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ECON 492
May 5th, 2023

Testing the Effect of Foreign Capital Inflows on Fixed Capital Formation in Developing African Countries

Introduction

Developing African countries have long been in a disadvantageous position. Not due to a lack of resources but rather because of a lack of a functioning political and business environment that can create new value for these nations to exploit. This isn't for a lack of trying. African nations have had no shortage of foreign aid, yet the development seen in African nations seems to always come short of their similarly situated peers. The major claim is corruption that syphons off AID so it is much less effective than it could be. "Illicit financial flows out of Africa… cost African countries more than $88 billion every year… That exceeds the $52 billion in annual international aid…" (Ibrahim, 2022). Ibrahim continues to argue that the main reason that African nations cannot develop as quickly as they would like is because of the AID that swamps the continent and cheaper interest rates on loans would go further than AID. Therefore, there is a convincing argument to be made that those countries donating funds to Africa should reevaluate their policies for doing so.

This critique has led to a conversation that it may be more important how a country donates rather than the amount a country donates. It seems counterintuitive that aid could be doing just as much harm as good. There are now articles like this Guardian article titled, *As a System, Foreign Aid is a Fraud and Does Nothing for Inequality* (Malik, 2018). While claims that foreign aid is completely ineffective may be overblown, there seems to be some truth here. It may be the case that donating countries have simply chosen an ineffective method of providing help that is beneficial in the short run but creates dependency in the long run. The policy goal should be one to provide immediate relief when needed, but also to create a stable policy

environment in the receiving country so that it can support itself in the long term. It seems that current aid solutions have not addressed the latter. Ultimately, this would lead to a closing of the wealth gap between emerging and developed markets as these developing countries become more productive.

Productivity, being the heart of economic growth, should then be the focus of the international community's aid efforts. Capital is a key component in productivity, and it is also something that developing countries lack when compared to their more developed peers. Therefore, if the international community wants to help African nations in the long term, they should focus on policies that have the highest conversion to fixed capital, because that would lead to an increase in productivity. One caveat, however, is that even if there is fixed capital development, the value it generates may not be going to the local population, but rather to large multinational enterprises, which export this value abroad. This is important because the goal of aid should be to help the local population where it is going to, not the local multinational enterprises that happen to be in the area. However, for this paper we will not be worried about this effect, and this concern can be left to future research.

In this paper I advance the conversation about how to best support developing African countries by answering the question: Within developing African nations, do foreign capital inflows inhibit or assist the development of domestic fixed capital formation (FCF)?

Literature Review

There is a rich literature on the effects of international aid, foreign development assistance, foreign capital inflows and their effects on growth within developing countries. Most often authors are trying to measure growth in GDP or growth in domestic capital markets via some other indicator (usually FCF). However, it seems that much of the empirical foundation for

these effects doesn't consider or use data from developing countries in Africa. And even if African countries are included, often it is just a subset of countries or the authors are just looking at one form of capital flow. In this paper I hope to take the knowledge that has been cultivated in other regions of the world and apply it to developing African nations. Additionally, I hope to expand on the understanding of how financing operates in Africa along with the interaction of these capital flows. There are three important parts of the literature to highlight. First the effects of overall capital inflows on growth. Second, the interaction between these capital flows. And finally, the potential suppression of domestic investment.

First, turning to literature on overall growth. This part of the literature is important foundationally because there is no point studying how these various capital flows if they don't encourage growth in the long term and therefore better living standards. The main indicators that have been studied include overall foreign capital inflows (FCI), foreign direct investment (FDI), official development assistance (ODA), domestic investment (DI), and personal remittances (PI). As a point of clarification, some studies call ODA foreign aid (AID), but they are measuring the same idea. For this paper, I will use ODA. Additionally, there are many different ways to estimate DI, but most studies use gross fixed capital formation (FCF).

Younsi et al. (2021) studied the effects of FDI, ODA, and DI and the interactions between the three. They measured DI using FCF. They used the Generalized Method of Moments to measure the indicators' effects on growth. The authors found a nonlinear relationship between the indicators, but all indicators had a positive effect on growth. The nonlinearity is interesting and it can show that the makeup of FDI can affect growth in different ways; this gives credibility that there could be some interaction between capital inflows and domestic market development.

