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Determinants of Sectoral Private Investment in Ethiopia: Panel Data Analysis

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Abstract
Investment is a key to economic growth. While there are number of studies on determinants of private investment in Ethiopia, sectoral level studies are largely neglected. Yet understanding the diversification in Ethiopian sectoral private investment is important as they economy remains agrigarian. For this purpose, we investigate the determinants of private investment in six Ethiopian economic sectors for the period of 1992-2015. The study utilizes a flexible accelerator model of investment. The estimation technique was based on Panel Corrected Standard Error (PCSE) estimation model over other techniques because of cross sectional dependency, heteroskedasticity and serial correlation problem in our data. To account for global business cycle, we have controlled for time fixed effects. We have also accounted for sectoral heterogeneity by incorporating sectoral fixed effects. We find that that trade policy has positive effect on private investment flows in all the sectors of the economy while higher external debt and inflation have negative effects. Therefore, further trade liberalization, reducing external debt, and moderating inflation would attract private investment activities in the sectors.
Keywords: sectoral private investment; sectoral fixed effect; flexible accelerator; PCSE

1. Introduction

It is now a stylized fact that economic growth and development depend essentially on a country's ability to invest and make efficient utilization of its scarce resources. In this regards, the role of private sector is important both in terms of its contribution to the amount of domestic investment and its ability to allocate and employ resources efficiently. In fact, investment is both a result and cause of economic growth (Bayraktar, 2003).

Nianggolan (2015) argues that in the process of economic development, investment is an important component. It makes various means of production available, thereby maximizing production and hence promoting economic development. In turn, economic growth leads to an increase in aggregate demand which will further encourage new investment, employment and exports. Likewise, Salahuddin et al. (2009) argue that investment has been a very powerful variable in economic development. On account of this, private investment has been an issue of enormous interest to policy makers.

With regard to economic performance, Ethiopia has been experiencing double-digit economic growth, averaging 10.8% since 2005, which has mainly been underpinned by public-sector-led development. Real gross domestic product (GDP) is estimated to have grown by 10.2% in fiscal year 2014/15, and agriculture, services and industrial sectors have accounted for 38.8%, 46.6% and 15.2% of real GDP, respectively (Admit et al. 2016).

The Ethiopian economic policies before Ethiopia's Investment Proclamation of 1992 had relied heavily on state-owned enterprises, and for many years had actively discouraged private investment initiatives. However, the current Ethiopian policy on investment reform for private investment is openness due to political and economic reform program of 1992. The numbers of reform measures, which are best described as a part of the country's industrial policy, have also been put in place. Most of them are contained in the investment law which was first issued in 1992 with subsequent revision and improvements (Shiferaw, 2006).

Despite such economic and political reforms and range of investments incentives given, the roles of private investors have remained at low stage in the country. According to National bank of Ethiopia (2015/2016), Ethiopia's per capita income increased to $794 from $725 a year ago and poverty was estimated to have dropped to 22 percent from 38.7 percent a decade earlier. Investment to GDP ratio slightly declined to 38.5 percent from 39.4 percent while domestic savings to GDP ratio improved to 22.2 percent compared to the previous year.

A number of studies like Abdishu (2013); Ambachew (2010); and Hailu (2013) investigate the determinants of private investment in Ethiopia using time series data. However, none of these studies consider possible variation of private investment across different sectors of the economy. Consequently, they overlooked sector specific factors that may influence private investment ranging from the motivation to financing of the investment. In addition, they fail to account for global business cycle which could influence private investment flows. In this respective, we are inspired to undertake this study on the determinants of private investment by disaggregating it by sectors and accounting for global business cycle in the form of booms and recessions.

2. Review of Literature

In explaining investment behavior, different theoretical models are developed to study on behavior of investment decisions using different variants and extensions. Among those, Keynesian investment theory, the accelerator

investment theory, and neoclassical models of investment behavior theory of investment have wider coverage in investment literatures.

According to Keynes (1936) investment is defined as the increment of capital equipment, whether it consists of fixed capital, working capital or liquid capital. The author explained investment equals to saving since each of them is equal to the portion of income which is not consumed. This means investment leads to an increase in income and income increases saving.

