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EXTERNAL DEBT AND ECONOMIC GROWTH: NEW EVIDENCE FOR AN OLD DEBATE

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ABSTRACT

This study aims to contribute to the understanding of the impact of external debt on economic growth by using the data for moderately indebted middle-income countries over the period of 1985-2013. The paper employs a relatively recent panel analysis technique, the common correlated effects (CCE) framework, which considers cross-sectional dependence and heterogeneity implications in the data. Our overall findings suggest a negative linear effect of external debt for the panel despite some exceptions in the country-specific results. In the panel results, the impact of external indebtedness occurs through the debt stock rather than a direct impact of liquidity constraint represented by a debt service variable.

1.INTRODUCTION

During the 1950s and 1960s foreign resources were considered as significant for development and economic growth of less developed economies (e.g. Avromovic *et al.*, 1964; Chenery and Strout, 1966)[1]. It was argued that countries at early stages of development did not have sufficient resources that could be devoted to investment, which in turn, was crucial for economic development. External debt was seen as an important source of economic growth for developing economies through its impact on capital accumulation, human resource development and infrastructure improvement.

As foreign aid and/or foreign debt were seen almost inevitable, many developing countries exerted external resources at an increasing rate. Most of these countries borrowed to compensate insufficiency of domestic savings and to meet foreign currency need for imports of intermediate and capital goods. As a result, their indebtedness intensified and reached critical levels, eventually resulting in foreign debt crises in a number of economies at the end of the 1970s or in the early 1980s. In the meanwhile, the share of private loans compared to official financing in total foreign indebtedness started

[1] Although the Harrod-Domar model was not developed to offer solutions to the issues in the less developed economies, it was used by the economists who debated for the significance of external resources for those.

rising. With the liberalisation of international capital movements the nature of external borrowing/lending changed extensively from the late 1970s.

Debt crises of the developing countries led to serious concerns and debate. Following the crises, implications of foreign debt for developing economies were questioned in the academic and policy making circles. After the tough post-crisis experience, the conditions improved in most of the middle-income debtor countries. Then in the 1990s, high external indebtedness of a rather poor group of countries revived the debate. A number of low-income countries received debt relief under the Heavily Indebted Poor Countries (HIPCs) and Enhanced HIPCs Initiatives with the objectives of long-term debt sustainability and poverty reduction.[2] In return, those countries agreed to pursue the IMF- and World Bank-designed adjustment programmes and meet specific policy and performance criteria. It was argued that, in order to achieve debt sustainability and poverty reduction objectives, economic growth was inevitable while high levels of debt and debt service obligations impeded economic growth.

Foreign debt related issues have never been resolved for developing economies. The impact of high level of external indebtedness on economic performance has sustained as an issue of recurrent importance despite its changing nature. In the related literature, the adverse effects of external debt on economic performance have mostly been investigated through the 'disincentive effects' of high debts due to 'debt overhang' and macroeconomic uncertainty, as well as through the 'liquidity constraint effect', referring the impact of debt service. Empirical studies have been undertaken by using time series data for individual countries as well as employing cross-section or panel data analyses for different groups of developing economies. Despite the differences in model specifications and empirical methodologies, most of the empirical work seems to provide evidence for negative impact of high levels of external debt on economic growth, but without a general agreement on the channel(s) of impact.

Most of the empirical work since the 1990s has been undertaken in order to investigate the implications of heavy indebtedness of the HIPCs. The debt problems of the HIPCs differ in many aspects from those of the middle-income countries that received most of the attention during the debt crisis of the 1980s. The HIPCs are characterised also by poor economic performance beside heavy indebtedness. For most of the HIPCs an important part of debt was contracted on concessional terms, and most of their creditors are official as opposed to private commercial creditors. Therefore, different aspects of the middle-income countries and HIPCs should be taken into account in the analyses.

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[2] It was argued that high indebtedness was one of the main factors contributing to the limited development of the poor countries. One of the main motivations for the debt-relief initiatives stemmed from the believed damaging effect of a heavy debt burden on per capita income growth. The HIPC initiatives, and implications of and problems with the debt relief process do not consist one of the central issues of this study. There is a vast literature on the debate; for an overview see e.g. Claessens *et al*. (1996); Chowdhury, 2001; Easterly (2002); IMF (2002); Clements *et al*. (2003); Bhattacharya and Clements, 2004; Arnone *et al*. (2005).

This study aims to contribute to the understanding of the impact of external debt on economic growth in developing economies. To this end, the paper employs a relatively new panel data methodology advanced by Pesaran (2006), namely the common correlated effects (CCE) framework, by using the data for a group of moderately indebted middle-income countries over the period of 1985-2013. One of the critical issues in panel data analysis concerns the cross-sectional dependence, and the CCE methodology is preferred in the study as it considers any possibility of cross-sectional dependence as well as heterogeneity related issues in the data. To the best of our knowledge, the CCE estimation has not been used in the related empirical work with the exception of Eratas and Basci Nur (2013). Despite the finding of a negative impact of external debt on economic growth, the study has limitations owing to the model specification which is based on the external debt stock as the sole explanatory variable for economic growth.

In this study, to investigate the impact of external debt on growth, different specifications of an economic growth model are employed with alternative debt indicators along with some relevant control variables. The overall findings of the study suggest a negative linear impact of external debt on economic growth across the countries of interest with some exceptions in the country-specific results.

The rest of the paper is organised as follows. The next section briefly reviews the literature on the impact of external debt on economic growth. Section 3 presents the data set and model specifications, whereas Section 4 is devoted to the empirical analysis with the discussion of methodological issues and the findings of the study. Finally, Section 5 draws some conclusions.

