PAPER ID: 11A04F

REVISITING DETERMINANTS OF INVESTMENT THROUGH G-TO-S APPROACH FOR ASIAN COUNTRIES

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A R T I C L E I N F O

A B S T R A C T

Investment is one of the key components of an economy and any significant variations in it have persistent effects on the economy. This paper empirically finds the determinants of growth in domestic investment in Asian countries over the period 1987-2017. The main objective of this research is to find the impact of various variables like Capital investment, Domestic savings, Gross domestic product per capita, Trade, Government expenditure, inflation, lending rates and privatization on investment in selected Asian countries. The study used the Autometrics for analysis, which is the third-generation modeling technique and is the latest variant of general to a specific approach, and to identify the indicators in explaining the investment of sample countries. The result shows that Domestic savings, Gross domestic product per capita, Government expenditures have a positive impact and significant effect on domestic investment. The study clearly emphasizes the role of these policy variables in attracting investment and determining its growth and highlights a positive and significant impact of reforms on investment in selected countries.

Disciplinary: Economics Sciences (Investment).

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1. INTRODUCTION

Investment is one of the crucial factors of aggregate demand and any significant variations in it have persistent effects on the economy. There are a large number of empirical studies that have shown the importance of investment in attaining higher rates of growth (Barro and Lee, 1994; Collier and Gunning, 1999; Ndikumana, 2000). In developing countries, many studies investigate the investment – growth relation and the factors influencing variation in the investment rate. Investment can be classified into two main classes, i.e. domestic investment and foreign direct investment (FDI). Several studies have explained the determinants of FDI in middle- and low-income countries (Blonigen and Piger, 2011). However, the studies discussing the factors affecting domestic investment in these countries are fewer. In this study, we use the Autometrics to investigate the factors explain the domestic investment for low- and middle-income countries.

In between the class of panel data models, a model that is often used is representative of real-world data is the random coefficient model, which assumes the random coefficients and intercepts for each cross-section. The objective of this section is to apply Autometrics, as it is the latest variant of General to Specific modeling approach (G-to S) to identify a model representative of investment for all the countries. For this purpose, we are estimating the general model which includes maximum available candidate variables explaining the investment and then through a rigorous procedure of G-to-S modeling. This would help the regional policymakers to develop a better policy for their country.

2. LITERATURE REVIEW

Several researchers have studied the role of a variety of factors including macroeconomic variables in explaining investment behavior. The studies not only differ from each other based on factors included in the model and the estimation techniques applied but also on the basis of results arrived and a spectrum of conclusions. In a broader sense, the empirical literature on investment behavior in developing countries focuses on macroeconomic variables. The findings of some of the relevant studies on the topic are discussed below.

Typical studies include lagged investment as an explanatory factor for explaining investment. This gives a clear picture to investors about the economy of a country, so it has a positive affection on investment (Mileva, 2008; Salahuddin et al., 2009) for transition and developing countries respectively. An increase in aggregate demand tends firms to increase supply which may need enhancement of installed capacity and thus affect investment positively. Salahuddin et al. (2009) show that GDP per capita significantly explains domestic investment for Muslim developing countries. These results are also confirmed by various studies using different data sets (Oshikoya,1994; Ghura and Goodwin, 2000; Mileva, 2008; Peltonen et al., 2009).

Salahuddin et al. (2009) and Dar et.al. (2017) find domestic saving to be related positively with domestic investment for 21 Muslim developing economies. Feldstein and Horioka (1980) suggest that the saving-investment correlation is high in OECD countries, which implies low capital mobility among these countries; this is known as the F-H puzzle. Dooley et al. (1987) also reach a similar conclusion for the developing countries. Shahbaz et al. (2010) and found a weak correlation, maybe due to insufficient capital mobility for Pakistan and the South Asian countries showing a contradiction with the FH puzzle.

The interest rate and inflation have been found to have a mixed relationship with investment. Ghura and Goodwin (2000) show that interest rate has a negative effect on private investment for the developing countries of Asia, Latin America and Sub Saharan Africa. Salahuddin et al. (2009) study Muslim developing countries and find no significant influence on the real lending rate on private investment. Li (2006) finds a negative relation of inflation with domestic investment for 117 countries. Shahbaz et al. (2010) show a positive impact of inflation on investment for Pakistan. There exist another set of studies that concludes that there is no relation between domestic investment and inflation (Jaramillo, 2010; Salahuddin et al. 2009). International trade is considered to have positive relationships with investment. As the volume of imports and exports increases, the investors are induced to invest more. Salahuddin et al. (2009) find a positive relationship between trade and domestic investment. However, Mileva (2008) in a study on transition economies reports an insignificant influence of trade.