Adusah-Poku (2016) studied the effects of ODA, FDI and PI in the economic growth process of Sub-Saharan Africa. They specifically wanted to test the results that all capital flows increase GDP with the new pooled means group estimator. Using this technique, the authors estimated both the short and long run impacts of these capital flows to the host country. In the long run, the authors found that all three inflows have a significant effect on growth at the 1% level. They also confirmed these findings in the long run with the unit root test. However, in the short run they found that only personal remittances remain significant but only at the 5% level. This finding shows the need to consider a time dimension when trying to discern the effects of capital flows because as the authors point out these effects can vary depending on time scale. Additionally, it would be enlightening to see how the short run and long run effects differ across countries. It would be sensible to say the quality of institutions, and their ability to disperse capital to those who need it, would change the short-term relationship.

The findings in the literature are clear to the point that it could be considered mundane: it doesn't matter the capital flow; GDP will increase because of these flows in the long run. In the context of my paper, this means that we would expect ODA to have a positive effect on growth. However, this part of the literature shows little in the interaction between the capital flows, so it is hard to derive policy from this knowledge alone. While a positive relationship is an important theoretical baseline for this analysis, it has been well established both in theory and empirically many times.

The more topical area of interest is the interactions between these capital flows as that will give better policy guidance. Uneze (2012) tried to explain changes in private investment by disaggregating the effect of ODA into ODA received from multilateral institutions and bilateral institutions. The authors specifically looked at West African countries (sometimes referred to as

ECOWAS). The authors argued they selected this region because, "[ECOWAS] is the most populous and integrated of the regional economic groupings in Africa." They also highlight a second reason that since private capital inflows are low in West Africa, it makes the empirical work of discerning the effects of different types of ODA easier. The author found that when ODA was separated, only multilateral ODA had a significant impact on private investment, while bilateral aid was not significant. This finding shows that not all ODA should be treated the same. In this paper I use a similar dataset to the author of this study to account for different types of ODA.

In a similar vein, Kemmanang and Zamké (2021) looked at the quality of institutions, along with investment concentration, as a determinant of FDI. The authors found that the more concentrated the source of FDI inflows, the more it crowds out other sources of FDI. Additionally, the authors found that there is an inverse relationship between FDI concentration and the quality of institutions in the receiving country. The authors also make a somewhat novel theoretical argument, arguing that high levels of FDI concentration represent the legacy of the colonizer-colonized relationship. They posit that high levels of FDI concentration represent a risk to investors because it could demonstrate a relationship that gives unfair advantages to capital that originates from the former colonizer. Unlike some of the previous studies discussed, the authors looked at data from 37 African countries between 2009 and 2018. This data makes Kemmanang and Zamké's work much more impactful because it has some of the most comprehensive data out of all the studies, especially in the context of this paper. This study demonstrates that the FDI makeup for each country should be considered as well.

Both Uneze (2012), and Kemmanang and Zamké (2021) demonstrate that there are complex relationships between differing capital flows. However, both are myopic in their

approach. The only capital inflow Uneze (2012) had in their model was ODA. In Kemmanang and Zamké (2021) case they had both FDI and ODA, but instead of separating ODA into bilateral and multilateral parts, they split it into ODA from the colonizer and ODA from everyone else. This has a big drawback the authors themselves even recognize; not every country that has high levels of FDI concentration receives a plurality of their FDI from their original colonizer (China, Russia and the United States have replaced many). Therefore, since their theoretical foundations are based on this colonizer-colonized relationship, we cannot put too much weight on their findings for the effects of ODA. In my paper, I combine the best data from these studies to gain a more complete understanding of capital flow interactions in Africa.

Continuing with domestic investment, the previous section's articles notably omitted this capital flow. I would argue domestic investment is the most important indicator of success if we are considering Africa's long term economic growth prospects. It would be preferable for ODA to help develop the recipient country's political/business environment so that the recipient country can create its own value in the future that it can exploit. Because of these considerations, the last section of the literature I would like to highlight is how ODA affects behavior by the recipient country.

Benedek et al. (2012) studied whether ODA crowds out government revenue collection. This study is unique from the other studies on ODA discussed. The authors broke down ODA into two parts: grants and loans. First, ODA loans are loans often given out at an advantageous interest rate for the borrower. Second, ODA grants are funds that do not need to be paid back. They had a large set of panel data for 118 countries. They confirmed, generally, that ODA crowds out government tax revenue. However, they offer many caveats. The authors note that both the makeup of the government and their type of tax scheme both matter in the effect of

ODA on government revenues. They also note that the composition of ODA matters. ODA grants had a much more significant impact on government revenues than ODA loans. This fact would imply that ODA grants and government revenue are complements. Therefore, because of all these considerations the authors discuss, it is necessary to study each region, or maybe country, if possible, to independently assess their relationship with ODA.