2.LITERATURE REVIEW

2.1 Debate on the Impact of External Debt on Economic Growth

While the early work on the debt-growth relationship focused on the positive aspects of and need for external borrowing like in the *growth-cum-debt* view, critical studies considering negative implications of external debt for developing economies emerged from the 1970s onwards.[3] According to one of those arguments, most of the external resources are not used for economic development and growth of those countries, hence creating additional burden. Moreover, even they are, positive impacts can be ruined due to various factors, such as issues stemming from debt servicing processes and uncertainty led by high levels of external debt. Considerable amount of newly borrowed resources are also used in debt servicing. Besides, external debt may enhance economic growth only to a certain point. Once debt piles up and reaches high levels, it becomes a major destabilising factor and a serious holdup to long-term economic growth.

It has been argued that external debt can potentially help promote higher economic growth when it is used to finance investments. Owing to the alleged channel from investment towards economic growth, the debate -and empirical work- on the impact of

[3] The paper by Griffin and Enos (1970) is one of the leading studies that argue for the negative impact of external debt on economic growth empirically as well as theoretically.

foreign debt on economic growth has mostly been undertaken through its impact on domestic investment directly or indirectly. However, the impact of external debt on economic growth may occur through some other channels different than the level of investment. In the literature, the channels through which a heavy debt burden can affect economic growth have been discussed mostly under the debt overhang, liquidity constraint, and uncertainty effects, among others.

The literature on the impact of external debt on economic growth has largely relied on the debt overhang view. Despite its common use, the debt overhang hypothesis was not originally developed to analyse the effects of external debt on economic growth.[4] It was adapted for middle income countries that experienced debt crises in the 1980s. The argument became a key concept in the debate on the debt relief programmes for highly indebted poor countries in the 1990s and 2000s.[5]

The 'debt overhang' is defined by Krugman (1988) as "the presence of an existing, 'inherited' debt sufficiently large that creditors do not expect with confidence to be fully repaid" (p.254). In other words, "a country has a debt overhang problem when the expected present value of potential future resource transfers is less than its debt" (p. 255). According to the debt overhang hypothesis, once a country's total debt stock is believed to exceed its repayment ability with some probability in the future, expected debt service will probably be an increasing function of its output level (Claessens *et al*., 1996). Consequently, the expected rate of returns from productive investments in such an economy will be anticipated low since a significant portion of any subsequent economic progress will be 'taxed away' by foreign creditors. Hence, investment by domestic and foreign investors will be discouraged, adversely affecting economic growth (Krugman, 1988; Sachs, 1989).

The debt overhang argument is extended by a 'debt Laffer curve'. According to this representation, external borrowing plays a critical role in enhancing economic growth up to a certain level. If the debt stock continues to increase, the impact becomes negative,

[4] The term 'debt overhang' was originally developed in the corporate finance literature to indicate a situation in which a firm's debt is so large that any earnings generated by new investment projects are entirely appropriated by existing debt holders, and hence, even projects with a positive net present value cannot reduce the firm's stock of debt or increase the value of the firm (Myers, 1977). The concept was adapted by the international finance literature with a series of influential papers following the foreign debt crises in developing countries in the mid-1980s; see e.g. Krugman (1988) and Sachs (1989).

[5] The debt overhang theory argues that when a country's debt burden is as large as that it could possibly pay even with maximum adjustment effort, there is no reason for the country to make an effort since the reward goes only to the creditors. On the other hand, the presence of a debt overhang may give creditors an incentive to lend at an expected loss to protect their existing claims (Krugman, 1988). Hence, it makes sense for the creditors to demand less than this maximum, in order to provide the country with some incentive to adjust (Krugman, 1988, 259). Once a debt reduction in the face value of future debt obligations is provided, distortions due to implicit tax will be reduced, and this will increase investments.

giving rise to an inverse U-shaped curve.[6] Debt overhang starts after the maximum point, implying a disincentive to invest because potential investors perceive that most of the gains will be taxed away to pay the lender. Hence, any levels to the right of the threshold translate into sluggish economic growth. According to this narrow interpretation of the debt overhang linked to the tax disincentives argument, the alleged implicit tax will have a distortionary effect on investment choices, and hence, reduce economic growth.

In its first formulation, the debt overhang view focused on the adverse impact of high external debt on physical capital investment. The argument has been developed in a broader sense to consider negative implications of debt for investment in human capital and in technology acquisition, and for the government's willingness for implementation of macroeconomic reforms (Claessens *et al*., 1996; Clements *et al*., 2003).

The debt overhang argument implies a relationship between a reduction in current debt stock, i.e. future debt service payments, and an increase in current investment. But it is also possible that a reduction in current debt service payments may result in an increase in current investment for any level of future indebtedness (Cohen, 1993). If there is no debt overhang, an increase in investment level could be achieved by a new loan or a reduction in debt service, debt reduction is not necessary for an increase in current investment. Therefore, two effects of debt should be distinguished, i.e. the implications of debt service for economic growth should also be considered for any given level of external debt.

It is argued that external debt service payments can potentially influence economic growth by creating a 'liquidity constraint', which is also captured as a 'crowding out' effect, since limited resources should be distributed among alternative uses, such as consumption and investment, and transfers to pay outstanding debt (Cohen, 1993; Claessens *et al*., 1996; Fosu, 1996; Pattillo *et al*., 2002, 2004; Clements *et al*., 2003; Arnone *et al*., 2005). According to this view, high debt service payments can directly crowd out investment by preventing a country from devoting resources to productive investment areas. Other things being equal, high public debt service can raise the government's interest bill and the budget deficit, reducing public savings. This, in turn, may crowd out private investment by leading to tax increases and/or by raising interest rates, and hence reducing available funds for private investments. Moreover, a reduction in public investments can also have an indirect effect by leading to a decrease in complementary private investments.

The impact of high debt service payment can also occur as it squeezes the amount of resources available for infrastructure and human capital formation, with further negative effect on growth and development. High debt service can impede imports of intermediate

[6] The debt Laffer curve was first introduced by Sachs (1989). In the original specification, the curve illustrates the expected debt repayment as a function of the face value of the debt. On the upward-sloping, 'right' side of the curve, an increase in the face value of debt service leads to an increase in repayment, whereas on the 'wrong' side, an increase in the face value of debt service reduces debt repayment. In the later versions the debt Laffer curve is used, for example, to represent the contribution of debt to economic growth.

and technological goods, which are critical for production, hence hampering economic growth. This impact can occur through price rationing (devaluation of the domestic currency) or non-price rationing (import restriction) (Serieux and Samy, 2001).

