ABSTRACT

Determinants of Total Factor Productivity Growth in Sub-Saharan African Countries

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While Sub-Saharan African countries are resolved to achieve sustainable economic development, their productivity remains low. In such economies where R&D is low, productivity and technological development is dependent on the emulation of technology from the highly innovating countries. The ability to emulate technology is determined by the robustness of contact and absorptive capacities. Using a fixed-effects model this paper finds two outstanding results. First, growth in Total Factor Productivity (TFP) is consistently positively dependent on improvement in economic freedom and institutions. Second, foreign direct investment is a positive contributor to TFP but uniquely where human capital is high, in democracies, and interestingly among non-oil exporting countries. The results also show that the effects of other contact variables like trade and aid on TFP growth depend on the unique characteristics of countries like income levels, geography, economic and political institutions.

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DETERMINANTS OF TOTAL FACTOR PRODUCTIVITY GROWTH IN SUB-SAHARAN AFRICAN COUNTRIES

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By

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Finally, I would like to recognize the invaluable assistance of my friends and family who patiently endured the nights of long edits and indulged my endless brainstorming sessions. Their support was instrumental in the conclusion of this project.

DEDICATIONS

To my mother, Wememandah Oriji, this is for you.
Your prayers kept me.
You are my wind; you are my roots.
Because of you, I know I can.

Chineke gozie gị

CHAPTER ONE

Introduction

The rapid economic growth rates in recent decades in Sub-Saharan Africa (SSA) have engendered a lot of policy debates about its sustainability. Some studies have focused on whether the rapid growth rates have been accompanied by structural change (McMillan et al. (2014)). Others, such as Harchaoui and Ungor (2018), have investigated the potential relationship between rapid growth rates and convergence to the U.S. level of income per capita. What is under-investigated for the sustainability of SSA's growth are the drivers of the driving factors of economic growth.

In the standard economic growth model, economic growth is a product of two processes: factor accumulation and productivity growth (Lucas (1988); Romer (1986); Grossman and Helpman (1991)). Of the two, productivity growth is the most intricate. The Cobb Douglas production function breaks down these determinants into physical capital, human capital, and total factor productivity. The purpose of this paper is to analyze data from1990 to 2017 on Total Factor Productivity growth in 25 Sub-Saharan countries to understand its determinants. Considering the role productivity is slated to play in Sub-Saharan African development in the next decade, it becomes imperative to understand what variables are associated with increases in productivity growth. Evidence investigated in this thesis also seeks to examine current macro-economic trends on the continent to understand how they might influence productivity (and thus economic growth) in the next decade.

According to the African Development Bank (AfDB) (2020), economic growth in Africa is currently driven by capital accumulation. This has set the growth rate on the continent to a little more than 2 percent per year. However, this growth rate is not enough to significantly reduce the population living in extreme poverty. To increase their economic growth rates, SSA countries have now designed their development plans to include strategies to increase productivity.

In addition to technological change and improvement in efficiency, productivity growth can be achieved through structural transformation. In economies like those in SSA where innovation is low, productivity growth is often increased through emulation, also known as catch-up growth. Emulation of technology requires that the developing country come into contact with developed countries. This contact may take the form of foreign investment, trade or aid. However, contact alone is not enough. Developing countries also need to have the capacity to absorb and replicate the technology gotten from other countries. The ability of a country to absorb technology largely depends on the level of human capital and the economic institutions in place.

The results of this study show that the association between foreign investment and productivity in SSA countries varies and depends on certain characteristics of each country. Trade has a negative association with productivity for all SSA countries except upper middle-income countries where the association is positive. Developmental aid usually has a negative association with productivity unless the recipient countries also increase the level of human capital or the quality of their economic institutions.

For absorptive capacities, the association between human capital and productivity growth depends on the unique characteristics of each country and also the overall quality

of education. On the other hand, the association between economic institutions and productivity is always positive.

Based on these findings, SSA countries need to pair policies aimed at increasing foreign investment, trade or development aid with a focus on improving the quality of human capital in their countries as well as strengthening economic institutions.

Theoretical Framework

Solow (1957) used a method of growth accounting that attributed growth to increases in either factor accumulation or productivity. He used a production function:

$$Y = A\,F(K, L) \tag{1}$$

where, in the case of a country, Y is the GDP of a nation; K is its physical capital stock; L is its labor stock and A is a measure of its TFP. Therefore, for a given level of A, the total output (Y) is a function of K and L. Equation (1) can be specified as:

$$Y = AK^{\alpha}L^{\beta} \tag{2}$$

where α and β are the shares of output assigned to capital and labor respectively. β is (1-α). Thus, TFP can be expressed as:

$$A = \frac{Y}{K^{\alpha}L^{\beta}} \tag{3}$$

From Equation (2), percentage changes in growth can be expressed as

$$\frac{\Delta Y}{Y} = \alpha\left(\frac{\Delta K}{K}\right) + \beta\left(\frac{\Delta L}{L}\right) + \left(\frac{\Delta A}{A}\right) \tag{4}$$

where $\left(\frac{\Delta A}{A}\right)$ is the growth rate of TFP.

The goal of this thesis is to find the direction of association between the determining factors of TFP and TFP growth. This is because TFP growth represents the increase in Y

that is not attributed to labor or capital accumulation. It is a measure of increases in productivity and is measured indirectly by rearranging

Equation 4:

$$\left(\frac{\Delta A}{A}\right) = \frac{\Delta Y}{Y} - \alpha\left(\frac{\Delta K}{K}\right) - \beta\left(\frac{\Delta L}{L}\right) \quad (5)$$

Increases in productivity can be attributed to increases in technology and efficiency. According to Coe et al. (1997) innovation of new technology is limited to a few industrialized countries. For the rest of the world, technology has to be transferred via contact points such as foreign direct investment (FDI), international trade, official development aid (ODA), and international movements of people.

Foreign Direct Investment occurs when a foreign entity purchases a management interest (usually 10 percent or more) in a firm located in another country. FDI is believed to generate positive externalities for the host country because of knowledge spillovers into the host country. Some developing countries try to induce foreign investments by offering tax breaks and subsidies. They do this because they believe foreign firms can introduce new technologies or processes that domestic firms can emulate. Local firms can also benefit from the training given to workers and labor turnover. According to Aitken and Harrison (1999), as experienced workers leave foreign firms, their accumulated knowledge becomes available to domestic firms that hire them. However, positive spillovers may not occur if foreign firms hire expatriates or situate themselves in a sector with limited labor mobility or little domestic interaction.

Trade is another contact point to acquire technology. Theoretically, developing countries can import technology in the form of capital goods from advanced countries. Also, an export-oriented country would need to increase productivity to compete in the

global market. A similar explanation applies to ODA, which is monetary and nonmonetary aid given to developing countries for the goal of economic development. ODA may be invested in R&D, training, and capital investments such as communication, electricity, and transportation infrastructure, all of which can boost productivity.

According to Coe, Helpman, and Hoffmaister (1997), contact with innovating economies is necessary but not sufficient to acquire technology. Developing countries must also possess sufficient absorptive capacity to take in the new technology. If the stock of human capital in the labor force is not high enough, the country may be unable to take advantage of the technology available. The stock of human capital in a nation can be increased through education and improved health of the labor force.

The efficiency of the institutions also affects the productivity of a country. Better institutions often lead to peace and a reduction in corruption. These may indirectly lead to increases in FDI and trade which in turn increases productivity. However, scholars debate about the effect of political institutions like democracy and autocracy on economic growth. According to Przeworski and Limongi (1993), the political system does not matter much. What is more important is the state's ability to perform its economic functions with minimal outside interference.

Differences in economic orientations also affect the incentives for members of that society. For example, a country with a market economy is more likely to reward innovation. This will lead firms to search for better technology. On the other hand, a communist economy does not reward innovation and so firms in that society may not seek to improve technology.

Finally, better economic institutions minimize transaction costs. If a society enforces property rights, entrepreneurs are more likely to seek out new technology and innovate more thus increasing productivity in the economy.

Hypothesis

An increase in the contact variables (FDI, trade, and aid) and the absorptive capacities (human capital and the quality of economic institutions) should be associated with an increase in the TFP of SSA countries. The model will control for Inflation (as a proxy of macroeconomic stability), and Domestic Credit to Private Sector (as a proxy of the development of financial institutions). However, SSA countries are not homogenous. Thus, the direction of association between the variables in question and productivity will be influenced by some of the prevailing characteristics in individual countries including income levels, political institutions, geography, and oil export.

CHAPTER TWO

Literature Review

Under the assumption of diminishing returns, the early neoclassical production functions concluded that once the economy reaches its long-run potential level of income, economic growth simply matches population growth, and average income growth would not be sustained. Solow (1956), on the other hand, observed that high-income countries continued to sustain growth in per capita income over long periods. Solow's answer to this paradox was technological change. Hence, Solow modeled total production as a factor of physical capital, labor, and technology (or ideas). In the case of a country, total production would be the GDP of the country and it is a function of its capital and labor stock at a given level of technology.

However, in Solow's theory, ideas (or technology) were public goods that were available to everyone and the growth of ideas was exogenous to the model. Solow does not explain how technology comes about. Variations in economic growth between countries are attributed to variation in other direct inputs of production. Romer (1990) defined a growth model where technology as endogenous. Increases in a nation's technology were not because of outside forces but were a result of ideas produced by profit-maximizing firms. With the endogenous growth theory, economic growth is no longer a function of capital and labor, but also how much technology a country has, and how well that technology has been used to manage other factors of production. Essentially, the rate of economic growth is a result of how *productive* the factors of production are.

Besides Solow, other economists have studied the effects of productivity on output. Abramowitz found that only 10 percent of the growth in output per American worker from 1869 to 1953 can be attributed to an increase in physical capital, the rest can be attributed to productivity growth (1956). Solow attributed 88 percent of the growth in output per American worker from 1900 to 1949 to productivity (1957). Jorgeson et al (1987) and Jones (1997) have reduced the amount attributed to productivity but the role played by productivity is still significant.

Van Ark (2014) defined Total Factor Productivity as the increase in output not accounted for by other inputs of production. Dhyne and Fuss (2014) defined TFP as the efficiency with which goods and services are produced using a given technology. Baier (2006) defines TFP growth as "deviations of actual output…due to technology, institutional change, failure of the twin assumptions of constant returns to scale and competitive market failure and other factors." This term encompasses more than just technology, it is a measure of not just how much technology an economy possesses but how well an economy utilizes and manages other factors of production.

Baier (2006) found that TFP growth accounted for 14 percent of the increase in output per worker worldwide. However, this estimate does not apply to all countries. TFP growth accounted for: 34 percent of per worker growth in Western countries and 26 percent in Newly Industrialized Countries. For African countries, the growth in TFP has been negative from 1960 to 2000. Therefore, these countries need to understand the factors that determine their TFP and make changes to stop the decline.

These factors are often divided into two: deep determinants and proximate determinants. According to Bloch and Tang (2004), deep determinants—those that affect

TFP in the long-term—include factors like trade, institutions, and geography. Proximate determinants include factors like infrastructure and health. On the other hand, Isaksson (2007) divides the determinants of TFP into four overlapping categories based on their functions: Creation and transmission of knowledge; Factor supply and efficient allocation; Institutions, integration and invariants; and competition, social dimension, and environment.

Since a developing country's economic growth is largely dependent on increases in TFP, then it is pertinent to understand the direction of association between TFP growth and its determinants. This is especially important because of the economic situation in Sub-Saharan African countries. Sometimes, the levels of their absorptive capacity variables are so low that increasing a contact variable alone may not be enough to increase productivity. Often, there needs to be an increase in a contact variable *and* an improvement in an absorptive capacity simultaneously to induce increases in productivity.