The author also proposed an investment function as the relationship between investment and interest rate $I = I0 + I(r))$ which indicates that firms presumed to rank various investment projects depending on their marginal efficiency of investment. With a given rate of interest, firms chose those projects whose marginal efficiency of investment exceeded the rate of interest. This indicates that there is inverse relationship between investment and rate of interest. Keynes further postulated that the decisions to undertake capital investment are based on what he referred to as the "animal spirit" of the investors. This implies that the decision to invest or divest largely depends on the individual investor's expectations about the possible outcome of the investment venture (Mohamed, 2002).

The simple accelerator principle model developed by Clark (1917) as cited by Twin, et al. (2015) asserts that investment is proportional to the change in output. The model implies that demand varies not with the volume of the demand for the finished product, but rather with the acceleration of that demand. The model is later reformulated into the so-called flexible accelerator model of investment by allowing investment to vary with other relevant variables, including those related to uncertainty and market imperfections. This is especially important when analyzing investment behavior in developing economies.

Neoclassical theory of investment, as first formalized by Jorgenson (1963) as cited in Combey (2016) suggests that private investment has been negatively affected by real interest rates. The central feature of this theory is that the response of the demand for capital to changes in relative to factor prices or the ratio of factor prices to the price of output.

From empirical perspective, there are a number of studies which have attempted to investigate the determinant of private investment in different developing countries. For example, a study conducted by Mgbemena et al. (2015) using annual time series data found that the investment of manufacturing growth is positively related to GDP, exchange rate and but negatively affected by an increase in interest rate.

Similarly, Tawiri (2011) conducted a study on factors affecting domestic private investment on Libyan manufacturing sector based on annual time series data between 1962 and 2008. The study result shows that per capital GDP and openness level has positive impact on private investment while public investment on manufacture sector in the long run has negative impact on private manufacture investment.

By using Pakistan's manufacturing sector, Ahmad and Qayyum (2009) found that public development expenditures enhance private investments whereas non-development expenditures and macroeconomic uncertainty negatively affects private investment.

Likewise, Khalid and Scholar (2014) studied determinant of private investments in the case of Pakistan using annual time series data of 1972-2013. The result found that real GDP and public investment are positively related with private investment while interest rate and external debt have negative impact in the growth of private investment.

A study by Tadeu et al. (2013) found that credit disbursement has positive impact on private invest while external debt has negative impact on private investment.

Pertaining to Ethiopia, Ambachew (2010) conducted a study on determinants of private investment using annual time series data set for 1950-2003. According to the author, private investment in Ethiopia is influenced positively by return to capital, domestic market, trade openness and liberalization measures, infrastructural facilities, and foreign direct investment. However, the author found that government activities, macroeconomic uncertainty, and political uncertainty were negatively associated with private investment.

As reviewed above, none of studies which focused on Ethiopia has disaggregated private investment by sectors and attempts to account for the global business cycle. This study, therefore, tries to fill these gaps.

3. The Data and Estimation Strategy

3.1. Data Source and Type

Secondary data is used in carrying out this study and the study has employed annual panel data covering the period of 1992-2015 based on data availability. The data were collected from Ethiopian Investment Commission, National Bank of Ethiopia and the World Bank.

3.2. Model Specification

The Benchmark model for this study is based on the flexible accelerator model. The reason for selecting this model is that it is the most comprehensive model in examining a determinant of private investment in Developing countries. Since Ethiopia is also one of developing countries, the behaviors of investment are

affected by different variables and flexible accelerator model is useful to analyze the determinants of private in the country. Accordingly, the function of flexible accelerator model is written as following.

$$I_t = \alpha \Delta Y_t \quad (1)$$

The coefficient of Y_t captures the accelerator effect and is expected to be positive (Erden, 2005). I_t denotes the amount of investment. As explained previous section of this paper, the flexible accelerator model allows the relevant macroeconomic variables that affect private investment that are related to investment. Following different empirical studies like Mbaye (2014, and Erden, (2005), the benchmark model is augmented as follows:

$$I_{it} = \alpha_0 + \alpha \Delta Y_{it} + \beta X_{it} + \epsilon_{it} \quad (2)$$

Where I_{it} represents investment in a sector in any year t; Y_{it} stands for output of sector i in year t; X_{it} represents $1 \times k$ vector of macro and sectoral level variables that possibly affects private investment; ϵ_{it} is an error term such that $\epsilon_{it} \sim N(0, \sigma^2)$.

