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Ssozi, John and Asongu, Simplice

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John Ssozi
Economics Department,
Hankamer School of Business
Baylor University
Waco, TX 76798, USA.
E-mail: John_Ssozi@baylor.edu.

Simplice A. Asongu
African Governance and Development Institute,
Yaoundé, Cameroon.
E-mail: asongusimplice@yahoo.com

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John Ssozi & Simplice A. Asongu

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Abstract

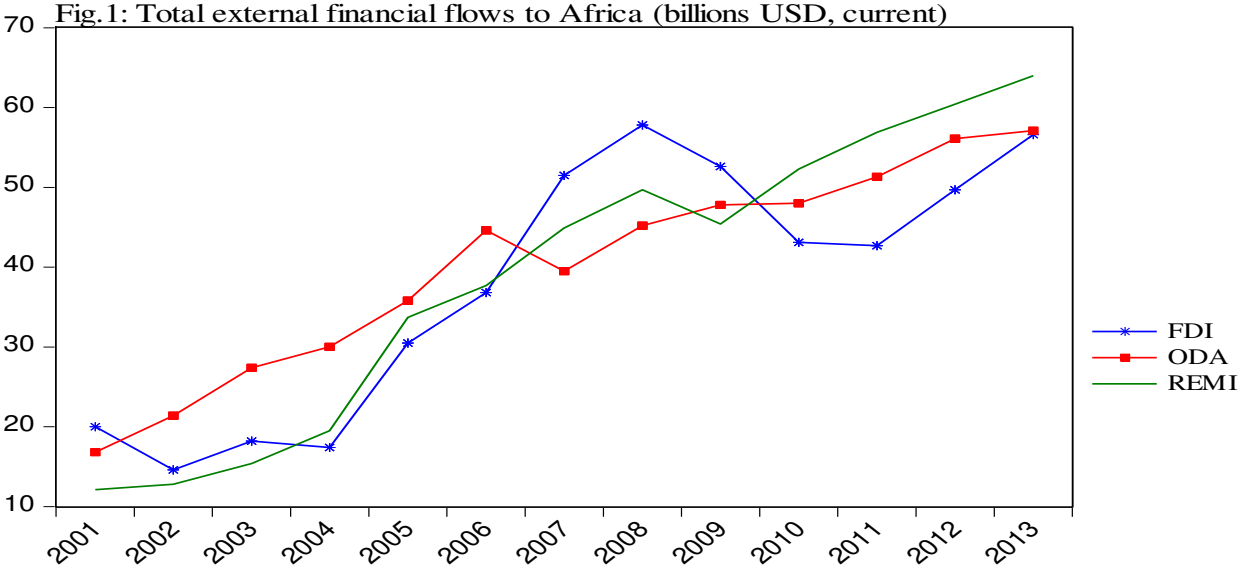
This paper uses a production function to examine the channels through which remittances affect output per worker in 31 Sub-Saharan Africa (SSA) countries from 1980-2010. We find that remittances directly increase output per worker if complemented with education. The indirect effects vary with the economic characteristics of the recipient nations: while remittances have increased human capital among the low-income nations, among the upper-middle-income nations, they have mostly increased total factor productivity, but are still inversely related to factor inputs among the lower-middle-income nations of SSA. Finally, remittances are more effective when institutional risk is reducing.

JEL classification: F22. F24, F35, F43, F63, O15, O16; O43; O55
Key words: remittances, output per worker, total factor productivity, Sub-Saharan Africa

1. Introduction

According to the African Economic Outlook (AEO, 2014), external financial flows have quadrupled since 2000 and are projected to reach over USD 200 billion in 2014. Fig.1 illustrates that official remittances (REMI)[1]have overtaken official development assistance (ODA) and foreign direct investment (FDI) as the largest source of international flow of financial resources into Africa. The composition of these flows has also changed progressively with foreign investments and remittances from non-OECD countries, underpinning this positive trend.

Fig.1: Total external financial flows to Africa (billions USD, current)



Source: African Economic Outlook 2013 - © OECD 2013

The AEO (2014) report points out that the aggregate numbers in Fig.1 hide the differences in the relative importance of the financial flows into countries at different levels of average income, namely, the low-income, lower-middle-income, and upper-middle-income countries. Among the 27 low income countries, ODA makes more than 50 percent of the total external financial flows, however as a share of GDP, while still highest, it is on a decline from an average of 13.1 percent in 2000-2005 to 9.5 percent in 2013 and is projected to be 8.9 percent in 2014. On the other hand, among the lower-middle-income African countries, remittances are the most important, representing approximately 55 percent of the external financial flows, while among the upper-middle-income African countries, private investment, on average, accounts for70 percent of total external flows over 2010-2014. In addition, while remittances are the largest single external flow to Africa, in 2013 North Africa received close to half of all

remittances due to its proximity to Europe. Of the 27 low-income nations in SSA, our sample includes 16; of the 13 lower-middle-income, it includes 10, and of the 7 upper-middle-income, we include 5. When scaled by gross domestic product, REMI are relatively higher than ODA and FDI among the middle-income nations of SSA, most of which are included in our sample, thus making our sample very representative for the study of remittances.

