PUBLIC INVESTMENT TAXES AND INSTITUTIONS

GROWTH TESTS ON EMERGING MARKETS

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ABSTRACT

Generally, this research highlights three macro fiscal sectors with revenue generation based on taxes from output and production, revenue spending with public investments from tax funded budgetary allocations and government delivery by extension of its institutions.

The first empirical chapter examines broad tax issues affecting growth within our sample. We construct tax variables within a revenue-neutral framework and check for the observed growth effects. These results were subsequently ranked according to the magnitude of growth distortions. Corporate income tax reported the most distortionary growth coefficients, while personal income tax, consumption taxes and property taxes were less distortionary to output growth. Within the revenue neutral framework results obtained from the emerging markets studied, growth can be triggered with a reduction in income taxes and a corresponding increase in consumption taxes while leaving the overall burden of taxation unchanged.

The second empirical chapter focused on core investment issues in the public sector and productivity effects of public capital within a panel of emerging countries. Six new measures of public investment were constructed from available secondary data and plugged into our growth model with neoclassical and endogenous foundations while conditioning for the budget constraint and introducing the net marginal productivity of capital as an alternative dependent variable. We conclude that public investment is positively associated with growth irrespective of how these investments are financed. Our estimates also suggest a complimentary relationship with private investment ratios and we find no evidence of crowding out in our sample except beyond a 7 percent threshold.

The third empirical chapter looks at institutional effects that cause growth and development progress in these countries. Using Rodriks taxonomy, we broadly model market creating institutional indicators from the Frasier Institute and Polity IV datasets and examine the growth impacts. The research concludes that Institutions matter for growth and our sample institutions need to improve on the legal protection of rights and basic legal enforcement to continually attract and keep new investments.

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CHAPTER ONE-INTRODUCTION

1.1 Background

The questions regarding the effect of public investment on GDP per capita growth has risen in importance in recent years in terms of its value in driving government policies and the extensive discuss in literature on growth theory. Arguments exist on the efficiency of factor allocation mechanisms in the public sector. In the 1980's various structural adjustment programs were carried out by high debt developing countries with the objectives of rebalancing public and private sector investments. Importantly public investment spending increases the available stock of public capital and this is financed in part by the revenues generated from taxation. Public investment and the stock of available public capital can be viewed as crucial determinants of GDP per capita economic growth (Dessus and Herrera: 2000), yet the capital allocation between public and private investment remains crucial. The roots of the arguments on complementarities and private capital crowding out are old with foundations in the early neoclassical models, however this has been revived with the advance of the endogenous growth theories. Theoretically, the analysis of the impacts of public investment on economic per capita growth is still partly controversial with methodological challenges regarding the assumptions within the neoclassical and endogenous growth models. From the earlier literature, assessing the impacts at the macro level has been criticized for two main reasons; namely the unit roots in the public investment and public capital series and output alongside the endogenous concerns among fiscal variables used in empirical studies which may lead to simultaneous bias (Aschauer, 1989; Gramlich, 1994). This can invalidate the plausibility of obtained results. Broadly we attempt to address these concerns by first estimating with a panel framework which exploits both the time series and cross-sectional dimensions of the macro data. This takes care of the spurious regression issues without resorting to techniques of cointegration. Second, we also introduce error correction models and methodology that addresses the simultaneous bias

and endogeneity problem in the data. This allows our study to examine the impacts of public investment alongside introduced measures for a sample of emerging economies. This issue is examined with respect to important government budget constraints on the financing implications. The budget constraint will likely affect the allocation of government investment resources as well as the returns on the public capital. The results from our analysis rooted in the endogenous growth theory, conclude that GDP per capita growth is positively affected by public capital. Additionally, other inputs within the production function are significant and in line with expectations from prior studies. Our study also checks for the GDP-per capita growth impact of tax variables within a revenue neutral framework and the effectiveness of the market creating institutions in separate empirical chapters.

1.1.2 Neoclassical Growth and Convergence

The question of convergence has been highly discussed in the neoclassical models. It simply indicates that the starting point of per capita income is inversely related with the rate of predicted growth because of diminishing returns to capital. This means that poor countries should grow relatively faster than richer countries if other factors except initial level of per capita intensities are held constant. There exist numerous dissimilarities between economies and with these underlying differences; convergence is only conditional when observed with other variables of interest such as human capital, government policies and investment. The primary framework for convergence in the neoclassical model is diminishing returns to capital. The model assumes that nations with less capital per worker should have higher growth rates and higher rates of return for the same savings-investment ratio.

Another prediction of the neoclassical model is that in the absence of permanent advances in technology, per capita growth must finally end. However as Barro (1991) noted, analysis of long run data across countries show increasing rates of per capita growth can continue for over long periods of time and these growth rates have do not show any sign of

declining. The notion of an exogenous technical progress function however supports the explanation of the persistence of growth even with high initial level of per capita. With this assumption, endogenous (new growth) growth theorists argue that the neoclassical model explains everything except long run growth[1].

In summary, the neoclassical growth model made popular by Solow in 1956 assumed exogenous technological change and constant returns to scale as well as substitutability between capital and labour and diminishing marginal productivity of capital. A rise in the capital to labor ratio (investment and savings ratio) is first inferred as a basic source of economic growth before economies reach the steady state where fresh increases in capital will not generate economic growth unless there are improvements (technological) that will enable production with fewer resources. Another claim to note is that for similar amounts of capital available, the less developed economies will grow faster than the more advanced ones until steady state is reached and as such economic convergence can be achieved.

In response to the perceived failures of the neoclassical model, scholars developed models in which steady growth can be generated endogenously that is can occur without any exogenous technical progress at rates that may depend upon the taste and technology parameters and also policy.

1.1.3 Endogenous Growth

A critical observation of present and historical macro data will lead us to conclude that first world countries are much higher in per capita income levels than third world countries in present times when compared to earlier times in history. The core and periphery[2] seem not to be converging. Finding lack of convergence among world economies thus inspired the new

[1] This is because the determinant of steady state growth is not explained within (exogenous) the model as argued by McCallum (1996)

[2] Developed and Developing countries

growth (endogenous growth) theories pioneered by Romer (1986)(1990) and Lucas (1988). These theories in contrast to the neoclassical perspective indicate that the introduction of new accumulation factors such as knowledge and innovation to offset diminishing return to capital will induce self-sustained economic growth which ultimately leads to divergent growth patterns (Arvanitidis, Pavleas, & Petrakos, 2009). Comparatively, the new growth theory stretched the neoclassical model of growth by considering the steady state rate of growth as endogenous because it is affected by taste factors (for instance the savings ratio) and it is determined inside the model. At first, an endogenous growth rate was established by substituting Solow's notion of diminishing returns to capital by constant returns to capital broadly defined hence an important point of departure of these studies is the relaxation of the assumption of diminishing returns of capital which is inherent in the neoclassical models. The crucial property of these models is the constant or increasing returns to capital caused by the endogenous character of production technology. As outlined by Thirlwall (2011) work within this framework highlighted significant sources of growth which includes new knowledge, (Romer1990: Grossman & Helpman 1991) innovation (Aghion & Howitt 1992) and public infrastructure (Barro 1990). According to Thirlwall (2011), if there are not diminishing returns to capital, investment is important for long run growth and growth is endogenous in this sense. We can further assume positive externalities associated with human capital formation (for example, education and training) and research and development that prevent the marginal product of capital from falling and the capital-output ratio from rising.

1.1.4 Neoclassical Vs Endogenous Growth Summary

Traditional neoclassical (Solow-Swan[3]) growth models, which assume exogenous and universal technological progress and diminishing returns to capital accumulation, predict

[3] Introduced by Robert Solow in 1956

convergence of countries to the same steady-state rate of growth and level of income and capital per person, with initially poor countries catching up but not overtaking the rich countries.

By contrast, endogenous (Barro[4]) growth models, in which productivity growth is the outcome of incentive structures that may differ across countries, entertain the possibility of persistent divergence in growth performance and thus of the overtaking of one country by another or of ever-widening gaps between leaders and followers. This implies that the growth prospects of countries can be influenced by government policies.

The basis of this difference is their treatment of technical change and returns to capital accumulation. The neoclassical treatment of technical change is exogenous, while the endogenous model's treatment is within the model with the understanding that much of the technical innovation is the outcome of systematic investments in research and education (Isaksson 2007) hence part of the overall capital formation. Also regarding capital accumulation, the neoclassical growth model assumes diminishing returns to scale in contrast with the endogenous models that assume constant or increasing returns.

[4] Barro(1990)

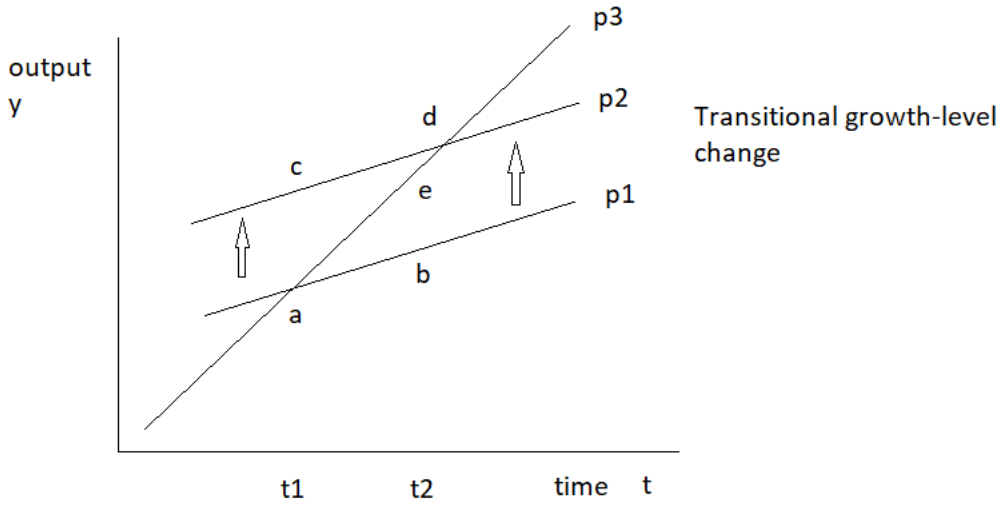


Figure 1 illustration of level (transitional) and growth (steady state) effects
Source: Author's presentation adopting Myles (2009a) approach

[5]

In summary the neoclassical model argues that long run growth can only be affected by exogenous changes hence any policy changes will affect only transitional or short run growth path[6] as shown in figure 1 above. This can also be described as a level change where the true growth path of a country remains unaltered. Using endogenous theory, economic growth has different effects in the short term and long term as illustrated in figure 1 adapted from Myles(2009a) presentation. p1 represents the pathway for output growth before a policy shock. With time, there will be movement from point a to b. The introduction of a fiscal shock will cause movement from a to c and this represents a level change with the slope remaining the same which implies the growth rate is still the same but there is a shift to a higher level of output. The level effect of a policy shock in p2 represents the temporary or short-term increase in growth rate while the output transitions to a new steady state.

Growth path p3 represents output shift from a to e as a result of a different policy shock that affects the long term growth rate with a steeper gradient. The economy moves from point

[5] Lines p1, p2 and p3 represent different output growth paths over time with movements from p1 to p2 representing a level change while p3 highlights a change in the slope
[6] P1, p2 and p3 represent different output growth paths

a at t1 to point e at time t2. Due to the cumulative effect of the higher growth rate, output eventually reaches a higher level.

In the neoclassical theory, any fiscal policy shock is only expected to have transitory or level effect while the growth rate is exogenously determined.

For growth studies on fiscal policy rooted in the endogenous framework, the long term growth path (p3) is estimated by excluding the effect of short term economic fluctuations usually based on five year averaging[7] of the data. This research is theoretically based on the endogenous growth model. The implications from our results is valid for transitional and long run growth from our treatment of data averaging and application of a long run growth model with a speed of adjustment parameter.

To conclude this section, we can generally infer that the development of the public sector and improvement on efficiency parameters in its macro-fiscal activities is vital for setting the right foundations for countries to thrive. This is particularly important for emerging markets that aim to complete the leap from underdeveloped market conditions to advanced market conditions. The focus on fiscal activities of government and the presence of growth promoting fundamentals that can reduce distortions and increase competition is important for emerging markets with observed deficiencies in public capital, inefficient institutions and tax systems.

1.2 Research Questions

The aim of this thesis is to extend the debate and highlight the GDP per capita growth and productivity effects of new public investments that add to the existing capital stock. Empirical growth tests on the role of different types of taxes within a revenue neutral framework is also presented alongside the impacts of market-creating institutions within our sample.

[7] Kneller, Bleaney and Gemmell (1999) argue that this allows for separation of short run and long run effects though it was later Bleaney et al. (2001) argued that the long run effects are not fully isolated

This research broadly aims to answer the following research questions

1. What is the GDP per capita growth impact of taxation in emerging markets? Can different types of taxes affect growth differently without changing the overall tax ratio?
2. To assess the contribution of public investment and public capital estimates to GDP per capita growth and productivity measures. Can we identify any crowding out effects of resources?
3. Do institutions matter for GDP per capita growth in emerging markets? We aim to evaluate the institutional conditions in these markets and report the growth impacts

To answer these broad questions, we study fundamental growth determinants alongside our variables of interest within our sample. With public investment as the central theme of this thesis, we examine first the revenue generation implications for government via the tax setting in a revenue neutral framework, after which the spending and institutional implications are presented as independent growth essays.

1.3 Significance of Our Study:

This research provides a comprehensive assessment of growth determinants at the macro level. To highlight countries' ability to promote output increases, using a top down approach, we examined the growth effects of public investment, taxes and institutions at aggregate level across countries. Though studies exist on macro-determinants of growth, we make various contributions to the existing literature by splitting the investment ratio to the private and public component, the introduction of different time specification to control for volatile business cycles within our data and the introduction of different quantitative measures of public investment. This gives robust implications to the results and helps to correct for

potential correlation or endogeneity between the main public investment measure and output growth.

There are different ways of highlighting capital returns or its productivity and this study takes the innovative approach of presenting a simple measure of productivity of capital and testing the public investment impacts within a panel framework. This research also produces original estimates on the crowding out implications for our sample of countries and the introduction of the budget constraint in the model is a first for emerging markets to the best of my knowledge during the study period.

This research also yields original regression estimates to highlight revenue neutrality within an emerging market context on taxes. Readily available literature on the subject abounds for OECD and other sub samples of high income countries but none addresses the tax structural implications for emerging markets as we have presented alongside identification of a long run growth relationship.

Regarding the novelty of our analysis on the empirical chapter covering institutions, we adopt Rodrik(2005) classification to test explicitly for market creating institutions and introduce a range of sub components and interaction terms which yield original estimates highlighting the growth impact of legal system and property rights alongside security of property rights amongst other institutional variables.

1.4 Econometric Estimation - Panel Data Methods:

In order to test for the different questions in this thesis, we assembled a panel dataset of 21 Emerging countries from 1990 to 2012[8]. Panel data addresses unique problems. Its two dimensional nature implies an increase in the number of observations and the amount of variation, thereby leading to more degrees of freedom and greater efficiency of econometric estimates. Moreover, the problem of collinearity that greatly affect time-series and cross-sectional data is significantly reduced. Additionally, panel data models deal with endogeneity bias stemming from correlation between individual specific effects and the error term (Hsiao, 2003). This section, therefore discusses the different panel data models adopted for econometric analysis in this study. Namely, fixed or random effects estimator[9]; generalized method of moments (GMM)[10], Pooled mean group estimator (PMG)[11].

1.5 Fixed and Random Effects Estimators

The two most popular linear panel data models are arguably the fixed and random effect estimators. In fact, they are usually the starting point of most econometric analysis panel data studies. Given a panel regression specification as follows;

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \qquad (1.1)$$

Where y_{it} is the dependent variable, α_i is the unobserved individual or country effect which is constant over time and peculiar to each individual country. It is also the time-invariant component of the error term. X is a vector of independent variables while ε_{it} is the idiosyncratic

[8] 2010 in Chapter 3 due to the incomplete sub categories of tax data.
[9] The Pooled OLS is also included and choice based on hausman tests
[10] 2-step variant also introduced
[11] The Mean Group(MG) and Dynamic fixed effects (DFE) also tested but not included in main results

error term which is assumed to have zero mean and is uncorrelated with the explanatory variables.

In the fixed effects model, α_i is allowed to be correlated with the regressions in X which implies some form of endogeneity. This endogeneity problem is resolved by subtracting the means of each variable from equation (1.1) thereby eliminating the fixed effects. The mean difference equation is specified as follows;

$$y_{it} - \bar{y}_{i} = + \beta(x_{it} - x_{it}) + (\varepsilon_{it} - \varepsilon_i) \qquad (1.2)$$

The FE or within estimator hence performs an ordinary least squares estimation of the equation 1.2 leading to consistent estimates of parameters. The coefficients of β are also constrained to be the same for all individuals. One main drawback of the FE estimator is its inability to estimate the coefficient of any time-invariant variable. Also when the model is dynamic with the introduction of a lagged dependent variable, the model may be subject to bias unless the time dimension of the data is large compared to the number of groups.

The Random effects estimator is the feasible generalized least squares estimation of the equation 2 under the assumption that the individual effect and idiosyncratic error term are independent and identically distributed (i.i.d). That is,

$$y_{it} = \beta X_{it} + (\alpha_i + \varepsilon_{it}) \qquad (1.3)$$

where $\alpha_i \rightarrow (0,\sigma^2)$ and $\varepsilon_{it} \rightarrow (0,\sigma^2)$. In addition, the RE can estimate coefficients of time invariant variables; an advantage it possesses over the FE estimator. The random effects estimator produces efficient and consistent estimates; however, if the fixed effect is the appropriate model, then the RE is inconsistent. To choose between FE and RE estimators, a Hausman (1978) specification test is performed. This post-estimation test has the null hypothesis that there is no correlation between the individual effect (α_i) and the error term. In

other words, if the null hypothesis is not rejected, the RE is the appropriate estimator; otherwise FE is employed.

1.6 Generalized Method Of Moments

The generalized method of moments (GMM) is an instrumental variable estimator developed by Holtz-Eakin, Newey and Rosen (1988); Arellano and Bond (1991); Arellano and Bover (1995) and Blundell and Bond (1998). It is a linear dynamic panel estimator in which the lagged dependent variable is introduced as one of the regressors. The GMM is suited for models in which some of the explanatory variables are endogenous or predetermined; where there are fixed effects and, where heteroscedasticity and autocorrelation are present among variables.

Assume we want to estimate a dynamic panel model as specified in equation (1.4) below:

$$y_{it} = \eta y_{i,t-1} + \beta X'_{it} + \alpha_i + \varepsilon_{it} \qquad (1.4)$$

Where y_{it} is the dependent variable and η is the coefficient of the lagged dependent variable. X is a vector of explanatory variables; α_i is the individual fixed effects while ε_{it} is the idiosyncratic error term which is uncorrelated across individuals.

The presence of the fixed effects in equation (1.4) above introduces some form of endogeneity which Arellano and Bond(1991) estimates by first differencing as shown in equation (1.5) below.

$$Y_{it} - Y_{it-1} = \eta(Y_{i,t-1} - Y_{i,t-2}) + \beta(X'_{it} - X_{it-1}) + (\varepsilon_{it} + \varepsilon_{it-1}) \quad (1.5)$$

This can be rewritten as

$$\Delta y_{it} = \eta \Delta y_{i,t-1} + \beta \Delta X'_{it} + \Delta \varepsilon_{it} \quad (1.6)$$

The first-difference transformation or "Difference GMM" has a weakness[12]. It tends to magnify the gaps in unbalanced panel data so that if y_{it} is missing for instance, then both Δy_{it} and $\Delta y_{i,t-1}$ will be invariably missing in the transformed data. This shortcoming motivated Arellano and Bover (1995) to introduce another type of transformation which minimizes data loss and is called "forward orthogonal deviations"(FOD). Instead of subtracting the previous observation from current ones, it subtracts the average of all future observations of a variable as shown in equation (1.7) below. In order words, this transformation is computable for all observations except the last one for each individual, regardless of how many gaps are in the data. It is important to note that we adopt the forward orthogonal deviations transformation as the panel data is unbalanced.

$$Y_{it} - \bar{Y}_{it} = \eta(Y_{i,t-1} - \bar{Y}_{i,t-1}) + \beta(X'_{it} - \bar{X}'_{it}) + (\varepsilon_{it} + \bar{\varepsilon}_{it}) \quad (1.7)$$

This can also be rewritten as

$$\forall Y_{it} = \eta \forall Y_{i,t-1} + \beta \forall X'_{it} + \forall \varepsilon_{it} \quad (1.8)$$

Where $\forall$ represents the Forward Orthogonal Deviations sign

$$\bar{Y}_{it} = \frac{1}{T-(t+1)} \sum_{k=t+1}^{T} Yik$$

[12] Arellano-Bover(1995) and Blundell-Bond(1998) augmented the difference GMM estimator by making an assumption that first differences of instruments are orthogonal to fixed effects. This allows the introduction of more instruments and therefore improves efficiency. This is called system GMM

$$\nabla Y_{it-1} = \frac{1}{T-(t+1)} \sum_{k=t+1}^{T} Yi, k\text{-}1$$

$$\nabla X'_{it} = \frac{1}{T-(t+1)} \sum_{k=t+1}^{T} Xik$$

$$\nabla \varepsilon_{it} = \frac{1}{T-(t+1)} \sum_{k=t+1}^{T} \varepsilon ik$$

Although equation (1.8) contains no fixed effects, the inclusion of the lagged dependent variable presents another potential source of endogeneity. Put differently, y_{it} term in $\nabla y_{i,t-1}$ is correlated with the ε_{it} in $\nabla \varepsilon_{it}$. The conventional solution to this problem is to find instrument variables that are correlated with the regressor $y_{i,t-1}$ but uncorrelated with the error term. According to the GMM, the only available instruments are internal: that is longer lags of the endogenous variables. In equation (1.8) for example both $y_{i,t-2}$ and $\Delta y_{i,t-2}$ are valid instruments for $\nabla y_{i,t-1}$ as they are related to the later but not with the error term.

1.7 Diagnostic Testing

Serial Correlation: The GMM produces consistent and efficient estimates if there is no autocorrelation in the idiosyncratic error term. For instance if the error term ε_{it} in equation (1.4) was serially correlated of order 2 then $y_{i,t-2}$ will become an invalid instrument as it is endogenous to the lagged error term $\varepsilon_{i,t-2}$. This will imply that the instruments set should be restricted to lags 3 and longer. However if there is a third-order autocorrelation, then even longer lags are required. Arellano and Bond (1991) developed an autocorrelation test which is applied to the residuals in differences. The evidence of a first-order serial correlation in differences is expected in this test as $\Delta\varepsilon_{it}$ is correlated with $\Delta\varepsilon_{i,t-1}$ via the presence of $\varepsilon_{i,t-1}$ in both variables, thus making this result irrelevant. The result of the second-order correlation test is however relevant for checking serial correlation of order-1 in levels. This is based on the presumption that the test will detect the correlation between the $\varepsilon_{i,t-1}$ in $\Delta\varepsilon_{it}$ and $\varepsilon_{i,t-2}$ in $\Delta\varepsilon_{i,t-2}$. In other words, the serial correlation result of order $\tau+1$ shows the presence of autocorrelation of order τ. In our results, we present the P-Value of the second order correlation test of the error term. A rejection of the null hypothesis will mean there is no serial correlation of order-1 in levels[13]

[13] This method will not work for the orthogonal deviations GMM as all residuals in the deviations are mathematically interrelated, depending on the number of forward lags. Therefore the test is applied to residuals in differences even after using deviations GMM to estimate parameters

1.8 Test of Over-Identifying Restrictions:

The validity of the GMM estimator rests on the central assumption that the instruments are exogenous. If the model is exactly identified, then it will be impossible to detect invalid instruments as the number of instruments equal the number of endogenous variables. However, if the model is over-identified, a joint validity test of the moment conditions (that is over-identifying) restrictions under the null hypothesis that the excluded instruments are valid; that is they are orthogonal to the error term. If the null hypothesis is rejected then the validity of instruments is nullified. The test statistic is a chi-square with degrees of freedom equal to the degree of over-identification.

Hansen (1982) also developed a test for over-identifying restriction called the J-statistic. This test is equivalent to that of Sargan (1958) under the assumption of conditional homoscedasticity.

1.9 Instruments Proliferation

The GMM estimator tends to generate many instruments which can overfit endogenous variables, thereby leading to biased results. However the literature is scanty on what can be defined as "too many" instruments (see Roodman 2009 and Ruud 2000).

1.10 Robustness:

All GMM estimations have standard errors that are robust to different patterns of heteroscedasticity and autocorrelation with panels

1.11 Pooled Mean Group: The PMG is a maximum likelihood estimator in which coefficients, intercepts and error variances are allowed to change in the short run while estimates of the parameter are constrained to be equal across the panel in the long run. The autoregressive distributive lag model is used and all regressors are assumed to be stationary. The speed of adjustments of each country within the panel is estimated alongside the individual

short run estimates. The error correction model basically estimates variables in differences and levels.

In comparison with two similar methods employed in the estimation of dynamic panel models namely the Dynamic Fixed Effects (DFE) method and the Mean Group (MG) estimator. The PMG serves as a preferred intermediate procedure (Acosta et al., 2012). The MG method analyses the short run and long run coefficients distinctly for each country while analysing the distribution of country-specific estimates.[14] The DFE method imposes a homogeneity assumption, indicating the short- and long run coefficients and error variances are the same across countries. The PMG approach constrains the long run coefficients to remain homogenous across countries while allowing heterogeneity in the short run components and the error variances. Hence, more efficient estimates are obtained using PMG in comparison to MG and DFE[15]

To highlight the PMG method also applied in this study, Consider an Autoregressive – Distributed Lag (ADL) model shown below:

$$y_{it} = \sum_{j=1}^{P} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \epsilon_{it} \qquad (1.9)$$

$$i = 1,2, \dots N, and\ t = 1,2, \dots T$$

Where $X_{it}(k \times 1)$ is a vector of explanatory variables for each group $i; \lambda_{ij}$ are scalars and δ'_{ij} are a vector of coefficients; μ_i shows the fixed effects and the error term is represented by ϵ_{it}. When the equation is rearranged, the error correction term is obtained as introduced by Pesaran, Smith and Shin (1999)

$$\Delta y_{it} = \emptyset_i \left(y_{i,t-1} + \frac{\beta'_i}{\emptyset_i} X_{it} \right) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta^{*\prime}{}_{ij} \Delta X_{i,t-j} + \mu_i + \epsilon_{it} \qquad (1.10)$$

[14] Often the average.
[15] For completeness and comparison we also examine our sample using the MG and DFE.

Where $\emptyset_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$, $\beta_i = \sum_{j=0}^{q} \delta_{ij}$, $\lambda_{ij}^* = -\sum_{m=j+1}^{p} \lambda_{im} (j = 1,2, \dots p - 1)$ and $\delta_{ij}^* = -\sum_{m=j+1}^{q} \delta_{im} (j = 1,2, \dots q - 1)$.

This error correction model specified separates the long run relationship among the variables as its main advantage and this is captured by the term $(y_{i,t-1} + \frac{\beta'}{\emptyset_i} X_{it})$, from the short run convergence of adjustment. The speed of convergence is measured by the parameter $\emptyset_i$ towards the relationship in the steady state. All coefficients are i specific. The homogeneity assumption in the long-run restricts $\frac{\beta_i'}{\emptyset_i}$ to be equal across groups. The restricted equation then becomes

$$\Delta y_{it} = \emptyset_i (y_{i,t-1} - \theta X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta^{*\prime}{}_{ij} \Delta X_{i,t-j} + \mu_i + \epsilon_{it} \qquad (1.11)$$

Where $\theta = \theta_i = -\frac{\beta_i'}{\emptyset_i}$. The PMG estimator as used by Arnold et al is obtained when the restricted equation is estimated using the maximum likelihood method.

1.12 Estimation Summary: The fixed/random effects, FOD Generalized method of moments and pooled mean group were adopted in chapters two and three. In chapter four, the FOD generalized method of moments, 2 step GMM and fixed effects estimators were applied.

1.13 Limitations and Further Research

The empirical approach in all the chapters are an original contribution specifically to the emerging market sample we have chosen. The poor quality of readily available data alongside incomplete/data gaps for sub components of our variables of interest constrains the results and limits the way we are able to utilize and intreprete the coefficients.

The heterogenous nature of countries in a panel also limits the interpretation of implications for an individual country within the group hence our results can be further

validated by within country bottom-top analysis with which to compare to the panel group average.

1.14 Organisation of the Thesis:

Chapter 2 highlights revenue neutrality and the role of taxes, which are ranked according to the distortionary impacts on growth. Chapter 3 presents the spending implications of public capital and addresses challenges present in the literature with the introduction of internal instruments and alternative measures while noting the budget constraint implications. Chapter 4 debates the role of different types of institutions after which we check for interaction effects and Chapter 5 presents a summary of our findings and policy recommendations.

Chapter 2: Revenue neutral shifts on broad composition of taxes

2.1 Introduction

Instruments of public policy such as tax rate changes have different effects in the exogenous and endogenous growth literature. The prediction of the exogenous growth model indicates that changes in government policies do not lead to permanent growth of output. This means that structural changes in applicable taxes within a country will only have an effect on its growth path that is at best transitory (Ramsey, 1928; Solow, 1956; Cass, 1965). This indicates that a country will ultimately return to its previous long run growth path with a level change. Hence the growth of output only increases or decreases during the transition phase. However this is not the case with the endogenous growth theories as the policy effects of changes in tax rates or structure may have an effect on growth (Romer, 1986; 1990; Lucas, 1988; Rebelo, 1991; Padda & Akram, 2009). Taxation also affects other determinants of economic growth including labour,[16] savings[17] and investment[18] (Leibfritz et al., 1997).

Some of the available studies have checked the growth effect of tax policy with a focus on OECD or high-income countries, and research considering emerging countries is limited. The aim of this chapter is to examine the link between economic growth and tax structures in our emerging sample for the longest period available. We first construct the emerging dataset using the World Bank economic outlook data for macro variables and the Government Revenue ICTD dataset for the broad and sub-categories of taxes, while the human capital data was obtained from the Barro and Lee dataset on education. The emerging sample contains on average about 20 years of overall tax data for each country.

We also explore the relationship between the total tax revenue and per capita GDP growth, robust to different time specification using the Fixed Effect estimation subject to

[16] Creates a wedge between hours worked and wages earned. This potentially serves as a disincentive to work.
[17] Increasing personal income tax decreases the disposable income which leaves less for savings for households.
[18] Corporate investment decisions are also affected by corporate income taxes.

varying time-averaged data between annual and five-year periods. We extend the research study to shed light on potential endogeneity among model variables using the Forward Orthogonal Generalised Method of Moments technique (FOD GMM).

Using our dataset in a panel framework, we apply a Pooled Mean Group approach as introduced by Pesaran et al. (1999) to examine the long run relationship between tax composition and economic growth. This is broadly split between direct and indirect tax ratios in a revenue-neutral setting where total revenue is the common denominator in the data construction. Effectively, direct plus indirect tax gives unity.

Specifically, we investigate if the tax structure changes within a revenue-neutral setting affect GDP output growth in the long run, as suggested by Arnold et al. (2011), although with one distinct feature: the authors examine the impact of different tax composition changes using the GDP per capita level, while this study uses GDP per capita *growth*[19] rate as the dependent variable. Hence this research shares a common objective of examining fiscal policy variables relationship with GDP per capita growth as examined by Acosta et al. (2012), Gemmell et al. (2011) and Kneller et al. (1999). However, our study is focused on emerging markets and we extend the analysis with the GMM technique and different time specifications.

Highlighting the core results, we conclude that, if the overall tax-GDP ratio is unchanged, raising direct taxes while reducing indirect taxes will negatively affect growth. The negative relationship shows greater significance if corporate income tax is increased, as reflected in the highly negative coefficients from our estimation. On the other hand, our results within the revenue-neutral framework suggests that an increase in the indirect tax with a corresponding decrease in direct tax will be growth-promoting. The results for sub-categories of taxes presented non-robust values largely due to the poor quality of available data.[20]

[19] This approach is also used by Acosta et al. (2012).

[20] For sub categories, IMF paper Acosta et al. (2012) also obtained non-robust values for low income countries.

The rest of the paper is structured as follows. Section two presents the theoretical relationship between GDP growth and taxes while highlighting some empirical results from similar studies, after which we discuss the data, methodology and results before drawing conclusions.

Section 2.2: Literature Review

2.2.1 Neoclassical vs Endogenous Framework

Padda and Akram (2009), argue that the main feature of the endogenous theory of economic growth is that permanent changes in the long run growth path of a country can be caused by permanent changes in a variable, which are potentially influenced by government policies. This sharply contrasts with the exogenous growth theory with its prediction of only temporary effects. According to Myles (2007), endogenous growth can arise when labour and capital are augmented by introducing inputs in the production function[21]. For instance, introducing a public good financed by taxation can help to understand the link between economic growth and government policy. Such public sector input in the production function provides a direct mechanism through which policy can affect growth. Inference from the endogenous growth theory indicates that financing through taxes will have an effect on welfare and growth by distorting investment decisions as the structure of taxes allows some investments to be more profitable than others. Taxes also affect the labour supply through time allotment between leisure and work. The empirical literature suggests both inverse and direct relationship between rates of growth and the tax burden. This indicates that a higher burden of tax can elevate or decrease the rate of economic growth. Hence, as explained by Yi (1996) and Scully (2006), future economic output may increase with the optimal tax rate. Hence future revenues

[21] The AK model is usually adopted as the basis for the production function. By design the model assumes a constant return to scale assumption

from taxes would be higher even with a lower rate of taxation if the present rate is higher than the optimal rate.

