THE DYNAMIC LINKS BETWEEN INVESTMENT, TRADE AND GROWTH: EVIDENCE FROM ETHIOPIA[1]

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Abstract

The existing pool of evidence on the growth effects of investment and trade, as well as the reciprocal effects, is hardly sufficient, rendering their connections to remain inconclusive. The insufficiency of such studies is chronic when it comes to the Ethiopian economy. The investment, trade and growth connections in the Ethiopian economy have not been well researched, calling for such kinds of studies. Targeting at characterising the patterns of impact flows between investment, trade and growth in Ethiopia and contributing a little in filling some aspects of the lacuna, this study becomes a short-run causality analyses on their dynamic links using time series data over the period 1955-2003. According to the estimated VAR results, there is no feedback between any pair of the variables, out of the 3 hypothesised dynamic feedback links. Nonetheless, we have observed two uni-directional positive causalities that run from economic growth to enhanced trade openness and from the latter to investment. However, the evidence should not be interpreted as investment and trade do not contribute to growth. Rather, it could be signalling the low investment and trade performances of the country despite the unknown minimum thresholds of the rate of investment and trade openness for their respective impacts to be recognizable. Hence, measures that improve the performance of both activities, their linkages and the contribution of trade to investment could help the economy to build its productive capacity and then to grow faster.

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1. Introduction

Economic growth often refers to improvements in the main economic performance measures that ultimately improve the wellbeing of a nation. The term economic growth often represents the increase or growth of a specific performance measure such as GDP or Per Capita GDP. La Grandville (2009) defines economic growth simply as an increase of income per person (P. 29). Economic growth can also be seen as the expansion of the productive capacity of a nation.

Growth performances vary greatly across the world due to several reasons. As emphasised in many empirical growth studies, factors that contribute to the cross-country growth differences include a set of quantifiable variables such as the initial level of income, rate of investment, human capital, government activities, demographic factors like population growth or rate of fertility, policies, the rule of law, macroeconomic stability, changes in terms of trade and openness to trade, institutions, etc (see Barro, 2003, P. 231, Thrilwall, 2006, P. 157-160).

Annotating the observed dynamism in developing economies, contrasting the dramatic changes in some against the dire poverty in others, recognizing the diversity of country experiences ranging from astonishing successes to devastating failures and building on the framework of Maddison (1988), a recent study has classified the sources of growth into three broader categories: *proximate (measurable), intermediate (policy-related) and ultimate (non-measurable) sources.* According to this study, the *proximate sources* of growth include saving and capital accumulation, increased scale of production, efforts, efficiency, accumulation of human capital, natural resources, changes in technology and the organization of production; *intermediate factors* are related to trends in domestic/global demand and a variety of policies while *ultimate sources* comprise geographic and climatic factors, demographic and epidemiological trends, political centralization, history of state formation, the dynamics of class relationships/political conflicts, institutions such as property rights, financial intermediaries, rule of law & order, international order, trade regime, technological gap and absorptive capacity (Szirmai, 2008, P. 5, 13-17). In both of the above analytical theoretical and empirical approaches, the growth spurring roles of investment and trade are emphasised. Hence, differences in investment and trade performances could be among the possible explanations for

the observed growth disparities across countries of the world. Defined as the sum of exports and imports or either of the components, it is said that the growth of trade volume is closely related to the growth of output (Jones, 2002, P. 15). Referring to one of the implications of the Solow model, Jones (2002) elaborates also that countries with high savings/investment rates end to be richer, ceteris paribus; while those with more capital per worker have high output per worker (P. 32).

After discussing the main implications of various growth theories with a particular focus on the roles played by investment and trade, Mekonnen (2011b) asserts,

> *"we learn the economic significance of: (i) investment as a way of capital accumulation and building productive capacity; (ii) trade as a conduit for knowledge-technology transference and a vent of surplus products enabling the exploitation of economies of scale; and, (iii) market mechanisms as the main governing forces imposing disciplines on the efficiency of institutions, all favouring growth. Conversely, the investment and trade performances are also highly tangled to and influenced by economic growth"* (forthcoming).

However, the effectiveness of further investment and trade liberalization efforts in Africa is still debating. There are researchers who argue that investment in Africa is too high; its growth effect in the region is insignificant; and conclude as there is no supportive evidence that private as well as public capitals are productive in Africa (Devarajan, Swaroop and Zou, 1996, P. 338-339, Dollar and Easterly, 1999, P. 552, Devarajan, Easterly and Pack, 2001, P. 81). Based on his cross-country regressions, using data from 87 countries over three different 10-year periods (1965-1974, 1985-1984 & 1985-1994), Barro (2003) has also reported that the positive growth effects of the rate of investment and trade openness become weak when other variables are controlled (P. 231, 235, 259, 273). Others also explain that the existing evidence, obtained from different parts of the world, on the impact of trade openness to economic growth could not lead into a single generalization. For instance, Szirmai (2008) explains the striking contrast between the effects of openness to trade in the South-East Asian (SEA) and African economies. According to him, the most successful South-East Asian economies are characterized as open to the world and

engaged in international trade while trade liberalization in Africa initially led to further economic decline, deindustrialization and stagnation as the non-competitive enterprises were exposed to international competition (P. 25-26). Similar explanations have also been documented in Caves *et al* (1999, P. 132-133).

In sum, from the above brief review, we grasp that the existing pool of evidence on the growth effects of investment and trade, as well as the reciprocal effects, is hardly sufficient, rendering their connections to remain inconclusive. The insufficiency of such studies is chronic when it comes to the Ethiopian economy. To the best of my knowledge, the investment-trade-growth link in the Ethiopian economy in particular is not well studied. However, being translated into a series of plans of export-led transformation towards industrialization with adequate effort to improve agricultural productivity up to its potential, the recent Ethiopian economic policies and strategies emphasise the roles of investment promotion and trade expansion to achieve rapid and sustained economic growth with declining income inequality. Hence, with the intention of understanding the interaction between these economic forces on the face of the emphasis of the national economic policy on their promotion, investigating the investment-trade-growth nexus in the Ethiopian context becomes the objective of this research. Specifically, the study tries to examine the existence of three feedback links: *investment vs. trade, investment vs. growth, and trade vs. growth*. Then, what follows is the identification of the pattern of impact flows amongst these three economic forces in the Ethiopian Economy.

Intended to serve as a medium of transmitting the learning outcomes and main findings of the study on the tri-partite links between investment, trade and economic growth in Ethiopia and invoke other rounds of research, this paper is organized as follows. The next section assesses the existing literature on growth and its main determinants, with special emphasis on the investment-trade-growth links. The third section is a glimpse at the Ethiopian socio-economic situation. The fourth section presents econometric tests and estimation results while the fifth section concludes the paper.

2. Determinants of Growth and Its link with Investment and Trade

2.1. Economic Growth and its Macro-determinants

The world has experienced a wide variation in growth performance and welfare of nations, spatially as well as temporally. Although economists in the field share the facts of variation in per capita income, growth rates, the contributions/influences of factors such as technological progress, increased factor inputs, and the widening gap between the per capita income and living standards across countries, there are some debating issues in explaining the cross country growth deviations. Growth is a complex issue in that many factors interact towards a certain level or rate of growth. Though growth models parsimoniously focus on some but main determinants of growth, for simplicity, finding factors that affect growth performance of nations is not as such simple. There could be a long list of determinants of growth with interwoven interaction among themselves. For instance, Sala-i-Martin (1997) has surveyed a number of production function studies and found that different authors have included at least 62 different variables to explain growth (in Thirlwall, 2003, P. 172). However, Maddison (1988) has classified factors that cause growth differences between countries of the world as *'ultimate'* and *'proximate'* factors. According to him, the domain of ultimate factors include the characteristics of institutions, degrees of social conflict, international orders, ideology and economic policies while 'proximate' (measurable) causes consist of natural resources, raw labour, human capital, physical capital, demographic changes, technological progress and diffusion, international trade and changes in economic structure (in Mekonnen, 1999, P. 3). Maddison himself (1997) has reclassified these factors into four main building blocks. Appreciating world growth as "Since 1820, world per capita income has risen eight-fold", he says

> *There have been four main causal influences which go a long way to explain why such a large increase has been feasible. These are: (a) technological progress; (b) accumulation of physical capital in which technical progress usually needs to be embodied; (c) improvement in human skills, education, and organizing ability; and (d) closer integration of individual national economies through trade in goods and services, investment, intellectual and entrepreneurial interaction. In the literature on economic growth, there are also three other elements considered to*

> *have had an important causal role. These are economies of scale, structural change, and the relative scarcity or abundance of natural resources. All of these causal influences have been interactive so it is not easy to separate the specific role of each* (P.1).

