.40	0.13	0.37	0.41	0.31	0.38
N	61	56	62	59	54	57	55	50	53	51	51	51

Standard errors robust to heteroskedasticity in parentheses. Constant terms are omitted for space. $*p < 0.10$, $** p < 0.05$, $*** p < .01$.

APPENDIX D

SUMMARY STATISTICS FOR CUSTOM INEQUALITY DATASETS

Table D.1: Summary Statistics & Sources, Net Income Gini Coefficient Dataset

(1) Country	(2) # Ginis	(3) Min	(4) Max	(5) Mean	(6) Year(s)	(7) Source(s)
Armenia	1	0.613	0.613	0.613	95	WIID2C
Australia	6	0.312	0.332	0.326	80-00,05	LIS
Austria	5	0.230	0.304	0.280	85,95,00,05,10	LIS (4); ATG (1)
Azerbaijan	4	0.175	0.210	0.190	00,03-05	ATG
Belgium	5	0.243	0.330	0.278	85-00, 10	LIS (4); ATG (1)
Bolivia	2	0.588	0.601	0.595	95-00	WIID2C
Botswana	2	0.537	0.556	0.547	85,95	WIID2C
Brazil	1	0.533	0.533	0.533	05	LIS
Bulgaria	10	0.310	0.384	0.347	90-06, 10	WIID2C (9); ATG (1)
Canada	9	0.309	0.366	0.329	70-00, 05,07	LIS
Chile	4	0.528	0.614	0.565	85-00	WIID2C
China	4	0.290	0.536	0.416	95-00,05	WIID2C
Colombia	1	0.562	0.562	0.562	05	LIS
Costa Rica	1	0.475	0.475	0.475	80	WIID2C
Croatia	2	0.288	0.368	0.328	80,05	WIID2C (1); ATG (1)
Cyprus	1	0.281	0.281	0.281	10	ATG
Czech Rep.	5	0.207	0.274	0.252	90-00, 05,10	LIS (3); ATG (2)
Denmark	7	0.229	0.270	0.249	75,85-00,05,10	LIS (5); WIID2C (1); ATG (1)
Dominican Rep.	1	0.505	0.505	0.505	90	WIID2C
Ecuador	2	0.545	0.547	0.546	95-00	WIID2C
El Salvador	2	0.529	0.533	0.531	95-00	WIID2C
Estonia	6	0.301	0.392	0.358	95-02,05.10	ATG (4); LIS (2)
Finland	11	0.224	0.298	0.261	70-02,05,10	WIID2C (9); LIS (1) ATG (1)
France	7	0.311	0.340	0.322	75-80,90-00,05,10	LIS (5); WIID2C (1); ATG (1)
Georgia	1	0.253	0.253	0.253	90	ATG
Germany	13	0.281	0.321	0.303	75-05,07,10	LIS (8); WIID2C (4); ATG (1)
Greece	6	0.327	0.365	0.339	95-00,05,10	LIS (3); ATG (1)
Guatemala	2	0.546	0.548	0.547	00,05	LIS (1); WIID2C (1)
Hungary	9	0.209	0.329	0.267	70-00, 05,10	LIS (4); WIID2C (4); ATG (1)
Iceland	1	0.285	0.285	0.285	10	ATG
India	1	0.524	0.524	0.524	05	LIS
Ireland	6	0.300	0.370	0.332	75,85,95-00,05,10	LIS (4); WIID2C (1); ATG (1)

Table D.1 - Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Israel	8	0.355	.428	.389	80-00,05,07, 10	LIS
Italy	7	0.313	0.371	0.346	85-00,05,10	LIS (5); ATG (1)
Kazakhstan	3	0.236	0.319	0.283	90-95,05	ATG (5)
Korea, South	1	0.326	0.326	0.326	05	LIS (1)
Kyrgyz Republic	2	0.226	0.428	0.327	90-95	ATG
Latvia	7	0.235	0.391	0.340	90-00,02-03,05,10	WIID2C (5); ATG (2)
Lesotho	1	0.631	0.631	0.631	85	WIID2C
Lithuania	8	0.302	0.357	0.330	90-03, 05, 10	WIID2C (6); ATG (2)
Luxembourg	6	0.268	0.310	0.286	85-00,05,10	LIS (5); ATG (1)
Macedonia	3	0.324	0.349	0.334	90-00	ATG (2); WIID2C (1)
Mexico	6	0.472	0.533	0.511	85-00,02,05	LIS
Moldova	8	0.385	0.464	0.428	95-06	WIID2C
Mongolia	1	0.325	0.325	0.325	00	ATG
Netherlands	6	0.266	0.308	0.291	85-00,05,10	LIS (5); ATG (1)
New Zealand	4	0.278	0.341	0.309	80-95	WIID2C (4)
Nicaragua	1	0.559	0.559	0.559	00	WIID2C
Norway	7	0.246	0.300	0.268	80-00,05,10	LIS (6); ATG (1)
Panama	3	0.488	0.547	0.523	80,90-95	WIID2C
Peru	3	0.483	0.543	0.507	95-00, 05	WIID2C (2); LIS (1)
Poland	7	0.258	0.354	0.312	75,85-00, 05,10	LIS (5); WIID2C (1); ATG (1)
Portugal	3	0.320	0.362	0.337	80,90,10	WIID2C (2); ATG (1)
Romania	5	0.313	0.375	0.339	95-00,02,05,10	ATG (4); LIS (1)
Russia	6	0.346	0.420	0.377	90-00,05, 07, 10	ATG (2); LIS (4)
Serbia	3	0.298	0.371	0.323	95-01	ATG
Slovak Rep	10	0.202	0.299	0.254	90-06,10	WIID2C (8); LIS (1); ATG (1)
Slovenia	11	0.231	0.265	0.246	90-05,07-08,10	WIID2C (7); LIS(3); ATG (1)
South Africa	1	0.698	0.698	0.698	10	LIS
Spain	8	0.317	0.364	0.338	75-80,90-00,05,10	LIS (5); WIID2C (1); ATG (1)
Sweden	9	0.228	0.298	0.254	70-00,05,10	LIS (8); ATG (1)
Switzerland	5	0.316	0.357	0.332	80,90,00,02,05	LIS
Taiwan	6	0.297	0.322	0.306	80-00,05	LIS
Turkey	2	0.470	0.470	0.470	85,95	WIID2C
Ukraine	2	0.214	0.314	0.264	90,95	ATG
United Kingdom	11	0.284	0.374	0.345	70-00,05,10	LIS (8); ATG (1)
United States	9	0.338	0.405	0.381	75-00,05,07,10	LIS
Venezuela	2	0.442	0.466	0.454	95,00	WIID2C

The figures indicated in column six are the last two digits of the year and represent the assigned base year rather than the actual year. Figures separated by a dash indicate that all years in the interval are available. For instance, 90-00 indicates that a Gini is available for 1990, 1995 and 2000 for that country. Numbers in parentheses in column seven represent the number of Gini coefficients from the specified database source for a given country when there is more than one source. LIS is Luxembourg Income Study, WIID2C is World Income Inequality Database version 2c, and ATG is Milanovic's All the Ginis database.

Table D.2: Summary Statistics & Sources, Gross Income Gini Coefficient Dataset

(1) Country	(2) # Ginis	(3) Min	(4) Max	(5) Mean	(6) Year(s)	(7) Source(s)
Albania	1	0.286	0.286	0.286	95	ATG (1)
Algeria	2	0.346	0.388	0.367	90-95	ATG (2)
Argentina	12	0.443	0.533	0.491	90, 00-10	SEDLAC (11); ATG (1)
Armenia	1	0.555	0.555	0.555	00	WIID2C (1)
Bangladesh	4	0.280	0.387	0.319	75, 85-95	WIID2C (2)
Barbados	1	0.393	0.393	0.393	95	ATG (1)
Belize	2	0.529	0.603	0.566	95-00	SEDLAC (2)
Bolivia	9	0.547	0.598	0.572	95-02,03-07, 10	SEDLAC (9)
Brazil	14	0.537	0.604	0.570	80-08, 10	SEDLAC (13); WIID2C (1)
Bulgaria	2	0.390	0.540	0.465	90-95	WIID2C (2)
Cameroon	1	0.610	0.610	0.610	95	WIID2C (1)
Central Afr. Rep.	1	0.595	0.595	0.595	95	ATG (1)
Chile	7	0.518	0.561	0.542	80-00,03, 05, 10	SEDLAC (7)
China	8	0.348	0.478	0.435	90-03, 05, 07	ATG (8)
Colombia	13	0.549	0.596	0.570	90-10	SEDLAC (12);WIID2C (1)
Costa Rica	13	0.440	0.502	0.480	90-10	SEDLAC (13)
Cyprus	2	0.297	0.305	0.301	90-95	ATG (2)
Czech Rep.	1	0.251	0.251	0.251	95	ATG (1)
Dominican Rep.	13	0.472	0.520	0.498	90-10	SEDLAC (12); ATG (1)
Ecuador	10	0.488	0.585	0.532	95-00, 03-10	SEDLAC (10); ATG (1)
Egypt	1	0.330	0.330	0.330	10	ATG (1)
El Salvador	13	0.455	0.527	0.492	90-10	SEDLAC (13);
Estonia	1	0.331	0.331	0.331	95	ATG (1)
Ethiopia	1	0.464	0.464	0.464	95	WIID2C (1)
Fiji	1	0.430	0.430	0.430	80	WIID2C (1)
Guatemala	6	0.532	0.582	0.558	90, 00, 02-05	SEDLAC (5); ATG (1)
Guinea-Bissau	1	0.545	0.545	0.545	90	ATG (1)
Guyana	3	0.432	0.519	0.480	90-00	SEDLAC (1); ATG (2)
Haiti	1	0.592	0.592	0.592	00	SEDLAC (1)
Honduras	13	0.541	0.594	0.569	90-10	SEDLAC (12); ATG (1)
Hong Kong	3	0.434	0.497	0.464	90-00	ATG (3)
Hungary	2	0.246	0.295	0.271	95-00	WIID2C (1); ATG (1)
Indonesia	3	0.386	0.396	0.391	85-95	WIID2C (3)
Iran	3	0.418	0.450	0.434	00, 05, 10	ATG (3)
Jamaica	5	0.559	0.676	0.606	95-02, 05	SEDLAC (4); ATG (1)
Japan	4	0.234	0.258	0.244	90-02	ATG (4)
Kazakhstan	2	0.295	0.352	0.323	95-00	ATG (2)
Korea	3	0.288	0.335	0.311	90-00	ATG (3)