2.2.2 Total Tax Effects on GDP Growth

Efforts to empirically identify the overall[22] effects of taxes on economic growth are quite challenging as the effect of taxes on investment, savings and labour, alongside the potential substitution between these factors raises complexities. A few studies[23] mainly influenced by the endogenous growth theories that take a 'top-down' approach[24] and try to determine at the macro level the impact of taxes on growth. Most of these studies conclude that tax-GDP ratio is inversely related with growth of the real GDP. This implies that economic

[22] Total Tax/GDP ratio, this represents the government revenue as a ratio of GDP
[23] See Barro & Redlick, 2011.
[24] Scholars have suggested complementing with the bottom-up approach to validate obtained estimates

growth is hampered by higher tax rates beyond an optimal point. Table 2.1 shows a summary of research on taxation and economic growth.[25]

Table 2.1. Summary of Research on Taxation and Economic Growth

Study	Method/Data	Findings
(Gemmell, Kneller, & Sanz, 2011) (Bleaney, Gemmell, & Kneller, 2001) (Kneller, Bleaney, & Gemmell, 1999)	Pooled Mean Group OECD Countries(17) from 1970-2004 OECD Countries from 1970-1995	Income and Profit taxation are most distortionary and affect growth inversely. Consumption taxes are least harmful on growth
(Arnold, et al., 2011)	Pooled Mean Group. OECD Countries(21) from 1971 to 2004	Ranking of taxes from least harmful include property taxes, consumption, personal income taxes and corporate income tax as the most harmful
(Barro & Redlick, 2011)	Fixed Effects (Neoclassical Setting). United States from 1912 to 2006	Reduction in the average marginal tax rate leads to an increase in per capita growth the following year
(Romer & Romer, 2010)	VAR Study Post World War United States (New exogenous measures)	Tax increases affects investment negatively and a 1 % increase in federal revenue leads to a 3% fall in output
(International Monetary Fund, 2010)	Dynamic Fixed Effects Advanced Countries(15) 30 year data	Fiscal consolidation lowers output and increases unemployment in the short term. it is worsened with reliance on tax hikes
(Lee & Gordon, 2005)	Panel fixed effects. 70 countries 1980-1997	Increase in corporate tax rates leads to lower future growth rates
(Miller & Russek, 1997)	Pooled Cross Section and Fixed Effects. Developed and Developing countries from 1975	Spending from tax financed revenue increases growth in developing countries but reduces growth in developed countries
(Mendoza, Milesi-Ferretti, & Asea, 1997)	5-year Panels. OECD countries(18) from 1965-1991	No effect on growth from the overall burden of tax levels
(Easterly & Rebelo, 1993)	Cross-section evidence from 1970-1988. Developed and Developing countries	Found no significant effect and concluded that it is difficult to isolate the tax effects empirically

[25] Arnold paper examines GDP per capita level as the dependent variable.

2.2.3 Structure of Taxation – Revenue-Neutrality

In the existing literature, tax structure is classified broadly into five categories. This corresponds with the classification in the OECD Revenue Statistics namely:

- Labour[26] income taxes, capital[27] income taxes and consumption[28] taxes[29]
- Distortionary[30] taxes and non-distortionary[31] taxes
- Direct[32] taxes and indirect[33] taxes[34]
- Income taxes, consumption taxes, and property taxes[35]
- Other taxes[36]

The estimation methods usually involve fixed effects, dynamic panels[37] or PMG[38] estimations that distinguish between long run and short run effects.

This research adopts the tax revenue neutrality as used by Arnold et al. (2008: 2011); Xing (2011: 2012); Santiago and Yoo (2012) is shown in Equation (2.l), where T is the total tax revenue (total tax/GDP ratio) and T_i is an individual (sub category) tax of the tax revenue. When the share of each individual tax, making up the total tax revenue, is added up, the result is 1.

$$\sum_{i=1}^{n}(T_i/T) = 1 \qquad (2.0)$$

[26] Made up of taxes on income profits and capital gains of individuals
[27] Includes taxes on capital gains of corporations and income profits
[28] Includes broad taxes on goods and services
[29] Adopted by Mendoza et al. (1995;1997); Angelopous et al. (2006)
[30] Introduced by Kneller et al. (1998:1999); can be described as taxes that hinders decision making of agents to save and invest and these include income and payroll taxes.
[31] These do not affect the decision making of economic agents to save and invest
[32] Includes income taxes, payroll taxes and social security contributions
[33] Mainly comprise of consumption taxes
[34] Mercedes and Mehrez (2004); European Commission (2006) use this method of classification
[35] Widmalm (2001); Arnold et al. (2008: 2011); Santiago and Yoo (2012) use this classification
[36] Includes other forms of taxation not classified under the OECD Revenue Statistics
[37] Bleaney et al. (2001); Gemmell et al. (2007: 2011)
[38] Gemmell et al. (2007: 2011); Arnold et al. (2008: 2011); Xing (2011: 2012); Santiago and Yoo (2012)

Empirical estimations under the revenue neutrality condition involves omitting one of the individual tax categories in the regression. The omitted tax variable is interpreted as the compensating variable and the overall tax ratio as the control variable in this setting remains unchanged.

2.3 Data

This empirical study considers average rates of growth and tax ratios from 1990-2012 which spans just over two decades, with suitable time for long run growth dynamics to be observed, with an attempt to capture the direction of causation between growth rates and the taxes under investigation.[39] The data under review is obtained and constructed from various sources. The investment data is the gross fixed capital formation as a percentage of GDP which is retrieved from the World Bank dataset alongside per capita income, constructed growth rates of the working population, government consumption and GDP growth rates. Human capital, which is a notable variable within the endogenous growth framework made popular by Barro (1991), is measured by the average years of schooling of the adult population obtained from the Barro-Lee human capital data,[40] while tax rates were obtained from the ICTD Government Revenue Database. This study focuses on 21[41] emerging markets with comparatively high growth rates. Some underlying differences in political index can be observed with the heterogeneous sample as we can note different underlying institutions and types of governments (Russia may be considered less democratic and China more communist) and instances of regime changes within the time period under review and the sample set. The dataset may also contain measurement errors or inconsistencies. According to Barro (1999), notable

[39] To confirm that the resulting estimates are not due to potential fiscal endogeneity of variables.
[40] This was annualised using the cubic spline interpolation method.
[41] Brazil, India, Mexico, Turkey, Bulgaria, Peru, Ukraine, Thailand, Czech Republic, Estonia, Slovenia, Venezuela, Argentina, Chile, Greece, Hungary, Korea, Lithuania, Nigeria, Poland and Romania

diversities within observed cross country samples may lead to measurement errors and inconsistent or biased results.

Descriptive statistics for the complete data set are presented below. Surprising growth rate figures can be observed and this can be attributed to high impact shocks in the countries; for instance high negative growth rates are observed in Ukraine during the political turmoil of the early 1990s, while values in excess of 30% can be observed from the Nigerian[42] data in 2004.[43] Such extremes in the data are an indication of the volatile nature of the countries under examination, although our methods will eliminate the effect of outliers observed.

[42] Rebasing the output measurement in 2014 adjusted historical rates – China reports the next higher growth rate.
[43] Technological spread from GSM introduction-forward market extensions are among reasons given.

Descriptive-Statistics
Table 2.2

Variable	Mean	Std. Dev.	Min	Max
GDP per capita growth	2.684336	5.351261	-22.55085	30.3440
GDP per capita	6945.135	5336.325	399.3269	24306.9
Average years of schooling	8.623817	2.204253	2.96	12.1
Total Investment	22.3126	5.926539	5.458996	41.6315
Government consumption	14.94966	4.775384	2.975538	27.8369
Working population growth	1.032733	2.08579	-9.869221	10.8008
Total tax revenue	18.40688	5.581544	3.3574	33.326
Direct tax	7.282642	3.136328	. 44S8	23.08
Indirect tax	11.13834	3.351175	2.006	18.021
Income tax	6.627418	2.725547	0.5543	22.826
Personal income tax	3.529724	2.270664	0.0166	8.782
Corporate income tax	2.719933	1.491369	0.5299	11.845
General sales tax	9.627542	3.572781	0	16.91
Trade tax	1.077092	0.9166495	-0.0017	4.392
life expectancy	71.28268	6.536196	46.07283	81.3682
Fertility rates	2.114168	1.11681	1.076	6.4

The trend of tax systems in these countries is of empirical interest; hence figure 2.1 shows average overall tax ratios of our cluster of emerging economies as compared with advanced countries' averages.

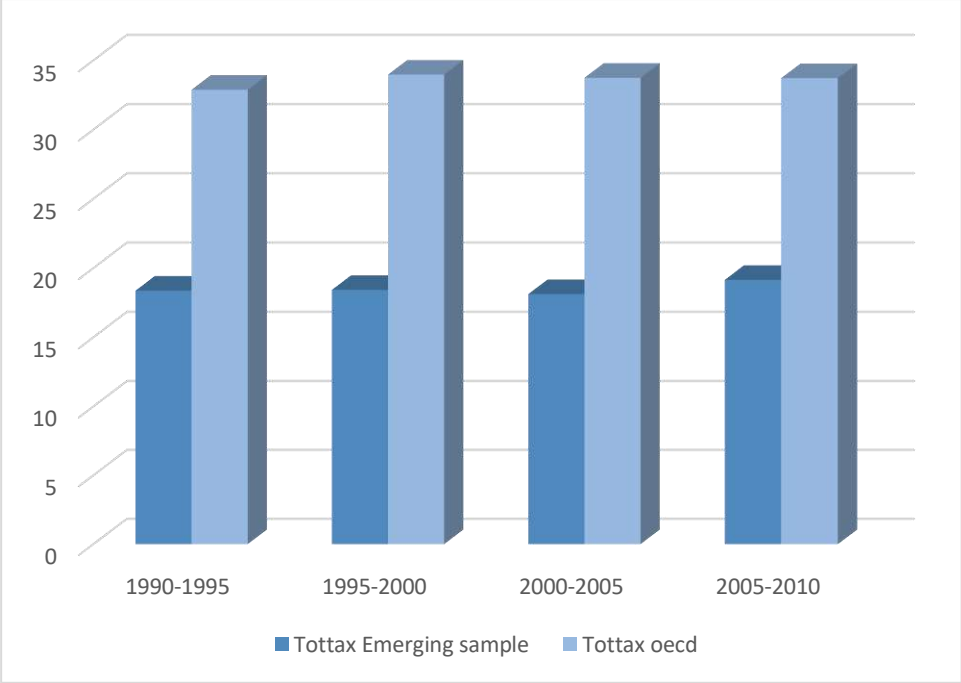


Figure 2.1. Tottax ratios

We can observe relatively low figures for emerging markets, consistently less than 20% of GDP across the period under review. Our sample consists of tax ratios starting at roughly 18% in the first five-year period in the early 1990s with fairly consistent mean rates over the next decade and increasing to a high of just over 19% of GDP in the period from 2005. In contrast, the OECD group of industrialised countries report consistent rates of tax revenues in excess of 30% of GDP over time. These rates have been maintained and the data reports a peak of 34% at the start of the 20th century. A simple eyeball test and interpretation of this graph indicates that this research sample is relatively undertaxed (roughly 50% difference) when compared with obtainable rates in advanced economies, although caution should be applied in interpretation as the optimal tax rate of each country is expected to be unique to its individual characteristics[44].

[44] Tax optimality measurement is beyond our chapter scope

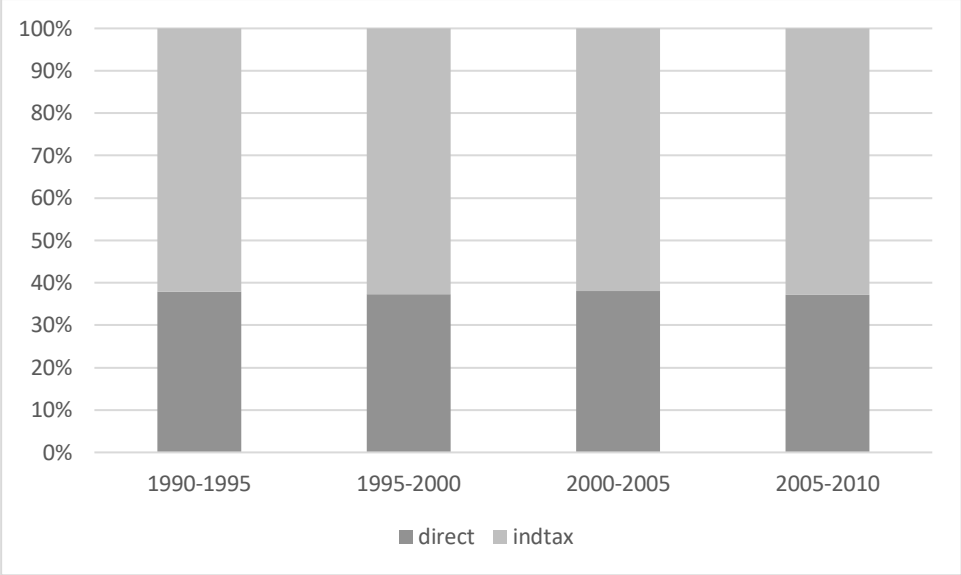


Figure 2.2 Direct-indirect ratios

Figure 2.2 displays graphs for the sub aggregates of the total tax revenue for emerging markets split into two broad categories of direct and indirect taxes. The direct and indirect tax mix will be the analysed in the next section as the main empirical focus of this chapter, and we can observe rates split at around 40-60%, again consistent within the time focus of this chapter. This split is different from the mean average split direct-indirect rates of roughly 50% of each category observed in OECD countries.

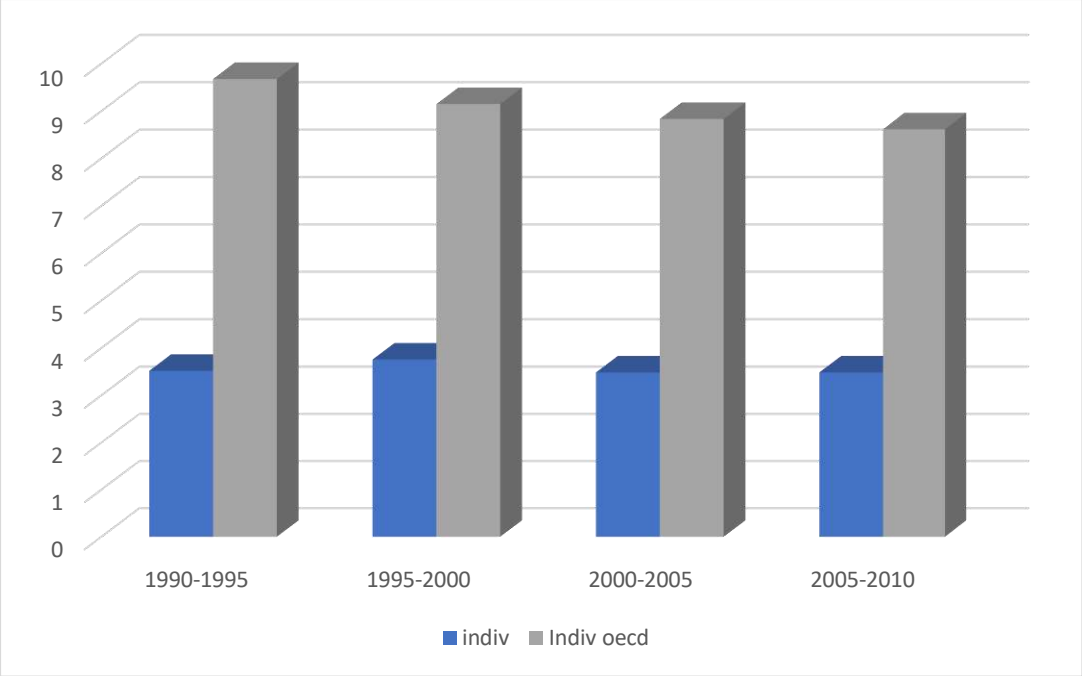


Figure 2.3. Individual tax ratios

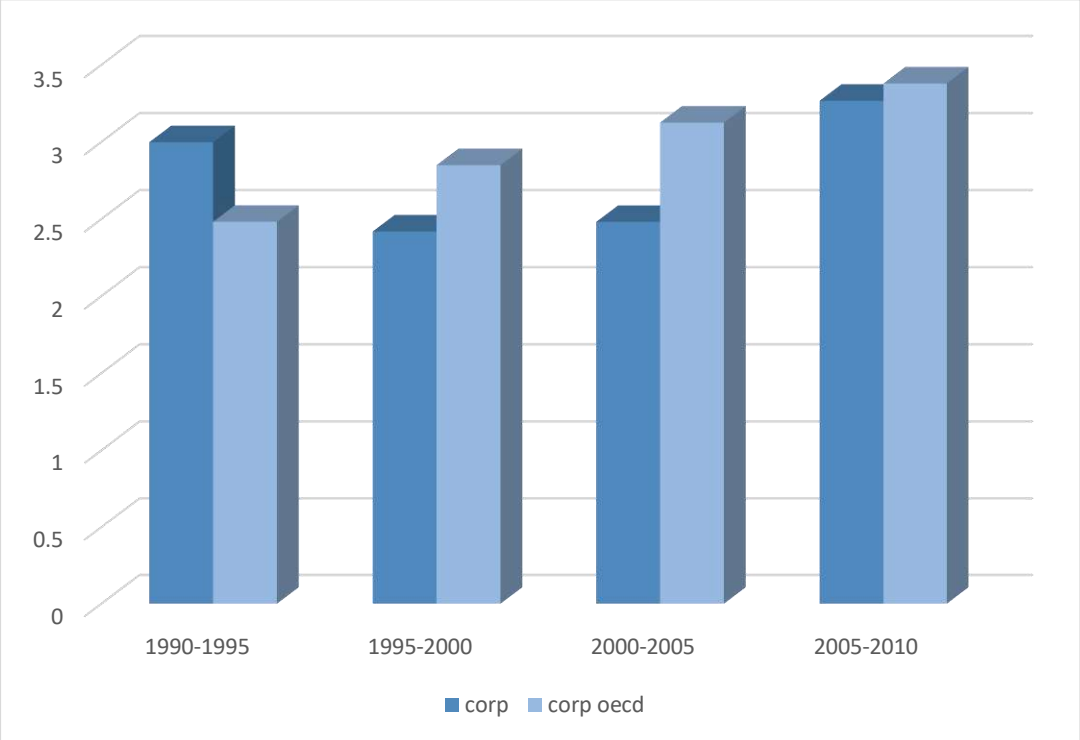


Figure 2.4. Corporate tax ratios

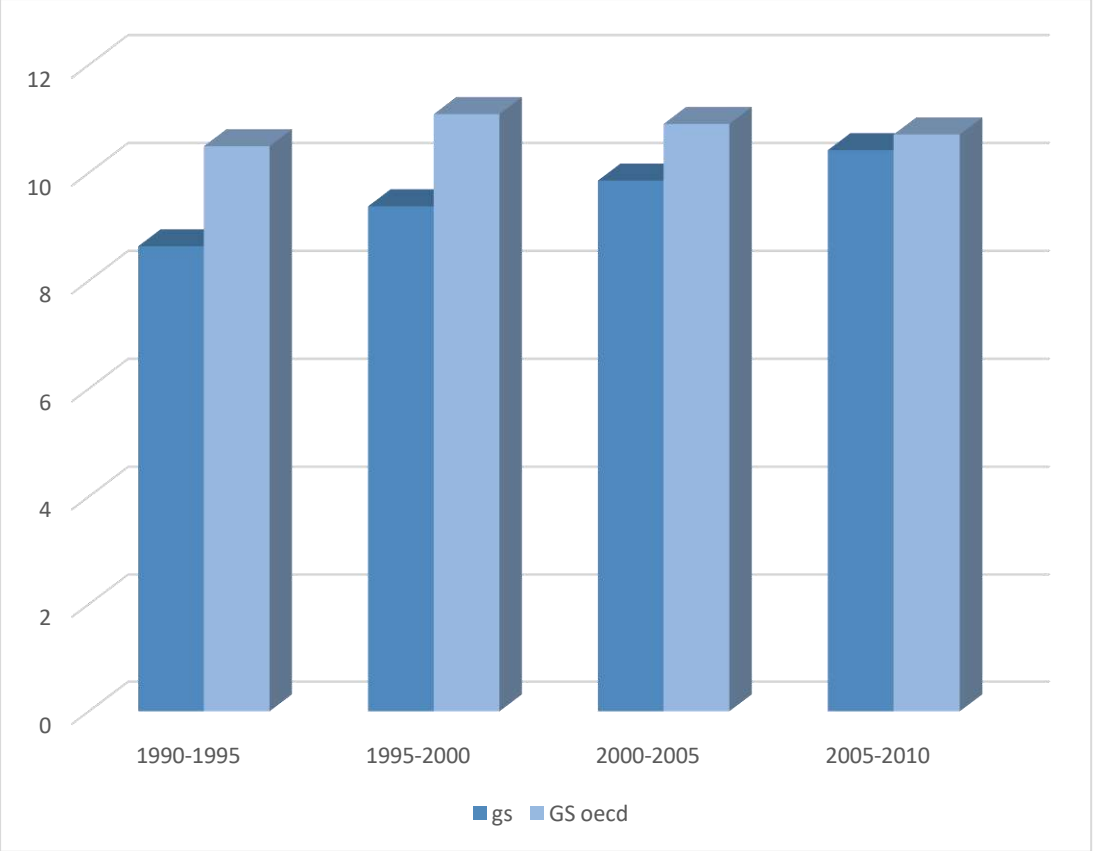


Figure 2.5. General and Sales tax ratios

Figure 2.3 shows that individual taxes maintained roughly over 3% share of contribution to the total tax revenue from the period starting in 1990 through two decades to 2010. This contrasts greatly with the average as observed with the statistics on the OECD countries, averaging above 9% in the period 1990-1995.

Figure 2.4 on corporate tax ratios paints a different picture on the observed differences or similarities in our sample of emerging economies as compared to presented averages of OECD countries. The starting five-year period shows that corporate taxes on average accounted for just under 3% of GDP as compared with reported averages of just over 2% of GDP for OECD economies. However, the period ending at the start of the new millennium reports a reverse in the trend with OECD countries reporting higher rates of corporate tax ratios in comparison with our sample. This trend continues in the next period business cycle with the data on OECD countries reporting averages of 3% of GDP. Our sample data reports values that

remain relatively unchanged although increases can be observed in the next business cycle period ending in 2010 where the averages of mean corporate tax ratios converging around the 3% point of total GDP.

The averages of the data on general sales taxes as the main component of indirect taxes follow a similar trend with greater differences in the starting business cycle period starting in 1990 with reported rates of 8.6% in emerging economies while OECD country averages indicate a ratio of 10.5%. The next five-year period reports a rise in the ratios in both our sample and the OECD averages with rates of 9.4% and 11.1% respectively. The trend continues up to our end period data with the mean GS ratios reaching 10.4% in our sample while the OECD group reports a reduced rate of 10.7% of GDP.

The composition of taxes is of importance; hence we note the tax structure composition of the main categories in the direct taxes, which is income tax on individuals, corporations and capital gains, and indirect taxes which is mainly composed of general sales tax alongside trade tax (and a number of other uncategorised taxes). These sub-categories of taxes were chosen due to the relative availability of the data across our sample of emerging economies.

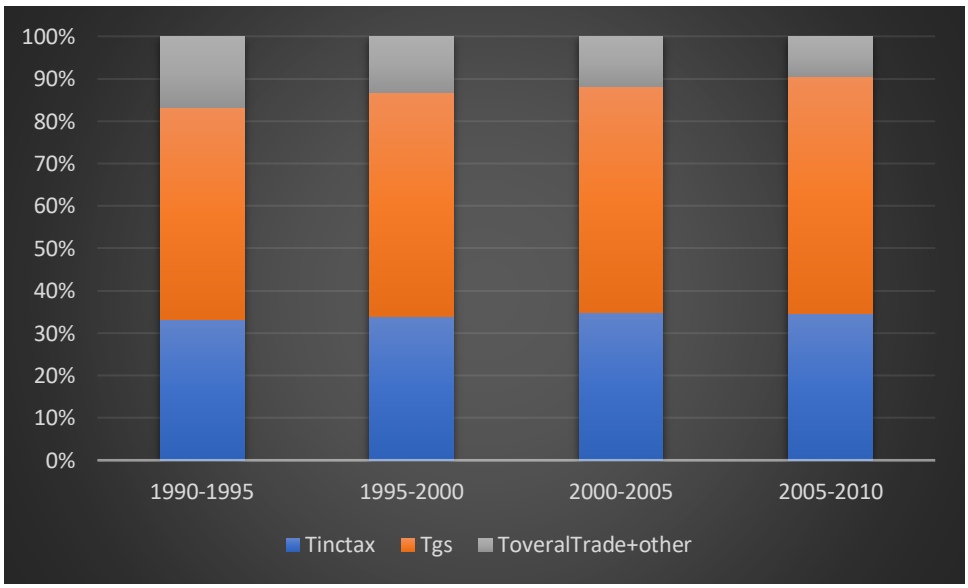


Figure 2.6. IncTax-GS-Other Tax Ratios of Tottax

We can see from Figure 2.6 that the reliance on trade and other taxes within our sample group significantly declines across the period under review. This reports trends moving away

from trade taxes towards general sales taxes mainly comprised of VAT. This may be interpreted as being caused by the reduction or elimination of trade barriers, which is the global trend, the shift away from trade and other taxes was directed to consumption or more broadly, general sales tax. The trade tax within the same period for OECD countries reports mean averages of about 6% at the start period with a steady and rapid decline until our end period, reporting mean values of less than 1%. The starting period from 1990 indicates that income taxes hold about 30% share of all total tax revenues and this trend continues through the five-year business cycle periods until 2010. The income tax receipts of our sample are fairly consistent within the period under review. The performance of general sales tax reports a slight contrast with modest increases from 49.5% to 52.1% across the four business cycles until the period ending in 2010. It is important to note that our emerging country sample[45] possesses many characteristics of developing countries as they are essentially developing countries with observed increased growth rates and potential to become more developed.

2.3.2 Descriptive summary points

In summary, we notice the main points of differences in our country sample data and OECD countries:

1. The tax-GDP ratio is significantly smaller when compared to OECD countries within the same period, with almost twice as much tax ratios been reported.

2. Individual or personal income taxes report low mean averages when compared with the GDP ratios of OECD countries within the period.

3. Corporate tax ratios and GS taxes hold higher values but still fall short of the rates obtainable in OECD countries.

4. The broad split of direct and indirect taxes as shares of the total tax revenues indicate more revenue in this sample of countries is obtained from indirect

[45] Classification by the IMF.

as opposed to direct taxes. This is in contrast with the OECD averages with rates evenly split, and with some countries holding even higher ratios of revenue from direct taxes.

2.3.3 Empirical strategy and model specification

This section presents the empirical strategy which we adopt to address the research question on GDP growth impact of taxation in emerging countries. As reported by Murphy (1997) the methods chosen should be appropriate to the research question and the inferences drawn should be consistent with the study objectives. Noting the emerging countries macro level data outlined above alongside our research question 'What is the growth impact of taxation in emerging markets? Can different types of taxes affect growth differently without changing the overall tax ratio?'

We estimate using a panel framework which uses both the time series and cross-sectional aspects of the data. This implies an increase in the number and amount of variation leading to greater efficiency of econometric estimates and more degrees of freedom. Hence some of the spurious regression issues are tackled without using cointegration techniques. we initially analyse using the fixed effects method, which is widely used in panel studies of this nature.

As presented in equation (1.1) the dependent variable Y_{it} is introduced in this estimation as GDP per capita growth, while the constant term α_i is the unobserved individual or country effect which is peculiar to each emerging country in our sample and constant over time. This is also the time-invariant element of the error term. In the fixed effects estimation, some form of endogeneity is implied as the α_i can be correlated with the regressors but this problem is

addressed by introducing a mean difference equation which deducts the means of each variable thereby eliminating the fixed effects. FE basically performs an ordinary least squares estimation of the mean difference equation and this results in consistent parameter estimates. We also note that the coefficient of the regressors are constrained to be the same for all sample individuals. A notable limitation of the FE estimator is the inability to estimate the coefficient for any time-invariant variable. In this study, we also estimate using random effects method[46] and introduce the Hausman specification test to check for the appropriate model. Though the RE can estimate coefficients of time invariant variables, if FE is the appropriate model, RE is inconsistent. We also introduce PMG and GMM as alternative estimation methods which are discussed in separate sections.

The concentration of the analysis here is on the structure of taxes as opposed to their level. Thus, all estimations contain the tax level, presented as the share of aggregate/total tax revenue to GDP, as a control variable. Given that the total tax is controlled for, going forward poses another challenge. Any adjustment in revenue coming from tax instrument will influence the sum of taxes that should be raised from the rest of the instruments to maintain same overall revenue. Hence the econometric challenge that this introduces is that entering the share of revenue for all tax instruments at the same time into a growth regression, while also controlling for the total tax, would result in over-identification issues for the equation.

This is addressed by removing each of the sub tax components at a time, hence the omitted instrument can be thought of as the variable that would be decreased when the new variable incorporated into the specification is raised and vice versa. This approach is exceptionally helpful, as it permits assessing different tax policy changes under the assumption of revenue neutrality.

[46] This performs a feasible generalized least squares estimation under the assumption that the individual effect and idiosyncratic error term are independent and identically distributed

This research will be analysed with panel data which is a similar method used in the growth regression framework as made popular by Barro (1991; 1999). The first econometric equation model will be specified as:

$$g_{it} = a + b_1(PCY)_{it-1} + b_2 M_{it} + b_3 Z_{it} + \epsilon_{it} \qquad (2.1)$$

Dependent variable g is the forward-looking growth rate of per capita GDP.

Independent Variables:

PCY is the initial level of per capita income (expected sign -)

Where M is regarded as a vector of other variables of interest with the error term which may also be significant to economic growth depending on which variant of the growth theory is been analysed[47]. The other variables of interest which will be used in our regression will include:

- *Avgsch* is the human capital education variable represented by average years of schooling for adult population (expected sign +).
- *Invtotal* is the Gross fixed capital formation as ratios of GDP. This represents the variable on the physical capital stock (expected +).
- *Govtcon* is the government consumption expenditure (expected -).
- *Workpgrowth* is variable for population growth and it is represented by the constructed growth rate of the working population (expected -/+ depending on the country specific excess or deficiency of productive labour).
- *Z* is a vector of tax variables analysed and includes the total tax revenue alongside broad splits of direct and indirect tax classification.

Following the approach used in the existing literature[48] to confirm the long run relationship between our fiscal variables and GDP per capita growth, we introduce the Pooled Mean Group (PMG) error correction model specified in the above equation. An advantage of the error correction equation rests on its ability to simultaneously separate and estimate the respective short run adjustment parameters and the long run equilibrium relationship. The long

[47] For annual panels in line with Bleaney et al. (2001) introduction of lagged growth in annual panel estimations is analogous but not identical to the inclusion of initial income in static panel or cross sectional regressions
[48] Including Arnold et al (2011) Xing (2012) Acosta et al(2012)

run equilibrium relationship is captured by the error correction term while the short run dynamics are captured by the first difference term specified in the equation.

In our study, the focus is on the GDP growth effects of shifts in broad tax composition as against changing the total tax burden, hence all tax variables are presented as ratios of overall tax revenue under the revenue-neutral framework.[49] In our regression approach, we follow in the footsteps of Arnold et al. (2011) and Acosta et al. (2012) and input the total tax-GDP ratio as a control variable while omitting one of our broad tax categories as the compensating variable. For instance, if direct tax and total tax revenue are present in the equation, the changes in direct taxes are offset in the opposite direction by changes in indirect tax while the overall tax-GDP ratio remains unchanged. By implication, the variations in tax policy are carried out under revenue-neutrality.

2.4 Methodology and Results

This section presents the result of our estimation and econometric analysis of any revenue-neutral shifts or adjustments of the tax structure that can be linked with higher national output, and analysis of results on whether there is any revenue-neutral tax structure adjustment that could be associated with a higher level of growth in the long run. This is particularly important following the global economic recession and slowdown of growth in emerging markets. Following these events, countries may explore growth-promoting tax structures while preserving fiscal stability. The study adopts a robust methodological approach, initially employing the random and fixed effects estimation and then moving further to investigate the issue using the PMG estimations which specify the model in a less restrictive way by relaxing the homogeneity restriction on some of the slope coefficients in the growth equation. The GMM estimation is also conducted to address potential endogeneity issues. The results are presented and discussed.

[49] In introductory estimations, we also test for partial impact of sub categories of taxes on GDP growth.

2.4.2 Fixed effects estimation partial impact on growth

We test jointly and independently the data using a fixed effect panel model by progressively including variables to the baseline specification in each regression. The results from the first set of estimated fixed effects regressions indicates that the convergence parameter reports insignificant coefficients with the expected negative sign; total investment as share of GDP ratio and labour force growth are also insignificant. The human capital variable represented by the average years of schooling of the adult population conforms with the expected positive sign and significance[50] with variations in the point estimates depending on which variables are added or omitted across the different regressions. Government consumption, again as expected, reports negative and consistently significant estimates across all five year averaged fixed effect regressions, while the overall level of tax revenues reports a negative effect on growth rates in our sample of countries at the 5% level of significance. Sub-aggregate tax components, which are the main variables of interest, are introduced in the second five year fixed effects regression, and the broad classification of direct and indirect taxes report large point coefficients with direct taxes seemingly more harmful for growth with a negatively signed coefficient, while indirect taxes report positive growth effects, although they are insignificant. Further disaggregation of direct-indirect broad split taxes into sub-categories of income (personal, corporate and capital gains) tax and general sales tax report fairly consistent estimates with income taxes reporting negative growth effects significant at the 5% level, while general sales taxes as the main share of indirect taxes, report more positive effects on growth though insignificant.

[50] At least 5% level of significance across our first 5yr F.E estimations.

Table 2.3 5 Year F.E

Dependent Var GDPgrowth	1	2	3	4	5
lnGDP per capita	-0.050	-0.034	-0.011	-0.009	-0.009
	(1.58)	(1.09)	(0.29)	(0.29)	(0.27)
Total Investment	0.085	-0.037	-0.019	0.085	0.088
	(0.45)	(0.19)	(0.09)	(0.47)	(0.49)
Working population growth	-0.021	0.025	0.107	-0.028	0.142
	(0.07)	(0.08)	(0.31)	(0.11)	(0.54)
Avg years of schooling	0.032	0.026	0.021	0.020	0.028
	(3.65)**	(2.93)***	(2.10)**	(2.22) **	(3.40)**
Government consumption	-0.687	-0.609	-0.692	-0.514	-0.512
	(2.31)**	(2.12)**	(1.97)**	(1.86)*	(2.01)*
Total tax revenue	-0.445				
	(2.01)**				
Direct tax		-0.767			-0.828
		(3.06)***			(3.08)*
Indirect tax		0.140	0.008	0.041	
		(0.39)	(0.02)	(0.13)	
Income tax			-0.619		
			(2.15)**		
Personal income				0.966	
				(1.76)*	
Corporate income				-1.442	
				(3.43) ***	
General sales tax					-0.453
					(1.42)
Trade tax					1.228
					(1.70)*
_cons	0.336	0.229	0.088	-0.012	0.001
	(1.61)	(1-11)	(0.36)	(-0.06)	(0.00)
R2	0.32	0.38	0.29	0.43	0.42
N	81	81	74	72	72

* p<0.1; ** p<0.05; *** p<0.01

Fixed Effects regressions are based on five year averages from 1990-2010. Figures in Parentheses are t-statistics. Period dummies are included in all regressions. Reduced number of observations from column 3 for sub-categories of taxes with incomplete observations within panel. All fixed effects regressions reported have overall model significance at 1%

Column 1 of Table 2.3 shows that a 1 percentage point rise in the total tax revenue as a share of GDP will lead to a decline in GDP per capita growth of approximately 0.45 percentage points for our emerging market sample in the long run *ceteris paribus*. The second column separates the direct and indirect taxes as shares of GDP per capita to identify their separate effects. The results show that a 1 percentage point increase in direct taxes is associated with a negative growth value of 0.77 percentage points for GDP per capita while indirect taxes have a positive but statistically insignificant effect.