Alternatively, if we mesh the macro-determinants of growth considered by Thirlwall (2003, P. 177-183) and Barro (1991, P. 407-439, 2003, P. 273), the list includes the initial level of per capita income, saving and investment ratios, fertility or population growth, variables that affect the productivity of labour (such as education, health, embodied technological spill over, FDI and others), R & D, trade, political stability (as measured by proxies like political assassinations, revolutions, coups and others), government expenditure, economic system (socialism, mixed economy or free market systems), market (price) distortions, inflation, fiscal and monetary variables and other factors. Here, it is important to note that there are widely overlapping similarities in that trade and investment are included in both of the two alternative categorical lists.

Most empirical studies base their analyses on variables in the above domain although it is possible to cite a number of more determinants of growth. Thus, notwithstanding the possibility of including other more factors in describing growth, it is unlikely to be exhaustive in incorporating all the determinants in theoretical as well as empirical models. Indeed, all determinants of growth have their own contributions to or influences on growth. Nonetheless, the respective influence of factors would vary one from the other or some may work through others. Thus, it might be advisable to focus on certain macro-determinants. It seems partly due to this idea that most empirical studies include only a few determinants and found that income growth is positively related to initial human capital (robustly), investment ratio (robustly), political stability, and negatively related to initial level of per capita GDP (robustly), government share of consumption, and market distortions while it is insignificantly related to the share of public investment (Barro, 1991, P. 407-437, 2003, P. 231-274, Mankiw *et al*, 1992, P. 425-433 & Thirlwall, 2003, P. 177-181).

Hence, following the emphasis of the existing literature on investment as the main path of expanding a productive capacity and openness to trade as a means of technology transference from advanced to less advanced countries and a vent for

surplus products, we delimit our investigation to focus on the interactive links between investment, trade and growth with the expectation of self-reinforcing synergies amongst themselves. As indicated on the summary table of Thirlwall (2003), in the studies of Levine and Renelt (1992) and Levine and Zervos (1993) trade has shown fragile behaviour while it is significantly included in Knight's *et al* (1993) growth regressions. Refereeing to the above studies, Thirlwall says "Interestingly, the variables of significance turnout to be those which have traditionally been at the heart of the main stream growth and development theory, particularly the importance of investment and capital accumulation." (P. 181). However, the question why the role of trade shows fragility remains unaddressed with a normative justification as it might have been working through investment. Thus, the investment-trade-growth link remains elusive. The plausible feedback between trade and investment does not get due attention. Thus, this study attempts to contribute to the existing debate focusing on the investment-trade-growth link using a time-series case study on a less investigated area: *the Ethiopian economy*.

2.2. Investment-Trade-Growth Connections

In the investment-trade-growth relation, plausibly, there could be bi-directional channels through which one causes the other. It would not be unreasonable if we hypothesise that *international trade would lead to greater investment*, *the latter would foster the former and thereby both engender growth.* International trade leads to greater investment by allowing import of investment goods particularly if the country is developing. Imports could increase owing to two reasons. Firstly, the demand from exporting firms would be high. The second is the effect of foreign exchange earnings from exports. Particularly, if the need for investment is emanating from the exporting sector, the process will follow a self-generating circular causation. The exporting sector could import capital goods that are likely to embody state-of-the-art technologies and export more. In such a manner, the process continues without limit. If the economy is outward oriented, domestic firms are encouraged to produce for international market. This lifts the demand constraint that would have been in effect had the economy been inward looking. Hence, investment and production would not be demand constrained. The learning effects (imitating foreign practices) could also motivate to start a new venture or expand the existing one. As long as trade involves imports and business trips, the acquisition

of new ideas and technologies is inevitable. On top of that, if there is a conscious action to bolster imitation, similar to the *reverse engineering and technology licensing schemes* of some SEA countries, international trade liberalization opens the door to new technologies and ideas wider.

Looking at the reverse causality also enables to understand some of the mechanisms through which investment would foster trade. As investment increases, the volume and quality of products would be improved providing competitive advantage to the producing firm and positive externalities to the economy. If the economy is outward oriented, the hypothesis would be more realistic as more of the investment is supposed to be in the exporting sectors which are not constrained by demand limits. This, in its own, enables to improve foreign exchange earnings relaxing the restraint of importing more. In sum, investment fosters both exports and imports or total international trade. The other channel is that investment increases domestic demand which is one of the stimuli to more domestic investment, and attraction for FDI and imports. In this sense, domestic investment increases exports production, attracts imports and FDI. If this argument is persuasive, it could be sensible to prescribe for developing countries to begin with the promotion of domestic investment targeting at export expansion, FDI attraction and then faster growth.

In the growth literature, the attributes of investment attains greater attention. In emphasizing its importance in the process of growth, Bellemore (1964) explains the role of investment as a vital one. The economic essence of investment is attached to capital formation. According to him, the greater the production and employment of capital goods, the greater the capacity to produce goods and services. He says also, the process is self-generating. A larger stock of capital goods will allow greater production, and greater production will generate potentially larger surplus to be saved in capital goods and so on. This is the manner in which the productivity of workers and the level of living could be improved (P. 1). After his extensive analysis, Arthur Lewis (1965) also says "…investment is necessary for economic growth. From this it follows, in a passive sense, that saving is necessary to growth, because investment has to be matched by saving." (P. 213-214). Besides, in their applied research on Namibian economy, Shiimi and Kadhikwa (1999) state that the effects of investment on economic growth are two-folds. Firstly, investment generates part of aggregate demand in the economy stimulating production of investment goods

which in turn leads to high economic growth and development. Secondly, capital formation improves productive capacity enabling an economy to produce more output. Investment in new plant and machinery raises productivity growth by introducing new technology which also could lead to faster economic growth (P. 4).

In general, albeit in varying approaches and degrees of emphasis, all growth models extending from the classical to the neoclassical and endogenous growth thoughts give crucial role to saving and investment in determining, at least, the level of per capita income and standard of living (neoclassical), or the rate of growth of output and living standards (Barro, 1991, P. 429, Plosser, 1992, P. 67, Jones, 2002, P. 32, Thirlwall, 2003, P. 143, Sorensen and Whitta-Jacobsen, 2005, P. 77, Romer, 2006, P. 18-19). That seems why different intellectuals underscore the requisite of investment to growth and development.

Trade liberalization is the other policy prescription for faster growth. It is one of the main explanations given to the miraculous growth of the South East Asian countries and their descendants like China, Vietnam and the Philippines (World Bank, 2006, P. 311, UNCTAD, 2008, P. 4). Based on its study on the trade and growth performances of world countries in the period 1990-2004, the World Bank concludes "In an integrated world, trade spurs growth and growth spurs trade" (2006, P. 311).

From the empirical perspective, lots of works have also been done on the trade-growth link. Surveying many seminal works and using his own empirical analysis, Edwards (1998) has provided evidence as to how openness affects growth. According to him, Romer (1986) and Lucas (1988) have offered persuasive support for the properties that openness affects growth positively, focusing on externality effects as the core of their arguments. In addition, Grossman & Helpman (1991), Romer (1992) and Barro & Sala-i-Martine (1995) have argued that countries that are more open to the rest of the world have a greater ability to absorb technological advances generated in leading nations (P. 1). Based on the coefficient of openness in growth equations obtained from OLS and IV estimations, data from 93 countries, Edwards also concludes that more open countries have indeed experienced faster productivity growth although causality issues are left open (1998, P. 396). Hence, all these ideas share the notion that regards trade as an engine of growth. That seems why eliminating artificial trade barriers, i.e., tariffs, quotas, subsidies, voluntary

export restraints, discriminatory government procurements and local content distortions are at the heart of trade liberalization policy.