Table D.2 - Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Latvia	2	0.279	0.315	0.297	95-00	ATG (2)
Madagascar	1	0.595	0.595	0.595	95	WIID2C (1)
Malaysia	3	0.461	0.485	0.477	85-95	WIID2C (3)
Mali	1	0.489	0.489	0.489	95	ATG (1)
Mauritania	1	0.380	0.380	0.380	95	ATG (1)
Mexico	9	0.475	0.543	0.510	90-00, 02, 04-06, 08, 10	SEDLAC (9)
Nepal	1	0.505	0.505	0.505	95	WIID2C (1)
New Zealand	3	0.353	0.404	0.380	85-95	WIID2C (3)
Nicaragua	4	0.501	0.563	0.522	90-00, 05	SEDLAC (3); ATG (1)
Panama	10	0.521	0.565	0.551	90-06, 10	SEDLAC (10)
Paraguay	11	0.507	0.579	0.544	95-00, 02-10	SEDLAC (11)
Peru	12	0.472	0.546	0.507	95-10	SEDLAC (12)
Philippines	2	0.468	0.491	0.479	90-95	WIID2C (2)
Poland	1	0.324	0.324	0.324	95	ATG (1)
Romania	2	0.304	0.321	0.313	95-00	ATG (2)
Russia	2	0.353	0.480	0.416	95-00	WIID2C (1); ATG (1)
Rwanda	1	0.259	0.259	0.259	85	ATG (1)
Senegal	2	0.519	0.527	0.523	90-95	ATG (2)
Serbia	1	0.298	0.298	0.298	00	ATG (1)
Singapore	2	0.417	0.425	0.421	90-95	ATG (2)
Slovak Rep	2	0.253	0.271	0.262	95, 05	ATG (2)
Slovenia	2	0.282	0.308	0.295	95-00	ATG (2)
South Africa	2	0.590	0.672	0.631	95, 10	WIID2C (1); ATG (1)
Sri Lanka	4	0.375	0.566	0.461	85-00	WIID2C (3); ATG (1)
Taiwan	4	0.290	0.317	0.298	85-00	ATG (4)
Tanzania	1	0.363	0.363	0.363	95	ATG (1)
Thailand	5	0.464	0.560	0.531	80-00	WIID2C (5)
Trinidad & Tob.	2	0.411	0.423	0.417	90-95	ATG (2)
Tunisia	1	0.398	0.398	0.398	05	ATG (1)
Uganda	2	0.484	0.536	0.510	90, 00	WIID2C (2)
Ukraine	1	0.233	0.233	0.233	90	WIID2C (1)
Uruguay	13	0.421	0.476	0.457	90-10	SEDLAC (13)
Venezuela	12	0.387	0.475	0.441	90-08, 10	SEDLAC (12)

The figures indicated in column six are the last two digits of the year and represent the assigned base year rather than the actual year. Figures separated by a dash indicate that all years in the interval are available. For instance, 90-00 indicates that a Gini is available for 1990, 1995 and 2000 for that country. Numbers in parentheses in column seven represent the number of Gini coefficients from the specified database source for a given country when there is more than one source. SEDLAC is Socio-Economic Database for Latin America and the Caribbean, WIID2C is World Income Inequality Database version 2c, ATG is Milanovic's All the Ginis database.

Table D.3: Summary Statistics & Sources, Consumption Gini Coefficient Dataset

(1) Country	(2) # Ginis	(3) Min	(4) Max	(5) Mean	(6) Year(s)	(7) Source(s)
Albania	4	0.286	0.317	0.30033225	95,00,05,10	ATG (4)
Angola	2	0.401916	0.581233	0.4915745	95.00	ATG (2)
Armenia	8	0.257	0.457	0.30727425	90-03,05,10	ATG (8)
Azerbaijan	1	0.312349	0.312349	0.312349	10	ATG (1)
Bangladesh	6	0.25851	0.40864	0.319897833	85-00,05,10	ATG (5); WIID2c (1)
Benin	1	0.362	0.362	0.362	05	ATG (1)
Bolivia	5	0.4442	0.596	0.5180544	90-00,02, 05	ATG (5)
Bosnia and Herzegovina	3	0.268	0.355634	0.308544667	00,05,07	ATG (3)
Bulgaria	1	0.294341	0.294341	0.294341	05	ATG (1)
Cameroon	4	0.389566	0.49	0.4380165	85,95-00,05	ATG (3); WIID2c (1)
Central Afr. Rep.	2	0.4331	0.562366	0.497733	05,10	ATG (2)
Chad	2	0.395	0.39514	0.39507	02,03	ATG (2)
Congo, Dem. R.	2	0.440535	0.4442	0.4423675	05,10	ATG (2)
Congo, Rep. Of	1	0.469044	0.469044	0.469044	05	ATG (1)
Cote d'Ivoire	5	0.360522	0.452	0.4068342	90-00,02,10	ATG (5)
Croatia	3	0.22146	0.333	0.285672	90,00,10	ATG (3)
Czech Rep.	1	0.281	0.281	0.281	00	ATG (1)
Egypt	5	0.317838	0.382203	0.3480082	75,95-00,04-05	ATG (4); WIID2c (1)
Estonia	4	0.34	0.366	0.3537	95-00,03,05	ATG (1) WIID2c (3)
Ethiopia	3	0.279	0.289398	0.284997333	95-00,05	ATG (2); WIID2c (3)
France	1	0.24	0.24	0.24	00	ATG (1)
Gabon	1	0.411	0.411	0.411	05	ATG (1)
Georgia	9	0.38	0.421	0.398228222	95-06,10	ATG (9)
Ghana	5	0.33	0.428	0.3862314	90-00,05-06	ATG (5)
Greece	3	0.319742	0.3537	0.333913	85,95-00	ATG (3)
Guinea-Bissau	2	0.353	0.382792	0.367896	00,05	ATG (2)
Haiti	2	0.509	0.515	0.512	85-90	WIID2c (2)
Hong Kong	1	0.495	0.495	0.495	00	ATG (1)
Hungary	3	0.2679	0.311	0.293033333	01, 03, 05	ATG (3)
India	10	0.2917	0.340655	0.3213668	70-00,04-05,07	ATG (7); WIID2c (3)
Indonesia	7	0.307	0.390135	0.345933429	85-00,02.05.10	ATG (5); WIID2c (2)
Iran	3	0.420755	0.43	0.424015333	90-00	ATG (3)
Israel	1	0.389	0.389	0.389	00	ATG (1)
Jamaica	4	0.369287	0.45508	0.3997225	90-00, 05	WIID2c (4)

Table D.3 - Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Jordan	5	0.293837	0.386	0.3459756	85-00, 10	ATG (5)
Kazakhstan	5	0.267433	0.377	0.318529	95-00,05,10	ATG (5)
Kenya	4	0.298945	0.57242	0.44662375	90-95,05,07	ATG (4)
Kyrgyz Republic	6	0.186359	0.42797	0.313907333	90-00,02,05,10	ATG (6)
Latvia	3	0.331	0.364	0.348333333	00,03,05	ATG (3)
Lesotho	3	0.520435	0.6625	0.597628333	85,95-00	ATG (3)
Lithuania	5	0.197547	0.368422	0.29801	90-00,02,05	ATG (5)
Macedonia	6	0.282	0.412	0.364717667	95-00,02-03,05,10	ATG (6)
Madagascar	6	0.3792	0.696796	0.47984	80,95-01,05,10	ATG (6)
Malawi	3	0.386021	0.495107	0.423709333	95,04-05	ATG (3)
Malaysia	1	0.479	0.479	0.479	00	ATG (1)
Mali	4	0.330384	0.389	0.3677315	90,00,05,10	ATG (3); WIID2c (1)
Mauritania	3	0.378	0.4045	0.3905	95-00, 10	ATG (2); WIID2c (1)
Moldova	8	0.200297	0.421	0.344844125	90-03,05,10	ATG (8)
Mongolia	4	0.3227	0.358217	0.33373925	00,05-07	ATG (4)
Montenegro	2	0.290707	0.318634	0.3046705	05,10	ATG (2)
Morocco	4	0.3185	0.403	0.3771155	90,00-01,05	ATG (4)
Mozambique	3	0.412925	0.464	0.444236	00,05-06	ATG (3)
Nepal	3	0.3284	0.432	0.388612333	95,05,10	ATG (2); WIID2c (1)
Niger	3	0.373044	0.5023	0.436448	95,05,07	ATG (3)
Nigeria	6	0.374314	0.5107	0.437056833	85-95,03,05,10	ATG (6)
Pakistan	5	0.2717	0.325276	0.2991534	90-00,05,10	ATG (5)
Pap. New Guinea	1	0.326125	0.326125	0.326125	95	ATG (1)
Philippines	5	0.4104	0.480572	0.4437944	85-00,05	ATG (1); WIID2c (4)
Poland	4	0.335	0.354	0.34575	00,03-05	ATG (4)
Romania	4	0.294	0.321	0.30675	95-00,03,05	ATG (4)
Russia	5	0.367	0.416691	0.3865712	00-02,05,10	ATG (5)
Senegal	2	0.389424	0.463	0.426212	00,05	ATG (2)
Serbia	6	0.274	0.304	0.292374	00, 03-06,10	ATG (6)
Sierra Leone	2	0.381	0.421667	0.4013335	03,05	ATG (2)
Slovenia	4	0.244	0.304	0.28325	00,02-03,05	ATG (4)
South Africa	2	0.573	0.62	0.5965	95-00	ATG (2)
Spain	2	0.317797	0.3207	0.3192485	90,00	ATG (2)
Sri Lanka	5	0.295	0.4025	0.3515942	85-90,00,02,05	ATG (4); WIID2c (1)
Syria	2	0.357762	0.37	0.363881	03,05	ATG (2)
Tanzania	2	0.344	0.375857	0.3599285	00,05	ATG (2)
Thailand	8	0.393	0.485777	0.429507375	80-00,02,04-05	ATG (3);