Since we are interested to control for sector fixed effects and account for global business cycle in the form of booms and recession, our final model will take the following form:

$$I_{it} = \alpha_0 + \alpha \Delta Y_{it} + \beta X_{it} + \gamma_i + \varphi_t + \epsilon_{it} \quad (3)$$

Where γ_i captures all unobserved, time-invariant factors that affect I_{it}; and φ_t is time fixed effect introduced to capture global business cycle.

More specifically, our final model takes the following form:

$$lnI_{it} = \beta_0 + \beta_1 lnRGDP_{it} + \beta_2 lnCP_{it} + +\beta_3 lnINFR_{it} + \beta_4 lnOPEN_t + \beta_5 lnIR_t + \beta_6 lnDEBT_t + \beta_7 INFLA_t + \gamma_i + \varphi_t + \varepsilon_{it} \quad (4)$$

Where lnI_{it} is natural logarithm of private investment (both domestic and foreign) in i sector in year t; $lnCP_{it}$ is natural logarithm of credit disbursed to sector i in year t. This variable measures the amount of credit availability to the sector i in year t. $lnINFR_{it}$ represents level of infrastructure, which is proxied by government capital expenditure invested in sector i in year t. This variable captures infrastructural development in the sector. $lnOPEN_t$ measures the overall macroeconomic openness of the economy. It is measured by dividing the sum of export and import to GDP and expressed in natural logarithmic form. $lnIR_t$ is nominal interest rate; $lnDEBT_t$ is external debt as a percentage of GDP; $INFLA_t$ is inflation to incorporate macroeconomic instability.

3.3. Description of Variables and Hypothesis of the Study

In this study, the dependent variable is private investment of sectors i (I_{it}) any year t measured by the amount invested in sector i. It captures both domestic and foreign private investments on the sector over the period under consideration. Based on existing theories and previous studies, we consider the following explanatory variables such as real gross domestic product for sector (+); credit disbursement for sectors (+) measured through the amount of credit availability to major sub-sectoral of the economy by financial institutions; Infrastructure (+) which is measured by government capital expenditure invested in a sector (+); Openness of the economy calculated as a ratio of exports plus imports to GDP (+); Interest rate measured by nominal lending rate (-); external debt as a percentage of GDP and inflation to proxy for macroeconomic instability (-). The signs corresponding to each variable in the bracket show the expected effects, namely, negative (-) and positive (+) of the variables on sectoral investment.

3.4.3. The Diagonistic Tests

To decide between fixed or random effect estimators, we run a Hausman test. The test confirms that fixed effect model is an appropriate estimator.

In addition, we conducted other relevant tests such panel unit root test, normality test for error term. Furthermore, we conducted diagnostic test for cross-sectional dependence problem, heteroskedasticity problem as well as serial correlation problem. Whenever the data failed to pass the diagnostic test, we took remedial actions such transforming the data to logarithmic form or shift to other estimation techniques which perform when the assumptions are violated.

4. RESULT AND DISCUSSIONS

4.1. Descriptive Statistics

In this section, we discuss the change in average growth of private investment before and after implementation of gross transformation plan (GTP)[1].

4.1.1 Average Change of Private Investment Growth across Sectors

In this section, we analyze change in average value of private investment growth in each sector over two period categories. The entire period of the study is categorized into two sub-periods, from 1992 to 2010 and 2011–2015

[1] GTP is Ethiopia's ambitious plan to transform the country's economy so that the country will join the club of middle income countries by 2025.

based on the Ethiopian government policy of gross transformation plan introduced in 2010/2011. The first period is considered as the initial phase for economic transformation before implementation of GTP while the second period is the economic transformation with implementation of GTP.