Fosu (1996) underlines the deterioration in investment decisions due to the liquidity constraint effect stemming from debt service payments. The author argues that a country facing large debt service payments is likely to have a relatively low productive investment mix. Foreign exchange liquidity constraints can decrease the availability of investment funds and necessitate increased reliance on relatively short-term projects in order to service the debt rather than long-term investments. Furthermore, high debt service may result in substitution away from productive investments requiring expensive imported materials critical to economic growth. Hence, as a result of the adverse effects on investment mix, debt service payments could decrease output growth 'directly' by diminishing productivity even if debt service payments do not reduce saving and investment levels substantially. The author refers to this effect as the 'direct effect of debt hypothesis' and suggests that both debt stock and debt service may be burdensome and deleterious to economic growth due to investment choices even the level of investment is not affected.

One other channel through which external debt may lead to sluggish growth concerns the uncertainty about future resource inflows and debt service payments, with their implications for macroeconomic stability (Serven, 1997; Pattillo *et al*., 2002; Arnone *et al*., 2005). Although this argument is similar to the debt overhang hypothesis, the focus here is not on the disincentives stemming from the possibility that the gains will be taxed away by the creditors, but on the general uncertainty that dominates the economy and distorts investment choices by leading to misallocations and withdrawals.

The level of country risk increases with the level of external indebtedness, leading to limited and expensive borrowing opportunity with a concern for sustainability. The volatility of future inflows rises with the risk of default, rescheduling and arrears, whereas the access to capital markets depends on the perceived sustainability (Arnone *et al*., 2005). In these circumstances, the government policies and reforms also depend on conditional lending and rescheduling. Furthermore, high external debt can reduce a government's incentive to carry out important structural and fiscal reforms if it anticipates that foreign creditors will reap most of the benefits. Increasing uncertainty about the government's actions and policies to meet its debt service obligations can also lead to capital flight if the private sector fears a forthcoming devaluation and/or increases in taxes to service the outstanding debt (Oks and Wijnbergen, 1994).

In this uncertain environment domestic and foreign investors are likely to exercise the 'waiting' option due to the sustainability concerns, even if the debtor country's fundamentals are improving (Serven, 1997). Moreover, investment decisions under uncertainty are not likely to have forward-looking character; short-term, low-risk investments and trading activities with quick returns are preferred to the long-run, high-risk and structural investments. This misallocation of resources results in a decline in the overall efficiency and productivity of capital, leading to a slowdown of economic growth (Serven, 1997).

2.2 Empirical Studies

There is a large number of empirical studies that have investigated determinants of economic growth and/or investment in developing countries, and in some of those debt indicators have been used along with various explanatory variables. To a large extent the implications of external debt for economic growth has been examined through its impact on investment. The empirical work, which consists of individual time series as well as cross-sectional and panel data analyses, has generally provided evidence to support a negative or insignificant effect of external debt on economic growth/investment, especially when it reaches high levels.

To isolate the channels of adverse impact of external debt on growth different debt indicators have been used in the related literature. While some studies do not intend to distinguish among the alternative channels of impact, generally a debt stock variable has been used to identify the debt overhang effect, whereas a variable representing debt service payments has been included to control for a possible liquidity constraint / crowding out effect. As discussed above, use of foreign debt in non-productive short-term investments and inefficient resource allocation may be the causes of the negative impact of foreign debt on economic growth.

Most of the empirical studies have focused on the debt overhang hypothesis and a number of them have exploited the notion of debt Laffer curve more specifically. In those studies nonlinear model specifications are employed to investigate a possible inverse U-shaped curve and a specific threshold level (e.g. Claessens, 1990; Desphande, 1997; Elbadawi *et al*., 1997; Pattillo *et al*., 2002, 2004; Clements *et al*., 2003; Schclarek, 2004; Cordella *et al*., 2005)[7]. The authors argue that external debt feeds economic growth upto the threshold level, which changes across the studies, and after that point, the marginal effect becomes negative. It is assumed that when the impact of external debt on growth appears to be negative, the country is on the 'wrong' side of the hypothetical debt Laffer curve.

In one of the early studies, Claessens (1990) finds that five out of 29 countries are on the 'wrong' side of the curve, suggesting that partial debt reduction could increase the expected repayments, whereas in Claessens *et al*. (1996) the number of countries that were on the 'wrong' side of the curve changed from 6 to 15 out of 35, depending on the model specifications.

Fosu (1996) investigates a direct relationship between external debt and economic growth rather than through investment channel. The author argues that debt may negatively affect economic growth even if it has little impact on investment. In his study on 35 sub-Saharan African countries, he finds a negative impact of debt via a reduction in the marginal productivity of capital. The results also suggest a non-monotonic impact of debt

[7] It should be underlined that the empirical studies on the debt overhang argument suggest different levels of thresholds at which the impact of external debt on growth becomes negative. This stems from the choice of sample countries as well as from model specifications and methodologies employed.

in the long term; it is positive at low levels of investment and becomes negative after the threshold.

Elbadawi *et al*. (1997) consider nonlinear effects of debt on growth by including the debt-to-GDP ratio both in linear and quadratic forms and find evidence for the debt overhang hypothesis for 99 developing countries. Their analysis suggests an inverse U-shaped curve. Pattillo *et al*. (2002) also find a nonlinear relationship between debt and growth using panel data for 93 developing countries. Pattillo *et al*. (2004) use a panel of 61 developing countries and confirm their previous findings about the debt overhang hypothesis. They also show that the nonlinear relationship between debt and economic growth works through the channels of physical capital and factor productivity, while relevance of human capital seems to be negligible. In a growth model using panel data for 55 low-income countries Clements *et al*. (2003) investigate the relationship between external debt and growth and also find evidence supporting the debt overhang case.

