THE DETERMINANTS OF INVESTMENT: PANEL DATA ANALYSIS OF G7 COUNTRIES

Okyay Ucan**, **PhD
Nigde University , Turkey

Abstract

Foreign direct investment has registered a renewed interest by changing global economic and political environment. One of the fundamental aims of economic policies is to increase capital accumulation in terms of investment that is necessary to maintain a desirable and sustainable growth rate in the developing and developed countries. The majority of empirical studies show that per capita GDP growth, external debt, foreign trade, capital flows, public sector borrowing requirements, and interest rate are the main determinants of investment. Therefore, the aim of this study is to investigate whether financial development has contributed to an increase in investment in G7 countries. To reach an empirical and firm conclusion, an investment function, including the traditional potential determinants along with financial development, is estimated by utilizing the developments in the panel data econometrics in terms of panel unit root tests and panel cointegration for the period 1994-2010 in G7 countries.

Keywords: Pedroni panel data, full modified ordinary least square, investment, financial development

Introduction

Levine and Renelt (1992) has shown that the rate of accumulation of physical capital is an important determinant of economic growth by using large sample of countries' data.

The decline in investment is a matter of concern, given the close connection between the level of investment and the rate of economic growth as documented in recent studies (Ben-David, 1998; Chari, Kehoe & McGrattan, 1997; Barro, 1991; Khan & Reinhart, 1990; Kormendi & Meguire, 1985). It is therefore worthwhile to investigate the factors that determine the level of domestic investment in the developing and developed countries. This paper investigates the role of financial factors in determining domestic investment and private investment in G7 countries. The premise of this study is that financial development facilitates the channeling of resources from savers to the highest-return investment activities, increases the quantity of funds available for investment, and thus reduces the liquidity constraints. Thus a large and liquid financial system reduces the overall costs and risks of investment, which stimulates capital accumulation.

The analysis is based on a reduced-form investment model that relates a country's domestic investment to the level of financial development while controlling for other nonfinancial factors. Following a standard practice in panel data analysis, the investment equation is specified as a dynamic model (see Hsiao, 1986; Anderson & Hsiao, 1982, 1981). To test the effects of financial development on investment, four indicators are used alternatively: credit to the private sector, total liquid liabilities of financial intermediaries, credit provided by banks, and a composite index combining these three indicators. Before 2000 there are lots of studies that have been done for industrialized countries. Lately, there is

no study using G7 countries data. To analyze the last effect of FDI to these countries is the contribution of this study.

Theoretical Approaches

Conventional models such as the flexible accelerator proved quite successful in explaining aggregate investment in industrial countries. However, there is not an exact applicable model for the developing countries. The main underlying assumptions of these models are the assumption of perfect capital markets, absence of liquidity constraints, and abstraction from the role of government. Research in the past decades has shifted attention toward the role of financial factors in explaining investment over time and across countries. Studies that emphasize the role of financial determinants for investment in developing and developed countries have revived the original ideas of Schumpeter (1932) about the importance of the financial system in promoting technological progress. These studies also embed the Keynesian view that the ``state of credit" is an important determinant of investment (Keynes, 1937, 1973). One key difference between developed and underdeveloped countries, as Gurley and Shaw (1955) argued, is the level of organization and sophistication of financial intermediaries, especially because of their role in facilitating the flow of loanable funds between savers and investors.

Recent studies go beyond the McKinnon(1973)- Shaw(1973) tradition that is based on the assumption that limited access to credit in developing countries forces investors to accumulate enough real balance before they can initiate investment projects. This view establishes a positive relationship between real interest rate and investment. These studies also relate investment to financial development in general by emphasizing the special services that financial intermediaries provide to investors. The financial system is the key to matching financial resources to investors' needs both through short-term credit expansion and, through its maturity transformation function, by channeling saving into long-term credit markets. Financial markets play an important role in allocating investment capital to high return activities (Greenwood & Smith, 1997).

Some studies (Bayoumi, 1990; Dooley, Frankel & Mathieson, 1987; Feldstein & Horioka, 1980) find that countries with low saving rates also have low investment rates. The positive relationship between domestic saving and domestic investment is often viewed as evidence of imperfect international capital flows and various country-specific institutional and noninstitutional rigidities (Feldstein & Horioka, 1980). However, this approach, that assumes that saving directly causes investment, has important limitations. First, this view is an equilibrium (static) approach. Second, this view only considers the real side of the saving behavior and regards saving as a residue of income after consumption.

Empirical studies have shown that a number of nonfinancial factors also affect domestic investment in developing and developed countries. This paper pays particular attention to three categories of factors: factors hypothesized by conventional investment theory (output growth and interest rate); factors related to government policy (government consumption, government borrowing, and inflation); and open-economy factors (trade flows, foreign debt, and black market activities).

Government policies may also affect domestic investment. First of all government spending may crowd out domestic investment by raising interest rates, reducing the pool of funds in the markets, and increasing distortionary taxation on investment activities. It is also possible, however, for government spending to "crowd in" domestic investment through the accelerator channel. The net effect depends the empirical data period.