The trade-growth transmission channels can be broadly classified into four: the channels of investment, productivity, market, and increasing government commitment/ policies towards spurring growth (Wacziarg, 2001, P. 395-398, Yanikkaya, 2003, P. 73, Anderson and Babula, 2008, P. 9). Similar explanations have also been offered by others, as well. Thirlwall (2003) emphasizes as there are several mechanisms through which trade liberalization may influence the long-run growth rate of an economy. According to him, more trade encourages investment which confers externalities on an economy. If the investment goods come from abroad, greater trade means large volume of output and greater scope of specialization, leading to learning by doing. Trade leads to technology transfer and the prospect of faster total productivity growth (P. 639). Sachs & Warner (1995) also stresses that trade liberalization not only establish powerful linkage between the economy and the world system, but also effectively forces governments to take actions on the other parts of the reform program under the pressure of international competition (P. 2). All the above referred studies focus mainly on a few important mechanisms through which trade may affect growth. These include the channels of investment, new ideas and technology transfer, access to wider market and the discipline that trade imposes on governments, all favouring growth.

In spite of numerous studies explaining the separate episodes and determinants of growth, trade and investment in various spatial and temporal horizons, the evidence on the investment-trade-growth connexions in developing countries is still insufficient and inconclusive. The role of trade liberalization in the process of economic growth is still ambiguous. Some found a lagging positive association (Greenaway *et al*, 1998, P. 1558) while others found it fragile, with a hypothetical justification as it could be working through investment as elaborated in Thirlwall (2003, P. 180-181). Furthermore, the plausible bi-directional link between trade and investment does not get due attention, being in need of further studies. Hence, investigating the investment-trade-growth nexus in the Ethiopian context becomes the objective of this research.

3. A Glimpse of the Ethiopian Socio-Economic Situation

Ethiopia, as one of the least developed countries, has been backward in socio-economic development. Agriculture has been the main source of income and stay of the population. Its overall situation had been deteriorated by prolonged internal & external wars, wrong policies and recurrent drought coupled with ever-rising population resulting into economic stagnation, image deterioration and unattractiveness to investment expansion.

Nonetheless, recent efforts based on pro-poor development policies focusing at economic recovery has started to show promising achievements in socio-economic performances in general attributed to the special emphasis given to the enhanced move to implement *Agricultural Development-Led Industrialization (ADLI)* strategy and deepening policy reforms. Particularly, performances in the recent half a decade years are encouraging. Table 1 shows the recent situation of the country compared to that in the last two decades. As of 2006, the Ethiopian population had been estimated about 72.2 million. In 2000-2006, on average, the Ethiopian urban population is estimated to be only 16 percent while it is estimated to be 36% and 30% for Sub-Sahara Africa and low income countries, respectively. From the whole Ethiopian population, the agricultural employment accounts around 80% while industry & construction hold 8%, and the rest 12 % are employed in government and service sectors (see Figure 1).

The Ethiopian people are living in an extremely low standard. In 2006, the Gross National Income (GNI) per capita of Ethiopia, as measured with atlas method, was estimated to be 180 USD while the respective figures for sub-Saharan Africa (SSA) and low-income countries were estimated to be USD 842 and 650, respectively. Ethiopian GDP had shown a decline from 9.8 billion USD in 1986 to 8.5 billion USD in 1996 while it revived to 11.4 billion USD in 2005 and 13.3 billion USD in 2006. The percentage of people living below the national poverty line (a dollar a day) was estimated to be 44% for the period 2000-2006, on average, while it was estimated to be 38.7% in 2006 fiscal year alone. In the period 2002-2006, the rate of adult literacy in Ethiopia was 36% while the averages of Sub-Saharan and low-income countries were 51% and 61%, respectively. According to CIA (2008), rate of adult literacy has reached 42.7% in 2007. In gross primary enrolment, Ethiopia's achievement was 100%, which is inspiring, while that of the Sub-Saharan and the low-income averages were 92% and 102%, respectively.

Table 1: Some Indicators of the Overall Ethiopian Socio-Economic Situation

Main Indicators			Ethiopia	SSA	Low Income	1986	1986 - 1996	1996	996 - 2006	2005	2006
Population (mill, 2006)			72.7	770	2,403	-	-	-	-	-	-
Urban Population (%, 2000-06)			16	36	30	-	-	-	-	-	-
Literacy (% of population aged 15+, 2000-2006)			36	59	61	-	-	-	-	-	-
Gross primary enrolment[3] (%, 2000-06)			100	92	102	-	-	-	-	-	-
GNI Per Capita (US$, 2006)			180	842	650	-	-	-	-	-	-
GDP (USD, billions)			-	-	-	9.8	-	8.5	-	11.4	13.3
Poverty[4] (%, 2000-06*)			44*	-	-	-	-	-	-	-	38.7
Performance of the Ethiopian Economy	Gross Domestic savings[5]/GDP (%)					11.6	-	9.6	-	-1.6	-6.1
	Gross National savings[6]/GDP (%)					14.3	-	17.4	-	13.7	9.4
	Structure of the Economy (% of GDP)										
		1	Agriculture			56.3	-	56.7	-	46.6	47.3
		2	Industry			11.7	-	10.5	-	13.8	13.5
			Manufacturing			*4.6*	-	*5.1*	-	*5.4*	*5.3*
		3	Service			32	-	32.8	-	39.6	39.2
	Average Annual Growth Rates	1	GDP (%)			-	1.7	-	4.6	10.2	9.0
		2	GDP Per Capita (%)			-	-0.9	-	2.3	8.2	6.8
	Average Annual Growth										
		1	Agriculture			-	3.0	-	2.8	13.4	11.2
		2	Industry			-	-2.1	-	6.2	8.1	*7.4*
			Manufacturing			-	*-3.5*	-	*4.4*	8.0	*8.1*
		3	Service			-	1.4	-	5.9	8.1	8.5

Source: Compiled from World Bank Data, 2007

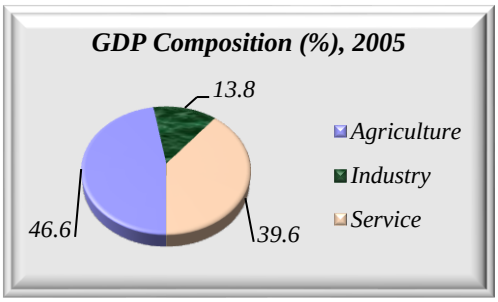
[3] Gross primary enrolment is measured as the percentage of school age population.
[4] Poverty is measured by percentage of population below the national poverty line.
[5] Gross domestic savings are calculated as the difference between GDP and total consumption by households and the general government.
[6] Gross national savings is gross domestic savings plus net income and net current private transfers from abroad.

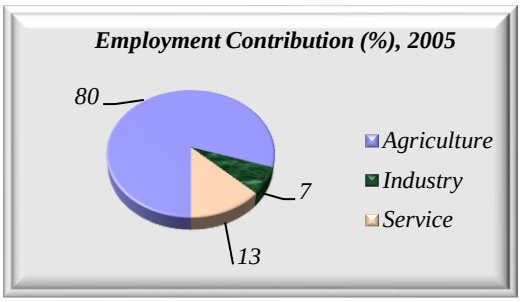
The disappointing economic performance of Ethiopia might have been deep-rooted in the past eras. Let alone centuries, a contrast between the recent two decades, 1986-1996 & 1996-2006, shows that the performance of the economy under the first decade was worse. Indeed, per capita income was declining at an annual average of 0.9%. Whereas, the economy performed better in the second in that both GDP and per capita GDP grew at positive rates with slight tendencies of economic transformation from the agricultural ubiquity (56.7% - 47.3%) towards service (32.8% - 39.2%) and a little to the industrial (10.5%-13.5%) wings. However, the transformation has been lethargic and unhealthy in that the economy is tending to transform to the service sector that most of its activities are subject to diminishing returns in productivity and could not play a leading role in the development process while the promising industrial sector remains stagnated for long time (Table 1).