Foreign Direct Investment (FDI)

Woo (2009) examined the effect of technology diffusion via FDI on the TFP growth of 92 developing and developed countries. The author concludes that FDI has a statistically significant positive effect on TFP growth and it serves also as a source for technology diffusion to developing countries. Woo did not find any evidence that the economic growth achieved through FDI was only limited to countries with a certain level of absorptive capacity.

Aitken and Harrison (1999), using data from Venezuelan plants show increased productivity of firms with foreign equity which suggests a positive spillover. However,

this productivity was limited to firms with less than 50 employees. For larger firms, these spillovers were nonexistent which led them to conclude that the increased productivity in smaller firms was because multinationals seek to invest in high productivity sectors. Aitken and Harrison (1999) also find that increased foreign ownership negatively impacts domestic firms in the same sector. They attribute this negative effect to the "market-stealing-effect." In conclusion, the authors state that the positive effects of FDI slightly outweigh the negative impact on the economy in general and find no evidence of positive spillovers on domestic firms.

Malikane and Chitambara (2017) found a weak but positive link between FDI and productivity in 45 African countries. The authors conclude that this may be because African countries may lack the absorptive capacity to adopt the foreign technologies that come with FDI. This may show that a positive effect of FDI may depend on the local conditions of the domestic country. Borensztein et al. (1998) conclude that FDI yields a more positive effect when the domestic economy has sufficient human capital to absorb any positive spillovers.

Herzer and Donaubauer (2018) explore the relationship between FDI and TFP in 49 developing countries. They find that increase in FDI per capita hurts TFP in the long run. They also suggest that FDI received by developing countries appear to be driven by natural resources. However, they find that countries with high levels of human capital, trade openness, and financial development, the effect of FDI on TFP is positive and significant. They conclude that human capital, trade openness and financial development together are the parameters necessary to measure the effect of FDI on TFP.

Adnan et al (2019) study the determinants of TFP in four South Asian countries (Bangladesh, Pakistan, India and Sri Lanka). They find that FDI has a significant positive effect on all the countries. They also note that since trade and FDI bring innovation into developing economies, it is necessary to include both variables in the study to get the true measure of their effects.

Sadik and Bolbol (2001) analyzed the effect of FDI on the growth of Arab economies. First, they noted that FDI was coming into the petrochemical, manufacturing and pharmaceutical sectors. Second, they found that though FDI spurred growth, it did not produce any technological spillovers therefore it did not improve the TFP in those countries.

Using data from 49 countries, Baltabaev (2014) found that FDI has a positive effect on TFP growth. Also, the distance from the technology frontier increases the positive effects of FDI on TFP. This means the TFP of countries with larger technology gaps has a greater positive impact from FDI than countries with smaller gaps. Akinlo (2005) also finds that FDI has a positive effect on the TFP of 34 African countries.

Savvides and Zachariadi (2005) study the channels of foreign technology diffusion in the manufacturing sector of 32 developing countries. They try to find the impact of these channels on the TFP of the manufacturing sector of these economies. They note that FDI had a small but positive impact on the TFP of their manufacturing sectors.

In finding the determinants of TFP in Nigeria from 1970 to 2009, Akinlo and Adejumo (2016) find that FDI hurts TFP in the short run but has a positive impact in the long-run.

Trade

Trade is another channel of contact that developing countries use to acquire technology. Coe et al (1997), analyze data from 77 developing countries and conclude that trading can boost their total productivity if they import intermediate goods and capital equipment from industrialized countries that invest heavily in R&D. These capital goods would embody technology that developing countries can use to improve their productivity. However, this productivity increase is contingent on the quality of the country's labor force (i.e. human capital embodied in the labor force).

Isaksson (2002), agrees with this theory. Analyzing data from 73 developed and developing countries, he shows a positive correlation for trade and economic growth only when trade interacted with human capital. This shows that for a country to enjoy the technology transfer that comes with trading, it must have an adequate amount of human capital.

Miller and Upadhyay (2000), study the effects of trade openness and human capital on total factor productivity. Analyzing data from 83 developing and developed countries, they conclude that opening up the economy to trade (i.e. increasing exports to GDP ratio, improving terms of trade and lowering the value of domestic currency) tends to increase the TFP of countries. However, the extent of their influence is dependent on the level of income and the quality of the human capital in the country. For low-income countries, human capital interacts negatively with TFP until trade openness exceeds a certain point. After that, the interaction becomes positive.

Using the export-GDP ratio as a measure of trade, Akinlo (2005) found that trade had a positive and significant effect on the TFP of 34 Sub-Saharan African countries.

Edwards (1998) used data from 93 different countries to analyze the relationship between TFP and trade openness. Using indexes for trade policy, he finds that countries that are more open to trade experience faster productivity growth.

In studying the transfer of imported technology in OECD countries, Mendi (2007) finds that trade had a positive and significant effect especially on countries that are not G-7 countries.

Human Capital

Habib et al. (2019) define human capital as a "blend of knowledge, skills, and abilities of the individual to perform a specific task." One of the major components of human capital is education. Although education can be seen is a direct input in the production function through human capital, research has shown that increases in education improve TFP as well.

According to Nelson and Phelps (1966), education can be seen as increasing the stock of human capital. Assuming technological growth rate depends on the stock of human capital, and distance from the technological frontier, then the impact of new technology on output is only felt when it interacts with human capital. From this perspective, human capital does not directly enter the production function and it is measured as a change in productivity.

Benhabib and Spiegel found that education attainment (as a proxy for human capital) insignificantly explains growth per capita. However human capital was found to also significantly affect TFP (1994). Benhabib and Speigel conclude that human capital significantly affects TFP because it influences the technology catch up of countries.

Miller and Upandhyay (2000) find that an increase in human capital harms TFP in high-income countries, has a positive impact middle-income countries and the effect on low-income countries moves from negative to positive as those countries become more open to trade. This shows that the effect of human capital on TFP is dependent on other factors like trade and income levels.

Alvi and Ahmed (2014), Kumar and Chen (2013), and Edwards (1998) all found that improvements in human capital positively affects the TFP of various countries. Analyzing the determinants of TFP in Mexico, Indonesia, Nigeria and Turkey, Olomola and Osinubi (2018) find that human capital positively and significantly affect the TFPs of these countries in the short and long run.

Habib (2019) found that differences in human capital significantly explain the variances between the TFP of BRIC and CEEC countries. Akinlo (2005) found that human capital is one of the macroeconomic factors that positively influence the TFP of Sub-Saharan African countries.

Official Development Aid (ODA)

Alvi and Senbeta (2012) find that foreign aid has a significant positive impact on capital accumulation but it also has a significant negative effect on the TFP of recipient countries. Burnside and Dollar (2000); Collier and Dollar (2001; 2002); and Alvi and Senbeta (2012) all conclude that aid does increase economic growth. This growth, however, does not come from increases to TFP.

Institutions

Fadrian and Akanbi (2017) explored the determinants of TFP in Sub-Saharan Africa. They determined that the effects of factors like R&D, Human Capital, financial development are reduced when institutions are introduced. Therefore, institutions significantly impact TFP in Sub-Saharan Africa. They also conclude that economic institutions-like property rights-play a more significant role in the TFP growth rate than political institutions.

Barro (1991) studied 98 countries from 1960 to 1985 and concluded that political instability (as measured by revolutions and coups) negatively impacts economic growth (measured as GDP per capita). He speculates that the negative impact may be as a result of the inverse relationship between political instability and property rights.

Hall and Jones (1999) conclude that the variation in output per worker across countries can be partly attributed to variations in each country's Solow Residual which increases the productivity of inputs. However, in the long run, this increased productivity is powered by what they call 'social infrastructure'. This social infrastructure encompasses institutions and government policy that often shapes the economic environment of each country.

Tebaldi (2016) concludes that the quality of government and institutions are significant determinants of TFP and suggests that developing countries focus on improving the quality of their institutions to spur TFP growth.

Bjornskov and Meon (2015) analyze the effect of social trust on TFP and conclude that the effect is positive and significant. However, they also note that the link

between TFP and social trust is an indirect one. Social trust affects TFP through its influence on economic and judicial institutions that protect property rights.

Fosu (2013) concludes that increases in the quality of institutions (measured as 'constraints on the executive branch of government') positively impacts TFP and suggests developing countries include executive checks as a tool for development.

CHAPTER THREE

Methodology

Table 3.1. Summary of Data Sources

Variable	**Measurement**	**Source**
TFP	TFP at constant national prices (2011=1)	Penn World Table 9.1
FDI	net inflows of FDI (percentage of GDP)	World Bank: World Development Indicators
TRADE OPENNESS (TRADE)	Sum of exports and imports (as a percentage of GDP)	World Bank: World Development Indicators
ODA	ODA (percentage of GDP)	World Bank: World Development Indicators
EDUCATION INDEX (EDU)	Education Index of the Human Developmental Index	World Bank: World Development Indicators
ECO	Economic Freedom Score Summary Index	Fraser Institute
INFLATION	Inflation, GDP deflator (annual percentage)	World Bank: World Development Indicators
DOMESTIC CREDIT (DOM. CREDIT)	Domestic credit to the private sector (Percentage of GDP)	World Bank: World Development Indicators
IMPORT PENETRATION (IMP. PEN.)	Imports /(GDP+Imports-Exports)	World Bank: World Development Indicators

Table 3.2. Summary of Descriptive Statistics

Variable	Mean	Median	Standard Deviation	Min	Max
TFP	.989	.995	.233	.424	2.200
FDI	2.888	1.619	5.236	-8.589	40.167
TRADE	71.553	62.255	34.531	19.684	212.842
ODA	8.797	6.285	8.996	-.25	94.442
EDU	.388	.393	.145	.082	.729
ECO	5.707	5.78	.952	2.87	8.11
IMP. PEN	36.201	32.761	14.895	12.867	87.117

Description of Variables

Total Factor Productivity (TFP)

This variable is sourced from the Penn World Tables (PWT). According to Feenstra et al. (2015), it is derived by decomposing growth GDP per capita into contributions from physical capital and labor and TFP. It is calculated using the TFP of 2011 as the base year (meaning it has a value of 1). Data spans from 1990 to 2017 and encompasses 25 Sub-Saharan African countries.

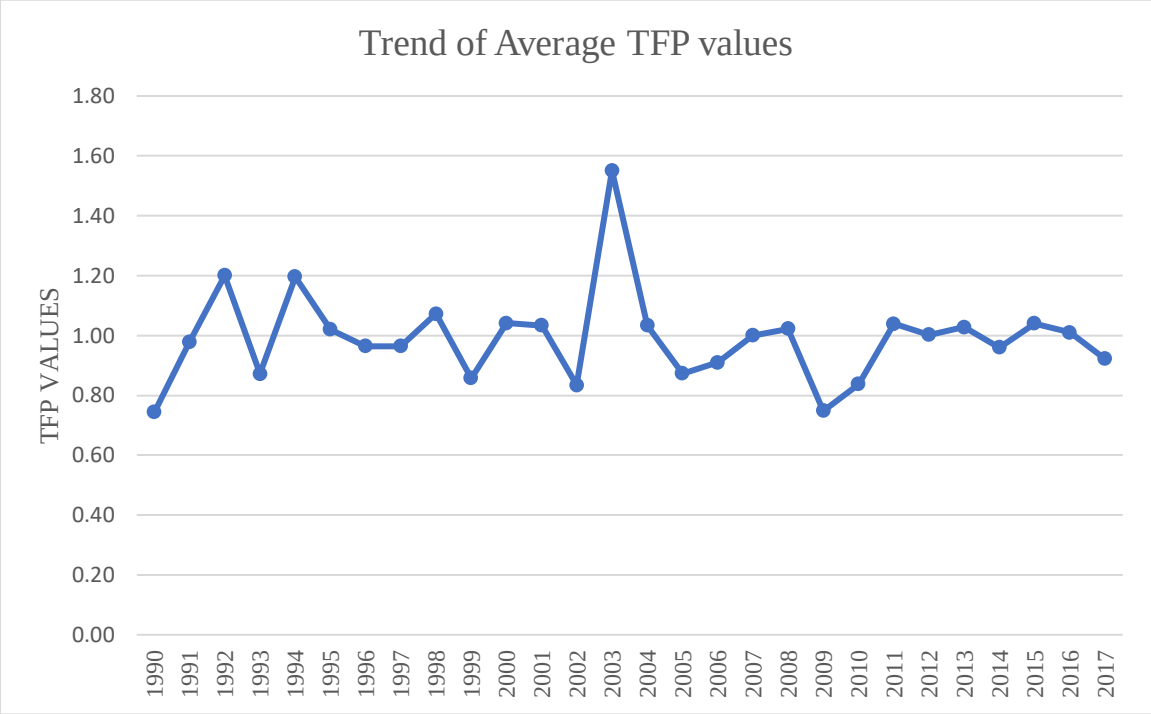

Figure 3.1. Graph Showing Trend of Average TFP in SSA countries

It has a mean value of .989 and a mean value of .995. However, the maximum value indicates the possibility of outliers. Plotting the average annual TFP on a graph shows some volatility before 2011 that seems to have stabilized after 2011. Additionally, there is evidence of a downward trend since 2015 however it is too early to confirm.