Table-1: Average Value of Private Investments across Sectors

Sectors	The average of private investment (in logarithmic form)		
	1992-2010	2011-2015	Change (%)
Agriculture	6.12	6.73	0.61
Construction	5.56	6.46	0.9
Hotel and restaurants	4.34	5.15	0.81
Manufacture	7.28	8.72	1.44
Real state, machinery and consultancy service	5.37	6.66	1.29
Tour operation, transport and communication	3.28	3.69	0.41

Source: Own computation: Data from Ethiopia Investment Commission (1992-2015)

As can be seen from Table 1, average growth of private investment increased in all sectors from 1992-2010 to 2011-2015 though the rate of increments of various across sectors. The third column presents sector wise change in average private investment growth between the two periods. Average growth of private investment is highly increased in manufacturing sector from 7.28 in 1992-2010 to 8.72 in 2011-2015 i.e. 1.44% increase on average as compared to the other sectors. The real state, machinery and consultancy service sector, construction sector, and hotel and restaurants follows the manufacture sector with the change increments of 1.29%, 0.9 and 0.81% on average respectively.

On other hand, the average growth of private investment is slightly increased in tour operation, transport and communication shows only by 0.41% increase on average followed by agriculture sector which enjoys an average growth of private investment increase of 0.61% on average during the same period.

4.2. Econometric analysis

4.2.1 Panel Unit Root Test

The results of panel unit root tests, supporting unbalanced panel data is the test of Im, Pesaran and Shin (2003); Combey, 2016).

Table 2: Results of Panel Unit Root Test using IPS method

variable	statistic	probability	statistic	probability
Sectoral Private Investment $_{it}$	-5.095	0.0000***		
Sectoral Real GDP$_{it}$	-0.947	0.1719	-5.4263	0.0000***
Sectoral Credi disbursement$_{it}$	-3.401	0.0003***		
Sectoral Infrastructure$_{it}$	-4.205	0.0000***		
Overall Openness$_t$	-3.951	0.0000***		
Overal External Debt$_t$	-2.288	0.0111**		
Overall Iterest rate$_t$	-7.486	0.0000***		
$Macreconomic\ instability_t$	-5.074	0.0000***		

Source: Own Computation

Notes: i. (***) Significant at 1 %, (**) Significant at 5 %; ii. Null Hypothesis: Ho: All panels contain unit roots; iii. All variables except macroeconomic instability variables are in their natural logarithmic form.

Our data is unbalanced and here we make use of IPS test developed by Im, Pesaran, and Shin (2003). The IPS test result presented in Table 3 shows that all variables are stationary at level except log of real gross domestic product, which is stationary at first differencing. The unit root test of using IPS panels stationary are conducted at both panel specific and trend for variables. Hence, we have taken the stationarity level of all the variables for estimation.

4.2.2. Model Specification Test

To select the benchmark model of panel data between pooled OLS, fixed effect, and random effect, we utilized Wald F-test for fixed effect against pooled OLS, and LM test for random effect against pooled OLS and Hausman test for random and fixed effect model. The following table shows the result of F-test, LM test, and Hausman test.

Table 3: Model Specification Test Result

F-test (Wald test)	Breusch-Pagan Lagrange Multiplier (LM)	Hausman test	Appropriate model
0.0000***	1.0000	0.0000***	Fixed effect model

Source: own calculation;

Notes: i. Ho (for F-test) = no fixed effect; Ho (for LM test) = no random effect; Ho (Hausman test) = random affect is appropriate; ii. (***) indicate rejection of null hypothesis at 1 percent level of significance based on P-

values.

From Table 3, both LM test and Hausman test rejects the random effect model while F- test and Hausman test prefers the fixed effects estimator to random effect estimator. The LM test prefers pooled OLS model but it is rejected by F-test. Therefore, the overall appropriate model is fixed effect estimator. Accordingly, we report the fixed effects estimator results only.