The industrial sector has remained at its infant stage in that its contribution to the economy is very minimal. It was accounting for about 12% in 1986. But, after 20 years, its contribution has not increased more than 2 percentage points. The manufacturing sub-sector has also shown a sluggish increase from 4.6% in 1986 to 5.3% in 2006. Thus, the sluggish drag of the economic transformation towards industrialization seems at the root of the economy's stagnation. Annualized average growth rates of the respective sub-sectors explain the bad performance in the first and improvements in the second decades (see Table 1).

However, still the economy is highly agrarian (Figure 1) making it very sensitive and vulnerable to natural shocks particularly rain/drought, in addition to its nature of diminishing productivity and demand inelastic limits.

Figure 1. GDP Composition and Employment Contribution of the Ethiopian Economy, 2005





Source: Table 1 (World Bank, 2007)

Source: Data from World Bank, WDI, 2010

Using another set of data, the economic performance of the country has been evaluated based on the political regimes coinciding with different economic systems, the pre-1974 feudalist, the 1974-1991 socialist and the post-1991 market orientated economic systems. Although it does not cover the whole periods of the three economic systems, Table 2 presents the average achievements of four macroeconomic variables for 1962-2005, on five year basis.

According to Table 2, on average, real GDP had been growing at declining rates for three successive five-year terms. It declined from 4.7% in 1962-66 to 4% in 1967-71 and to 1.3% in 1972-76. Following its moderate improvements in the two subsequent five-year periods, it sharply fell to -0.01% in 1987-92, most likely due to the power-shifting war. Following the improved average growth performance (5.7%) of the 1993-2000, the economy had enjoyed the best average rate of growth in the recent period, 2001-2005 (6.6%). Here, it is noteworthy to remember that the *coup d'état* of the feudal and the overthrow of the socialist systems were carried out in 1974 and 1991, respectively. Hence, the growth performances, in the time ranges in which these years of critical political turmoil lie, had been the worst of all signifying the worth of political stability to prosperity.

Inflation had two digit figures in the periods that include years of *power-shift*. According to Gylfason (1999), high inflation could be a symptom and/or a result of economic mismanagement, imperfect institutions such as fragile banks, financial market and other factors (P. 1039). The performance of exports relative to import was high and increasing during the feudal system and had fallen steadily reaching

below half of imports in the last period, 2001-2005. For the whole pre-1992 period, openness of the country measured by the volume of exports plus imports as a percentage of GDP had been fluctuating around an average of 24.7% with its lowest of 20.2% in 1987-92 and its highest 29.1% in 1977-81. During the period 1962-1992, it has never been above 30%. Nonetheless, in the period 1992-2000, the measure of openness rose to 37.8% followed by further rise to 42.6% in the period 2001-2005. Hence, these facts clearly show the relatively closed nature of the economy and the suppression of trade in the pre-1992 while relative improvements in trade openness and liberalization are exhibited in the post-1992 period.

Table 2: Major Macro Economic Indicators of Ethiopia, 1962-2000

Indicators	Performance Periods							
	1962- 1966	1967- 1971	1972- 1976	1977- 1981	1982- 1986	1987- 1992	1993- 2000	2001- 2005
Real GDP Growth Rate (%)	4.7	4.0	1.3	2.3	3.7	-0.01	5.7	6.6
Total Investment as % of GDP	13.5	12.6	9.7	11.0	14.3	13.4	15.9	23.0
Private investment as % of GDP	3.9	4.1	3.1	2.7	3.7	4.0	4.8	5.5
Saving as % of GDP	11.4	11.0	9.0	4.7	6.5	7.1	5.3	19.2
Inflation (%)	-	1.7	11.4	10.7	3.4	11.8	3.8	3.44
Exports & Import as % of GDP	24.1	22.1	26.5	29.1	26.0	20.2	37.8	42.6
Export as % of Imports	83.6	86.6	95.8	53.6	53.7	52.3	56.4	47.2

Source: NBE and MEDaC (2002); Private investment as % of GDP is computed from PWT, Version 6.2 (2006), and all except the Private investment data for 2001-2005 are taken from the World Bank, WDI Online Database, 2010.

Investment has been very low and declining over time in spite of the recent revival. On average, total investment as a percentage of GDP revealed the same fall and rise trends. It declined from 13.5% (1962-66) to 9.7% (1972-76) while it appeared at its highest (23%) in 2001-2005. Private investment is extremely thin in Ethiopia. It has never constituted more than 33 percent of total investment. The slight revival of the

average rate of private investment (saving) from 3.7% (6.5%) in 1982-1986 to 4% (7.1%) while total investment declined by 0.9% in the same period could be reflecting the effects of policy shift from the socialistic to the mixed economic system enacted within the last years of the 1987-92 period. From these facts, one can understand that the middle socialist system had experienced the worst of the three while the last market-oriented system had achieved relatively finest achievements in real GDP growth and rates of investment though performances in the recent years are not considered. Hence, political systems, the accompanying policies and the interwoven adverse effects of political and macroeconomic instabilities (exacerbated by the devastating prolonged civil war) seem among the causes for the deterioration of the economy in general, the private sector in particular and inter-temporal performance differences. However, this study is not intended to investigate the impacts of political systems & policies enacted. Rather, it attempts to address a question: *how investment, trade and growth interact in the economy?*

4. Empirical Investigation on the Investment-Trade-Growth Links

This section attempts to provide some evidence on the dynamic interdependence between private investment, trade openness and economic growth, expecting three feedback links: *investment vs. trade openness;* i*nvestment vs. economic growth; and, trade openness vs. economic growth*.

4.1. Data and Related Tests

The data set is annual time series covering the past five decades (1950-2003) with a total of 54 observations, involving three variables: *trade to GDP (openness) ratio, private investment and real per capita GDP.* The GDP data series is given in 2000 constant US dollar price adjusted for Terms of Trade (TOT) changes while private investment and trade openness are given as percentage shares of GDP. The data are taken from Heston, Summers and Aten's Penn World Tables, Version 6.2 (2006). Since the original investment data is given as a percentage share of GDP, multiplying the share by GDP and then dividing by 100 generates the annual real dollar value of investment, adjusted for TOT. The descriptive statistics of the levels data have been displayed on Appendix Table 1. As the variables defined above are typical time series, they may involve non-stationary or unit root process. Working with non-

stationary time series in that the mean, variance and covariance are not time-invariant could lead a researcher to end-up with a spurious regression superficially looking good but seldom reflecting the true relationship between the variables of interest. Hence, a Unit Root test of stationarity has been conducted using Augmented Dickey Fuller (ADF) test developed by Dickey and Fuller (1979).

i. Unit Root Test of Stationarity

The formal Unit Root test of stationarity has been conducted on the present and 4 lag values in that the ADF statistics are used at 5% and 1% significance levels on the log levels & their first-differences. In addition to its ability to accommodate higher-order autoregressive error processes or some forms of serial correlation, the ADF test is taken for its superior property of taking short-run dynamics into account to whiten the residuals, compared to the Dickey–Fuller (DF) test (Greene, 2003, P. 643). Moreover, indicative of the powerful finite sample features of the DF tests over the Phillips-Perron (1988) tests, Greene (2003) explains "The Dickey–Fuller procedures have stood the test of time as robust tools that appear to give good results over a wide range of applications. The Phillips-Perron (1988) tests are very general, but appear to have less than optimal small sample properties" (P. 645). Hence, for its advantage in accommodating higher order serial correlations over the DF and superior finite sample properties over the Phillips-Perron tests, the ADF unit root test of stationarity has been employed based on the following autoregressive specification that contains lagged differences with the optional inclusion of a constant, or a constant & trend:

$$\Delta y_t = \alpha + \mu t + \beta - 1\ y_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta y_{t-i} + \varepsilon_t$$

In this test, the null hypothesis is that *'the underlying time series is non-stationary ($\beta - 1$= 0 implying a unit root)'* against the alternative hypothesis of *'the time-series is stationary ($\beta - 1$<0)'*. Hence, a rejection of the null hypothesis implies stationarity of the series under consideration. As indicated in Table 3, the ADF test on the levels data series does not reject the non-stationarity hypothesis at both 1% and 5% significance levels. The stationarity test results show that the levels series of these variables are found non-stationary while their first-differences are stationary dominantly up to the fourth lags at 5% and 1% significance levels. The Unit Root test

of stationarity is not altered by the alternative inclusion of a constant or a constant & trend. Hence, we characterize the data series as integrated of order 1, I(1).