Table D.3 - Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)
						WIID2c (5)
Togo	1	0.342209	0.342209	0.342209	05	ATG (1)
Tunisia	3	0.325246	0.407	0.363833	85-95	ATG (3)
Turkey	3	0.401	0.447947	0.422458	95-00,05	ATG (3)
Uganda	5	0.371	0.436	0.4175902	90-00,05,10	ATG (5)
Ukraine	10	0.201041	0.428	0.2921181	90-06,10	ATG (10)
Vietnam	5	0.328079	0.388044	0.3603408	95-00,02,04-05	ATG (5)
Zambia	5	0.416	0.615313	0.5155246	90-00,02,05	ATG (5)
Zimbabwe	2	0.4695	0.514966	0.492233	90-95	ATG (2)

The figures indicated in column six are the last two digits of the year and represent the assigned base year rather than the actual year. Figures separated by a dash indicate that all years in the interval are available. For instance, 90-00 indicates that a Gini is available for 1990, 1995 and 2000 for that country. Numbers in parentheses in column seven represent the number of Gini coefficients from the specified database source for a given country when there is more than one source. WIID2C is World Income Inequality Database version 2c, and ATG is Milanovic's All the Ginis database.

APPENDIX E

APPENDICES TO CHAPTER FOUR

Table E.1: Summary Statistics, Variable Description & Sources – Chapter Four

Variable	N	Mean	SD	Min	Max	Description	Source(s)
SWIID Net Gini	926	38.61	11.11	15.88	73.74	SWIID Net income Gini. Each country-year observation assigned to nearest quinquennial period spanning 1970-2010. For instance, observations occurring from 1968 to 1972 assigned to 1970, and those occurring from 1973 to 1977 assigned to 1975. If multiple Gini observations assigned to same quinquennial period, then arithmetic average is taken.	Solt, Frederick. 2009. "Standardizing the World Income Inequality Database." *Social Science Quarterly* 90(2): 231-242. SWIID Version 4.0, September 2013. Data obtained from: <http://myweb.uiowa.edu/fsolt/swiid/swiid.html>
SWIID Gross Gini	926	43.67	9.30	18.14	76.24	SWIID Gross income Gini. Each country-year observation assigned to nearest quinquennial period spanning 1970-2010. For instance, observations occurring from 1968 to 1972 assigned to 1970, and those occurring from 1973 to 1977 assigned to 1975. If multiple Gini observations assigned to same quinquennial period, then arithmetic average is taken.	Solt, Frederick. 2009. "Standardizing the World Income Inequality Database." *Social Science Quarterly* 90(2): 231-242. SWIID Version 4.0, September 2013. Data obtained from: http://myweb.uiowa.edu/fsolt/swiid/swiid.html
UTIP Gross Gini	718	41.31	6.91	21.81	64.25	Gross household income Gini coefficient. Estimated using data on manufacturing pay inequality, Gini coefficients from various sources, and other variables.	Galbraith and Kum (2005). University of Texas Inequality Project. Data obtained from: http://utip.gov.utexas.edu/data.html
Chpt. 3 Net Gini	270	34.12	9.35	17.52	69.77	Net income Gini coefficient.	See chapter 3 and appendix Table D.1
Chpt. 3 Gross Gini	189	46.11	10.34	23.30	67.59	Gross income Gini coefficient.	See chapter 3 and appendix Table D.2
Chpt. 3 Consumption Gini	234	37.84	8.50	18.64	69.68	Consumption Gini coefficient.	See chapter 3 and appendix Table D.3
90/10 Ratio	572	19.78	18.85	3.45	150.06	Ratio of income held by top 10 percent to bottom 10 percent of the income distribution.	World Income Inequality Database version 2C; World Bank (2013) World Development Indicators

Table E.1 - Continued

Variable	N	Mean	SD	Min	Max	Description	Source(s)
80/20 Ratio	572	9.97	7.30	2.67	59.29	Ratio of income held by top 20 percent to bottom 20 percent of the income distribution.	World Income Inequality Database version 2C; World Bank (2013) World Development Indicators
EFW	939	6.06	1.34	1.78	9.14	Chain-linked economic freedom composite index. Comprised of 5 area ratings, each of which is on a 0-10 scale that is increasing in EFW. Index represents an average of each area.	Gwartney, Hall, and Lawson (2013) Annual Economic Freedom of the World Report. Vancouver: Frasier Institute. Data Obtained from: www.freetheworld.com
EF1	1015	5.70	1.68	0.94	10.00	Chain-linked economic freedom area 1 – size of government. Higher scores reflect smaller government. 0-10 scale.	Gwartney, Hall, and Lawson (2013) Annual Economic Freedom of the World Report. Vancouver: Frasier Institute. Data Obtained from www.freetheworld.com
EF2	893	5.57	2.01	1.14	9.62	Chain-linked economic freedom area 2 – legal institutions and property rights. Higher scores reflect greater protection of private property rights and private contract enforcement. 0-10 scale.	Gwartney, Hall, and Lawson (2013) Annual Economic Freedom of the World Report. Vancouver: Frasier Institute. Data Obtained from www.freetheworld.com
EF3	1059	6.83	2.31	0.00	10.00	Chain-linked economic freedom area 3 – sound money. Higher scores reflect lower inflation and inflation volatility. 0-10 scale.	Gwartney, Hall, and Lawson (2013) Annual Economic Freedom of the World Report. Vancouver: Frasier Institute. Data Obtained from www.freetheworld.com
EF4	930	5.94	2.35	0.00	10.00	Chain-linked economic freedom area 4 – freedom to trade internationally. Higher scores reflect more freedom to trade. 0-10 scale.	Gwartney, Hall, and Lawson (2013) Annual Economic Freedom of the World Report. Vancouver: Frasier Institute. Data Obtained from www.freetheworld.com
EF5	931	5.98	1.36	1.08	8.99	Chain-linked economic freedom area 5 – freedom from regulation internationally. Higher scores reflect less regulation of business, credit, and labor markets. 0-10 scale.	Gwartney, Hall, and Lawson (2013) Annual Economic Freedom of the World Report. Vancouver: Frasier Institute. Data Obtained from www.freetheworld.com
RGDPL	1186	10,050.84	12,353.37	179.99	136,311.00	Real GDP per capita in constant 2005 PPP-adjusted dollars.	Heston, Summers and Aten (2012) Penn World Table Version 7.1
LRGDPL	1186	8.45	1.34	5.19	11.82	Log of Real GDP per capita in constant 2005 PPP-adjusted dollars.	Heston, Summers and Aten (2012) Penn World Table Version 7.1

Table E.1 - Continued

Variable	N	Mean	SD	Min	Max	Description	Source(s)
GROWTH	1043	9.06	16.77	-82.83	100.58	5-Year Growth Rate of Real GDP per capita	Heston, Summers and Aten (2012) Penn World Table Version 7.1
POLRIGHTS	1206	5.47	3.61	0.00	10.00	Measures the degree to which political rights and liberties are respected. Comprised of three main areas: electoral process, political pluralism and participation, and functioning of government. Original data range from 1-7, with higher scores representing less freedom. Rescaled to 0-10 measure that is increasing in freedom.	Freedom House (2013)
CIVLIB	1206	5.50	3.09	0.00	10.00	Measures the degree to which civil liberties are respected. Comprised of four main areas: freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. Original data range from 1-7, with higher scores representing less freedom. Rescaled to 0-10 measure that is increasing in freedom..	Freedom House (2013)
AYS25	1217	6.01	3.16	0.03	13.27	Average years of schooling for the adult population (above age 25)	Barro and Lee (2013) Data obtained from: http://www.barrolee.com/data/dataexp.htm
HUMCAP	1143	5.55	5.55	0.00	31.95	Share of the adult population (above age 25) with a completed tertiary education.	Barro and Lee (2013) Data obtained from: http://www.barrolee.com/data/dataexp.htm
UNDER15	1292	33.43	10.58	12.14	49.97	Share of population under the age 15.	World Bank (2013); Taiwan Statistical Data Book 2012
OVER65	1292	6.84	4.57	0.33	23.67	Share of population above the age 65.	World Bank (2013); Taiwan Statistical Data Book 2012
DEP2LABOR	1292	0.69	0.20	0.17	1.13	Dependency-to-labor force ratio. Ratio of (1) sum of shares of population below age 15 and above age 64 to (2) share of population between ages 15-64.	World Bank (2013); Taiwan Statistical Data Book 2012
URBAN	1283	51.42	24.25	2.38	100.00	Share of population residing in an urban location.	World Bank (2013); Taiwan Statistical Data Book 2012

Table E.1 - Continued

Variable	N	Mean	SD	Min	Max	Description	Source(s)
INDUSTRY	649	23.82	8.58	2.10	56.25	Share of labor force employed in industrial sectors of economy (mining, quarrying, manufacturing, construction, public utilities). Data available annually over period 1980-2013. Not all country-year observations available, so assigned each available observation to nearest period ending in zero or five. For instance, if actual year of observation between 1968 and 1972, then assigned to 1970. If between 1973 and 1977, then assigned to 1975. If multiple observations assigned to the same year, then the average of these values is used. For instance, literacy rates available for Brazil for 2007, 2008 and 2009. The value assigned to 2010 is the arithmetic average of these three years.	World Bank (2013); Taiwan Statistical Data Book 2012
SERVICE	649	53.77	16.85	5.59	87.20	Share of labor force employed in professional service sector of economy (wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services). Data available annually over period 1980-2013. Not all country-year observations available, so assigned each available observation to nearest period ending in zero or five. See INDUSTRY for additional information on assignment criteria.	World Bank (2013); Taiwan Statistical Data Book 2012
KDOT	186	11.49	1.58	6.91	15.38	5-Year Growth Rate of Per Capita Capital Stock	Heston, Summers and Aten (2012) Penn World Table Version 7.1
LKL	1043	0.11	0.41	-1.87	1.63	Log of Real Per Capita Capital Stock (raw data in constant 2005 PPP-adjusted dollars)	Heston, Summers and Aten (2012) Penn World Table Version 7.1
GDOT	1186	10.61	1.29	5.71	14.00	5-Year Growth Rate of Per Capita Government Consumption	Heston, Summers and Aten (2012) Penn World Table Version 7.1
LGL	1043	0.10	0.27	-1.63	1.54	Log of Real Per Capita Government Consumption (raw data in constant 2005 PPP-adjusted dollars)	Heston, Summers and Aten (2012) Penn World Table Version 7.1

