DE GRUYTER OPEN
REBS Review of Economic & Business Studies
DOI 10.1515/rebs-2018-0062
Volume 11, Issue 1, pp.9-30, 2018
ISSN-1843-763X

GENERATION OF TAX REVENUES AND ECONOMIC DEVELOPMENT: A PANEL-ANALYSIS FOR EMERGING ECONOMIES IN ASIA

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Abstract: *Particularly in an emerging or developing economy context, generating sufficient tax revenues is essential for the provision and upkeep of well-needed public infrastructure/public capital that supports the development process. However, tax policy can also cause distortionary and negative effects to economic activity and growth, especially if excessive taxation is imposed. The aim of this paper is to examine the role of tax revenues and estimate its overall net impact on economic growth in emerging economies in Asia. The dataset covers emerging economies from South, Southeast, and East Asia during 1998-2015. The results show that tax revenues have an overall positive net impact on the growth rate of real GDP per capita, suggesting the positive effects associated with taxation outweigh the negative and distortionary effects of taxation. Thus, evidence is found that the collection of adequate amounts of tax revenues (with which public investments were financed) contributed significantly to economic development.*

Keywords: *Asia, Emerging Markets; Growth Regression; Public Finance; Taxation.*

JEL Classification: *O10, O47, H20*

1. INTRODUCTION

The capacity of countries to generate tax revenues is crucial in giving governments the fiscal space to provide necessary public infrastructure and capital as well as key public goods and services. An effective taxation system, which on the one hand, generates sufficient tax revenues that are efficiently invested into essential public capital and services, and on the other hand, causes minimal market distortions, has a beneficial effect on productivity and economic growth and development. (e.g. Gruber, 2016; Barro and Sala-i- Martin, 1992).

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Especially, in a developing or emerging economy context, where public infrastructure and capital are rather deficient, public finance plays a particularly important role in the economic development process. It enables public investments and thus, the creation of necessary infrastructure that supports economic growth. Under this perspective, hence, it is essential that the tax policy: [i] generates a sufficient amount of tax revenues, [ii] uses efficiently the tax resources for public investment, and [iii] provokes the least possible negative effects to economic activity and growth.

Interestingly, the empirical evidence on the growth effect of total tax revenues is rather mixed, and there is no clear consensus. In some countries total tax revenues have been found to have a clearly positive impact on economic growth and development. This suggests that the positive effects of tax revenues / taxation (tax resources efficiently spent on public investment, infrastructure, etc.) outweigh the negative and distortionary effects (e.g. inefficient and misuse of tax resources leading to smaller amounts of public investments, heavy tax burden leading to economic disincentives and less private investment, etc.).

On the other hand, in many countries it seems that total tax revenues are associated with an overall mixed or neutral impact on growth (positive and negative effects are of equal magnitude). However, in some countries there is a clearly negative growth effect of tax revenues, indicating that the positive effects of taxation are smaller than the negative effects, leading to an overall negative effect of tax revenues on growth (e.g. Kneller and Misch, 2017; Johansson, 2016).

Furthermore, the literature suggests that besides broad cross-country views, an examination focusing on individual economies or country groups of the same region sharing similar economic characteristics has merits for a more precise and case specific assessment of the impact of taxation on economic development. In emerging and developing economies of South, Southeast, and East Asia, tax revenues and public finance is a highly relevant issue to economic development efforts (e.g. World Bank, 2016; Straub and Terada-Hagiwara, 2010). However, there is generally limited evidence on the subject matter.

Given this scarcity of detailed information on developing and emerging Asia, the objective of this paper is to empirically examine the the role and overall quantitative effect of tax revenues on economic development. By assessing the overall growth effect associated with taxation, we can infer the relative sizes of the

positive and negative effects of the tax policy and provide a quantitative estimate of the overall contribution of tax revenues to economic growth. The empirical growth analysis is conducted for emerging economies from the South, Southeast, and East Asia region over the 1998-2015 period.

The rest of the paper is organized as follows. The next section provides a brief review of the literature. The third section presents the econometric methodology. It also provides a description of the data and variables, as well as an analysis of the cross-country patterns and trends in tax revenues and economic growth and development over the sample period. The fourth section reports and discusses the empirical results. The final section offers the concluding remarks.

2. REVIEW OF THE LITERATURE

We briefly review the relevant literature, in which only the main points and findings are summarized, as there are plenty of recent in-depth review papers on this rich subject matter.[1] First, it has to be noted that the theoretical literature is based on growth models with public finance (e.g. Barro and Sala-i-Martin, 1992; Barro, 1990; 1991a; 1991b). Initially, the main interest and analytical focus was placed entirely on the growth effect of public capital, and subsequently, the role of taxation was also explicitly taken into account and analyzed.

