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Introduction

- Economists have always been concerned with how a high and sustainable economic growth can be achieved.
- Since the beginning of the 1980s developing countries have experienced a pronounced slowdown in economic growth. An important among the reasons for this slowdown has been a decline in investment rates, which have been shown to be positively and significantly related to real growth rates in a large sample of developing countries (see International Monetary Fund (1988)).
- In particular, Modigliani (1961) and Diamond (1965) first, and later Saint-Paul (1992), take a theoretical approach based on a neoclassical growth model and suggest that an increase in public debt will always decrease the growth rate of the economy.
- In growth theories, capital accumulation and productivity remains the proximate determinants of long term growth.
- Most of the researchers' emphasis on the impact of public debt on growth but neglects its impact on two key (linking) determinants of growth i.e. capital accumulation and productivity.

Significance of the study

- As we see in the literature that there is a lot of research work done on the debt and growth relationship and on the debt and investment as well, but up to my knowledge there is a very little work done on the relationship of debt with the two key determinants of the growth that are capital accumulation and productivity.
- Although there is enough stock present in the literature for the OECD and developed countries but for the Developing Asian Economies we don't have satisfactory work done. So our work is purely on the developing economies of Asia and as we know that these are the economies that are suffering from the debt and deficit issues.
- we have used two methodologies. 5-year average panel fixed effect which will help us to remove the short term business cycle fluctuations and reverse causality issue and secondly system GMM is employed which is used to tackle the endogeneity and a larger sample will help us by giving more reliable results.

This study contributes to literature in many aspects:

- This type of study is not yet done for developing Asian economies in which impact of debt is examined on the two key determinants of growth (capital accumulation and productivity) rather than growth directly.
- This study uses two different techniques; panel fixed effect on 5-year average data and system GMM on the annual data. Two techniques are used to tackle the reverse causality, endogeneity issue and to smooth out the short term business cycle fluctuations.
- This study has taken a larger set of variables than the previous empirical studies.

Literature Review

YEAR	AUTHOR NAME	PAPER NAME	CONCLUSION
2012	Simone Salloti and Carmine Trecroci	Even worse than you thought: The impact of govt. debt on aggregate investment and productivity	They found linear and negative relationship between debt and investment and productivity.
2010	Reinhart and Rogoff	Growth in a time of debt	They found non linear negative relationship between debt and growth.
2011	Afonso and Jalles	Growth and Productivity: the role of Government Debt	They found negative effect of government debt on productivity and growth, also found negative effect of financial crises on growth.

YEAR	AUTHOR NAME	PAPER NAME	CONCLUSION
2010	Checherita and Rother	The impact of high and growing government debt on economic growth.	They found a nonlinear negative impact of debt on growth with a turning point beyond which govt. debt to GDP ratio has a deleterious effect on long term growth.
2012	Panizza and Presbitero	Public debt and economic growth: is there a causal effect?.	This paper uses an instrumental variable approach and find negative causal effect of public debt on economic growth in a sample of OECD countries.
2011	Naeem Akram	Impact of public debt on economic growth of Pakistan	Study finds that public external debt has negative relationship with per capita GDP and investment confirming the existence of —Debt Overhang effect.

Objectives

- To check whether there exists a negative relationship between debt and investment and debt and productivity
- To check whether there is a linear relationship between debt and investment and debt and productivity

Theoretical framework:

Theoretical frame work is discussed in two parts, first part consists of the relationship of *debt and investment* and the second one is the relationship of *debt and productivity*.

Debt and investment

➤ Crowding Out Hypothesis:

Crowding out effect is the criticism by monetary economists on the expansionary fiscal policy. According to monetary economists expansionary fiscal policy leads government to borrow money by selling government bonds and by this interest rate is increased and this will discourage the private investment and a decrease in private consumption can also be expected.

➤ **Debt Over-hang Hypothesis**

A well-known concept for the fall in investment is that where there is a heavy debt burden there is a reduction in the incentive to invest of debtor country; this is known as *debt over-hang effect*.

Debt and Productivity

Simple Solow-swan model

Let's consider the simple production function

$$Y(t) = A(t)F(k(t), L(t))$$

$K(t)$ = Capital stock at time t .

$L(t)$ = Labor at time t .

$A(t)$ = Total factor productivity or Solow residual at time t .