Cordella *et al*. (2005) also provide evidence of nonlinearity in the debt-growth relationship. However, the authors argue that beyond the threshold level, the impact of debt on economic growth becomes nil, creating a 'debt irrelevance' zone. According to the study, the debt overhang hypothesis is valid only for the non-HIPCs as the HIPCs are on the debt irrelevance side of the debt-Laffer curve.

To investigate the implications of external debt through alternative channels, a debt service variable is included in the models. Despite some evidence in favour of the crowding out/ liquidity constraint effect, the empirical studies are not conclusive. Some studies suggest that both external debt burden and debt service payments reduce investment and economic growth (e.g. Elbadawi *et al*., 1997; Chowdhury, 2001). For instance, in Pattillo *et al*. (2002, 2004) the debt service variable does not appear to be significant, and the authors underline the relevance of the negative effect of the debt stock. On the other hand, the empirical results obtained by Cohen (1993) for 81 developing countries confirm the crowding out effect, contrary to the debt overhang hypothesis. The findings suggest a significantly negative relationship between debt service and investment, whereas the link between debt stock and investment does not appear to be significant. Similarly, for a large sample of developing countries, Savvides (1992) provides some evidence confirming the crowding out effect of debt service, whereas the debt-to-GNP ratio has a negative but insignificant coefficient, indicating no debt overhang effect. Greene and Villanueva (1991) argue that external debt service negatively affects private investment, while Serieux and Samy (2001) find a similar link between debt service and total investment. Clements *et al*. (2003) show that debt service has no direct effect on growth, but find some evidence supporting the crowding out effect of debt service on public investment, though very weak.

Chowdhury (2001) employs panel data analysis for two groups of countries, namely the HIPCs and non-HIPCs. The author uses alternative debt indicators in a linear setting, and irrespective of the debt variable, provides some evidence to support a negative causality running from debt to economic growth in both groups. Presbitero (2005) also finds a negative linear relationship between external debt and growth, suggesting the lack of a debt-Laffer curve, contrary to the empirical studies mentioned above. On the other hand, the debt service variable has an adverse impact on the rate of economic growth only in low income countries. The author argues that the main channel for the impact of external debt on economic growth seems to be a reduction in the quality and efficiency of investment rather than its level.

Pattillo *et al*. (2002) argue that although the theoretical literature suggests nonlinear effects of external debt on growth through the investment channel, the effects may operate through productivity. The authors claim that the main channel through which debt has an impact on economic growth is the quality and efficiency of investment rather than its level as the exclusion of the investment variable from the growth equation does not change the adverse effect of debt significantly.

3.DATA AND MODEL SPECIFICATION

3.1 Data

The empirical analysis in this study is based on the data for 13 middle-income countries over the period of 1985-2013. The data are provided from the World Development Indicators database of the World Bank.

The variables used in the model specifications are the real GDP growth rate (*gdpgr*), real GDP per capita growth rate (*gdppcgr*), external debt stock-to-GDP ratio (*stock*), external debt service-to-exports ratio (*service*), investment ratio as a share of GDP (*inv*), inflation rate (CPI) (*inf*), and trade openness (*open*).

The average values of growth rates and relevant debt indicators for the countries of interest are given in Table 1. The GDP per capita values are measured in real US$, whereas growth rates represent annual changes in real GDP and in real GDP per capita.

Table 1. Growth and Debt Variables of the Sample Countries

Country	GDP per capita (US$)	GDP growth (%)	GDP per cap growth (%)	Debt stock/ GDP (%)	Debt Service/ Exports (%)
Argentina	5046	3.12	1.96	49.68	36.17
Brazil	4596	2.99	1.55	29.04	43.34
Bulgaria	3329	1.65	2.38	79.73	16.35
Colombia	3249	3.83	2.07	32.26	34.85
India	629	6.38	4.59	21.78	22.37
Indonesia	1152	5.32	3.69	57.90	27.49
Malaysia	4676	5.78	3.40	49.58	8.95
Mexico	7322	2.58	0.93	33.49	25.04
Pakistan	617	4.45	2.00	41.89	25.40
Peru	2621	3.74	2.10	55.92	22.51
Phillipines	1121	3.82	1.62	59.95	21.22
Thailand	2265	5.37	4.39	44.48	14.82
Turkey	6171	4.31	2.73	42.32	34.96

Source: World Development Indicators

3.2. Model Specification

Following the earlier studies, an economic growth model is augmented by using external debt indicators along with relevant explanatory variables to evaluate the impact of external debt on economic growth. The growth of GDP and growth of GDP per capita are used interchangeably as the dependent variable of the models.

A country should arrange enough resources to serve its debt obligations and to improve its economic performance. Hence, implications of debt service may differ from those of debt stock, which indicates an overall burden on the economy. In order to distinguish possible channels through which external debt can affect economic growth, two debt indicators, namely the external debt-to-GDP ratio and the debt service-to-exports ratio, are used in the model specifications.[8] A number of control variables, such as the investment ratio, inflation rate, and trade openness, are included in the growth equation in order to avoid specification bias, whereas some other possibly relevant variables, such as secondary school enrolment rate and fiscal balance could not be included in the analysis due to data limitations.

Investment constitutes a significant determinant for the overall growth performance of an economy. Therefore, the ratio of fixed capital formation to GDP is incorporated in the model specifications, with an expected positive sign.

Policy related variables such as trade openness and inflation rate are included to control for macroeconomic conditions. Openness is measured by total international trade, i.e. the sum of exports and imports, as a percentage of GDP. This indicator reflects to what extent economic activities of a country are linked to the world. Although the role of openness on economic growth is controversial due to possible damaging effects through imports/trade deficits, it is generally expected that an economy with more international trade links may benefit from transfers of new ideas and technologies from the rest of the world to increase productivity and economic performance.