Continuing this idea, Bakhtiari et al. (2013) wanted to test how official development assistance affects domestic government behaviors. The authors found, "developing countries public sector authority reduce their revenue collection efforts when net official development assistance is made available to them." This finding gives one clear conclusion: in the context of the countries studied, ODA crowds out public sector funding. They also found that government expenditure does not go up when receiving ODA. Therefore, the economic implication is that ODA and public sector borrowing are substitutes for each other; ODA does not increase current expenditures and may be underwriting the debts of foreign countries. However, the data they used included no developing countries in Africa. In fact, they have countries in their model from every continent except Europe and Africa, but they offer no explanation of why certain countries were included or excluded. This lack of data is quite unfortunate because as Benedek et al. (2012) previously remarked, the effects of ODA on government revenue is highly region/country dependent.

Eregha (2012) studied the effect of FDI on DI. They specifically were looking at the economies of ECOWAS countries. This is useful because they are looking at domestic investment in Africa, however, the focus of this study is FDI, and they make no mention of ODA in the paper. The authors used a lagged variable of FDI to account for the time it takes for FDI to disperse throughout an economy. The authors found that FDI had a negative influence on

domestic investment but only in the lagged terms and current year FDI is not significant on current year GDP growth. This is consistent with Adusah-Poku (2016) which found that all kinds of capital flows are much more significant in the long term. This find also reinforces Bakhtiari et al. (2013) conclusion that ODA and DI are complements but on a more general scale. Instead of just showing the government changes its behavior, it has a general effect on the level of DI in the economy as a whole.

I would also like to take the time to explain how these studies measure DI. The issue is there is no data on investment that originates domestically for developing African countries, so we need a proxy. Many studies use domestic investment as a percentage of GDP to measure domestic investment levels. They define "domestic investment" to mean gross fixed capital formation (FCF). However, there is a discrepancy here in the methodology of some studies. Eregha (2012) subtracted foreign capital inflows from FCF to account that all these inflows are going to increase domestic investment, and to remove the portion that would have come from outside the domestic economy. Younsi et al. (2021), however, only looks at gross FCF and does not subtract foreign capital inflows. The second method creates a problem. How does one know whether this increase in fixed capital formation is from domestic funding or international funding? By not subtracting foreign capital inflows, this substitute for domestic investment functions more as a level of efficiency. Given that we can't discern between domestic and foreign effects if fixed capital expenditures correlated with GDP growth this would just show that building new capital increases GDP; and the magnitude of the effect could be considered some level of efficiency in the deployment of capital.

However, for my analysis I will use the method described by Younsi et al. (2021) because I estimated a total change in fixed capital formation as a function of both foreign and

domestic investment. Therefore, since I am accounting for both in my explanatory variables, I will not subtract off foreign investment.

In review, the literature has a few key findings. First, it doesn't matter about the capital flow, the more inflows to a country, the more it will grow. This leads to the second key finding that the type of capital flows into a country are interrelated, so policy needs to be aware of these implications. Finally, there is a clear theme in the literature that ODA crowds out domestic expenditures, but there is no good data to prove this hypothesis within developing African nations.

In this paper I hope to contribute to the literature by filling in an apparent gap in knowledge about how foreign capital inflows affect domestic capital markets. Specifically, I hope to examine the relationship between multiple forms of capital inflows, and the amount of private investment generally within the recipient's economy. I also will use FCF as a proxy for overall capital investment and the savings rate as a proxy for domestic investment to see if there is a relationship there. While the literature seems to have a consensus that ODA does have a significant effect on domestic financial decisions; however, what those effects are, and the magnitude of those effects vary. Africa, while it receives a large portion of global ODA, has not been studied as closely as other developing markets. This paper hopes to fill this gap.

Description of Economic Theory

The literature establishes that all foreign capital inflows studied have a significant effect on growth in the long run. This would make intuitive sense because for an economy to become more productive it would need to build more fixed capital. Previous literature on growth focused heavily on FDI as the primary driver of growth from abroad. However, FDI is far from the only capital inflow that can affect fixed capital formation. ODA in its different types can also be

deployed to build capital. For example, China has made heavy use of ODA in the form of loans to advance its Belt and Road Initiative. While it isn't a perfect assumption, in this paper I will assume that all types of capital flows are perfect substitutes. Therefore, I need a model that does two things. One, it needs to be able to account for both domestic and foreign capital flows; two, foreign capital flows need to be able to be broken up into their component parts.

The most comprehensive framework for this analysis would be what Agosin and Mayer (2000) describe in their paper. They created an adaptation of the neoclassical theory of investment but for developing countries. The authors wanted to know if foreign investment crowded out domestic investment. The main thrust of their argument for crowding-out is, "the very act of foreign investment may take away investment opportunities that were open to domestic entrepreneurs prior to the foreign investments" (Agosin & Mayer, 2000, p. 3). However, the authors also argue the counter point; often in highly advanced fields, foreign investment can have a crowding-in effect because of a dissemination of knowledge as in the case of South Korea and Japan. Again, this caveat reinforces the importance of doing this research on a regional basis.