Production function is represented by Cobb-Douglas form, then

$$Y(t) = A(t)K(t)^\psi L(t)^{1-\psi}$$

Where, $0 < \psi < 1$ is share of capital and $(1 - \psi)$ is labor share.

Intensive form of this Cobb-Douglas function is as

$$y(t) = A(t)k(t)^\psi$$

By taking first derivate we will get:

$$f'(k(t)) = A(t)\psi k(t)^{\psi-1} > 0$$

And

$$f''(k(t)) = -A(t)\psi(1-\psi)k(t)^{\psi-2} < 0$$

Standard inada conditions:

$$\lim_{k \rightarrow \infty} f'(k(t)) = 0$$

And

$$\lim_{k \rightarrow 0} f'(k(t)) = \infty$$

Implication of these inada conditions is that the above mentioned Cobb-Douglas production function is satisfying the properties of neo-classical production function.

Equation of motion of capital stock is given as:

$$\dot{k}(t) = s.f(k(t)) - (n + \delta).k(t)$$

Substitute $y(t) = f(k(t)) = Ak(t)^\psi$ in eq (), we get

$$\dot{k}(t) = s.A(t)k(t)^\psi - (n + \delta).k(t)$$

The term $(n + \delta)$ on the right hand side of the equation can be thought as the effective depreciation rate for capital-labor ratio, $k \equiv K(t) / L(t)$

Rearranging eq () will result in

$$\dot{k}(t) / k(t) = s.A(t)k(t)^{\psi-1} - (n + \delta)$$

Since we know that

$$y(t) = A(t)k(t)^\psi \quad \text{Or} \quad y(t)^\circ = A(t)\psi k(t)^{\psi-1}$$

By rearranging again we can get the following equation

$$y(t) = A(t)\psi k(t)^\psi .k(t)^{-1}$$

Or

$$y(t)^\circ / y(t) = \psi [1/k(t)]$$

$$y(t)^\circ / y(t) = s \cdot f'(k(t)) - (n + \delta)\psi$$

Where, $f'(k(t)) = A\psi k(t)^{\psi-1}$

Growth rate of output per capita which depends on the following parameters of the model as:

$$y(t)^\circ / y(t) = g(s, \psi, \delta, A(t), n)$$

It is assumed that $A(t)$ depends negatively on external debt ED .

Therefore, we further assume that

$$A(t) = g(ED(t))$$

Therefore

$$y(t)^\circ / y(t) = g(s, \psi, \delta, ED(t))$$

And the final equation is as:

$$y_{it} = \alpha + \beta ED_{it} + \sum_j \omega_j X_{jit} + ky_{it-1} + \varepsilon_{it}$$

Hypothesis

The above model can be formally hypothesized as given below

H₀¹: There is a negative relationship between debt and investment

H₀²: There is a negative relationship between debt and productivity

H₀³: There is a linear relationship between debt and investment

H₀⁴: There is a linear relationship between debt and productivity

MODELS AND VARIABLES

. EFFECTS OF DEBT ON INVESTMENT:

$$privinv_{i,[t,t+4]} = \alpha_1 debt_{i,t} + \beta_{inv} capstock_{i,t} + \delta W_{i,t} + \xi_t + \eta_i + \varepsilon_{i,t}$$

EFFECTS OF DEBT ON PRODUCTIVITY:

$$prodgr_{i,[t,t+4]} = \varphi_1 debt_{i,t} + \varphi_2 capstock_{i,t} + \varphi_3 educ_{i,t} + \beta_{prodgr} gdphw_{i,t} + \theta W_{i,t} + \sigma_t + \omega_i$$
$$+ v_{i,t}$$

- ***Privinv***_[t,t+4] denotes the five year average of real expenditure on investment(gross fixed capital formation of the private sector) between year t and t+4, in logarithms
- ***Debt***_t is the gross government debt / GDP ratio at the beginning of the five-year period
- ***Capstock***_t is the logarithm of the real stock of the capital of the economy
- ***W***_t is the vector of control variables, including:
 - the long term interest rate
 - trade openness
 - the population growth rate
 - Financial development
 - the CPI inflation rate

- $Prodgr_{[t,t+4]}$ denotes the five-year average of the growth rate of real GDP per worker
- $Captstock_t$ is the logarithm of the real stock of capital in the economy
- $Educ_t$ is human capital (measured by the log of average years of secondary schooling in the population over age 15 in the initial year)
- $Gdppw_t$ is the logarithm of the real GDP per worker
- W_t is the same vector of the control variables as in our 1st model.