Table 3: Unit Root Test Results with *Constant*, and *Constant and Trend*

Ho: *Non-stationary*

Variables	t - ADF With Constant					t - ADF With Constant and Trend				
	Lags					Lags				
	0	1	2	3	4	0	1	2	3	4
inv	-1.023	-0.880	-0.861	-0.964	-1.049	-3.658*	-3.186	-3.127	-2.995	-2.840
open	-0.980	-0.890	-1.131	-0.843	-0.834	-1.898	-1.838	-2.262	-1.853	-1.899
rgdppc	-1.565	-1.001	-1.091	-1.087	-1.364	-2.484	-1.714	-1.859	-1.912	-2.419
Δinv	-8.517**	-5.852**	-5.088**	-4.683**	-4.147**	-8.432**	-5.798**	-5.036**	-4.643**	-4.071*
Δopen	-7.238**	-4.329**	-4.468**	-3.801**	-3.356**	-7.192**	-4.309**	-4.436**	-3.756*	-3.502*
Δrgdppc	-9.785**	-5.149**	-4.003**	-2.880**	-2.510**	-9.673**	-5.058**	-3.907*	-2.803	-2.464
Critical Values	5 %	(-2.92)		1 %	(-3.57)	5 %	(-3.50)		1 %	(-4.16)

Note: *Lower case letters indicate the natural logarithmic levels of the data.*

Despite the non-stationarity of each data series, there could be a linear combination between the variables that could produce stationary process. Hence, whether contegrating relationships exist should be checked before passing to the next specification steps.

ii. Cointegration Test

With the help of Johansen's (1988) Trace test for cointegration of I(1) with the inclusion of up to 4^{th} lags, we found that there is no cointegrating relationships between the variables considered.

Table 4: Johansen's Co-integration of I(1) Test results (with 4 lags)

H0: Co-integrating rank, r ≤ p, (where p = 0, 1, 2)

Null Hypothesis	Trace Statistic [Prob]	Implications
r = 0	21.793 [0.320]	1. Do not reject the null hypothesis (r = 0)
r ≤ 1	10.594 [0.242]	2. VAR in differences is stable
r ≤ 2	2.656 [0.103]	3. No long-run relationships

The use of a year dummy variable as an unrestricted regressor (YD = 1 for years 1955 – 1960, 1984, 1987, 1988 and 1991 and zero otherwise), owing to some outlying observations, does not alter the outcome of the test results.

4.2. Empirical Model Specification and Estimation Methodology

Appropriate to the properties of the data set and the research objective, Sims' (1980) Vector Autoregression (VAR) methodology has been proposed as a solution to the estimation problem. The stationarity test results reported in Table 3 show that the levels series of the variables are non-stationary while their first-differences are stationary dominantly up to the 4th lag. In addition, Johansen's (1988) Trace test indicates the non-existence of cointegrating relationships amongst the variables (r = 0) implying VAR in differences is stable; no long-run relations between the variables while it could be informative about short-run relationships. Hence, we specify a VAR(*p*) model with the first differences of the variables as:

$$\Delta \boldsymbol{y_t} = \boldsymbol{\alpha} + \sum_{i=1}^{p} \boldsymbol{\beta}_i \Delta \boldsymbol{y_{t-i}} + \boldsymbol{\varepsilon_t} \qquad \textbf{(1)}$$

where Δ is the change in our vector of endogenous variables $\boldsymbol{y_t}$ *(logINV, logOPEN & logRGDPPC) at time t; α is a vector of constant terms;* $\boldsymbol{\beta}$ *is a matrix of parameters and* $\boldsymbol{y_{t-i}}$ *is a vector of pre-determined variables, at lag i; and* $\boldsymbol{\varepsilon}$ *is a vector of white noise disturbances.*

The next step is to determine the optimal lag length (*p*). The test results, displayed in Table 5, show that lags 2-4 are not significantly different from zero in both tests for each lags separately and for all 2-4 lags jointly while only the first lag appears significant.

Table 5. Optimal Lag Length Determination

H0: the lag coefficient is zero

Tests on the significance of each lag			Joint Tests on the significance of lags up to 4		
Lag	**F-Test Value [Prob]**	**Decision**	**Lag**	**F-Test Value [Prob]**	**Decision**
Lag 4	F(9,82) = 0.431 [0.914]	Do no reject Ho	Lag 4 –4	F(9, 82) = 0.431 [0.914]	Do no reject Ho
Lag 3	F(9,82) = 1.419 [0.193]	Do no reject Ho	Lag 3 - 4	F(18, 96) = 0.833 [0.658]	Do no reject Ho
Lag 2	F(9,82) = 0.417 [0.922]	Do no reject Ho	Lag 2 - 4	F(27, 99) = 0.669 [0.884]	Do no reject Ho
Lag 1	F(9,82) = 3.289 [0.002]***	Reject Ho	Lag 1 - 4	F(36,101) = 1.422 [0.088]*	Reject Ho

Based on these information, a *vector autoregressive of order 1, VAR(1)* model is specified as*:*

$$\Delta \boldsymbol{y_t} = \boldsymbol{\alpha} + \boldsymbol{\beta}\Delta \boldsymbol{y_{t-1}} + \boldsymbol{\varepsilon_t} \qquad \textbf{(2)}$$

That could be expanded as a 3-dimensional vector of equations:

$$\begin{matrix} \Delta inv_t \\ \Delta open_t \\ \Delta rgdppc_t \end{matrix} = \begin{matrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{matrix} + \begin{matrix} \beta_{11}\ \beta_{12}\ \beta_{13} \\ \beta_{21}\ \beta_{22}\ \beta_{23} \\ \beta_{31}\ \beta_{32}\ \beta_{33} \end{matrix} \begin{matrix} \Delta inv_{t-1} \\ \Delta open_{t-1} \\ \Delta rgdppc_{t-1} \end{matrix} + \begin{matrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{matrix} \qquad \textbf{(3)}$$

The coefficients from the estimation of this specification will be interpreted as follows: *the cross-diagonal coefficients are short-run spillover effects of one over the other. The diagonal coefficients represent the effect of the past on its own current.* The variables are the first-differences of the logs of private investment, trade openness (trade to GDP ratio) and real per capita GDP. The descriptive statistics of the data of the three variables are presented in Table 6.

Table 6. Descriptive statistics of the first differences (growths) of the data

	Statistical Summary				Correlation Matrix		
Variables	**Mean**	**St. Dev.**	**Min**	**Max**	**Δinv**	**Δopen**	**Δrgdppc**
Δinv	0.086	0.220	-0.45	0.63	1.000		
Δopen	0.035	0.137	-0.29	0.51	0.370	1.000	
					(0.006)		
Δrgdppc	0.013	0.067	-0.23	0.22	0.009	-0.230	1.000
					(0.949)	**(0.097)**	

The figures beneath the correlation coefficients are significance p-values.
Sample period: 1951 – 2003

4.3. Results of VAR(1) Estimation

According to the diagnostic test results, the explanatory powers of the estimated models are modest. The residuals from each of the equations and the system are checked for no-autocorrelation, normality and homoscedasticity properties. As indicated in the lower panel of Table 7, all the tests have not rejected their null hypotheses of *no-autocorrelation, normality and homoscedasticity* for all equations separately and for all vectors of the variables jointly at all conventional significance levels except normality in the investment equation where it is rejected marginally at 10 percent significance level. Hence, the fulfilment of the required properties in all

of the equations and their system jointly are in support of the use of the estimated models for the intended analyses. Furthermore, the non-serial correlation in errors is preserved and the effective number of observations (49) is greater than 30 so that estimates and test results remain valid to rely on, *by the central limit theorem.*

Based on these justifications, our causality estimates between investment, trade openness and economic growth suggest that there is no feedback link between any pair of the variables considered out of the 6 ($n \times n\text{-}1$) expected spillover effects; where n is the number of endogenous variables. Nonetheless, we have observed two uni-directional positive short-run causalities that run from real per capita GDP to trade openness and from trade openness to investment. The uni-directional causality running from real per capita GDP to trade could be indicating the direct positive effects of increased production on either the supply of exports or the demand for imports, or both. The identified positive effect of growing trade openness on investment could also be interpreted as a multifarious impact of trade in that exports relieve the foreign exchange stress which is necessitated to import investment goods and indispensable intermediate inputs. Trade also provides access to large markets so that investment and production could not be demand constrained, opportunities to learn from foreign practices and facilitates the transfer of new ideas such as new ways of doing things, efficient management styles, developing new products, marketing skills, etc.