Literature review up to date is given in Table 1. Both investment and economic growth relationship and determiners of the investment examples are chosen to consider.

Table 1. Literature Review

Authors	Methodology	Country	Result
Scaperlanda and Laurence (1969)	Least-squares multiple regression	European Economic Community	U.S. direct investment appeared to have been somewhat affected by the establishment of the E.E.C., the stability of the market-size elasticity between the pre- and post-E.E.C. periods indicated that the E.E.C. has had little impact on the sensitivity of investment to changes in growth.
Agarwal (1980)	Review	All	A survey about determinants of foreign direct investment
Terpstra and Yu (1988)	OLS	USA	Oligopolistic reaction in foreign investment activities may involve a larger number of players in service industries than in manufacturing industries.
Morck et al. (1990)	OLS	USA	The explanatory power of relative stock returns for investment might be evidence of the market exerting pressure on managers, although it also seemed likely that the market was picking up the effect of imperfectly measured fundamentals
Loree and Guisinger (1995)	OLS	USA	Significance is found for non-policy variables such as political stability, cultural distance, GDP per capita and infrastructure.
Chen (1996)	Time Series	China	The lack of clear delineation of private property rights, the lack of a clearly established system of contract and patent law as well as the high levels of political risk have discouraged advanced technology transfer.
Borenstein et al. (1998)	Cross Country Regression	OECD Countries	FDI is more productive than domestic investment. The effect of FDI on growth depends on the human capital accumulation.
Cheng and Kwan (1999)	Dynamic Panel Regression	China	There is no convergence in the equilibrium FDI stocks of the regions. On the other hand, there is a convergence in the deviations from the equilibrium FDI stocks.
Chakrabarti (2001)	OLS	135 Countries	Market size of the host country as measured by per capita GDP is found a potential effect on FDI.
Asiedu (2002)	OLS	Africa	A higher return on investment and better infrastructure has a positive effect on foreign direct investment.
Saumitra N. Bhaduri (2005)	Panel Data Analysis	India (firms)	The empirical findings revealed mixed evidence in favor of the hypothesis that the liberalization effort has succeeded in relaxing financial constraint faced by the Indian firms
Koo and Maeng (2005)	Panel Data Analysis	Korea (firms)	Financial liberalization significantly reduced the financial constraints confronted by firms
Günçavdı and Bleaney (2005)	Vector Error Correction Model	Turkey	The short-run dynamics of investment were altered by financial liberalization, with reduced sensitivity to the

			availability of credit, but with no evidence of increased sensitivity to the cost of capital.
Ndikumana (2006)	Dynamic serial-correlation model	30 sub-Saharan African countries	Financial development could stimulate economic growth through capital accumulation.
Love and Zicchino (2006)	Panel Data Analysis	36 Countries	The impact of financial factors on investment, which indicates the severity of financing constraints, is significantly larger in countries with less developed financial systems.
Aykut and Sayek (2007)	Cross Sectional Analysis	54 Countries	Both demand and the supply factors are the main indicators of investment.
Jongwanich and Kohpaiboon (2008)	Cointegration	Thailand	The key finding was that private investment in Thailand had borne the brunt of aggregate demand contraction since the outbreak of the Asian financial crisis in 1997
Ang (2009)	Cointegration	Malaysia and India	Financial repressionist policies, in the form of significant directed credit controls, appear to have retarded private investment in both India and Malaysia.

Data and Methodology

All data are gathered from International Financial Statistics online services reported by the International Monetary Fund (IMF) and World Bank data services. This publication has annual data for G7 countries from 1994 to 2010. The variables used in this paper are private domestic investment as a percentage of GDP, PI_t; real per capita gross domestic product, $PGDP_t$;discount rate (real interest rate), r; and financial development indicators (see Ndikumana, 2000; Levine, 1997 for a discussion of measuring the items of financial development). By following Ndikumana (2000),

- Total credit to the private sector as a percentage of GDP (**FD1**)
- The ratio of broad money to GDP is used as a measure of size of the financial sector (**FD2**)
- The relative importance of banks in the supply of credit is measured by total domestic credit provided by the banking sector as a percentage of GDP (**FD3**)
- Claims on government as a percentage of GDP (**FD4**)
- A composite index of financial development (**FDindex**)

The formula for the FDindex that is developed by Demirgüc-Kunt and Levine (1996) is adapted to our paper as the following:

$$FDindex = \frac{1}{4}\sum_{i=1}^{4}\left[100*(FD_i / \overline{FD_i}\right] \quad (1)$$

where FD_i is an indicator of financial development, $\overline{FD_i}$ is the sample mean of indicator i.