Data and Methodology

➤ Data:

In this study for empirical investigation the data is used from 1984 to 2007.
And the data sources are “**IFS**” and “**WDI**”

➤ Methodology:

This study uses two models and two data frequencies the reason is that, it is likely that multiple sources are affecting debt and growth relationship.

- ✓ Firstly, Panel fixed effect estimates methodology is applied using 5-year non-overlapping periods.
- ✓ Secondly, system GMM estimates are applied on the annual data.

Results and Discussions

As the main focus of our study is the negative relationship between debt and investment and we have done empirical investigation on the 7 Asian developing countries considering the investment in its three specifications (aggregate investment, aggregate private investment, per capita private investment). Our secondary objective is to further investigate the relationship of debt and productivity for this we have used two specifications: first using labor productivity and second using TFP.

	Mean	Median	Maximum	Minimum	Std. Dev	Sample
DTGDP	0.41883	0.41869	0.944282	0.054453	0.19969	161
DEFTGDP	-2.21849	-1.38914	0.082141	-17.82293	3.18251	161
GS	10.9018	11.4237	16.78491	4.136337	3.21518	161
LPPE	5.00647	4.9943	6.083549	4.224425	0.39822	161
CS	11.303	11.2448	12.9296	9.541454	0.66364	161
HK	53.6296	54.6711	96.45	18.98336	20.5525	161
IR	12.0763	12.06	28.61167	3.41	4.3341	161
PG	1.89725	1.96868	3.37689	-1.609576	0.71406	161
TO	63.5449	43.3279	220.4074	11.52452	51.4487	161
GRTFP	0.09489	0.09242	0.307567	-0.231857	0.08159	161
GRPPE	29.603	3.36099	971.2319	-92.17369	114.801	161
GFCF	24.2047	23.024	43.58616	13.93139	6.71991	161
FD	8.28883	8.39791	13.02347	1.247032	2.38983	161
CPI	6.7737	6.12672	24.23709	-1.407892	4.64968	161
LGFCFPC	2.22939	2.16279	3.207996	1.565717	0.38983	161
LGDPC	2.85806	2.7745	3.69065	2.407116	0.34135	161

Sr. #	Variables name	Level	Fist Difference	Stationary at
1	DEBT	0.0057		I(0)
2	DEFICIT		0.0000	I(1)
3	PROD	0.0109		I(0)
4	POP GROWTH	0.0000		I(0)
5	TRADE OPP		0.0004	I(1)
6	INTEREST RATE	0.0107		I(0)
7	GOVT SIZE		0.0093	I(1)
8	INV PER CAPITA		0.0010	I(1)
9	HUMAN CAPITAL		0.0010	I(1)
10	REAL CAPITAL STOCK	0.0111		I(0)
11	TFP	0.0001		I(0)
12	GRPPE	0.0000		I(0)
13	INV PRIV		0.0008	I(1)
14	FD		0.0001	I(1)
15	CPI	0.0001		I(0)
16	GDP PC		0.0038	I(1)
17	AGGREGATE INVESTMENT		0.0000	I(1)

	Aggregate investment			
	5-year FE	Annual GMM	5-year FE	Annual GMM
Debt	-0.839* (3.03)	-0.839* (3.04)	-0.839* (3.03)	-0.839* (3.04)
Deficit	-0.4608* (0.12)	-0.4608* (0.12)		
GE			-0.3567** (0.15)	-0.3567** (0.15)
CS	0.6427 (0.84)	-0.3568** (0.15)	0.6427 (0.84)	-0.3568** (0.15)
LPPE	0.2203* (6.96)	0.2203* (6.96)	0.2203* (6.96)	0.2203* (6.96)
IR	0.9124* (0.14)	0.9124* (0.14)	0.9124* (0.14)	0.9124* (0.14)
TO	0.21* (0.02)	0.2424* (0.10)	0.21* (0.02)	0.2424* (0.10)
PG	0.2043** (1.05)	0.2043** (1.05)	0.2043** (1.05)	0.2043** (1.05)
FD	0.7199 (0.46)	0.7199 (0.46)	0.7199 (0.46)	0.7199 (0.46)
CPI	0.0679 (0.09)	0.0679 (0.09)	0.0679 (0.09)	0.0679 (0.09)