Columns 3-5 introduce a mix of sub categories of taxes that generally can still be grouped under the direct[51] and indirect[52] tax categories[53]. Sub categories of taxes in our sample data possessed missing values and this is also observed in the results with poor significance of coefficients and drop in number of observations from regressions 3-5 from our first 5 year fixed effects estimation. From the significant coefficients reported, income taxes[54] is associated with a negative point value of 0.62 percent as presented in regression 3, while personal income taxes report a point coefficient of 0.97 significant at 10 percent level and corporate income taxes report a strong negative value of 1.44 percentage points significant at 1% level as presented in regression 4. Correspondingly, regression 5 reports a negative relationship between direct tax and GDP per capita growth with a 1 percent increase in direct tax leading to a 0.83 percentage point fall in GDP per capita growth in our sample. As a sub category of indirect tax, the general sales tax reports insignificant estimates while trade tax reports a positive relationship with GDP economic growth.[55] Noting the five year averaging of the data which smoothens out the business cycle effects, the results presented highlights the long run relationship in our sample.

[51] Income taxes as a sub category of direct taxes in regression 3; personal and corporate income taxes in regression 4.
[52] General sales tax here is presented in regression 5 as indirect taxes.
[53] Slight differences in the measurement and classification of trade tax in our sample, here it is introduced as some other form of indirect tax.
[54] Which comprises direct taxes, mainly personal and corporate income taxes.
[55] This result though not conventional with similar studies for the OECD may indicate amongst others; either a less than optimal/efficient trade tax collection system or a need for increased protection of indigenous industries

These results help to weigh the direct relationship between GDP per capita growth and sub categories of taxes before the revenue neutral analysis where the total tax/GDP variable is introduced as a control variable alongside the sub categories.

To compare for consistency, we replicate this table regressions 1-5 using the random effects method and the Hausman test results indicate the fixed effects is the preferred method.

as argued in the literature on trade but beyond scope of this chapter. This may also be due to the paucity of the data on trade. It has the most null values among the tax variables in the sample data.

2.4.3 Random Effects result partial impact

Though the random effects estimator can produce efficient and consistent estimates; if the fixed effect is the appropriate model, then the RE is inconsistent. Hausman specification test results indicate the fixed effects is the preferred method across all regressions. Similar estimation with the same variables was tested with the RE and our results are poorly behaved however the fiscal variables and different tax categories have the expected signs, the results are generally insignificant. The first reported Tables 2.3 and 2.4 capture the partial impact of different sub-components of taxes as reflected in the regression results.

Tab 2.4 5yr RE	1	2	3	4	5
lnGDP per capita	-0.001	-0.007	-0.013	-0.029	-0.027
	(0.47)	(0.21)	(0.07)	(0.51)	(0.35)
Total Investment	0.025	0.024	0.024	0.026	0.023
	(0.90)	(0.19)	(0.76)	(0.85)	(0.25)
Working	0.084	0.137	0.248	0.131	-0.092
population growth	(0.10)	(1.05)	(1.39)	(1.60)	(0.96)
Average years of	-0.003	-0.003	-0.003	-0.004	-0.028
schooling	(1.66)*	(3.58)***	(3.46)***	(2.51)**	(3.58)***
Government	-0.013	-0.068	-0.058	-0.076	-0.041
consumption	(0.11)	(0.54)	(0.45)	(0.56)	(0.29)
Total tax revenue	-0.006				
	(0.05)				
Direct tax		-0.048			
		(0.38)			
Indirect tax		-0.031			
		(0.23)			
Income tax			-0.151		
			(1.08)		
Personal income				-0.329	
tax				(1.40)	
Corporate income				-0.211	
tax				(1.52)	
General sales tax					-0.331
					(0.92)
Trade tax					-0.101
					(1.12)
_cons	0.081	0.749	0.108	0.235	0.174
	(6.67)	(6.68)	(1.69)*	(1.21)	(1.34)
R2	0.29	0.26	0.29	0.28	0.27
N	81	81	74	72	72

* p<0.1; ** p<0.05; *** p<0.01

Dependent variable is GDP per capita growth. Random Effect regressions are based on five year averages from 1990-2010. Figures in Parentheses are t-statistics. Period dummies are included in all regressions. Reduced number of observations from column 3 for sub-categories of taxes with incomplete observations within panel

The baseline growth model variables for the random estimation results are generally not significant except for average years of schooling (*avgsch*)[56]. However, the major aim of

[56] This would imply that an extra year of schooling will lead to an increase in GDP per capita growth by 0.003 percentage points if the random effects estimator is chosen as the correct specification with the Hausman test.

this research is to check for revenue-neutral tax changes and corresponding growth effects, assuming the overall tax revenue to GDP ratio remains unchanged.

Hence we move over to Tables 2.5 and 2.6 which reports broad classification of taxes into direct and indirect split as part of the overall tax revenues collected in the chosen emerging country sample within the timeframe under consideration. In these tables, we initially begin with the benchmark regression which is the same with regression 1 in the first set of presentations in table 2.3. The second and third regression in table 2.5 introduces direct and indirect tax as a share of total tax revenue. This adjustment implies that the total tax variable is present in regressions 2 and 3 as a control variable while the omitted tax variable is interpreted as the financing tax variable. Our five year revenue neutral regressions imply that a 1 percentage point increase in direct tax with a corresponding 1 percent point reduction in indirect tax will lead to a fall in GDP per capita growth by 0.131 percentage points if total tax remains unchanged however this value is statistically insignificant. The omitted tax in regression 2 is the indirect tax while regression 3 is the reverse with direct tax as the omitted variable. By implication, a shift from indirect taxes to direct taxes when the overall tax ratio remains unchanged is associated with negative GDP per capita growth while shifts from direct tax to indirect tax will be more growth promoting if the overall tax burden remains unchanged.

Specifically, we find that direct taxes have negative coefficients in column 2, which suggests that increases in direct taxes with a corresponding reduction in indirect tax tends to have a limiting effect on growth under the revenue neutral framework. The direct/indirect tax coefficients have the expected signs, although insignificant for our five year averaged data specification. Table 2.6 presents the RE specification for comparison as the Hausman test points to the FE regressions as the appropriate estimates.

Table 2.5: 5yearFE Revenue-neutral specification

Dependent - GDPgrowth	1	2	3
InGDP per capita	-0.05	-0.040	-0.040
	(1.58)	(1.23)	(1.23)
Total Investment	0.085	0.035	0.035
	(0.45)	(0.19)	(0.19)
Working population growth	-0.021	0.045	0.045
	(0.07)	(0.15)	(0.15)
Average years of schooling	0.032	0.028	0.028
	(3.65)***	(3.22)***	(3.22)***
Government consumption	-0.687	-0.634	-0.634
	(2.31)**	(2.15)**	(2.15)**
Total tax revenue	-0.445	-0.286	-0.286
	(2.01)**	(1.19)	(1.19)
Direct tax		-0.131	
		(1.59)	
Indirect tax			0.131
			(1.59)
_cons	0.336	0.300	0.169
	(1.61)	(1.45)	(0.73)
R2	0.32	0.35	0.35
N	81	81	81

* p<0.1; ** p<0.05; *** p<0.01

Revenue-neutral regressions are based on five year averages from 1990-2010. The overall tax ratio is the control variable. The omitted tax variable corresponds with the compensating tax variable leaving the overall ratio unchanged figures in parentheses are t-statistics.

The broad composition of taxes into direct and indirect taxes as shares of the tax revenues are tested to check for their effects on growth. The examination within this framework is again similar to existing studies, and we find similar results indicating that revenue generation shifts from direct taxes to indirect taxes will be growth-promoting to a point value of 0.131, while a reverse in revenues collected from indirect to direct taxes will be growth-retarding by the same point value of -0.131, however this value is insignificant. The finding is similar to that of Acosta-Ormaechea and Yoo (2012), who found that a percentage point increase in income taxes leads to a fall of GDP growth rates of around 0.07–0.14%. We attempt

to further test the disaggregated data within our sample but the resulting estimates, though largely conforming in sign, were generally insignificant due to incomplete data on sub-categories, hence we limit our reports to the broad split categorisation of direct and indirect taxes.

The findings indicate that income taxes reduce output growth through distortions, and shifts to indirect taxation are more growth-promoting in line with the endogenous models. For instance, the growth model analysed by Mendoza (1997) predicts that all taxes can potentially cause distortions to output but 'indirect taxes do so to a lesser extent' than direct taxes. There are more channels for distortion through direct taxes; for instance through reduced returns on investment which can act as a disincentive to human and capital investment. Prichard (2016) notes that the acceptance that increases in personal and corporate income taxes are bad for growth has become policy orthodoxy for multilateral institutions like the IMF, which argues that that indirect taxes are more growth promoting than direct taxes (IMF 2011; 2015). We report similar findings with analysis of the five year averaged data on the RE method in Table 2.6.

Table 2.6- 5yr RE Revenue Neutral	1	2	3
Direct tax		-0.101	
		-(1.26)	
Indirect tax			0.101
			(1.26)
_cons	0.011	0.011	-0.103
	(0.40)	(1.16)	(1.12)
N	81	81	81

* p<0.1; ** p<0.05; *** p<0.01

GDP growth is the dependent variable. Revenue-neutral regressions are based on five year averages from 1990-2010. The overall tax ratio is the control variable. The omitted tax variable corresponds with the compensating tax variable leaving the overall ratio unchanged figures in parentheses are t-statistics. All baseline specification also estimated.

The reported estimates on the revenue-neutral shift of direct and indirect tax indicate that if revenue to GDP ratios are kept constant, shifts from direct to indirect taxes will lead to faster growth with point estimates of 0.101, while a reverse in revenues raised caused by a shift from indirect taxes to direct taxes will reduce the growth rate by 0.101 however these values are insignificant, although the Hausman test results highlight the fixed effects estimates as its choice model when tested against RE[57]. Following Kneller (1999), we attempt to make tests on robustness of our specification of the model equation. The first test is to check the sensitivity of the results to the inclusion of initial levels of GDP against the data after which comparative tests on the annual data for our group of countries are carried out. Endogeneity of the fiscal

[57] Table 2.6 reports the tax variables in the revenue neutral random effects estimation with insignificant coefficients. Other growth determinants used in previous tables were also included in the specification but not presented. Subsequent RE estimations were carried out but not presented as the Hausman test points to FE as the preferred estimator.

variables is also a common problem with regressions of this nature, as is potential simultaneity bias which we attempt to eradicate. As noted by Easterly(1993) and Kneller (1999), growth regressions of this nature are sensitive to the presence or exclusion of initial levels of GDP and its removal simply conditions our estimated equation to a basic growth accounting exercise. The findings with the omission of this variable reduces the overall goodness of fit of our regression, although coefficient signs remained largely unchanged. The resulting estimates are sensitive to this variable. It raises the issue of whether business cycles are fixed around the same turnaround time for all countries in our sample, and whether 5-year averages are better substitutes for the actual collected annual data. This leads to our next model equation estimated with the benchmark equation.

2.4.4 Annual regression

Business cycle effects may be smaller or larger than the forced 5 year period traditionally used in estimations of this nature, hence our chosen lag criteria may be significantly different from the actual business cycle turnaround time for our sample of countries and this introduces annual estimation using the actual obtained data as against 5 year averages. The second method adopted in our growth analysis is mainly drawn from the conventional Panel Fixed Effect analysis used by Cellini (1997) and by Arrellano and Bond (1991) with lagged RHS variable of initial per capita income.

$$\Delta lny_{i,t,} = \alpha_0 + \beta_1 lny_{it-1} + \beta_2 M_{it} + \varepsilon_{i,t} \qquad (2.2)$$

The equation is first estimated, after which an error correction mechanism is introduced. The per capita growth variable is a function of lagged initial per capita GDP and other variables of interest which includes human and physical capital proxy and government consumption with tax ratio as the benchmark regression. Different sub-categories of taxes are introduced, starting with the broad direct/indirect classification. The results of our fixed effects regression with this model are summarised in Table 2.7.

Table2.7

Annual F.E

Dependent - GDPgrowth	1	2	3	4	5
L.lnGDP per capita	-0.169	-0.159	-0.140	-0.164	-0.138
	(9.06)***	(8.05)***	(6.36)***	(8.I5)***	(6.14)*
Total Investment	0.491	0.449	0.360	0.540	0.402
	(6.13)***	(5.44)***	(4.00)***	(6.51)***	(4.56)**
Working population growth	-0.004	0.029	-0.013	-0.028	0.015
	(0.02)	(0.19)	(0.07)	(0.19)	(0.09)
Average years of schooling	0.043	0.044	0.039	0.049	0.041
	(8.72)***	(7.55)***	(6.44)***	(7.68)***	(6.34)**
Government consumption	-0.437	-0.436	-0.530	-0.646	-0.673
	(3.34)***	(3.31)***	(3.71)***	(4.75)***	(4.94)**
Total tax revenue	-0.308				
	(2.40)**				
Direct tax		-0.485			-0.392
		(3.11)***			(2.03) *
Indirect tax		0.021	0.143	-0.131	
		(0.11)	(0.66)	-0.68	
Income tax			-0.002		
			(0.01)		
Personal income tax				0.391	
				(1.35)	
Corporate income tax				-0.669	
				(2.53) **	
General sales tax					-0.231
					(1.12)
Trade tax					0.519
					(1.14)
_cons	1.048	0.994	0.866	0.991	0.904
	(8.07) ***	(7.14)***	(5.59)***	(7.32)***	(5.60)**
R2	0.26	0.26	0.21	0.34	0.26
N	386	37	342	333	319

* p<0.1; ** p<0.05; *** p<0.01

Annual regressions extend the sample to 2012(5-yr 2010 forced by averaging). Figures in Parentheses are t-statistics. Period dummies are included in all regressions. Reduced number of observations from column 3 for sub-categories of taxes with incomplete observations within panel

In this section we begin with an estimate of the benchmark regression 1 with the total tax variable. Subsequent columns 2-5 in table 2.7 check for sub categories of the tax ratios following the approach in the five year estimate.

The calculated coefficient from our benchmark regression implies that an increase in one percentage point of initial GDP per capita across countries is related to a decrease in the GDP growth by 0.17 percentage points. The estimated coefficient of the convergence variable as known both from the endogenous and neoclassical growth theory is expected to be negative with poor countries expected to grow faster than rich countries if other conditions are held constant. Regressions 2-5 also present a similar range of point convergence coefficients between -0.14 and -0.17 significant at 1 percent level.

The estimated coefficients for other variables of interest are also presented in the benchmark regression 1 and subsequent regressions 2-5. Total investment as a share of GDP gives a positive range of values between 0.36 and 0.54 which implies that an increase in the investment share will be growth promoting while the workforce population growth variable returns insignificant estimates in our sample.

The human capital variable represented by average years of schooling reports positive and significant estimates which is expected as observed from similar studies under the new growth theory. An extra year of stock of human capital is associated with an increase of approximately 0.05 percentage points in GDP per capita growth *ceteris paribus*. Subsequent regressions 2-5 also report similar coefficients with a range from (0.04-0.05) all at 1% level of significance. As the final non tax variable in our benchmark regression analysis, government consumptions presents a range of statistically significant negative values between (-0.44 and -0.67). To interpret regression 1 specifically, an increase in the government consumption ratio by 1

percentage point will lead to a growth decline of 0.437 percentage points. This has implications for the role of government unproductive expenditures in our sample.

In summary of the coefficients for the non tax variables, we can observe properly signed and significant variables in our benchmark regression with one period lagged initial GDP, stock of capital including human and physical (represented by average years of schooling and GFCF respectively) alongside government consumption. The exogenous variable of growth of the labour force has been insignificant across all regressions.[58] The estimated coefficients highlight a per capita growth relationship in the short run due to the annual data used in Table 2.7 regressions.

Noting the improved performance of other variables of interest in our benchmark regression using annual data, we highlight the growth implication of the tax variables. The fixed effects coefficient on the total tax revenue variable reports negative growth relationship with a point estimate of 0.308, significant at the 5% level. This implies that a 1 percent point increase in the total tax revenue will lead to a growth decline of approximately 0.31 percentage points *ceteris paribus*. Further regressions indicate direct taxes are more harmful for growth with negatively signed coefficients and significance, and indirect taxes report positive signs although insignificant. Specifically, a 1 percentage point increase in direct tax/GDP ratio will lead to a decrease in per capita income growth by 0.49 percentage points in the short run. Here we obtain no statistically significant relationship among other sub categories of taxes except corporate income tax in regression 4 with a high negative point estimate of -0.67. This implies that a 1 % increase in corporate income tax will lead to a 0.67 percentage point decline in growth within our sample. Further sub-components of taxes report insignificant results except corporate taxes which show strongly negative growth effects.

Table 2.8 reports the corresponding broad tax composition and revenue-neutral changes in our estimates. The resulting coefficients again indicate that direct taxes are more harmful for

[58] This is observed in all model regressions and it is omitted in regressions where it significantly reduces the overall goodness of fit.

growth. It is important to note that total tax revenue as a share of GDP is taken as a control variable, hence any change in one variable should be equally offset by a change in another to keep the overall tax burden unchanged (Arnold, 2011). With our broad categorisation of taxes, we omit one tax variable at a time in each regression and interpret the estimated coefficient as the effect of a shift from the omitted variable to the variable under consideration.

2.4.5 Annual regression – revenue-neutral result (fixed effects)

Table 2.8 Annual FE Rev-neutral

Dependent - GDPgrowth	1	2	3
L.lnGDP per capita	-0.169	-0.158	-0.158
	(9.06) ***	(8.03) ***	(8.03)***
Total Investment	0.491	0.461	0.461
	(6.13)***	(5.64) ***	(5.64) ***
GDP per capita growth	-0.004	0.032	0.032
	(0.02)	(0.21)	(0.21)
Average years of schooling	0.048	0.045	0.045
	(8.72)***	(7.79)***	(7.79)***
Government consumption	-0.437	-0.429	-0.429
	(3.34)***	(3.25)***	(3.25)***
Total tax revenue	-0.308	-0.203	-0.203
	(2.40)**	(1.47)	(1.47)
Direct tax		-0.094	(2.05)**
		(2.05)**	
Indirect tax			0.094
			(2.05)**
_cons	1.048	1.015	0.920
	(8.07)***	(7.40)***	(6.32)***
R2	0.26	0.26	0.26
N	386	378	378

* p<0.1; ** p<0.05; *** p<0.01

Annual revenue neutral regressions extend the sample to 2012. The overall tax ratio is the control variable. The omitted tax variable corresponds with the compensating tax variable leaving the overall ratio unchanged Figures in Parentheses are t-statistics. ***, ** and * denote significance levels at 1%, 5% and 10% respectively

Column 1 in table 2.8 represents the benchmark regression also presented in Table 2.7 with other macro determinants of growth while columns 2 and 3 reports the revenue neutral effects of our broad categories of taxes[59]. The data on direct and indirect taxes have been

[59] Other sub categories of taxes data contain missing values in our sample hence we restrict our revenue neutral analysis to the estimation of direct and indirect tax

converted to shares of the Total tax revenue which is also presented as a control variable. In Table 2.8, the fixed effects results are presented and the corresponding estimates for our broad classification of taxes indicate that direct taxes are more harmful for growth, and that increased growth rates can be obtained with shifts from direct taxes to indirect taxes within our country sample. Specifically, the result implies that a 1 percentage point shift towards direct tax away from indirect taxes is associated with a 0.09 percentage point decrease in GDP per capita growth while the overall burden of taxation (total tax revenue) remains unchanged. In reverse, table 2.8 column 3 also implies that a 1 percentage point shift towards indirect tax from direct tax leads to positive growth at 0.09 percentage point. This means that any revenue-neutral shifts which increase the indirect tax composition balanced by reductions in direct taxes will lead to growth-positive effects within the 5% and 1% significance levels, respectively[60] while the total tax revenue/GDP ratio remains unchanged as the control variable.

2.4.6 Alternative Estimator-PMG

The Pooled Mean Group Estimator constrains long run coefficients to be equal while allowing for heterogeneity in short-run effects across countries. Within a panel, it assumes a long run relationship that is equal across countries. This homogeneity[61] assumption of long run parameters might be valid for groups of countries with similar economic climates such as the OECD, G5, BRICS or other closely matching emerging market groups. Bias in the estimation may arise if countries within a sample are open to similar shocks or volatile business cycles, which may be correlated with the independent variables in the regression.[62]

This approach introduced by Pesaran, Shin and Smith (1999) is a maximum likelihood estimator in which coefficients, intercepts and error variances are allowed to change in the

[60] Mean average of point estimates reported with the FE and POLS.
[61] Long-run parameter homogeneity implies that sample countries grow the same over time.
[62] Pesaran (2006) introduces a simple procedure to allow for a form of cross-section dependence with a multiplicative factor structure. This allows sample countries to have an unobserved common factor and slope coefficient.

short run while estimates of the parameter are constrained to be equal across panel in the long run. The autoregressive distributive lag model is used and all regressors are assumed to be stationary. The speed of adjustment of each country within the panel is estimated alongside the individual short run-term estimates. The error correction model basically estimates variables in differences and levels. The equation to be estimated is given as:

$$\Delta lny_{i,t,} = \alpha_0 + \beta_1 lny_{it} + \beta_2 M_{it} + \varepsilon_{i,t} \quad (2.3)$$

All variables will be lagged by one period. The equation is thus transformed as shown below to an ARDL (one lag) dynamic panel specification form.

$$\Delta lny_{i,t,} = \delta_i + \beta_{10i} lny_{it} + \beta_{11i} ln_{yit-1} + \beta_{20i} M_{it} + \beta_{21i} M_{it-1} + \Delta lny_{i,t-1,} + u_{i,t} \quad (2.4)$$

The subsequent error correction equation is given below:

$$\Delta lny_{i,t,} = \varphi_i(\Delta lny_{i,t-1,} - \alpha_0 - \beta 1 lny_{it} - \beta_2 M_{it}) - \lambda_{11i} \Delta lny_{it} + \lambda_{21i} \Delta M_{it} + u_{it} \quad (2.5)$$

Where:

$$\varphi_i = -(1-v_1),$$

$$\alpha_0 = \delta i / 1-v_1,$$

$$\beta_1 = \lambda_{10i} + \lambda_{11i} / 1-v_1,$$

$$\beta_2 = \lambda_{20i} + \lambda_{21i} / 1-v_1, \quad (2.6)$$

β_1, β_2, are coefficients of initial per capita income, and summation of other tax variables of interest as used in the previous regression including direct and indirect taxes alongside sub-categories, while φ_i represents the speed of adjustment. The mean group estimator also proposed by the same authors alongside the dynamic fixed effects was also estimated and reported in the appendix. The values obtained from the initial pooled mean group estimation, presented in Table 2.9, reconfirms earlier results indicating that economic growth and the overall burden of taxation share a negative relationship in the long run. The point estimate

reports -0.035 as the coefficient value for the tax-GDP ratio significant at the 5% level while the coefficient of direct taxes and indirect taxes presented reports significant values of -0.043 and -0.066 respectively. The magnitude of this effect implies that a 1 percentage point increase in total tax/GDP leads to a decrease in long run per capita GDP growth by 0.035 percentage points while direct and indirect tax ratios also highlight this negative relationship. Specifically a 1 percentage point increase in the direct tax/GDP ratios leads to a 1 percentage point decline in the long run GDP per capita growth by 0.043 percentage points[63] as presented in Table 2.9.

Table 2.9 PMG Direct Tests on growth

GDP per capita	-0.049		GDP per capita	-0.049	GDP per capita	-0.050
	(20.14)***			(20.37)***		(18.80)***
Total Investment	0.007		Total Investment	0.005	Total Investment	0.016
	(0.58)			(0.44)		(1.24)
Average years of schooling	0.003		Average years of schooling	0.003	Average years of schooling	0.003
	(5.42)***			(5.73)***		(5.54)***
Total tax revenue	-0.035		Direct tax	-0.043	Income tax	-0.066
	(2.15) **			(1.82) *		(2.48) **
_cons	0.382		_cons	0.375	_cons	0.391
	(31.17)***			(33.27)***		(31.32)***
	376	N		376	N	367

* p<0.1; ** p<0.05; *** p<0.01

Long run coefficients reported for partial growth tests. Figures in Parentheses are t-statistics. ***,** and *and denote significance levels at 1%, 5% and 10% respectively MG and DFE estimations also reported a negative relationship with relationship wit less significance however the Hausman specification test points consistently to PMG as the preffered estimation

[63] MG and DFE estimations also reported a negative relationship with less significance however the Hausman specification test points consistently to PMG as the preferred estimator

Further PMG analysis introducing sub-aggregate taxes were largely insignificant and in an attempt to check for the long run growth relationship of each sub tax component,[64] the PMG was estimated with omitted growth variables which makes the specification subject to bias. Table 2.10 reports the sub aggregate tax output of our pooled mean group estimator which allows for common long run coefficients and averaged parameter estimates in the short run[65] (Blackburne & Frank, 2007). The first regression tests specifically for the effect of sub-categories of taxes on economic growth while controlling for initial per capita GDP. The long run results are reported, and the resulting point estimates suggest that personal income taxes promote growth in the long run. This is dissimilar to our comparative studies and it could be a consequence of omitted variable bias, but it may also be interpreted that our sample countries can do more to raise the level of revenue generated from personal income taxes. Studies such as Miller and Russek (1993;1997) Angelopoulos et al. (2006) and Shinohara (2012) also identify a similar positive relationship for developing countries. Reference to our descriptive stats indicates that the level of revenue generated from personal income taxes is relatively low compared to the high income group of countries. Again, the effective rates of personal income tax falls in the range of 5% in some cases with very low band progressivity. Corporate income taxes report the most growth-reducing figures in the long run with point estimates of -0.11% in the first regression, while general sales tax reports insignificant estimates.

The second regression in table 2.10 adds trade taxes to the mix while omitting the insignificant GS tax, and the initial levels of per capita income, personal income and corporate income taxes report similar signed and significant estimates, while the newly introduced trade tax report insignificant results. The third regression broadly introduces indirect tax as the corresponding sub-components reported insignificant results. The point estimates report a

[64] Significance improved with exclusion of other growth variables.
[65] See appendix for reports of the short run coefficient and mean group estimates.

value of -0.0836. Regression four simply tests for the long run implication of overall tax effects on growth and as expected the estimates reflect an overall negative relationship with a value of -0.0353.

Table 2.10 Pooled Mean Group Direct on GDP growth

GDP growth	1	2	3	4
GDP per capita	-0.00002	-0.00002	-0.00002	
	(-10.58)***	(-9.07)***	(-10.33)***	
Personal income tax	0.3047	0.2964	0.3563	
	(7.46)***	(7.77)***	(9.30)***	
Corporate income tax	-0.1136	-0.1459	-0.1105	
	(-2.86)***	(-3.49)***	(-2.84)***	
General sales tax	-0.03988			
	(-1.58)			
Trade tax		-0.07185		
		(-1.49)		
Indirect tax			-0.0836	
			(-3.35)***	
Total tax revenue				-0.0353
				(-2.46)**
No of Observations	307	280	320	377

Long run coefficients reported for partial growth tests. Figures in Parentheses are t-statistics. ***, ** and * denote significance levels at 1%, 5% and 10% respectively.

Table 2.11 presents the first revenue-neutral effects of taxes on growth using the PMG estimator to identify a long run relationship. The estimation follows the pattern of previous methods with our benchmark PMG regression with total tax revenue/GDP ratio as the control[66] variable estimated before the introduction of direct tax with indirect taxes omitted, while the third regression introduces indirect taxes while omitting direct taxes from the mix. The long run coefficients are reported in table 2.11 while the speed of adjustment implications for the short run dynamic adjustments are presented in table 2.12.

Table 2.11 PMG Annual Rev-neutral

	GDP per capita	-0.049	GDP per capita	-0.050	GDP per capita	-0.050
		(20.14)***		(20.17)***		(20.26)**
	Total Investment	0.007	Total Investment	-0.006	Total Investment	-0.001
		(0.58)		(0.43)		(0.08)
	Average years of schooling	0.003	Average years of schooling	0.003	Average years of schooling	0.003
		(5.42)***		(6.05) ***		(5.78)***
	Total tax revenue	-0.035	Total tax revenue	-0.041	Total tax	-0.043
		(2.15)**		(2.56)**		(2.69) ***
			Direct tax	-0.004	Indirect tax	0.002
				(0.75)		(0.40)
	_cons	0.382	_cons	0.389	_cons	0.386
		(31.17)***		(34.29)***		(33.94)**
N		376	N	367		367

Long run coefficients reported. Figures in Parentheses are t-statistics. ***, ** and * denote significance levels at 1%, 5% and 10% respectively. MG and DFE estimations also reported a negative relationship with less significance however the Hausman specification test points consistently to PMG as the preferred estimator

The results from table 2.11 are insignificant with our revenue-neutral tests on growth in the long run however the coefficient signs are in line with prior expectation. The short run coefficients, however, report significant estimates and indicate that revenue-neutral increases in direct taxes financed by a reduction in indirect taxes will be more harmful for growth than

[66] This tottax control variable is used to eliminate the bias which may exist from the correlation between direct and indirect taxes and the overall tax burden.

the reverse, with increases in indirect taxes financed by increases in direct taxes. This result is similar with compared studies. However, as noted by Gemmell (2011), the interpretation of the short run effects should be done cautiously as the estimation may not be as precise as the long run coefficients, but the results are useful in giving an indication of the feasible time lags involved in a new equilibrium adjustment after a fiscal shock with the speed of adjustment parameter.[67]

Table 2.12 Short Run Dynamic Adjustments

No of years to achieve long run effect	Proportion of disequilibrium corrected within 1 year	No of Countries
0	>90	18
1-2	50-90	3
3 and above	<50	0

Following Gemmell (2011) we report the speed of adjustment parameter for our sample as this trajectory is determined by the lag structure estimated on each country's fiscal variable alongside its error correction parameter φ_i. The error correction parameters reported indicate a relatively quick adjustment process with 18 of our 21 countries moving to equilibrium within 1 year of an exogenous shock. Three countries return to equilibrium within two years. These results are similar to those of Gemmell, Kneller and Sanz (2011). This reflects the combined speed of return to the trend line of all variables in the regression.

[67] Half-lives, as explained by Gemmell et al. (2011), are the more usual indicator of adjustment speeds but may not be applicable in this case due to the relatively rapid speed of adjustment reported.

2.4.7 Alternative Estimator- GMM

There is potential for flaws in regressing growth equations which includes tax policy variables as errors of measurement, omitted variables and, more importantly, endogeneity problems might be present. This will significantly bias and affect the estimated results' explanatory powers. According to Acosta (2012) the particular concerns of endogeneity of regressors makes it difficult to interpret the resulting coefficients as tax policy effects on growth because of the simultaneous relationship between GDP growth and taxes, as observed growth in GDP may also influence changes in the tax levels or corresponding structures. Hence, the reported coefficients may only report the inherent simultaneous equation bias, which can simply be interpreted as correlation rather than causation between the tax variables and GDP growth. The potential for simultaneous bias introduces the generalised method of moments to the applied methods. This is an instrument variable estimator developed by Holtz-Eakin, Newey and Rosen (1988) and made popular by Arellano and Bond (1991; 1998). It functions as an instrumental dynamic panel estimator which introduces the lagged dependent variable as a regressor. This method is suited for models with the potential for endogeneity with some of the right hand side variables predetermined. It may be noted that the first difference transformation has limits as it tends to magnify gaps in an unbalanced panel data[68]. The forward orthogonal deviations, introduced by the same authors, minimise data loss by subtracting the average of all future observations from the current ones, and this technique is adopted as the panel data available for this research is unbalanced. Lagged growth of GDP per capita and initial values of GDP are treated as endogenous, while average years of schooling and labour growth are treated as exogenous or predetermined. This research contributes to the existing literature by extending the analysis to this technique and the resulting estimates are reported below. Table 2.13 reports estimates of different categories of taxes on growth in groups of sub

[68] see introduction section 1.6

aggregates, and Table 2.14 reports revenue-neutral shifts with broad direct-indirect tax classification.

Table 2.13 Annual GMM direct on growth

GDP per capita growth	1	2	3	4	5
L.GDP per capita growth	0.287	0.263	0.352	0.194	0.257
	(2.59)**	(2.46)**	(4.35) ***	(1.93)*	(2.72)**
L.lnGDP per capita	-0.157	-0.152	-0.139	-0.172	-0.151
	(3.95)**	(3.83)***	(3.60)***	(4.17)***	(4.10)**
Average years of schooling	0.041	0.038	0.033	0.047	0.037
	(3.28***	(3.07)***	(2.87)***	(3.35)***	(2.81)**
Total Investment	0.316	0.290	0.185	0.425	0.269
	(2.38)**	(2.21)**	(2.20)**	(2.53)**	(2.02)**
Working population growth	-0.077	-0.036	-0.132	-0.064	-0.078
	(-0.47)	(0.21)	(0.59)	-0.36	(0.38)
Government consumption	-0.351	-0.355	-0.387	-0.568	-0.534
	(1.92)*	(1.81)*	(2.07)**	(3.45)***	(5.08)***
Total tax revenue	-0.252				
	(1.62)				
Direct tax		-0.405			-0.267
		(1.98)**			(0.79)
Indirect tax		-0.032	-0.011	-0.175	
		(0.18)	(0.07)	(0.90)	
Income tax			-0.057		
			(0.22)		
Personal income tax				0.053	
				(0.11)	
Corporate income tax				- 0.475	
				(0.68)	
General sales tax					-0.213
					(0.76)
Trade tax					0.158
					(0.23)
N	361	353	320	310	296

* p<0.1; ** p<0.05; *** p<0.01

The lagged gdpgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions.