Given the surge in remittances during the decade when economic growth in Africa has also been at an all-time high, it is crucial to investigate how and whether remittances have contributed to the economic performance of Africa. This paper uses a standard production function framework to investigate the direct and indirect effects of remittances on output per worker. Specifically we ask two questions: first, do remittances directly increase output per worker in SSA? Second, could the effects of remittance on output per worker be more indirect than direct? The indirect effects are investigated via the impacts of remittances on the contributions of physical capital, human capital, and total factor productivity to output per worker in SSA while controlling for the official assistance flows, foreign direct investment, and openness.

We find that the impacts of remittances are more indirect than direct, and often with a lag. Remittances are in both cash and kind, but remitters not only send funds and equipment, they also send entrepreneurial ideas on how funds, tools, and businesses are to be managed. There are several ways in which remittances can increase capital stock: sending equipment and machinery, using the sent cash to purchase machinery, and increased consumption demand can induce capital investment. The idea that remittances increase capital investment is supported by the positive effect from the lag of remittances. The effect of remittances on human capital is also found to be lagged: remittances flow at the cost of emigration, which reduces the average level of skill in the country of emigration. However, the lag of remittances has a positive effect on human capital. This implies a combination of several impacts: remittances are either putting more individuals in school and/or for more years, or emigration encourages schooling, and/or improvement in human capital driven by other factors increases the effectiveness of remittances than otherwise. Remittances ostensibly boost the contribution of total factor productivity to output per worker in SSA. Total factor productivity is a multifactor variable that represents efficiency, knowledge of the production process, management, skill, experience, technology, institutions, and other influences to productivity. Above all, remitters also create contact

between a higher income and lower income economies, which can help to defuse knowledge and efficiency.

The contributions of remittances to productivity can be ambiguous because of their connection with emigration. Lucas (1988) points out that since education is a major determinant of long-term growth, migration of individuals with above average skills is detrimental for the country of emigration. However, this view has been brought under some theoretical questioning. According to Beine at al. (2001) if in a poor country the return to education is low, there will be limited incentives for schooling. Migration to countries with higher returns to education would thus restore the incentive to invest in education. Another variation of this argument can be: individuals would invest more in education, and students apply themselves more to learning for the purpose of the migration opportunity which might not materialize. Since only a fraction of the educated individuals migrate, the remaining population would, on average, be more educated than otherwise.

Essentially, remittances come at the cost of brain drain, in which case, the cost might be balanced-off by the inflows. Thus the long-run net effect of remittances versus emigration on output per worker is not obvious both in literature and practice. Ngoma and Ismail (2013), Osabuohien and Efobi (2013), and Nyarko and Gyimah-Brempong (2011) have postulated that in the long-term, education is a more optimal mechanism of social protection than such cash transfers. Since average output per worker is a stronger form of social protection, and education is the metric of human capital, we translate the problem statement into a production function. As far as we have reviewed, the strands of literature that document the effects of remittances in Africa have not employed variables that directly enter into the production function: Beine et al., (2001); Woodruff and Zenteno (2007); Yang (2008, 2011); Fosu (2012)[2]; Nyamongo et al., (2012); and Ebeke (2012). This paper fills that gap by using a production function framework to assess the effects of the increasing remittances on output per worker. Instead of selecting channels from outside the output model, we examine the effect of remittances on the contributions of factor inputs towards output per worker, namely, capital per worker, human capital, and total factor productivity. We prefer to do this, above all, because standard growth models have, at their core, a production function.

Our analysis begins with an aggregate production function adopted from Hall and Jones (1999), also used by Frankel and Romer (1999), whereby output per worker is a function of the

capital-worker ratio, human capital and total factor productivity. To examine the contribution of remittances to output per worker, we proceed in two stages: first, we estimate an aggregate production function where output per worker is the dependent variable with capital-per-worker ratio and human capital are the independent variables. This specification enables us to capture the total factor productivity and to account for the output per worker. Since we want to find out whether remittances have any direct contribution to output per worker, we again estimate an extended aggregate production function where output per worker is the dependent variable, controlling for remittances and other forms of foreign financing, namely, foreign direct investment and aid, and trade openness in addition to capital-per-worker and human capital. We find that remittances are negatively related to output per worker, but the interactive term between remittances and average years of schooling is positive and statistically significant. Hence our initial estimations are sensitive to specifications and are inconclusive.

Second, since remittances do not directly enter a production function as an input, we assess how remittances might contribute to the output per worker by examining the extent and direction in which they affect the contributions of capital per worker, human capital, and factor productivity to output per labor. At this stage of analysis, we do a growth accounting analysis and develop three equations: where the contributions of physical capital, human capital, and total factor productivity are the dependent variables in three different equations in which we regress on the remittances while controlling for foreign direct investment, aid, trade-openness, institutions, income group level, and interaction terms. The interaction terms are important because remittances might have an effect on output through other factors, especially education, trade, official development assistance, and foreign direct investment, but also depending on the level of average income or institutional risk. The interactive terms might have either a positive effect or a substitution effect. In the event of a substitution effect, the interactive term will have a statistically significant negative coefficient.