Table E.2: Economic Freedom-Inequality Pairwise Correlations, by Year

	Measure of inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A: t = 2010							
EFW	-0.30	-0.02		-0.29	0.27	-0.28	0.14	0.12
EF1	0.51	0.11		0.27	-0.02	-0.20	0.09	0.02
EF2	-0.57	-0.17		-0.30	0.23	-0.26	-0.14	-0.12
EF3	-0.36	-0.01		-0.44	0.24	0.02	0.23	0.25
EF4	-0.27	0.03		-0.26	0.29	-0.16	0.28	0.23
EF5	-0.16	0.02		-0.15	0.37	-0.35	-0.07	-0.04
N	91	91		32	19	16	51-52	52
	Panel A: t = 2005							
EFW	-0.29	0.04	-0.61	-0.43	-0.05	-0.18	0.01	0.01
EF1	0.40	0.21	0.06	0.41	0.29	0.19	0.18	0.22
EF2	-0.47	-0.09	-0.49	-0.63	-0.48	-0.39	-0.28	-0.25
EF3	-0.36	-0.06	-0.65	-0.46	0.04	-0.15	0.07	0.03
EF4	-0.25	0.06	-0.53	-0.43	0.02	-0.09	0.14	0.10
EF5	-0.16	0.08	-0.54	-0.36	-0.01	-0.14	-0.03	-0.01
N	112-113	112-113	33	39	23	45	76-77	76-77
	Panel A: t = 2000							
EFW	-0.25	-0.05	-0.51	-0.21	-0.10	0.24	-0.01	-0.02
EF1	0.51	0.26	0.44	0.75	0.50	0.46	0.46	0.52
EF2	-0.54	-0.26	-0.57	-0.72	-0.63	-0.16	-0.44	-0.48
EF3	-0.21	-0.06	-0.49	-0.15	0.02	0.15	0.05	0.03
EF4	-0.34	-0.09	-0.54	-0.37	-0.24	0.07	-0.03	-0.07
EF5	-0.08	0.09	-0.38	-0.21	-0.09	0.08	0.02	0.01
N	109-110	109-110	88	42	38	43	86-87	86-87
	Panel A: t = 1995							
EFW	-0.25	-0.08	-0.24	-0.02	0.07	-0.10	-0.02	-0.05
EF1	0.52	0.31	0.51	0.73	0.50	-0.04	0.35	0.35
EF2	-0.53	-0.29	-0.55	-0.56	-0.42	-0.24	-0.26	-0.25
EF3	-0.27	-0.11	-0.19	-0.08	0.01	-0.12	-0.08	-0.12
EF4	-0.40	-0.15	-0.39	-0.36	-0.09	0.00	-0.11	-0.17
EF5	-0.05	0.03	-0.11	0.09	0.18	0.13	0.09	0.08
N	105-110	105-110	98-102	43-44	51-54	32-33	89-92	89-92
	Panel A: t = 1990							
EFW	-0.41	-0.20	-0.33	-0.23	-0.28	-0.28	-0.27	-0.33
EF1	0.35	0.28	0.47	0.57	0.13	-0.26	0.17	0.21
EF2	-0.62	-0.40	-0.53	-0.67	-0.40	-0.04	-0.35	-0.34
EF3	-0.30	-0.14	-0.26	-0.11	-0.22	0.10	-0.24	-0.33
EF4	-0.36	-0.12	-0.39	-0.35	-0.08	-0.09	-0.17	-0.24
EF5	-0.13	0.00	0.11	0.03	-0.16	-0.13	-0.04	-0.08
N	93-105	93-105	88-93	27-32	32-35	22-26	73-82	73-82
	Panel A: t = 1985							
EFW	-0.40	-0.31	-0.39	-0.31			-0.31	-0.33
EF1	0.41	0.33	0.35	0.50			0.39	0.42
EF2	-0.63	-0.51	-0.56	-0.64			-0.38	-0.42
EF3	-0.37	-0.33	-0.36	-0.45			-0.23	-0.25
EF4	-0.41	-0.27	-0.41	-0.31			-0.40	-0.41
EF5	-0.06	0.02	-0.05	-0.08			-0.13	-0.14
N	78-82	78-82	87-97	24			49-51	49-51
	Panel A: t = 1980							
EFW	-0.40	-0.37	-0.48				-0.20	-0.22
EF1	0.31	0.22	0.28				0.27	0.28
EF2	-0.54	-0.50	-0.66				-0.32	-0.33
EF3	-0.44	-0.42	-0.35				-0.31	-0.34
EF4	-0.42	-0.35	-0.52				-0.27	-0.27

Table E.2 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EF5	0.02	0.10	-0.06				-0.06	-0.08
N	58-70	58-70	73-88				49-57	49-57
Panel A: t = 1975								
EFW	-0.30	-0.20	-0.45					
EF1	0.08	0.00	0.30					
EF2	-0.40	-0.28	-0.59					
EF3	-0.41	-0.34	-0.34					
EF4	-0.31	-0.21	-0.55					
EF5	-0.11	-0.01	-0.18					
N	41-61	41-61	59-84					
Panel A: t = 1970								
EFW	-0.57	-0.43	-0.45					
EF1	0.18	0.11	0.38					
EF2	-0.65	-0.53	-0.59					
EF3	-0.32	-0.30	-0.17					
EF4	-0.47	-0.26	-0.50					
EF5	-0.21	-0.07	-0.40					
N	30-63	30-63	36-80					
Panel J: Mean Correlations, All Periods								
EFW	0.35	-0.18	-0.43	-0.25	-0.02	-0.12	-0.09	-0.12
EF1	0.36	0.20	0.35	0.54	0.28	0.03	0.27	0.29
EF2	-0.55	-0.34	-0.57	-0.59	-0.34	-0.22	-0.31	-0.31
EF3	-0.34	-0.20	-0.35	-0.28	0.02	0.00	-0.07	-0.10
EF4	-0.36	-0.15	-0.48	-0.35	-0.02	-0.05	-0.08	-0.12
EF5	-0.11	0.03	-0.20	-0.11	0.06	-0.08	-0.03	-0.04
Panel K: Share Moderate Correlations, $0.3 \leq \lvert\rho\rvert < 0.5$								
EFW	0.44	0.33	0.63	0.33	0.00	0.00	0.14	0.29
EF1	0.44	0.22	0.63	0.17	0.00	0.20	0.43	0.29
EF2	0.22	0.22	0.13	0.17	0.60	0.20	0.57	0.57
EF3	0.78	0.33	0.50	0.50	0.00	0.00	0.14	0.29
EF4	0.78	0.11	0.38	0.83	0.00	0.00	0.14	0.14
EF5	0.00	0.00	0.25	0.17	0.20	0.20	0.00	0.00
Panel L: Strong Correlations, $\lvert\rho\rvert \geq 0.5$								
EFW	0.11	0.00	0.25	0.00	0.00	0.00	0.00	0.00
EF1	0.33	0.00	0.13	0.67	0.40	0.00	0.00	0.14
EF2	0.78	0.22	0.88	0.83	0.20	0.00	0.00	0.00
EF3	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
EF4	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.00
EF5	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
Panel M: Share Negative Correlations, $\rho < 0$								
EFW	1.00	0.89	1.00	1.00	0.60	0.80	0.71	0.71
EF1	0.00	0.00	0.00	0.00	0.20	0.60	0.00	0.00
EF2	1.00	1.00	1.00	1.00	0.80	1.00	1.00	1.00
EF3	1.00	1.00	1.00	1.00	0.20	0.40	0.57	0.57
EF4	1.00	0.78	1.00	1.00	0.60	0.60	0.71	0.71
EF5	0.89	0.33	0.88	0.67	0.60	0.60	0.71	0.71
Panel N: Share Negative & Moderate or Stronger Correlations, $\rho \leq -0.3$								
EFW	0.56	0.33	0.88	0.33	0.00	0.00	0.14	0.29
EF1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EF2	1.00	0.44	1.00	1.00	0.80	0.20	0.57	0.57
EF3	0.78	0.33	0.63	0.50	0.00	0.00	0.14	0.29
EF4	0.78	0.11	1.00	0.83	0.00	0.00	0.14	0.14
EF5	0.00	0.00	0.38	0.17	0.00	0.20	0.00	0.00

Table E.2 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel O: Share Positive & Moderate or Stronger Correlations, $\rho \geq -0.3$							
EFW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EF1	0.78	0.22	0.75	0.83	0.40	0.20	0.43	0.43
EF2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EF3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EF4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EF5	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00

Contemporaneous simple pairwise correlations reported. Omitted if less than 20 observations.