A growing number of studies over the years have examined the effects of public capital/investment, and more recently, of taxation on economic growth (e.g. Alinaghi and Reed, 2017; Gaspar et al., 2016; Dackehag and Hansson, 2015; Macek, 2014; Fricke and Süssmuth, 2014; Attila, 2008; Arnold, 2008; Barro, 1991b). The most usual empirical approach is based on estimating growth regressions across a sample of countries, with either cross-section analyses or panel econometric techniques being applied. The focus is on analyzing either the growth effect of public capital/investment/expenditure or tax revenues.

The majority of studies examine developed and/or OECD countries, whilst due to data unavailability and other measurement issues, the number of studies focusing on developing countries is smaller. Government expenditures on investment as a percentage of GDP is usually taken as a proxy for public

[1] For such reviews, see, for instance, Kneller and Misch (2017), Alinaghi and Reed (2017), and Johansson (2016).

capital/investment, whilst tax revenues as a percentage of GDP is the most commonly used empirical measure for taxation (which reflects the relative magnitude of both, revenues and tax burden). In general, the empirical evidence suggests that public finance (viewed and assessed through either government expenditures and / or tax revenues) has a significant positive impact, while some papers indicate a negative effect. However, it needs to be stressed that for total tax revenues, the evidence is more ambiguous and dependent on the specific country or countries under consideration.

One of the first comprehensive empirical studies on the role of public finance is Barro (1991b), which for a sample of ninety-eight countries during a 26-year period it is found that government expenditures associated with public investment contribute to economic growth. Rather than the role public finance is general, other studies specifically consider taxation.

For instance, Arnold's (2008) analysis for twenty-one OECD countries over a time span of 34 years indicates that overall tax revenues as well as property, consumption and personal income taxation have a significantly positive impact on growth, while the corporate income tax has a negative effect. By estimating an empirical endogenous growth model, Attila (2008) found that when high corruption is present in a country, taxation is harmful to economic growth. The study by Fricke and Süssmuth (2014) for eleven Latin American developing economies over a 20-year period concludes that tax revenues strongly and positively affect economic growth in the long-run.

Studies that focus particularly on developing economies in Asia are scarce. Acosta-Ormaechea and Yoo (2012) consider a large number of countries, including Asian economies. However, their growth analysis focuses on changes in tax composition rather than the effect of overall tax revenues. Loganathan et al. (2017) analyze how economic growth and the stock market affect tax revenues in six emerging Asian economies. Through panel cointegration and Granger causality tests they find that a bi-directional causality relationship exists, that is tax revenues cause growth and vice versa. Overall, thus, the evidence on Asian developing economies is rather insufficient.

3. METHODOLOGY

3.1. Model Specification

The empirical counterpart of a Solow-type theoretical transitional growth equation in a cross-section framework can be represented by a regression equation of the following general form (Barro, 1991b; Mankiw et al., 1992):

$$\log(y_{i,t}) - \log(y_{i,0}) = \beta \log(y_{i,0}) + X\alpha + Z\varphi + \varepsilon_i \quad (1)$$

On the other hand, for conceptual and statistical reasons, the empirical growth model in a panel-data context should be specified as a dynamic panel regression, in which a lagged dependent variable is included as an additional regressor (Islam, 1995):

$$\log(y_{it}) = b \log(y_{it-1}) + X\alpha + Z\varphi + \mu_i + \nu_t + \varepsilon_{it} \quad (2)$$

$$b = (1 + \beta) \Rightarrow \beta = b - 1$$

Our sample is a panel-dataset, and consequently, we limit the presentation of the econometric methodology to the panel-data context. Equation (2) regresses the log of real GDP per capita on (i) time lagged log of real GDP per capita, (ii) a set of determinants based on growth theory including public finance, represented by matrix $\boldsymbol{X}$, and (iii) a set of several general control variables in logs, included in matrix $\boldsymbol{Z}$. In general, $\boldsymbol{X}$ includes the log of physical private capital, log of human capital, and the log of a public finance variable (public capital or taxation, depending on the analytical focus), which is in accordance with the theoretical growth equation.

Since the present empirical analysis focuses on the assessment of the overall effect of tax revenues on economic growth, the public finance variable included in the growth regression is total tax revenues as a percentage of GDP. The column vector of regression coefficients (including the constant) for $\boldsymbol{X}$ is $\boldsymbol{\alpha}$, whilst that of $\boldsymbol{Z}$ is $\boldsymbol{\varphi}$. Country specific fixed effects and time specific effects are denoted by μ_i and ν_t, respectively.

Because economic growth is an endogenous phenomenon, the dynamics of growth and the simultaneous and reverse causality (endogeneity) associated with the explanatory variables must be explicitly taken into account in the econometric estimation of the growth regression (Sasaki, 2015; Siddiqui and Ahmed, 2013; Acemoglu et al., 2003; 2001; Barro 1990). For instance, human capital can have a beneficial effect on growth and at the same time, economic growth and

development can have a beneficial effect on human capital. This applies more or less to other growth determinants as well, including tax revenues.