Within the author's framework, they do not include interest rates because they were found to not be a significant factor in investment within developing countries. This fact could illuminate a conclusion before the model is even estimated. If interest rates are not significant, why would countries change their behavior, when a discounted loan is made available to them, if the only difference between ODA in the form of loans and every other normal loan is the interest rate?

Their framework has been the theoretical foundation for much of the work studying capital flows into developing nations such as Mišun and Tomšík (2002); Kapingura (2018);

Eregha (2012) and more all used this theoretical framework. The model starts with a simple assumption that all types of capital are perfect substitutes. They define overall investment as:

$$I_t = I_{d,t} + I_{f,t}$$

Where I_t is total investment in time *t*, $I_{d,t}$ is total domestic investment and $I_{f,t}$ is total foreign investment. Agosin and Mayer (2000) then further define $I_{f,t}$ as:

$$I_{f,t} = \psi_0 F_t + \psi_1 F_{t-1}$$

Where *F* is FDI and is considered to be an exogenous variable from the perspective of the recipient country. This is because FDI is highly dependent on international macro-economic conditions and cannot be directly controlled by the recipient country. However, this is where I will change the model slightly. Instead of simply having *F* be a level of FDI flows to a country I will define it as:

$$F_t = FDI_t + ODA_{Grants,t} + ODA_{Loans,t}$$

Now *F* represents all the different types of capital flows to a country not just FDI. There is an issue with this method, this equation would assume equal liquidity between the flows. Since ODA often has requirements for how it is spent it is definitely not as liquid as FDI. However, this assumption isn't completely off base because FDI often has different types of requirements imposed by multinational institutions. I will make no adjustments to the domestic investment portion of the original model. Adapting the original model with this foreign capital modification to get the final equation of total investment as:

$$I_t = \alpha_0 + \alpha_1 G_t^e + \alpha_1 y_t + \alpha_2 FDI_{t-1} + \alpha_3 FDI_{t-2} + \alpha_4 ODA_{Grants,t-1} + \alpha_5 ODA_{rants,t-2}$$
$$+ \alpha_6 ODA_{Loans,t-1} + \alpha_7 ODA_{Loans,t-2} + \alpha_8 I_{t-1} + \alpha_9 I_{t-2}$$

Where G_t^e is the expected growth rate in time *t*, and y_t is the difference between actual output and full-capacity output. Additionally, there are theoretical definitions for all the α terms, but they are not relevant to this discussion. All that is left is to estimate the model is define the G_t^e term for the growth rate expectations of the domestic agents. Agosin and Mayer (2000) write, "If expectations are rational, expected growth should not deviate systematically from actual growth. In this case, $G_t^e = G_t$. The alternative is adaptive expectations" (p. 8). Therefore, we can define:

$$G_t^e = \beta_0 G_{t-1} + \beta_1 G_{t-2}$$

Therefore, growth expectations for period *t* are a linear combination of previously observed growth rates. Now we are ready to estimate the model. To test my hypothesis, I expect to see that foreign capital inflows increase domestic investment all other things equal.

Data

The data used for my analysis was collected from The Organization for Economic Cooperation and Development (OECD) and the World Bank data sources. For my model I will only be using data collected during or after 1991 until 2021 inclusive. This is for two main reasons. The first is data availability; many developing countries in Africa don't have complete, or for that matter any, until around 1990. Additionally, with the fall of the Soviet Union in 1991, this would cause some major changes in the international macro-economic environment that may change the relationships between the indicators studied.

Now to define the data being used. To measure the total level of investment within a recipient nation I need some measure of *Capital* within the recipient nation. Specifically, gross fixed capital formation (FCF). This indicator was also used by Bakhtiari et al. (2013) and Eregha

(2012). I will not be doing any manipulation of *Capital***.** While Eregha (2012) subtracted foreign capital inflows, they were using it as a measure of DI not overall capital deployment like I am here.