2. Brief literature review

Our paper has a dual focus on the SSA and the use of a production function framework. The focus on the SSA nations is based on Singh et al. (2011), whom find that while using a broad sample increases the degree of freedom, it may introduce unwanted heterogeneity if the factors that explain remittance differ across country groups. Most the empirical literature on the

remittances-economic growth relationship has been based on an assortment of various samples of countries. There are not many papers that focus specifically on the SSA, yet economic interventions have had different outcomes in the SSA relative to other developing regions, especially, Asia and Latin America. Our sample is exclusively selected from SSA because the pattern of economic realities in SSA has behaved differently for most of the 1980s, 1990s, and 2000s. According to Freeman and Lindauer (1999), modern economic growth has succeeded in increasing the wellbeing of hundreds of millions of people in many developing economies throughout the world, but it has sputtered throughout most of Africa. Perkins et al. (2013) find that by 2005, the poverty gap had fallen to 10 percent or less everywhere, but in SSA, it remained at over 20 percent. For instance, Perkins et al. (2013) find that poverty reduction was dramatic throughout all of East Asia, but the trend was worse in SSA; whereas population grew in SSA, absolute poverty increased from 214 million in 1981 to 391 million in 2005. The effectiveness of remittances might also be different in the various major regions of the world, hence the need for region specific studies.

The application of a production function framework is in turn based on Rao and Hassan (2012) who hold that while it is common to regress an average growth rate or income level on remittances and set of controls variables, but some of these variables also include the channels through which remittance affect growth. Such specifications are likely to provide unreliable estimates because the channels may also capture the growth effects of remittances. Hence the growth effects of remittances are found to be generally insignificant or even negative. Rao and Hassan (2012) investigate whether the direct and indirect growth effects of remittances are significant using an assortment of 40 countries, including only 10 SSA nations. To find the direct effects, they estimate an extended production function with income per worker as the dependent variable, while capital per worker is the independent variable controlling for remittances, investment rate, foreign direct investment, development of the financial sector, exchange rate, inflation, and government consumption. Using a system of GMM estimation, they do not find any direct effects of remittances on growth. However, they find strong evidence of the effects of remittances on the channels of volatility of output, financial sector development, investment rate, and real exchange rate. While our paper also estimates a production function using GMM dynamic panel data techniques of estimation, our consideration of channels is different. Instead of selecting channels from outside the model, we examine how remittances

affect the inputs in a standard production function, namely, capital per worker, human capital, and total factor productivity as the key channels through which remittances may indirectly promote output per worker.

Singh et al. (2011) use fixed effects and two-stage least squares techniques on data from 36 SSA countries and find the effect of remittances on the growth rate of per capita real GDP to be negative and significant, whether or not interaction terms are included. This result suggests that the adverse effects of emigration on growth may dominate, at least in the SSA. However when Singh et al. (2011) interact remittances and domestic institutions, they find that SSA nations with improving domestic institutions unlock the potential for remittances to contribute to faster economic growth. Thus remittances have either a less negative or even a positive impact where institutions are strengthening and the financial sector is developing. Other papers that find a negative association between remittances and growth are: Chami et al. (2003), Chami et al. (2006), and Chami et al. (2008). They study the role of remittances in the context of labor supply and find that remittances may reduce labor supply or labor market participation of recipients, a moral hazard problem, leading to a decline in output and greater volatility in economic activity. However, using a sample of 70 countries, including both advanced and developing economies, Chami et al. (2009a,b) find that remittance flows provide a stabilizing influence on output. Their results, however, indicate that this stability-enhancing contribution is achieved at the lower levels of remittances and are not significant in countries receiving large flows of remittances. In their growth-remittances estimated equation, Singh et al. (2011) include along with remittance variables whichRao and Hassan (2012) term as channels in the same equation, namely, investment, financial development, government expenditure, inflation, and exchange rate together with interactive terms.

Nyamongo et al. (2012) investigate the role of remittances and financial development on economic growth in a panel of 36 countries in Sub-Saharan Africa over the period 1980–2009. Using a panel of 36 African nations, they estimate an extended growth model where the growth rate of real GDP per capita is regressed on its lag, remittances, and financial development while controlling for the ratio of gross investment to GDP, inflation, human capital, ratio of government consumption and trade openness. In the pooled, and in random effects, models remittances to GDP have positive and significant coefficients. However the fixed effects models yield insignificant results, except when remittance volatility is added. The 2SLS models that

take care of endogeneity yield negative insignificant coefficients. They also interact remittances with ratio of domestic credit to GDP, which is a measure of financial development, to find whether there is complementarity or substitutability between remittances and financial development. They find that the interactive term in the fixed effects and 2SLS models is positive and significant. Nyamongo et al. (2012) conclude that remittances are important in explaining economic growth in Africa. The problem with such a specification is that it does not distinguish between direct and indirect effects; above all the variables included can affect and/or be affected by remittances. The presence of a lagged dependent variable also complicates the estimation that the standard fixed effects (within) estimates are potentially biased. The OLS is not biased by the lagged dependent variable but fails to control for the country-specific unobserved effects. However if remittance, or any other dependent variable such as inflation and government consumption, is correlated with economic growth, OLS will yield biased and inconsistent estimates.