A common and widely-used dynamic panel-econometric approach that controls for the above mentioned issues and estimates consistently and efficiently an empirical growth model is the general method of moments (GMM) technique. First, the dynamic panel regression equation (2), in which all the variables are in logs, is first-differenced to account for the country fixed effects. This produces the following empirical panel growth regression, which is estimated by GMM using instrumental variables (lagged dependent and explanatory variables):

$$\Delta log(y_{it}) = \alpha_0 + b\Delta log(y_{it-1}) + \alpha_1 \Delta log(TAX_{it-1}) + \alpha_2 \Delta log(K_{it-1}) + \alpha_3 \Delta log(H_{it-1}) + \Delta \mathbf{Z}\varphi + \Delta \nu_t + \varepsilon_{it} - \varepsilon_{it-1} \quad (3)$$

$i = 1, 2, 3, \dots, 15$

$t = 1998, 1999, 2000, \dots, 2015$

$\beta = b - 1$ (conditional convergence speed)

with:

$\alpha_1 > 0$ (i) if tax revenues have an overall positive net impact on economic growth.

or

$\alpha_1 < 0$ (ii) if tax revenues have an overall negative net impact on economic growth.

or

$\alpha_1 = 0$ (iii) if tax revenues have an overall neutral net impact (various effects cancel out).

With respect to equation (3), Δ denotes the first-difference operator, which transforms the log variables in first difference logs, that is in growth rates [ie. Δlog(yit)= log(yit) – log(yit-1)]; $\varepsilon_{it} - \varepsilon_{it-1}$ is the stochastic error term (which follows a first order moving average process, MA(1), brought about by the first-difference transformation); TAX is the tax revenues (public finance) variable, K denotes private physical stock capital, and H stands for the human capital stock variable.

Since the dependent variable and all explanatory variables have been converted to growth rates, the regression coefficients reveal how an increase in the rate of growth of an explanatory variable (e.g. human capital stock) relates to a rise

in the growth rate of real GDP per capita.[2] More specifically, the estimated regression coefficients indicate the change in the real GDP per capita annual growth rate (in percentage-points) as a result of one percentage-point change in the growth rate of an explanatory variable.

The role and quantitative effect of tax revenues on economic growth, which is the main point of our empirical analysis, is assessed through the estimation of the dynamic panel-econometric equation (3). If the TAX variable is found to exhibit a statistically significant and positive regression coefficient, it indicates an overall positive net growth impact associated with tax revenues. In this case, we could infer that the various positive effects of tax revenues outweigh the adverse and distortionary effects, which cause a negative impact on growth.

Regarding the data, we have to underline that one particularly crucial issue is stationarity. Non-stationary data can lead to spurious relationships and dynamic instability, rendering the empirical findings unreliable and invalid. We have confirmed through panel-unit root testing that our panel-dataset is stationary. With respect to GMM estimation, the first-differenced GMM estimator (Arellano and Bond, 1991) may be biased in panels with a short time dimension and variables that exhibit a high degree of time persistence (eg. Bond, Hoeffler & Temple, 2001).

In such a situation, it is suggested that an alternative estimator (system GMM) should be employed, which, in addition to lagged levels as instruments for variables in first differences, uses lagged first differences as instruments for variables in levels (Arellano & Bover, 1995; Blundell and Bond, 1998).[3] Since in our panel, the time dimension is rather long and the variables are not highly persistent, the above mentioned issues do not arise. In any case, we have estimated equation (3) with both, the first-differenced GMM and the system GMM estimator. The empirical results that we obtained from the two GMM estimators are almost identical.

[2] This is in accordance with the theoretical model, in which the various variables in the transition-to-the-steady-state (transitional growth) equation reflect accumulation / growth rates in the capital stocks and public finance variable.

[3] Through a Monte-Carlo simulation study, Blundell and Bond (1998) show that when the series are highly persistent (close to a random walk) in short panels, the system GMM estimator is more robust.

3.2. Data and variables

The sample of our empirical analysis consists of fifteen Asian emerging and developing economies (Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Timor-Leste, Vietnam) during the 1998-2015 period. As the observations are pooled across countries and years, the sample is a panel-dataset. Furthermore, since data are available for all countries and all years under study, we have a fully balanced panel. Descriptive statistics are given in Table A3.

Economic development/ growth

The two key variables in our analysis are economic development / growth (coded as DEV or y), which constitutes the dependent variable and is proxied by real GDP per capita (in constant 2010 US dollars), and tax revenues (TAX), as measured by total government tax revenues as a percentage of GDP.

Taxation

The taxation variable we use indicates (in relative terms) both the tax revenues, with which public investments and other expenditures can be financed, and the tax burden on the private sector and economic agents (corporations, entrepreneurs, capital owners, workers, consumers, etc.). The above empirical measure is standard in the growth literature as well as in various literatures on taxation effects. The remaining variables included in the empirical analysis are factors associated with the augmented Solow growth model (see next section).