4.2.3. Diagnostic Tests Result

In this sub-section, we have conducted diagnostics test of the model for normality of error term, contemporaneous cross section dependency, group wise heteroskedasticity, and serial correlation of the error terms.

Table: 4 Diagnostic test results

Test type	Null hypothesis	P-	Test result
Normality test			
Normality on e	H0: normal distribution	0.1287	Normal
Normality on u	H0: normal distribution	0.6414	Normal
Cross sectional	H0: no cross section		Cross section
Dependency	Dependency	0.0443	Dependency
	H0: sigma (i) ^2 = sigma^2		
Heteroskedasticity	For all i	0 .0000	Heteroskedasticity
	H0: no first - Order		
Serial Correlation	Autocorrelation	0.0109	Serial correlation

Source: Calculated by the authors

As can be seen from Table 4, error term is normality distributed. However, there are problems of cross sectional dependency, heteroskedasticity and serial autocorrelation. Therefore, to address these problems, we utilize panel data estimation model like Panel Corrected Standard Error (PCSE) which allows the cross sectional dependency, heteroskedasticity and serial correlation.

4.2.4 Panel Corrected Standard Error Result

Since our data have the problem of heteroskedasticity and cross-sectional dependence/ or contemporaneous correlation, we use contemporaneous correlation model which is estimated either by Feasible General Least square (FGLS) or PCSE as a better method of estimation technique. In particular, model for time series and cross sectional data often allow for temporally and spatially correlated errors as well as heteroskedasticity. According to Beck and Katz (1995) an appropriate method for dealing with these problems is general least squares (GLS). The authors criticized the FGLS as technique of estimating the standard errors of the estimated coefficients to understate their true variability. Based on the problem of FGLS, Beck and Katz (1995) developed the simpler method of panel corrected standard error model for estimating time series cross sectional data having correlated errors as well as heteroskedasticity problem. Therefore, our estimation model is based on panel corrected error model. The following table shows the panel corrected standard errors estimation result.

Table 5: Estimation Result of Panel Corrected Standard Errors (PCSEs)

Dependent Variable: Sectoral Private Investment	Model 1	Model 2	Model 3	Model 4
Sectoral Level Real GDP	0.965	0.811	1.099	0.317
	(1.751)	(1.429)	(1.930)	(1.525)
Sectoral Level Credit Disbursement	0.735***	0.137	0.748***	0.179
	(0.142)	(0.138)	(0.146)	(0.138)
Sectoral Infrastructural Development	0.348**	0.120	0.397***	0.182
	(0.138)	(0.160)	(0.143)	(0.155)
Overall Economic Openness	1.684**	1.963***	0.745***	0.846***
	(0.718)	(0.651)	(0.044)	(0.076)
Nominal Intesrest Rate	-0.111	0.669		
	(1.308)	(1.160)		
Overall Debt to GDP Ratio	-0.700***	-0.625***	-1.124***	-0.959***
	(0.220)	(0.189)	(0.071)	(0.107)
Macroeconomic Instability (Inflation)	-0.009	-0.001	-0.021***	-0.025***
	(0.011)	(0.011)	(0.003)	(0.002)
Sector fixed effects	No	Yes	No	Yes
Year fixed effects	No	No	Yes	Yes
Constant	-10.837	-14.196		
	(10.244)	(9.424)		
N	136	136	136	136
R-sq	0.257	0.742	0.333	0.815
rmse	1.274	0.968	1.296	0.940

1. Significant coefficients are denoted by ***, ** , and * at 1%, 5% and 10%.
2. Panel corrected standard errors are in parantheses.
3. All variables except sectoral Real GDP are stationary at level.
4. We took first difference of sectoral Real GDP to make it stationary
5. Nominal interest rate and constant are dropped because of collinearity in Models 3 and 4

Table 5 presents results from panel of six sectors of Ethiopia economy, where we have estimated the relationship between private investment and its determinants over the period 1992-2015 using PCSE model. In Model 1, sectoral level credit disbursement, sectoral level infrastructural development and overall economic openness are positively associated with sectoral level private investment. However, the overall debt to GDP ratio was negatively associated with sectoral level private investment. The positive association between credit disbursement and private investment is consistent with Tadeu et al. (2013); Abdishu (2013); and Esubalew (2014). Nevertheless, these findings are less reliable since sector fixed effect, which captures the unobservable heterogeneous natures of the sectors of the economy are not taken into account. In addition, such model specification is less reliable since time fixed effect, which could capture global business cycle, is not incorporated.