It is believed that prices play a significant role in an economy by giving signals to economic agents. On the other hand, high and rising prices can distort this signaling role and create uncertainty, which reduces incentives for investment, and hence, growth. Therefore, high level of inflation is expected to have a negative impact on economic growth by adversely affecting decision-making processes of economic agents.

As noted earlier, there are theoretical arguments suggesting that a linear specification of the debt-growth relationship might be inadequate. The relationship may have an inverse U-shaped form, i.e. the impact of debt could be positive at low levels of external debt, but could become negative at high levels of indebtedness as debt overhang might be growth-impeding. Therefore, to consider possible nonlinearity in the debt-economic growth relationship, square of the debt ratio is also incorporated in the model.

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[8] The debt service-to-exports variable has the advantage of being more informative regarding the capacity of a country to generate enough foreign currency to meet its debt obligations. On the other hand, it may be subject to the volatility of exports in those economies. The models in the study are also run by using the debt service-to-GDP ratio, the results do not change significantly.

The basic models estimated in the study can be given by the following linear and quadratic forms:

$$y_{it} = \propto_{it} + \beta X_{it} + \gamma D_{it} + \sigma DS_{it} + \varepsilon_{it}$$

$$y_{it} = \propto_{it} + \beta X_{it} + \gamma D_{it} + \delta D_{it}^2 + \sigma DS_{it} + \varepsilon_{it}$$

where y_{it} represents the alternative definitions of the economic growth rate, whereas D_{it} is used for the external debt stock-to-GDP ratio and DS_{it} for the external debt service-to-exports ratio. X_{it} represents the control variables discussed above.

Throughout the analysis, Model I comprises only the debt stock-to GDP ratio along with the control variables, whereas in Model II the debt service-to-exports ratio is included as well. In order to consider any nonlinearity in the data, Model III is run by incorporating the square of debt stock.

4.EMPIRICAL ANALYSIS

4.1. Preliminary Analysis

One of the significant issues in panel data analysis is the possibility of cross-sectional dependence in the data, which implies the existence of common factors across the units. For instance, a shock affecting one country may spillover onto the others, and in a highly integrated world economy this possibility rises. Cross-sectional dependence has implications for the unit root and cointegration tests as well as for the choice of estimation techniques, and hence, should be considered prior to the empirical analysis. One of the empirical procedures to examine the possibility of cross-sectional dependence is the cross-sectional dependency Lagrange multiplier (CDLM) test developed by Breusch and Pagan (1980). The Breusch-Pagan LM test is based on the sum of squared coefficients of correlation among cross-sectional residuals obtained through OLS. The test statistic denoted by CD_{LM} can be calculated as

$$CD_{LM} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2$$

where $\hat{\rho}_{ij}$represents the sample estimate of the cross sectional correlation among residuals. Under the null hypothesis of 'no cross-sectional dependence', with fixed N and $T \to \infty$, the CD_{LM} statistic is distributed as χ^2 with N(N-1)/2 degrees of freedom.[9]

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[9] The Breusch-Pagan test is not applicable when N gets large, and to overcome this problem the Lagrange multiplier test developed by Pesaran (2004) can be employed. The LM test in Pesaran (2004) can be given as $CD_{LM} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T \hat{\rho}_{ij}^2 - 1)$. Under the null of "no cross-sectional dependence" with first $T \to \infty$ and then $N \to \infty$, this test statistic has asymptotic standard normal distribution. Since the number of countries in our analysis is not very large, we proceed with the Breusch-Pagan test.

The results from the Breusch-Pagan test for the variables are reported in Table 2 with 'constant' and 'constant and trend' options. The results indicate that the null hypothesis can be rejected, providing evidence for the existence of cross-sectional dependence across the countries of the analysis. These findings imply that a shock affecting one of the countries can be transmitted to the others, and hence, cross-sectional dependence should be taken into account in the estimation process.

Table 2. Cross-Sectional Dependence Tests for Variables

Variable	CD_{LM}	
	Statistic	**p-value**
	Constant	
gdpgr	179.595	0.000
gdppcgr	179.080	0.000
service	100.286	0.045
stock	124.922	0.001
stocksq	154.131	0.000
open	121.062	0.001
inf	206.173	0.000
inv	124.062	0.001
	Constant and Trend	
gdpgr	183.013	0.000
gdppcgr	182.034	0.000
service	99.499	0.051
stock	136.077	0.000
stocksq	164.815	0.000
open	126.391	0.000
inf	201.148	0.000
inv	127.077	0.000

Having tested for the cross-sectional dependence, time-series properties of the variables should be investigated before proceeding. To this end, two second generation panel unit root tests considering cross-sectional dependence, namely the CIPS test (Pesaran, 2007), and the Z_A^{SPC} and the Z_A^{LA}tests (Hadri and Kurozumi, 2012), are employed.

The CIPS test uses the standard ADF regression with the cross-section averages of the lagged levels and first-differences of the individual series. The test procedure includes estimation of the separate cross-sectionally augmented Dickey-Fuller (CADF) regressions for each country, hence allowing for different autoregressive parameters for each member of the panel. The CADF regression is given by

$$\Delta x_{it} = z_{it}\gamma_i + \rho_i x_{i,t-1} + \sum_{j=1}^{k_i} \varphi_{ij}\Delta x_{it-j} + \alpha_i \bar{x}_{t-1} + \sum_{j=0}^{k_i} \eta_{ij}\Delta\bar{x}_{t-j} + v_{it}$$

where $\bar{x}_t$ is the cross-section mean of x_{it}, i.e. $\bar{x}_t = N^{-1} \sum_{i=1}^{N} x_{it}$. The null hypothesis is that each series contains a unit root, $H_0 = \rho_i = 0$ for all *i*, while the alternative hypothesis is that at least one of the individual series in the panel is (trend) stationary, $H_1 = \rho_i < 0$ for at least one *i*. To test the null hypothesis, the CIPS statistic is calculated as the average of the individual CADF statistics:

$$\text{CIPS} = N^{-1} \sum_{i=1}^{N_i} t_i$$

where t_i is the OLS t-ratio of ρ_i in the above CADF regression (Herzer and Vollmer, 2012, p.496). Critical values are tabulated by Pesaran (2007).