Other control variables

A number of other general control variables are also included in order to account for additional economic factors and avoid omitted variable bias (economic openness; country population; economic restructuring away from agricultural production; and macroeconomic instability). Besides theory and prior empirical studies, the selection of control variables is based on the availability of data for all countries in our sample. The descriptions and data sources for all variables are reported in Table A1 in the appendix. As discussed in detail in the next section, all variables included in the empirical growth regression are transformed to logs and first-differenced (before econometric estimation), and thus the variables reflect annual rates of growth. Table A2 in the appendix, which reports the correlation

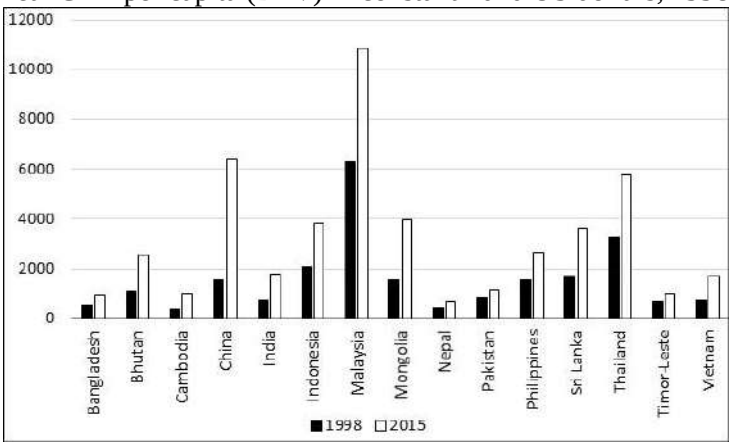
matrix as well as the variance inflation factors for the explanatory variables, indicates that there is no multicollinearity problem, and hence all variables can be retained and considered in the analysis.

3.3. Descriptive patterns and trends 1998-2015

Before turning to the findings of the econometric analysis, it is informative to have a first look at the descriptive patterns and trace the trends of the two key variables across our sample of countries over the 1998-2015 period. First, as it is evident from Figure 1, in all countries real GDP per capita has increased between 1998 and 2015. In some economies this increase is small, whilst in several countries it is substantial (especially in China, as seen more clearly in the next Figure). According to this indicator, Malaysia, China, and Thailand appear to have the highest economic development level among the 15 countries from the South, Southeast, and East Asian region. On the other hand, Nepal, Bangladesh, Timor-Leste, and Cambodia are among the least developed.

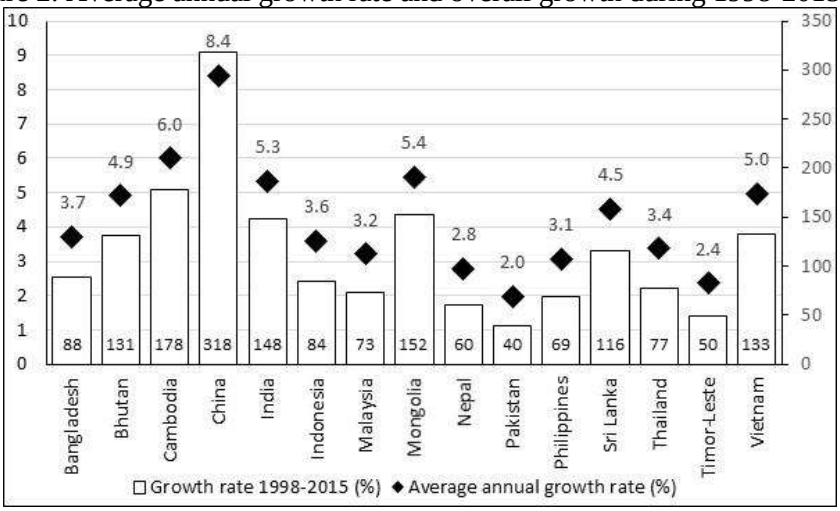
Next, Figure 2 shows the average of the annual growth rates in real GDP per capita (%) over 1998-2015 (as diamond-shaped markers measured on the left vertical axis), as well as the overall growth (%) that has been achieved during that period (as white columns measured on the right vertical axis). It is apparent that China exhibits the highest average annual growth rate (8.4%) and has more than quadrupled its real GDP per capita between 1998 and 2015 (an increase of about 318%). Cambodia, Mongolia, and Vietnam show the next highest average growth rate and overall growth, while Pakistan and Nepal exhibit the lowest growth rates.

Figure 1: Real GDP per capita (*DEV*) in constant 2010 US dollars, 1998 and 2015



Source: Author(s) compilation based on data from WDI (World Development Indicators).