Table E.3: Additional OLS Regressions – Berggren Specification

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A: t = 2010							
EFW	-3.398**	-0.198		-6.199		5.121	1.909	-6.199
ΔEFW	1.580	0.364		-1.276		-7.730**	-3.006**	-1.276
Short-Run	-1.82	0.17		-7.48		-2.61	-1.10	-7.48
EF1	3.562***	0.608		3.123**		2.558	0.729	3.123**
ΔEF1	-1.790***	-0.451		-2.357		-3.368**	-1.604**	-2.357
Short-Run	1.77	0.16		0.77		-0.81	-0.88	0.77
EF2	-2.788***	-0.591*		-1.874**		-2.139	-0.954	-1.874**
ΔEF2	1.767**	0.276		0.288		2.087	1.556	0.288
Short-Run	-1.02	-0.31		-1.59		-0.05	0.60	-1.59
EF3	-2.621***	-0.098		-8.147		3.424*	1.551**	-8.147
ΔEF3	0.229	0.137		0.062		-1.089	-0.413	0.062
Short-Run	-2.39	0.04		-8.08		2.34	1.14	-8.08
EF4	-2.099*	0.179		-3.187		4.178**	1.362**	-3.187
ΔEF4	2.520**	0.402		0.543		-6.407**	-2.900**	0.543
Short-Run	0.42	0.58		-2.64		-2.23	-1.54	-2.64
EF5	-1.934**	0.140		-1.497		0.857	0.591	-1.497
ΔEF5	1.402	-0.117		-1.897		-7.597***	-3.214**	-1.897
Short-Run	-0.53	0.02		-3.39		-6.74	-2.62	-3.39
N	90-91	90-91		32		51-52	51-52	32
	Panel B: t = 2005							
EFW	-3.147***	0.042	-3.867***	-7.363***		-0.891	1.052	0.423
ΔEFW	-2.264**	-1.562*	-1.386	-3.044*		-2.994**	-7.074***	-2.642***
Short-Run	-5.41	-1.52	-5.25	-10.41		-3.88	-6.02	-2.22
EF1	3.302***	1.269***	0.424	3.079***		2.013***	3.184***	1.363***
ΔEF1	-3.124***	-1.232**	-0.583	-3.363***		-2.637***	-5.800***	-2.169***
Short-Run	0.18	0.04	-0.16	-0.28		-0.62	-2.62	-0.81
EF2	-2.372***	-0.314	-1.736**	-3.234***		-2.258***	-2.859***	-1.030**
ΔEF2	0.971	-0.012	1.477	3.066		0.063	-0.875	-0.046
Short-Run	-1.40	-0.33	-0.26	-0.17		-2.20	-3.73	-1.08
EF3	-2.325***	-0.276	-3.175***	-5.723***		-0.390	1.115	0.236
ΔEF3	0.087	-0.212	-0.400	-0.384		-0.643	-0.720	-0.273
Short-Run	-2.41	-0.49	-3.57	-6.11		-1.03	0.39	-0.04
EF4	-1.923**	0.082	-1.916***	-4.568**		-0.802	1.326	0.295
ΔEF4	0.893	-0.275	2.468***	1.719		0.286	-1.851*	-0.687*
Short-Run	-1.03	-0.19	0.55	-2.85		-0.52	-0.52	-0.39
EF5	-1.219*	0.700***	-3.072***	-5.254**		-0.149	1.708	0.856
ΔEF5	-2.572***	-1.722**	0.169	-3.051*		-2.230*	-6.579***	-2.752***
Short-Run	-3.79	-1.02	-2.90	-8.30		-2.38	-4.87	-1.90
N	106-113	105-113	32-33	39		40-45	71-77	71-77
	Panel C: t = 2000							
EFW	-3.086***	-0.661	-3.331***	-2.172	-1.912	2.752*	-1.089	-0.515
ΔEFW	1.113	-0.090	1.444**	3.854**	2.021*	0.374	5.303**	2.089***
Short-Run	-1.97	-0.75	-1.89	1.68	0.11	3.13	4.21	1.57

Table E.3 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EF1	3.627***	1.398***	1.630***	4.442***	3.284***	2.221***	7.258***	2.660***
ΔEF1	-1.602	-1.187	0.214	-0.555	-1.460	-1.328*	-3.234	-1.071*
Short-Run	2.03	0.21	1.84	3.89	1.82	0.89	4.02	1.59
EF2	-3.567***	-1.319***	-2.243***	-4.256***	-5.245***	-1.148	-6.362***	-2.247***
ΔEF2	1.919***	0.842	1.543***	2.674***	1.562**	1.631*	2.433	0.925*
Short-Run	-1.65	-0.48	-0.70	-1.58	-3.68	0.48	-3.93	-1.32
EF3	-1.462***	-0.313	-1.809***	-1.689**	-0.659	0.531	-0.194	-0.191
ΔEF3	0.644	0.157	0.443	2.134***	0.870	0.251	1.988**	0.798***
Short-Run	-0.82	0.16	-1.37	0.44	0.21	0.78	1.79	0.61
EF4	-2.456***	-0.633	-1.925***	-5.310**	-2.872*	0.788	-0.446	-0.357
ΔEF4	0.423	-0.539	0.984***	0.451	0.530	-0.622	2.563**	0.876*
Short-Run	-2.03	-1.17	-0.94	-4.86	-2.34	0.17	2.12	0.52
EF5	-1.041*	0.491	-2.320***	-3.140*	-0.904	0.686	0.142	-0.093
ΔEF5	-0.397	0.104	0.162	0.119	-2.101	-2.286**	-0.885	-0.192
Short-Run	–1.44	0.59	-2.16	-3.02	-3.01	-1.60	-0.74	-0.28
N	95-108	95-108	79-87	35-40	33-37	34-41	41-85	74-85
				Panel D: t = 1995				
EFW	-3.664***	-1.339**	-2.183***	-3.008**	-0.940	-1.084	-1.997	-1.029*
ΔEFW	2.255***	1.042	1.324*	5.027***	1.967*	0.246	4.491**	1.745***
Short-Run	-1.41	-0.3 0	-0.86	2.02	1.03	-0.84	2.49	0.72
EF1	2.756***	0.914	2.198***	5.065***	3.075***	0.275	3.230	1.091
ΔEF1	0.718	0.718	-0.730	-1.834*	-1.192	-0.654	1.150	0.734
Short-Run	3.47	1.63	1.47	3.23	1.88	-0.38	4.38	1.83
EF2	-3.893***	-1.711***	-2.485***	-4.595***	-3.510***	-2.295	-3.940***	-1.577***
ΔEF2	1.770***	0.893	0.764*	3.106***	1.775*	0.700	3.190**	1.216**
Short-Run	-2.12	-0.82	-1.72	-1.49	-1.73	-1.60	-0.75	-0.36
EF3	-1.903***	-0.775**	-1.013***	-2.118***	-1.151*	-0.939	-1.828	-0.904**
ΔEF3	0.663	0.397	0.387	1.685***	1.333***	0.602	1.439	0.666*
Short-Run	-1.24	-0.38	-0.63	-0.43	0.18	-0.34	-0.39	-0.24
EF4	-2.376***	-0.637	-1.450***	-4.978***	-0.394	0.590	-0.774	-0.493*
ΔEF4	1.077**	0.274	1.014***	1.012	0.482	-0.120	2.521**	0.907**
Short-Run	-1.30	-0.36	-0.44	-3.97	0.09	0.47	1.75	0.41
EF5	-1.548*	-0.735	-1.094**	0.705	0.495	0.811	0.163	-0.073
ΔEF5	1.666	1.468*	0.096	3.073*	0.857	0.151	2.089	1.044*
Short-Run	0.12	0.73	-1.00	3.78	1.35	0.96	2.25	0.97
N	92-103	92-103	89-96	35-38	44-50	27-31	77-86	77-86
				Panel E: t = 1990				
EFW	-3.270**	-1.541***	-2.462***	-3.191*	-1.138		-3.064**	-1.609***
ΔEFW	-3.533***	-1.523	0.121	-0.634	-1.881		-8.077*	-4.326*
Short-Run	-6.80	-3.06	-2.34	-3.82	-3.02		-11.14	-5.93
EF1	2.412***	1.275**	2.053***	2.842**	2.032		2.979*	1.545*
ΔEF1	-0.134	0.348	-0.317	1.273	-0.124		-0.329	-0.662
Short-Run	2.28	1.62	1.74	4.11	1.91		2.65	0.88
EF2	-3.047***	-1.642***	-1.889***	-4.276***	-1.657*		-3.103**	-1.198***
ΔEF2	-1.963	-0.511	0.635	-3.571*	2.470*		-2.650	-1.057
Short-Run	-4.01	-1.13	-1.25	-7.85	0.81		-5.75	-2.25
EF3	-1.860***	-0.999***	-1.525***	-2.059**	-1.068*		-2.487**	-1.243***
ΔEF3	-0.022	0.048	0.888**	1.049	-0.352		-1.391	-0.805
Short-Run	-1.88	-0.95	-0.64	-1.01	-1.42		-3.88	-2.05
EF4	-1.939***	-0.692*	-1.343***	-2.615**	-0.391		-2.014**	-1.144**
ΔEF4	0.588	0.569	0.288	1.154	0.712		2.141	1.070
Short-Run	-1.35	-0.12	-1.06	-1.46	0.32		0.13	-0.07
EF5	-0.463	0.216	0.201	-0.043	0.464		2.222	0.550
ΔEF5	-4.787**	-2.752	-0.984	-1.504	-8.294***		-16.430***	-6.976***
Short-Run	-5.25	-2.54	-0.78	-1.55	-7.83		-14.21	-6.43
N	79-98	79-98	72-90	24-27	29-34		64-75	64-75
				Panel F: t = 1985				
EFW	-2.950***	-1.907***	-2.783***			-1.874	-0.922	-2.950***
ΔEFW	-4.775**	-3.845**	0.365			-5.078	-2.270	-4.775**
Short-Run	-7.73	-5.75	-2.42			-6.95	-3.19	-7.73
EF1	2.928***	1.951***	1.569**			3.921***	1.863***	2.928***
ΔEF1	0.716	0.449	0.054			-2.401	-1.045	0.716
Short-Run	3.64	2.40	1.62			1.52	0.82	3.64