In the Hadri-Kurozumi unit root test procedure, the null hypothesis of ‘stationarity’ is with cross-sectional dependence in the form of a common factor. This specification also allows for serial correlation in the disturbance (Hadri and Kurozumi, 2012).

$$y_{it} = z_t' \delta_i + f_t \gamma_i + \varepsilon_{it}, \varepsilon_{it} = \emptyset_{i1} \varepsilon_{it-1} + \cdots + \emptyset_{ip} \varepsilon_{it-p} + v_{it}$$

for *i* =1, …, N and *t* = 1, …, T, where z_t is deterministic. In this model, $z_t' \delta_i$ is the individual effect while f_t is one-dimensional unobserved common factor, γ_i is the loading factor and ε_{it} is the individual-spesific error-term. Two test statistics provided by the Hadri-Kurozumi test are:

$$Z_A^{SPC} = \frac{1}{\hat{\sigma}_{iSPC}^2 T^2} \sum_{t=1}^{T} (S_{it}^{\omega})^2$$

$$Z_A^{LA} = \frac{1}{\hat{\sigma}_{iLA}^2 T^2} \sum_{t=1}^{T} (S_{it}^{\omega})^2$$

Under the null hypothesis of stationarity the Z_A^{SPC} and the Z_A^{LA} are asymptotically distributed as standard normal.

Table 3 and Table 4 present the CADF (CIPS) and Hadri-Kurozumi unit root test results respectively. The CADF test results suggest that all variables are stationary except for the openness and investment variables, which are difference-stationary. According to the Hadri-Kurozumi test results the investment variable is difference stationary according to Z_A^{LA}, without trend, whereas all other variables are stationary at levels.[10]

[10] Although the unit root tests mostly indicate stationarity of the series, due to the possibility of unit root in investment and openness variables, a panel cointegration test is employed prior to the model estimations. The LM bootstrap cointegration test developed by Westerlund and Edgerton (2007) is used, and according to the test results, the null of ‘no cointegration’ cannot be rejected for any of the model specifications.

Table 3. Unit Root Tests: CADF

Variable	Constant			Constant and Trend		
	CIPS Statistic	Critical Values		CIPS Statistic	Critical Values	
gdpgr	-2.883***			- 3.267***		
gdppcgr	-2.945***			-3.247***		
service	-2.506***			-3.026***		
stock	-2.511***			-2.776*		
stocksq	-2.800***	1%	-2.45	-2.926**	1%	-2.96
		5%	-2.25		5%	-2.76
open	-1.437	10%	-2.14	-1.968	10%	-2.66
inf	-2.476***			-2.808**		
inv	-1.558			-2.557		
Δopen	-3.151***			-3.375***		
Δinv	-3.234***			-3.228***		

Δ indicates the lag operator. Lag length is taken 3. Critical values for the CIPS test are obtained from Pesaran (2007). *, **, *** indicate significance levels at the 10%, 5% and 1%, respectively.

Table 4. Unit Root Tests: Hadri-Kurozumi

Variable	Constant				Constant and Trend			
	Z_A^{SPC}		Z_A^{LA}		Z_A^{SPC}		Z_A^{LA}	
	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
gdpgr	-0.2471	0.598	-0.121	0.505	-1.0010	0.842	-0.6881	0.754
gdppcgr	-0.4501	0.674	-0.2270	0.590	-1.0086	0.843	-0.7274	0.767
service	-0.6389	0.739	0.3337	0.369	-1.1861	0.882	0.1037	0.459
stock	-1.6293	0.948	-0.5047	0.693	-1.3156	0.906	-1.4626	0.928
stocksq	-1.1825	0.882	0.5675	0.285	-1.1466	0.874	-1.7150	0.957
open	-1.2811	0.899	-2.5252	0.994	-2.7069	0.996	-3.4480	0.999
inf	-1.0696	0.858	0.0348	0.486	0.2780	0.390	0.986	0.162
inv	0.9569	0.169	2.4103	0.008	-2.0228	0.979	-2.6654	0.996
Δinv	-	-	-0.2279	0.590	-	-	-	-

Δ indicates the lag operator. Lag length is 3.

In a panel data analysis it is also important to investigate whether estimated coefficients are homogeneous or not across the panel. The homogeneity assumption for the parameters is not able to capture the heterogeneity due to county specific characteristics. To identify homogeneity of slope coefficients in panel, Pesaran and Yamagata (2008) developed the following delta statistic

$$\tilde{\Delta}= \sqrt{N}\left(\frac{N^{-1}\tilde{S}-k}{\sqrt{2k}}\right)$$

When (*N, T*) → ∞, and the error terms are normally distributed, the $\tilde{\Delta}$ test has an asymptotic standard normal distribution under the null hypothesis of 'homeogeneity'. The small sample properties of the $\tilde{\Delta}$ test can be improved when there are normally distributed errors by using the following mean and variance bias adjusted version

$$\tilde{\Delta}_{adj}= \sqrt{N}\left(\frac{N^{-1}\tilde{S}-E\,(\tilde{Z}_{it})}{\sqrt{var(\tilde{Z}_{it})}}\right)$$

where $E\,(\tilde{Z}_{it})$ = k, $\sqrt{var(\tilde{Z}_{it})} = 2k(T-k-1)/(T+1)$ (Pesaran and Yamagata, 2008).

Table 5 presents the results for cross-sectional dependence and homogeneity tests for the regressions. The Breusch-Pagan LM test statistics given in the first part of the table suggest cross-sectional dependence in all model specifications. According to the delta tests, the null hypothesis of homogeneity cannot be rejected for Model II and III at 5% significance level for any of the growth variables, whereas the null hypothesis is rejected for Model I at 5%. Model II for *gdpgr* and and Model III for *gdppcgr* indicate heterogeneity at 10%.