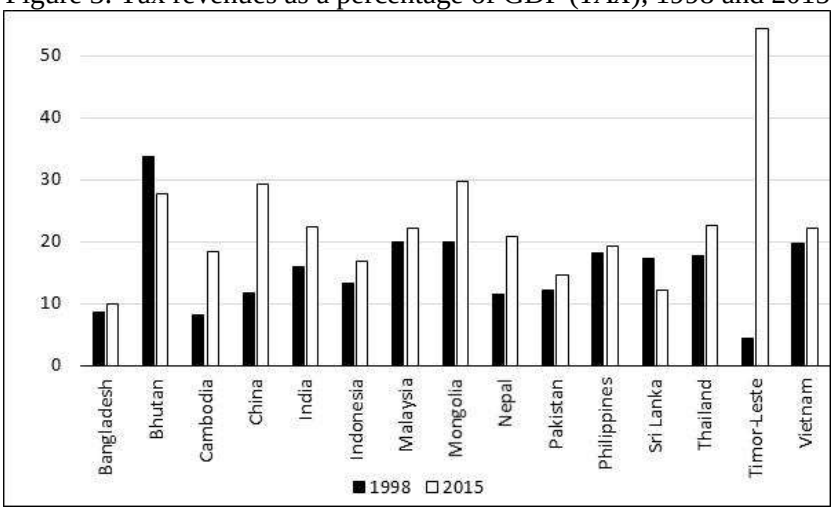
Figure 2: Average annual growth rate and overall growth during 1998-2015 (%)



Source: Author(s) compilation based on data from WDI (World Development Indicators).

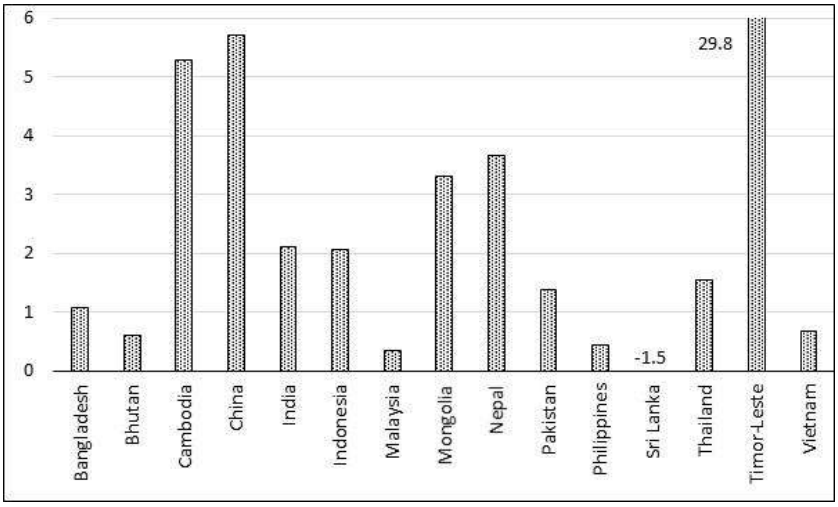
With respect to taxation, from Figure 3 it can be discerned that tax revenues as a percentage of GDP in 2015 are at a higher level compared to the level in 1998 (the initial year) in all countries except Sri Lanka and Bhutan.

Figure 3: Tax revenues as a percentage of GDP (*TAX*), 1998 and 2015



Source: Author(s) compilation based on data from World Economic Outlook, IMF.

Figure 4: Average annual growth rate of *TAX* (%) during 1998-2015

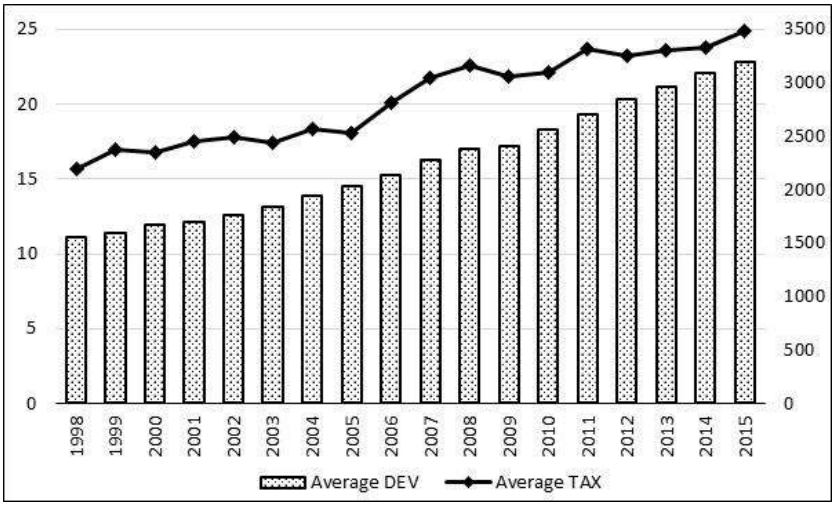


Source: Author(s) compilation based on data from World Economic Outlook, IMF.