Besides, two negative own impulse-response transmission mechanisms from lagged investment to current investment, consistent to our single equation estimation results of the full sample period (Mekonnen, 2011, P. 176); and, from lagged per capita GDP to current per capita GDP (perhaps exhibiting short-run cyclicality) have been observed. The alarming evidence is that the one period lag of either of the growth force is not supported to provide information in explaining real per capita GDP growth of the country. Rather, the estimates are signed unexpectedly negative despite insignificant (see Table 7). It is a contradiction to our finding for the SSA economies on average (Mekonnen, 2011a and 2011b, forthcoming). In this sense, Ethiopia, where the mechanisms for the translation of investment into grapes of economic growth seem malfunctioning, may not be an ideal representative of the SSA economies.

Table 7: Results of Parameter Estimation and Diagnostic Tests, VAR(1)

Endogenous variables: Δinv, Δopen, Δrgdppc; Sample: 1955 - 2003; Obs = 49

			Equations in the System of VAR (1)		
			Δinv	**Δopen**	**Δrgdppc**
			Coef. [P-Value]	**Coef. [P-Value]**	**Coef. [P-Value]**
Vector of	Δinv_1		-0.305 [0.035]**	0.118 [0.141]	-0.051 [0.197]
	Δopen_1		0.412 [0.068]*	0.058 [0.644]	-0.062 [0.313]
	Δrgdppc_1		0.499 [0.242]	1.234 [0.000]***	-0.373 [0.003]***
	Constant		0.032 [0.318]	-0.007 [0.689]	0.025 [0.006]***
Diagnostic Tests	R^2(LM)		0.21		
	Equations	*AR1-4 Test F(5,38)*	*0.574 [0.683]*	*0.703 [0.595]*	*1.880 [0.133]*
		ARCH1-3 F(5, 33)	*0.014 [0.998]*	*1.068 [0.374]*	*0.936 [0.433]*
		Normality Chi^2(2)	*5.124 [0.077]**	*0.202 [0.904]*	*2.372 [0.305]*
		hetro test F(9, 33)	*0.959 [0.490]*	*0.844 [0.582]*	*1.380 [0.237]*
		helto-X test F(17, 25)	*1.151 [0.366]*	*0.649 [0.820]*	*1.678 [0.117]*
	Vector	*AR1-4 Test F(36, 86)*	*0.882 [0.656]*		
		Normality χ^2(6)	*5.856 [0.439]*		
		hetro test F (54, 147)	*0.886 [0.690]*		
		helto-X test F(102, 121)	*1.082 [0.338]*		

Note: 1. *Numbers in parentheses are P-value; 2. In addition to the removal of the first 4 observations, two year dummy variables have been employed to account for outlying observations and correct for normality problems in the distribution of the variables (INV: YD_1 = 1 for years 1955–1960 & 1984; GDP: YD_2 = 1 for years 1984, 1987, 1988 and 1991 & zero otherwise); hence, forecasting is impossible.*

As indicated by the estimated correlation coefficient (-0.23), the association between trade openness and economic growth are also negative. The results on the last column of Table 7 show as there is no significant causal effect from trade openness to economic growth in Ethiopia. This is also a contradiction to our bi-directional positive feedback finding from the 3SLS and SUR analyses for SSA economies, on average (Mekonnen, 2011a and 2011b, forthcoming). All the above analyses have also been supported by the respective impulse-response functions (IRFs) (Appendix Figure 1) and short-run Granger causality test results (Appendix Table 2). The stability and other behaviours of the estimated VAR model have also been illustrated by the companion matrix and the scaled residuals plotted as Appendix Figures 2 and 3.

There could be a number of reasons for the non-recognizable estimates of investment and trade openness in the growth equation of Ethiopia including the low quantity as well as poor quality of investment, exports and imports or the methodological pitfalls, the behaviours of the data set and its inadequate treatment.

Related with the quantity of investment, it could be worth remembering that the share of private investment in GDP has stayed below 6% up to 2003. This small share of private investment in GDP might have made its growth contribution negligible as its weight is less than 0.06. The trade performance has also been suppressed until recently; particularly, the performance of exports relative to imports has been continuously declining. On average, it decline from 86.6% in 1967-1971 to 56.4% in 1993-2000 and then to 47.2% in 2001-2005 (refer Table 2). This relative decline of exports could have resulted in a persistent deficit in the trade balance of the country exacerbating the balance of payments difficulties; i.e., foreign exchange stress obstructing the importing capability and then the efforts of relaxing the supply capacity of the country.

In addition to the quantity considerations, studies also emphasis the underlying conditions and the quality of investment, the type of products traded and the stock of human capital for investment and trade to be effective. For instance, Gylfason (1999) argues that without factors that encourage high-quality investment like stable prices and proper incentives, gigantic investment alone does not guarantee rapid and sustainable growth (P. 1049-1050). This could be one of the reasons for the insignificance of investment in the growth estimations of SSA as discussed in Devarajan, Swaroop and Zou (1996), Dollar and Easterly (1999), Devarajan, Easterly and Pack (2001) where investment is argued to be high but not productive, and that of ours obtained from this study, using VAR estimation.

While trade is regarded as a conduit of technology-knowledge transference from advanced to less advanced countries, as predicted by the endogenous growth models, accessing the available technology-knowledge is argued to be conditional on the absorptive capacity of the lagging economies. The latter is highly dependent on the stock and quality of human capital which is not sufficiently available in the SSA countries like Ethiopia, worsened by endless brain drain. Furthermore, agrarian economies exporting dominantly primary products, for that Ethiopia is a typical

example, may not benefit from their trade engagements. There are studies that argue as specializing on primary exports as unpromising. Justifying with the adverse trends and the high variance of the prices of primary products, Bleaney and Greenaway (2001) conclude "Specialization in primary product exports reduces growth" (P. 491). A synthesis of similar arguments have also been provided in Thirlwall (2006, P. 528-529). However, the results indicating the non-recognizable effects of investment and trade may not be associated with a single cause; rather, many of the above reasons might have contributed to the observed weakness of the econometric estimates.

Related with the data and methodological pitfalls, the employed annual time series data may not be sufficient while VAR estimation is data intensive; differencing might have caused loss of some useful information; and, significant correlation between the growths of investment and trade variables with a coefficient of 0.37 (see Table 6) may also indicate their modest collinearity. In addition, if trade enhances economic growth through its impact on investment, their simultaneous inclusion into growth regressions could lead to the insignificance of both. Hence, their alternative inclusion in the growth estimations could be among the approaches suggested for future research.

On top of the above suspicions, time series studies generally are also observed to produce such weak results. Reppas and Christopoulos (2005) say "…causality tests are in general unsupportive of the export-led growth hypothesis" (P. 930). Substantiating with Ram's (1987) and Greenaway & Sapsford's (1994) weak results, Thirlwall (2006) asserts that the relationship between exports and growth is much weaker when time series studies are conducted for individual countries against the strong positive associations supported by cross-section studies (P. 534). Thus, if not reflecting the true relationships, our VAR estimation results could have appeared weak due to the employed time series data or estimator, requiring further checks with the inclusion of the recent data, alternative consideration of investment and trade variables in VAR estimations and the use of other estimation approaches such as single equation estimations.