Foreign Direct Investment (FDI)

FDI is gotten from the World Development Indicators of the World Bank. It is calculated as the total inflows of FDI as a percentage of the nation's GDP for each year. The data goes from 1990 to 2017 for the 25 countries in the sample.

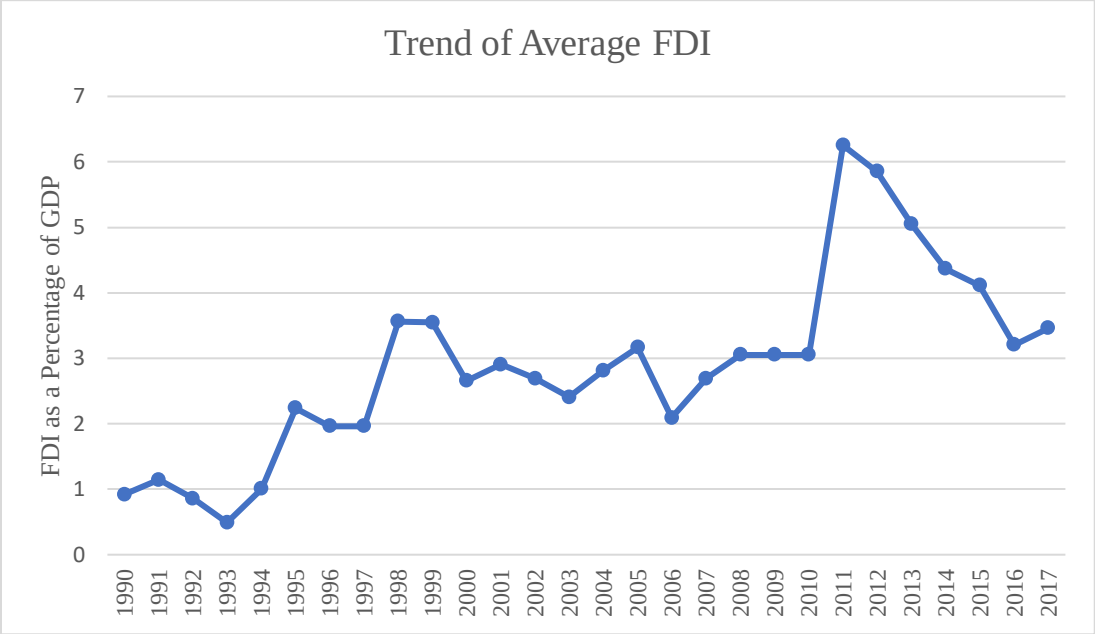

Figure 3.2. Graph Showing the Trend of Average FDI in SSA

This variable has a mean value of 2.888 and a median value of 1.619. The maximum value of 40.17 indicates a number outliers to the right of the mean value. The graph plotting the annual average FDI as a percentage of GDP shows an upward trend until 2011 and a downward trend following. However, this should not be taken as an evidence of a decline in foreign investment in the sub-region. Since the variable is a ratio (FDI as a percentage of GDP), this trend could likely be because the GDP of these countries has grown faster than the FDI inflows.

Trade Openness (TRADE)

Trade Openness is a measure of how receptive countries are to trade. It is calculated as the sum of a country's imports and exports as a percentage of its GDP. Values of imports, exports and GDP are sourced from the World Bank's World Development Indicators. The data spans 1990 to 2017 and is calculated for all countries in the sample.

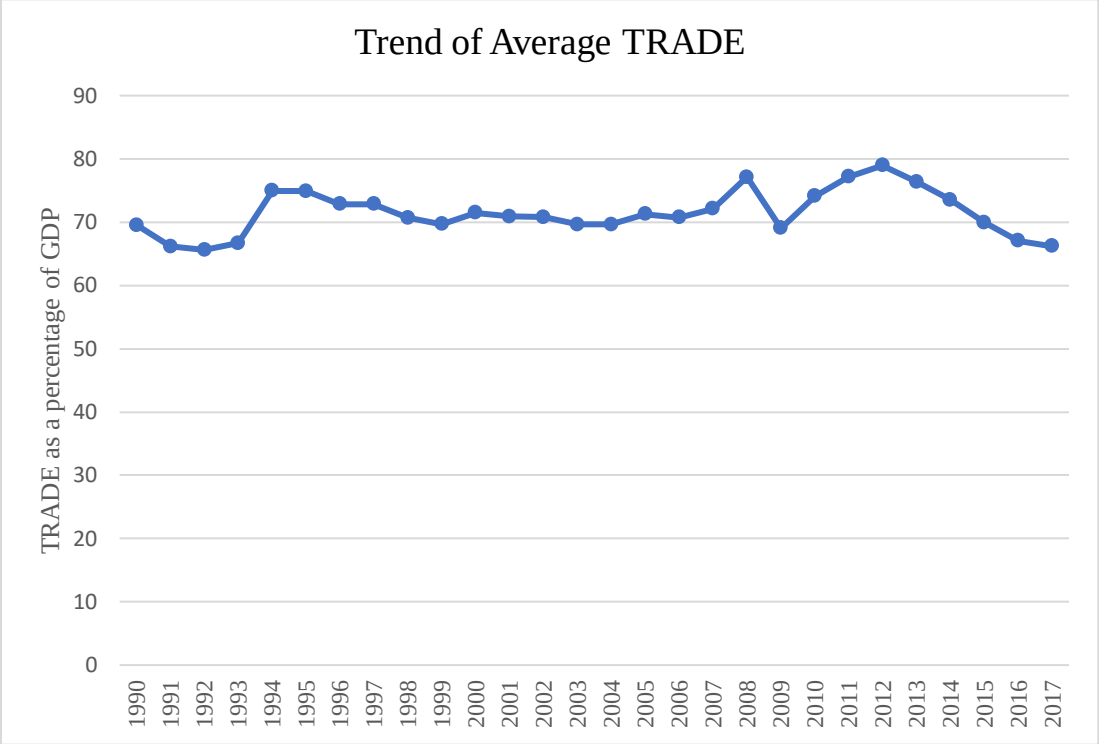

Figure 3.3. Graph Showing the Trend of Trade Openness in SSA Countries

With a mean value of 71.553 and a median value 62.255, there is evidence that the data is skewed to the right. Also, the maximum value of 212.84 indicates a number of outliers to the right of the mean value. A graph plotting the trend of annual average TRADE in the region shows an overall steady trend. However, there has been a

downward trend since 2014. This could either because the amount of import or exports has been declining or the GDP growth rate of these countries is larger than those of their imports or exports.

Official Development Aid (ODA)

Data on ODA is gotten from the World Development Indicators of the World Bank. It is measures absolute ODA inflows as a percentage of each country's GDP. The data goes from 1990 to 2017 for all the countries in the dataset.

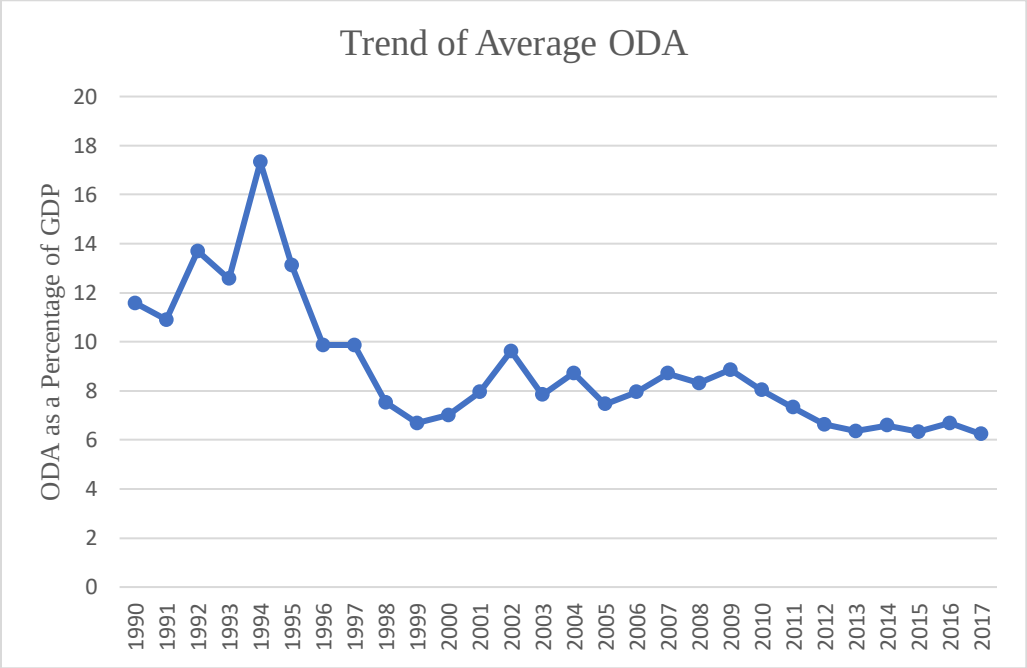

Figure 3.4. Graph showing Trend of ODA in SSA Countries

The variable has a mean value of 8.797 and a mean value of 6.285. This suggests that the data is skewed to the right. The maximum value of 94.44 suggests significant outliers that bias the mean value upward. A graph of the trend of annual average ODA in

the region shows volatility before 2002. The trend has been steady since 2002 although there is evidence of a slightly downward trend since 2009. Since this variable is a ratio, this could be because the growth rate of the GDP of these countries has been more than that of their ODA inflows.

Education Index (EDU)

This variable is sourced from the Human Develpoment Index. It is a measure of the education component of the HDI. This variable is used as a proxy of the level of human capital in countries in the sample. The index ranges from 0 to 1 and measures education attainment of countries. It is calculated using the mean and expected years of schooling for countries. The value assigned represents the current level of achieveable education. For example, a country with a value of .50 means that country as attained 50 percent of the achievable education. The data ranges from 1990 to 2017 for all the contries in the sample.