Both forms of ODA are pulled from the OECD. Like, detailed before ODA_{Grants} is development assistance that doesn't need to be paid back, while ODA_{Loans} is development assistance that does need to be paid back but often time given an advantageous interest rate to the recipient nation. This method is different when compared to how Kemmanang and Zamké (2021) split ODA into multilateral and bilateral parts. I choose to not use this split because there is no actual data that breaks down the difference. The OECD does have this split; however, it is an imputed amount. Therefore, there could be some type of error in the estimation of the effects on investment. Additionally, I believe there is a stronger theoretical argument for splitting it between loans and grants. There is a clear incentive difference between loans and grants. A recipient country that knows it must pay back the loan may be more incentivized to use those funds productively in order to generate the funds to pay back the loan. We don't see this same incentive difference when splitting ODA into multilateral and bilateral parts. The final issue with ODA is how it is reported. The OECD only reports ODA data in millions of dollars. This can create some issues in the accuracy of the estimator, but there is unfortunately nothing that can be done about it.

For the final two indictors, *Savings* is simply the gross savings amount in the recipient economy. For growth expectations, since I assumed expectations are rational, so, past period GDP growth will be used to assess growth expectations. Additionally, GDP for the current year is included as well. All GDP data came from The World Bank. Table 2 contains the summary statistics for all data used.

Empirical Model

Following the same procedure as defined by Agosin and Mayer (2000) I will estimate both my models using simple OLS regression. As I stated before, there are two models of interest. First, estimating the simpler model:

(1) $$Capital_t =$$

$$\beta_0 + \beta_1 GDP_{Growth,t-1} + \beta_2 GDP_{Growth,t-2} + \beta_3 FDI_t + \beta_3 FDI_{t-1} + \beta_4 FDI_{t-2} + \beta_5 ODA_{Grants,\ t} + \beta_5 ODA_{Grants,\ t-1} + \beta_6 ODA_{Grants,t-2} + \beta_7 ODA_{Loans,t} + \beta_7 ODA_{Loans,t-1} + \beta_8 ODA_{Loans,t-2} + \beta_9 Capital_{t-1} + \beta_{10} Capital_{t-2} + \beta_{11} GDP_t + e$$

Where *e* is a serially uncorrelated error term. The second specification is similar to the first, but I add a couple more explanatory variables. The second model is specified as:

(2) $$Capital_t =$$

$$\beta_0 + \beta_1 GDP_{Growth,t-1} + \beta_2 GDP_{Growth,t-2} + \beta_3 FDI_t + \beta_4 FDI_{t-1} + \beta_5 FDI_{t-2} + \beta_6 ODA_{Grants,\ t} + \beta_7 ODA_{Grants,\ t-1} + \beta_8 ODA_{Grants,t-2} + \beta_9 ODA_{Loans,t} + \beta_{10} ODA_{Loans,t-1} + \beta_{11} ODA_{Loans,t-2} + \beta_{12} Capital_{t-1} + \beta_{13} Capital_{t-2} + \beta_{14} Savings_t + \beta_{15} Savings_{t-1} + \beta_{16} Savings_{t-2} + \beta_{17} GDP_t + e$$

The inclusion of the *Savings* term gives some measure of domestic capital markets, beyond what would be captured by the expectations of previous GDP. However, it was relegated to the second specification only because of limited data.

My primary hypothesis is that ODA_{Grants} will have either no effect on the level of *Capital* or it would have a negative effect indicating that ODA_{Grants} crowds out other forms of investment. Secondarily, I expect ODA_{Loans} to have no significant effect. As stated before, if interest rates are insignificant (Agosin & Mayer, 2000) in general, countries should not change their behavior if ODA_{Loans} are made available to them. I expect FDI to have a negative effect on *Capital*. I also

expect *Savings* to have a positive impact on *Capital*, because the more money saved the more money available to borrow with the host economy. I expect both *Capital* and *GDP* growth to be positive as well.

Results

Results are reported in Tables 4 and 5. Looking at the two models together. The limited model without *Savings* had an adjusted r-squared of 0.980. The second expanded model had an adjusted r-squared of 0.986. These values suggest that both models have strong explanatory power. Additionally, the first model had an F-statistic of 2767, and the second model had an F-statistic of 3352. Therefore, it appears that *Savings* within an economy does have significant explanatory power when it comes to predicting FCF.

First turning to the original more limited specification of the model which had an adjusted R-squared value of 0.980. The first interesting result is the significance of ODA_{Grants}. First, ODA_{Grants} is significant at the 1% level for each period. However, the sign changes depending on the period. The first period has a coefficient of 140 which would mean that a one dollar increase in ODA_{Grants} increases fixed capital formation by 140 dollars. I find it hard to believe that ODA_{Grants} has such an extreme crowding-in effect, but the second period observation sheds some light on this situation. It has a coefficient of -101 meaning in the first period after ODA_{Grants} funds are received it has an almost exact inverse effect of the period when it is received. However, it is hard to say if it is a net positive change or net negative change because of the size of the standard errors. For the second period after the ODA_{Grants} funds are received we see a positive effect again, but a significantly reduced coefficient of 44. It appears that funds received in the form of ODA_{Grants} affect spending patterns but not overall long-term behavior. To

be more specific, it appears that governments use ODA_{Grants} to speed up the production of fixed capital but not to produce more of it.