Ahortor and Adenutsi (2008) study a sample of 31 small-open developing countries, 16 of which are in Latin America and the Caribbean, and 15 are from SSA for the time period 1996-2006. Their dependent variable is the log of real GDP per capita and the independent variables are the log of remittances, human capital, fixed capital formation, inflation, government spending, and economic openness. The impacts of all these variables are estimated in one equation without any distinctions between direct and indirect effects. They also lag the log of remittances and find that the contemporaneous and first lag had positive impacts while the second lag has a negative impact on growth. Osabuohien and Efobi (2013) study 44 SSA nations from 1995-2010 for the effect of remittances interacted with institutional quality on investment as percentage of GDP. Using system GMM, they find that remittances increase the investment rate, and both financial development and intuitional quality have significant complementary roles on the impact of remittances.

Giuliano and Ruiz-Arranz (2009) use a sample of 100 nations, and find that remittances promote growth in countries with less developed financial systems by providing an alternative way to finance investment and helping overcome liquidity constraints. They also interact remittances with indicators of financial development and examine the extent of substitutability or complementarity. Would this imply that remittances will most likely boost growth in SSA, or are there some extra conditions necessary for remittances to boost growth even in nations with

less developed financial systems? It is possible that there are other factors that may explain the effect of remittances on growth other than the degree of financial development? For this reason we follow the World Bank classification of nations into low income, lower middle income, upper middle income and high income, and test the direct and indirect effects of remittances. Apart from including 21 African nations in their sample, Giuliano and Ruiz-Arranz (2009) do not control for SSA to give us an Africa-specific effect.

There is a lot more literature on the economic effects of remittances on developing nations, which focuses on the relationship between remittances and financial development, effect of remittances on poverty reduction, or the institutional environment through remittances can be effective. This paper focuses on using a production framework to examine the effects of remittances on output per worker in SSA.

3. Model, Data and Estimation Methodology

3.1: Aggregate Production Function

To apply a production function framework, we follow Hall and Jones (1999) and Frankel and Romer (1999) to introduce the behavior of firms: an economy is considered where technology and schooling are labor augmenting. This specification is particularly relevant to SSA where labor isthe most abundant resource. We use an aggregate production function, where $Y_i$is the real GDP in country i, specified as follows:

$$Y_i = K_i^{\alpha}\left[A_i e^{\emptyset(E_i)} L_i\right]^{1-\alpha} \quad (1)$$

where K, A, E and L are physical capital, labor augmenting measure of total factor productivity, average years of schooling, and labor respectively. Since we do not have the data of the hours of work for the nations in the sample, labor is measured in terms of the percentage of the population between 15 and 64 years; where$\phi$is the growth rate of human capital. Thus $\phi(E_i)$ measures the effect of the average years of schooling to the productivity of labor, and the production function exhibits human capital-augmented labor. Equation (1) can be re-written in output per worker terms dividing both sides by L_i:

$$\left(\frac{Y}{L}\right)_i = \left(\frac{K}{L}\right)_i^{\alpha}\left[A_i e^{\emptyset(E_i)}\right]^{1-\alpha} \quad (2)$$

Taking the natural logs and of equation (2) creates a linear production function:

$$\ln\left(\frac{Y}{L}\right)_{it} = \alpha \ln\left(\frac{K}{L}\right)_{it} + (1-\alpha)\emptyset(E_i) + (1-\alpha)\ln(A)_{it} \quad (3)$$

Equation (3) says that output per worker is determined by the capital per worker, educational attainment and total factor productivity. Since total factor productivity $ln(A_{it})$ is not directly observed, equation (3) is estimated and $ln(A_{it})$ is computed as the natural logarithm of output per worker not accounted for by capital per worker and human capital.

$$(1-\alpha)\ln(A)_{it} = \ln\left(\frac{Y}{L}\right)_{it} - \alpha\ln\left(\frac{K}{L}\right)_{it} - (1-\alpha)\emptyset(E_i) \qquad (4)$$

Using this as our starting point we examine the channels through which remittances might affect output per worker.

3.2:Data

The dataset is made up of 31 selected sub-Saharan African (SSA) countries over the time period 1980-2010, and are all taken from the World Bank Database. Countries are included on the basis of data availability for two key variables: remittances and average years of schooling. According to the World Bank, "personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees." Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals.

The variables for the estimation of the production function are: real GDP per worker derived from GDP per capita and physical capital per worker, which is in turn generated from the gross capital formation as a percentage of GDP using the perpetual inventory method; the labor force is the percentage of the total population between 15 and 64 years. The proxy stock of human capital is the Barro-Lee average years of schooling per person 15 years and older. In accordance with the Barro-Lee five-year averaging of the years of schooling, all data are averaged over a 5-year periods: 1980, 1985, 1990, 1995, 2000, 2005, and 2010. Averaging has

an extra advantage in that it mitigates the macroeconomic business cycles in investment and total factor productivity.