5. Conclusion

The investment and trade performance of the Ethiopian economy has been weak until recently. Private investment has also remained thin. It has never constituted more than 33 percent of total investment. Despite its recent revival reaching 42.6 % of GDP, trade (measured by the sum of exports and imports as a percentage of GDP) has been suppressed for the most of the pre-1992 period; the socialist regime being the worst. The investment, trade and growth connections in the Ethiopian economy have not been well researched. With the objective of characterising the patterns of impact flows between investment, trade and growth in Ethiopia, this study becomes a short-run causality analyses on their dynamic links using time series data over the period 1955-2003.

Our causality analyses on the dynamic link amongst investment, trade and economic growth have brought us about to conclude as there is no feedback between any pair of the variables considered out of the three hypothesised dynamic feedback links. Nonetheless, we have observed two uni-directional positive causalities that run from economic growth to enhanced trade openness and from the latter to investment.

The estimated results are sensible in most instances but some are alarming as well as puzzling. There could be a number of reasons for some of their puzzling properties. The crucial point is the unsupported contribution of the lags of both investment and trade towards economic growth which have been revealed by the corresponding insignificant coefficients in the growth equation. In fact, the share of private investment in GDP has never been above 6% up to 2003. This small share of private investment in GDP might have made its growth contribution negligible as its weight is less than 0.06. The trade performance has also been suppressed until recently. Thus, it is not surprising that the investment-trade-economic growth links are weak in a country where the overwhelming economy is dominated by the production of primary products, which has also been devastated by prolonged war, recurrent drought, inappropriate policies low institutional capacities and discipline, low social and infrastructural services, highly dependent on aid and debt and so forth structural problems.

However, the evidence should not be interpreted as investment and trade do not contribute to the growth process of the country. Rather, it could be signalling the low investment and trade performances of the country for long time though the minimum thresholds of the rate of investment and trade openness are unknown for their respective impacts to be recognized. Hence, measures that improve the performance of activities, their linkages and the contribution of trade to investment could help the economy to build its productive capacity. But, it is our conviction that some of the results should be taken cautiously and checked with different data sets and single equation estimations. Since trade is also argued to impact economic growth through investment, their simultaneous inclusion could lead into the insignificance of the two variables. Hence, the alternative inclusion of investment and trade variables in VAR estimations could be among the lines of further research.

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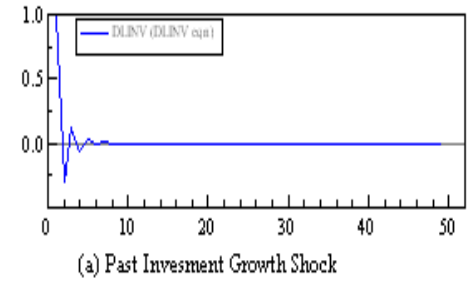
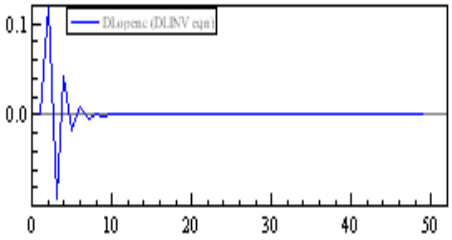
Appendix

Appendix Figure 1. Impulse-Response Shock Transmission Mechanisms:
Amongst the Growths of Domestic Private Investment, Openness to Trade & GDPPC of Ethiopia

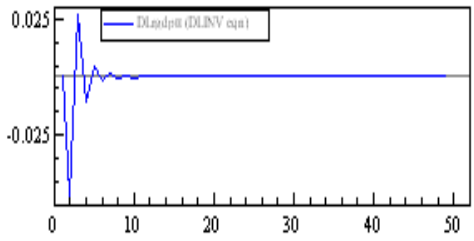
(i) Single IRF of Investment Growth



(a) Past Invesment Growth Shock

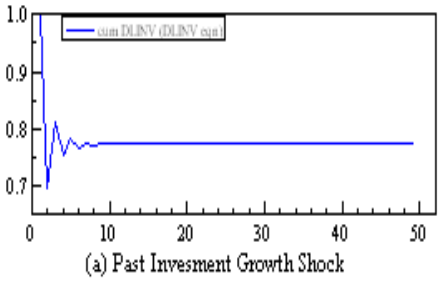


(b) Openness to Trade Growth Shock

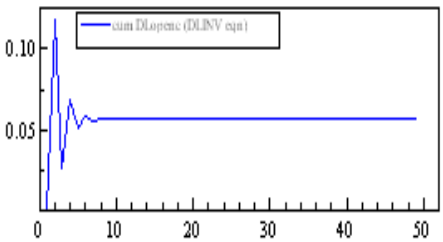


(c) Real GDP Growth Shock

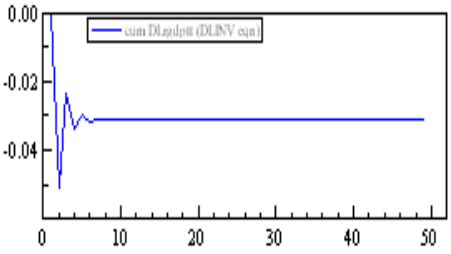
(ii) Accumulated IRF of Investment Growth



(a) Past Invesment Growth Shock

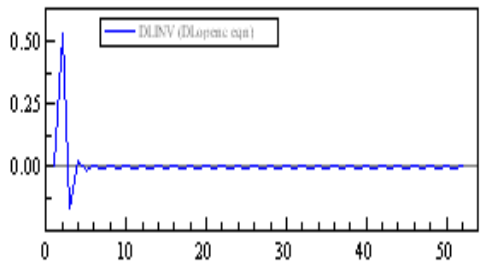


(b) Openness to Trade Growth Shock

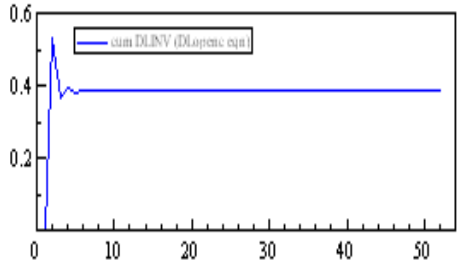


(c) Real GDP Growth Shock

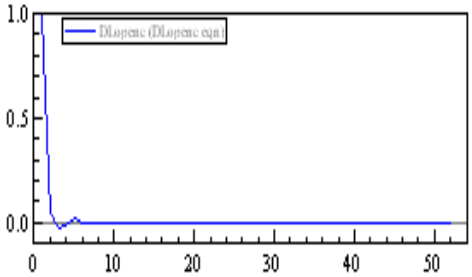
(iii) Single IRF of Openness to Trade Growth **(iv) Accumulated IRF of Openness to Trade Growth**