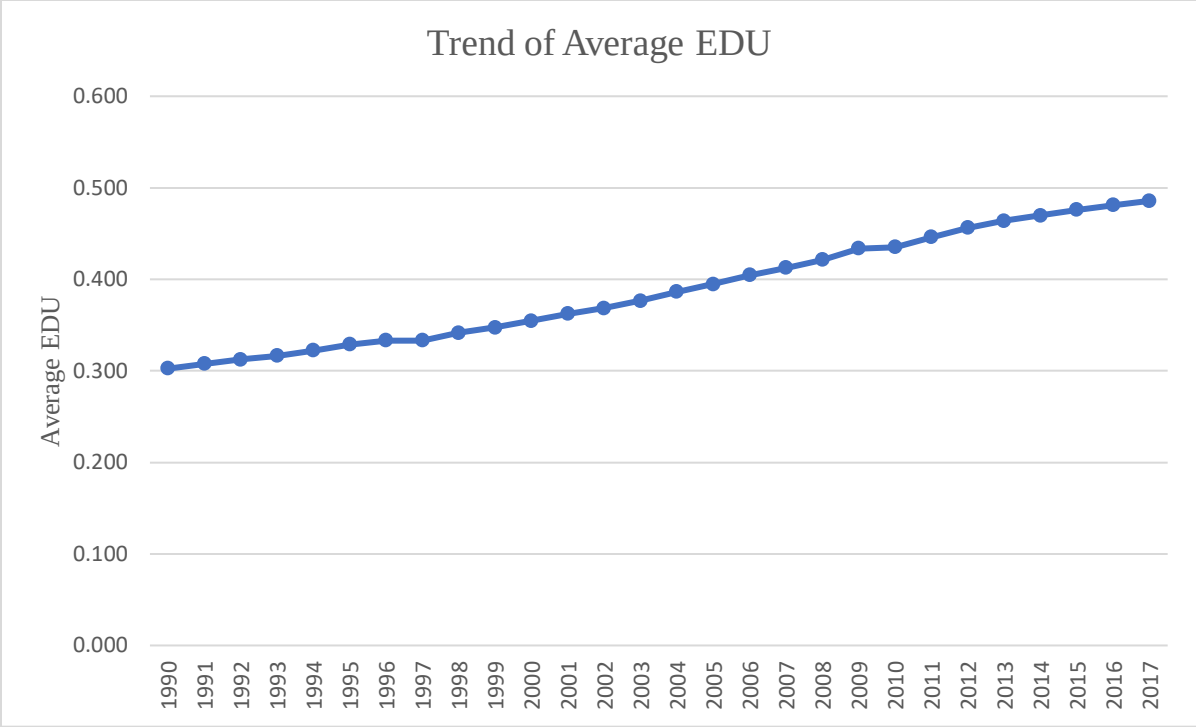

Figure 3.5. Graph Showing Trend of Average EDU in SSA Countries

The variable shows a mean value of .388 and a median value of .393. The minimun value of .082 and maximum value of .729 indicate that the data has a normal distribution. The graph showing the trend of average EDU shows an upward trend.

Economic Freedom Score Summary Index (ECO)

The Economic Freedom Index measures the level to which the institutions, legislations, and policies of a country enable economic freedom. It is sourced from the Fraser Institute. The index ranges from 0 to 100. The summary index is the average of 5 different indices measuring: Size of Government, Legal System and Property Rights, Sound Money, Freedom to Trade Internationally, and Regulation. Annually, the countries are divided into four quartiles with Q1 being most free and Q4 being the least free. For 2017, countries in the first quartile had scores ranging from 7.51 to 8.91. The second

quartile scores range from 6.86 to 7.49. The third quartile scores range form 6.21 to 6.84 and the fourth quartile have scores ranging from 2.58 to 6.20. The data used in this paper spans 1990 to 2017 for all the countries in the sample.

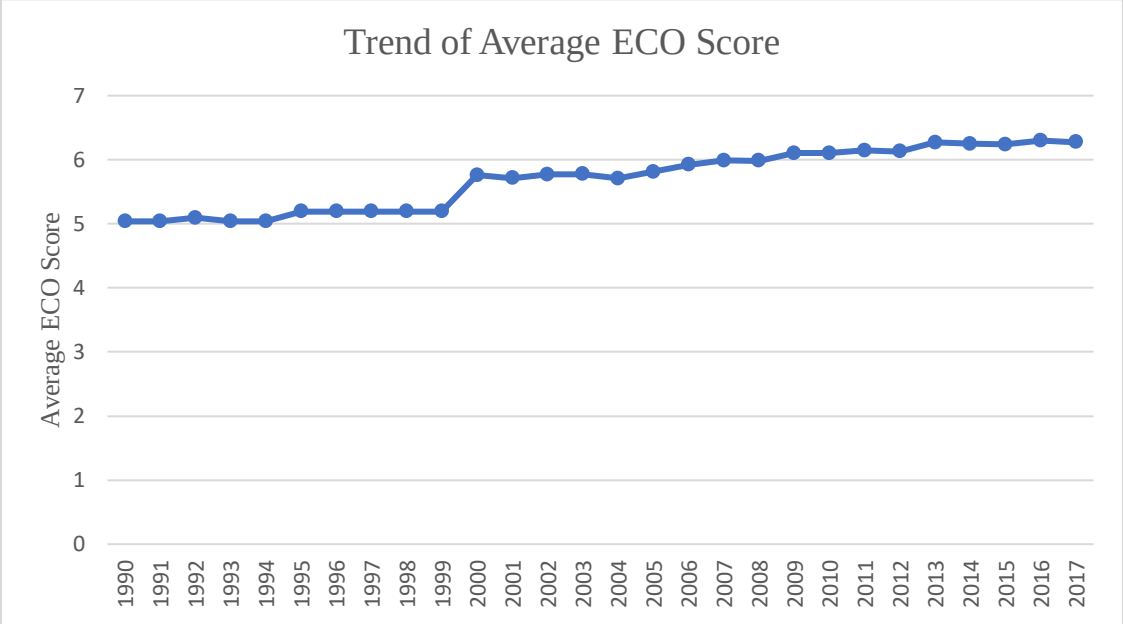

Figure 3.6. Graph Showing Trend of Average ECO in SSA Countries

The variable has a mean value of 5.707 and a median value of 5.78 which suggests a normal distribution. However, the minimum value of 2.87 and the maxium value 8.11 suggests out outliers on both sides of the mean value. The graph of the annual average ECO in the region shows a steady trend apart from a slight upward trend in 2000.

Import Penetration (IMP. PEN.)

Import penetration measures the amount of domestic consumption supplied by imports. Like trade openness, it can also be used to measure the effect of trade on a country. It is calculated as Imports as a percentage of domestic consumption (GDP +

Imports – Exports). The data used to construct this variable is gotten from the the World Development Indicators of the World Bank. It ranges from 1990 to 2017 for all the countries in the sample.

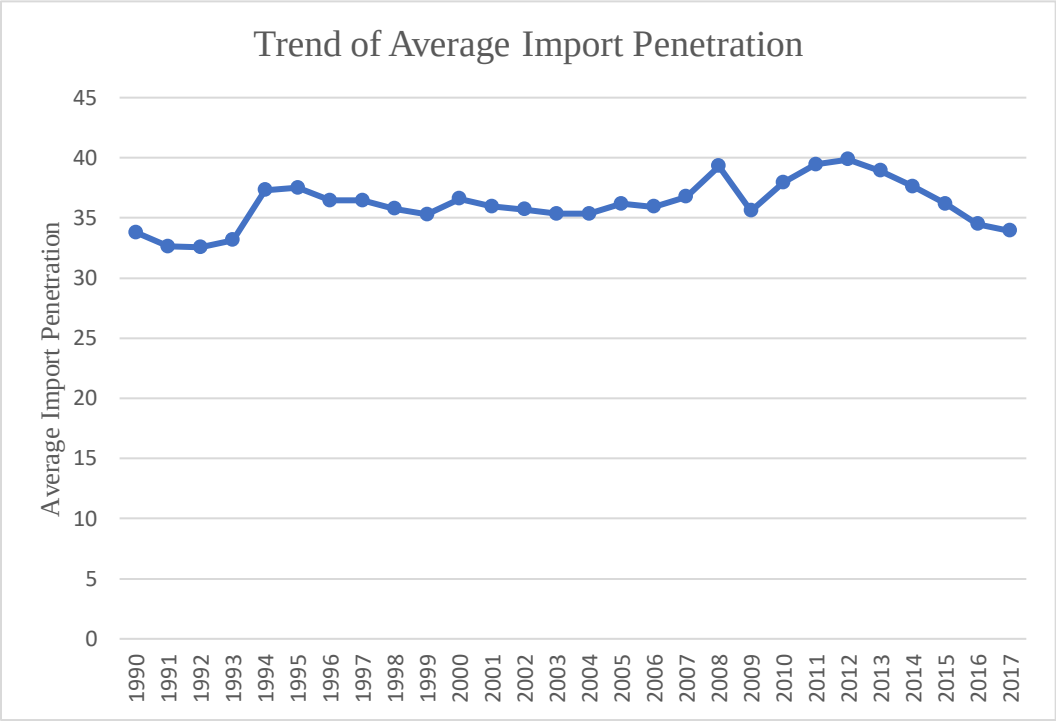

Figure 3.6. Graph Showing Trend of Average Import Penetration in SSA Countries

The variable has a mean value of 36.20 and a median value of 32.76. The maximum value of 87.11 suggests outliers on the right side of the mean value which biases the mean value upward. The graph showing the trend of the variable shows an overall steady trend.

Pairwise Correlations

The pairwise correlations show that Economic Freedom (ECO) and the control variables of Inflation and Domestic Credit to the Private Sector are the only variables that

have a significant correlation to TFP. Economic Freedom and Domestic Credit have a positive correlation to TFP while Inflation has a negative correlation to TFP.

Table 3.3. Pairwise Correlation

Variables	TFP	FDI	IMP. PEN	TRADE	ODA	EDU	ECO	INF	DOM. CREDIT
TFP	1.000								
FDI	-0.046	1.000							
IMP. PEN.	-0.040	0.394***	1.000						
TRADE	-0.054	0.432***	0.978***	1.000					
ODA	0.029	-0.191***	-0.183***	-0.281***	1.000				
EDU	0.030	0.251***	0.383***	0.448***	-0.653***	1.000			
ECO	0.350***	0.221***	0.230***	0.233***	-0.276***	0.497***	1.000		
INF	-0.264***	-0.003	0.072*	0.082**	0.007	-0.054	-0.309***	1.000	
DOM. CREDIT	0.221***	0.014	0.264***	0.277***	-0.452***	0.548***	0.548***	-0.214***	1.000

Estimation Methodology

Although the pairwise correlation matrix above gives us an idea of the association between various determinants and TFP, it is limiting because it does not control for other factors that may bias the estimators. In order to control for these factors, and get more accurate estimators, we will use the fixed effects model.

To begin, we start with a basic econometric model:

$$y_{it} = X'_{it}\beta + u_{it}$$

where X are the variables estimated, u_{it} is the disturbance term,. *i* denotes the individual country, and *t*, the year. Additionally, the u_{it} is assumed to be comprised of α_{it}, τ, and ε_{it}:

$$u_{it} = \alpha_{it} + \tau + \varepsilon_{it}$$

where α_{it} is the country specific effects, τ are time-specific effects that are similar to all countries within that time period and ε_{it} is the idiosyncratic error term. α_{it} and τ are assumed to be fixed since they only vary across one dimension of the panel. α_{it} varies across countries but is consistent across time for each country. These country specific characteristics are things like geography, climate, culture and values. Time effects (τ) vary across time but are similar across all countries. These include things like global economic trends that affected all countries in the sample set. ε_{it} are assumed to be random disturbances and vary across countries and years.

Fixed Effects Model

In the fixed effects (FE) model, we assume that the vectors of the α_i and τ could be correlated with the explanatory variables in the equation. This could bias the

coefficients of the estimates. To avoid this, the fixed effects of α_i and τ are treated as separate parameters to be estimated in order to get an accurate estimate of the coefficients. Applying this to this specific research question:

$$TFP_{it} = x'_{it}\beta + z'_{it}\beta + \alpha_i + \tau + \varepsilon_{it}$$

where TFP in country *i* at time *t* (TFP_{it}) is a function of the explanatory variables (x'_{it}), the controlling variables (z'_{it}), a time fixed effect (τ), a country fixed effect (α_i), and an error term (ε_{it}). By estimating α_i and τ, the remaining coefficients are more accurately estimated.

This paper uses the mean-deviation form of the FE model. It is derived by subtracting the average values of the model's components from the individual values. To derive the average, the values of each of the model's components for all time periods are summed up and divided by *t* for each country *i*. This mean value is then subtracted from the individual values resulting in "de-meaned" values.