Table E.3 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EF2	-4.060***	-2.774***	-2.195***			-1.830**	-0.957***	-4.060***
ΔEF2	-0.652	-0.531	0.938*			0.074	0.016	-0.652
Short-Run	-4.71	-3.31	-1.26			-1.76	-0.94	-4.71
EF3	-2.083***	-1.388***	-1.368***			-1.494	-0.690*	-2.083***
ΔEF3	0.684	0.106	0.998***			0.901	0.386	0.684
Short-Run	-1.40	-1.28	-0.37			-0.59	-0.30	-1.40
EF4	-1.915***	-1.169***	-1.606***			-1.767**	-0.805***	-1.915***
ΔEF4	-1.175***	-0.782*	0.892***			-1.246	-0.595*	-1.175***
Short-Run	-3.09	-1.95	-0.71			-3.01	-1.40	-3.09
EF5	0.202	0.708	-0.528			0.474	0.087	0.202
ΔEF5	-5.597**	-5.028***	-1.189			-9.166*	-3.968*	-5.597**
Short-Run	-5.39	-4.32	-1.72			-8.69	-3.88	-5.39
N	48-80	48-80	48-96			39-51	39-51	48-80
				Panel G: t = 1980				
EFW	-4.750***	-3.875***	-2.959***				-4.237**	-2.030**
ΔEFW	2.279	0.635	0.878				-3.172	-1.773
Short-Run	-2.47	-3.24	-2.08				-7.41	-3.80
EF1	1.955*	0.937	0.601				2.713*	1.356*
ΔEF1	-2.222	-1.844	-0.373				-1.104	-0.383
Short-Run	-0.27	-0.91	0.23				1.61	0.97
EF2	-3.614***	-2.968***	-2.045***				-3.132*	-1.566**
ΔEF2	3.090***	1.836**	1.160***				2.430	1.201
Short-Run	-0.52	-1.13	-0.89				-0.70	-0.36
EF3	-2.857***	-2.516***	-1.046***				-2.727**	-1.311**
ΔEF3	1.056	1.139*	-0.134				1.829	0.675
Short-Run	-1.80	-1.38	-1.18				-0.90	-0.64
EF4	-2.580***	-1.945***	-1.652***				-2.513**	-1.130**
ΔEF4	0.779	0.471	0.513**				-0.244	-0.148
Short-Run	-1.80	-1.47	-1.14				-2.76	-1.28
EF5	-1.186	-0.158	-1.912**				-0.516	-0.390
ΔEF5	3.363	0.512	3.926**				-4.319	-2.033
Short-Run	2.18	0.35	2.01				-4.84	-2.42
N	40-73	40-71	39-85				30-57	30-57
				Panel H: Fixed Effects Specification				
EFW	0.023	0.392	1.257***	1.759***	-0.283	1.522***	-1.246	-0.573
ΔEFW	(0.35)	(0.42)	(0.32)	(0.32)	(0.38)	(0.49)	(1.01)	(0.39)
R^2	-0.413	-0.581**	-0.128	-0.473	1.104***	-1.804***	0.201	-0.229
N	(0.28)	(0.29)	(0.28)	(0.33)	(0.25)	(0.48)	(0.88)	(0.36)
Countries	-0.39	-0.19	1.13	1.29	0.82	-0.28	-1.04	-0.80
Short-Run	0.00	0.01	0.11	0.24	0.11	0.08	0.00	0.02
EF1	601	601	404	203	164	159	434	434
ΔEF1	117	117	104	55	55	60	110	110
R^2	0.049	0.081	1.505***	1.123***	-0.005	0.874*	-1.534	-0.495
N	(0.45)	(0.49)	(0.36)	(0.34)	(0.40)	(0.47)	(1.00)	(0.35)
Countries	-0.026	0.104	-0.391**	-0.137	0.691**	-0.740***	0.911	0.232
Short-Run	(0.24)	(0.26)	(0.18)	(0.26)	(0.27)	(0.24)	(0.69)	(0.30)
EF2	0.02	0.19	1.11	0.99	0.69	0.13	-0.62	-0.26
ΔEF2	-0.00	-0.00	0.15	0.16	0.06	0.04	0.01	0.01
R^2	637	637	463	210	170	162	461	461
N	118	118	111	56	59	60	112	112
Countries	0.044	0.488	0.927***	1.019***	0.139	1.124**	-1.306	-0.360
Short-Run	(0.32)	(0.39)	(0.24)	(0.31)	(0.47)	(0.49)	(0.96)	(0.27)
EF3	-0.210	-0.338	-0.354**	-0.540***	0.196	-1.037**	0.008	0.053
ΔEF3	(0.20)	(0.24)	(0.15)	(0.20)	(0.28)	(0.44)	(0.58)	(0.21)
R^2	0.00	0.01	0.06	0.09	-0.00	0.06	0.01	0.00
N	564	564	367	203	162	155	419	419
Countries	116	116	98	55	55	61	109	109
Short-Run	-0.17	0.15	0.57	0.48	0.33	0.09	-1.30	-0.31
EF4	0.013	0.224	-0.081	0.727***	-0.429**	0.592*	-0.014	-0.149
ΔEF4	(0.18)	(0.24)	(0.21)	(0.22)	(0.17)	(0.33)	(0.53)	(0.24)
R^2	-0.195	-0.260	0.191	-0.215	0.364***	-0.472	-0.210	-0.108
N	(0.12)	(0.16)	(0.14)	(0.13)	(0.13)	(0.30)	(0.43)	(0.14)
Countries	0.01	0.01	0.00	0.12	0.04	0.03	-0.00	0.01
Short-Run	661	661	487	218	176	171	483	483

Table E.3 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EF5	118	118	114	56	63	60	113	113
ΔEF5	-0.18	-0.04	0.11	0.51	-0.06	0.12	-0.22	-0.26
R^2	-0.153	-0.163	0.700***	1.129***	0.215	0.612*	-0.445	-0.416
N	(0.22)	(0.24)	(0.21)	(0.28)	(0.31)	(0.36)	(0.58)	(0.27)
Countries	0.037	-0.103	-0.165	-0.269	0.516***	-0.366	0.602*	0.218
Short-Run	0.63	1.32	2.11	1.17	-0.01	0.17	-0.82	-0.53

Significance levels correspond to heteroskedasticity-robust standard errors for panels A-G - omitted for space. Standard errors robust to heteroskedasticity and autocorrelation reported in panel H. *p < 0.10,** p < 0.05,*** p < .01.

Table E.4: Additional Non–Linear FE Regressions - Carter Specification

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A							
EFW	-3.431**	-2.943	1.976	-1.329	2.049	-4.876	-9.998*	-3.672*
	(1.73)	(2.21)	(1.57)	(1.37)	(2.23)	(4.33)	(5.92)	(2.00)
EFW^2	0.305**	0.314	-0.127	0.193*	-0.129	0.472	1.048**	0.381**
	(0.15)	(0.20)	(0.13)	(0.10)	(0.21)	(0.39)	(0.52)	(0.17)
R^2	0.26	0.30	0.46	0.45	0.33	0.46	0.10	0.12
N	514	514	345	216	157	127	387	387
Countries	107	107	96	56	52	52	100	100
EFW^*	5.62						4.77	4.82
	Panel B							
EF1	0.257	1.017	2.634***	-0.259	-1.459	0.662	-1.696	-0.910
	(0.94)	(1.07)	(0.84)	(0.78)	(1.36)	(3.67)	(3.70)	(1.10)
$EF1^2$	-0.001	-0.053	-0.172**	0.079	0.225**	-0.067	0.180	0.096
	(0.08)	(0.10)	(0.07)	(0.09)	(0.11)	(0.30)	(0.37)	(0.11)
R^2	0.26	0.30	0.52	0.45	0.40	0.42	0.08	0.10
N	515	515	346	216	157	126	387	387
Countries	107	107	96	55	52	52	100	100
$EF1^*$			7.66					
	Panel C							
EF2	-0.700	-1.415**	-0.218	0.973	0.300	0.886	-1.749	-0.192
	(0.88)	(0.71)	(0.69)	(0.95)	(1.54)	(1.77)	(2.14)	(0.79)
$EF2^2$	0.058	0.156**	0.030	-0.062	-0.021	-0.006	0.092	0.003
	(0.07)	(0.06)	(0.05)	(0.08)	(0.16)	(0.19)	(0.18)	(0.07)
R^2	0.22	0.28	0.46	0.40	0.34	0.47	0.08	0.10
N	508	508	338	215	156	127	383	383
Countries	107	107	94	56	52	52	99	99
$EF2^*$		4.54						
	Panel D							
EF3	-1.086**	-1.402**	0.464	-0.200	0.044	-2.702***	-4.055**	-1.369***
	(0.54)	(0.55)	(0.37)	(0.45)	(0.73)	(1.01)	(1.66)	(0.52)
$EF3^2$	0.084*	0.123**	-0.052*	0.031	-0.016	0.223**	0.448***	0.150***
	(0.05)	(0.05)	(0.03)	(0.04)	(0.07)	(0.08)	(0.17)	(0.05)
R^2	0.28	0.32	0.48	0.43	0.32	0.51	0.14	0.16
N	517	517	347	217	157	127	389	389
Countries	107	107	96	56	52	52	100	100
$EF3^*$	6.46	5.70	4.46			6.06	4.53	4.56
	Panel E							
EF4	-0.660	-0.603	0.401	-2.367**	2.454**	0.719	-0.814	-0.357
	(0.51)	(0.57)	(0.38)	(1.05)	(1.11)	(0.68)	(1.51)	(0.50)
$EF4^2$	0.078*	0.091*	-0.014	0.188**	-0.180**	-0.038	0.165	0.056
	(0.04)	(0.05)	(0.03)	(0.07)	(0.09)	(0.08)	(0.13)	(0.04)
R^2	0.25	0.29	0.46	0.45	0.37	0.46	0.09	0.11
N	510	510	339	216	156	125	384	384
Countries	106	106	93	56	52	51	99	99
$EF4^*$				6.30		6.82		
	Panel F							
EF5	2.171	4.065**	4.652***	0.225	1.715	-11.272***	1.300	1.116
	(1.73)	(1.79)	(1.52)	(1.02)	(2.16)	(3.95)	(2.71)	(1.02)
$EF5^2$	-0.169	-0.302*	-0.313**	0.008	-0.156	0.987***	-0.121	-0.092
	(0.14)	(0.15)	(0.12)	(0.10)	(0.22)	(0.34)	(0.21)	(0.08)
R^2	0.26	0.31	0.53	0.43	0.32	0.50	0.08	0.10
N	513	513	341	217	157	126	387	387
Countries	107	107	96	56	52	52	100	100
$EF5^*$			6.73	7.43		5.71		

Corresponding measure of inequality is dependent variable in all regressions. The same vector of control variables used in the results reported in Tables 4.4 and 4.5 of chapter 4 are included in each specification - coefficient estimates for control variables omitted for space. Standard errors robust to heteroskedasticity and autocorrelation reported in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < .01$.