Table 5. CDLM Cross-Sectional Dependence and Delta Homogeneity Tests for Models

Model	***CDLM***		$\tilde{\Delta}$		$\tilde{\Delta}_{adj}$	
	Statistic	**p-value**	**Statistic**	**p-value**	**Statistic**	**p-value**
			gdpgr			
I	124.455	0.001	1.995	0.023	2.231	0.013
II	127.377	0.000	1.518	0.092	1.518	0.065
III	124.553	0.001	1.106	0.134	1.264	0.103
			gdppcgr			
I	124.930	0.001	1.618	0.053	1.809	0.035
II	128.585	0.000	1.093	0.137	1.248	0.106
III	126.978	0.000	1.207	0.114	1.379	0.084

4.2. Estimation and Discussion of the Results

In a panel analysis, due to common factors included in error terms, estimations can be inconsistent and misleading, and hence, it is crucial to consider cross-sectional dependence that arises from multiple factors that cannot be observed or controlled for. In the last few years some estimation techniques have been developed to control for cross-sectional dependence across the panel. In this study we make use of the common correlated effects (CCE) estimator advanced by Pesaran (2006) to account for the cross-sectional dependence as well as heterogeneity in the data. The CCE estimator asymptotically eliminates strong as well as weak forms of cross-sectional dependence in large panels (Pesaran, 2006). It can be used regardless of whether T is greater than N or not.

There are two versions of the CCE estimator for the mean value of individual coeffcients, β_i. The CCE mean group estimator (CCEMG) is used in the presence of heterogeneity in the data and allows coefficients of interest to vary across countries. The CCEMG estimator, $\hat{b}_{MG}$ is defined as a simple average of the individual CCE estimators, $\hat{b}_i$of β_i.

$$\hat{b}_{MG} = N^{-1} \sum_{i=1}^{N} \hat{b}_i.$$

If the individual slope coefficients, β_i, are the same, efficiency can be achieved from pooling observations over cross-section units. That is how the second CCE estimator, the common correlated effects pooled (CCEP) estimator, performs. The CCEP estimator, $\hat{b}_P$ is defined by

$$\hat{b}_P = \left(\sum_{i=1}^{N} \theta_i X_i' \bar{M}_\omega X_i \right)^{-1} \sum_{i=1}^{N} \theta_i X_i' \bar{M}_\omega y_{i.}$$

y_{it} is the observation on the *i*th cross-section unit at time *t* for *i* =1, 2, …, *N*, *t* = 1, 2, …, *T* and supposed to be generated according to the linear heterogeneous panel data model

$$y_{it} = \alpha_i' d_t + \beta_i' x_{it} + e_{it},$$

where d_t is a *n* × 1 vector of observed common effects (including deterministic variables such as intercepts or seasonal dummies), x_{it} is a *k* × 1 vector of observed individual-specific regressors on the *i*th cross-section unit at time *t*, and the errors have the multifactor structure

$$e_{it} = \gamma_i' f_t + \varepsilon_{it},$$

in which f_t is the *m* × 1 vector of unobserved common effects and ε_{it} are the individual-specific (idiosyncratic) errors assumed to be independently distributed of (d_t, x_{it}) (Pesaran, 2006).

The common correlated effects mean group (CCEMG) and the common correlated effects pooled (CCEP) estimates are reported in Table 7. The results are given in two sets of model specifications for the alternative growth variables, i.e. the growth of real GDP (*gdpgr)*and growth of real per capita GDP (*gdppcgr)*. The CCEMG and CCEP estimators are applied depending on the results suggested by the homogeneity tests given in Table 5. Accordingly, except for the specifications of Model II for the growth rate of real GDP and Model III for the growth of real per capita GDP variables, the CCEP estimator is employed for the rest of the specifications.

Table 6. Common Correlated Effects (CCE) Estimates for the Panel

Variables	Model I	Model II	Model III
		gdpgr	
Stock	-0.1219** (-2.378)	-0.1197** (-2.032)	-0.0585 (-1.037)
service	--	-0.0166 (-0.421)	--
Open	0.1224* (1.456)	0.0874 (0.858)	0.0096 (0.372)
Inf	-0.1372** (-2.277)	-0.1175** (-2.083)	-0.0004 (-0.353)
Inv	0.0959 (0.941)	0.1964* (1.643)	0.1063* (1.553)
stocksq	--	--	0.0005* (-1.396)
		gdppcgr	
Stock	-0.1170** (-2.309)	-0.1226*** (-5.625)	-0.2088 (-1.085)
service	--	-0.0055 (-0.205)	--
Open	0.1198* (1.468)	0.0123 (0.432)	0.0377 (0.347)
Inf	-0.1368** (-2.252)	-0.0001 (-0.106)	-0.1296** (-2.042)
Inv	0.1067 (1.069)	0.1742*** (2.903)	0.1114 (0.753)
stocksq	--	--	0.0019 (1.083)

t-statistics are given in parantheses and critical values for the *t*-ratios are 2.32, 1.64 and 1.28 for 1%, 5% and 10% respectively.
*, **, *** indicate significance levels at the 10%, 5% and 1%.

Model I for each growth variable indicates a statistically significant negative impact of debt stock on economic growth, providing support to the most of the previous studies. According to the results in Table 7, a one percentage point increase in debt stock leads to around 0.12 percentage points decrease in economic growth. The openness and inflation variables also have significant coefficients with expected signs, at 1% and 5% respectively. The coefficients of the variables appear to be stable with similar values across the regressions.

However, Model I cannot capture potential effects of the debt service payments on economic growth. Due to the possible implications discussed above, the debt service-to-exports ratio is included in the equations of Model II in order to avoid omitted variable problem. Although the results do not indicate any significant impact through debt service on economic growth, the debt stock ratio sustains significant coefficients around -0.12 per cent in both equations. Moreover, the investment variable, which is critical for economic growth, appears to be sensitive to the inclusion of debt service and becomes significant with a positive sign. One percentage point increase in the investment-to-GDP ratio results in 0.20 and 0.17 percentage points increases in Model II regressions. Furthermore, the model specification for the GDP growth has a negative significant effect of the inflation variable around 0.12 per cent.