The FE mechanism is applied as follows: All the TFP_{it} is summed up across all time periods *t* for a specific country *i*. This value is then divided by *t* resulting in a mean value for the TFP of country *i*: $\overline{TFP_i}$. This value ($\overline{TFP_i}$) is subtracted from TFP_{it}, resulting in a "de-meaned" value of TFP_t which is then regressed on the demeaned values of the estimated variables, controlled variables and time effects. Note that the country specific effects cancel out. This leaves a baseline model of:

$$TFP_t = \beta_1 + \beta_2 FDI_t + \beta_3 TRADE_t + \beta_4 ODA_t + \beta_5 EDU_t + \beta_6 ECO_t + +\beta_7 Inflation_t + \beta_8 Domestic\ Credit_t + \tau + \varepsilon_t$$

In order to convert the β coefficients into elasticities, we will use the natural log of all the variables in the analysis. While the baseline model becomes the first step in understanding the associations between TFP and the explanatory variables, we can adjust

it to answer more questions. For example, during the analysis, we will swap the TRADE variable for the IMPORT PENETRATION variable to better study the effects of imports alone.

We also know that often times, the effect of altering a contact variable and an absorptive capacity variable simultaneously can magnify the effect of both variables. To study this amplifying effect, we will interact some contact variables with the absorptive variables. We interact FDI with EDU and ECO because often times the level of human capital and economic institutions in place often determine the kind of foreign investments that enter a country. We also interact TRADE and IMPORT PENETRATION with ECO because the economic institutions play a role in determining the trade patterns of a country. If a nation's economic institutions support innovation and protect property rights, more people will import goods necessary for innovation which in turn will influence TFP. Also, the reason we interact ODA with EDU and ECO is because the effect of aid may be magnified if the level of human capital is increasing or the economic institutions allow the aid to be properly channeled to sectors where it is needed.

Finally, this paper assumes that countries with certain characteristics react to these variables differently. Consequently, we will break the sample set into various categories to see if the level of income, the kind of political institutions, the geography, or oil-exportation affects the way SSA countries react to these variables.

CHAPTER FOUR

Results

Baseline Results

Overall FDI has a positive but insignificant association with TFP. However, when FDI interacts with EDU the association is positive and significant. This suggests that overall, increasing the absorptive capacity of a nation by increasing the years of schooling increases the contribution of FDI to TFP. This is in line with Borensztein et al. (1998) who suggest that the effect of TFP is contingent on absorptive capacity. However, it is also against the propositions of Woo (2009) who suggests that the effect of FDI is not contingent on the levels of the absorptive capacity of countries. The differing results may be because Woo used a sample that consisted of fewer Sub-Saharan countries.

Additionally, when FDI interacts with ECO, the association becomes less negative and suggesting that ECO also increases the contribution of FDI to TFP. This is in line with Borensztein et al. (1998) who suggest that the effect of FDI is aided by the absorptive capacity of the recipient country. This result suggests that a higher level of economic freedom in a country allows the technology brought into a country in the form of FDI to be better emulated and absorbed.

In analyzing the coefficient of trade openness, TRADE appears to have a significant negative association with TFP. This is contrary to the hypothesis of this paper and the findings of Akinlo (2005) who suggests that trade positively impacts TFP in Sub-Saharan Africa. However, it agrees with the findings of Fadrian and Akanbi (2017). They

attribute this negative association between trade and TFP to the nature of goods being traded in the sub-region. Since the manufacturing sector in the sub-region is undeveloped, most of the goods being imported are likely to be consumer goods which do not help increase productivity.

Additionally, these goods being imported may price-out domestic substitutes thus negatively impacting the TFP of the domestic country. This theory is supported by the fact that Import Penetration appears to be significantly and negatively associated with TFP as well. However, the direction of association changes from negative to positive when TRADE interacts with ECO. This suggests that increasing economic freedom may help countries begin to harness benefits from trade. An example of this could be better reverse engineering mechanisms where local business are better equipped to take apart imported products to learn how they are produced and begin to produce them locally.

ODA appears to have a negative association with TFP growth overall. This is contrary to the hypothesis of this paper but in line with the findings of Alvi and Senbata (2012). They attribute this negative association partly to the corruption and rent-seeking behavior of recipient countries and their weak institutions. However, it is worth noting that countries tend to receive more aid when they are performing poorly economically thus this negative association may be because development aid is often increased when Sub-Saharan African countries perform poorly economically and not that aid itself that *causes* them to perform poorly economically. Like other contact variables, the association becomes positive when ODA interacts with ECO. This suggests that strengthening economic institutions may positively impact the contribution of aid to TFP growth.

ECO has a positive association with TFP growth. This is in line with the hypothesis of this paper and the findings of Fadiran and Akanbi (2017) who suggest that economic institutions like strong property rights significantly impact TFP growth in Sub-Saharan countries.

Table 4.1. Baseline Regression Results

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	0.006	0.006	0.037***	-0.088**	0.005	0.009**	0.005	0.006
	(0.005)	(0.005)	(0.013)	(0.037)	(0.004)	(0.004)	(0.004)	(0.004)
TRADE	-0.113***		-0.117***	-0.117***	0.506**	-0.123***	-0.116***	
	(0.033)		(0.034)	(0.033)	(0.201)	(0.032)	(0.033)	
ODA	-0.036***	-0.034**	-0.033**	-0.032**	-0.046***	0.269***	-0.008	-0.054***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.056)	(0.029)	(0.013)
EDU	-0.091	-0.099	-0.045	-0.061	-0.124*	0.068	-0.204	-0.114*
	(0.063)	(0.062)	(0.065)	(0.063)	(0.063)	(0.067)	(0.124)	(0.060)
ECO	0.648***	0.645***	0.662***	0.670***	2.056***	0.947***	0.648***	-0.235
	(0.067)	(0.067)	(0.067)	(0.067)	(0.456)	(0.084)	(0.067)	(0.171)
INFLATION	-0.022***	-0.022***	-0.021***	-0.022***	-0.022***	-0.022***	-0.022***	-0.023***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
DOM. CREDIT	0.033	0.034	0.032	0.017	0.039*	0.021	0.035	0.039*
	(0.024)	(0.023)	(0.023)	(0.024)	(0.023)	(0.022)	(0.023)	(0.022)
IMP. PEN.		-0.131***						0.922***
		(0.035)						(0.192)
FDI x EDU			0.025**					
			(0.010)					
FDI x ECO				0.058**				
				(0.023)				
TRADE x ECO					-0.367***			
					(0.118)			
ODA x ECO						-0.180***		
						(0.032)		
ODA x EDU							0.031	
							(0.029)	
IMP. PEN x ECO								-0.629***
								(0.113)
Constant	-0.619***	-1.242***	-0.572***	-0.571***	-3.020***	-0.847***	-0.721***	0.253
	(0.215)	(0.150)	(0.214)	(0.214)	(0.798)	(0.212)	(0.236)	(0.305)
Observations	532	532	532	532	532	532	532	532
R-squared	0.320	0.323	0.329	0.329	0.333	0.361	0.321	0.365
Number of Countries	25	25	25	25	25	25	25	25
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Subgroup Results

Income Levels

Low-Income Countries. Low-income countries are classified as countries with Gross National Income per capita of less than $1,025 by the World Bank.

For these countries, FDI has a positive and significant association with TFP growth. This is in line with the hypothesis of this paper and the findings of Woo (2009) and, Akinlo and Adejumo (2016) which suggest that the kind of foreign investment coming into low-income countries is the sort that either spurs healthy competition with domestic firms or brings in technology that can be diffused and absorbed into the economy. Like the baseline model, interacting FDI with EDU also positively impacts the contribution of FDI to TFP growth.

In line with the baseline model, TFP appears to negatively depend on ODA in low-income countries. This may be because aid is usually given to countries that are doing poorly economically. Consequently, the negative association may be because these countries *already* have low growth as opposed to aid *causing* them to have low economic growth rates. Interacting ECO and EDU with ODA changes the association of ODA and TFP to a positive one. This suggests that the contribution of ODA to productivity becomes increasingly positive when there is an increase in the absorptive capacity of the recipient country.

In line with the baseline model, ECO has a positive association with TFP for low-income countries. Although TRADE has a positive but insignificant association, import

penetration has a positive and significant association with TFP when it interacts with ECO. This is in line with the findings from the baseline model.

Table 4.2. Regression Results for Low-Income Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	0.016***	0.017***	0.114***	-0.148***	0.016***	0.022***	0.014**	0.016***
	(0.005)	(0.005)	(0.019)	(0.045)	(0.005)	(0.005)	(0.005)	(0.005)
TRADE	0.018		0.006	0.011	0.294	-0.012	0.028	
	(0.044)		(0.042)	(0.043)	(0.295)	(0.042)	(0.043)	
ODA	-0.050**	-0.048**	-0.031	-0.042**	-0.054***	0.406***	0.186***	-0.072***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.079)	(0.064)	(0.020)
EDU	-0.025	-0.015	0.108	0.013	-0.028	0.132	-0.785***	0.010
	(0.091)	(0.090)	(0.091)	(0.090)	(0.091)	(0.090)	(0.217)	(0.089)
ECO	0.621***	0.615***	0.638***	0.658***	1.269*	1.184***	0.661***	-0.336
	(0.079)	(0.079)	(0.076)	(0.078)	(0.690)	(0.121)	(0.078)	(0.263)
INFLATION	-0.018*	-0.018*	-0.012	-0.020**	-0.018**	-0.019**	-0.021**	-0.021**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)
DOM. CREDIT	0.015	0.017	0.024	-0.006	0.014	0.014	0.014	0.011
	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)
IMP. PEN.		-0.004						1.117***
		(0.046)						(0.300)
FDI x EDU			0.071***					
			(0.013)					
FDI x ECO				0.106***				
				(0.029)				
TRADE x ECO					-0.169			
					(0.179)			
ODA x ECO						-0.281***		
						(0.047)		
ODA x EDU							0.217***	
							(0.056)	
IMP. PEN x ECO								-0.693***
								(0.183)
Constant	-0.861***	-0.783***	-0.719***	-0.806***	-1.907*	-1.393***	-1.844***	0.885*
	(0.283)	(0.203)	(0.272)	(0.278)	(1.143)	(0.282)	(0.377)	(0.484)
Observations	333	333	333	333	333	333	333	333
R-squared	0.325	0.325	0.387	0.356	0.327	0.401	0.359	0.358
Number of Countries	18	18	18	18	18	18	18	18
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Lower-Middle-Income Countries. Lower-middle-income economies are those with a Gross National Income per capita of between $1,026 and $3,995.

For these countries, FDI has a negative but insignificant association with TFP. However, when it interacts with EDU, the association becomes positive. Because of this oscillation, it is difficult to determine the direction of association between FDI and TFP in lower-middle-income countries.

In line with the baseline model, TRADE and Import Penetration overall has a negative association with TFP. However, when Import Penetration interacts with ECO, the association becomes positive. Similarly, ODA overall has a negative association with TFP.

Surprisingly, EDU has a negative and significant association with TFP overall. This is contrary to the findings of Akinlo (2005). This may be as a result of the variable chosen to estimate human capital. The education index measures mean and expected years of schooling in a country. It does not take into account the quality of education in the country. This is a very significant detriment. If the quality of education of the labor force is not enough to absorb the technology being brought in by FDI, trade and other contact variables, an increase in the years of schooling may not necessarily be associated with an increase in TFP. For lower-middle-income countries, it could be that the quality of education may not be as high as upper-middle-income countries. This may explain why EDU has a negative association with TFP.