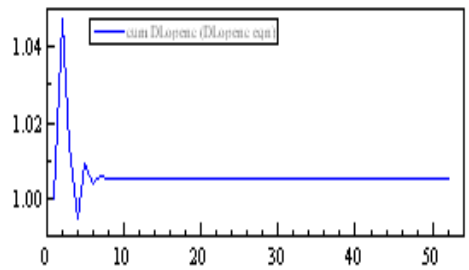
(a) Investment Growth shock



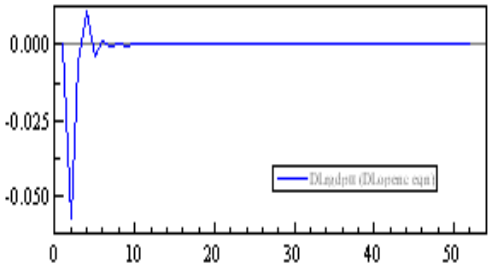
(a) Investment Growth shock



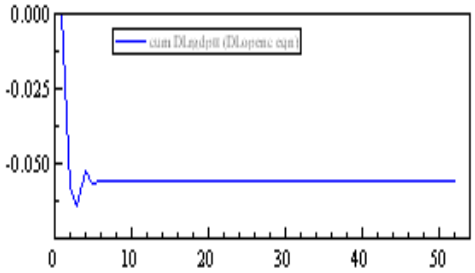
(b) Openness to Trade Growth Shock



(b) Openness to Trade Growth Shock

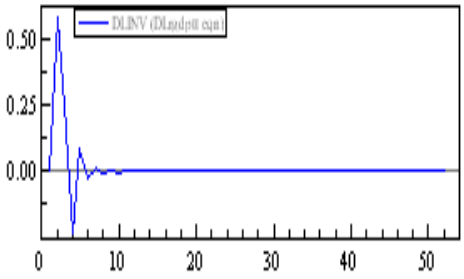


(c) Real GDP Growth Shock

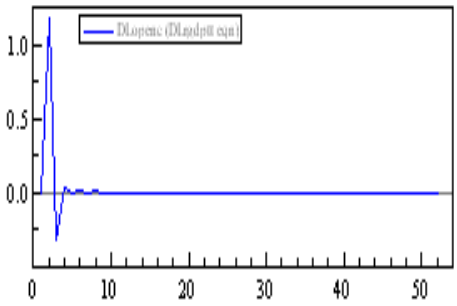


(c) Real GDP Growth Shock

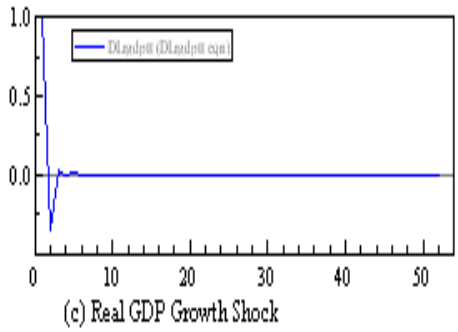
(v) Single IRF of Real GDPPC Growth



(a) Investment Growth Shock

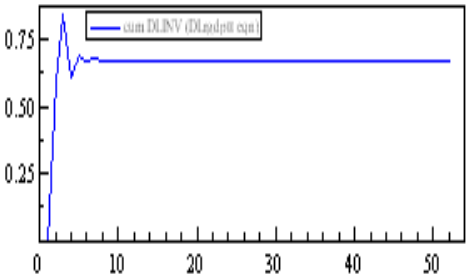


(b) Openness to Trade Growth Shock

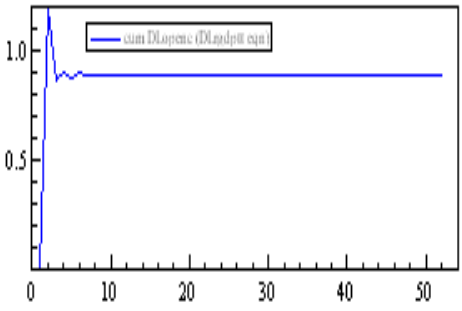


(c) Real GDP Growth Shock

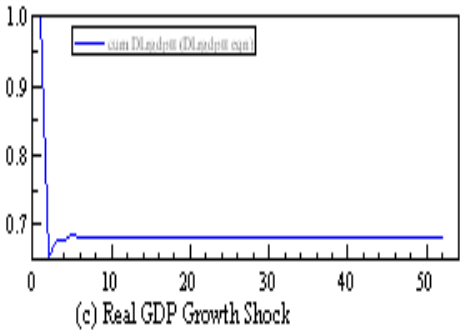
(vi) Accumulated IRF of Real GDPPC Growth



(a) Investment Growth Shock

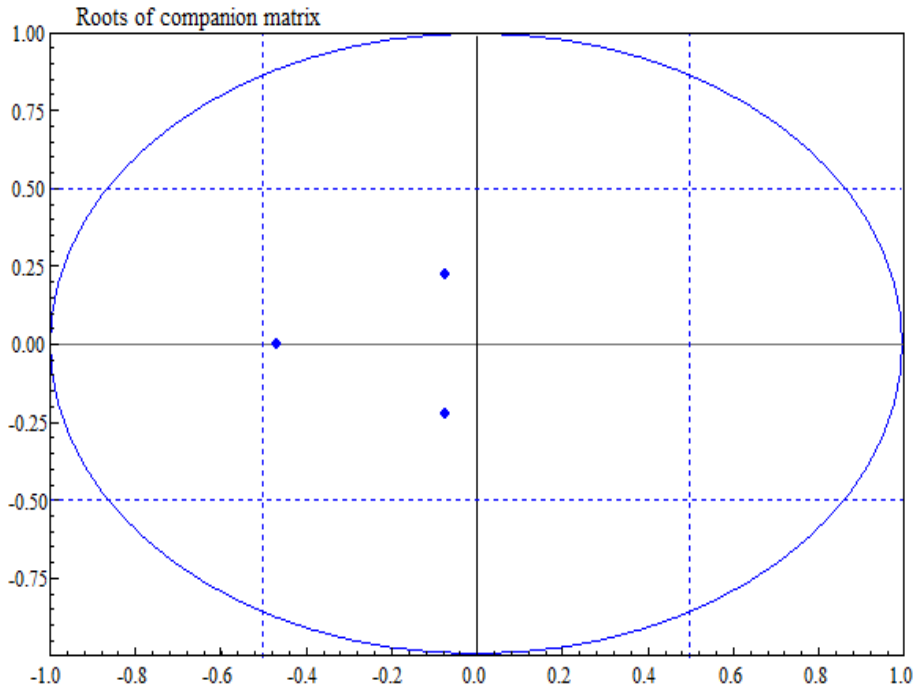


(b) Openness to Trade Growth Shock



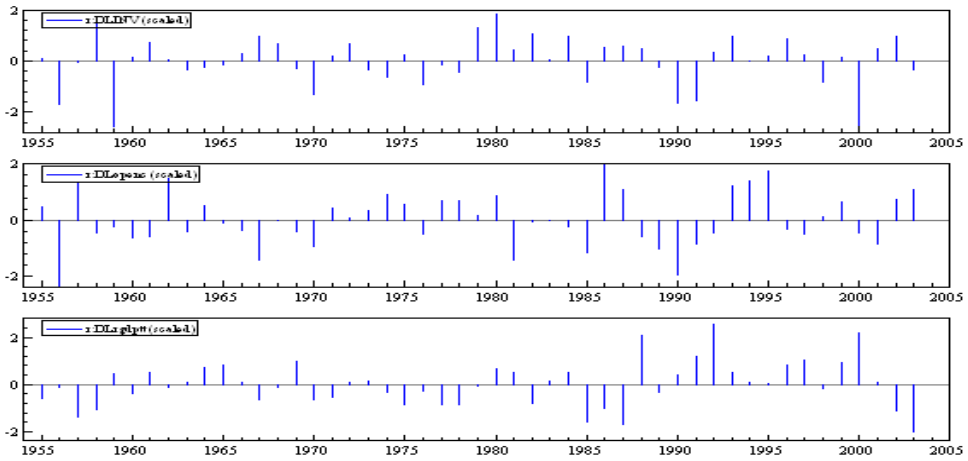
(c) Real GDP Growth Shock

Appendix Figure 2. Stability of the estimated VAR model ***(All the Eigen values or roots of the Companion Matrix are inside the unit circle; hence, the system is stable)***



Appendix Figure 3. Plots of Scaled Residuals (*Residual/equation standard error*) of *Investment, Trade Openness* and *GDPPC Growth* Equations (in order) of the VAR model

(The rule of thumb for dramatic outliers is out of ± 3.5)



Appendix Table 1. Descriptive Statistics of the Levels Data

Variable	Description	Measurement Unit	Obs	Mean	St. Dev.	Min	Max
INV	*Private investment*	2000 US$, in per capita terms	54	11.19	10.29	0.34	34.31
OPEN	*Openness to trade*	percent	54	26.80	10.23	8.74	55.75
RGDPPC	*Real GDP per capita*	2000 US$, adjusted for TOT	54	500.83	90.39	328	732.57

Appendix Table 2. Short-run Granger Causality Test Results

H0: No Granger Causality

Variables		Equations		
		Δinv	**Δopen**	**Δrgdppc**
		χ2[P-value]	***χ2[P value]***	***χ2[P-value]***
Exclusion Restrictions	Δinv_1	5.101 [0.024]**	0.613 [0.433]	1.545 [0.214]
	Δopen_1	6.293 [0.012]**	0.144 [0.705]	1.018 [0.313]
	Δrgdppc_1	2.020 [0.155]	23.991 [0.000]***	9.888 [0.002]***