Direct tax variable is the only significant tax result from Table 2.13 GMM estimation, which implies that a 1 percentage point increase in direct tax will lead to a decline in GDP per

capita growth in the short run by 0.405 percentage points. This is comparable to the resulting estimate from the annual fixed effects regression.

Other resulting estimates from Table 2.13 indicate that growth may be persistent as the lagged growth rates report positive and significant coefficients at the 5 and 10% level of significance across all regressions. This indicates that previous growth is an explanatory factor for future growth for our sample. Initial levels of GDP report consistent negatively significant coefficients, as can be observed across all regressions and this is consistent with expectations as the conditional convergence variable. Human and physical capital also report positively significant estimates at the 5% level, while government consumption reports negatively significant coefficients. The overall burden of taxation represented by total tax revenue as a percentage of GDP, reports a point estimate of -0.252 significant at the 10% level when the variable *workpgrowth* is dropped. Direct taxes also reports significantly negative effects on growth, while indirect taxes and other sub-categories report insignificant results. Specifically, a 1 percentage point increase in direct tax/GDP ratio is associated with a decrease in GDP per capita growth by approximately 0.41 percentage points.

Table 2.14 GMM Rev-Neutral

GDP per capita growth	1	2	3
L. GDP per capita growth	0.299	0.265	0.265
	(2.72)***	(2.51)**	(2.51)**
L. GDP per capita	-0.160	-0.146	-0.146
	(3.97)***	(3.72) ***	(3.72)***
Average years of schooling	0.041	0.038	0.038
	(3.30)***	(3.07) ***	(3.07)***
Total Investment	0.310	0.291	0.291
	(2.35)**	(2.18)**	(2.18)**
Working population growth	-0.091	-0.049	-0.049
	(0.55)	(0.28)	(0.28)
Government consumption	-0.349	-0.349	-0.349
	(1.93)*	(1.76)*	(1.76)*
Total tax revenue	-0.243	-0.160	-0.160
	(1.60)	(1.07)	(1.07)
Direct tax		-0.074	
		(1.70)*	
Indirect tax			0.074
			(1.70)*
N	360	352	352

* p<0.1; ** p<0.05; *** p<0.01

The lagged gdpgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions.

The revenue-neutral estimates in table 2.14 which explain the broad tax composition reports results that are consistent with our earlier models. Revenue-neutral shifts to indirect taxes with reduction in direct taxes are more growth-promoting, while shifts from indirect taxes to direct taxes are more harmful for growth with significance at the 10% level. Regarding the size of the economic effect, a 1% shift of tax revenues from indirect tax(as the omitted variable) to direct tax in column 2 will lead to a decline in the GDP per capita growth rate by 0.07 percentage points. Column 3 also reports the expected opposite results which implies that a 1% shift towards indirect taxes with a corresponding reduction in direct tax will lead to increased GDP per capita growth by 0.074 percentage points while the total tax ratio remains unchanged.

This suggests a growth promoting tax mix with valid implications for the structure of taxation for our sample of countries.

Further sub-categories of taxes report insignificant results, except corporate taxes that reports consistent significantly negative coefficients across our regressions as the most harmful for growth, a finding which is in line with existing studies. All instruments used were of lag 3 and above, while the Hansen test of over-identifying restrictions confirms validity of the specification, although results may still be weakened by many instruments.

Table 2.15. GMM diagnostic test

Sensitivity Test	12(1)	12(2)	12(3)	12(4)	12(5)	13(1)	13(2)	13(3)
AR(1)-P Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR(2)-P value	0.149	0.166	0.285	0.355	0.239	0.163	0.187	0.187
Hansen Test p-	0.371	0.366	0.394	0.397	0.387	0.375	0.376	0.376

Table 2.15 presents the specification tests values for the presented GMM estimations. The Hansen test looks at identifying restrictions to check the aggregate validity of the instruments and examines if all the instruments are collectively exogenous which is confirmed in our case; while the AR-2 test seeks to check second order serial correlation of the hypothesis.

Summarised table of the revenue neutral growth specification

Table 2.16[69]	**5yr F.E**	**Annual F.E**	**Annual GMM**
Direct	-0.131	-0.094	-0.074
	(1.59)	(2.05)**	(1.70)*
Indtax	0.131	0.094	0.074
	(1.59)	(2.05)**	(1.70)*

Table 2.16 presents a summary of the main tax coefficients obtained across different models under the revenue neutral framework as shown in the previous regression output tables.

Though we indicate no preferences as each method has unique advantages alongside limitations, we discuss the summary of main results conditioned under the revenue neutral assumption. The five-year FE method helps to eliminate the business cycle effects across our group of countries by averaging the data hence the coefficients obtained can be interpreted directly as long run effects on the dependent variable which is GDP per capita growth. The PMG as an alternative estimator introduced also presents long run results however the iterative process was not suited for our revenue neutral test using sample data with limited number of observations though we used this method to identify a valid long run relationship[70] for the total tax revenue variable. PMG presents both the long run and short run coefficients for the group of countries as a unique advantage. Finally, the annual F.E and GMM highlight the short run relationship between per capita GDP growth and our tax variables of interest.

The overall burden of taxation represented by the total tax/GDP ratio is the control variable under the revenue neutral framework and does not represent the effect on GDP because it takes no account of how any additional tax revenue might be spent.

[69] Summary table of the estimated coefficients for the revenue neutral specification for direct and indirect taxes

[70] The speed of adjustment parameter suggests a quick return to equilibrium after a shock

The coefficient of direct tax for the 5year fixed effects estimations indicate that a 1 % shift from indirect tax to direct tax will lead to reduced GDP per capita growth in the long run however this result is insignificant for the emerging countries in this study. Similarly the long run relationship under the PMG approach also reported insignificant estimates under the revenue neutral specification which may be due to the poor quality of data in our sample[71].

The annual (Annual F.E and GMM) estimates presents a range with point estimates between (0.074 and 0.094) for our broad classification of direct and indirect taxes. This implies that a 1% shift from direct taxes to indirect taxes will increase GDP per capita growth by a range between 0.074 and 0.094 percentage points across emerging countries.

[71] The PMG requires full/balanced panels for complete iteration

To summarise our empirical approach and note the differences across models. We started our estimation approach by introducing the five year averaged data to test our baseline specification. Though we obtained expected results for the total tax/GDP ratio, human capital and government consumption variables, we were unable to confirm the negative conditional convergence criteria and it implies the results may be biased under the endogenous framework assumption. To compare with the Hausman specification test, we also introduce the RE estimations. For our sample, this bias may come in two ways:

1. The reduced number of observations from the time averaging of the data[72] because the sample time dimension T is not large and the sub categories of our tax variables are unbalanced.

2. The potential for endogeneity among the fiscal variables in the estimation.

To tackle the first point, we introduce annual data which increases the number of observations in our estimations. To explore the relationship with growth, we estimate an annual specification of our variables using the approach by Cellini (1997) with the introduction[73] of one lag to the conditional convergence variable. The results confirm the conditional convergence hypothesis in the endogenous literature which implies the constant returns to scale assumption is valid. Our variables are also significant jointly with the F-test[74] and individually except the growth rate of the working population in the baseline specification.

Total tax to GDP ratio reported expected negative estimates significant at the 5% level which implies a negative relationship with GDP per capita growth. Direct taxes reported strong significant negative relationship at 1% while the estimates for indirect taxes were insignificant. For sub categories of taxes, we are able to identify strong negative coefficient with 5%

[72] the five year averaging may not be the ideal business cycle for our sample with volatile trends

[73] We test the sensitivity of this lag inclusion specification and the conditional convergence assumptions are not violated

[74] indicates the model is correctly specified

significance from corporate tax while other sub categories were insignificant due to incomplete data.

The estimation is then transformed to include the revenue neutral setting where the broad categories are tested with the total tax/GDP ratio as the control variable. The conditioned estimates indicate that all things been equal, where total tax burden remains unchanged, a 1% shift from indirect taxes towards direct taxes is harmful for growth with a negative coefficient value of -0.094. The reverse regression where direct taxes are now omitted also indicates that a shift towards indirect taxes will be more growth promoting with a 0.094 value.

Due to the elimination of the time averaging criteria of the data, these results may only be valid for short run growth. To test for a long run relationship, we introduce the PMG which is estimated with assumptions valid for identifying a long run relationship through the speed of adjustment parameter. Here we identify quick convergence to the equilibrium path after a shock for our sample. Though we identify a negative long run growth relationship with omitted variables from the baseline specification on the Total tax/GDP ratio, the sub categories were insignificant in all estimations. This reinforces the problem of incomplete data in our sub-sample.

We conclude our empirical approach by introducing the GMM estimations which tackles the endogeneity problem noted among fiscal variables by transforming the equation specification and introducing lagged variables as internal instruments. Here we identify robust results similar to the Annual FE estimates with reduced absolute coefficient values. This points to the presence of endogeneity in the data. Under the revenue neutral condition which controls for the overall burden of taxation, a 1% shift from direct taxes to indirect taxes will promote growth with a range of possible values between 0.074 and 0,094, with a 10% level of significance. The results are valid from the interpretation of the robust diagnostic tests across all models.

2.5 Summary, conclusion and recommendations

According to Myles (2007), 'from an endogenous growth perspective the link between taxation and growth seems self-evident. Corporate taxation affects the return to innovation and hence must affect the optimal amount of research and development. Personal income taxation reduces the returns to education so must reduce the accumulation of human capital'.

This study examines the revenue-neutral shifts on the broad composition of taxes and the effect on growth. The emphasis on tax structures other than overall tax revenue levels is necessary as variations in aggregate tax levels to a large extent depict the preferences of society in relation to the standard level of government spending.

Although some of the studies[75] on the relationship between changes in the tax structure and economic growth put emphasis on the effects on GDP levels in OECD countries, this study employs GDP per capita growth rates as any effect on GDP level will also be reflected in the growth rates of GDP.

2.5.2 Main findings

The overall tax burden is negatively associated with growth and our estimates report relative significance across regressions. However, the magnitude depends on the methodology applied and the assumed time dimension of the data. This negative relationship is consistent with the prediction of the endogenous growth as taxes can distort economic agents' decisions to save and investment or substitute between labour hours and leisure.

Revenue neutral shifts from direct taxes to indirect taxes are more growth-promoting, while shifts from indirect taxes to direct taxes are more harmful for growth. These results were significant to different specification (both FE and GMM) however the annual data used implies it may only be valid for short run growth. Regarding the size of economic effect, a 1% increase from direct taxes to indirect taxes will produce a 0.07 percentage increase in output while the

[75] For instance, the Arnold 2011 paper.

overall tax burden is kept constant. A reverse shift from indirect to direct taxes will produce the exact opposite effect while controlling again for the overall tax burden.

For the sub-categories of direct and indirect tax, all taxes except corporate income taxes report sensitive and mostly insignificant coefficients, although properly signed. However, the data on these sub-categories is incomplete and inconsistent in the availability within our sample.

Corporate income taxes report strongly negative coefficients across all regressions, and it is the main driver of the negative coefficient of direct taxes. From our sample data, it was observed that, although differences in tax structures exist across the emerging economies examined, the main source of tax revenue are taxes from corporate incomes and consumption and from VAT, while personal income taxes represent a low share of overall tax revenue.

Highlighting the core results, we conclude that, if the overall tax-GDP ratio is unchanged, raising direct taxes while reducing indirect taxes will negatively affect growth. The negative relationship shows greater significance if corporate income tax is increased, as reflected in the highly negative coefficients from our estimation. On the other hand, our results within the revenue-neutral framework suggests that an increase in the indirect tax with a corresponding decrease in direct tax is associated with an increase in GDP per capita growth.

Appendix

Variables	Description
Gdpgrowth	Annual percentage growth rate of GDP at market prices. Aggregates are based on constant 2005 U.S. dollars. Source: World Bank Data
GDP	GDP per capita at constant 2010 US dollars (for 5 year averaged estimations, GDP represents the averaged period starting level of per capita income at constant US Dollars). Source: World Bank Data
Avgsch	Average years of Schooling(Interpolated using the cubic spline methodology) Source: Barro-Lee Data
Invtotal	Gross fixed capital formation, total (percentage of GDP). Source: World Bank Data
Govtcon	Government consumption (percentage of GDP). Source World Bank Data
Workpgrowth	Growth in the Labour force participation rate is the proportion of the population ages 15-64 that is economically active. Constructed from the world bank data
tottax	Total Tax Revenue (percentage of GDP). Source ICTD
direct	Total Direct Taxes excluding social contributions and resource revenue, calculated as the sum of Taxes on Income, Profits and Capital Again. Source ICTD
indtax	Total Indirect Taxes excluding resource revenues, calculated as the sum of Taxes on Goods and Services, Taxes on International Trade and Other Taxes. Source ICTD
inctax	Total taxes on income, profits and capital gains, including taxes on natural resource firms. This figure is always exclusive of social contributions. Source ICTD
indiv	Total Individual Taxes on Income. Source ICTD
Corp	Total Corporate Taxes excluding resource revenue
gs	Total Taxes on Goods and Services (observations are flagged where figures are potentially inclusive of resource revenue). Some irresolvable inconsistency across countries in whether this category includes sales taxes/VAT collected by customs agencies. Source ICTD
Trade	Total Taxes on International. Some irresolvable inconsistency across countries in whether this category includes sales taxes/VAT collected by customs agencies. Source ICTD

Chapter 3:

Public Investment and Economic Growth:

Evidence from Emerging Markets

3.1 Introduction

Public investment ratios as a share of gross domestic product (GDP) per capita income have been on the decline in developed countries since the 1970s. Data indicates that gross fixed capital formation within the EU recently hovered around two percent of GDP, in contrast with the four percent and above levels recorded in earlier decades. United States data also shows a decline, although less significant, in recent public investment ratios. Data on public investment in developing and emerging markets from the early 90s has only recently been made readily available and empirical studies on emerging countries are very limited. Reasons for the observed downtrend in public investment ratios include a reduced role for government in economic activity, increased privatisation and entry of private firms into infrastructure investments previously assumed to be the sole responsibility of the state. The presence of alternate mediums for financing infrastructure investment, including public-private partnerships, has been highlighted as a valid reason for the decline in public investment (Valila & Mehrotra, 2005). However, the authors say these stated reasons can be rejected, since the decline of public investment in developed countries is unlikely to be affected by privatisation: only records of investment financed directly from regional or national government accounts can be classified as public investment. This implies that investments made by public enterprises or parastatals are classified under different investment platforms in national account statistics.

Another argument against the smaller role for the state as a possible explanation for declining public investment rates can be refuted using data on aggregate tax ratios as percentages of GDP. With increasing rates over time, the argument of smaller size or reduced economic roles for government becomes rather implausible—public-private partnerships have

only recently become a trend amongst countries and may not be a valid reason to explain the decline in public investment. Roy, Heuty and Letouze (2006) argue that the influence of inadequate budget provisions in declining public investment is stronger than current spending, since it is easier to cut budgets. Since the late 1990s, there has been heightened agitation for higher budgetary provisions to improve funding for public investment initiatives. According to Heller (2005), underlying this clamour for more budgetary provision for public investment efforts is the belief in the productivity of public investment.

An evaluation of prior studies shows that researchers have looked at public capital in two major approaches. The first entails viewing public capital as a single aggregate (e.g., Ratner 1983; da Silva Coata et al., 1987; Merriman, 1990; Iwamoto, 1990). Conversely**,** other studies break public capital into smaller categories. The direct implication of breaking down public capital into components is that empirical estimations of their effects will easily vary across studies. According to Arslanalp (2010) the empirical evidence on the impact of public investment on growth is mixed. Previous studies on such impact have not produced clear-cut results (IMF, 2004 & 2005b). This has led researchers to argue that public investment is not productive. The literature has also often argued that total factor productivity (TFP), rather than capital accumulation, matters in explaining growth differentials[76] (Easterly & Levine, 2001). At the same time, a study by the World Bank (2007) concludes that there are positive growth effects in general resulting from public spending, and in particular from spending on infrastructure, education and health. Arslanalp (2010) further states 'the report from the Commission on Growth and Development (2008) came to an even stronger conclusion by noting that a common element in fast-growing countries is high public investment, defined as 7 percent of GDP or more. Other studies argue that fiscal multipliers for investment spending are higher than those for other public spending or tax cuts (Perotti, 2005; Zandi, 2008)'.

[76] As the main exogenous component that affects the steady state.

The objective of this chapter is to examine the relationship between public investment and per capita GDP growth. Additionally, our study also aims to check crowding out effects in the sample. The impacts of total investment as a share of GDP are initially tested using a panel fixed effects approach similar to Kneller et al. (1999) and in the spirit of Barro's (1990 &1999) approach with foundations in the endogenous growth framework.

This study's empirical strategy follows the traditional approach of averaging[77] the data to smooth out short-run or business cycle effects, however, it extends the analysis to check for crowding-out of private investment[78] following the dummy threshold specification approach used by Le and Suruga (2005). In the sample of countries examined in this study, the investment variable is split into public and private sections, tested for a long-run relationship and modelled for government budget finance implications. The study's research introduces three[79] alternative quantitative measures of public investment: as level and flow data, alongside two measures of public capital constructed from 1990. The constructed stock of capital is novel[80] for emerging markets and distinctly identifies public capital as an accumulation of public investment spending to capture the growth impact of public assets. A depreciation premium is also applied consistent with existing studies on public capital, as suggested by Arslanalp et al. (2010). Following the estimation approach[81] of Neil and Thirlwall (2014), this study concludes its empirical approach with the introduction of the net marginal productivity of capital (NMPC) as a dependent variable and checks for the existence of relationships amongst the main public investment measures.

[77] Barro (1990:1999); Kneller et al(1999); Arnold et al(2011)
[78] Dummy estimation approach following Le and Suruga (2005).
[79] Including the public investment share of GDP as the first public investment variable.
[80] Similar approach by Marquetti and Foley (2008) for total capital stock; Hoeffler and Pattillo (2001) for SSA countries; Arestoff and Hurlin (2006) use infrastructure specific depreciation rates (insert ref).
[81] The authors test for total investment using a cross sectional framework while this study's approach tests specifically for public investment using panel.

The rest of this chapter reviews research literature on public investment, highlights the empirical methods applied to this area of study, and presents research results and conclusions.

3.2 Literature Review

3.2.1 Public investment. Investment is defined as current spending for expected future benefits, while consumption spending brings about immediate benefits. Hence, public investment can be described as current government expenditure for benefits expected beyond the current budget or fiscal year. According to Lansing (1995), the main broad classification of public investment that can be observed includes physical infrastructure programmes such as environmental and transportation facilities, human capital programmes which increases the knowledge and skills for labour and government funded research and development that is crucial for technological progress. Public investment records only include expenditure financed directly from the government budget and does not include expenditure by public enterprises or government owned corporations.

According to the Economic Policy Institute (2012), public investment improves a country's capital stock by investing in core basic physical infrastructure such as rail lines, roads, airports, bridges, water distribution, human capacity development and green investments such as clean power sources and weatherisation. All of these investments ultimately result in improving a country's productive capacity and living standards. The classical reason justifying public provision of infrastructure is traceable to the concepts of public goods and market failures. The argument is that markets may not find the motivation to engage in provisioning a socially beneficial public good because it is non-rival and nonexcludable. Potential under-provision of infrastructure also arises where services exhibit network effects, positive externalities or natural monopoly characteristics. These attributes could confer on a private provider both the incentive and the ability to raise prices and/or control output below levels

that may be socially desirable. This is a major rationale for public presence in the provision of certain infrastructure. Another important consideration is the need to address social or equity considerations in the allocation of resources.

As indicated by IMF (2015), public investment is characterised as general government fixed capital formation (GFCF). It contains the aggregate net estimation of general government acquisitions of fixed resources amid an accounting time frame, in addition to variations in the valuation of non-produced resources (e.g., subsoil resources). General government includes local and sub-national governments. However, public investment does not include other public entities such as enterprises owned by the state and public-private partnerships (PPP). The IMF characterises public capital stock as the amassed estimation of public investment after some time that is adjusted for depreciation and is the vital contributor to the creation of public capital.

The IMF (2015) notes further that following many years of consistent decrease, public investment as a share of GDP started increasing in different economies. In advanced economies (AEs), public capital relentlessly diminished from a high of just about five percent of GDP in the late 1960s to a noteworthy low of a little more than three percent of GDP in 2012. Conversely, in developing markets (EMs) and low-income developing nations (LIDCs) public investment rates peaked at more than eight percent of GDP in the late 1970s to mid-1980s, declined to around four to five percent of GDP in the mid-2000s and have since recouped to six to seven percent of GDP. Consequently, public investment rates in AEs stay at memorable lows, yet have in part recouped in EMs and LIDCs within the last decade.

Warner (2015)[82] says public investment driven by the government is highlighted by huge changes in either public investment proportion (I/Y) or public capital growth. Identification is determined by choosing scenes of large and evident changes in public

[82] Using the Big Push Model, large policy investment drives were checked for different growth impacts.

investment on the basis that they reflect exogenous choices by government to support GDP growth. The model highlights large discernible changes in markets, supporting the idea that booms were the result of policies purposely picked by the government[83] to foster growth.

Anderson, de Renzio and Demand (2006) characterise public investment as expenditure by government that adds to general physical capital stock. This would incorporate the building of such infrastructure as roads, ports, schools, and hospitals. This compares to the meaning of public investment in national records information, or, to be specific, capital expenditure. The authors contend that attention on public investment is advocated by the re-established accentuation on attainment of the MDGs through 'enormous push' systems favouring expanded levels of public investment (Anderson, de Renzio & Demand, 2006).

Truger (2015), in discussing the golden rule of investment, defines public investment as those government expenditures that have positive implications on the economy, either through stimulating growth by providing significant future payoff or avoidance of future cost. However, this definition may be seen as being narrower than what a benchmark explanation of public investment should be in the light of a public accounts system. Notwithstanding, Välilä and Mehrotra (2005) hold that there frequently is disarray about the expressions 'infrastructure investment' and 'public investment'. While the volume of public investment is largely investment in infrastructure, not all infrastructural investments are actually public capital—a great deal of investment in infrastructure is attempted by businesses and is erroneously accepted as public investment. The authors point out that only investment specifically financed by government can be correctly described as public investment.

3.2.2. The need for public investment. The main argument for government provision of essential public investment expenditure is the standard 'public good' argument which suggests that the market may not be able to undertake provisioning of certain projects if the

[83] Confirmed by policy documents and news sources to validate investment drives.

benefits appear difficult to attain. Another argument for public investment is that the risk associated with certain types of investment is better handled by the government. One example is the high risk and cost of certain types of research and development. Investment in human capital is also socially desirable to increase productivity and reduce the income inequality gap (Lansing, 1995). However, public investment spending can also be interpreted as increased government borrowing that reduces capital available to the private sector or raises taxes. Hence, any justifiable increase in such spending should offer a higher rate of return for public investment when compared with private investment (Lansing, 1995).

Research into the productive effects of public capital have not reached a conclusion. The literature, as well as economic intuition, suggests that expansion in infrastructure investments would impact positively on private output, but there is no agreement on the extent of this impact. How large would it be? Will increased government spending justify increased borrowing or higher taxes? Will expansion in infrastructure cause a miraculous rise in productivity and growth?

3.2.1 Macroeconomic Effects

Complementarities for public and private capital.

In examining the influence of public investment in stimulating growth, researchers make the argument that a complementary relationship exists between public and private capital. This theory appears to be valid, since public and private capital often consists of unique components. Public capital is significantly comprised of stocks of public goods, such as infrastructure; private capital is comprised of private merchandise. Thus, the broad production function of an economy can be specified as:

$$y_t = \tilde{A}^* \, \mathrm{F(L,K,N,G)} \qquad (3.1)$$

where *Y* = 'aggregate output'; *K* = 'private capital', which could be either physical or human; *G* = 'public capital'; *N* = 'natural resources'; *L* = 'labour force'; and *A* = 'technology level'.

An increase in the stock of public capital causes an expansion in aggregate output. This increase additionally causes an expansion in the efficiency level of different production factors. For labour markets, an expansion in the productivity of labour brings about an increment in real wages.

It is noteworthy that when private and public capital share this complementary relationship, an increase in a country's public investment will result in a rise in the growth rate, at least up to a point. To illustrate, consider Cobb-Douglas in equation[84] (3.2):

$$y = A\left(k^{\alpha} G^{\beta}\right) \tag{3.2}$$

where y = '*Y/L* is output per worker', k = '*K/L* is private capital per worker', g = '*G/L* is public capital per worker', and the parameters α and β = 'elasticities of aggregate output with respect to private and public capital respectively'. In addition, it is assumed that the rate of private saving is not influenced by private investment returns. The long-run or 'steady-state' level of output per worker (y^*) is then given by:

$$y^* = A^{1/\gamma}\left(\frac{s_p}{\delta_k}\right)^{\alpha/\gamma}\left(\frac{s_g}{\delta_g}\right)^{\beta/\gamma} \tag{3.3}$$

where s_p = 'share of private investment in national income', S_g = 'share of public investment in national income', δ_k and δ_g = 'rates of depreciation of private and public capital respectively' and γ = '$1-\alpha-\beta$'. In this context, the model predicts countries with higher rates of public investment will tend to experience higher levels of output per worker (*ceteris paribus*) in the long run. In the short- to medium-run, as they approach their long-run steady-state level of output per worker, countries with higher rates of public investment will have higher rates of economic growth (again, *ceteris paribus*)[85].

[84] As demonstrated by Anderson, Renzio and Levy (2006)
[85] Positive growth impacts with a persistent transition period and higher production output per worker.

Equations 3.1 to 3.3 could incorporate a few unique sorts of public capital and investment, each with a possible impact on long-run output per worker and economic growth. Equation 3.2 could likewise be stretched out to a broader useful frame. As demonstrated by Anderson, Renzio and Levy (2006) for this situation, the effect of public investment on growth will be more diverse and will rely upon no less than four things: the sort of public investment; the amount of investment; the underlying public capital stock; and the economic setting in which investment happens[86].

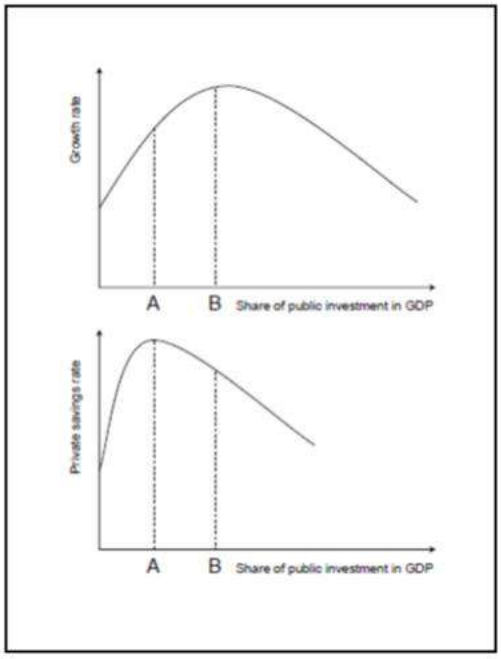
Crowding-in in private investment. When public and private capital are complements, public investment raises the efficiency of private capital. The subsequent impact is an expansion in the returns to private investment. If private savings are adaptable, the amount of private investment will rise as private investment funds increase because of increasing returns. Thus, this 'crowding in' of private investment causes an increase in the rate of growth in an economy. In any case, while public investment is practically sure to crowd-in private investment when beginning from a low level, it is impossible that this influence will hold at all levels. This is because increases in public investment bring about a progressively declining positive effect on private investment returns. It seems unavoidable that expanding public investment will inevitably crowd-out private investments. However, emerging economies seem far off this point[87].

The crowding-in and crowding-out dynamics of public investment is explained by Barro (1990). In the model, it is practical to recognise three phases as delineated in Figure 3.1. For levels of public investment up to point A[88], public investment causes a rise in returns to private venture, savings and growth rate; this is the 'crowding-in' stage at the point public investment pushes up the scale of private venture. After point A, the (negative) impacts of

[86] Including budget finance settings.
[87] Public capital and large core infrastructure gaps still exist in emerging markets.
[88] Emerging Markets are assumed to be below this point.

higher tax assessments balance the (positive) impacts of more public capital on profits to private investment; further increments in public investment brings down the private saving rate. Between points A and B, increments in public investment still raise the rate of growth, since public investment remains gainful.

Figure 3.1 Different Stages of Public Investment (source: Barro 1990)[89]



Along these lines this can be depicted as the 'effective crowding out' stage. Zones above point B demonstrate that public investment is becoming less beneficial: henceforth additional increments will tend to reduce savings[90] and growth rates. This stage is the 'inefficient crowding-out phase'. The ideal level of public investment, as a proportion of GDP, is point B. A critical point to note in Barro (1990) is the presumption that public investment is financed using tax revenue. In cases, where this may not hold entirely, for example, when investment is financed through external borrowings, the impacts of public investment on

[89] Adapted from Anderson et al. Levy (2006)
[90] Strong implication for capital finance and productivity by extension.

growth may be quite complex and rely upon the presumptions set regarding time horizons. This is an issue that must be examined experimentally. For investment financed through aid, a few models foresee a similar opposite U-shaped pattern shown in Figure 3.1 (Lensink and White, 2001), despite the fact that this may occur for various reasons not similar to the Barro (1990) model.

Productivity of public capital. A great deal of research consideration has been dedicated to measuring the efficiency of public capital using a variety of methodologies. Some studies embrace the production function approach[91] where public capital stock is incorporated as an extra input factor. Some depend on a cost or profit function where the public capital stock is incorporated, while others utilise the VAR approach where limitations are forced to address the issues raised by the production function. The examples examined here found that public capital is beneficial, despite using an extensive variety of hypothetical and experimental systems.

In particular, Aschauer (1989; 1998) was the first to argue that there is a vital part for public capital in clarifying the fall in productivity observed in the US in the 1980s. The studies succeeding Aschauer additionally demonstrated the impact of public capital on growth. In particular, Munnell (1990) indicated the effect of public capital on growth to be between 0.31–0.39, which is in accordance with what was found in Aschauer (1989). Similarly, Lynde and Richmond (1993) demonstrated that public capital is an imperative piece of the production procedure, and that productivity decreases of about 40 percent can be explained by a fall in the public capital–labour proportion. Similar papers achieved comparative conclusions

3.2.2 Theoretical Framework: A Representative Model

In the existing literature, it is typically assumed that public sector infrastructure capital enters the aggregate production function, composed as a Cobb-Douglas function, as a resource

[91] Valid implications from early studies, e.g. Aschauer (1989) to recent papers e.g. Isaksson (2009).

input. The production function approach indicates a production function in which public capital is incorporated as a factor of production. Following Heinz (2010), a standard production function including public capital is:

$$Y = AK^{\alpha}L^{\lambda}P^{\gamma} \tag{3.4}$$

with Y = 'private sector output'; K = 'private fixed capital'; L = 'labour inputs'; P = 'public capital resources'; and A = 'general productivity parameter' representing upgrades in the production procedure. The production function parameters are α, λ, and γ = 'contribution to private output of private capital, labour and public capital separately'. This checks whether public capital affects the productivity of private capital. Subsequently, the production function in relation to average capital productivity is expressed:

$$Y / K = AK^{\alpha-1}L^{\lambda}P^{\gamma} \tag{3.5}$$

Note that this change modifies the exponential coefficient on the capital stock term. The coefficients on the labour input (λ) and the general public capital stock (γ) remain unaltered. When the coefficients on the labour input and the general public capital stock factors are estimated[92], these coefficients can be translated regarding their effect on the productivity of private capital stock or in relation to their effect on output (Y) if the supply of private capital (K) is held consistent. Using the common logarithm and accepting that parameter A increments at an exogenously given rate of δ yields the accompanying model communicated as a long-run relationship:

$$\ln(Y / K) = \ln A_0 + (\alpha - 1)\ln K + \lambda \ln L + \gamma \ln P + \partial t \tag{3.6}$$

In the above expression, A_0 = 'underlying estimation of the innovation parameter' is presented as a constant, such that the estimation of ln$A$ in time period (t) would rise to lnA_0 + δt. If constant returns are imposed to scale confinement for the model, the exponential

[92] Point of interest in derivation of the net marginal productivity of capital.

coefficients in 3.7 will aggregate to zero. This implies, with constant returns to scale, (α−1) + ($\lambda + \gamma$) = 0. Substituting −($\lambda + \gamma$) for (α−1), the coefficient on the private capital stock term gives the accompanying expression for the steady returns to scale function:

$$\ln(Y/K) = \ln A_0 + \lambda(\ln L/K) + \lambda \ln(P/K) + \partial t \tag{3.7}$$

To assess the connections in the conditions stated, a dynamic fixed model from these fundamental production processes can be applied. In particular, the long-run relationship is expressed as an autoregressive distributed lag (ADL) model. The articulation for an ADL(1,1) specification of Equation 3.7 is given in Equation 3.8:

$$\ln_{(Y/K)t} = c + \pi \ln_{(Y/K)t-1} + \beta_1 \ln K_t + \beta_2 \ln K_{t-1} + \lambda_1 \ln L_t + \lambda_2 \ln L_{t-1} + \gamma_1 \ln P_t + \gamma_2 \ln P_{t-1} + \partial t + \varepsilon_t \tag{3.8}$$

In the above model, π = 'coefficient on the lagged endogenous variable', the constant term, *c*, replaces the consistent parameter, ln*A0*, in condition (Equation 3.6), and ε_t is presented as a stochastic error term. For clarity, the coefficient on the private capital stock term, (α−1), is replaced with another coefficient, β. This also applies to the coefficients on alternate factors, embracing the tradition that a subscript of *1* on the coefficient implies a contemporaneous estimation of the variable and a subscript of *2* on the coefficient alludes to one-period lagged estimation of the variable. The lag structure extends beyond the fundamental ADL(1,1) structure by adding extra lagged variables to right hand side of the equation.