The second finding was much less surprising being that ODA_{Loans} were not significant in any period. This could imply that governments view ODA_{Loans} as simply another form of debt. In other words, governments don't view these loans as an increase in spending power and don't change their expenditures because of it. This would be consistent with previous findings in the literature that interest rates are insignificant in estimating FCF.

FDI had behavior that was consistent with that of previous literature. In period *t* and *t–1* both coefficients are insignificant. Then in period *t-2* there is a negative coefficient of -23 which is significant at the 1% level. This effectively would mean that any gains in capital formation would be offset in later periods. It seems that *FDI* is not effective at increasing the level of FCF. This result could be because of multinationals building capital and then exporting all the goods they create with it. Therefore, *FDI* may drain more capital out of the recipient's economy than it puts back in.

The final parameters, *GDP*, GDP_{Growth} and *Capital*, are significant at the .001% level. GDP_{Growth} was significant and negative. This would imply that as an economy grows, all things equal, it would have a negative effect on FCF. While I am not sure exactly why this is, it could be that as a developing economy grows it shifts to more consumption and less production. Finally, *Capital* in both the previous periods are significant. Extending similar logic that was applied to GDP_{Growth}. The combined effect of periods *t-1* and *t-2* is approximately one. Meaning that in the long run, fixed capital will continue to grow at a similar rate to what was observed in the past all things equal. For *GDP*, the coefficient was approximately 4. Meaning every dollar of *GDP* leads to 4 dollars of *Capital*. However, I don't put any explanatory power in this estimate.

It was included to control for economy size and with such a negative intercept for the model, I would not consider it reasonable that one dollar of *GDP* leads to 4 dollars of FCF.

Moving to the expanded model. ODA_{Grants} was only significant in period *t* at the 1% level and in period *t-1* and *t-2* it was significant at the 10% level. Again, there is still the pattern of alternating coefficient signs. Again, because of the size of the standard errors I don't know if the overall effect is positive or negative. ODA_{Loans} again are insignificant in every period considered. *FDI* in the second model has a similar estimation result as the first. The coefficients have the same signs as the first model and only *FDI* in period *t-2* with a coefficient of approximately -17.

Now onto the main difference in this model, *Savings*. *Savings* was significant in period and *t* at the 1% level. Period *t* has a coefficient estimate of 26. Meaning that every dollar saved in this period results in 26 dollars of fixed capital formation. Then in period *t-1* I obtained a coefficient estimate of -7. Given that they both have relatively small standard errors I can actually put some weight into these estimates. It clearly seems that the positive effect on *Capital* in period *t* outweighs the negative effect in period *t-1*. However, there could be an endogeneity concern here. If fixed capital formation increases overall income, economic intuition would say that consumers marginal propensity to save would also go up. Therefore, there could be endogeneity feedback between the two indictors. The final indicator to note is that *Capital* has a similar result as the other regressions, so the same argument extends here as well.

There is one major caveat to this whole regression analysis: multicollinearity. It should be obvious that each of my lagged variables could be significantly correlated with the other periods of that variable. Additionally, there is probably some correlation between ODA_{Loans} and ODA_{Grants} so there needs to be caution used when interpreting coefficient results.

Conclusion

The goal of this paper was to determine the effects of various foreign capital inflows on fixed capital formation in developing countries, specifically within Africa. I focused on FCF because it represents the ability of a nation to generate value using their natural resources and their citizens. Then using the model described by Agosin and Mayer (2002), the coefficient of the terms showed the marginal effects, on average, of differing capital flows and how that affects fixed capital development.

First, I would like to point out some drawbacks of my analysis before discussing policy implications. The biggest concern being multicollinearity. It is obvious that there is a potential concern that for each indicator, there could be considerable collinearity between each of the periods included. As FDI in period t-1 is likely to correlate with FDI in period t. Therefore, when interpreting these results to obtain some policy guidance, we should be cautious with the accuracy of the estimators. Luckily for my analysis, this should not bias the estimators but rather will just make them more inefficient. Additionally, since both models seem to agree on the sign of all the estimators, I will not worry about unstable estimates as it does not seem to be a concern.

Generally, my findings confirm what already existed in the literature and extend findings from other regions as well. First turning to the discussion on the crowding-in or crowding-out effects of the differing capital flows. Unfortunately, due to my modifications to Agosin and Mayer (2000) model, I cannot use the same test they did for crowding-in and out, but there still can be some conclusions that can be drawn.