In this paper, we create a model dealing with private investment (PI_t). In this model besides real interest rate (R), real per capita gross domestic product ($PGDP_t$),; financial development indicators are changed to each other to see their individual effect on PI_t, i.e.:

$PI_t = f(PGDP_t, R, FD_i)$ for $1 \le i \le 4$ and i=index (2)

Empirical Results

In the analysis, to ensure robustness for the common components private domestic investment as a percentage of GDP, PI_t; real per capita gross domestic product, $PGDP_t$;discount rate (real interest rate), R; financial development indicators (FD_i) and a compozite indicator (FD_{index}) unit root test is employed.

Table 2. Im Peseran and Shin Unit Root Test Results

Series	W Statistics (Probabilities)		
	Level	**First Difference**	**Results**
PI	-0.752 (0.2257)	-3.800 (0.000)	I(1)
PGDP	-0.382 (0.351)	-3.849 (0.000)	I(1)
R	-0.839 (0.052)	-4.240 (0.000)	I(1)
*FD*1	1.339 (0.909)	-2.338 (0.009)	I(1)
*FD*2	2.794 (0.997)	-3.037 (0.001)	I(1)
*FD*3	2.590 (0.995)	-2.528 (0.005)	I(1)
*FD*4	0.247 (0.597)	-3.746 (0.000)	I(1)
FDindex	2.036 (0.979)	-2.839 (0.002)	I(1)

1) Newey-West bandwidth selection using Bartlett kernel.
2) Individual Effects

Im Peseran and Shin (2003) unit root test results are presented in Table 2. According to the unit root test results, we have found that PI, PGDP, R, FD1, FD2, FD3, FD4 and FD_{index} series are stationary in first differences.

Due to the VAR lag order selection criteria, it is found that lag length is 1. We use the Akaiki information criteria and Schwarz information criteria that is the mostly used in the literature.

Having verified that the series are non stationary and same order integration as I(1), it is tested whether there exist any long run equilibrium relationship between the variables using Pedroni and Kao panel cointegration tests.

Table 3. Panel Cointegration Tests

Panel A .Pedroni Panel Cointegration Test			
Within Dimension Test Statistics		Between Dimension Test Statistics	
Panel v-statistics	-1.388(0.9175)	Group rho-statistics	3.480(0.999)
Panel rho-statistics	2.662(0.9961)	Group PP-statistics	-4.000(0.000)*
Panel PP-statistics	-2.901(0.001)*	Group ADF-statistics	-4.230(0.000)*
Panel ADF-statistics	-3.657(0.000)*		
Panel B. Kao Residual Cointegration Test			
t-statistics		-5.154(0.000)*	

Notes: *Probability values are in parenthesis. Out of the seven tests, excluding Panel v-statistics and Group pand rho-statistics all remaining tests reject the null hypothesis of no cointegration at the 5% significance level.*

Because of the data constraint we use PI, PGDP, R, FD1, FD2, FD3 and FD4 for the Pedroni test. On the other hand , for the Kao(1999) test we use PI, PGDP, R, FD1, FD2, FD3, FD4 and FDindex. We have seen from the Pedroni Panel Cointegration test, four out of seven statistics reject the null hypothesis of no cointegration. That is, there is a long run relationship

between the variables. Due to test statistics Kao cointegration test also reject the null hypothesis of no cointegration.

In the next step, the fully modified ordinary least square (FMOLS) technique for heterogeneous cointegrated panels is estimated (Pedroni 2000)[1]. Table 4 shows this FMOLS result.

Table 4. Panel FMOLS Estimation

:	$PI = 1.20PGDP + 12.43R + 1534.80FDindex$
	(4.25) (4.10) (3.99)

Note: T statistics are in paranthesis.

According to FMOLS estimation; the effect of per capita GDP on private investment is positive and statistically significant. In addition, interest rate's effect on private investment is positive and statistically significant, too. The last variable that is used for index of the broad money, total credit to private sector, domestic credit provided by banking sector and claims of government has a positive influence on pirivate investment.

Conclusion

This paper's aim is to analyze relationship between private investment and its determiners using panel data for G7 countries over the period 1994-2010 within a multivariate framework. 1997 Asian crises, 1998 Russian crises and the early 2000s recession was a decline in economic activity which mainly occurred in developed countries. The recession affected the European countries during 2000 and 2001 and the USA in 2002 and 2003. The UK and Canada,avoided the recession. Japan's 1990s recession continued. On the other hand, mortgage crisis in USA in 2007, also affected the other developed and developing countries. Following by GDP fall in USA, interest rates was forced to decline by the government. So savings were used either for import or as foreign saving in the third world countries that had relatively higher interest rate. Because of this, domestic investment began to fall. This can be the first view for explaining positive relationship between the interest rate and investment. Secondly, the positive relationship between interest rate and private investment shows that limited access to credit forces investors to accumulate enough real balance before they can initiate investment projects as McKinnon (1973) and Shaw (1973) mentioned.

For the further studies, together with financial development indicators and index, one may use other macroeconomic indicators. Also it may be good to compare developing countries data with industrialized ones.

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[1] All variables are tested for FMOLS. If it is requested, wemay send it.

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