Table 4.3. Regression Results for Lower-Middle-Income Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	-0.010	-0.011	0.083**	-0.297	-0.012*	-0.006	-0.010	-0.012*
	(0.007)	(0.007)	(0.033)	(0.184)	(0.007)	(0.007)	(0.007)	(0.006)
TRADE	-0.186***		-0.136***	-0.199***	0.391	-0.208***	-0.191***	
	(0.041)		(0.043)	(0.042)	(0.458)	(0.043)	(0.046)	
ODA	-0.030**	-0.029**	-0.022*	-0.019	-0.030**	-0.322*	-0.010	-0.030**
	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)	(0.189)	(0.074)	(0.012)
EDU	-0.223*	-0.212*	-0.149	-0.157	-0.260**	-0.264**	-0.249	-0.275**
	(0.116)	(0.118)	(0.113)	(0.123)	(0.119)	(0.118)	(0.151)	(0.118)
ECO	-0.207	-0.209	-0.207	-0.413**	1.159	-0.458**	-0.204	-0.773***
	(0.136)	(0.137)	(0.128)	(0.188)	(1.090)	(0.210)	(0.137)	(0.282)
INFLATION	-0.010	-0.010	-0.009	-0.008	-0.009	-0.008	-0.010	-0.008
	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
DOM. CREDIT	0.070**	0.075**	0.030	0.044	0.090***	0.054*	0.071**	0.109***
	(0.029)	(0.029)	(0.031)	(0.033)	(0.033)	(0.030)	(0.029)	(0.032)
IMP. PEN.		-0.189***						0.842*
		(0.044)						(0.456)
FDI x EDU			0.116***					
			(0.039)					
FDI x ECO				0.164				
				(0.105)				
TRADE x ECO					-0.316			
					(0.250)			
ODA x ECO						0.168		
						(0.108)		
ODA x EDU							0.022	
							(0.085)	
IMP. PEN x ECO								-0.574**
								(0.253)
Constant	0.653**	-0.337	0.585*	1.168**	-1.940	1.182**	0.649**	0.511
	(0.312)	(0.210)	(0.296)	(0.452)	(2.075)	(0.459)	(0.315)	(0.425)
Observations	112	112	112	112	112	112	112	112
R-squared	0.849	0.846	0.867	0.855	0.853	0.855	0.850	0.857
Number of Countries	13	13	13	13	13	13	13	13
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Upper-Middle-Income Countries. Upper-middle-income economies are those with a Gross National Income per capita of between $3,996 and $12,375.

For these countries, TFP positively depends on TRADE and Import Penetration. This is in line with the findings of Coe et al. (1997) and Akinlo (2005) where trade results in a positive impact on TFP. This suggests that these countries have sufficient local consumer goods that can compete with imports. Alternatively, it could also suggest that these countries may be importing more capital goods relative to other countries which suggests a bigger manufacturing sector relative to other Sub-Saharan countries. Additionally, EDU has a significant positive association with TFP. This is in line with the findings of Akinlo (2005), and Olomola and Osinubi (2018). This may suggest that the education in these countries is of sufficient quality that increasing the years spent in school has a positive association with TFP growth.

It is worthy of note that this is the only sub-sample in which the association between ECO and TFP was positive but insignificant.

Table 4.4. Regression Results for Upper-Middle-Income Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	-0.010	-0.011	0.083**	-0.297	-0.012*	-0.006	-0.010	-0.012*
	(0.007)	(0.007)	(0.033)	(0.184)	(0.007)	(0.007)	(0.007)	(0.006)
TRADE	-0.186***		-0.136***	-0.199***	0.391	-0.208***	-0.191***	
	(0.041)		(0.043)	(0.042)	(0.458)	(0.043)	(0.046)	
ODA	-0.030**	-0.029**	-0.022*	-0.019	-0.030**	-0.322*	-0.010	-0.030**
	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)	(0.189)	(0.074)	(0.012)
EDU	-0.223*	-0.212*	-0.149	-0.157	-0.260**	-0.264**	-0.249	-0.275**
	(0.116)	(0.118)	(0.113)	(0.123)	(0.119)	(0.118)	(0.151)	(0.118)
ECO	-0.207	-0.209	-0.207	-0.413**	1.159	-0.458**	-0.204	-0.773***
	(0.136)	(0.137)	(0.128)	(0.188)	(1.090)	(0.210)	(0.137)	(0.282)
INFLATION	-0.010	-0.010	-0.009	-0.008	-0.009	-0.008	-0.010	-0.008
	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
DOM. CREDIT	0.070**	0.075**	0.030	0.044	0.090***	0.054*	0.071**	0.109***
	(0.029)	(0.029)	(0.031)	(0.033)	(0.033)	(0.030)	(0.029)	(0.032)
IMP. PEN.		-0.189***						0.842*
		(0.044)						(0.456)
FDI x EDU			0.116***					
			(0.039)					
FDI x ECO				0.164				
				(0.105)				
TRADE x ECO					-0.316			
					(0.250)			
ODA x ECO						0.168		
						(0.108)		
ODA x EDU							0.022	
							(0.085)	
IMP. PEN x ECO								-0.574**
								(0.253)
Constant	0.653**	-0.337	0.585*	1.168**	-1.940	1.182**	0.649**	0.511
	(0.312)	(0.210)	(0.296)	(0.452)	(2.075)	(0.459)	(0.315)	(0.425)
Observations	112	112	112	112	112	112	112	112
R-squared	0.849	0.846	0.867	0.855	0.853	0.855	0.850	0.857
Number of Countries	13	13	13	13	13	13	13	13
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Political Institutions

To classify political institutions, this paper uses the Polity IV data series that measures the level of democracy in countries. The score ranges from -10 to +10 with autocracies having a score less than -5; anocracies are given a score between -5 and +5, and democracies are scored above +5.

Autocracies. FDI in autocracies has a positive and significant association with TFP growth which agrees with the hypothesis of this paper. This is might be because autocracies tend to attract FDI from less democratic countries with weaker institutions. It could also be because autocracies may have less bureaucracy which may make FDI more efficient.

Like the baseline model, TFP growth appears to negatively depend on TRADE. Like lower-middle-income countries, EDU appears to be negatively associated with TFP growth. This could be attributed to the quality of education being taught in these countries. It is worthy of note that unlike other countries, ODA does not appear to have a positive association with TFP even when it interacts with EDU and ECO. This suggests that increases in absorptive capacities may not be enough to change the impact of aid in these countries. It could also be because ODA has become conditional on certain factors like human rights and pledges to tackle corruption. These are things that may be lacking in autocratic countries. This findings are in line with those of Alvi and Senbata (2012) who suggest that weak institutions cause aid to have a negative effect on TFP. ECO appears to have an overall negative and insignificant association with TFP growth.

Table 4.5. Regression Results for Autocratic Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	0.034***	0.035***	0.066	0.404**	0.036***	0.025*	0.044***	0.039***
	(0.012)	(0.012)	(0.080)	(0.174)	(0.010)	(0.013)	(0.013)	(0.011)
TRADE	-0.126*		-0.128*	-0.103	2.199***	-0.134**	-0.120*	
	(0.063)		(0.063)	(0.061)	(0.558)	(0.062)	(0.061)	
ODA	-0.029	-0.030	-0.028	-0.028	-0.059*	-0.567*	-0.303**	-0.058*
	(0.036)	(0.037)	(0.037)	(0.035)	(0.031)	(0.323)	(0.143)	(0.032)
EDU	-1.834***	-1.796***	-1.850***	-1.587***	-1.239***	-1.842***	-1.063**	-1.351***
	(0.288)	(0.290)	(0.294)	(0.300)	(0.282)	(0.282)	(0.481)	(0.267)
ECO	0.004	0.008	0.007	-0.259	5.161***	-1.148	0.028	-2.532***
	(0.314)	(0.319)	(0.318)	(0.326)	(1.260)	(0.755)	(0.304)	(0.657)
INFLATION	-0.010	-0.011	-0.009	-0.011	-0.029*	-0.015	-0.005	-0.025
	(0.018)	(0.019)	(0.019)	(0.018)	(0.016)	(0.018)	(0.018)	(0.016)
DOM. CREDIT	-0.122	-0.120	-0.118	-0.151	-0.227**	-0.200*	-0.074	-0.219**
	(0.101)	(0.103)	(0.103)	(0.098)	(0.089)	(0.110)	(0.101)	(0.090)
IMP. PEN.		-0.110						2.309***
		(0.067)						(0.574)
FDI x EDU			0.022					
			(0.055)					
FDI x ECO				-0.238**				
				(0.112)				
TRADE x ECO					-1.497***			
					(0.358)			
ODA x ECO						0.334		
						(0.200)		
ODA x EDU							-0.219*	
							(0.112)	
IMP. PEN x ECO								-1.573***
								(0.371)
Constant	-1.552	-2.153**	-1.591	-0.822	-8.280***	0.521	-0.826	2.806*
	(0.942)	(0.924)	(0.957)	(0.968)	(1.794)	(1.545)	(0.984)	(1.406)
Observations	93	93	93	93	93	93	93	93
R-squared	0.804	0.798	0.805	0.823	0.863	0.816	0.821	0.860
Number of Countries	18	18	18	18	18	18	18	18
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Anocracies. For anocracies, FDI has a positive *but* insignificant association with TFP. However interactions with EDU and ECO make the association more positive. This is similar to the results of the baseline model and along with the findings of Borensztein et al. (1998). It suggests that these countries need to increase their absorptive capacity to reap the benefits of FDI to TFP. Like autocratic countries, TRADE, Import Penetration and ODA seem to have a negative association with TFP. However unlike autocracies, the interaction of TRADE or ODA and ECO does make the association more positive. Additionally, ECO and EDU have positive and significant associations with TFP. This suggests that increasing the absorptive capacities of these countries is not only associated with an increase in TFP but also makes the association of contact variables more positive which is in line with the hypothesis of this paper.

Democracies. Unlike the baseline model, democratic countries overall have a positive *and* significant association between TFP and FDI. This corresponds with the hypothesis proposed by this paper. Like the baseline model, TRADE and Import Penetration still have a negative association with TFP growth. This suggests that democracy alone does not impact the trading patterns of SSA countries. Democratic countries have similar trading patterns to other countries on the continent and either bring in very little capital goods or import consumer goods that price out domestic consumer goods.