However, only Sri Lanka has witnessed an overall and continuous decline in the *TAX* variable over the whole sample period (as reported in the next Figure). In addition to Timor-Leste (which represents a somewhat special case, exhibiting a huge increase from a very low level of tax revenues), Mongolia, China, Bhutan, Thailand, India, and Vietnam are among the countries with the highest *TAX* level in the end year of the sample period under study. Many of those countries have achieved the largest growth in tax revenues, as it is evident from Figure 4, which shows the average annual growth rate of *TAX* over 1998-2015. This growth rate is clearly "off the chart" in the case of Timor-Leste (29.8%), whilst negative only in Sri Lanka (-1.5%).

Finally, Figure 5, which depicts the evolution in the country-group average real GDP per capita (measured in constant US dollars on the right vertical axis) and tax revenues (measured as a % of GDP on the left vertical axis) over 1998-2015, it is evident that overall, there is a strong upward trend in the level of both *DEV* and *TAX*. Notably, average tax revenues (% of GDP) increased from a level of around 15% to almost 25%. This highlights the rising importance of tax revenues in the economy, and implies a substantial expansion in government expenditures and public capital and services. It also suggests that in recent years the average tax burden has become heavier, and is, to some extent, approaching medium-high levels.

Figure 5: Country-group average of real GDP per capita (*DEV*) and *TAX*, 1998-2015



Source: Author(s) compilation based on data from WDI and WEO.

4. RESULTS AND DISCUSSION

4.1. Short-run Impact of Taxation on Economic Growth

Since in dynamic panel-data models, short-run as well as long-run effects can be estimated, we have two sets of estimation results. First, Table 1 reports the findings for the short-run impact of the explanatory variables on the dependent variable and the beta convergence parameter, with which the speed of conditional convergence in real GDP per capita across countries is measured. In Table 2, we show the empirical results with regard to the long-run or cumulative effect of the independent variables. Overall, the estimated empirical growth model is satisfactory, as all but one independent variables are statistically significant. Furthermore, there is no problem with second-order serial correlation and the instruments are valid.

It is found that tax revenues have an overall positive effect on economic development. The short-run regression coefficient of *TAX*, which is highly statistically significant, indicates that the annual growth rate of real GDP per capita increases by about 0.042 percentage points due to a one percentage point increase in the growth rate of the *TAX* variable. The estimated short-term growth effect is conditional on all the other country factors included and considered (remaining

explanatory variables, country-specific characteristics captured by fixed effects, and initial development level).

Table 1: Estimation of Growth Determinants (Short-run Effects)

Explanatory Variables	Regression Coefficient	t-statistic	p-value
Tax Revenues (*TAX*)	**0.0419355**	**2.83**	**0.005**
Private Capital Investment	0.0166774	1.86	0.064
Human Capital Investment	0.2206300	1.81	0.070
Economic Openness	0.0053254	2.20	0.028
Country Population	0.1829114	2.10	0.035
Agricultural Production	-0.0957441	-3.76	0.000
Macroeconomic Instability	0.0030453	1.00	0.318
b (*Lagged dependent variable*)	0.8220466	26.17	0.000
$\beta = b - 1$ *(convergence speed parameter)*	-0.1779534	-5.67	0.000
Statistics			
AR(2) test (*p-value*)	0.3102		
Sargan test (*p-value*)	0.9893		
Wald test *(p-value)*	0.0000		

Note: Results on short-run parameters obtained by estimating equation (3).

The same holds for the long-term estimates. Though the magnitude of the short-run growth impact might seem small, it has to be noted that it represents the instantaneous effect; that is to say, the effect of the current value of the *TAX* variable growth rate at time *t* on the current value of the income (real GDP per capita) growth rate at *t*.

4.2. Long-run Impact of Taxation on Economic Growth

In the case of tax revenues, there might be reasons to expect that the size of the immediate impact on economic development to be less pronounced. Some of the beneficial effects on growth associated with taxation could take a certain amount of time to materialize. For instance, the productivity benefits to the economy associated with revenues that are spent on large-scale public investments on infrastructure, which require many years of construction, are likely to accrue

over a long time horizon. Hence, the long-run growth impact of taxation might be more informative.

The estimated long-run regression coefficient for the *TAX* variable suggests that, on average, the cumulative effect of a one percentage point increase in the tax revenues growth rate over the longer-term amounts to an increase of almost a quarter of a percentage point in the annual growth rate of real GDP per capita (Table 2).

Table 2: Estimation of Growth Determinants (Long-run Effects)

Explanatory Variables	Regression Coefficient	t-statistic	p-value
Tax Revenues (*TAX*)	**0.2356545**	**2.14**	**0.032**
Private Capital Investment	0.0937177	1.91	0.056
Human Capital Investment	1.2398190	2.13	0.034
Economic Openness	0.0299260	1.91	0.056
Country Population	1.0278610	2.32	0.020
Agricultural Production	-0.5380292	-3.64	0.000
Macroeconomic Instability	0.0171128	1.01	0.313

Note: Results on long-run (LR) effects obtained from short-run estimation results as follows: $= \frac{\alpha}{1-b}$, where α is the estimated coefficient of a given independent variable and b is the coefficient of the lagged dependent variable.