3.2.3 The Government Budget Constraint (GBC)

In line with prior studies (Bleaney et al., 2001; Kneller et al., 1999), there is some level of acknowledgement that irrespective of the importance given to fiscal policy, taxes could either distort or not distort investments and expenditures could be 'productive' or 'unproductive'. Keeping these possibilities in mind is necessary when examining the influence that a government's fiscal direction can have on growth. The authors cited above hold that the meaning of the outcomes from such an examination of fiscal policy effects results and relies to

a large extent on acknowledging the part played by government budget constraints. Since a government budget is made up of revenue and expenditures and resulting deficits or surpluses, this can be seen as 'closed system'. Any adjustment in one component must require an equivalent adjustment in other components. This generates some consequences in relation to how estimates of fiscal policy variables in growth regressions which incorporate at least one component of the government budget constraint (GBC).

Following analyses by Arnold et al. (2007), assume that g_t refers to the growth in GDP for an individual country at time *t*. Going forward, g_t, depends on the set of *k's* which are not fiscal variables, Z_{kt}, and a set of *m's* representing the fiscal variables, and X_{mt}. u_t depicts the error term. A representative model specification for growth is given below:

$$g_t = a + \sum_{k=1}^{k} \beta_k Z_{kt} + \sum_{m-1}^{m} \gamma_m X_{mt} + \mu_t \qquad (3.9)$$

Broadly, policy makers may be concerned about how considerations regarding the change in the rates of any tax components or the amount of public spending will affect growth in either a positive or negative manner. Keeping in mind that a change in any of the fiscal components needs an equivalent change from any of the other components, no singular fiscal component can be considered on its own. To put this in proper perspective, appraise a situation in which one kind of expenditure, *e*, is funded with a combination of revenue coming from a proportional tax, *y*, and also with what revenues come in from the tax given by $r = \tau y$, where τ refers to the marginal tax rate. In a case where public spending is greater that tax revenue, the balance is funded by government borrowings.

Defining $E = e/y$, $R = r/y$ $(= \tau)$, and $D = d/y$ where *d* refers to budget deficit, transformations to examine if the variables exact any significant influence each on growth and hence (3.9) becomes:

$$g_t = a + \sum_{k=1}^{k} \beta_k Z_{kt} + \gamma_r R_t + \gamma_e E_t + \gamma_d D_t + \mu_t \qquad (3.10)$$

However, defining the GBC as:

$$D_t = R_t - E_t \tag{3.11}$$

and using *D* in Equation 3.11 to substitute for D_t in Equation 3.10 gives:

$$g_t = a + \sum_{k=1}^{k} \beta_k Z_{kt} + (\gamma_r + \gamma_e) R_t + (\gamma_e - \gamma_d) E_t + \mu_t \tag{3.12}$$

Bringing together the parameters on R_t and E_t in Equation 3.12, yields $(\gamma_r + \gamma_e)$

The fiscal parameters, $\gamma_r, \gamma_e, \gamma_d$, are difficult to identify standing alone. In fact, it is challenging to meaningfully discuss them in terms of their separate effects. The reason is that it is almost not feasible to have an effect show up on a growth effect analysis from just a single fiscal component. Any observed effect on growth must come from an interaction with at least two of the fiscal components. Going forward with an estimation, it appears that the logical thing to do is to at least omit one of the fiscal components to reduce the chances of perfect collinearity in the estimation as in Equation 3.12. The component that is taken out is thought to be the one that compensates for any changes that occur to the constraint imposed by government's budget. Hence, the appropriate meaning to be adduced to every one of the estimated fiscal variables is the impact of a one-unit change in the particular fiscal variable, compensated by a unit change in the fiscal component removed from the regression.

In this regard, the coefficient of a productive expenditure may tend to be higher if it is funded side-by-side with a policy move that is financed by non-distortionary taxation rather than distortionary taxes—because in the former case γ_r in the expression $(\gamma_r + \gamma_e)$ is thought to be less negative, or zero. However, the challenge is not addressed simply by removing many components of the government budget constraint from the regression equation as compared to just removing one. As highlighted by Arnold (2007), the key difficulty here is to accurately identify the implicit financing source of a particular expenditure.

3.2.4 Allowing for Heterogeneous Fiscal-Growth Effects.

Studies discussed here dealing with the influence of fiscal actions of government on growth in emerging markets have in several cases been based on cross-section data adopting five-year averages that eliminate the effects of business cycles and reduce short-run effects. Because of the short time span, these studies often employed static or dynamic data estimation approaches. The challenge introduced by this method is the bias resulting from regressing endogenous variables, which could end up giving misleading estimates and research outcomes for longer time periods and larger sample sizes. In order to surmount this estimation challenge, this study introduces instruments of the public investment variable in a GMM framework. The results are also validated by controlling for heterogeneity via the use of the pooled mean group (PMG) and mean group (MG) estimators (Pesaran et al., 1999). The MG gives room for parameter heterogeneity both in the short-run and in the long-run, while the PMG enforces homogeneity in the long run.

3.3 Data

This section considers average rates of growth and public investment ratios alongside other macro growth determinants from 1990-2012 which provide a suitable time for long-run growth dynamics to be observed while examining the relationship from public investment. The data under review was obtained and constructed from various sources. Specifically, the investment data is the gross fixed capital formation as a percentage of GDP retrieved from the World Bank dataset. The dataset was split into public and private data using their respective share of GDP ratios. Growth rates of the working population, government consumption and GDP growth was also obtained using World Bank data, while human capital information was obtained from the Barro-Lee human capital data.

Descriptive Statistics.

Table 3.1 Descriptive Statistics of Macro Investment Variables All Countries

Variable	Mean	Std Dev	Min	Max
Total Investment Ratio	22.60785	7.083422	6.1678(Latvia)	46.82102(China)
Private Investment	16.47375	5.135956	7.51425(China)	34.41259(Thailand)
Public Investment	6.154711	5.439765	(Latvia)-1.006416	29.83014(China)

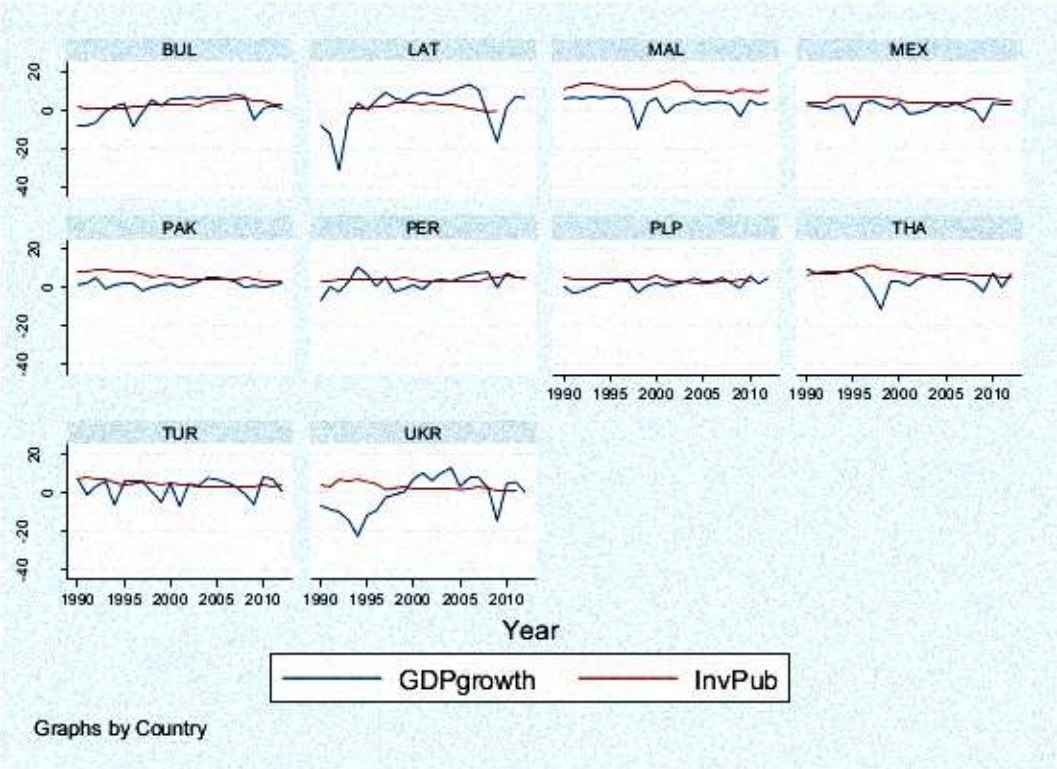
* *Descriptive: An overview of the investment summary statistics of the emerging economies under review indicated that Latvia, with a minimum value of public investment*[93] *(-1 percent), also recorded the lowest growth rate, while China, with the maximum public investment value, recorded the highest per capita growth rate. However, this showed association evidence from the data that countries with higher investment ratios also recorded higher growth during attempts to establish causation from the regression analysis in this research.*

From Figure 3.2 the panel data line plots for the emerging economies under review can be observed. A rather smooth trend around a fixed point averaging about five percent also can be observed for the public investment plot while the per capita growth rate within the period was more volatile with noticeable kinks around the period 07-08 (a recent economic recession period). Figure 3.3 shows that private investment fits better with the growth line and it can be

[93] This anomaly may be due to capital depreciation and new capital may be less than the existing gross.

argued that private investors, in order to maximise their interests, make decisions after careful analysis of the current macroeconomic situation and forecasts for future periods.

Figures 3.2 and 3.3: Per Capita Growth and Public/Private Investment Subset2[94]



[94] Subset 1 is BRICS economies only while Subset 2 includes all other economies except the BRICS.

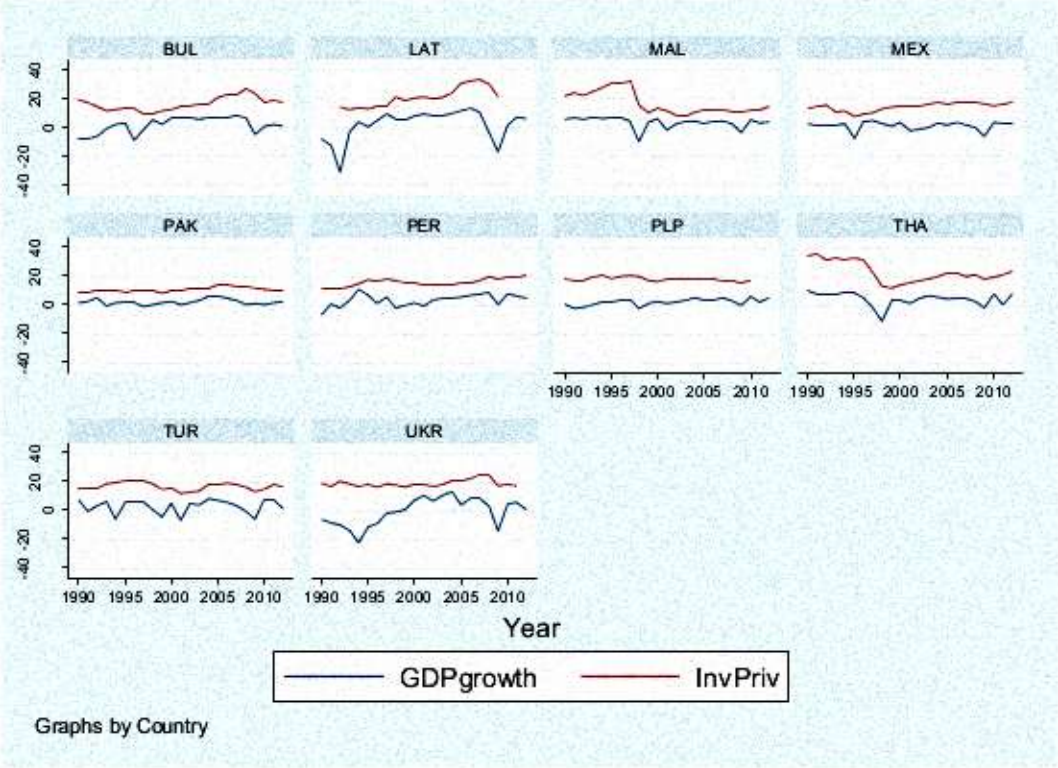


Table 3.2: Correlation Statistics: GDP Per Capita Growth

Independent Variables	Coefficients
Initial Per Capita GDP	-0.2613
Public Investment	0.5505
Private Investment	0.1241
Total Investment	0.6562

Correlation statistics. Table 3.2 shows the correlation statistics between the independent vector of variables in this analysis and in economic growth. The extended neoclassical growth theory basically explains that the initial level of per capita income is negatively related to growth and the correlation results affirm this statement with initial per capita income having a negative relationship with growth. Convergence therefore is implied from this association as poor countries should grow faster than richer countries and their

levels of per capita income should meet at some point. The investment ratios (public, private and total) showed positive relationship with growth and this conformed to the expected signs.

3.3.1 Estimation Results

Table 3.3: GDP Per Capita Growth

Table 3.3 -5 yr F.E	GDPgrowth-Deficit Financed	GDPgrowth-Tax Financed	GDPgrowth-Unprod Financed
L.lGDP	-0.060	-0.010	0.004
	(2.32)**	(0.30)	(0.10)
Average years of schooling	0.011	0.010	-0.003
	(1.58)	(1.57)	(0.47)
Government consumption	-0.282	-0.329	
	(0.89)	(1.08)	
Inflation	-0.037	-0.034	0.002
	(1.64)*	(1.55)	(0.03)
Working population growth	-0.273	-0.430	-0.163
	(0.92)	(1.33)	(0.61)
Total tax revenue	-0.089		-0.068
	(0.28)		(0.25)
Private investment	0.23	0.15	0.27
	(1.98)**	(2.07)**	(1.43)
Public investment	0.349	0.217	0.372
	(1.18)	(1.02)	(0.76)
Deficit		-0.082	-0.137
		(0.75)	(0.63)
_cons	0.367	0.270	-0.257
	(2.28)**	(1.58)	(0.76)
R2	0.51	0.54	0.47
N	58	56	37

* p<0.1; ** p<0.05; *** p<0.01

Fixed effects regressions are based on five-year averages from 1990-2010, annual and three year intervals extending to 2012. Figures in parentheses are t-statistics. Time and country dummies are included in all regressions. All fixed effects regressions reported have overall significance at 1%.

Table 3.3 represents the estimations using the 5 year averaged fixed effects that has been conditioned for the budget constraint. The first result column represents deficit financed public investment while columns 2 and 3 represents tax financed and Unproductive financed

expenditures as conditioning variables respectively (Regression 1 omits the deficit variable, regression 2 omits the tottax variable while regression 3 omits government consumption variable). The public investment variable was insignificant across all 3 regressions in Table 3.3 irrespective of the financing assumptions. Specifically, the point estimates suggest that a 1 % increase in deficit financed public investments is associated with a 0.35 percentage point increase in GDP per capita economic growth in the long run while a similar 1% increase in public investment financed by the unproductive government consumption variable leads to a 0.37 percentage point increase in the GDP growth rates. The coefficients seem to suggest that tax financed public investment is associated with the lowest growth value (0.217), however all the estimates regarding public investment are insignificant in this five year analysis and this may be due to potential endogeneity among fiscal variables in the regression or the reduced number of observations from our averaging of the data. In this instance, T is small relative to the number of observed N which represents the sample group.

Table 3.4 GDP Per Capita Growth

Table 3.4 -5yr FOD GMM	Deficit Financed	Tax Financed	Unprod Financed
L.GDPgrowth	-0.366	-0.110	-0.488
	(2.70)***	(0.84)	(2.73)***
L.lgdp	-0.092	-0.043	-0.082
	(2.28)**	(1.28)	(2.07)**
Average years of	0.011	0.013	0.019
schooling	(2.09)**	(2.17)**	(3.17)***
Government consumption	-0.648	-0.491	
	(2.28)**	(1.68)	
inflation	-0.045	-0.039	-0.056
	(1.60)	(1.67)*	(1.61)
Working population	-0.148	-0.187	-0.253
growth	(0.64)	(0.99)	(1.04)
Private investment	0.197	0.182	0.187
	(2.57)***	(2.19)**	(2.27)**
Public investment	0.117	0.121	0.192
	(1.21)	(0.76)	(1.37)
deficit		-0.057	0.032
		(1.05)	(0.62)
Total tax revenue	-0.108		0.120
	(1.52)		(1.26)
N	38	38	37
AR 1 & (2) p-value	0.000(0.327)	0.000(0.363)	0.000(0.271)
Hansen Test p-value	0.311	0.415	0.256

Dependent Var is GDPgrowth per capita. Five-year panel data is used for estimation. The lagged GDPgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are treated as endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions.

Following our approach in chapter 2, we replicate these tables using FOD GMM and our results appear similar in the coefficient signs but the values are broadly insignificant as reported in table 3.4. The public investment coefficients seem to suggest that public investment financed by unproductive government expenditures is associated with higher GDP per capita growth value when compared to the deficit financed and tax financed coefficients. Though we report similar signed estimates with the 5 year fixed effects estimations, the main difference with the GMM approach is in the introduction of lagged variables as instrument to tackle the potential for endogeneity among the fiscal variables. Generally the results are not robust for our main variables of interest (public investment as a share of GDP) irrespective of the financing assumptions. The other variables are also not robust using the five year averaging specification which may be due to the reduced number of observations from averaged data.

Table 3.5: GDP Per Capita Growth

Table 3.5 Annual F.E	GDPgrowth d.financed	GDPgrowth T.Financed	GDPgrowth-Unprod Financed
L.l GDP per capita	-0.099	-0.100	-0.092
	(5.92)***	(6.49)***	(6.07)***
Average years of	0.028	0.025	0.026
schooling	(6.07)***	(6.15)***	(6.45)***
Government	-0.454	-0.777	
consumption	(2.73)***	(5.03)***	
inflation	-0.004	-0.003	-0.004
	(4.34)***	(3.93)***	(4.46)***
Working population	0.106	-0.013	-0.007
growth	(0.82)	(0.11)	(0.06)
Private investment	0.374	0.296	0.307
	(6.53)***	(5.67)***	(3.59)***
Public investment	0.271	0.179	0.322
	(1.98)**	(1.74)**	(1.67)*
Total tax revenue	-0.049		-0.064
	(0.36)		(0.27)
deficit		-0.031	-0.072
		(0.73)	(1.21)
_cons	0.571	0.677	0.621
	(5.20)***	(6.69)***	(6.30)***
R2	0.25	0.27	0.30
N	384	380	362

Fixed effects regressions are based on five-year averages from 1990-2010, annual and three year intervals extending to 2012. Figures in parentheses are t-statistics. Time and country dummies are included in all
regressions. All fixed effects regressions reported have overall significance at 1%. Columns 1-3 represent
estimations each conditioned by different financing assumptions.

Table 3.5 presents the annual estimates also conditioned for the budget constraint. The calculated coefficient from our benchmark regression implies that an increase in one percentage point of initial GDP per capita across countries is related to a decrease in the GDP growth by 0.10 percentage points. The estimated coefficient of the convergence variable as

known both from the endogenous and neoclassical growth theory is expected to be negative with poor countries expected to grow faster than rich countries if other conditions are held constant.

Columns 2-3 also present a similar range of point convergence coefficients between -0.09 and -0.10 significant at 1 percent level. The estimated coefficients for other growth determinants are also presented in the benchmark regression 1 and subsequent regressions 2-3.

Public investment as a share of GDP gives a positive range of values between 0.18 and 0.31 which implies that an increase in the public investment share will be growth promoting conditional on the implicit financing assumptions in our model. Column 1 suggests that a 1 percentage point increase in public investment financed by the budget deficit is associated with a 0.27 percentage point increase in GDP per capita growth across countries in our sample ceteris paribus. The tax financed public investment spending also reports a positive but reduced value of 0.18. This implies that tax financed public investment spending is associated with the lowest positive impact on GDP per capita growth in our sample. The third column produces the largest reported coefficient value for public investment financed by government unproductive expenditure and this gives a point value of 0.31. Specifically, this indicates that a 1 percentage point increase in government unproductive expenditure will lead to a 0.31 percentage point increase in the GDP per capita growth in the short run.

Private investment as a share of GDP per capita also reports positive relationship with growth. Specifically, a 1 percentage point increase in private investment leads to an increase in per capita income growth by between 0.30 percentage points and 0.37 points. The role of both public and private investments points to a positive growth relationship though there are differences in the magnitude depending on the specification for our sample of countries.

The human capital variable represented by average years of schooling reports positive and significant estimates which is expected as observed from similar studies under the new growth theory. An extra year of stock of human capital is associated with an increase of approximately 0.03 percentage points in GDP per capita growth ceteris paribus. Subsequent regressions 2 and 3 also report similar coefficients with approximately 0.03 percent value while the workforce population growth variable returns insignificant estimates in our sample. Inflation also presents a low negative relationship with GDP per capita growth in our sample with the reported point values of -0.004 significant at 1%.

The reported coefficients in this panel estimate are valid for short run or annual changes as implied from our use of annual changes. The reported positive coefficients for public investment variables are plausible with increased spending from budgetary allocations in the current period which leads to employment of new resources including labour and capital which directly affects output. A one year period is not sufficient for many investments including roads, bridges alongside other public infrastructure projects that will require years on average as gestation periods till completion. Hence these short run reports may not be viewed as improvements to long run growth and productivity from the completed public investments. For instance, a road construction project between a rural and urban area may immediately lead to increased employment of diggers and support workers from the rural area and high skilled staff (engineers, surveyors etc) from the urban area when the initial funds are released for such project in the first year. Subsequent years may still show positive impacts with slight variations depending on the employment of labour and capital for different phases of the construction. The improvements to output and productivity can only be fully captured when the project is complete for instance improved transportation with shorter travel times between markets which ceteris paribus may lead to lower prices by the reduced overall cost for rural farming output in urban stores.

Table 3.6: GDP Per Capita Growth

Table 3.6 FoD Annual GMM	GDPgrowth D.Financed	GDPgrowth T.Financed	GDPgrowth-Unprod Financed
L. GDP per capita growth	-0.087 (0.65)	0.197 (3.53)***	0.425 (1.78)*
L.lGDP per capita	-0.351 (4.97)***	-0.067 (3.57)***	-0.152 (3.37)***
Average years of schooling	0.044 (3.19)***	0.017 (4.93)***	0.035 (4.39)***
Government consumption	-1.109 (4.09)***	-0.511 (3.60)***	
inflation	-0.004 (1.75)*	-0.002 (1.87)*	-0.001 (0.91)
Working population growth	0.220 (1.38)	-0.067 (0.63)	-0.059 (0.39)
Private investment	0.242 (4.25)***	0.166 (4.77)***	0.219 (3.71)***
Public investment	0.147 (1.37)	0.122 (1.41)	0.208 (3.58)
Total tax revenue	-0.109 (1.35)		-0.036 (0.82)
deficit		-0.052	-0.127
AR 1 & (2) p-value	0.000(0.297)	0.000(0.213)	0.020(0.371)
Hansen P-value	0.347	0.435	0.224
N	361	359	339

The lagged gdp growth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are endogenus . T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5%, and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions

Table 3.6 also present the analysis of our GMM estimate which reports similar signs consistent with theory for our fiscal determinants across all regressions in columns 1-3. Here we also highlight the different implicit financing assumptions as presented in the previous tables and the calculated coefficients of public investment reports a range of values between 0.12 and 0.21 percentage points. Specifically, in column 1, a percentage point increase in public

investment is associated with an increase in GDP per capita growth by approximately 0.15 percentage points though statistically insignificant.

To further discuss the summary of our approach and results, in the first table with five-year averaged data with a deficit financed assumption, the negative sign of the lagged regressor represents the convergence variable and is standard and robust across regressions. Education, measured by the average years of schooling (avgsch), impacted positively though insignificantly[95] on the economic growth. The significance and robustness improved with the annual fixed effects and GMM estimates. This finding is in line with investigations by different scholars, including Barro (1998), that showed a positive association between the stock of education and the growth of per capita income across countries. Theoretically, education gives workers the opportunity to utilise existing capital more efficiently, to stimulate the growth and dissemination of new innovation and to improve the capacity of imitation and adoption of techniques already in use in developed countries. Education also has beneficial external effects on productivity (Sarquis and Arbache, 2002), is very useful in efficiency and technical change and, hence, productivity growth. However, average years of schooling (avgsch) across emerging economies needs to be improved if this factor is expected to significantly drive growth in the future: Brazil (5.8 years), India (4.22 years), Mexico (7.74 years), Turkey (6.0 years) and Pakistan (4.04 years), especially when compared with those of advanced economies like the United States (12 years), Canada (11.6 years) and Germany (10.2 years). Nevertheless, despite the positive role of education theoretical growth empirical research has found at best mixed evidence supporting the hypothesis (Pritchett, 2002; Temple, 2001). This may be due to the problems with how education is measured (Krueger and Linddahl, 2001)[96].

[95] Five-year averaged results are generally less robust in this study's model due to the data size with reduced observations.

[96] Depending on societal factors, there exist slightly different implications if male years of schooling is used as the human capital proxy.

Government consumption (govtcon), deficit and total tax ratios are budget conditioning variables and suggest the financing assumptions of the public investment spending hence the coefficients cannot be interpreted as growth effects. In each column where one conditioning variable is omitted, it implies the source of financing for the public investment spending.

Inflation shows a significant negative effect on growth. As stated by Neil (2017), the main channel through which macro-instability reduces growth is through the difficulty an unstable economy has in maintaining a full employment level of output. 'Stop and start policies of governments confronted with inflation and other sources of instability are not conducive to the full utilisation of capital capacity' (Neil 2017). The labour force, represented by the growth of the working population (workpgrowth) between ages 16 and 64, was negative and insignificant. Though this result highlights the growth of the working population year on year within the timeframe of the study, this variable is insignificant across all model regression. However, it is an important input as standard neoclassical arguments indicate that population growth is an important exogenous variable.

Private investment reported strong positive and significant effects on the output growth of emerging markets, with positive point values and significance across the five-year averaged regressions. This could be explained as private investment effectiveness in the area of stimulating economic growth. However, as observed by Hemming et al. (2002), it appears that for emerging markets the extent of public-private investment substitutability does not necessarily generate significant crowding-out effects. This is so because emerging economies' public investment spending addresses existing infrastructure shortages, hence its alleged non-substitutability as regards to private investment. The result supports the finding for a panel of 14 Organisation for Economic Co-operation and Development (OECD) countries by Aschauer (1989b) and Argimón, González-Páramo and Roldán (1997), that public investment tends to,

on the aggregate, crowd-in private investment and that both public and private capital could be seen as complementing each other.

The variable of interest in this study, the public investment coefficient, is insignificant though positive across the five-year regression models but is strongly significant across different time specifications, as shown in the annual regression table. The coefficient reports the most value when financed from unproductive expenditures, though it reports less significance than the deficit-financed public investment coefficient.

3.3.2 Budget Constraint Implications

From the financing perspective implication of public investment, this study omits one of the fiscal budget variables as demonstrated in empirical studies by Bleaney et al. (2001) Gemmell et al. (2007) and Arnold et al. (2007). Generally, public investment reported the most significant estimates when financed by the net[97] budget deficit, while public investment financed from unproductive expenditures, represented in the model by the government consumption expenditure, reported the largest positive impacts of public investment. Tax-funded public investment also reported positive and slightly sensitive estimates[98]. From the trend of the results obtained, all public investment coefficients were consistently positive, irrespective of the assumed financing from the model. However, this study highlights the deficit financed estimations in subsequent tables as the most consistent and significant financing assumption in the chosen sample of emerging markets. Also regarding the budget constraint assumptions, the tax financed specification ideally should be split between distortionary and non distortionary taxes while government consumption expenditure omits other unproductive

[97] Also incorporates surplus variables to generate the net effect however countries reported more deficits except China within the sample.

[98] Split tests from direct and indirect taxes financing implications also reported insignificant estimates largely due to the gaps in the split data for the sample.

expenditures not available for our sample. These are limitations for the implicit financing assumptions under the tax financed and government consumption expenditure specifications.

Private Investment: Crowding-Out Implications. It can be argued that public investment crowds out private investment and may lead to negative growth impacts, especially at high levels of public investment. The study tests for complimentary relationships and confirms whether there exists any evidence of crowding-out at different levels of public investment. Following Le and Suruga (2005), this study introduces a dummy variable that allocates *value 1* to investment data above the threshold[99] and *0* to values below. A public investment dummy variable is introduced at five percent and seven percent.

[99] Representative threshold of five percent and seven percent presented to capture below and above sample average.

Table 3.10: GDP Per Capita Growth

Tab 3.10 Annual F.E Pubdummy	GDPgrowth D.financed	GDPgrowth dum 5%	GDPgrowth dum 7%
L. GDP per capita	-0.099	-0.098	-0.095
	(5.92)***	(5.79)***	(5.31)***
Average years of schooling	0.028	0.027	0.024
	(6.07)***	(5.91)***	(5.06)***
Government consumption	-0.454	-0.532	-0.791
	(2.73)***	(5.07)***	(3.96)***
inflation	-0.004	-0.003	-0.003
	(4.34)***	(3.43)***	(3.75)***
Working population growth	0.106	-0.050	-0.07
	(0.82)	(0.37)	(0.53)
Public investment	0.271	0.252	0.284
	(1.98)**	(2.05)**	(1.95)**
Private investment	0.374	0.327	0.314
	(6.53)***	(6.09)***	(5.93)***
Total tax revenue	-0.049	-0.052	-0.057
	(0.36)	(0.29)	(0.33)
Public investment*Private investment	-0.004		
	(0.73)		
Dum*Private investment		-0.023	-0.035
		(1.24)	(1.78)*
_cons	0.563	0.477	0.443
	(5.20)***	(4.73)***	(4.24)***
R2	0.25	0.27	0.30
N	384	380	362

Fixed Effects regressions-Annual from 1990-2012. Figures in Parentheses are t-statistics. Pub interaction is first computed and the five and seven percent dummies are introduced.

The results reported insignificant estimates for the public and private investment dummy and cannot confirm the crowding-out effects of public investment on private investment activities. Columns 2 and 3 highlighted the implications at different levels of investment with the introduction of a threshold dummy. The estimates showed negative but

insignificant results at the five percent level but became significant and strongly negative at seven percent, with the impact of private investment also reduced in coefficient value. The results suggest that public investment crowds out private investment at higher levels of investment[100] from 7% of GDP and above for our emerging sample.

3.3.3 Initial Summary of Growth Determinants:

The first part of this regression analysis is the five-year, fixed effects average which showed convergence values were negative and significant, consistent with the growth literature. Average years of schooling representing the human capital variable within the growth model also reported positive values that were significant and consistent. The coefficient of inflation showed a low negative relationship, which may be interpreted as an indication of instability in price markets. The size of the labour force variable, represented by the portion of working age population, reported an insignificant relationship (within other regressions this may be due to population size of countries within the sample, with China, India and Brazil accounting for sizeable population numbers). Also, as the population growth in emerging markets is outpacing the world average with lower maternity and infant death rates alongside relatively high fertility rates (5.17 in Nigeria), population size may affect growth rates negatively and per capita incomes directly. Private investment fared consistently well across the regressions with a positive and significant effect on growth. Crowding-out estimates confirmed significant drops in private investment when public investment was at a high threshold of seven percent. Specifically, any public investment/GDP ratio beyond 6.9 percentage point is associated with crowding out private investment. Our sample public investment ratios are still below this point.

[100] Coefficients became significant at 6.8% threshold but not consistent. At lower levels results generated inconsistent insignificant estimates.

The budget deficit ratio, government consumption to GDP ratio and the total tax ratios were introduced as conditioning variables in our initial set of estimations. Results were also sensitive to the inclusion of the budget deficit partly due to the deficit variable data gaps[101] for our sample. Subsequent estimations omitted this variable and we focus on the implicit deficit financing assumption for the rest of our analysis. We have also discussed the specification flaws regarding the tax[102] financed and government consumption[103] financed assumption that guide our focus on implicit deficit financed assumption.

3.3.4 Robustness: Public Investment Measures

To further discuss the role of public investment as a growth determinant in emerging markets, this study introduces new measures of public investment derived from the public investment growth ratio and tests for the partial growth effects using the baseline specification model. The study makes this robust to different time lags between annual and five-year data and also tests for lag implications.[104]

Measures of public investment:

- M1[105]: The standard public investment/GDP ratio. Introduced as Measure 1
- M2[106]: The growth variable of M1 constructed as the net changes in year-on-year public investment/GDP ratio

[101] With positive impacts of public investment, irrespective of how financed, this study highlights the deficit financed model as the most consistent in subsequent regressions.
[102] Unable to split distortionary from non distortionary taxes due to data limitations
[103] Omits other government unproductive expenditure not available for our sample.
[104] Largely insignificant above lag2 and on averaged models due to the reduced number of observations.
[105] The standard public investment variable as we have used in preceding estimations represents the share of public investment obtained as a ratio of output growth hence the public proportion of investment to income ratio(I/Y)
[106] The variable construct of public investment net changes. It represents the percentage increase in the public investment/GDP ratio

- M3[107]: Introduced as the log value of the level of public investment in 2010 dollars
- M4[108]: Introduced as the growth value of yearly public investment level stock
- M5[109]: Represents the log value of a construct of public capital with yearly accumulated M3 at 2010 dollars and a flat depreciation premium of 2.5%[110]
- M6[111]: Represents the growth of constructed public capital stock

Though each of these variables are variants of public investment, only two (M1 and M6)[112] are mainly used in the endogenous growth literature. The other constructs are only explored as alternative quantitative proxies with M2 and M4 representing variables used in the big push models with one important distinction[113] while the M3 variable is the dollar amount of public investment spending and this was insignificant in across the growth estimations.

The study tests these measures with the baseline specification as presented in previous tables 3.3 to 3.6 in the fixed effects model and FOD GMM, which includes other fundamental growth determinants. The results of these measures are presented below.

[107] The dollar value of public investment levels within countries. The values obtained from split total investment across private and public lines

[108] The change value of the M3 variable across our cross country panel. It is constructed as the change or growth variable derived from the 2010 dollar levels of public investment spending

[109] This instrument is the near best construct of Public Capital (1990 + (invpub*output) adjusted for net depreciation limitations : the net depreciation of public capital may be higher than the country average reported in available data. The construction assumes most public investment spending adds up to public capital subject to depreciation but it is not unusual to find investments that barely get off gestation period and never get completed in emerging countries

[110] As used in U.S and OECD studies. Assuming more investments for infrastructure compared to IT or technological investments in emerging, this 2.5% depreciation premium should be lower but maintenance is inefficient hence 2.5% is used.