Table 4.6. Regression Results for Anocratic Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	-0.003	-0.004	0.058***	-0.183***	-0.003	0.000	-0.003	-0.004
	(0.006)	(0.006)	(0.016)	(0.049)	(0.006)	(0.006)	(0.006)	(0.006)
TRADE	-0.134***		-0.141***	-0.144***	-1.256***	-0.172***	-0.133***	
	(0.047)		(0.045)	(0.046)	(0.310)	(0.044)	(0.048)	
ODA	-0.046**	-0.047**	-0.031	-0.029	-0.017	0.432***	-0.051	-0.040*
	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.082)	(0.050)	(0.021)
EDU	0.207**	0.179*	0.310***	0.284***	0.253**	0.398***	0.224	0.179*
	(0.102)	(0.101)	(0.102)	(0.101)	(0.099)	(0.099)	(0.189)	(0.101)
ECO	0.677***	0.690***	0.748***	0.689***	-1.950***	1.116***	0.677***	0.877***
	(0.093)	(0.093)	(0.092)	(0.091)	(0.725)	(0.114)	(0.094)	(0.253)
INFLATION	-0.026***	-0.026***	-0.025***	-0.027***	-0.025***	-0.026***	-0.026***	-0.026***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)
DOM. CREDIT	0.018	0.016	0.028	-0.006	0.014	0.007	0.018	0.016
	(0.029)	(0.029)	(0.028)	(0.029)	(0.028)	(0.027)	(0.029)	(0.029)
IMP. PEN.		-0.124**						-0.365
		(0.049)						(0.305)
FDI x EDU			0.047***					
			(0.011)					
FDI x ECO				0.112***				
				(0.031)				
TRADE x ECO					0.663***			
					(0.181)			
ODA x ECO						-0.293***		
						(0.049)		
ODA x EDU							-0.005	
							(0.050)	
IMP. PEN x ECO								0.144
								(0.179)
Constant	-0.617**	-1.368***	-0.608**	-0.495	3.701***	-0.674**	-0.601*	-1.747***
	(0.310)	(0.214)	(0.298)	(0.302)	(1.219)	(0.285)	(0.346)	(0.520)
Observations	237	237	237	237	237	237	237	237
R-squared	0.533	0.529	0.570	0.564	0.564	0.608	0.533	0.530
Number of Countries	18	18	18	18	18	18	18	18
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Table 4.7. Regression Results for Democratic Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	0.020***	0.020***	0.017	-0.062	0.020***	0.020***	0.021***	0.020***
	(0.006)	(0.006)	(0.015)	(0.085)	(0.006)	(0.006)	(0.006)	(0.006)
TRADE	-0.179***		-0.182***	-0.168***	0.184	-0.177***	-0.171***	
	(0.045)		(0.046)	(0.047)	(0.419)	(0.045)	(0.047)	
ODA	0.021	0.023	0.022	0.021	0.019	-0.047	0.009	0.020
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.104)	(0.026)	(0.015)
EDU	0.125*	0.127*	0.118*	0.147**	0.079	0.103	0.193	0.074
	(0.066)	(0.066)	(0.070)	(0.069)	(0.084)	(0.073)	(0.135)	(0.083)
ECO	0.429***	0.442***	0.425***	0.440***	1.291	0.368**	0.452***	0.194
	(0.142)	(0.142)	(0.143)	(0.142)	(1.000)	(0.168)	(0.148)	(0.280)
INFLATION	-0.011	-0.010	-0.011	-0.009	-0.012	-0.010	-0.010	-0.011
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
DOM. CREDIT	-0.077**	-0.078**	-0.078**	-0.074**	-0.071**	-0.076**	-0.079**	-0.071**
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
IMP. PEN.		-0.191***						0.262
		(0.049)						(0.443)
FDI x EDU			-0.004					
			(0.015)					
FDI x ECO				0.045				
				(0.046)				
TRADE x ECO					-0.201			
					(0.231)			
ODA x ECO						0.036		
						(0.053)		
ODA x EDU							-0.020	
							(0.036)	
IMP. PEN x ECO								-0.254
								(0.246)
Constant	0.372	-0.603**	0.387	0.327	-1.246	0.455	0.358	-0.231
	(0.320)	(0.244)	(0.325)	(0.323)	(1.884)	(0.343)	(0.321)	(0.436)
Observations	202	202	202	202	202	202	202	202
R-squared	0.317	0.315	0.317	0.321	0.320	0.319	0.319	0.319
Number of Countries	14	14	14	14	14	14	14	14
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Geography

Landlocked Countries. Overall, FDI appears to have a positive and significant association with TFP in landlocked countries. This suggests that the kind of FDI coming into these countries are those that spur competition in domestic industries. It is most likely coming into industries that have domestic competition. The interaction with EDU increases the positive association of FDI to TFP. This is in line with the hypothesis of this paper. Like the baseline model, TRADE and Import Penetration have negative and significant associations with TFP suggesting that landlocked countries may predominantly export commodities. It may also suggest that they mostly import consumer goods which may not have a positive association with TFP growth.

Additionally, like the baseline model, the interaction between import penetration and ECO leads to a positive association between import penetration and TFP. This may suggest that increasing economic freedom lets domestic firms better replicate technology that is imported.

On the other hand, EDU appears to have a negative association with TFP which contradicts the hypothesis of this paper and suggests that the quality of education may be too low to absorb the technology that may come in contact with the country.

Like the baseline model and in line with the hypothesis paper, ECO has a positive and significant impact on TFP.

Coastal Countries. Unlike landlocked countries, FDI is negatively and insignificantly associated with TFP. This is contrary to the hypothesis of this paper and may suggest

that the FDI going into these countries may be in specific industries where it cannot be diffused into other parts of the economy.

Additionally, TRADE and Import Penetration have an insignificant association with TFP. However when they interact with ECO, the association becomes positive and significant. This is similar to what was suggested earlier in this paper that absorptive capacities often increase the impact of contact variables on TFP.

Table 4.8. Regressions for Landlocked Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	0.016**	0.017**	0.059**	-0.077	0.017**	0.016**	0.016**	0.017**
	(0.008)	(0.008)	(0.024)	(0.066)	(0.007)	(0.007)	(0.008)	(0.007)
TRADE	-0.195***		-0.200***	-0.207***	0.729	-0.189***	-0.193***	
	(0.064)		(0.064)	(0.065)	(0.468)	(0.063)	(0.065)	
ODA	-0.039	-0.032	-0.030	-0.026	-0.054*	-0.417***	-0.002	-0.054*
	(0.027)	(0.028)	(0.028)	(0.029)	(0.028)	(0.150)	(0.054)	(0.029)
EDU	-0.333**	-0.323**	-0.237*	-0.295**	-0.436***	-0.427***	-0.472**	-0.459***
	(0.130)	(0.130)	(0.139)	(0.133)	(0.139)	(0.133)	(0.220)	(0.140)
ECO	0.763***	0.743***	0.718***	0.784***	2.953***	0.266	0.756***	-0.349
	(0.120)	(0.120)	(0.122)	(0.121)	(1.104)	(0.227)	(0.121)	(0.482)
INFLATION	-0.022	-0.022	-0.020	-0.023*	-0.019	-0.020	-0.023	-0.019
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.014)	(0.013)
DOM. CREDIT	-0.060	-0.064*	-0.059	-0.076*	-0.048	-0.071*	-0.058	-0.047
	(0.038)	(0.038)	(0.038)	(0.040)	(0.038)	(0.038)	(0.038)	(0.038)
IMP. PEN.		-0.235***						1.232*
		(0.072)						(0.632)
FDI x EDU			0.030*					
			(0.016)					
FDI x ECO				0.058				
				(0.041)				
TRADE x ECO					-0.560**			
					(0.281)			
ODA x ECO						0.212**		
						(0.082)		
ODA x EDU							0.041	
							(0.052)	
IMP. PEN x ECO								-0.879**
								(0.376)
Constant	-0.574	-1.594***	-0.388	-0.508	-4.295**	0.181	-0.710	0.091
	(0.468)	(0.365)	(0.474)	(0.468)	(1.922)	(0.544)	(0.499)	(0.806)
Observations	176	176	176	176	176	176	176	176
R-squared	0.440	0.446	0.454	0.449	0.456	0.467	0.443	0.468
Number of Countries	9	9	9	9	9	9	9	9
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Table 4.9. Regressions for Coastal Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	-0.001	-0.001	0.003	-0.056	-0.001	0.009	-0.000	0.002
	(0.006)	(0.006)	(0.020)	(0.051)	(0.006)	(0.006)	(0.006)	(0.005)
TRADE	-0.045		-0.044	-0.043	1.249***	-0.075*	-0.039	
	(0.041)		(0.041)	(0.041)	(0.225)	(0.038)	(0.042)	
ODA	-0.018	-0.018	-0.018	-0.019	-0.035**	0.407***	-0.039	-0.042***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.060)	(0.035)	(0.014)
EDU	0.121	0.115	0.123	0.125	0.095	0.309***	0.211	0.101
	(0.082)	(0.082)	(0.083)	(0.082)	(0.078)	(0.080)	(0.164)	(0.076)
ECO	0.696***	0.689***	0.701***	0.710***	3.592***	1.037***	0.703***	-0.612***
	(0.102)	(0.101)	(0.105)	(0.103)	(0.505)	(0.105)	(0.103)	(0.197)
INFLATION	-0.010	-0.009	-0.010	-0.010	-0.011	-0.013	-0.010	-0.010
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
DOM. CREDIT	0.119***	0.121***	0.117***	0.109***	0.144***	0.089***	0.116***	0.144***
	(0.030)	(0.030)	(0.031)	(0.032)	(0.029)	(0.028)	(0.031)	(0.028)
IMP. PEN.		-0.059						1.360***
		(0.042)						(0.193)
FDI x EDU			0.003					
			(0.018)					
FDI x ECO				0.034				
				(0.031)				
TRADE x ECO					-0.765***			
					(0.131)			
ODA x ECO						-0.254***		
						(0.035)		
ODA x EDU							-0.023	
							(0.036)	
IMP. PEN x ECO								-0.854***
								(0.114)
Constant	-1.028***	-1.288***	-1.031***	-1.025***	-6.006***	-1.156***	-0.968***	0.842***
	(0.263)	(0.165)	(0.263)	(0.263)	(0.888)	(0.244)	(0.280)	(0.322)
Observations	356	356	356	356	356	356	356	356
R-squared	0.387	0.388	0.387	0.389	0.449	0.477	0.388	0.484
Number of Countries	16	16	16	16	16	16	16	16
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Oil Export

Oil-Exporting Countries. For oil-exporting countries, the association of FDI to TFP is surprisingly insignificant and negative. However this may be suggestive of the kind of FDI that is brought into these countries. Most of the FDI coming into these countries are for the oil industry. However this kind of FDI has little interaction with the domestic economy. Also the technology used in this industry cannot be used in any other sector so it cannot be diffused into the domestic economy. Alternatively, it could be that the level of education in these countries may be too low to absorb any other advantages being brought in in the form of FDI. This is suggested by the fact that the interaction of FDI and EDU is positive meaning that increasing FDI and EDU simultaneously leads to a positive association with TFP growth.

Non-Oil-Exporting Countries. For countries that do not export oil, FDI appears to have a positive and significant association with TFP. This in line with the results previously noted in this paper. It suggests that unlike oil-exporting countries, the FDI coming into these countries are moving into industries with significant labor mobility or significant domestic interaction. This allows the incoming technology to be diffused and absorbed into the domestic economy. As an example, the FDI could be coming into the agricultural, manufacturing or service sectors. These sectors all have domestic counterparts that can absorb this new technology either by copying them or by labor turnover.

For both groups, TFP growth negatively depends on TRADE and ODA have a negative and significant association with TFP growth. ECO also has a positive and significant association with TFP in both groups.

Table 4.10. Regressions for Oil Exporting Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	-0.007	-0.011	0.066*	-0.227	-0.007	-0.007	-0.010	-0.010
	(0.011)	(0.012)	(0.035)	(0.144)	(0.011)	(0.012)	(0.011)	(0.012)
TRADE	-0.344***		-0.341***	-0.364***	-0.500	-0.344***	-0.288***	
	(0.066)		(0.064)	(0.066)	(0.428)	(0.067)	(0.068)	
ODA	-0.039**	-0.042**	-0.032*	-0.032*	-0.036*	-0.049	-0.199***	-0.046**
	(0.017)	(0.018)	(0.017)	(0.018)	(0.019)	(0.173)	(0.070)	(0.020)
EDU	0.145	0.158	0.040	0.084	0.116	0.139	0.503*	0.199
	(0.218)	(0.229)	(0.219)	(0.220)	(0.233)	(0.246)	(0.263)	(0.245)
ECO	1.322***	1.367***	1.275***	1.193***	0.982	1.326***	1.324***	1.144**
	(0.165)	(0.173)	(0.163)	(0.184)	(0.935)	(0.177)	(0.161)	(0.491)
INFLATION	-0.017	-0.020	-0.016	-0.016	-0.016	-0.017	-0.022*	-0.020*
	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
DOM. CREDIT	0.090**	0.087*	0.095**	0.075	0.087*	0.090**	0.073*	0.089*
	(0.044)	(0.046)	(0.043)	(0.045)	(0.045)	(0.045)	(0.044)	(0.047)
IMP. PEN.		-0.285***						-0.086
		(0.069)						(0.414)
FDI x EDU			0.079**					
			(0.036)					
FDI x ECO				0.133				
				(0.086)				
TRADE x ECO					0.093			
					(0.254)			
ODA x ECO						0.005		
						(0.103)		
ODA x EDU							-0.172**	
							(0.073)	
IMP. PEN x ECO								-0.123
								(0.254)
Constant	-0.820**	-2.618***	-0.870**	-0.581	-0.287	-0.836*	-0.607	-2.204**
	(0.367)	(0.249)	(0.360)	(0.396)	(1.490)	(0.456)	(0.369)	(0.891)
Observations	129	129	129	129	129	129	129	129
R-squared	0.835	0.819	0.844	0.840	0.836	0.835	0.845	0.819
Number of Countries	9	9	9	9	9	9	9	9
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