Government expenditure can affect investment in either direction. High government borrowing may affect the interest rate which tends to reduce the size obtainable funds in the financial market for the private sector, which leads to crowding out of the private investment. Ghura and Goodwin (2000) find results that favor this hypothesis for developing countries from Asia, Latin America and Sub Saharan Africa. The Government can enhance investment by utilizing the funds on the improvement of basic infrastructure to develop a comfortable environment for investors (Asante, 2000).

The literature shows several factors affecting investment. However, the patterns of variables may change depending upon the sample features or the techniques of estimation used for analysis. Due to the constraints of data availability, it is not always possible to have the entire candidate variables. The following set of variables are incorporated in the analysis: lagged investment, real Gross domestic product (GDP) per capita growth, domestic credit to the private sector, domestic saving, government expenditures, trade, inflation and interest rate.

3. METHOD

This study considers the data from middle-income Asian countries classified by the World Bank. The data is taken from WDI online database. As said earlier, due to data constraints, it is not possible to have all the countries in our analysis, so we managed 10 cross-sections/countries' annual data from 1987 to 2017. The countries included in the study are Bhutan, China, Fiji, Indonesia, India, Srilanka, Malaysia, Pakistan, Philippine and Thailand.

The main objective of this study is to select the model that would be representative of all the selected countries. This research used the Autometrics (Doornik, 2006,2008) developed under the assumption of a random coefficient model. The general model will include all the above-mentioned variables along with their first lag. So, the general model we start with includes sixteen variables along with intercept. In order to find the role of the financial and macroeconomic variables on the domestic investment, we use an investment model which is a variant of the model earlier used by Ndikumana (2000). The model in its general form is given as

$$I_{it} = \beta_0 + \beta_1 I_{it-1} + \sum \beta_i X_{it} + \sum \beta_J X_{it-1} + \epsilon_{it} \tag{1},$$

where I is the domestic investment (as a percentage of GDP) of country i at time t. X indicates the set of all possible variables and X_{t-1} as the lag of variables and $\beta_0, \beta_1, \beta_i, \beta_J$ are the respective coefficients. It can also be written as

$$I_{it} = \beta_0 + \beta_1 I_{it-1} + \beta_2 GE_{it} + \beta_3 GE_{it-1} + \beta_4 Inf_{it} + \beta_5 Inf_{it-1} + \beta_6 PRIVT_{it} + \beta_7 PRIVT_{it-1} + \beta_8 R_{it} + \beta_9 R_{it-1} + \beta_{10} S_{it} + \beta_{11} S_{it-1} + \beta_{12} T_{it} + \beta_{13} T_{it-1} + \beta_{14} Y_{it} + \beta_{15} Y_{it-1} + \epsilon_{it}$$

$$\tag{2},$$

Where

I_{it} = Gross Fixed Capital Formation (% of GDP);

GE_{it} = Government final consumption expenditure (% of GDP);

Inf_{it} = Inflation, GDP deflator (annual %);

$PRIVT_{it}$ = Domestic credit to private sector as a percentage of GDP;

R_{it} = Lending interest rate (%);

S_{it} = Gross domestic savings (% of GDP);

T_{it} = Trade (% of GDP);

Y_{it} = GDP per capita growth (Annual %);

ϵ_{it} = error term ~ IID (μ, δ^2), where μ is mean and δ^2 is variance;

β_0 is intercept and β_1 to β_{15} are the respective coefficients for each variable.

Gross fixed capital formation (a proxy for gross domestic investment) is expressed as a percentage of GDP and is used as dependent variable (*I*) which includes land developments (fences, drains); machinery; plant, equipment purchases; and construction which includes railways, roads, offices, schools, hospitals, commercial and industrial buildings and private residential residences. Mileva (2008) and Arazmuradov (2011) analyzed the determinants of investment using the same variable. General government final consumption expenditure (*GE*) indicates current government expenditures for goods and services and expenditure on security and defense; however, the expenditures on the government military are excluded from it.

Inflation (*Inf*) is measured by the GDP deflator which specifies the overall rate of change in price in the economy. Domestic credit to the private sector *(PRIVT)*, a financial variable that defines the role of a bank in financing the private sector. Lending interest rate (*R*) is the rate of interest claimed by banks on finances from the lender. Gross domestic saving *(S)* is calculated by taking the difference between GDP and final consumption expenditures. Trade (*T*) is the total amount of imports and exports of the goods and services as a percentage of GDP. GDP per capita growth (*Y*) is the annual growth rate of GDP per capita (the ratio of gross domestic product and the midyear population).