[111] This represents the growth variable of M5 as a measure that reduces the correlation and potential endogeneity that exist between the public capital variable and output. It presents a good trend instrument of public capital and is mainly applied in similar growth literature

[112] Some studies also use the stock of public capital per capita for empirical analysis with the idea that whatever effects are captured in the growth variables are also identified in the level variable

[113] Studies based on the big push model e.g Warner (2014)use big long-lasting drives in public capital spending(usually around 65% threshold as observed in structural programs in the 1970s to 1980s), as these were arguably clear and exogenous policy decisions while we use only net annual changes in the public investment spending as limited by our sample data. For our sample we only observe an average of 4 data points per 20 year period for such large increases in public investment to meet the big push threshold which does not meet a sufficient number of observations for panel estimations

Table 3.11: GDP Per Capita Growth-Deficit Financed

Table 3.11 growth	**5yr**		Annual		**3yr**	
	F.E	GMM	F.E	GMM	F.E	GMM
M1	0.349	0.117	0.271	0.147	0.399	0.227
	(1.18)	(1.21)	(1.98)**	(1.37)	(1.80)*	(1.46)
M2	0.102	0.132	0.021	0.103	0.081	0.131
	(3.22)***	(0.37)	(2.62)***	(1.56)	(3.66)***	(1.29)
M3	0.125	0.091	0.181	0.13	0.15	0.173
	(1.19)	(1.37)	(0.83)	(0.92)	(1.58)	(1.63)
M4	0.048	0.105	0.048	0.037	0.076	0.090
	(1.33)	(0.85)	(5.38)***	(2.25)**	(5.94)***	(3.26)***
M5	0.046	0.044	0.077	0.137	0.045	0.117
	(4.79)***	(2.14)**	(8.96)***	(5.37)***	(3.99)***	(4.63)***
M6	0.09	0.150	0.176	0.166	0.217	0.124
	(1.19)	(5.77)***	(21.95)***	(10.77)***	(11.65)***	(2.44)**

Fixed effects regressions are based on five-year averages from 1990-2010, annual and three-year intervals extending to 2012. Figures in parentheses are t-statistics. Investment measures reported only, other growth determinants coefficients and implications are similar with earlier results. For GMM estimations, The lagged gdpgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions. Only investment measures are reported

Data on the public investment ratio (public investment spending as a share of GDP) (M1) and data on growth of (estimates of) the stock of public capital (M6) are presented as the main variables with theoretical foundations in the endogenous growth literature.

According to Warner (2015) there is no ultimately decisive argument for preferring either series over the other, so this chapter will use both. An argument for using the investment

measure of spending effort. Also, it is the basic raw data upon which estimates of the capital stock are built. As noted by the IMF study by Warner (2015) If avoidance of measurement error is a prime criterion as is the case for our constructed measures, the investment ratio should be preferred because whatever measurement problems it poses, the capital stock series will have greater measurement error because its computation requires an additional educated guess about the initial capital stock. The main argument for using growth in the public capital stock is that this variable directly affects GDP output in widely-used production functions both in the endogenous and neoclassical literature. Although we use both kinds of data, we will rely on the public investment ratio as the prime measure for purposes of determining the effect on GDP per capita growth, as it has lower measurement uncertainty while we also highlight the role of the variable on the growth of public capital. It is important to note that public investment and public capital variables can differ substantially for a country. These variables can grow at different rates, depending on the initial level of capital stock.

Also according to Arnslap et al. (2010) "there is an endogenous link between public investment and growth that can potentially complicate econometric identification. Public investment and growth are flow variables determined in equilibrium and observed over the same period". For example, public investment may fall in an economic downturn simply due to lack of resources, as it is often among the first expenditure items to be cut in a downturn. As an advantage, public capital stock does not suffer from this drawback, given that it is measured at the beginning of the period. A year in which growth is low would not affect the (beginning of the period) capital stock.

Table 3.11 highlights the partial impacts of the public investment/GDP ratio (M1), alongside introduced measures M2 to M6 of public investment and public capital. These were estimated individually with the employed baseline specification which presented similar values as presented in column 1 of tables 3.3 to 3.6 with signs in line with endogenous growth theory,

however only the main variables of interest are presented in table 3.11 to conserve space[114]. The deficit variable was omitted across the regressions presented here which suggests a deficit finance assumption for all the public investment measures reported in the Table. The coefficients presented here can be interpreted directly as elasticities as both dependent and independent variables are in ratios or log linear form.

M1 as the standard variable on public investment presented weak evidence and was not generally statistically significant from our estimations. Though all reported coefficients suggest a positive relationship with GDP per capita growth, the only significant values for M1 are the annual and three year averaged fixed effects estimates while M6 presented a more consistent relationship with positive and significant coefficients across the different time specifications[115]. Specifically for M6 using the 5 year and 3 year averages, a 1 percentage point deficit financed increase in the growth of the stock of public capital will approximately lead to a range between 0.12 and 0.22 percentage point increase in the GDP per capita growth in the long run for our sample of countries *ceteris paribus* significant at 1%[116]. The results from our annual specification suggests that a 1 percentage point increase in the growth of the stock of public capital will approximately lead to a range between 0.17 and 0.18 percentage point increase in GDP per capita growth in the short run when financed by the budget deficit. M1 and M6 as the public investment/GDP ratio and the growth of the stock of public represents the main theoretical variables for our study however we also briefly discuss the summary of estimates from other measures including M2-M5 though these were subsequently dropped from further estimations.

[114] The other growth determinants obtained slight variations in the magnitude of coefficients subject to the FE or GMM model and time specification such as observed in previous tables, all the signs are also consistent with theory.

[115] 5 year FE as the only insignificant exception across our specification.

[116] Insignificant point estimate 0.09 for the 5 year F.E

M2 and M5 reported the only significant estimates across public investment proxies for five year averaged regressions. Point estimates of 0.102 and 0.046 significant at the five percent level indicated a positive relationship, while M1, M3, M4 and M6 gave values of 0.269, 0.125, 0.048, and 0.09, respectively, although all values were statistically insignificant.

Aside from challenges with the reduced sample size after the five-year averaging, it is important to note endogeneity challenges, especially potential bias stemming from similar time series movements in the public investment variables, their respective constructs and the per capita GDP growth variable.

3.3.5 FOD GMM Estimates

The introduction of the GMM regression in table 3.11 helps to address this issue by introducing internal instruments for the endogenous variables within the model. Within the FOD model, this study restricts the lags instruments to two lags forced by the minimum condition and the revised averaged sample size. The fiscal variables are modelled as potentially endogenous alongside public investment measures.

The results from the regression table 3.11 with the benchmark specification indicated that M5 and M6 variables reported significant relationships with growth with point estimates 0.044 and 0.150, respectively. These are noted measures of public capital (M5) and its year-on-year changes (M6).

Various challenges arose from the first reported estimates averaged at five-year periods. First, the time dimension assumed a generalised business cycle time frame also used in advanced markets, but short-trend volatility was observed in growth patterns from our data. Thus, the assumed five-year period may be inadequate for this sample. Second, the range of values after averaging reduced the sample size which limited the robustness quality of the results.

To address these issues, the annual model is first introduced using fixed effects before applying the PMG approach to specifically identify long-run relationships.

The annual model results improved significantly, with the fixed effects regressions showing a positive relationship across variables of interest and the prior expected relationship from this study's vector of variables in the benchmark growth equation. To highlight the variables of interest, 0.271 significant at five percent is reported for M1 while M2-M6 reported significant relationships at five percent minimum, excluding M3 which reported insignificant but positive estimates. Correcting for endogeneity, the FOD GMM is introduced with the assumed endogeneity setting for fiscal measures: M1-M2 lost the statistical significance reported in the fixed effects. M3 remained insignificant but positive while M4-M6 retained the positive near coefficient values, but reduced T-stats (only reduced M4 from one percent to five percent significance).

For alternative time intervals, we present the three-year average though all feasible time dimensions (2 and 4 year) were explored. This is supported by the fast speed of convergence parameters from our PMG estimations[117] reported in table 3.12 which indicates a fast return to equilibrium path after a shock. As the mean value of our feasible range, this interval is likely suited for our sample and this is reflected in the obtained estimates.

The regressions for 3-year averages reported significant results for fixed effects coefficients from M1-M6 with M3 as an exception. The GMM reported a 0.09 point positive coefficient value for M4 as the moving average ratio of constructed levels of public investment spending. M5 and M6 also reported significance at the five percent level with approximately 0.12 percentage point positive relationship with growth. From our results, M4, M5 and M6 were exceptionally good proxy constructs of public capital, although limited by data

[117] This is presented in the next section

measurement quality[118]. To interpret the obtained values, a one percent point increase in deficit-financed public investment should lead to a 0.9 percentage point growth increase (*ceteris paribus*), while a 1 percentage point deficit-financed addition to the stock of public capital from assumed completed and functioning public investment should lead to a roughly 0.12 percentage point premium on the growth value[119].

The coefficient values for tax financed measures shared the same direction but reported insignificant[120] and lower magnitudes while the expenditure-financed by government consumption variable acting as the proxy unproductive expenditure lead to higher magnitudes but overall model insignificance[121]. The assumption of a mix of finance sources with deficit-tax funded tests and deficit-unproductive expenditure tests recorded slightly improved estimates by significance, but omitting more than one variable creates challenges in that will violate the three tier closed budget constraint.[122]

3.3.6 Long-Run Relationships

To introduce the formal tests for long-run growth relationships within a heterogenous or cross-country sample, this research utilises a pooled mean group (PMG) regression and its variant as presented by Pesaran Smith and Shin (1999). This model introduces parameter constraints in a heterogenous sample and derives a long-run relationship which is represented by the sign and significance of the speed of adjustment variable (a negative and significant relationship implies a long-run relationship). The model has several challenges, including requiring long and full panels (short available sample timeframes and missing values in variables are a disadvantage).

[118] The starting point of measurement should be preferably longer.

[119] Lag implications were also tested to check for growth impacts, but were inconsistent and with insignificant estimates and reduced number of observations.

[120] Sometimes over-identified when corrected.

[121] Due to the addition of the deficit with incomplete data across countries.

[122] Splitting taxes broadly across direct and indirect taxes reported largely insignificant estimates.

The attempt to correct this implies reducing the sample size to 15[123] countries for comparatively full values of public investment measures.

The PMG is a maximum likelihood estimator in which coefficients, intercepts and error variances are allowed to change to change in the short run while estimates of the parameter are constrained to be equal across panel in the long run. The autoregressive distributive lag model is used and all regressors are assumed to be stationary. The speed of adjustments of each country within the panel is estimated alongside the individual short run estimates. The error correction model basically estimates variables in differences and levels.

The equation to be estimated is given as

$$\Delta lny_{i,t,} = \alpha_0 + \beta_1 lny_{it} + \beta_2 I_{pb}/gdp_{it} + \beta_3 I_{pr}/gdp_{it} + \beta_4 M_{it} + \varepsilon_{i,t} \qquad (3.13)$$

All variables will be lagged by one period. The equation is thus transformed as shown below to an ARDL (one lag) dynamic panel specification form.

$$\Delta lny_{i,t,} = \varphi_i(\Delta lny_{i,t-1,} - \alpha_0 - \beta 1 lny_{it} - \beta_2 I_{pb}/gdp_{it} - \beta_3 I_{pr}/gdp_{it} - \beta_4 M_{it}) - \lambda_{11i}\Delta lny_{it} + \lambda_{21i}\Delta I_{pb}/gdp_{it} + \lambda_{31i}\Delta I_{pr}/gdp_{it} + \lambda_{41i}\Delta M_{it} + u_{it} \qquad (3.14)$$

Where

$\varphi_i = -(1 - v_1)$, $\alpha_0 = \delta i / 1 - v_1$, $\beta_1 = \lambda_{10i} + \lambda_{11i} / 1 - v_1$, $\beta_2 = \lambda_{20i} + \lambda_{21i} / 1 - v_1$,

$\beta_3 = \lambda_{30i} + \lambda_{31i} / 1 - v_1$, $\beta_4 = \lambda_{40i} + \lambda_{41i} / 1 - v_1$

$\beta_1, \beta_2, \beta_3, \beta_4$, are coefficients of initial per capita income, public investment ratio, private investment ratio and summation of other variables of interest as used in the previous regression. The mean group estimator also proposed by the same authors will also be estimated and reported in the appendix however the Hausman test points to the PMG as the preferred method.

[123] Brazil, Russia, India, China, South Africa, Mexico, Turkey, Bulgaria, Philippines, Peru, Pakistan, Malaysia, Ukraine, Thailand and Latvia.

Table 3.12[124]: Dependent variable GDP growth: Pooled Mean Group

Independent Variables	1	2	3	4	5	6
Speed of Adjustment	-0.85	-0.86	-0.87	-0.86	-0.94	-0.87
	(-39.64)***	(-38.28)***	(-42.34)***	(-34.38)***	(-44.78)***	(-38.76)***
GDP	-0.00051	-0.00059	-0.00065	-0.00064	-0.0008	-0.00058
	(-10.43)***	(-13.92)***	(-8.38)***	(-15.13)***	(-13.69)***	(-10.15)***
Public Investment	0.068	0.066	0.058	0.037	0.075	0.058
	(5.24)***	(5.27)***	(3.85)***	(2.34)**	(4.36)***	(3.38)***
Private Investment		0.042	0.044	0.038	0.02	0.039
		(5.28)***	(4.01)***	(4.66)***	(2.56)**	(4.27)***
Avg Yrs of Schooling			0.044			
			(0.92)			
Govt Consump				0.032		
				(1.69)*		
tax					-0.027	
					(-0.42)	
Working Population						-0.056
						(-0.28)
No of Observations	307	307	282	307	302	307

Table 3.12 reports positive and significant coefficients from public investment. However, caution should be applied to interpretation due to the omitted fiscal variables in the

[124] Table 3.12 Pooled Mean Group specification. Dependent Var is gdpgrowth per capita. Annual panel data is used for estimation. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Negative speed of adjustment coefficient indicates our variables have a long run relationship with GDP per capita growth.

regression, no assumption on financing and the high[125] speed of adjustment parameter. The mean group and dynamic fixed effects variants were also tested, although the Hausman test prefers PMG as the preferred model. This study reports it to indicate the long-run relationship validated by the negative and significant value of the speed of adjustment parameter. Specifically, a 1 percentage point increase in the public investment as a share of GDP ratio is associated with an increase in GDP per capita growth by approximately 0.07 percentage point in our sample subset. The results for the public investment variable was not sensitive to inclusion or removal of other variables and the range of plausible values are between 0.04 and 0.07 percentage points in the long run for our sample of countries. The coefficient for private investment also yielded positively significant estimates for our subset sample in the long run. Specifically, column 2 indicates that a 1 percentage point increase in the private investment/GDP ratio, is associated with a 0.04 percentage point increase in GDP per capita growth in the long run.

3.3.7 Net Marginal Productivity of Capital

Following the work of Nell and Thirlwall (2014) in explaining differences in the productivity of countries, this study introduces a simple measure of capital productivity with the net marginal productivity of capital (NMPC) constructed as the ratio of output growth (Y) to investment ratio (I/Y)[126].

$$\frac{dY/Y}{I/Y} = \frac{dY}{I} = \frac{dY}{dK} \tag{3.15}$$

The NMPC data constructed for the sample is presented in Table 3.13:

[125] Potentially from omitted variable bias and incomplete data.

[126] Following earlier estimations, the growth and investment variables are obtained from the world development indicators dataset from the World Bank.

3.3.8 NMPC Data Description And Presentation Of Results

Table 3.13. Mean analysis of the sample of emerging countries

CON	Period	Gdpgr	nMpc
Brazil	90-99	0.00278	0.01112
	00-012	0.02401	0.1284
IND	90-99	0.0374	0.1608
	00-012	0.0537	0.1808
MEX	90-99	0.01685	0.0845
	00-012	0.0096	0.04475
TUK	90-99	0.0232	0.08955
	00-012	0.0306	0.1415
PER	90-99	0.0137	0.0526
	00-012	0.04149	0.2031
UKR	90-99	-0.09	-0.3685
	00-012	0.0507	0.2292
THAI	90-99	0.04108	0.0905
	00-012	0.03621	0.1495
VEN	90-99	0.00286	0.0247
	00-012	0.0198	0.0889
EGY	90-99	0.0229	0.1151
	00-012	0.02517	0.131
IRN	90-99	0.0231	0.07356
	00-012	0.0296	0.0974

MAL	90-99	0.0452	0.1121
	00-012	0.0318	0.14037
MAU	90-99	0.037	0.1432
	00-012	0.0362	0.153
RUS	90-99	0.019	0.1187
	00-012	0.0538	0.2868
SFA	90-99	-0.008	-0.0476
	00-012	0.01854	0.10564
PLP	90-99	0.0038	0.01345
	00-012	0.0297	0.1474
LAT	90-99	-0.025	-0.38
	00-012	0.057	0.1908
BGD	90-99	0.0244	0.1272
	00-012	0.0419	0.1615

Figure 3.4.

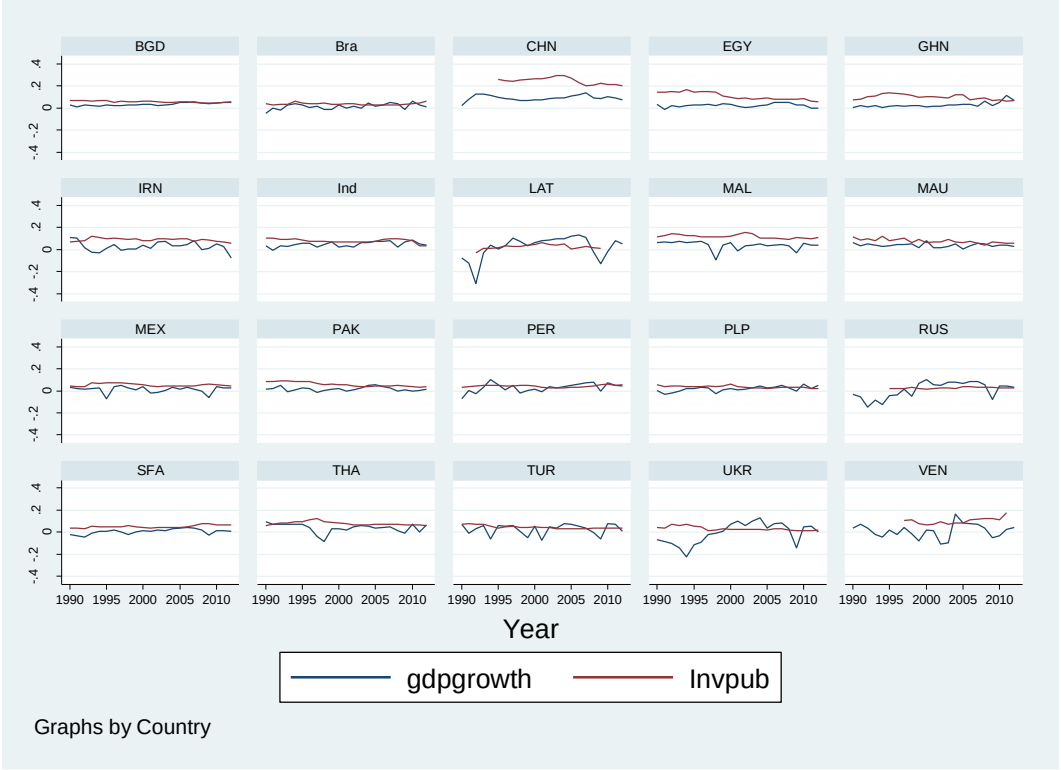


Figure 3.5.

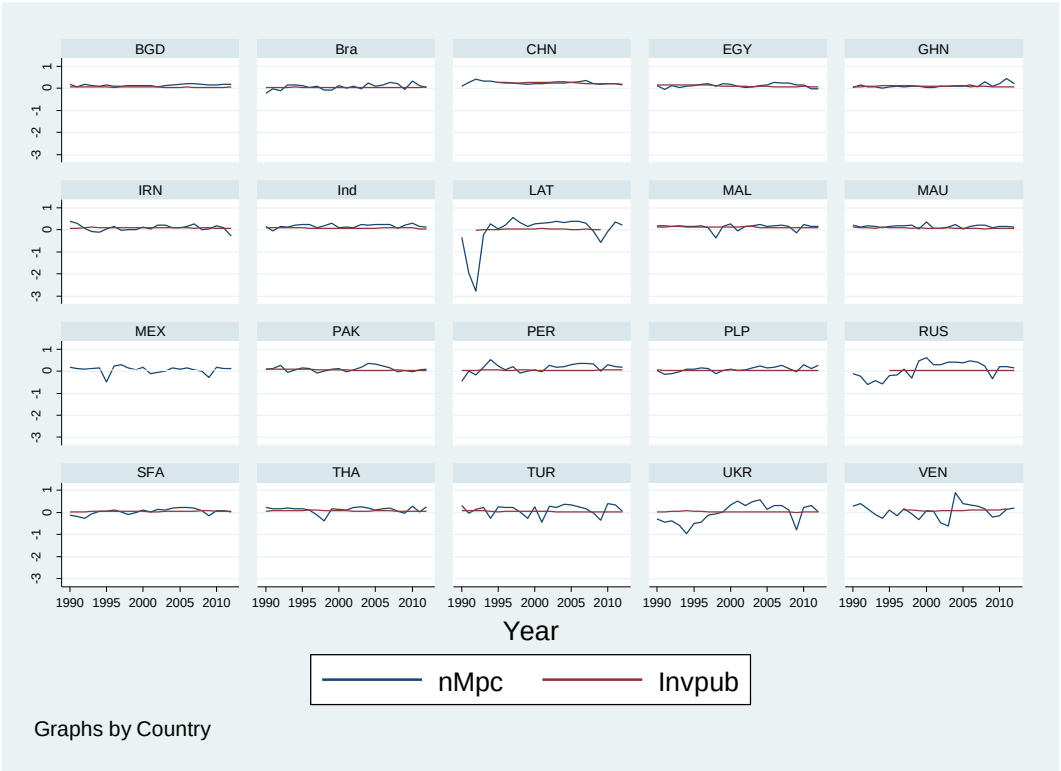


Figure 3.6.

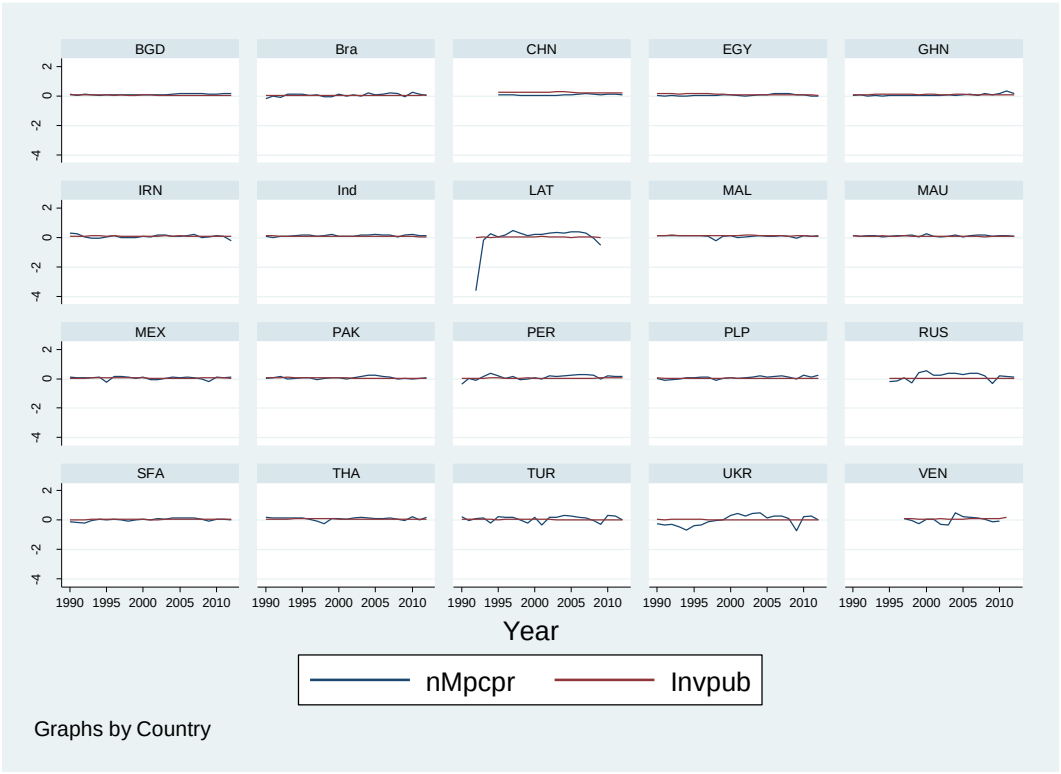


Figure 3.7.

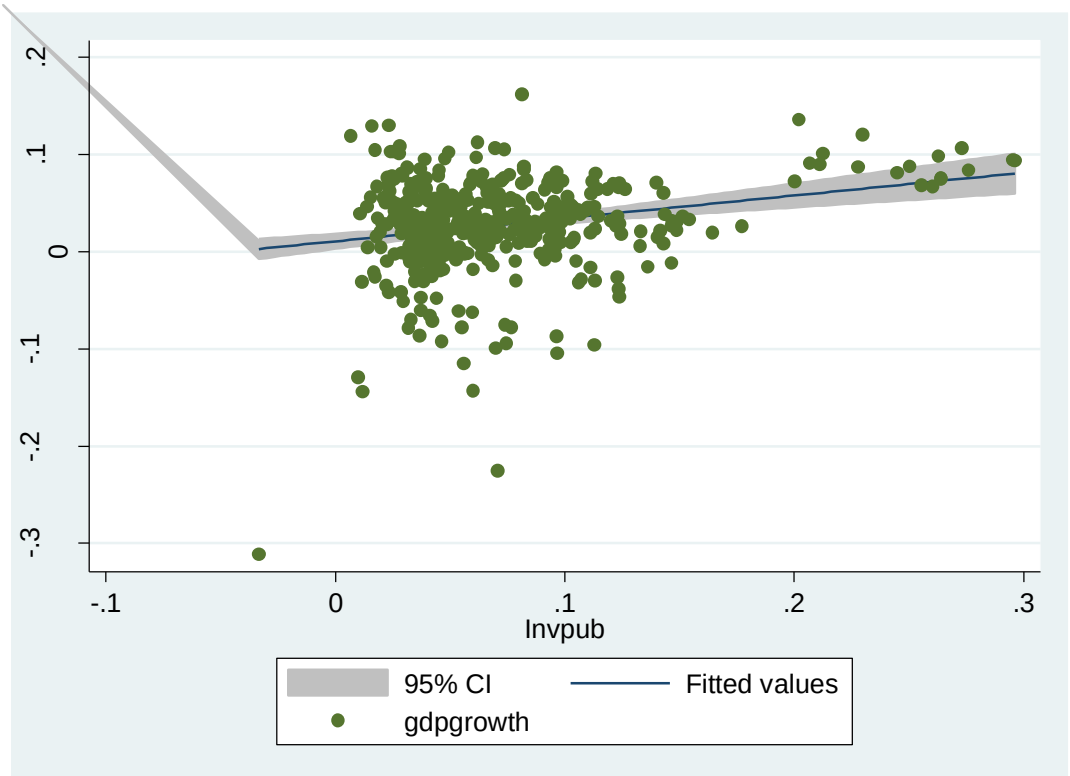


Figure 3.8.

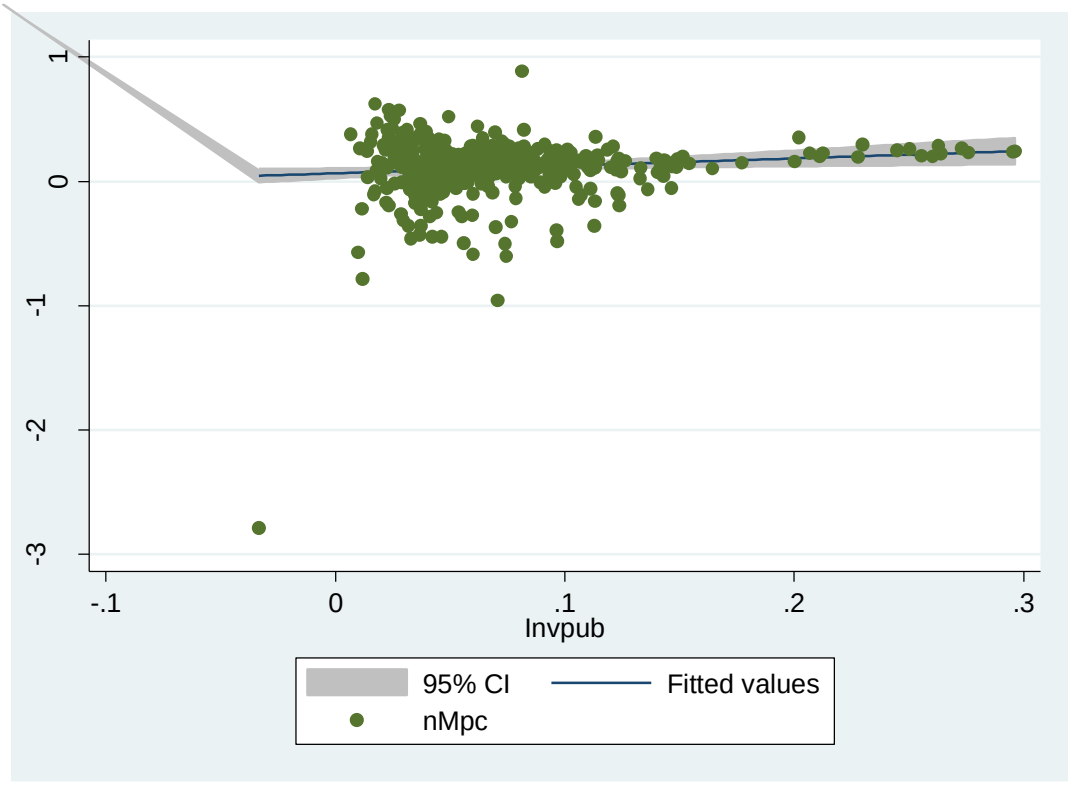


Table 3.10 shows the means for growth and net marginal productivity of capital as dependent variables for the countries in the sample. The means are examined for two periods: Period 1 (1990-2000) and Period 2 (2000-2012). There was evidence of benign improvements in the sample with rising NMPC from Period 1 to Period 2 for most of the countries in the sample; for example, Brazil (0.011-0.128), Indonesia (0.1608-1.1808), PER (0.0526-0.2292), Turkey (0.089-0.1415), Ukraine (-0.128-0.2292) and Malaysia (0.1121-0.140). Amongst the reasons for this outcome was a blend of growth slowdown in some of the developed countries[127] and cyclical factors; for example, overflows from a slowdown in advanced economies, adjustments in external financing conditions and domestic policy contractions. However, only Mexico witnessed a decline in their NMPC from an average growth of 0.1808 in Period 1 to

[127] For instance capital transfers and investments and accompanying technology will shift from regions with slow growth to emerging markets with faster growth for increased potential profits

0.044 in Period 2. Córdova and Padilla (2016) explain this is caused by a declining multifactor productivity level in Mexico. Multifactor productivity by sector from 1990-2014 computed by the Mexican Ministry of Finance and Public Credit showed that for the 19 sectors analysed for the period, only five had positive levels ranging (0.2-0.5). Mexico's low productivity largely stemmed from a misallocation of both inputs. In particular, the disappointing productivity levels stemmed from a misallocation of productive resources, mainly labour and capital. In Mexico, six out of 10 workers were employed in the informal sector (National Geography Mexican Ministry of Finance and Public Credit and Statistics Institute, 2015).

Economic growth in developed economies has been slow in the wake of the worldwide financial crisis (2007-2008). This crisis, together with a slowdown in growth figures for China, resulted in growth-dampening economic activity in EMEs. In Russia, problems in demographic patterns dragged down that country's potential growth. In addition, lower energy prices and global sanctions fortified long-standing obstructions to higher investment and growth, creating infrastructure bottlenecks and a poor business atmosphere, which in turn prompted capital outflow over numerous years (Economic Bulletin, 2015). In Brazil, potential growth slowed as lower product prices hit key exports. Low productivity was strengthened by controls on infrastructural investment and restricted structural reforms (Economic Bulletin, 2015). Less accommodative domestic and worldwide financing conditions suggest that growth in EMEs will proceed at a more stifled pace. Growth in public investment and public gross capital formation for emerging economies in the sample group remained positive for most countries, but weak for all averaging around 0.04 for Period 1 and 0.03 for Period 2. This weakness was set against the backdrop of exceptionally benign domestic (and global) financing conditions. Kose Ohnsorge Ye and Islamaj (2017) have shown that in the majority of emerging economies, public investment and capital growth have both been beneath their long-run averages. Another important factor responsible for this pattern is that emerging economies have limited fiscal

space for expansionary policy, given their debt burdens and sizeable deficits (Banerjee, Kearns and Lombardi, 2015; Barkbu, Berkmen, Lukyantsau, Saksonovs, & Schoelermann, 2015). Kose et al (2017) also state that elevated debt and wide fiscal deficits restrict the use of counter-cyclical fiscal stimulus in a number of EMDEs. This pattern largely accounts for the huge initial fiscal stimulus and subsequent policy tightening in large EMDEs, especially in China, which is responsible for more than half of emerging economy public investments.

We introduce a simple construct of productivity for our sample here to capture the individual effects of our standard public investment/GDP ratio variable. Any observed GDP growth effects may also be captured in improvements to productivity from completed public investments hence the NMPC provides a good alternative dependent variable. With the NMPC as the dependent variable, this study tested for impacts of public investment measures M1 and M6 using the benchmark regression model financed implicitly by the budget deficit. The results for five-year and three-year averages of our introduced measure are presented alongside annual regressions.

Table 3.14 Summarised Partial Results for Net Marginal Productivity of Capital Estimates.

Table 3.14 NMPC	5yr		Annual		3yr	
	F.E	GMM	F.E	GMM	F.E	GMM
M1	0.349	0.27	0.396	1.693	-0.574	-1.683
	(1.18)	(1.44)	(2.60)***	(0.74)	(0.69)	(1.24)
M6	0.251	0.19	0.180	0.806	0.219	0.230
	(8.61)***	(0.92)	(22.98)***	(21.78)***	(13.91)***	(2.61)***

NMPC as dependent variable. Regressions are based on five year averages from 1990-2010, annual and three-year intervals extending to 2012. The lagged GDPgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are treated as endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10%, respectively. Max 4 lags for internal instruments are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions. Investment measures reported only, other growth determinants coefficients and implications are similar with earlier results.