Table 1: Descriptive Statistics (1980-2010)[±]

Entire sample from SSA: 31 nations					
Variables: all are five year averages	mean	Std. Dev.	Min.	Max.	Obs.
GDP per worker	2366.69	2996.82	235.95	14988.6	170
Capital per worker	5587.2	8346.02	140.75	45154.9	170
Years of schooling (15 years or older)	4.28	2.09	0.62	9.56	171
FDI/GDP	6.94	10.40	-3.56	62.23	170
AID/GDP	15.95	17.04	-0.19	94.82	168
Remittances percentage of GDP	4.34	12.80	0.002	95.31	171
Openness	72.53	37.46	13.37	191.11	171
Low Income: 16 SSA nations					
GDP per worker	811.93	981.62	235.95	9460.88	86
Capital per worker	1379.90	2288.88	140.75	21131.25	85
Years of schooling (15 years or older)	3.19	1.81	0.62	9.56	86
FDI/GDP	2.42	4.69	-3.56	24.91	86
AID/GDP	27.93	15.95	3.24	94.82	86
Remittances percentage of GDP	1.96	2.45	0.002	10.73	86
Openness	57.65	21.83	25.33	139.87	86
Lower Middle Income: 10 SSA nations					
GDP per worker	1914.53	1063.22	660.91	4763.49	56
Capital per worker	4859.87	3946.26	276.28	18443.89	57
Years of schooling (15 years or older)	4.72	1.56	1.28	7.69	57
FDI/GDP	16.21	12.61	2.56	62.23	57
AID/GDP	3.15	4.51	-0.19	24.66	57
Remittances percentage of GDP	9.57	21.11	0.02	95.32	57
Openness	86.65	49.65	13.37	191.11	57
Upper Middle Income: SSA 5 nations					
GDP per worker	8046.40	3049.61	3187.72	14988.6	28
Capital per worker	19840.18	10949.1	7993.28	45154.9	28
Years of schooling (15 years or older)	6.72	1.42	3.12	9.14	28
FDI/GDP	1.78	2.28	-3.07	7.226	27
AID/GDP	3.95	4.37	0.41	16.41	25
Remittances percentage of GDP	1.0	1.46	0.004	4.82	28
Openness	89.48	28.26	37.77	128.51	28

[±] The summary statistics include only those years where data for the remittances as a percentage of GDP are available. The nations included are: Benin, Botswana, Burundi, Cameroon, Central African Republic, Democratic Republic of Congo (Zaire), The Republic of Congo, Cote d'Ivoire, Gabon, Gambia, Ghana, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

Table 1 presents the descriptive statistics summarizing data for the entire sample, the low-income, the lower-middle-income, and the upper-middle-income, all from the SSA. For the

entire sample we find that average remittances as a percentage of GDP are 4.23 percent, the average official development assistance as a percentage of GDP are 15.95 percent, and the average foreign direct investment as percentage of GDP are 6.94 percent. Of the three forms of foreign financing, official development assistance is the most volatile with a standard deviation of 17, while fluctuations in foreign direct investment and remittances are very close at 10.4 and 12.8 respectively. In our sample from SSA the share in GDP of official development assistance is higher among the low income nations with 27.9 share of GDP while the share of FDI is higher among the lower-middle –income nations at 16.2 percent.

3.3: Estimation Methodology

The focus of this paper is to find the extent and channels through which remittances affect output per worker in SSA, controlling for other forms of foreign financing and openness. We focus on three primary forms of foreign financing: remittances, foreign direct investment, and official development assistance. We use the fixed-effects and the two-step system GMM estimation procedures. The production function of equation (5) is typically estimated using the fixed effects to capture the input elasticity using the within transformation, but most importantly it enables us to compute the total factor productivity. This transformation eliminates both the individual country time-invariant effects and the constant.

$$\ln(\ddot{y}_{it}) = \frac{\alpha}{1-\alpha}\ln(\ddot{k}_{it}) + \emptyset\ddot{E} + \delta_t t + \ddot{v}_{it} \qquad (5)$$

where$\ddot{y}_{it} = y_{it} - \bar{y}_{it}$, the same transformation applies to the capital-output ratio, the average years of schooling, and the residual. Endogeneity is always of great concern when working with macroeconomic variables, especially at the second stage when we test for the indirect channels. We therefore use the two-step GMM, which provides a robust estimator because it does not require information about the exact distribution of the disturbances. It is based on the assumptions that the error term is not serially correlated. Thus disturbances in the equations are uncorrelated with the instrumental variables, which are lagged levels of the series after the equation has been first-differenced to eliminate country-specific effects. The GMM transformed equation is specified as follows:

$$\hat{\beta}\ln(Z)_{it} = \beta_0 + \sum_{f=1}^{g} \hat{\beta}_f \ln(Z)_{it-l} + \sum_{l=0}^{m} \delta_l \ln(FDI)_{it-l} + \sum_{p=0}^{q} \delta_p \ln(ODA)_{it-l} + \sum_{u=0}^{v} \delta_u \ln(REMI)_{it-l} + \sum_{w=0}^{x} \delta_w \ln(OPENNESS)_{it-l} + \delta t + \varepsilon_{it} \quad (6)$$

where Z is a vector for the contributions of capital per worker, human capital, and total factor productivity while $\hat{\beta}$ is a vector of the estimated coefficients of capital intensity, human capital, and total factor productivity respectively.