Starting with FDI. My results seem to confirm the results that Kemmanang and Zamké (2021) found; FDI crowds out investment in the long term. However, my rationale and theoretical basis is much different than theirs. They argued that FDI concentration from the

former colonizer crowds out FDI from other countries; I am arguing that FDI in general crowds out investment in developing African countries regardless of origin. Additionally, I found that FDI isn't significant until two years after the funds are sent to the recipient country. This could be the result of multinational enterprises sending in FDI to developing countries, and then instead of selling the value they create back to consumers in the recipient countries, they send it abroad, causing negative FDI outflows. For example, this could be a clothing firm building a factoring in a developing country. While in the short term there will be net inflows as the firm is building its fixed capital, afterwards, they may export all the goods that the factory creates causing net outflows. Additionally, since FDI does not have a significant effect in the period or in the period after it is received, it seems that FDI doesn't create new fixed capital either, rather it seems to replace fixed capital development. This result also gives support to Agosin and Mayer's (2000) argument that the act of foreign investing takes away investment opportunity from local investors. Therefore, there is a clear policy implication, that we should be wary of FDI as a way to promote economic growth in developing countries. Younsi et al. (2021) and Adusah-Poku (2016) both found FDI to be significant in long term GDP growth, and that result is not contradicted by mine, however, it may be important to see who is using that GDP; because, while FDI may cause GDP to increase in the long run, but if the economy is built to serve other nations with its exports receiving little in return, what good does that do these developing nations?

Next, turning to ODA, my results give a new explanation for some previous results seen in the literature. Benedek et al. (2012) and Bakhtiari et al. (2013) both argued that ODA crowds out government revenue. While my analysis didn't focus on government behavior, there seems to be similar behavior by both the government individual agents and the private sector. In both

contexts, it seems ODA, both grants and loans, crowds out investment opportunities. However, it seems the mechanism in which ODA crowds out other investments is different depending on the type and period. ODA_{Grants} appears to change governments' and private individuals' expenditure schedules, but not the overall level of expenditures.

The policy implications are different depending on which form of ODA is considered. In the case of ODA_{Grants}, countries need to consider what their grants are going to be used for. In some cases, it may be perfectly acceptable that grants don't change overall expenditure levels. For example, in the case of a natural disaster, recipients of ODA_{Grants} may use those funds for food aid or to give out cash transfers to struggling businesses. Neither of these acts would create fixed capital, however, I wouldn't call these activities a misuse of funds. However, given these findings, and previous findings in the literature, if the goal is to help African nations experience real growth, donor countries should not be developing countries them grants.

The policy implications for ODA_{Loans} are much different than ODA_{Grants}. First, if ODA_{Loans} are given out in response to some natural disaster, there is similar policy guidance as ODA_{Grants}. If that is not the case, countries should be much more hesitant to issue ODA_{Loans}. My results appear to indicate that ODA_{Loans} has no effect on fixed capital development. Again, if the goal is to have ODA create the most value for the recipient nations, it seems ODA_{Loans} has no effect on fixed capital development. The results for both forms of ODA are consistent with the results found by Benedek et al. (2012) and Bakhtiari et al. (2013). However, my research adds onto their findings by confirming a similar phenomenon in Africa, which had lacked data and attention in previous studies. Additionally, my findings support the hypothesis that interest rates do not have a significant impact on FCF in developing countries. If they did, there should have

been some significance to ODA_{Loans} since developing countries would prefer to use them because these loans have lower interest rates.

Thus, it seems that all three forms of foreign capital flows fail to enhance fixed capital formation in recipient countries. However, there was a very different finding for savings. Savings was significant in every period however it was positive in the current period with a large magnitude, and then was negative with a smaller magnitude in the period t-1 and t-2, but it was net positive over all periods. This would make intuitive sense, using economic intuition I would assume that current periods saved funds are used to build fixed assets, and then they would have to be paid back in the subsequent periods. This effect would manifest in a positive coefficient in the first period, and then negative in later periods. The policy implications would then be foreign countries need to help the people of Africa increase their savings rates.

I would also like to bring attention back to the main indicator that was not studied in this paper, personal remittances (PR). Due to scope, time, and potential data constraints, PR was not included in this analysis but as stated before, PR is shown to have a positive increase effect on growth. Because of the finding for Savings, I would theorize that PR has a similar effect as well. Since most foreign nationals are sending PR to support their families one could argue that a higher portion of these capital inflows would be spent in the recipient nation, unlike other forms of capital that seems to cause an exodus of value from the recipient nation. Future research on FCI into developing African nations should consider PR as a way to provide real wealth gains to recipient nations.