Table 3.14 follows the approach previously for main public investment and public capital variable with deficit financed assumptions**.** Specifically, each coefficient reported gives us a distinct NMPC relationship with different time specification and methodology applied. All the model estimations reported were carried out with the baseline specification variables in each regression. We initially estimate using the five year averaged fixed effects method after which we explore alternative time specification and methodology as we have previously reported. Here we only identify a short run relationship between public investment/GDP ratio and the net marginal productivity of capital using fixed effects while other specifications produced insignificant results. The annual estimates specifically reports that a 1 percentage point increase in the public investment/GDP ratio, M1 is associated with an increase in the net

marginal productivity of capital by 0.40 percentage points significant at 5% in the short run using fixed effects while the corresponding GMM estimated coefficient was insignificant. For the variable representing public capital (M6) the short run results indicate a positive relationship with net marginal productivity of capital with a range between point values 0.18 and 0.81 significant at 1% while the long run calculated coefficients reveal a positive relationship in the range between point values 0.22 and 0.25 for our 5 year and 3 year averaged estimates all significant at 1%. In general, each reported coefficient can be directly interpreted as elasticities on the value of net marginal productivity of capital as both dependent and independent variables were presented as percentage ratios or transformed into log linear form. Overall we identify a weak but mainly positive relationship between our variable on public investment ratio (M1) and the NMPC. On the other hand our measure on the growth of public capital suggests evidence of a stronger positive relationship with the productivity of capital. This is also implied from the literature as any improvements to productivity is likely channelled through the gains from completed public investment projects rather than gains from the public investment spending effort.

The results' implication suggests that growth of public capital stock, improves the net marginal productivity of capital for our sample of countries both in the short run and long run.

Table 3.15 Summary of Public and Private Investment Variables

GDP per capita growth Tab3.15 Deficit Financed	5-year GMM	3 year GMM	Annual GMM
Public Investment-M1	0.117	0.227	0.147
	(1.21)	(1.46)	(1.57)
Growth of Public capital-M6	0.150	0.124	0.166
	(5.77)***	(2.44)**	(10.77)***
Private Investment	0.197	0.178	0.242
	(2.57)***	(2.83)***	(4.25)***

Dependent Var is gdpgrowth per capita. The lagged gdpgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions. Only main investment variables presented.

Table 3.15 presents the GDP growth impact summary of the coefficients obtained for the main variables of interest in this chapter conditional on the deficit financed assumption. Though we also obtain results using total tax ratios and government consumption financing assumptions, the specification may be flawed as we were unable to specifically isolate the impact of distortionary taxes from non-distortionary taxes as limited by the data on the sub components of taxes for our sample. Also, the government consumption expenditure introduced as a conditioning budget constraint variable does not include other unproductive expenditures which may introduce flaws in the specification hence our focus on the deficit finance assumption though we discuss and draw inferences from all three financing assumptions.

We also indicate no preferences regarding the type of estimators used as each method has unique advantages alongside limitations and although there is no formal test for justifying the choice between the fixed effects and FOD GMM estimator, Coviello & Islam (2006), Kwok (2010) suggest a possible rule of thumb using the sample criteria. The authors argue ‘that in a dynamic panel model, the OLS estimator is biased and inconsistent as the lag dependent

variable is positively correlated with the country fixed effect and the error terms. On the other hand, the FE estimator, by estimating the within group difference, can remove this sort of inconsistency by transforming the equation to eliminate the country specific effect'. However, for panels where T is small relative to N as in our case especially with the time averaged specification, the first difference transformation induces a "non-negligible" correlation between the transformed lagged dependent variable and the transformed error term. The FE estimator, therefore, is also biased hence the FOD GMM method may be more suitable for our analysis.

From our summary table 3.15, the estimated coefficient of the public investment/GDP ratio suggests a positive relationship with GDP per capita growth across the GMM specification though insignificant, we find a strongly positive and robust relationship using the growth of the constructed public capital stock as an ideal alternative. Specifically, in the short run using the annual specification, a 1 percentage point increase in the growth of public capital stock is associated with a 0.17 percentage point increase in GDP per capita growth rate for our sample of countries when financed by the budget deficit. The long run implication using 5 year and 3 year specification also implies that a percentage increase in the growth of the stock of public capital is associated with a range between 0.12 and 0.15 percentage point increase in GDP per capita growth when financed by the budget deficit. The variable on private investment was also significant across our regression specification with a point value of 0.242 for the annual specification and a range between approximately 0.18 and 0.20 for the 3 year and 5 year averaging to smoothen out business cycle effects. This implies a positive relationship between private investment and economic growth for our sample of countries. In addition to the 7% public investment threshold value for our sample, this suggests a complimentary relationship and indicates there is no evidence of crowding out of private resources for the emerging countries considered in this study.

The results from our analysis rooted in the endogenous growth theory, conclude that GDP per capita growth is positively affected by public investment and growth of the public capital stock valid for both the short and long run. The magnitude of this relationship is subject to the implicit financing assumption. We also find no evidence of crowding out of private investment in our sample.

Additionally, other growth determinant inputs within the production function are significant and in line with expectations from prior studies in the growth literature.

To summarise the empirical approach used in this chapter, we test for the long run effect by introducing the 5 year averaged data in a government budget constraint setting. The initial estimates report insignificant coefficients for our public investment variable which can be explained by the reduced number of observations from the averaging criteria or endogeneity among the fiscal variables. FOD GMM estimates for five year averages also produced weak results.

We proceed to annual estimates which we introduce with a dummy variable to test for the private investment crowding out implication and our estimates indicate a 7% threshold. Beyond this point, increased public investments as a ratio of GDP crowds out the private investment component however we note that our sample of countries are generally below this point. The estimation results also point to a robust relationship between private investment share/GDP and per capita growth with robust positive relationship significant at 1% across our estimations with a range between 0.15 and 0.37 across all specifications with the lowest values reported under the tax financed budget constraint setting.

Overall the M1 variable produced positive but mainly insignificant results from the initial analysis. Our study introduces measures of the public investment variable tested alongside the baseline specification under the budget constraint condition. Here we also control for endogeneity by using the GMM estimator. Though M1 showed sensitive coefficients, the

growth of stock of public capital which is an accumulation of net public investment reported strong results. In this case, the annual estimates highlight the short run growth impacts while the three and five year estimates are valid for the long run.

We further test this long run growth impacts using a PMG approach which forces the homogeneity condition among countries. Here we utilise a subset of our sample with more complete data on the public investment variable while dropping each variable that fails to meet the minimum iterative condition to be estimated. We obtain improved results.

We then proceed to introduce NMPC as the dependent variable and the results obtained was sensitive for the variable on public investment but showed a stronger positive relationship with the growth of public capital stock. Further, the constructed growth of public capital stock(M6) however presented valid results for growth and productivity both in the short and long run from our annual and averaged estimates. This is in line with the predictions of the endogenous growth theory.

3.4 Conclusion and Recommendation

Economic theory proposes that public investment can increase output and that it can have an impact either on the level or on the rate of growth, depending on the behaviour of marginal returns. However, the span of the gainful impacts on growth can rely upon particular conditions. This study provides new confirmation of the impacts of public investment on productivity and growth in emerging economies. Data from twenty-one emerging markets covering the period from 1990 to 2012 was analysed utilising model estimations using fixed and GMM techniques with yearly and period average data. This study also identifies a crowding out point of 7% in relation to private investment. We also incorporated the budget constraint financing assumption that highlights a budget as a closed system with deficit, unproductive expenditure and taxes.

3.4.1 Main Findings

1. Public investment and its measures however financed gives a positive impact on GDP per capita growth though this is not always significant
2. Public investment ratios displayed positive effects and coefficients that suggest growth effects from new employment of resources within the immediate/near term of new budget-funded investment. Investments financed by unproductive government consumption expenditure reported the largest growth effects while investments financed by taxes reported the least effect on GDP per capita growth. Deficit financed investments reported intermediate positive estimates.
3. No evidence of crowding out private investment in our sample as we note consistent positive and significant coefficients across all specifications alongside an estimated 7% crowding out point however our sample public investment ratios were generally below this threshold

4. Lagged variables tested using annual data reports insignificant and inconsistent estimates, suggesting that positive coefficients are largely driven by new investments, which may take time to become useful or productive; hence the observed positive effects could be viewed as positive impacts from the employment of new resources in the immediate term.
5. Growth of public capital stock per capita represents the increases in stock of public capital and indicated completed investments show up with positive and significant impact on growth and the net marginal productivity of capital, which can imply productivity gains from completed public investment projects.

Appendix: Additional Presented Results with Inconsistent Lag Results[128]

FoD Annual GMM	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth
L.gdpgrowth	-0.087	0.197	0.425	0.174	0.184
	(0.65)	(3.53)**	(1.78)	(1.40)	(1.62)
L.lgdp	-0.351	-0.067	-0.152	-0.138	-0.108
	(4.97)**	(3.57)**	(3.37)**	(2.79)**	(2.40)*
avgsch	0.044	0.017	0.035	0.034	0.028
	(3.19)**	(4.93)**	(4.39)**	(4.11)**	(3.50)**
govtcon	-1.109	-0.511	-0.772	-0.966	-0.936
	(4.09)**	(3.60)**	(3.45)**	(5.26)**	(4.12)**
inflation	-0.004	-0.002	-0.001	-0.002	-0.003
	(1.75)	(1.87)	(0.91)	(1.14)	(0.82)
workpgrowth	0.220	-0.067	-0.059	-0.009	0.054
	(1.38)	(0.63)	(0.39)	(0.06)	(0.33)
lgcfpc	0.137				
	(5.37)**				
gcfpcgrowth		0.166			
		(10.77)**			
L.gcfpcgrowth			-0.036		
			(0.82)		
L2.gcfpcgrowth				0.018	
				(0.91)	
L3.gcfpcgrowth					0.019
					(1.52)
N	361	359	339	319	299

* p<0.05; ** p<0.01

FOD Annual GMM	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth
L.gdpgrowth	-0.147	0.055	0.211	0.188	0.153
	(1.33)	(0.67)	(1.34)	(1.55)	(1.65)
L.lgdp	-0.412	-0.074	-0.121	-0.121	-0.060
	(3.81)**	(4.22)**	(2.74)**	(2.55)*	(1.95)
avgsch	0.045	0.020	0.029	0.028	0.016
	(2.74)**	(5.55)**	(3.48)**	(3.11)**	(2.59)**
govtcon	-1.093	-0.700	-0.834	-0.912	-0.647
	(3.70)**	(4.80)**	(3.95)**	(4.76)**	(3.90)**
inflation	-0.003	-0.002	-0.002	-0.002	-0.002
	(1.54)	(2.12)*	(1.37)	(1.27)	(1.30)
workpgrowth	0.167	-0.009	-0.025	-0.095	-0.043
	(1.05)	(0.09)	(0.17)	(0.60)	(0.37)
lgfcfpc	0.176				
	(4.65)**				
gfcfpcgrowth		0.213			
		(9.50)**			
gfcfpcpubgrowth			0.037		
			(2.28)*		
L.gfcfpcpubgrowth				0.015	
				(2.10)*	
gfcfpcprivgrowth					0.123
					(3.00)**
N	361	359	341	322	341

* p<0.05; ** p<0.01

[128] Public investment ratios (M1) (Invpub), growth of public investment ratio (M2) (Invpubgrowth), level of public investment stock per capita (M3) (Lgfcfpcpub), Growth of public investment stock per capita (M4) (Lgfcfpcpubgrowth), constructed public capital stock per capita (M5) (Lgcfpc) and forward changes in the existing stock of public capital stock (M6) (lgcfpcgrowth). L. lag length.

FOD GMM ANNUAL	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth
L.gdpgrowth	0.172	0.115	0.087	0.065	0.172
	(1.10)	(0.81)	(0.70)	(0.55)	(1.10)
L.lgdp	-0.142	-0.096	-0.071	-0.095	-0.142
	(1.40)	(1.49)	(1.47)	(2.39)*	(1.40)
avgsch	0.037	0.031	0.028	0.027	0.037
	(3.04)**	(3.76)**	(3.59)**	(3.53)**	(3.04)**
govtcon	-0.914	-0.918	-0.893	-1.007	-0.914
	(3.98)**	(4.32)**	(3.83)**	(4.49)**	(3.98)**
inflation	-0.002	-0.002	-0.003	-0.021	-0.002
	(1.26)	(1.08)	(0.79)	(3.14)**	(1.26)
workpgrowth	-0.049	-0.049	-0.023	0.048	-0.049
	(0.27)	(0.28)	(0.13)	(0.33)	(0.27)
L2.lgcfpc	-0.008				-0.008
	(0.27)				(0.27)
L3.lgcfpc		-0.026			
		(1.39)			
L4.lgcfpc			-0.035		
			(2.30)*		
L5.lgcfpc				-0.017	
				(1.31)	
N	339	319	299	280	339

* p<0.05; ** p<0.01

Annual F.E

Introducing gcfpc gcfpcgrowth

	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth
L.lgdp	-0.181	-0.049	-0.095	-0.098
	(10.94)**	(5.22)**	(6.18)**	(5.79)**
avgsch	0.025	0.015	0.027	0.027
	(7.08)**	(6.08)**	(6.32)**	(5.91)**
govtcon	-0.833	-0.621	-0.875	-1.034
	(5.89)**	(6.03)**	(5.39)**	(6.07)**
inflation	-0.005	-0.003	-0.004	-0.003
	(5.95)**	(4.98)**	(4.07)**	(3.43)**
workpgrowth	0.176	-0.027	0.015	0.050
	(1.55)	(0.33)	(0.12)	(0.37)
lgcfpc	0.077			
	(8.96)**			
gcfpcgrowth		0.176		
		(21.95)**		
L.gcfpcgrowth			0.042	
			(3.46)**	
L2.gcfpcgrowth				0.024
				(1.79)
_cons	0.875	0.369	0.685	0.727
	(9.45)**	(5.66)**	(6.47)**	(6.24)**
R2	0.37	0.67	0.27	0.23
N	381	379	359	339

* p<0.05; ** p<0.01

3 yr avg fod gmm	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth	gdpgrowth
L.gdpgrowth	-0.339	0.422	1.447	1.099	0.223	2.188
	(0.77)	(0.87)	(1.25)	(2.21)*	(0.40)	(1.47)
L.lgdp	-0.325	-0.244	-0.394	-0.232	-0.288	-0.431
	(4.06)**	(2.15)*	(3.10)**	(3.20)**	(2.47)*	(2.96)**
avgsch	0.039	0.044	0.066	0.008	0.054	0.027
	(3.44)**	(2.07)*	(2.77)**	(0.61)	(4.96)**	(0.96)
govtcon	-0.998	-0.503	-0.255	-1.943	-0.712	-2.584
	(1.87)	(1.15)	(0.49)	(4.60)**	(0.62)	(1.96)*
inflation	-0.002	0.004	0.010	0.118	0.012	0.007
	(0.44)	(0.72)	(1.23)	(1.05)	(0.24)	(0.04)
workpgrowth	0.106	-0.227	0.084	-0.233	-0.003	0.082
	(0.24)	(0.70)	(0.15)	(0.72)	(0.01)	(0.18)
lgcfpc	0.117					
	(4.63)**					
gcfpcgrowth		0.124				
		(2.44)*				
L.gcfpcgrowth			-0.322			
			(1.33)			
L4.gcfpcgrowth				-0.061		
				(2.12)*		
L2.gcfpcgrowth					0.038	
					(1.07)	
L3.gcfpcgrowth						0.137
						(1.64)
N	96	95	93	36	74	55

* p<0.05; ** p<0.01

Chapter.4:

Tests on the Growth Impact of Institutions in Emerging Countries

4.1 Introduction

The impact of institutions on growth has become an integral aspect of economic development with an increasing understanding that institutional quality significantly accounts for variations in economic growth, particularly between developed and under-developed countries. This interest in the pervasive influence of institutions was heightened in the 1980s by the rise of a group referred to as 'Institutional Economics'. The part that institutions play in economic growth began to attract wide attention by the early 1990s as an important factor accounting for variations in development levels within countries; the concept also received significant attention from well-known, international institutions such the World Bank and the International Monetary Fund (IMF) (Stein, 2008). Consequently, these international organisations began to initiate several *governance related conditionalities* requiring countries seeking their support and assistance to improve both their institutional quality and how processes are managed (Kapur & Webber, 2000). The key point here is the growing belief that weak and badly functioning institutions are the primary reason for problems that developing economies face when trying to grow their economies.

The need to provide explanations for differences and divergences in growth between countries is largely responsible for the emphasis on the role of institutions. The IMF (2005) holds that an understanding of the process of how institutions affect growth outcomes is key in developing policies that can accelerate economic progress. The presence of weak institutions affects the usage and efficiency of factors and components of production such as capital, labour hours and innovation. Broadly, research aimed at evaluating the underlying factors that might explain economic differences amongst countries can be classified under different theories: the

neoclassical theory[129] which emphasises production factors with technology as the key factor affecting growth (Solow, 1956; Lucas, 1988; Romer, 1990); the *geographic* theory that focuses on the effect of geographical factors as the determinants of growth (Sachs, 2001); and the *institutional* theory in which North (1990) argues the quality of institutions is key as the fundamental initiator of growth. In his study, *Institutions, Institutional Change and Economic Performance*, North (1990) argues that quality institutions serve as key initiators of economic growth and hence they are important to growth. This characterisation of an institutional framework covers a broad range of systems ranging from formal to informal. North opines that 'formal and informal' rules and their implementation define the operational environment for wealth-maximising opportunities for firms and individuals. Therefore, in an environment where institutions are weak and of low quality, the activities of economic agents are hindered. According to Aron (2000), a relatively effective system that ensures protection of property rights that stimulate business is necessary for growth to occur in an economy.

Acemoglu et al., in their influential study, *Institutions as the Fundamental Cause of Long Run Growth*, do not adopt North's narrow categorisation of institutions that is limited largely to protection of property rights. They developed their own theoretical framework based on broader concepts, such as the supremacy of political institutions. Acemoglu et al. hold that political institutions are germane in that they influence and control the use of political power.

Broadly, Simon and Zlatko (2010) suggest that political institutions such as institutional frameworks promoting the control of power—how people come into power through elections—tend to shield the system against individuals with abusive or predatory tendencies and therefore provide economic agents the needed stability to conduct their activities. The pioneering efforts of North (1990) in providing a clear institutional framework-growth nexus

[129] The endogenous theory also builds from the production function with different assumptions on the returns to capital

is particularly important in identifying the channel of transaction cost. Growth can be influenced by the existence of transactions costs and, because of the direct link between the character and performance of institutions, the institutional framework is integral to the how these costs will rise in individual countries.

There is an increasing need for institutions that can help bolster growth and support a thriving economic environment and the behaviour of economic agents, all of which are critical for economic performance (Pande & Udry, 2006; Acemoglu, Johnson & Robinson, 2004; Rodrik, Subramanain & Trebbi, 2004; Huang, 2010). However, one unresolved area is the question of which institutional component is likely to be the most relevant in driving long term economic growth. Janine (1997) argues that writers of economic growth literature have not been unanimous about what actually constitutes an economic, political or social institution, how they evolve or the ways in which they affect economies.

This research study aims to identify the impacts institutions have on economic growth. A review of academic literature highlights the different types of institutions and identifies the important variables for this study of macroeconomic growth. Econometric tests are then carried out across different models and time criteria, are examined for robustness and results are reported. Conclusions are then drawn from these results in an attempt to answer these research questions: do institutions matter for growth in emerging markets? If the answer is yes, can we identify which institutions matter?

Section.4.2:

Literature Review

4.2.1 Institutions: Literature Background

The conceptualisation of institutions[130] is traceable to North (1990) who holds that institutions are the fundamental drivers of economic development and that their role in facilitating growth is extremely crucial. In his view, institutions represent the way a society functions and provide the set of systems and controls that govern and define human interaction. These controls, North says, covers a broad category of formal and informal laws. These sets of rules and the ways in which they are enforced define the boundary of activities for both individuals and organisations. North's definition of institutions influenced several subsequent studies.

Aron (2000) notes that institutions impact growth via costs of transformation as well as through transaction costs in the production process. There also is a shift amongst researchers away from the narrow categorisation of institutions posited by North (1990) to broader considerations of institutions. Scholars subscribing to this wider perspective are largely drawn to the primacy of institutions centred on politics over other types of institutional settings. The argument is that political institutions are actually the root of the differentials in economic institutions and growth between countries. Given that the economic agents find institutions useful in different ways, the resulting effect is a struggle to control the means by which social choices are made; therefore, the group that controls political power has the advantage in influencing the direction of economic decisions. The direction of political authority can then be seen as influenced by two main factors: those institutions that are directly concerned with the entire management of the process and those concerned with the allocation of wealth. Consequently, political institutions are crucial due to their role in influencing and determining

[130] As a mainstream economic variable.

the use of power by political offices. Therefore, the quality and effectiveness of political institutions in ensuring a transparent process and affecting the way political office is perceived and used can to a large extent point to the reason why particular countries are at particular economic levels.

Rodrik (2005) developed a framework with which to evaluate the quality of institutions. Effective institutions, according to Rodrik (2005), refer to institutions that efficiently ensure '(i) security of property rights, (ii) contract[s] are followed or implemented (iii) [and] competition' based on market forces and that no undue advantage is given to any single entity. He also points out that a political entity has to be capable to be able to enforce these attributes. Consequently, Rodrick (2005) suggests a taxonomy of four classifications of institutions, namely 'market-regulating', 'market-stabilising', 'market-creating', and 'market-legitimising'. Rodrik (2005) defines a market-regulating institutional taxonomy as the set of regulations dealing with information asymmetries, reducing the abuse of market power, internalising externalities, establishing product standards and ensuring safety standards are maintained. Market-stabilising institutions are those that relate to monetary, fiscal and other arrangements that address business cycles. Market-legitimising institutions refer to democratic governance. In overall terms, this classification system characterises and creates synergy for economic and political institutions and policies, bringing both economic and political institutions together to be tested under a unified framework Kwok (2010).

4.2.2 Measuring the Quality of Institutions

The task of measuring institutional quality is not as easy a process as that of measuring many macroeconomic variables. It is often the case that institutional qualities are most times ascertained using broad indicators. These indicators are developed by groups that advocate for more market-driven allocations of resources such as the World Bank, the Heritage Foundation and the World Economic Forum. Importantly, these measures are usually the outcome of

surveys. A key challenge encountered when employing these measures is the absence of objective data for a sufficiently long time span. For instance, the data provided by International Country Risk Guide (ICRG), a major body that provides data for most studies of economic institutions, only begins in 1984. Data from the World Bank, which has a robust coverage of several institutional measures like the quality of the bureaucracy and security of property rights, amongst others, dates from 1998. The indicator with the longest time frame is the Fraser Institute's Economic Freedom Index which begins in 1970[131].

4.2.3 Review of Institutional Empirical Studies

Knack and Keefer (1995) pioneered the use of indicators such as safeguard of property rights as proxies for this aspect of institutions. The results from their study shows that institutions that defend property rights are important for growth. Corruption in countries was found to be growth-reducing by Mauro (1995), while Knack (1996) finds institutional indicators that measure the levels of safeguarding contract and property rights are significant factors in determining the level of investments, and thus also have an impact on growth.

Shleifer et al. (1998) focuses on British common law and French civil law in investigating the impact of legal institutions on economic growth. Using a two-stage, least-square estimation, the study results support the theory that countries practising civil law tend to be associated with low levels of investor protection. In addition, the study shows that less debt and smaller equity markets are associated with countries where the level of investor protection is weak. Rodrik et al. (2004) find that the impact that institutional quality has on growth is a key factor affecting growth; their regression results shows that property rights and the rule of law consistently depicted theoretically expected signs and was statistically significant.

[131] Data spread in five year averages-annual indicators from 1995.

Acemoglu and Johnson (2005) investigated the nexus of institutions and economic development. They employ two classifications for institutions: (a) property rights institutions that defend individuals against exploitation and (b) institutions that create an environment for private enterprise. Results from the study, which employs instrumental variable estimation, indicate that institutions protecting property rights have a very strong and direct influence on growth and investment.

Parliamentary reforms and proportional and permanent democracy show the most growth-promoting policies, according to Persson (2005). Roll and Talbott (2002) find positively significant effects during their examination of the impact that electoral change of government has on growth. In their study, Giavazzi and Tabellini (2005) show that connections between reforms in both political and economic areas have positive and significant growth effects.

Glaeser et al. (2004) revisits the question of how political institutions actually drive growth, or whether growth and human capital development can result in the advancement and quality of political institutions. They find that human capital plays a more important role in fostering and driving growth than political institutions alone. Rigobon and Rodrik (2004) reveal that the rule of law and democracy as institutional measures show strong and positive impacts on economic growth with democracy showing up as a much stronger driver of incomes. The results also reveal that openness has a negative effect on income levels and for democracy. However, the impact of the rule of law variable was found to be positive. Higher levels of income corelate with higher levels of openness and quality of institutions, but these relationships appeared weak. However, the evidence suggests that rule of law and democracy variables can have feed-back effects.

Easterly and Levine (2003) employ a broad approach by using multi-country data to systematically test three key theories on growth and macroeconomic policy and the level to

which they account for growth. The results do not support the endowment theory[132] that variables (e.g., mortality rates, latitude, the extent to which the area is landlocked and crops/minerals production) affect per capita levels of real gross domestic product (GDP), after controlling for other factors such as institutions, legal origins and religions composition. Using instrumental variables estimations, the findings reveal that endowments have strong and positive effects on GDP per capita. Finally, macroeconomic policies are found not to account for significant variations in growth.

Rodrik, Subramanian, and Trebbi (2004) employ cross-sectional data to estimate the impact of institutions, geography and trade on income levels with the aid of instrumental variable regression. The study results indicate that when institutions are controlled for geography, there is an indirect impact on income levels that affects the quality of institutions. In contrast, the effect on trade is not significant. These results remain the same even after several robustness tests that make use of different set indicators and instruments to measure the impact of geography. Results from Sachs' (2003) study reveal that institutional quality captured by risk of expropriation does not impact income levels. Ahmad (2011) investigates the impact of institutions and how they drive growth in a developing sample. In general, the findings support the view that *institutions matter* in driving growth.

[132] Assumes goods are mobile and immobility of other factors of production.

4.3: Data, Methodology and Model Specification

This study's estimations follow the same theoretical and empirical foundation as used in the introductory models in previous chapters[133]. Institutions are introduced as extra growth determinants alongside the standard variables used within this study's framework to identify partial effects. The tested models are extended to include the 2-step GMM (generalized method of moments) system widely used in the literature to cross-validate the forward orthogonal deviation approach. Arellano and Bond (1991) view the generalised method of moments as essentially a linear reduced form dynamic panel data model and is specified for this study:

$$y_{i,t} = \alpha y_{i.t-1} + \beta' X_{i\,t} + \gamma' c_{i\,t} + \eta_i + u_{i,t} \qquad (4.1)$$

where i refers to 'the country (i =1, 2, …,)' and t = 'time period' yi,t = 'observation on the dependent variable for cross-sectional unit i in period t' and denotes the natural logarithm of per capita real GDP growth rate ($growth$); $C_{i,t}$ are control variables to include the investment, average schooling period, inflation and other growth determinants. These control variables are observed for country i in period t; $X_{i,t}$ is a vector of proxies denoting institutional quality measures (inst) observed for country i in period t; ηi is the i-th unobservable time-invariant country-specific effects and is independent and identically distributed in country i and $u_{i,t}$ is the idiosyncratic error term specific to country i in period t and is taken to be IID across all time periods in country i. $yi,_{t-1}$ is the natural logarithm of initial (lagged) per capita real GDP growth, which captures initial conditions for testing the convergence effect hypothesis with $|\alpha|<1$, so as to ensure stationarity, α, $\beta'$and γ' are parameters to be estimated.

The dynamic panel data model as specified in Equation 4.1 is characterised by the presence of a lagged endogenous variable as part of the regressors. However, the addition of a lagged endogenous variable as a regressor variable correlates with the disturbance term.

[133] See Chapter 1 for applied introductory models.

Potentially, the resultant effect is autocorrelation and individual effects characterising heterogeneity amongst the individual intercepts, which are allowed to vary amongst different cross-sections. More explicitly, Equation 4.1 can be expressed thus:

$$\text{growth}_{i,t} = \alpha\text{growth}_{i,t-1} + \beta'\text{inst}_{i,t} + \gamma'\text{C}_{i,t} + \eta\text{i} + \text{u}_{i,t} \quad (4.2)$$

In a more compact form, Equation 4.2 can be rewritten with the control variables Ci, included in the vector, Xi,t, and was earlier denoted as *inst* as follows:

$$\text{growth}_{i.t} = \alpha\text{growth}_{i,t-1} + \beta'\text{inst}_{i,t} + \eta_i + \text{u}_{i,t} \quad (4.3)$$

In order to control for the presence of endogeneity of some of the independent variables, the Arellano and Bond (1991) GMM procedure known as the difference GMM estimator is applied to the levels Equation 4.3 to eliminate the unobserved heterogeneity (ηi), which may capture the effect of other time-invariant factors alike. This transformation is first-differenced GMM estimator Equation 4.4:

$$\Delta\text{growth}_{i.t} = \alpha\Delta\text{growth}_{i,t-1} + \beta'\Delta\text{inst}_{i,t} + \Delta\text{u}_{i.t} \quad (4.4)$$

where Δ indicates first-difference operator. To address the econometric shortcomings in Equation 4.4, (such as the correlation amongst key variables, possibility of jointly endogenous variables and low precision), Nickell (1981) points out that Equation 4.4 is still open to dynamic panel bias since the endogeneity bias is still not addressed such that the lag of the dependent variable ($growthi_{,t-1}$) included in, $\Delta growthi_{,t-1}$ tends to correlate with the lag of the error term ($ui,t-1$) in the new error term, $\Delta ui,t$. In order to overcome this problem and assuming that only if the regressors are not strictly exogenous variables and the error term is not correlated in a serial pattern. Arellano and Bond (1991) suggest addressing the problem by employing the lagged levels of the regressors ($growthi_{,i,t-k}$ and $insti_{,t-k}$) dated $t-2$ and earlier (two periods or more) as instruments for the equation in first-differences. This difference GMM estimator relies upon the following moment restrictions:

$$E(\Delta u_{i,t}.\ growth_{i,\,t-k}) \quad = 0 \text{ for } t = 3,..., T \text{ and } k \geq 2$$

$$E(\Delta u_{i,t}.\ inst_{i,\,t-k}) \quad = 0 \text{ for } t = 3,..., T \text{ and } k \geq 2 \qquad (4.5)$$

where $growthi,t-k$ and $(inst)i,t-k$ represents the instruments set used in this GMM estimator.

Regrettably, the higher the persistence of the series used as instruments, the weaker the correlation between levels and subsequent differences. Conversely, the Arellano and Bond (1991) difference GMM approach may now tend to exhibit a large downward finite-sample bias as a consequence of small number of time periods (Blundell & Bond, 1998). It is recognised that in this case, per capita real GDP growth rate and institutional indicators are typically rather persistent over time. Given these conditions, lag of $growth$ and *inst* become only weak instruments for subsequent first-differences. This is especially so because the closer the autoregressive parameter, α to unity, likely instruments for the differenced equation are no longer strong (Arellano & Bover, 1995; Blundell & Bond, 1998). This implies that the use of instrumental variables in level form is close to random walk properties (that is, non-stationary). Consequently, the use of weak instruments asymptotically implies that as the variance of the coefficients increases more and more, it is not T-consistent. Put differently, in small samples such as this, the coefficients can be biased. Thus, the first-differenced GMM estimator is poorly behaved.

To reduce this potential bias and inaccuracy associated with the use of first-difference GMM estimator, the more efficient alternative to handling the weak instruments problem is employed. Blundell and Bond (1998), building on the work of Arellano and Bover (1995), developed a system GMM estimator to circumvent the finite-sample bias by expanding the instrument list to include instruments for the levels equation. By considering the additional assumption that first-differences of instrumenting variables are uncorrelated with the regressors and the country-specific effect (ηi) in Equation 4.3, the system GMM estimator is better suited

to estimate autoregressive models with persistent panel data. This is accomplished by considering an additional mild stationarity restriction that ($\eta i \Delta growthi2$)=0 $for\ i$=1,…,N. For the assumption to hold, it needs a sort of restriction on the stationarity and the initial conditions process, $growthi1$, which gives room for an extended system GMM estimator that uses lagged differences of the series as instruments for the levels Equation 4.3, in addition to the lag levels of the series as instruments for the differenced Equation 4.4, as indicated by Arellano and Bover (1995). This assumption yields *T – 2* further linear moment restrictions:

$$E[\Delta \text{growth}_{i,\,t-k}\,(\eta_i + u_{i,t})] \quad = 0 \text{ for } i = 1,\ldots, N \text{ and } t = 3,4,\ldots, T$$

$$E[\Delta \text{inst}_{i,\,t-k}\,(\eta_i + u_{i,t})] \quad = 0 \text{ for } i = 1,\ldots,N \text{ and } t = 3,4,\ldots,T \qquad (4.6)$$

Therefore, the system GMM estimator uses the equations in both levels (Equation 4.3) and first-difference (Equation 4.4) as one system, while using a broad set of instruments. The system GMM estimator has been shown to improve on the GMM estimator in the first-differenced model in terms of bias and root mean squared error (Bun & Windmeijer, 2010). Note that for the first-differenced equation, the instruments to be used are similar to those examined in Equation 4.4. For the levels equation (Equation 4.3), the predetermined and endogenous variables in levels are instrumented with necessary lags of their own first-differences, while the strictly exogenous variables can directly enter the instrument matrix for use in the levels equation. Hence, the variables in levels in Equation 4.3 are instrumented with their own lagged first-difference while that in Equation 4.4 is instrumented with its lagged levels. For Blundell and Bond (1998), the system GMM estimator exploits stationarity restrictions such that the regressors are stationary. As a warning, the system GMM estimator could face a challenge of too many instruments. This includes over-fitting of the dependent variables and as such fail to erase their endogenous parts. This reduces the power of the test for over-identifying restrictions if we do not set a limit on the set of instruments (Roodman, 2009). Hence, the more proficient, two-step GMM system estimator can deliver unbiased estimates

when the model is over-identified compared to results from a one-step GMM. There is a correction of the standard errors for finite-sample bias.