The two-step system GMM is particularly advantageous to use because it minimizes biases and imprecision if the lagged levels of the series are weakly correlated with the subsequent differences and thus are weak instruments. According to Blundell and Bond (1998), the system GMM estimator uses the levels equation 3 to obtain a system of two equations: one differenced (as described above) and one in levels, which increases efficiency. By adding the second equation additional instruments can be obtained. Thus the variables in levels in the second equation are instrumented with their own first differences.

Two tests are performed to assess the validity of the models: the Hansen over-identifying restrictions (OIR) test and the Arellano and Bond autocorrelation (AR (2)) test for the validity of the instruments and the absence of autocorrelation among the residuals, respectively. In order to further prevent the issue of instrument proliferation, we have ensured that for every specification, the instruments do not exceed the number of countries.

4. Estimation Results

4.1. Direct effects of remittances on income per worker

We focus first on the direct effects of remittances on output per worker by estimating equation (4) using fixed effects specification, which controls for the unobserved heterogeneity. The results are reported in Table 2. Column (1) is the baseline specification of the equation, whereby output per worker is the dependent variable regressed on the capital per worker and human capital. From this column of results, we computed the contribution of total factor productivity to output per worker as in Equation (4). Columns (2) through (7) consider the possibilities where remittances could have a direct effect on output per worker. While controlling for inputs into production and other forms of foreign financing plus openness, we re-estimate Equation (4) with

remittances as one of the independent variables. In almost all specifications, remittances as a percentage of GDP have a statistically significant negative coefficient. This negative coefficient might be due to the inclusion of both direct and indirect channels, or imply that the negative effect of emigration outweighs the potentially positive effect from remittance inflows. According to Gupta, Pattillo and Wagh (2009), there is possibility that in SSA the depth and severity of poverty might be motivating greater out-migration, so that poverty is positively associated with remittances. In our case, remittances related to out-migration are negatively associated with output per worker. The negative coefficient is also consistent with intuition and the predictions of economic theory. Accordingly, it is logical to expect that remittances could reduce the need to work or seek employment since a great chunk of remittance end-up being used for consumption purposes.

However in column (5), when remittances are interacted with human capital, the composite variable has a statistically significant positive coefficient. In other words, where human capital is increasing, an increase in remittances would increase output per worker. There is complementary effect. This implies that the educated are more predisposed to using remittances for the improvement of their income situations in a sustainable manner. It also follows that education mitigates the baseline negative impact of remittances on income per worker. The increase in human capital could have been brought about by the remittances, other interventions, or both.

The control variables have the expected signs. First, the significant effects of schooling and capital stock per worker on the dependent variables are in accordance with intuition. Second, 'the insignificant individual direct' effects of development assistance and trade also have logical explanations. With the exception of small cases like Rwanda, where foreign aid has substantially been used for reconstruction purposes, the economics of development assistance in Africa remain questionable for a plethora of reasons that are not within the scope of this paper (Asongu, 2014). Third, 'the insignificant direct interactive effect' of remittances with capital, foreign aid, and openness means that policy needs to put more effort in order to reap the benefits of the complementary effect.

Table 2: Fixed Effects (within) regressions of equation (5)

	Entire Sample 31 SSA nations						
	ln (average GDP per worker)	*ln (average GDP per worker)*	*ln(average GDP per worker)*	*ln(average GDP per worker)*	*ln (average GDP per worker)*	*ln (average GDP per worker)*	*ln (average GDP per worker)*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Average capital stock per worker	0.241***	0.220***	0.198***	0.211***	0.207***	0.185**	0.200**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Schooling	0.129***	0.129***	0.134***	0.133***	0.132***	0.138***	0.135***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Official Development Assistance: ODA		0.003	-0.002	-0.003	-0.004	-0.001	-0.001
		(0.835)	(0.907)	(0.878)	(0.789)	(0.964)	(0.934)
Remittances: REMI		-0.063***	-0.064***	-0.107**	-0.103***	-0.081***	-0.089
		(0.000)	(0.000)	(0.030)	(0.000)	(0.000)	(0.258)
Openness			0.069	0.067	0.044	0.103	0.077
			(0.259)	(0.275)	(0.475)	(0.124)	(0.244)
*Remittances * Average capital stock per worker*				0.006			
				(0.371)			
*Remittances * Schooling*					0.010**		
					(0.032)		
*Remittances * ODA*						0.008	
						(0.190)	
*Remittances * Openness*							0.006
							(0.746)
Constant	4.71***	4.85***	4.71***	4.62***	4.78***	4.64***	4.65***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.335	0.467	0.473	0.476	0.493	0.481	0.473
Observations	169	164	164	164	164	164	164
		Time-effects (years) are included in all the fixed effects (within) regressions					

Notes for Table 2: ***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in the parenthesis.

4.2: The indirect channels through which remittances affect income per worker

From the results of Table 2, remittances have a negative incidence on output per worker, perhaps because the equations include both the direct production inputs and indirect channels. This section investigates the effect of remittances on income per worker using indirect channels of factors of production, notably: the contributions of physical capital, human capital and total factor productivity. The basic specification for the indirect channels effect is equation (6). Following Ahortor and Adenutsi (2009), we include both the current and lagged remittances.The results for equation (6) are reported in Tables 3(a), 3(b), 3(c) and 4.