In Model 2, we control only for sectoral fixed effects. In this case, only two variables, namely, overall openness (positively) and overall debt to GDP ratio (negatively) associated with sectoral private investment. In Model 3, instead of sectoral fixed effects, we control for time fixed effects. The results obtained here are quite similar to the results obtained in Model 2 except that the overall macroeconomic instability now enters the model with statistically significant and negative coefficient. The later result is consistent with our expectation because macroeconomic instability discourages private investment.

Finally, in Model 4, we control both for sectoral and time fixed effects. In fact we rely on this model since it effectively incorporates unobservable sectoral characteristics that promotes or discourages private investment. In addition, this model includes time fixed effects that accounts for global business cycle in the form recessions and booms. Interestingly, economic openness remains statistically significant and enters the model with positive and statistically coefficient. This is intuitively appealing since more open economies attract more private foreign investment. The result also sounds well since there is a strong relationship between trade and investment Chala and Lee, (2015).

More specifically, as trade openness rise by one percentage, private investment increases by 0.846 percent,

holding all other variables constant. This result is consistent with finding by Attefah and Enning (2016), but contradicts a study by Esubalew (2014). The other variable that enters Model 4 with statistically significant coefficient is external debt to GDP ratio. It is statistically at 1% level of significance and carries negative coefficient. The result is consistent with our intuition and findings by previous studies. This could imply that 1% increase in external debt to GDP is associated with 0.96 percent decrease in private investment citrus paribus. Specifically, when debt burden increases, the private investment growth declines, since the capacity of people to save and invest falls. This result is similar with findings by Esubalew (2014); Attefah and Enning (2016), and Khalid and Scholar (2014). However, it contradicts with a finding by of Hailu (2013).

The other variable which is statistically significant in this model is macroeconomic instability proxied by inflation. Specifically, as inflation increases by one unit, private investment falls by 2.54 [1] percent all other thing being constant. This result is consistent with the empirical findings of Esubalew (2014); Nianggolan (2015); Hailu (2013) and Ambachew (2010). This means that a high inflation rate may have adverse impact on investment by increasing risk associated with long term projects as argued by Salahuddin et al., (2009).

5. Conclusion and Policy Implications

This study analyzed the determinants of private investments in six Ethiopian economic sectors for the period between 1992 and 2015. The functional form of the private investment is based on the flexible accelerator investment theory. We utilized panel corrected standard errors model. For specifying panel estimation models, we have relied on F-test and Hausman test statistics and the tests reveal that fixed effects estimator was preferred for estimation. However, after fixed effect model estimation, we have observed the existence of cross sectional dependency and hetrosecedasticity. To address these problems, we have employed panel corrected standard errors model which allows cross sectional dependency and heteroskedasticity. Overall, most of our findings are supportive of both theoretical and empirical considerations and the variables that affect private investment are consistent with the hypothesized signs and are robust.

These empirical findings have key policy implications for Ethiopian policy makers and other developing countries. Specifically, our findings show that the development of communication sector has high influence on private investment of other economic sectors. To this end, the government should allow and attract private investors in the areas of communication sectors for private investors. In addition, the government should further open up the economy through further trade liberalizations. The Ethiopian government should also reduce the external debt to attract more private investment to the various sectors of the economy. Furthermore, the government should pursue prudent fiscal and monetary policy that tackles inflationary pressure to promote private investment. .

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[1] While our dependent variable is its logarithmic form, macroeconomic instability proxied by rate of inflation is in its level form. Since inflation may assume negative value, we cannot take logarithmic form as logarithmic of a negative number is undefined. Consequently, we need to multiply the coefficient by 100.

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