Table E.5: Additional 2SLS Regressions – Scully Specification, by Year

	Measure of Inequality							
	SWIID Net Gini (1)	SWIID Gross Gini (2)	UTIP Gross Gini (3)	Chpt. 3 Net Gini (4)	Chpt. 3 Gross Gini (5)	Chpt. 3 Consumption Gini (6)	WDI/WIID 90/10 Ratio (7)	WDI/WIID 80/20 Ratio (8)
	Panel A: t = 2010							
EFW	-2.351**	0.298		-1.420			2.949	0.838
	(0.975)	(0.773)		(3.135)			(3.203)	(1.141)
GROWTH	39.433***	17.872**		20.981			35.341	11.079
	(9.774)	(7.738)		(27.699)			(23.106)	(10.578)
p(OID)	0.05	0.08		0.41			0.65	0.32
p(UID)	0.00	0.00		0.01			0.00	0.00
F(WID)	18.9	18.9		20.3			8.5	8.5
EFW	0.011	0.011		-0.055***			0.041**	0.041**
	(0.011)	(0.011)		(0.017)			(0.019)	(0.019)
KDOT	0.217***	0.217***		0.175***			0.187***	0.187***
	(0.043)	(0.043)		(0.030)			(0.054)	(0.054)
GDOT	0.153	0.153		0.054			0.144	0.144
	(0.106)	(0.106)		(0.105)			(0.114)	(0.114)
R^2	0.53	0.53		0.66			0.39	0.39
N	91	91		32			52	52
Direct	-2.351	0.298		-1.420			2.949	0.838
Indirect	0.434	0.197		-1.154			1.449	0.454
Total	-1.917	0.495		-2.574			4.398	1.292
	Panel B: t = 2005							
EFW	-1.845**	0.454	-1.582	-3.731**		1.168	3.284*	1.250
	(0.737)	(0.573)	(1.050)	(1.523)		(1.235)	(1.977)	(0.765)
GROWTH	-8.464	-8.942*	10.398	-11.809		-11.358	-36.796**	-13.153**
	(8.593)	(7.306)	(15.130)	(13.856)		(9.149)	(14.552)	(5.151)
p(OID)	0.67	0.72	0.81	0.44		0.10	0.67	0.68
p(UID)	0.00	0.00	0.01	0.01		0.00	0.00	0.00
F(WID)	15.0	15.0	15.7	49.1		24.7	42.7	42.7
EFW	0.011	0.011	-0.011	-0.030**		0.028	0.022	0.022
	(0.009)	(0.009)	(0.019)	(0.011)		(0.024)	(0.017)	(0.017)
KDOT	0.200***	0.200***	0.242***	0.269***		0.257***	0.289***	0.289***
	(0.065)	(0.065)	(0.044)	(0.038)		(0.050)	(0.035)	(0.035)
GDOT	0.129**	0.129**	0.091	0.275***		0.100	0.131**	0.131**
	(0.056)	(0.056)	(0.121)	(0.085)		(0.076)	(0.061)	(0.061)
R^2	0.38	0.38	0.57	0.78		0.44	0.56	0.56
N	113	113	32	39		45	77	77
Direct	-1.845	0.454	-1.582	-3.731		1.168	3.284	1.250
Indirect	-0.093	-0.098	-0.114	0.354		-0.318	-0.810	-0.289
Total	-1.938	0.356	-1.696	-3.377		0.850	2.474	0.961
	Panel C: t = 2000							
EFW	0.272	1.008	-1.580***	-0.372	0.812	0.812	2.299	0.634
	(0.860)	(0.700)	(0.477)	(1.015)	(1.549)	(1.549)	(1.727)	(0.597)
GROWTH	-42.694***	-24.784**	-26.356***	-20.253	-35.419**	-35.419**	-59.612**	-20.033**
	(13.586)	(11.986)	(8.106)	(16.814)	(14.034)	(14.034)	(28.798)	(9.070)
p(OID)	0.96	0.62	0.90	0.21	0.97	0.97	0.46	0.43
p(UID)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F(WID)	6.3	6.3	14.1	50.3	46.0	46.0	4.9	4.9
EFW	0.027***	0.027***	0.012**	0.014*	0.002	0.002	0.024***	0.024***
	(0.008)	(0.008)	(0.005)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
KDOT	0.170***	0.170***	0.117**	0.243***	0.239***	0.239***	0.168***	0.168***
	(0.053)	(0.053)	(0.047)	(0.030)	(0.028)	(0.028)	(0.058)	(0.058)
GDOT	0.132*	0.132*	0.238***	0.328**	0.264***	0.264***	0.104	0.104
	(0.077)	(0.077)	(0.060)	(0.134)	(0.081)	(0.081)	(0.080)	(0.080)
R^2	0.40	0.40	0.48	0.65	0.63	0.63	0.47	0.47
N	110	110	87	42	38	38	87	87

Table E.5 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct	0.272	1.008	-1.580	-0.372	0.812	0.812	2.299	0.634
Indirect	-1.153	-0.669	-0.316	-0.284	-0.071	-0.071	-1.431	-0.481
Total	-0.881	0.339	-1.896	-0.656	0.741	0.741	0.868	0.153
	Panel D: t = 1995							
EFW	-3.538***	-1.070**	-2.013***	-2.856***	-0.481	0.321	-2.634**	-1.135**
	(0.746)	(0.543)	(0.533)	(1.064)	(1.296)	(1.422)	(1.218)	(0.445)
GROWTH	18.294*	7.242	-1.125	15.145	1.967	-29.724	26.229	4.603
	(10.250)	(8.012)	(6.853)	(21.651)	(13.490)	(20.448)	(25.827)	(9.074)
p(OID)	0.14	0.19	0.04	0.01	0.00	0.37	0.16	0.18
p(UID)	0.00	0.00	0.00	0.01	0.00	0.27	0.00	0.00
F(WID)	19.9	19.9	20.6	37.4	29.0	2.1	15.9	15.9
EFW	0.013*	0.013*	0.014*	0.027***	0.021**	0.020	0.010	0.010
	(0.007)	(0.007)	(0.007)	(0.008)	(0.010)	(0.033)	(0.007)	(0.007)
KDOT	0.221***	0.221***	0.242***	0.357***	0.278***	0.112	0.200***	0.200***
	(0.055)	(0.055)	(0.064)	(0.041)	(0.038)	(0.101)	(0.056)	(0.056)
GDOT	0.176***	0.176***	0.182***	0.383***	0.229***	0.175	0.211***	0.211***
	(0.046)	(0.046)	(0.050)	(0.073)	(0.052)	(0.131)		(0.055)
R^2	0.47	0.47	0.43	0.79	0.69	0.14	0.45	0.45
N	100	100	94	36	48	30	83	83
Direct	3.538	-1.070	-2.013	-2.856	-0.481	0.321	-2.634	-1.135
Indirect	0.238	0.094	-0.016	0.409	0.041	-0.594	0.262	0.046
Total	-3.300	-0.976	-2.029	-2.447	-0.440	-0.273	-2.372	-1.089
	Panel E: t = 1990							
EFW	-2.481***	-0.861	-1.761***	-1.843	-0.830	-0.457	-3.079	-1.784**
	(0.760)	(0.589)	(0.498)	(1.203)	(1.293)	(1.811)	(2.046)	(0.752)
GROWTH	-15.060	-11.894	-5.649	-3.347	-11.195	-31.004**	-28.216	-10.711
	(9.801)	(8.030)	(6.004)	(16.852)	(11.612)	(13.670)	(19.547)	(6.927)
p(OID)	0.06	0.11	0.51	0.09	0.02	0.27	0.41	0.40
p(UID)	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.00
F(WID)	32.0	32.0	42.3	50.2	31.8	25.5	19.6	19.6
EFW	0.031***	0.031***	0.025***	0.013*	0.031***	0.032	0.024***	0.024***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.022)	(0.008)	(0.008)
KDOT	0.200***	0.200***	0.213***	0.361***	0.250***	0.092	0.195***	0.195***
	(0.048)	(0.048)	(0.047)	(0.047)	(0.045)	(0.059)	(0.055)	(0.055)
GDOT	0.218***	0.218***	0.233***	0.126	0.330***	0.334***	0.230***	0.230***
	(0.057)	(0.057)	(0.059)	(0.093)	(0.076)	(0.104)	(0.073)	(0.073)
R^2	0.63	0.63	0.64	0.81	0.83	0.55	0.58	0.58
N	95	95	87	27	32	23	74	74
Direct	-2.481	-0.861	-1.761	-1.843	-0.830	-0.457	-3.079	-1.784
Indirect	-0.467	-0.369	-0.141	-0.044	-0.347	-0.992	-0.677	-0.257
Total	-2.948	-1.230	-1.902	-1.887	-1.177	-1.449	-3.756	-2.041
	Panel F: t = 1985							
EFW	-2.140**	-1.318*	-1.909***				-0.289	-0.219
	(0.446)	(1.038)	(0.463)				(1.038)	(0.463)
GROWTH	-30.153***	-26.445***	-14.629***				-41.353***	-18.576***
	(7.564)	(7.040)	(4.888)				(12.914)	(5.594)
p(OID)	0.75	0.88	0.85				0.29	0.20
p(UID)	0.00	0.00	0.00				0.00	0.00
F(WID)	31.7	31.7	32.6				29.2	29.2
EFW	-0.005	-0.005	0.006				0.003	0.003
	(0.009)	(0.009)	(0.008)				(0.008)	(0.008)
KDOT	0.223***	0.223***	0.198***				0.186***	0.186***
	(0.037)	(0.037)	(0.036)				(0.033)	(0.033)
GDOT	0.273***	0.273***	0.255***				0.344***	0.344***
	(0.092)	(0.092)	(0.089)				(0.102)	(0.102)
R^2	0.58	0.58	0.54				0.73	0.73
N	77	77	89				49	49
Direct	-2.140	-1.318	-1.909				-0.289	-0.219
Indirect	0.151	0.0133	-0.088				-0.124	-0.056
Total	-1.989	-1.305	-1.997				-0.413	-0.275
	Panel G: t = 1980							
EFW	-3.280***	-2.243**	-2.561***				-1.189	-0.685
	(1.165)	(1.038)	(0.485)				(1.703)	(0.787)