4.3.1 Model Specification

The model is expressed in its functional form as:

$$growthi,= f(growth_{i,t-1}, inigdp_{i,t}\ inst_{i,t},, avgsch_{i,t}, govtcon_{i,t}, inflation_{i,t},$$

$$workpgrowth_{i,t}, inv\text{-}pri_{i,t}\ , inv\text{-}pub_{i,t}\ ) \quad (4.7)$$

4.3.2 Data Measurement, Definition and Sources

The panel dataset employed in this study covers 23 emerging economies with observations from 1990 to 2010. It contains both time-varying and time-constant variables. The determination of both cross-section as well as time-span of the dataset depends on the availability of data institutional quality indicators. A measure of per capita GDP is used to compute the growth rate as first-difference of the natural logarithm, which is proxy for economic performance. This measure is taken from the World Development Indicator. It is believed that other variables could have great impact on per capita real GDP growth. In view of this, the standard vector of growth variables is employed as applied in previous chapters. These are incorporated as control variables. Institutional development is measured using different indicator measures applicable in literature. In particular, the empirical analysis will typically consider five composite indicators of institutional measures that focus on broad measures of governance from the Frasier Institute. These series are applied in a multi-country framework panel.

As previously described in the literature, these indices of institutional quality (*inst)* are defined and denoted as follows:

1. Legal System and Property Rights (LegPro): Measures legal environment and protection
2. Security of Property Rights (SecPro): Measure of LegPro-Polity (IV) source

3. Government Effectiveness (GovEff): Measures proficiency of the bureaucracy and public service performance
4. Regulatory Quality (RegQual): Measures occurrence of market-unfriendly policies
5. Rule of Law (RuleLaw): Reflects several key issues such as contract enforcement, law enforcement machinery and judiciary

Section.4.4:

Presentation and Analysis of Results

4.4.1 Introduction

In this section the empirical estimation of the models specified are presented and analysed. The estimations start with five-year, fixed-effects tests to determine the immediate impacts of institutions on growth alongside other important growth variables, after which the system and FOD GMM are introduced to address potential endogeneity. It is important to check for the effects over time, especially with business cycle fluctuations. We then calculate averages across different time periods from five years to annual (using smaller business cycles for more volatile emerging markets, as they are prone to more shocks and tend to complete business cycles faster).

Though the use of fixed effects is useful in addressing the challenge of omitted variables controlling for effects that are country- and time-specific—giving room for unobserved time-invariant heterogeneity to be tackled—the challenge of endogeneity may still exist. Thus, the GMM estimation technique addresses this issue through the use of *internal instruments* based on lagged variables.

4.4.2 Institutions: Growth Regression, Fixed Effects Regression

Following our approach from previous chapters, we initially present the estimation results depicting the effect of institutions on growth using fixed effects estimates. The Hausman test was conducted and used as the basis for the selection of the FE results. The results are presented below:

Table 4.1:

Variables	FE-Results		
	gdpgr	Gdpgr	Gdpgr
	(1)	(2)	(3)
C	0.762***	0.675**	0.747**
	(9.45)	(6.47)	(6.24)
Legal-pro (Ins1)	0.077***		
	(8.96)		
Sec-rights (Ins2)		0.042***	
		(3.46)	
Reg-qual (Ins3)			
Govt-eff (Ins4)			0.024*
			(1.79)
Rule of law (Ins5)			0.12
			(0.83)
LGDP per capita (-1)	0.181***	-0.095***	-0.098***
	(10.94)	(6.18)	(5.79)
Average years of	0.025***	0.027***	0.027***
schooling	(7.08)	(6.32)	(5.91)
Government	-0.83**	-0.875***	-1.034***
consumption	(5.89)	(5.39)	(6.07)
Inflation	- 0.005***	-0.004***	-0.003***
	(5.95)	(4.07)	(3.43)
Working population	0.176	0.015	0.050
growth	(1.55)	(0.12)	(0.37)
Public investment	0.121***	0.112***	0.090***
	(5.37)	(4.88)	(4.89)
Private investment	0.216***	0.195***	0.346***
	(4.53)	(4.66)	(4.47)
R^2	0.37	0.33	0.32
N	381	379	339

Annual Fixed Effects regressions; Figures in Parentheses are t-statistics; Ins 3 (ReqQual) omitted with insignificant results and overall drag on the model when included for partial tests; GDPgr refers to GDP growth. Time and country dummies are included in all regressions. All fixed effects regressions reported have overall significance at 1%.

The regressions started with fixed effects tests for the immediate impacts of institutions on growth alongside other important growth variables. The five-year averaged data, which is the starting point of this estimation, reported insignificant estimates for variables of interest, and so are not reported here.

We then followed the approach from the previous chapters by regressing the range between the annual and five-year data. The annual estimation results in Table 4.1 show that the macro determinants, both private and public investment coefficients, are observed to be very significant and positive in all the estimations. Education measured by the average years of schooling (AvgSch) impacts positively and significantly on the economic growth across all specifications. Government consumption (GovtCon) has a negative impact on growth, which is significant across all specifications. Inflation has a negative and significant impact on growth across all specifications. Workpgrowth is not significant at all across all specification. Moving to the institutional variables, it can be seen that the results reveal that institutions affect growth significantly and positively. Specifically, for the annual data estimation, LegPro (0.077, t=8.96) and SecPro (0.042, t=3.46) have very significant effect on growth at one percent level. To highlight the size of economic effect, a one unit increase in the index of legal system and property rights is associated with approximately 0.08 percent increase in GDP per capita for our sample of countries in the short run. Table 4.1 also reveals that a 1 unit increase in the index of security of property rights is associated with a GDP per capita increase by 0.04 percentage points. Government efficiency (GovEff) reported positive significant estimates while Rule of Law (RuleLaw) did not show any statistical significance across the estimations though it has the expected the positive sign. The overall estimates performed poorly with the input of more than one institutional variable; therefore, we test for partial impacts for each institutional variable per regression. The statistical and positive effects of legal protection and security rights jointly emphasise that *market-creatin*g institutions both directly influence economic growth in emerging markets, a finding that is in line with previously discussed literature.

4.4.3Institutions: Growth Regression, Fixed Effects, Three-Year Average Results

Because it is important to check for effects over time, especially with business cycle fluctuations, we then make averages with three[134]-year averages[135]

[134] Results reported for consistency with this study's approach.
[135] Following the estimates from Chapter 3.

Table 4.2. Institutions: Growth Regression, Three-Year Average

Variables	3yr-FE Gdpgr
C	0.710**
	(6.05)
Legal system and property rights	0.069***
	(5.68)
Security of property rights	0.020**
	(2.34)
Regulatory quality	0.021
	(1.18)
Government effectiveness	0.019*
	(1.94)
Rule of law	0.001
	(0.73)
LGDP per capita (-1)	-0.093***
	(4.12)
Average years of schooling	0.021***
	(3.66)
Government consumption	-0.971**
	(3.98)
Inflation	-0.005**
	(2.20)
Working population growth	-0.086
	(0.39)
Public investment	0.054**
	(4.96)
Private investment	0.107**
	(4.07)
R^2	0.35
N	169

Three year Fixed Effects regressions; Figures in Parentheses are t-statistics; GDPgr refers to GDP growth. Time and country dummies are included in all regressions. All fixed effects regressions reported have overall significance at 1%.

Table 4.2 presents the estimation coefficients using 3 year averaged data for our sample, in this table, each institutional variable was individually tested alongside the other macro determinants of growth. In relation to the size of economic effect, our table suggests that a unit increase in the index of legal system and property rights is associated with a 0.069 percentage point increase in GDP per capita growth for our sample of countries. As this is a period averaged estimation to eliminate business cycle effects, this may be valid for the long run. Similarly for security of property rights, our results suggest that a unit increase in the index of security of property rights is associated with a 0.02 percentage point increase in GDP per capita growth for our sample *ceteris parius*.

The results of the estimation conducted show that macro growth determinants and both private and public investment coefficient are also very significant and positive in all the regressions. Education measured by the average years of schooling (AvgSch) impacts positively and significantly on the economic growth across all specifications. Government consumption (GovtCon) has a negative impact on growth, which is significant across all specifications. Inflation has a negative and significant effect on growth across all specifications. Workpgrowth is not significant at all across all specification. Moving to the institutional variables, the results reveal that institutions affect growth significantly and positively.

Specifically, the period averages estimation result indicate legal protection and security of rights and property are the most significant institutional variables while government effectiveness also produces significant estimates with a point coefficient of 0.019 (t=1.94) significant at 10% which can also be interpreted as suggestive of a positive impact on growth for our sample.

4.4.4 Institutions: Growth Regression, GMM Results

After the FE estimation confirmed the significance of institutions and other macroeconomic growth determinants result, several econometric challenges affect the FE estimations. Key amongst these is the endogeneity bias between growth regressors (Murray, 2006; Clemens & Bazzi, 2009). As previously noted, the use of fixed effects is important in addressing the challenge of omitted variables controlling for effects that are country- and time-specific. This thus gives room for the unobserved time-invariant heterogeneity to be tackled, since the challenge of endogeneity still exists. Caselli et al. (1996) points out that the dynamic GMM estimation method is able to address the effect that endogeneity issues have on estimations. The reliability of the GMM outcomes relies on the instrument validity. Following methods by Arellano and Bover (1995) and Blundell and Bond (1998), this study employs two specification tests: the Sargan/Hansen test looks at identifying restrictions to check the aggregate validity of the instruments and examines if all the instruments are collectively exogenous; the AR-2 test seeks to confirm second order serial correlation of the hypothesis. The results are presented and analysed in table 4.3.

Table 4.3 **Institutions: Growth Regressions, GMM Results**

GDPgrowth	FOD Annual	2-Step GMM Annual	FOD 3yr	2-Step GMM 3yr
Legal-pro	0.037***	0.052*	0.075**	0.043
	(5.37)	(1.65)	(2.26)	(1.72)*
Sec-rights	0.063***	0.024	0.024***	0.011
	(10.77)	(0.95)	(2.85)	(1.25)
Reg-qual	-0.036	0.012	-0.007*	-0.004
	(0.82)	(1.46)	(1.82)	(1.31)
Govt-eff	0.018	0.093	0.015**	0.02
	(1.91)	(0.87)	(2.05)	(1.47)
Rule of law	0.019	0.074	-0.020	0.002
	(1.52)	(1.36)	(0.31)	(0.77)
N	361	359	98	97

FOD and 2 step GMM presented for annual and three year. Five year estimates were largely insignificant. Baseline growth determinants included but not reported. The lagged GDPgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are treated as endogenous. T-stats are in parentheses, ***, ** and * denote significance levels at 1%, 5% and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hanan test is used for over-identifying restrictions

Table 4.3 presents the institutional coefficients obtained from our GMM methodology. The other determinants of growth largely consistent in this study's results across chapters follow expectations. However, the parameter of interest in this regression is the institutional variable. The coefficients of the GMM are better behaved than the FE values, which is suggestive of estimation control for endogeneity and measurement error. The results reveal that institutions affect growth significantly and positively. Specifically, for the five-year estimations, no significant relationship is recorded within variables of interest in both applied GMM estimators. Annual and three-year results present significant relationships. For annual data estimation, LegPro (0.037, t=5.36) and SecPro (0.063, t=3.77) have very significant effects on growth at one percent level. Both variables represent similar instruments on the

protection of private property rights and a significant implication for justice and the rule of law. This forms the fundamental basis for any business society to thrive. Government efficiency, which corresponds with a measure of government performance, also reports very low but positive significance. The nature of government within emerging markets, though relatively stable[136], is still inefficient at best when compared with any representative advanced country. Regulations report generally insignificant values alongside rule of law which did not show any statistical significance across the estimations. The statistical and positive effects of legal protection and security rights jointly emphasise that *market-creating* institutions both impose direct impacts on economic growth in emerging markets. This is line with findings of studies such as Acemogu *et al.*, (2001) and La Porta *et al.* (2008), Nunn (2009), and Botero, Djankov and Mahoney (2001). These key institutions are main determinants of income level differences across countries. Additionally, importance has also been given to the role of legal protection and security rights as mainstay indicators that help to reinforce growth, which makes them persistent (Besley & Ghatak, 2009). By implication, the role that the state plays in ensuring the formalisation and protection of such rights is crucial (Acemoglu & Johnson, 2000/2004).

There is evidence in the literature (Knack & Keefer, 1995; Acemoglu et al., 2001/2002/2005; Hall and Jones, 1999; Kerekes & Williamson, 2008) that shows there is a positive relationship between secure property rights and economic growth, which supports the notion that institutions, especially those relating to secure property rights, ultimately are drivers of economic performance. The economic argument in favour of protection of security rights is that investment affects growth and that it will be difficult to attract investments if there is a possibility those investments will not be safe legally (Everest-Phillips, 2008; Besley & Ghatak, 2009; Acemoglu et al., 2004). According to Besley and Ghatak (2011) there are different

[136] If we use democracy as a measure and peaceful transition of government in comparatively nascent democratic societies.

primary mediums through which property security rights can drive growth. First, the presence of property rights helps ensure investment can result in a flow of income that is guaranteed against expropriation—a major factor that investors consider before making an investment decision is the security of their property rights. Second, the protection of property rights also improves the establishment of a market-driven environment such that assets are transferred to those who can use them most productively. Third, protection of property rights leads to a decline in the cost of protecting assets and property so that economic agents need not spend a lot to protect their property, resulting in resources being made available for productive purposes.

However, there are also studies that do not go along with the notion that institutions and settings that specifically ensure protected property rights are basic necessities to drive growth (Glaeser et al., 2004; Fogel, 2004; McArthur & Sachs, 2001; Schmid, 2006). Some studies are critical about the proposal that protection of private, individual property rights stands out as the most suitable approach for achieving growth. Those holding this contrary view have argued that setting up systems to ensure protected property rights can result in conflict and could even heighten inequality levels in a society and therefore are detrimental to growth, particularly pro-poor growth (Easterly, 2001; Acemoglu et al., 2005). The emergence of the rentier society in Latin America is a classic example of this (Engelmann & Sokoloff, 2000; Hoff, 2003). The realities of key emerging economies such as China and India do not show clear evidence of strong institutions, especially with regard to property rights protection. As Allan, Qian, and Qian (2005) note, China has attained the highest and most persistent growth in history despite the presence of weak legal institutions. This suggests that, at least in the case of China, strong institutions may be a necessary but not sufficient condition for growth. Dominika Bochańczyk-Kupka's (2016) study on *A comparative analysis of intellectual property rights protection in China and India in the XXI century* uses ratings from the Heritage

Foundation, the Fraser Institute and the International Property Rights Index (IPRI) to conclude that evaluation of protection of property in countries shows significant variations when data provided by various ranking agencies is considered. However, on average the evaluation of intellectual property rights protection for key emerging economies like China and India is quite unsatisfactory. Basically, both countries have recognised right[137] systems that are almost the same as Western and American legal systems. In addition, these countries have signed notable international property rights protection agreements. However, the challenge for these economies, just like many other emerging economies, is the failure of robust enforcement. Paradoxically, the example of China and India shows that even without this protection, countries can still grow very quickly, sometimes even faster than other[138] countries. One clear reason for this inconsistency, especially for China, is that the presence of powerful state protection and ownership may override the absence or weakness of standardised legal protection. In the Chinese economy, state ownership acts as a powerful and effective alternative mechanism that grants state-owned firms substantial control over innovation and protection against expropriation. State owned enterprises in China have a multi-framework structure to protect against expropriation using governmental administrative measures (Snyder, 2012).

Broadly, Regulatory Quality (RegQual) and Rule of Law (RuleLaw) in all the various estimations did not show any significant effect on growth[139]. There are several classifications of regulation and it is even possible to often mix them up. Nevertheless, a general categorisation consists of three parts: economic, social and process regulation (Asoni, 2008; Haber et al., 2003). Economic regulation deals with boundaries on prices, quantity, entry and exit rules for specific industries. Social regulation deals with controls that influence numerous industries.

[137] With the observed pace of growth.
[138] Even with noted high population.
[139] except the three year FOD with a low negative point value of approximately 0.01 percentage point at 10% which suggests that a unit increase in the index of regulatory quality is negatively associated with GDP per capita for our sample

Finally, process regulation is associated with government control over public and private sector activity. This study's results show the statistical insignificance of regulation on growth. One reason for this outcome has been identified by corruption studies [e.g., Mauro (1995) and Djankov, Porta, Lopez-de-Silanes, et al. (2002)]. These studies hold that intensifying regulations in developing nations will cause corruption and probably explain the lack of any significant effect. This finding is echoed by Kwok (2010) who argues that in less developed economies, regulations may actually hinder growth because of poor enforcement and the extent of corruption and loopholes within the system. Another challenge is that institutions in developing economies have a tendency to move slowly in terms of implementing change. Given that economic institutions and regulatory institutions are largely issues of collective choices, the manner in which political power is determined is the key factor that explains development and efficiency (Kwok, 2010).

Information regarding the quality of regulation in developing countries is limited but still growing. In cases where studies have been performed, results indicate that the performance of state regulation has been far from satisfactory. In a study of 13 Asian countries Jacobs (2004) found that 80% of the regulatory institutions had no access to adequate training and, in most cases, lacked qualified administrative staffs. The report concludes that emerging economies in Asia often rely on under-equipped and unsupported independent regulators to carry out tasks beyond their capabilities (Jacobs, 2004). In Latin America, Ugaz (2003) observes there is an absence of political support for independent regulation and an absence of a strong dedication among the state authorities to ensure regulatory independence for institutions responsible for regulations. In the context of African economies, regulation is often part of sector-specific initiatives, but again suffer from poorly coordination (Campbell-White & Bhatia, 1998). In India, Lanyi (2000) observes that regulatory structures are often linked with an inefficient bureaucratic approach that has a dampening effect on enterprise. South Africa's abundance of

regulatory agencies is traceable to the absence of clarity about roles and duties (Schwella, 2002). Emerging economies also show much variability in the performance of the newly established regulatory institutions (Cave & Stern, 1998).

In relation to the rule of law, the dominant line of theoretical inquiry into the different channels through which the rule of law can drive growth has revolved around property rights and the requisite institutions needed for enforcement, including procedures that ensure maintenance of an independence government and judiciary. The coefficient of rule of law in this study has an expected, though not significant, positive sign at five percent. Empirical findings have been mixed. La Porta et al. (2004) find that judicial independence has positive effects on growth. However, the Glaeser and Shleifer (2002) study shows that judicial independence is not a significant driver of long run growth. Feld and Voigt (2003) offer a probable reason for these conflicting findings. They construct a new database on high courts that encompasses both de jure measures, such as formal institutional arrangements, and de facto measures such as the effective length of terms and trends in budgets. They find that GDP growth is not affected by de jure independence[140], but it is affected by de facto independence. The mixed findings in literature points to the problem of institutional complementarities as unresolved in the continuum of inter-dependent processes expected to uphold the rule of laws and that can significantly affect procedural outcomes. The pervasive influence of corruption is another factor receiving attention when explaining the empirical outcome of the non-statistical significance of rule of law while analysing growth in emerging economies. Many Asian countries, including China, Korea, Taiwan, Thailand, Malaysia, and Indonesia, are associated with inefficient rule of law and a high level of corruption during their transformative growth experiences (Campos, 2001; Rock & Bonnett, 2004).

[140] Independence from direct control of the government, e.g., constitutional courts.

4.4.5 Institutions: Interaction

Table 4.4 Three year averaged Interaction Terms

GDPgrowth	FOD GMM	2-Step GMM
Legal protection and property rights	0.049**	0.041*
Security of property rights	0.028*	0.011
Legal protection and property rights *	-0.015*	-0.001
Security of property rights	(1.72)	(1.02)

Partial interaction tests only presented. The lagged GDPgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are treated as endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at one percent, five percent and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed for FOD. Hansen test is used for over-identifying restrictions.

In identifying any form of interaction relationship between the different institutional indicators, this study finds a 10% significant relationship for legal protection and government effectiveness (-0.015), although this is inconsistent and becomes insignificant with the 2-step estimation; security of rights and property seem to underperform with no significant interaction relationship with other institutional instruments. A negative interaction coefficient means that the effect of the combined action of two predictors is less then the sum of the individual effects. As the reported interaction term is negative, this suggests that the growth effect of legal system and property rights will get smaller as the the security of property rights gets larger and vice versa. This is not robust and may be indicative of high collinearity between the two institutional index (legal system & property rights and security of property rights) as these represent similar information on property rights protection from the different sources[141].

4.4.6 Legal System and Property Rights Components

The study's results regarding institutional performance on growth highlighting political-legal institutions are extended by examining the sub-components of legal protection,

[141] legal system and property rights from Frasier institute while security of property rights was obtained from the Polity (IV) source

which is the most consistently reported estimate. Sub-components of legal protection from the Frasier Institute include indices on judicial independence, integrity of the legal system, business cost of crime and the reliability of police and are introduced in the model for partial growth tests. The results are presented below:

Table 4.5 Legal System and Property Rights Sub Components

GDP per capita growth	FOD GMM	2-step GMM
Judicial Independence L1	0.026 (1.54)	0.032** (2.11)
Integrity of the Legal System L2	0.0171**(2.35)	0.012 (0.84)
Business Cost of Crime L3	-0.112 (1.08)	-0.06 (1.29)
Reliability of Police L4	-0.013 (0.29)	0.001 (0.04)

Sub-variables were selected partly based on availability across the board. Partial tests only presented. The lagged GDPgrowth is estimated as pre-determined alongside average years of schooling and growth of the working population while other regressors are treated as endogenous. T-stats are in parenthesis, ***, ** and * denote significance levels at one percent, five percent and 10% respectively. Max 4 lags for internal instruments which are transformed by orthogonal deviation and collapsed. Hansen test is used for over-identifying restrictions

Table 4.5 extends the analysis of these results by unbundling the legal protection variable. The result of sub-three-year averaging shows significant and positive results for indices representing judicial independence while integrity of the legal system reports a point estimate of 0.0171 significance at the five percent level. The variables on business cost of crime and reliability of police revealed negative but insignificant estimates across the methods applied. Specifically, a one unit increase in the index on the integrity of the legal system is associated with an increase in growth by 0.02 percentage points however this value is not robust to different specification.

4.4.7 Estimation Summary

Examining institutional relationships including representatives of political and legal institutions reveals at a minimum that institutions matter. We can infer a positive relationship between legal protection (and sub-component) indicators and the growth variable within the applied framework[142]. Security of rights and property and government effectiveness revealed

[142] Consistent across models FE, GMM1&2.

significant relationships at three-year averages while legal protection revealed consistently positive and robust estimates across different averaging and model criteria.

4.4.8 Sub-Categories and Interaction Terms

Interaction effects for complementary relationships on growth amongst institutional variables reported significant relationships only with the variable on government effectiveness.

In unbundling the legal protection variable and introducing indicative measures, the results highlight judicial independence and the integrity of the legal system as important components with growth impacts when compared to insignificant estimates for business cost of crime and reliability of police however the relationship is not robust.

In summary, this chapter revisits the institutions growth argument by exploring two issues: do institutions matter in growth outcome of emerging markets? if yes which of these institutions matter most. We conclude from the empirical results, particularly the FOD GMM more suited for our unbalanced panel that:

1) institutions matter in promoting growth in our sample of countries and that improvements in the quality of institutions will promote growth in emerging countries

2) Legal system and property rights alongside security of property rights are important among the five indicators of institutions initially considered in this chapter. A range of coefficient values between 0.05 and 0.08 for legal system & property rights and 0.02-0.06 for security of property rights across annual and three year specifications suggest a slow moving growth impact of institutional change for our sample of countries in relation to property rights.

The economic argument in favour of protection of security rights as both variables jointly represent is that investment affects growth and that it will be difficult to attract investments if there is a possibility those investments will not be safe legally hence the presence of property rights helps ensure investment can result in a flow of income that is guaranteed against expropriation, this is a major factor for investment decisions. Further, the protection of

property rights also improves the establishment of a market-driven environment such that assets are transferred to those who can use them most productively. Finally, protection of property rights leads to a decline in the cost of protecting assets and property so that economic agents need not spend a lot to protect their property, resulting in resources being made available for productive purposes.

We also find no robust relationship between other institutional variables considered including the interaction terms and the sub components of the legal system and property rights though the variables generally conform to expected signs

Section.4.6:

Conclusion and Recommendation

The influence that institutions have on growth is widely acknowledged and is an integral aspect of policies recommended to drive growth, especially in emerging economies. As noted earlier, this interest in the pervasive influence of institutions has been heightened by research into institutional economics conducted in the 1980s and by North's studies a decade later. The need to provide a framework that explains why developed counties are able to achieve and maintain significant growth levels and why less developed ones appear to be stuck at lower levels has driven studies on the role of institutions. The key point is that weak and badly functioning institutions are a prime factor influencing problems faced by developing economies. The IMF (2005) holds that an understanding of the process of how institutions affect growth outcomes is vital in creating policies that can accelerate economic progress. Indeed North (1990) in his pioneering study on institutions, *Institutions, Institutional Change and Economic Performance,* suggests that quality institutions are the key drivers of economic growth. There is now a rising need for institutions that can help bolster growth and act in sync with the economic environment and the behaviour of economic agents, which are critical factors for economic performance.

The objective of this study was to investigate whether economic growth is influenced by different institutional measures, and especially by variables that closely affect market participants. Economic performance was represented by real GDP per capita data while the main institutional variables were represented by legal protection, security rights, regulatory quality, government efficiency and the rule of law. The estimations started with fixed effects tests to determine the immediate impacts of institutions on growth alongside other important growth variables. Because it was also important to check for effects over time, especially noting business cycle fluctuations, this study includes three-year averages for smaller business cycles,

since more volatile emerging markets are prone to more shocks and tend to complete a business cycle faster. The study also considers potential bias from the FE estimations and endogeneity bias between different growth variables including institutional indicators which are more likely to move in the same direction as growth (Murray, 2006; Clemens & Bazzi 2009). Although the use of fixed effects is useful in addressing several issues, the endogeneity problem creates a bias that makes it a good introductory or inferential point for this study. Thus the GMM estimation technique is used to address this issue through the use of internal instruments based on lagged variables. System and FOD GMM methods were applied. The most consistent across model significance was the FOD GMM, although the values obtained might have been weakened by many instruments however the diagnostic tests using the Hansen and Sargan tests implies that we do not reject the validity of over identifying restriction. Equally the Arellano-Bond test for autocorrelation show that there is no evidence of high order autocorrelation in all the regression

4.6.1 Main Findings

Specifically, for the data using fixed effects estimation, legal protection and security rights have a very significant effect on growth at the one percent level. The statistical and positive effects of legal protection and security rights jointly emphasise that *market-creating* institutions have a direct influence on economic growth in emerging markets. The estimation results also show that government efficiency is a significant factor.

Inferring from the similar GMM results, the convergence hypothesis is confirmed as the coefficients of lagged dependent variables have the anticipated negative sign and are significant. The coefficients of the GMM are more consistent than the FE, which is suggestive of estimation control for endogeneity. The results reveal that institutions affect growth significantly and positively, primarily via legal protections, security of property rights and internal instruments. This is line with findings of such studies as Acemogu et al. (2001), La

Porta et al. (2008), Nunn (2009), Botero, Djankov, and Mahoney (2001) and Kerekes and Williamson (2008). Government efficiency also has an expected positive and significant impact on growth. Tanzi (2005), Angelopoulos et al. (2008), Handler et al. (2005), and Lora & Panizza (2002) confirm that nations with more effective governments have a propensity to attain high levels of economic growth.

To conclude, we reiterate that Institutions matter for growth and our sample institutions need to improve on the legal protection of rights and basic legal enforcement to continually attract and keep new investments and this is line with findings of similar institutional studies such as Acemogu *et al.*, (2001) La Porta *et al* amongst others.

CHAPTER FIVE

CONCLUSION

5.1. SUMMARY OF KEY FINDINGS

This study is drawn from debates on the effects of the size and financing of government, the role of policy and the effects of public investment on the economic growth path in emerging markets. My research examines the dynamic effects of financing public investment and distortionary or re-allocative effects of taxation within a revenue-neutral framework on economic growth across 23 emerging markets. The role of institutions in these markets is also critically examined. Generally, the research highlights three macro fiscal sectors with revenue generation based on taxes from output and production, revenue spending with public investments from budgetary allocations and government efficiency delivery by extension of its institutions.

5.2. Revenue Neutral Shifts on Taxes

The first chapter examines broad tax issues affecting growth within a sample of 21 emerging countries. We split tax variables within a revenue-neutral framework and check for the observed growth effects. These results were subsequently ranked according to the magnitude of growth distortions. Corporate income tax reported the most distortionary growth coefficients, while personal income tax, consumption taxes and property taxes consecutively were less distortionary to output growth. Corporate taxes seem to be the main driver of the distortions or negative effects on growth by coefficient size and significance. Within the revenue neutral framework results obtained from the emerging markets studied, growth can be triggered with a reduction in income taxes and a corresponding increase in consumption taxes. Our examination within this framework is again similar with existing studies and we find similar results. The finding is similar with Acosta-Ormaechea and Yoo (2012) which found that a percentage point increase in income taxes leads to a fall of GDP growth rates of around

0.07–0.14 per cent. Mendoza(1997) argues that all taxes can potentially cause distortions to output but "indirect taxes do so to a lesser extent" than direct taxes. Prichard (2016) notes that the acceptance that increases in personal and corporate income taxes are bad for growth has become policy orthodoxy for multilateral institutions like the IMF (see IMF 2011; 2015)[143] both make reference to the thinking that indirect taxes are more growth-friendly than income taxes.

5.3. Public Investment and Growth

The second chapter focused on core investment issues in the public sector and productivity effects of public capital within a panel of emerging countries. Utilizing data from twenty one emerging markets covering from 1990-2010 and model estimations using fixed and GMM techniques with yearly and period average data. The study introduced six measures of public investment in a standard growth regression namely: Public investment ratios, growth of public investment ratio, level of public investment stock per capita, Growth of public investment stock per capita, public capita stock per capita, and forward changes in the existing stock of public capital stock. We initially test for the growth effects of these measures and focus on the public investment/GDP ratio and the growth of public capital stock as standard representations from the endogenous growth literature. The study also incorporates the budget constraint financing assumption that highlights the budget as a close system with deficit (intermediate)/surplus, unproductive (best)/productive expenditure and distortionary (worst)/non-distortionary taxes).

The results broadly indicate that funding new budgetary investments lead to a growth spike within the immediate term as new resources are employed. Properly completed public investment projects leads to slower but prolonged improvements in the long run growth and productivity when these projects become functional. These positive findings are in line with

Aschauer, (1989), Straub, (2007), Chakraborty and Dabla-Norris, (2009). The research also introduced the net marginal productivity variables with significant causal relationships with the measures of capital productivity and constructs of public capital. This finding is also supported by studies (Neil & Thirlwall, 2015 Buffie et al 2012; Ghazanchyan and Stotsky 2013). The results indicate Unproductive expenditures best finance public investment though it was most inconsistent in significance. Public investment financed from the deficit produced the strong positive results across models and time averaging. We also note that public investment and its measures however financed gives a positive impact on growth and NMPC. This may also indicate real deficiencies in the available public capital.

Importantly also, we answered the question of whether public investment crowd out private investment. We confirm crowding out only at higher than average rates of public investment and within our model, 7% threshold reported crowding out by reduction in the positive impacts of private investment and significance of the interaction dummy. By implication, emerging markets with deficiencies in public capital are far off the crowding out point however this is still constrained to the efficiency of the public investment spending in these markets. The complimentary relationship is highly sensitive to the current levels of public investment and levels beyond an optimal point may result in declining marginal gains for private investment and hence crowding out could set in.

5.4. Institutions and Growth

The third chapter looks at institutional effects that cause growth and development progress in these countries. We broadly model institutional indicators from the Frasier Institute and examine any interaction effects among variables. The economic growth was proxied by real GDP growth per capita while the main institutional variables are proxied by legal protection, security rights, regulatory rights, government efficiency and rule of law. The estimations start with fixed effects tests for the immediate impacts of institutions on growth

alongside other important growth variables. Next, we then take periodic averages. Despite employing the fixed effects (FE) estimation, several econometric issues have bedeviled the FE estimations and key amongst these being the endogeneity bias between institutions and growth (Murray 2006; Clemens and Bazzi 2009). Thus the GMM estimation technique was used to address this through the use of "internal instruments", based on lagged variables. The chapter on institutions is extended by unbundling the sub components of legal protection as a significant market creating institution and the results suggest judicial independence and integrity of the legal system as significant factors that affect growth though we were unable to identify a consistent interaction relationship from the variable mix. From the findings, comparatively the indicators in these countries fared worse than the data in advanced markets.

5.5. Policy Implications

In the first empirical chapter, we confirmed that revenue neutral shifts from direct taxes to indirect taxes appears to be more growth promoting while shifts from indirect taxes to direct taxes may be more harmful for growth, these results were significant to different specification. This research notes that adjustments in tax policy that is likely to have a positive effect on growth in emerging economies will depend on the conditions in the economy. However, a move towards consumption taxes while correspondingly decreasing corporate taxes for instance will be growth promoting though there may be concerns on widening income inequality in these countries. This is implied from our regression estimates and the existing literature on endogenous growth theory.

In the second empirical chapter the study confirmed that funding new budgetary investments lead to a growth increase from the immediate term. Properly completed public investment projects leads to slower but prolonged improvements in the long run growth and productivity when these projects become functional. The research also introduced the net marginal productivity variables with significant causal relationships with the measures of

public investment and constructs of public capital. From a policy view point for emerging markets, investments in public capital for instance road and railways should be associated with faster growth. This is linked with the catch up or beta convergence criteria that expects developing countries with lower stock of capital to catch up with rich ones. From our empirical results, the existing stock of public capital as a constructed measure indicates a positive output growth relationship, which can be interpreted as an increase in private productivity effect. This corresponds with the postulations of the neoclassical and endogenous growth frameworks.

In the third chapter, the study confirmed that Institutions matter for growth and our sample institutions need to improve on the legal protection of rights and basic legal enforcement to continually attract and keep new investments and this is line with findings of studies such as Acemogu *et al.*, (2001) La Porta *et al.* (2008), Nunn (2009), Botero, Djankov, Mahoney (2001), Kerekes and Williamson (2008), Tanzi, (2005), Angelopoulos et al. (2008), Handler et al. (2005) Lora and Panizza (2002). economic growth in the long term. Our GMM analyses also imply that institutional quality could associate with faster growth even in a shorter timeframe. This in line with the qualitative conclusion in the literature that security of property rights is a first-order principles of economic development. This implies that a sound institutional environment is necessary for the economy to thrive.

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