Given that this estimate represents the overall net effect of tax revenues (which is determined by various positive and negative effects), the degree of the favorable influence is not unsubstantial. The importance of this finding lies in the fact that as the annual growth rate of a country is higher by a quarter of a percentage point [for instance, instead of 4.25% , which is the mean value in the sample, it is increased to a rate of 4.5%] for every year, the beneficial effect of tax revenues on economic development is compounded and accumulates. Thus, a country achieves a higher growth rate in its GDP per capita than what it would

have been without the overall positive growth effect of tax revenues, reaching thereby to a higher absolute GDP per capita level next year.

Now from this higher GDP level (due to the growth effect of tax revenues of the previous year), the higher growth rate in the next year (by almost 0.25 percentage points) increases further the level of GDP per capita in the future. In other words, the positive growth rate differential due to tax revenues occurs every year and drives the absolute level of economic development ever-more higher. Overall, the results for the long-run growth impact of tax revenues clearly show that the estimated positive effect is not only statistical significant but has considerable economic consequence on economic development in the long-run.

Regarding the other explanatory variables, it is evident that all regression coefficients, except macroeconomic instability, are statistically significant. Notably, growth in the human capital stock exerts a particularly strong impact on growth in real GDP per capita. In fact, this variable exhibits the highest marginal effect among all regressors. The estimated short-run coefficient indicates that a rise of one percentage point in the growth rate of the human capital stock is associated with an immediate effect of a 0.22 percentage point increase in the development growth rate. The long-run impact is more impressive, as it amounts to an increase of around 1.24 percentage points.

Population growth shows the second highest short-run and long-run coefficients. In the long-term, the growth rate in a country's economic development (per capita income) level is enhanced by about 1.03 percentage points as a result of a one percentage point increase in the growth rate of a country's population.

This highlights the crucial importance of "healthy demographics" not just for GDP growth, but also for per capita GDP growth in the economies of the South, Southeast, and East Asian region. Interestingly, our finding of the substantial economic growth impact of population dynamics echoes the views of various policy institutions, which greatly emphasize the role of demographics as an important growth factor (e.g. World Bank, 2016; European Commission, 2015; IMF, 2004).

The coefficient of agriculture as share of GDP, which proxies for economic restructuring towards non-agricultural activities such as, manufacturing, construction, and services, is negative and highly statistically significant. Thus, it indicates that as

the national economy shifts away from agriculture and towards other activities, there is a considerable beneficial effect on a country's economic development level. More precisely, the estimated long-run regression coefficient suggests that a one percentage point fall in the growth rate of the agricultural GDP share, raises more than a half percentage points the real GDP per capita growth rate.

The final two statistically significant explanatory variables, rate of growth in the private capital stock and in the extent of economic openness,[4] both have a positive impact, but the magnitude of the effect is relatively small.

As regards conditional beta-convergence, the corresponding parameter is negative and highly statistically significant. This indicates that, given all the explanatory variables and individual country characteristics considered in the analysis, countries converge towards their balanced growth paths. Hence, the discrepancy between their current income levels and their steady-state income levels is reduced. Countries that are further away from their steady-state growth levels exhibit higher growth rates. This in turn, may imply that economies with initial lower development level exhibit higher growth rates compared to countries with a higher initial level of per capita GDP. It has to be stressed that conditional β-convergence does not imply that countries are converging towards a common steady state growth path, leading to the convergence of real GDP per capita levels.[5]

Notably, we find that the speed of the β-convergence is particularly high. The estimated parameter suggests that, on average, the countries convergence to their balanced growth paths at about 17% a year. This is much higher than the convergence estimates of most cross-section studies, which are between 2% and 4% (e.g. Barro, 2015). However, usually panel-data analyses produce considerably larger convergence parameters (e.g. Islam, 1995; Caselli et al., 1996; Evans 1997; Barro, 2015), with some estimates for OECD economies indicating a convergence of more than 10% annually (Islam, 1995).

[4] We have estimated the growth regression with a variety of different measures of economic openness (such as exports and imports as a % of GDP, several export-related variables, and a globalization index). However, only the openness indicator reported here was found to be clearly statistically significant at the 5% level.

[5] This is the notion of absolute (or unconditional) beta-convergence. Furthermore, another relevant concept that directly measures the extent of convergence/divergence of income levels among countries over time is σ-convergence.

Furthermore, it has been documented in the literature that when similar countries and/or countries from the same geographical regions are considered in the analysis, the estimated conditional β-convergence speed is significantly higher, implying, among other things, the existence of "convergence clubs" (e.g. Baumol, 1986; Baumol & Wolff, 1988; Dowrick & DeLong, 2003).

5. CONCLUDING REMARKS

This paper has first investigated the trends in total tax revenues and economic development across 15 emerging and developing economies from the South, Southeast, and East Asian region over 1998-2015. In addition, through GMM estimation of a dynamic panel growth regression, it has also examined the overall net growth effect of total tax revenues along with other relevant determinants of economic growth and development.