4. RESULT AND DISCUSSION

To see the results of different models we run the random coefficient model. The starting point of the search in Autometrics is the general model given by (2). Table 1 shows the coefficients, standard error, t and p values for all the variables at a 5% significance level. The general model consists of the variables explained in the above section, along with their one lag. The general model is estimated by a random coefficient model and results are given in Table 1. All the variables got the right signs and out of candidate variables seven are found significant at a 5% level and two variables are significant at a 10% level of significance.

Table 1: Estimated model through random co-efficient model.

	Coefficient	Standard err	t-value	p-value
Intercept	2.515	1.647	1.527	0.148
I(t-1)	0.831	0.032	26.274	<0.001
GE	0.293	0.122	2.412	0.029
GE(t-1)	-0.156	0.123	-1.263	0.226
Inf	-0.005	0.030	-0.155	0.879
Inf(t-1)	0.022	0.029	0.746	0.467
PRIVT	0.032	0.026	1.252	0.230
PRIVT(t-1)	-0.045	0.025	-1.781	0.095
R	-0.008	0.088	-0.089	0.930
R(t-1)	-0.072	0.083	-0.870	0.398
S	0.170	0.044	3.909	0.001
S(t-1)	-0.142	0.042	-3.366	0.004
T	0.037	0.020	1.894	0.078
T(t-1)	-0.042	0.020	-2.160	0.047
Y	0.199	0.048	4.122	0.001
Y(t-1)	0.160	0.050	3.182	0.006

Our main objective of this research is to find the factors of the investment which perform well in

a real panel data environment by using Autometrics i.e. the third generation G-to-S modeling approach. All the variables get the expected signs and magnitudes in the estimated general model. After estimating the general model Autometrics runs the reduction process which will give us the selected models. The final model given by Autometrics is shown in Table 2.

Table 2: Estimated General model through Autometrics (3rd generation G-to-S)

	Coefficient	Standard err	t values	p-value
Intercept	0.351	0.906	0.388	0.702
I(t-1)	0.843	0.026	32.871	<0.001
GE	0.163	0.056	2.894	0.008
S	0.138	0.041	3.377	0.002
S(t-1)	-0.130	0.039	-3.326	0.003
Y	0.208	0.042	4.962	<0.001
Y(t-1)	0.197	0.043	4.601	<0.001

Autometrics select six variables in the final model after the reduction from 14 variables in the general model. All have their expected sign. The lagged investment dependent variable showed a significant positive impact on the current investment. The positive coefficient of lagged investment shows that investment practice in the previous year acts as an indicator of the economic condition in all included cross-sections, thereby stimulating investment in the following year. Government expenditure also found a positive relation to investment. It may be because government expenditure on infrastructure (communication, transport and irrigation) and government spending on national defense and security creates a climate favorable for investment. The coefficient of saving is also found to affect the domestic investment positively for all the cross-sections. A positive relationship of gross domestic savings with domestic investment implies that the two variables are complimentary; however, a relatively smaller coefficient i.e. 0.138 indicates the higher mobility of capital from these countries. The coefficient of GDP per capita growth bears a positive sign and is statistically significant. This provides evidence in support of the endogenous growth theory (Lucas (1988) and Romer (1986)). The philosophy of the neo-classical theory of investment, that output growth is positively related to the investment due to the accelerator effect (The accelerator effect theory states Gross Domestic Product (GDP) stimulates investment. In response to a rise in GDP, firms increase their investments and thus the profits go up. Consequently, the fixed investments of firms explode, in the form of increased capital stock. This further leads to economic growth by raising consumer expenditure through the multiplier effect), also sustains by this relationship. Furthermore, it is not only the current level of per capita income that affects domestic investment, but its lagged value also determines investment positively and almost equally.

5. CONCLUSION

It is well defined that the investment of any kind is important in the growth of an economy. As per its importance, analyzing the factors affecting the investment is the main objective of the current study. This research used the data of different Asian countries to find out the determinants of domestic investment. To analyze the factors of investment this research used the third generation general to specific approach known as Autometrics (Doornik, 2006) which will give us a unique and robust model for the selected countries.

From the results, Government expenditure, domestic saving, and per capita GDP showed a positive relation to investment. It could be because of governmental expenditure on infrastructure, defense and security. A positive relationship of gross domestic savings with domestic investment

implies that the two variables are complimentary. The sampled countries can simultaneously emphasize, while making policy, on variables like real GDP per capita growth, domestic saving, government expenditures that are found to be the key determinants of domestic investment in the middle-income Asian countries.

6. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding authors

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