To investigate the debt overhang effect with a debt Laffer curve, the nonlinear specification incorporating the debt ratio with its square is employed via Model III. However, our results for the model do not indicate any nonlinear relationship between debt and economic growth. Furthermore, the results seem to be rather poor in general, in the GDP growth equation the investment ratio and the square of debt stock are highly significant, whereas in the model for the GDP per capita growth the only significant variable is the inflation rate.

Overall, therefore, our results seem to indicate that external debt has a negative impact on economic growth through the debt stock rather than liquidity constraints stemming from debt service payments directly. On the other hand, our model specifications do not reveal a debt Laffer curve with a threshold as suggested in the previous studies, the upward sloping 'right' side of the curve is not validated by the data of the study. It can be argued that a much larger sample of countries including developed economies as well as low-income countries might give an inverse U-shaped curve.

The negative impact of debt detected in the study may be caused by disincentive effects of outstanding debt on the level of investment, working through concerns regarding future macroeconomic instability or by a fall in the general productivity level owing to the inefficient short-term investment decisions. Although the implications of debt service payments cannot be captured directly by the debt service variable in the models of the study, they are likely to have an adverse impact through the misallocation of resources.

As discussed above, we focus on Model II and continue our analysis with the country-specific results estimated by the CCEMG estimator for the GDP growth rate as the related model has appeared to be heterogeneous. Table 8 reports the regressions for each country in the panel.

Table 7. Common Correlated Effets (CCE) Estimates for the Countries

Countries	*stock*	*service*	*open*	*inf*	*inv*
Argentina	0.067 (0.30)	0.091 (0.98)	-0.310 (-0.36)	-0.005*** (-2.50)	0.935 (0.79)
Brazil	0.134 (0.62)	-0.047 (-0.77)	-0.190 (-0.60)	0.000 (0.00)	0.322* (1.24)
Bulgaria	-0.119*** (-3.72)	-0.035 (-0.44)	-0.056 (-0.74)	-0.006*** (-3.00)	0.198*** (2.51)
Colombia	0.115 (0.82)	-0.021 (-0.72)	-0.281 (-0.99)	0.064** (1.64)	0.369** (1.90)
India	-0.051 (-0.36)	-0.049 (-0.25)	-0.100 (-0.49)	-0.395 (-1.03)	0.509* (1.34)
Indonesia	-0.015 (-0.63)	0.098 (0.95)	0.127 (1.22)	-0.288*** (-5.33)	-0.236** (-2.19)
Malaysia	-0.205** (-2.07)	-0.383** (-1.42)	-0.097*** (-2.49)	-0.017 (-0.14)	0.034 (0.28)
Mexico	-0.182** (-2.28)	0.172** (1.89)	0.196* (1.32)	0.012 (0.40)	0.759 (1.17)
Pakistan	-0.091 (-0.98)	-0.011 (-0.13)	0.098 (0.52)	-0.005 (-0.11)	0.145 (0.64)
Peru	-0.205*** (-2.66)	-0.100* (-1.54)	0.992*** (3.62)	-0.001 (-0.33)	0.083 (0.34)
Phillipines	-0.169* (-1.63)	0.053 (0.87)	-0.009 (-0.21)	-0.256*** (-3.46)	-0.741*** (-2.55)
Thailand	-0.124** (-1.97)	-0.118 (-0.67)	0.113** (1.77)	-0.605*** (-2.98)	0.301*** (3.14)
Turkey	-0.711*** (-3.91)	0.134 (0.52)	0.651**** (3.22)	-0.026 (-0.60)	-0.126 (-0.61)

t statistics are given in parentheses. Critical values for t-ratios are 2.32, 1.64 and 1.28 for 1%, 5% and 10% respectively. ***, **, * indicate significance levels at the 1%, 5% and 10%.

According to the results given in the table, in seven of the countries the debt stock variable has a negative and statistically significant coefficient. In two of those, the debt service also has a negative and significant coefficient whereas the impact of debt service on economic growth is unusually positive in Mexico. In some of the equations the investment ratio appears to be significant along with or without the debt variable(s). The significant openness and inflation variables generally have the signs as expected. The equation for Bulgaria reflects the most similar results of the panel estimation, and

Thailand has the highest number of explanatory variables. The country-specific regressions for Argentina, Brazil, India and Pakistan do not indicate any prevailing results.

5.CONCLUSION

This paper aims to make a contribution to the understanding of the impact of external debt on economic growth by using the data for a group of middle-income countries over the period of 1985-2013. To this end the study employs the common correlated effects (CCE) framework, which considers possibilities of cross-sectional dependence and heterogeneity in the panel.

According to the findings of the study, there is a negative linear impact of external indebtedness on economic growth in the countries of interest. The main channel through which debt has an impact on economic performance appears to be the debt stock rather than liquidity constraint effect represented by debt service directly. On the other hand, contrary to the previous studies we do not find an inverse debt Laffer curve for the debt-growth relationship. The uncertainty created by indebtedness may discourage new investments, and furthermore, may be distortionary for investment decisions, leading to less efficient and short-term investment choices, hence impeding economic growth.

The level of external debt that is supportive for economic development and growth also depends on various issues including the productivity of investment and the proportion of external debt devoted to investment compared to its use in non-productive areas. Furthermore, it is difficult to identify the amount of external debt that is growth enhancing as countries vary in terms of general economic conditions, institutions, and political and other country-specific risks. Therefore, given the negative impact of external debt on economic growth, the country analyses are critical for taking relevant measures to direct external debt towards long-term productive investments, which are expected to enhance economic performance. Economic policies should be implemented considering specific conditions of the countries, and obviously, in an environment where the external resources are mostly provided by international private creditors and where the countries are globally more dependent make this process more complicated and challenging.

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