Table E.5 - Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GROWTH	7.075	0.369	-0.288				-28.384	-11.652
	(16.940)	(14.402)	(5.127)				(22.949)	(9.480)
p(OID)	0.84	0.70	0.32				0.25	0.19
p(UID)	0.00	0.00	0.00				0.00	0.00
F(WID)	21.6	21.6	18.7				17.2	17.2
EFW	0.028**	0.028**	0.029**				0.029**	0.029**
	(0.012)	(0.012)	(0.013)				(0.013)	(0.013)
KDOT	0.243***	0.243***	0.267***				0.234***	0.234***
	(0.040)	(0.040)	(0.049)				(0.044)	(0.044)
GDOT	0.125	0.125	0.171				0.097	0.097
	(0.117)	(0.117)	(0.157)				(0.117)	(0.117)
R^2	0.56	0.56	0.50				0.52	0.52
N	59	59	61				48	48
Direct	-3.280	-2.243	-2.561				-1.189	-0.685
Indirect	0.198	0.010	-0.008				-0.823	-0.338
Total	-3.082	-2.233	-2.569				-2.012	-1.023
	Panel H: t = 1975							
EFW	-4.751***	-2.845**	-2.602***					
	(1.735)	(1.185)	(0.427)					
GROWTH	46.842**	23.735	6.400					
	(21.664)	(19.338)	(5.828)					
p(OID)	0.93	0.21	0.94					
p(UID)	0.00	0.00	0.00					
F(WID)	17.9	17.9	24.7					
EFW	0.010	0.010	0.014					
	(0.012)	(0.012)	(0.010)					
KDOT	0.251***	0.251***	0.270***					
	(0.048)	(0.048)	(0.044)					
GDOT	0.035	0.035	0.063					
	(0.088)	(0.088)	(0.095)					
R^2	0.57	0.57	0.67					
N	41	41	46					
Direct	-4.751	-2.845	-2.602					
Indirect	0.468	0.237	0.090					
Total	-4.283	-2.608	-2.512					

Heteroskedastic-robust standard errors reported in parentheses. Results omitted when N < 30. $*p < 0.10, ** p < 0.05, *** p < .01$.

APPENDIX F

DATA - CHAPTER FIVE

Table F.1: Summary Statistics, Variable Description & Sources – Chapter Five

Variable	Description	Source
SWIID Net / SWIID Gross	Mean net / gross income Gini coefficient over period 1990-2010. Each country-year observation assigned to nearest quinquennial period spanning 1970-2010. For instance, observations occurring from 1968 to 1972 assigned to 1970, and those occurring from 1973 to 1977 assigned to 1975. If multiple Gini observations assigned to same quinquennial period, then arithmetic average is taken.	Solt (2009) SWIID Version 4.0, September 2013 Data obtained from: http://myweb.uiowa.edu/fsolt/swiid/swiid.html
Chpt. 3 UTIP Gross	Mean estimated household income Gini coefficient over period 1990-2000.	Galbraith and Kum (2005). University of Texas Inequality Project Data obtained from: http://utip.gov.utexas.edu/data.html
Chpt. 3 Net Gini	Mean net income Gini coefficient over period 1990-2010. Database consists of measures from Luxembourg Income Study, United Nations University Worldwide Institute for Development Economics Research (UNU-WIDER) WIID2c, and Milanovic (2013). See SWIID for information on country-year observation assignment metric.	See chapter 3 and appendix Table D.2
Chpt. 3 Gross Gini	Mean gross income Gini coefficient over period 1990-2010. Database consists of measures from Socio-Economic Database for Latin America and the Caribbean, Milanovic (2013), and UNU-WIDER WIID2c. See SWIID for information on country-year observation assignment metric.	See chapter 3 and appendix Table D.3
Consumption Gini	Mean consumption Gini coefficient over period 1990-2005. Database consists of measures from Milanovic (2013) and UNU-WIDER WIID2c. See SWIID for information on country-year observation assignment metric.	See chapter 3 and appendix Table D.4
90/10	Ratio of income earned by top 10 percent to the bottom 10 percent of the distribution. Represents mean ratio over period 1990-2005.	World Bank (2013); UNU/WIDER WIID2c
80/20	Ratio of income earned by top 20 percent to the bottom 20 percent of the distribution. Represents mean ratio over period 1990-2005.	World Bank (2013); UNU/WIDER WIID2c
EF2	Mean legal system and property rights sub-index over period 1985-2005. Comprised of nine main components: judicial independence, impartial courts, protection of property rights, military interference in the rule of law and politics, integrity of the legal system, legal enforcement of contracts, regulatory restrictions on the sale of real property, reliability of police, and business costs of crime. Values on a 0-10 scale. Each component receives equal weighting for sub-index.	Gwartney, Hall, and Lawson (2013)
LWHEATSUGAR	Suitability of factor endowments for production of wheat relative to sugar. Measured as: log[(1+share of arable land suitable for wheat)/(1+share of arable land suitable for sugarcane)].	Easterly (2007)
FR	Dummy variable equal to one if a country classified as having French legal tradition, and zero otherwise.	La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999)
LWHEATSUGAR ×FR	LWHEATSUGAR interacted with French legal tradition dummy variable.	
TROPICS	Proportion of land area located in tropical region.	Gallup, Sachs and Mellinger (1999)
AYS15	Mean years of schooling for population above age 15 over period 1985-2005.	Barro and Lee (2013) Data obtained from: http://www.barrolee.com/data/dataexp.htm

Table F.1 - Continued

Variable	Description	Source
ILLITERACY	Mean share of adult (15+ years of age) population that is illiterate over period 1985-2005. Data available annually over period 1970-2013. Not all country-year observations available, so assigned each available observation to nearest period ending in zero or five. For instance, if actual year of observation between 1968 and 1972, then assigned to 1970. If between 1973 and 1977, then assigned to 1975. If multiple observations assigned to the same year, then the average of these values is used.	World Bank (2013)
DEP2LABOR	Ratio of (1) sum of shares of population below age 15 and above age 64 to (2) share of population between ages 15-64. Mean over period 1985-2005.	World Bank (2013)
URBAN	Mean share of population residing in an urban center over period 1985-2005.	World Bank (2013)
SERVICE	Mean share of labor force employed in professional service sector of economy (wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services) over period 1985-2005. Data available annually over period 1980-2013. Not all country-year observations available, so assigned each available observation to nearest period ending in zero or five. See illiteracy for additional information on assignment criteria.	World Bank (2013)
INDUSTRY	Mean share of labor force employed in industrial sectors of economy (mining, quarrying, manufacturing, construction, public utilities) over period 1985-2005. Data available annually over period 1980-2013. Not all country-year observations available, so assigned each available observation to nearest period ending in zero or five. See illiteracy for additional information on assignment criteria.	World Bank (2013)
GROWTH	Mean 5-year real growth rate of GDP per capita over period 1985-2005.	Heston, Summers, and Bettina (2012).
POLRIGHTS	Mean political rights value over period 1985-2005. Measures the degree to which political rights and liberties are respected. Comprised of three main areas: electoral process, political pluralism and participation, and functioning of government. Original data range from 1-7, with higher scores representing less freedom. Rescaled to 0-10 measure that is increasing in freedom.	Freedom House (2014)
CIVLIB	Mean civil liberties value over period 1985-2005. Measures the degree to which civil liberties are respected. Comprised of four main areas: freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. Original data range from 1-7, with higher scores representing less freedom. Rescaled to 0-10 measure that is increasing in freedom.	Freedom House (2014)
DEMOCRACY	Mean institutionalized democracy value over period 1985-2005. Comprised of three main areas: competitiveness of political participation, openness and competitiveness of executive recruitment, and constraints on the chief executive.	Marsall, Gurr and Jaggers (2013)
COAST	Share of the national population living within 100km of the coast	Gallup, Sachs and Mellinger (1999)
DMM	Distance by air to closest of the three major world markets (New York, Rotterdam or Tokyo)	Gallup, Sachs and Mellinger (1999)
EF1	Mean size of government sub-index over period 1985-2005. Comprised of four main components: government consumption, government investment and enterprises, transfer and subsidies, and top marginal tax rates. Values on a 0-10 scale that is decreasing in size of government. Each component receives equal weighting for sub-index.	Gwartney, Hall, and Lawson (2013)
TRANSFERS	Transfers and subsidies as share of GDP over period 1985-2005.	Gwartney, Hall, and Lawson (2013)

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BIOGRAPHICAL SKETCH

Daniel L. Bennett earned a B.A. in finance in 2005 and an M.A. in applied economics in 2008, both from Ohio University. In between, he worked as a contract specialist for the federal government until deciding to pursue a career as an economist. After completing the M.A. degree, he worked at a think tank doing research and policy work related to the economics of higher education. He decided to pursue a doctorate degree at Florida State University and began the program in fall 2010. He will graduate with a Ph.D. in economics spring 2014, and will begin a position as Assistant Professor of Economics in the Department of Government at Patrick Henry College in the fall.