	Aggregate Private investment			
	5-year FE	Annual GMM	5-year FE	Annual GMM
Debt	-0.2197** (0.849857)	-0.6666** (0.33)	-0.2197** (0.849857)	-0.6666** (0.33)
Deficit	0.0342*** (0.018356)	0.0236* (0.01)		
GE			-0.0352*** (0.018907)	-0.0274** (0.012635)
CS	0.099353 (0.108072)	-0.2223* (0.0751)	0.099353 (0.108072)	-0.2223* (0.0751)
LPPE	0.210806 (0.673333)	-0.2706* (0.053560)	0.210806 (0.673333)	-0.2706* (0.053560)
IR	-0.0298*** (0.014903)	-0.0152** (0.006235)	-0.0298*** (0.014903)	-0.0152** (0.006235)
TO	0.000923 (0.003015)	-0.0035* (0.001268)	0.000923 (0.003015)	-0.0035* (0.001268)
PG	-0.5309* (0.147340)	-0.2706* (0.053560)	-0.5309* (0.147340)	-0.2706* (0.053560)
FD	-0.071204 (0.058339)	0.7492* (0.164363)	-0.071204 (0.058339)	0.7492* (0.164363)
CPI	0.0026 (0.014055)	-0.0424* (0.009955)	0.0026 (0.014055)	-0.0424* (0.009955)

	Private Per Capita Investment			
	5-year FE	Annual GMM	5-year FE	Annual GMM
Debt	-0.2427* (0.08)	-0.3169* (0.10)	-0.2427* (0.08)	-0.3169* (0.10)
Deficit	-0.0089** (0.00)	-0.0115* (0.10)		
GE			0.0221* (0.00)	0.0122** (0.00465)
CS	0.0948*** (0.05)	0.5163* (0.06)	0.0948*** (0.05)	0.5163* (0.06)
LPPE	1.3783* (0.27)	1.7439* (0.21)	1.3783* (0.27)	1.7439* (0.21)
IR	0.0155* (0.003)	0.0096* (0.01)	0.0155* (0.003)	0.0096* (0.01)
TO	0.0015** (0.00)	-0.000701 (0.00)	0.0015** (0.00)	-0.000701 (0.00)
PG	0.0269 (0.03)	0.0684** (0.03)	0.0269 (0.03)	0.0684** (0.03)
FD	-0.0075 (0.02)	0.0584* (0.01)	-0.0075 (0.02)	0.0584* (0.01)
CPI	-0.0025 (0.00)	0.0013 (0.00)	-0.0025 (0.00)	0.0013 (0.00)

Debt and Investment

- Debt is negatively and significantly related to aggregate investment, private investment and private per capita investment.
- Coefficient of deficit is negatively and significantly related to the aggregate investment and private per capita investment whereas deficit shows a positive impact on aggregate private investment.
- Government size is significantly and negatively affecting both investment and productivity in different specifications.
- Coefficient of capital stock is negative in the aggregate private investment model.
- Productivity coefficient is positive in case of investment.
- IR, TO and PG shows a negative relationship with investment.
- Financial development variable shows a positive coefficient in investment models.

	Productivity			
	Labor Productivity			
	5-year FE	Annual GMM	5-year FE	Annual GMM
Debt	-0.79546** (3.91)	-0.25370* (0.44)	-0.79546** (3.91)	-0.25370* (0.44)
Deficit	0.0551 (0.22)	0.0462* (0.02)		
GE			0.3804 (0.25)	-0.0374** (0.018739)
LPPE	-0.135169** (5.95)	-0.3154*** (0.18)	-0.135169** (5.95)	-0.3154*** (0.18)
CS	0.3971 (0.09)	-0.5756* (0.61)	0.3971 (0.09)	-0.5756* (0.61)
HK	0.0494 (0.069003)	-0.0059 (0.01)	0.0494 (0.069003)	-0.0059 (0.01)
IR	-0.3287* (0.099022)	-0.0035 (0.01)	-0.3287* (0.099022)	-0.0035 (0.01)
TO	0.0473*** (0.025501)	0.0122* (0.00)	0.0473*** (0.025501)	0.0122* (0.00)
PG	1.7673 (1.534131)	0.0793 (0.10)	1.7673 (1.534131)	0.0793 (0.10)
FD	1.221* (0.22)	0.6136* (0.07)	1.221* (0.22)	0.6136* (0.07)