In conclusion, future policy research, aimed at helping African people increase their welfare, should focused less foreign capital flows and more on the domestic political and economic environment. The savings rate of a developing country cannot be easily manipulated,

especially from the outside, so any foreign capital flow will not be able to have that large of an effect. Then any country that seeks to create real fixed capital gains within the developing African nations should focus more on the domestic business environment and what policy they can help implement that would facilitate a higher savings rate. While fixed capital growth may not be the best proxy for general African welfare, it still suffices as a good proxy because even if fixed capital isn't wealth, if used correctly it can enable the people in these developing African nations to create wealth for themselves. My results appear to show that if the capital flow used to fund fixed capital formation is FDI, most of the value is then exported abroad in the periods after the capital is built, often far exceeding the original investment, with little of the wealth generated going to the host countries. If this capital was instead built with the purpose of creating wealth for the domestic residents, as seems to be the case with savings, we would see more capital being built in the long term. Hopefully then we will see real quality of life improvements because the capital is being used to produce goods for a domestic market, instead of a market abroad.

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Table 1

Description of Analytical Variables

Variable	Description
FDI	Foreign direct investment, net inflows (BoP, current US$). Source: World Bank
GDP	GDP growth (annual %). Source: World Bank
ODA_{Grant}	Official Development Assistance given out as grants. Millions of dollars (USD 2020). Source: OECD
ODA_{Loan}	Official Development Assistance given out as loans to be paid back. Millions of dollars (USD 2020). Source: OECD
Capital	Gross fixed capital formation (% of GDP). Source: World Bank
Savings	Gross domestic savings (% of GNI). Source: World Bank

Table 2

Summary Statistics for Expanded Model

	Mean	Std. Dev.	Minimum	Maximum	Count
FDI	-6.60E+08	2.44E+09	-4.10E+10	1.27E+10	808
ODA_{Grants}	4.88E+08	6.81E+08	8530000	1.22E+10	808
ODA_{Loans}	8376250	1.15E+08	-1.70E+09	8.25E+08	808
GDP_{Growth}	1.27E+11	3.68E+11	-2.10E+12	3.62E+12	808
Savings	7.13E+09	1.74E+10	-5.70E+09	1.53E+11	808
Capital	7.29E+11	1.52E+12	-2.10E+09	1.46E+13	808
GDP	3.42E+10	7.92E+10	2.26E+08	5.74E+11	808

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Table 3

Results from Limited Regression

Limited Regression	Coefficent	Std. Error	P-Value
const	1.51E+10	1.03E+10	0.142
FDI	4.220	3.561	0.236
FDI t-1	7.703	4.577	0.093
FDI t-2	-23.034	4.666	0.000
ODA_{Grants}	140.211	17.236	0.000
ODA_{Grants} t-1	-101.059	21.781	0.000
ODA_{Grants} t-2	44.518	17.757	0.012
ODA_{Loans}	4.120	76.243	0.957
ODA_{Loans} t-1	4.493	80.418	0.955
ODA_{Loans} t-2	-131.356	77.063	0.089
GDP_{Growth} t-1	-0.172	0.022	0.000
GDP_{Growth} t-2	-0.321	0.033	0.000
Capital t-1	1.312	0.036	0.000
Capital t-2	-0.432	0.037	0.000
GDP	4.098	0.360	0.000
R-Squared	0.980		
Adj-R Squared	0.980		
# Observations	808		

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Table 4

Results from Expanded Regression

Full Regression	Coefficent	Std. Error	P-Value
const	5.53E+09	8.60E+09	0.520
FDI	3.922	2.949	0.184
FDI t-1	7.252	3.789	0.056
FDI t-2	-16.885	3.885	0.000
ODA_{Grants}	54.146	16.074	0.001
ODA_{Grants} t-1	-35.741	15.441	0.067
ODA_{Grants} t-2	26.890	17.757	0.082
ODA_{Loans}	81.881	63.785	0.200
ODA_{Loans} t-1	101.188	66.760	0.130
ODA_{Loans} t-2	-72.691	64.070	0.257
GDP_{Growth} t-1	-0.150	0.020	0.000
GDP_{Growth} t-2	-0.321	0.031	0.000
Capital t-1	1.116	0.034	0.000
Capital t-2	-0.302	0.035	0.000
GDP	2.119	0.319	0.000
Savings	26.234	1.507	0.000
Savings t-1	-7.373	1.892	0.000
Savings t-2	-3.607	1.923	0.061
R-Squared	0.986		
Adj-R Squared	0.986		
# Observations	808		