Our empirical research has found that during the sample period, the development level (as indicated by real GDP per capita) has increased consistently in all countries (especially in China, Cambodia, Mongolia, India, and Vietnam). Tax revenues have also expanded significantly across our sample (except in Sri Lanka). In many of the economies which have experienced a substantial growth in tax revenues, real GDP per capita growth has been particularly strong. In fact, our analysis highlights that a significant correlation exists between those two variables, and our econometric analysis confirms that tax revenues have an overall positive net effect on economic growth.

This implies that the positive effects associated with total tax revenues (such as the efficient spending of tax resources on public investment for the creation and accumulation of public capital and provision of public services) outweigh the distortionary effects (which have a negative impact on the growth rate). Notably, the magnitude of this overall net growth effect indicates that, in the long-run, the annual growth rate in real GDP per capita is increased by almost a quarter of a percentage point. The quantitative estimates of the short-run and long-run growth impact of tax revenues, suggest that tax policy has had an influential overall effect on economic growth. Consequently, generating sufficient amounts of tax revenues (in order to be efficiently spent on public investment) represents a vital factor for economic development in emerging and developing economies in Asia.

Our findings also underline the crucial importance of human capital, demographics, and economic restructuring away from agriculture towards manufacturing and services. As the empirical analysis reveals that increased tax revenues have helped the development process, it implies that, in a developing country context, tax revenues and public finance should play an important part in a country's economic growth efforts. Consequently, it is imperative that a sufficient amount of tax revenues are collected in order to maintain and generate new infrastructure and other forms of productive public capital as well as provide various vital government services. This is particularly true for developing economies with a substantial lack of infrastructure and public services.

Furthermore, the generation of adequate tax revenues allows a government to finance this infrastructure through own funds, avoiding thus the accumulation of domestic and external debt. When government debt becomes unsustainably high, it can cause a series of economic and fiscal problems and undermine future growth prospects.

On the other hand, it has to be noted that although a rise in tax revenues and productive public expenditures is expected to be beneficial (especially for countries with in initial low levels of taxation and public capital), the tax burden on the economy cannot be increased excessively and become too heavy. The reason is that the distortionary effects would become larger, causing probably the overall net growth impact of taxation to become smaller or even negative. Thus, the government's tax policy (from which public productive investments are to be financed) needs to be carefully designed in order to avoid distortionary effects and burdens on the private sector.

APPENDIX

Table A1: Definitions of variables and data sources

Variable / Economic Concept	Definition of Empirical Measure	Data Source
Economic Development (*DEV* or *y*)	Real GDP per capita (in constant 2010 US dollars)	World Development Indicators (WDI) database, World Bank.
Tax Revenues (*TAX*)	Total government tax revenues as a percentage of GDP	World Economic Outlook (WEO) database, IMF.
Private Capital Investment (*PC*)	Private physical capital investment as a percentage of GDP	WEO database, IMF.
Human Capital Investment (*HC*)	Education index of human development report	Human Development Report database, United Nations.
Economic Openness (*EO*)	FDI inflows as a percentage of GDP	WDI database, World Bank.
Country Population (*PO*)	Total country population	WDI database, World Bank.
Agricultural Production (*AG*)	Value added of agricultural sector as a percentage of GDP	WDI database, World Bank.
Macroeconomic Instability (*MI*)	Annual inflation rate	WDI database, World Bank.

Table A2: Correlation matrix and variance inflation factors for explanatory variables

	TAX	*PC*	*HC*	*EO*	*PO*	*AG*	*MI*	VIF
TAX	1							1.140
PC	-0.0984	1						1.170
	[-0.117]							
HC	0.2276	-0.0714	1					1.120
	[0.000]	[0.255]						
EO	0.1067	0.2720	0.1689	1				1.190
	[0.089]	[0.000]	[0.006]					
PO	0.1473	-0.0699	-0.0731	-0.0592	1			1.060
	[0.018]	[0.266]	[0.244]	[0.346]				
AG	-0.0846	-0.2299	0.0103	-0.1308	-0.0215	1		1.110
	[0.178]	[0.000]	[0.869]	[0.036]	[0.732]			
MI	0.0941	-0.0086	0.1438	0.1659	-0.0779	0.1840	1	1.100
	[0.151]	[0.895]	[0.027]	[0.011]	[0.235]	[0.004]		
Mean VIF								*1.130*

Table A3: Summary statistics of variables

Variable	Obs.	Mean	Std. Dev.
DEV or *y*	270	2260.8110	2098.3930
TAX	270	20.1823	9.7718
PC	270	28.4084	10.8685
HC	270	0.6059	0.0927
EO	270	3.0154	4.2663
PO	270	2.2300E+08	4.0700E+08
AG	270	19.5911	8.6019
MI	270	6.0703	5.6283

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