Table 3(a) reports the effect of remittances on the contribution of capital per worker to output per worker. Most of the control variables are significant with the correct signs.We find that while the current remittances are either negatively or insignificantly related to capital per worker, the lagged remittances have a positive effect on capital per worker. The interpretation of the latter is broadly consistent with the explanation provided in the preceding section. The lagged remittances can increase investment and the contribution of capital per worker to output per worker over time, because while remittances are often meant for consumption, over time, they can indirectly and slowly boost investment due to higher demand. The negative effect of foreign aid can be explained in two ways: first, foreign aid breeds corruption (Asongu, 2012) and deteriorates institutional quality (Asongu, 2013a), which potentially discourages capital intensity investment, especially if channeled through government expenditure (Asongu and Jellal, 2013) or public investment (Baliamoune-Lutz and Ndikumana, 2008). In the same vein, Simeon Djankov, José García-Montalvo, and Marta Reynal-Querol (2006) and Stephen Knack (2001) find empirically that aid worsens democracy, bureaucratic quality, the rule of law, and corruption. Second, countries with deteriorating economic conditions tend to receive more aid. Hence there is an inverse relationship between ODA and capital per worker. We also find that trade openness increases physical capital and its contribution to output per worker. Generally openness enables firms to take advantage of the increasing returns to scale both for current production and for technological development, which can involve increasing physical capital investment.

Table 3(b)reports the effect of remittances on the contribution of human capital to output per worker. The estimation results are all valid because the null hypotheses of the Hansen Over-identification Restrictions and AR(2) tests are overwhelmingly rejected.The current remittances

have a negative effect while the lagged have a positive effect on the contribution of human capital to output per worker. This finding is consistent with Table 3(a) results that while current remittances are negatively associated with human capital due to the emigration effect, lagged remittances would increase human capital due to motivational effects for higher returns abroad, or put more students into school for longer than otherwise or both. The individual effect of ODA to human capital is negative; however the interaction term between ODA and remittances has a positive effect. Aid that is channeled towards education, health, and nutrition would increase human capital. We also find that openness has a positive effect to the contribution of human capital to output per worker both individually and in complementarity to remittances. At the same time, the positive effect of openness is consistent with the implications of globalization on human development in Africa (Asongu, 2013b).

On an income level analysis, human capital is significantly increasing among the low-income nations of SSA; and if remittances are sent, recipients in low-income nations are more likely to invest them in education. It is worth noting that while the lower-middle-income nations lead the other groups in term of remittances received as a percent of GDP, the remittances are negatively associated with the contribution of human capital to output per worker. This could be evidence to Lucas (1988) that migration of individuals with above average skills is detrimental for the country of emigration. Remittances flow at a cost of emigration: the cost might outweigh benefits from the external financial flows.

Table 3(c) reports the effect of remittances on the contribution of total factor productivity to output per worker. Again the specifications are all valid because the null hypotheses of the Hansen OIR and AR(2) tests are overwhelmingly rejected. Among the literature that has examined the role of total factor productivity in the growth process of African economies, Devarajan et al. (2003) finds that it is the low productivity rather than the level of investment that has been the main constraint to African growth. On the other hand, Fosu (2012) finds that while total factor productivity was the main source of the negative growth in the 1980s and early 1990s in SSA, the recent growth resurgence as of the mid-1990s can reasonably be attributed to major improvements in total factor productivity. The growing FDI in SSA has been accompanied by foreign investors (like China) bringing-in their own workers (Asongu and Aminkeng, 2013), who can have an effect on domestic labor productivity.

Our findings from the total factor productivity regressions are in line with Fosu (2012): first, we find that remittances either in current year or after a lag will increase the total factor productivity. Since some of the remittances are in cash or kind: tools and equipment, and remitters accompany them with entrepreneurial ideas, it is not surprising that remittances would increase total factor productivity. Second, we find that individual direct effects of FDI and foreign aid are positive on the dependent variable, whereas there is a substitution effect between remittances with other foreign financial flows, FDI and foreign aid. Third, on the income level analysis we find total factor productivity to be significantly increasing among the upper-middle-income nations of SSA, and that remittances to these nations are enhancing this rise.

Table 3(a): Capital per worker two-step system GMM regressions of equation (6)