Table 4.11. Regressions for Non-Oil Exporting Countries

VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
FDI	0.017***	0.017***	0.050***	-0.034	0.016***	0.017***	0.016***	0.017***
	(0.004)	(0.004)	(0.013)	(0.035)	(0.004)	(0.004)	(0.004)	(0.004)
TRADE	-0.096***		-0.099***	-0.098***	0.149	-0.094***	-0.098***	
	(0.035)		(0.035)	(0.035)	(0.244)	(0.035)	(0.035)	
ODA	-0.037**	-0.033**	-0.035**	-0.035**	-0.039**	-0.092	0.001	-0.036**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.080)	(0.030)	(0.016)
EDU	-0.102	-0.101	-0.032	-0.085	-0.135*	-0.122	-0.259**	-0.135*
	(0.069)	(0.068)	(0.073)	(0.070)	(0.076)	(0.074)	(0.126)	(0.076)
ECO	0.445***	0.438***	0.431***	0.463***	1.019*	0.375***	0.440***	0.217
	(0.074)	(0.074)	(0.074)	(0.075)	(0.572)	(0.125)	(0.074)	(0.225)
INFLATION	-0.014*	-0.014*	-0.012	-0.014*	-0.014*	-0.014*	-0.015*	-0.014*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
DOM. CREDIT	-0.001	0.000	-0.002	-0.010	0.002	-0.000	0.003	0.004
	(0.024)	(0.024)	(0.024)	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)
IMP. PEN.		-0.124***						0.193
		(0.038)						(0.308)
FDI x EDU			0.026***					
			(0.009)					
FDI x ECO				0.032				
				(0.022)				
TRADE x ECO					-0.144			
					(0.142)			
ODA x ECO						0.030		
						(0.044)		
ODA x EDU							0.044	
							(0.029)	
IMP. PEN x ECO								-0.186
								(0.178)
Constant	-0.238	-0.773***	-0.122	-0.223	-1.258	-0.149	-0.376	-0.438
	(0.238)	(0.196)	(0.240)	(0.237)	(1.035)	(0.270)	(0.254)	(0.377)
Observations	403	403	403	403	403	403	403	403
R-squared	0.257	0.264	0.272	0.262	0.260	0.258	0.262	0.266
Number of Countries	20	20	20	20	20	20	20	20
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.1

CHAPTER FIVE

Discussion & Conclusion

Discussion

In light of these results, we will look at recent macroeconomic trends occurring on the continent. These include the economic growth trend on the continent; the quality of African human capital; the African Continental Free Trade Agreement, and the presence of China in Africa.

According to the African Development Bank (AfDB 2020), growth across the continent has stabilized at a little over two percent. However, this growth has been through capital accumulation and that rate is not enough to pull most of the continent out of extreme poverty by 2030. Consequently, African countries need to focus on structural reforms that turn their economies away from low-skilled industries (like primary commodities) and focus them on industries with higher productivity like manufacturing and services. This is because the price volatility of commodities will heavily impact the budgets of these countries. An example of this is that the slump in oil prices in early 2020 has caused some oil-exporting countries to revisit their budget or look for loans.

Based on the results of this study, one of the ways to encourage the growth of higher-productivity industries is to remove economic constraints that hinder these industries. Land reform laws and increased property rights would increase economic freedom and thus encourage these industries. This is buttressed by the results of this study which show that an increase in economic freedom generally increases the association between FDI and TFP growth in SSA countries. African countries also need

to ensure that there is peace within their borders. Firms are unlikely to invest in long-term, high-productivity industries if there are pockets of unrest within a country. Therefore, the policies for increasing economic freedom should include solutions to civic unrest in the sub-region.

Some literature holds that the quality of human capital is limiting the labor productivity of the continent. According to the AfDB (2020), studies show that African students have consistently scored lower test scores than their counterparts in other parts of the world. This is a cause for concern since the quality of human capital often determines the sort of foreign investment that comes into a country (low-skilled versus high-skilled). It also influences the kinds of jobs available to the labor force. Currently, more than half of Africa's labor force is employed in low-skilled jobs which in turn affects the trade patterns of these countries (AfDB 2020).

Alternatively, it could also be that jobs that require a highly skilled labor force are not abundant on the continent, and, therefore, some of the labor force is underemployed even though they are highly-skilled. This ties back to the issue of structural reforms. Education often supplies labor in response to the kind of labor demanded. If African countries want to diversify their economies and attract more productive investments, they need to improve the quality of education on the continent. This education should be focused on skills that are needed by highly-productivity industries. This is buttressed by the fact that an increase in EDU generally increases the impact of FDI, TRADE, and ODA on the productivity of SSA countries. This means that SSA countries have to focus on improving the economic environment *and* the quality of human capital to properly implement structural transformation.

According to the AfDB (2020), official aid to education has been increasing worldwide. In 2017, the African continent received 36 percent of the 14.8 billion dollars of aid spent on education worldwide. Currently, that aid is used in various aspects of education including school administration, facility construction, teacher training and education research. However as we have seen in this paper, increasing the years schooling is may not be enough to increase productivity. We have also seen that official aid (which includes educational aid) is also negatively associated with a nation's productivity.

One reason for this could be because of weak institutions that allow aid earmarked for education to be diverted or embezzled. Alternatively, it could also be because aid that is not focused on improving the *quality* of education may not be effective. This is supported by a study cited by the AfDB (2020) which found that international aid was most effective when it was used in teacher training as opposed to project funding. Therefore to make educational aid more effective, these funds should be well targeted in ways that train students in skills that would be needed in highly productive sectors. This could include computer programing and ancillary skills necessary to support a vibrant manufacturing or services sector.

In 2019, the African Continental Free Trade Agreement (AfCTA) went into effect. It has been signed by 54 African countries and, if properly executed, creates the largest trading bloc since the WTO. Among other things, the first part of the agreement requires member countries to remove tariffs on goods traded within the bloc. This has the potential to make a monumental change in the trading patterns of many African countries. According to Shao (2019), intra-African exports are less than 20 percent as opposed to 59

percent of intra-Asian exports or 69 percent of intra-European exports. The hope, therefore, is that the removal of tariffs will significantly improve the amount of intra-African trade and thus spur competition in local industries.

However, the ability of these countries to take advantage of this agreement is contingent on a few factors: that goods produced in Africa are adequate substitutes for goods produced outside the continent so that the lowered prices would make people choose the former, and these countries have the transportation infrastructure necessary to transport goods across the continent.

Currently, the association of trade and productivity in most countries is negative. The only exceptions are upper-middle-income countries that generally have a significant manufacturing sector and better infrastructure. Therefore for SSA countries to take advantage of this agreement, they need to develop a manufacturing sector and significant transportation infrastructure. This is especially true for landlocked countries who need to rely on road and air transport only.

In recent years, as part of its Belt and Road Initiative, China has taken a more focused interest in Africa. Their development strategy has focused on building much-needed infrastructure on the continent. According to Mourdoukoutas (2019), African nations have to pay for these projects with debt or with strategic agreements that often grant huge concessions to China. These concessions can range from maritime rights to permission to build military bases.

The question, therefore, is do these African countries benefit from these projects undertaken by China? The answer to this question remains to be seen. However from the results of this study. We find that aid is often beneficial to the recipient country only

when it is paired with good economic institutions. Aid appears to have a negative association with productivity in countries with weaker institutions. This could be because of lax regulatory rules that may allow for the use of suboptimal materials for these infrastructural projects in return for kickbacks to government officials.

Conclusion

In this paper, we have tried to examine the associations between contact points of technology transfer and absorptive capacities on the productivity of Sub-Saharan African countries.

Overall, the association between foreign direct investment alone and productivity growth in SSA countries varies and depends on the industry receiving the investment and on the prevailing characteristics of the recipient countries. In countries with a high level of human capital, democratic countries, and countries that do not export oil, TFP positively depends of FDI. Trade is negatively associated with productivity for all SSA countries except upper-middle-income countries where the association is positive. Developmental aid usually has a negative association with productivity in SSA countries unless the recipient countries also increase the level of human capital or the quality of their economic institutions.

For absorptive capacities, the direction of association between human capital and productivity growth depends on the unique characteristics of each country and the overall quality of education. On the other hand, TFP growth is positively associated with better economic institutions overall.

Based on these findings, SSA countries need to pair policies aimed at increasing FDI, trade or development aid with a focus on improving the quality of human capital in their countries as well as strengthening their economic institutions.

APPENDICES

Appendix A

Summary of Literature Review

Author	Variables Examined	Number of Countries	Number of Countries in Sub-Saharan Africa
Aitken and Harrison (1999)	FDI (-)	1	0
Woo (2009)	FDI (+) Not contingent on absorptive capacity	92	23
Malikane and Chtambara (2017)	FDI (+) Distance from Technology Frontier (+)	45	45
Borensztein et al. (1998)	FDI (+) Contingent on absorptive capacity	69	29
Herzer and Donaubauer (2018)	FDI (-)	49	15
Adnan et al (2019)	FDI (+) Human Capital(+/-) Trade Openness (-) Govt. Expenditure(-/+)	4	0
Sadik and Bolbol (2001)	FDI (-)	14	1
Baltabaev (2014)	FDI (+)	49	3
Savvides and Zachariadi (2005)	FDI (+) Foreign R&D (+) Capital Goods Import (+)	32	6
Akinlo and Adejumo (2016)	FDI (+) Human Capital (+/-) Inflation (-) Unemployment (-)	1	1

Coe et al (1997)	Trade (+) R&D Capital of trade partners (+)	77	32
Isaksson (2002)	Trade (+) Contingent on Human Capital	73	17
Miller and Upadhyay (2000)	Trade (+) Human Capital (+/- depending on income)	83	17
Akinlo (2005)	FDI (+) Trade(+) Human Capital(+) External Debt (-) Inflation (-)	34	34
Edwards (1998)	Trade (+) Human Capital (+)	93	22
Mendi (2007)	Trade (+) Domestic R&D (+)	16	0
Habib et al. (2019)	Human Capital (+) Intellectual Property Rights (+) R&D Expenditure (+)	16	0
Nelson and Phelps (1966)	Human Capital(+)	1	0
Benhabib and Spiegel (1994)	Human Capital (+)	121	41
Alvi and Ahmed (2014)	Human Capital (+)	37	1
Kumar and Chen (2013)	Health (+) Education (+)	97	32
Olomola and Osinubi (2018)	Human Capital (+) Government Stability (+) FDI (-) Corruption (-)	4	1
Alvi and Senbeta (2012)	ODA (-)	62	23
Fadrian and Akanbi (2017)	Economic Institutions (+) Trade Openness (-)	26	26
Hall and Jones (1999)	Institutions (+)	127	42
Tebaldi (2016)	Institutions (+) Trade Openness (+)	63	22
Bjornskov and Meon (2015)	Institutional Quality (+)	67	13

Fosu (2013)	Institutions (+) Ethnic Division (-)	38	38
Le (2012)	Institutions (inconclusive) International R&D (+)	41	41

Appendix B

List Of Countries In Sample

Angola

Benin

Botswana

Burkina Faso

Burundi

Cameroon

Central African Republic

Cote d'Ivore

Eswatini (Swaziland)

Gabon

Kenya

Lesotho

Mauritania

Mauritius

Mozambique

Namibia

Niger

Nigeria

Rwanda

Senegal

Sierra Leone

South Africa

Tanzania

Togo

Zimbabwe

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