	Total Factor Productivity			
	5-year FE	Annual GMM	5-year FE	Annual GMM
Debt	-0.1190*** (0.061564)	-0.0857*** (0.050091)	-0.1190*** (0.061564)	-0.0857*** (0.050091)
Deficit	0.0050** (0.002090)	-0.0044 (0.003607)		
GE			0.3804 (0.25)	-0.0374** (0.018739)
LPPE	-0.1617 (0.152607)	-0.1572* (0.046428)	-0.1617 (0.152607)	-0.1572* (0.046428)
CS	0.0542*** (0.026978)	-0.0795* (0.013875)	0.0542*** (0.026978)	-0.0795* (0.013875)
HK	0.0003 (0.001161)	0.0019** (0.000928)	0.0003 (0.001161)	0.0019** (0.000928)
IR	-0.0007 (0.003092)	0.0032*** (0.001759)	-0.0007 (0.003092)	0.0032*** (0.001759)
TO	0.0008** (0.000346)	0.0006** (0.000326)	0.0008** (0.000346)	0.0006** (0.000326)
PG	0.0186 (0.018104)	0.0146 (0.015771)	0.0186 (0.018104)	0.0146 (0.015771)
FD	-0.0056 (0.006445)	0.0023 (0.005896)	-0.0056 (0.006445)	0.0023 (0.005896)

Debt and Productivity

- Debt coefficient shows a negative and significant result for TFP and Labor productivity as well.
- In case of productivity models coefficient of deficit shows a positive impact on labor productivity and negative and insignificant in case of TFP.
- Productivity coefficient shows a significant and negative impact on TFP and labor productivity specifications.
- Coefficient of IR is negative in the labor productivity model but is positive using TFP.
- Trade openness and population growth are positively related to the productivity models.
- Financial development variable shows a positive coefficient in productivity models.

Non linearity
Investment model results

Variables	Private investment
Debt	-0.45022* (1.407)
Debt sq	3.416* (1.180)
deficit	0.0291* (0.008)
HK	0.0111* (0.003)
FD	0.8161* (0.149)
CS	-0.2258* (0.074)
PG	-0.2354* (0.056)
CPI	-0.0374* (0.009)

Non linearity**Productivity model results**

Variables	Labor Productivity	TFP
Debt	0.60254*** (3.5423)	0.4330 (0.320)
Debt sq	-0.54559*** (2.885)	-0.5127*** (0.296)
deficit	0.0080 (0.026)	-0.0074*** (0.004)
HK	-0.0107 (0.022)	0.0019** (0.001)
PROD	0.29599* (0.367)	0.1759* (0.167)
FD	-0.2173** (0.091)	0.0286 (0.032)
CS	0.2906 (1.179)	-0.0661* (0.015)
PG	0.2369 (0.164)	0.0074 (0.017)
TO	0.0056 (0.006)	0.0004 (0.000)
IR	0.0380 (0.026)	0.002 (0.001)

From the above discussed tables we can conclude that there is existence of non-linearity, because our coefficient of debt squared term has showed a significant sign in private investment and in productivity models. So it can be said that in case of Developing Asian countries, non-linearity exists between debt and investment and debt and productivity

Policy Implications

The results highlight some really important points for our sample that is 7 Developing Asian Economies.

- As debt is negatively and significantly related to private investment and productivity so governing bodies should adopt a proper and debt reducing policy.
- Second implication is about government size; as these countries are the countries which have to face a heavy budget deficit every year and in this situation a larger government size is really an alarming situation for these economies so planning is required to tackle this issue.
- Deficit should also be reduced to enhance private investment and productivity.

Limitations of the Study

As the sample of this study is developing Asian economies and there is lack of data availability in case of these countries. Due to this problem we were restricted to take sample of 7 developing Asian countries. Some variables are also not used due to this problem otherwise we were interested to use a larger set of variables.

Future Research

Further research can be done on other countries because this type of studies are extensively done on OECD countries but remaining countries should also be covered because this debt-investment and debt-productivity nexus is not just a problem of some specific area rather it is a global phenomenon. Moreover further research can be done with a more dynamic set of variables like institutional, political and cultural variables. And this research can be extended by taking a larger time period.

Thank You