	Entire Sample (31 countries)										
$\alpha \ln\left(\frac{K}{L}\right)_{it}$	*Baseline Equation*	*Low, Low-Middle, Upper Middle Income and Openness*							*Interaction terms: REMI, ODA and Openness*		
Contribution of Capital per Worker (-1)	0.846*** (0.000)	0.864*** (0.000)	0.838*** (0.000)	0.827*** (0.000)	0.819*** (0.000)	0.888*** (0.000)	0.878*** (0.000)	0.860*** (0.000)	0.869*** (0.000)	0.852*** (0.000)	0.844*** (0.000)
Remittances	-0.001 (0.974)	-0.001 (0.770)	-0.002 (0.391)	0.001 (0.904)	0.001 (0.770)	-0.011 (0.106)	-0.013*** (0.003)	-0.008 (0.174)	-0.006 (0.383)	-0.016*** (0.001)	0.015 (0.377)
Remittances (-1)						0.009* (0.085)	0.006** (0.023)	0.011** (0.013)	0.008 (0.155)	0.006* (0.088)	0.005 (0.325)
ODA	-0.006 (0.288)	-0.004 (0.291)	-0.008 (0.244)	-0.007 (0.222)	-0.013*** (0.000)	-0.010* (0.066)	-0.011*** (0.003)	-0.008*** (0.010)	-0.005 (0.175)	-0.013*** (0.000)	-0.008* (0.070)
Openness		0.027** (0.025)				0.028*** (0.000)	0.026*** (0.000)	0.017*** (0.010)	0.019*** (0.006)	0.028*** (0.000)	0.029*** (0.004)
Low-Income			-0.029 (0.231)			-0.006 (0.766)					
Low-Middle Income				0.001 (0.993)			-0.020* (0.096)				
Upper-Middle Income					0.014 (0.119)			0.045*** (0.003)			
*Remittances * Low Income*						-0.001 (0.946)					
*Remittances * Low-Middle Income*							-0.010 (0.143)				
*Remittances * Upper-Middle Income*								-0.010* (0.070)			
Remittances ODA*										0.004*** (0.000)	
*Remittances *Openness*											-0.005 (0.264)
Constant	0.313*** (0.001)	0.160*** (0.006)	0.346*** (0.001)	0.350*** (0.000)	0.368*** (0.000)	0.125** (0.015)	0.158*** (0.000)	0.211*** (0.000)	0.187** (0.000)	0.199*** (0.000)	0.200*** (0.000)
Obs.	133	133	133	133	133	133	133	133	133	133	133
Instruments	16	20	18	18	18	28	28	28	22	26	26
AR(1) [p-value]	[0.173]	[0.242]	[0.199]	[0.165]	[0.168]	[0.986]	[0.816]	[0.718]	[0.520]	[0.297]	[0.312]
AR(2) [p-value]	[0.213]	[0.225]	[0.181]	[0.213]	[0.165]	[0.293]	[0.206]	[0.250]	[0.342]	[0.309]	[0.327]
Hansen Test [p-value]	[0.629]	[0.505]	[0.278]	[0.653]	[0.381]	[0.329]	[0.594]	[0.855]	[0.610]	[0.488]	[0.813]

Notes for Table 3(a): ***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in the parenthesis. FDI is not included in this regression to avoid double counting under the assumption that it forms part of a nation's stock of capital.

Table 3(b): Human Capital two-step system GMM regressions of equation (6)

	Entire Sample 31 nations											
$(1-\alpha)\emptyset(E_i)$	*B.E*	*Low; Low-Middle and Upper Middle Income*							*Interaction terms*			
Human Capital (-1)	0.967*** (0.000)	0.948*** (0.000)	0.965*** (0.000)	0.952*** (0.000)	0.967*** (0.000)	0.936*** (0.000)	0.963*** (0.000)	0.970*** (0.000)	0.956*** (0.000)	0.988*** (0.000)	0.938*** (0.000)	0.965*** (0.000)
Remittances	-0.006* (0.066)	-0.005*** (0.004)	-0.002 (0.311)	-0.007* (0.075)	-0.003 (0.125)	-0.019*** (0.000)	-0.017** (0.013)	-0.009*** (0.006)	-0.009*** (0.003)	-0.014** (0.003)	-0.029*** (0.000)	-0.036** (0.016)
Remittances(-1)						0.016*** (0.000)	0.018*** (0.002)	0.010*** (0.004)	0.006* (0.053)	0.001 (0.816)	0.013*** (0.000)	0.007** (0.027)
FDI	0.001 (0.831)	-0.001 (0.826)	0.004 (0.340)	0.007 (0.102)	0.002 (0.666)	-0.002 (0.920)	0.004** (0.027)	-0.003 (0.143)	-0.004* (0.073)	-0.001 (0.380)	-0.002 (0.171)	0.002 (0.383)
ODA	-0.006** (0.028)	-0.003* (0.090)	-0.013*** (0.001)	-0.016*** (0.003)	-0.006*** (0.009)	-0.014*** (0.000)	-0.016*** (0.000)	-0.007*** (0.007)	-0.001 (0.825)	-0.001 (0.896)	-0.006*** (0.002)	-0.001 (0.471)
Openness		0.031*** (0.000)							0.024*** (0.000)	0.026** (0.025)	0.016** (0.025)	0.014** (0.012)
Low-Income			0.023** (0.031)			0.008 (0.207)						
Low-Middle Income				-0.023** (0.014)			-0.032**** (0.000)					
Upper-Middle Income					-0.005 (0.202)			0.007 (0.338)				
*Remittances *Low-Income*						0.016*** (0.006)						
Remittances Low-Mid-Income*							0.003 (0.975)					
Remittances Upper-Mid-Income*								-0.028*** (0.008)				
Remittances FDI*										-0.002 (0.653)		
Remittances ODA*											0.006*** (0.001)	
Remittances Openness*												0.006** (0.050)
Constant	0.084*** (0.000)	-0.039* (0.056)	0.080*** (0.000)	0.109*** (0.000)	0.082*** (0.000)	0.111*** (0.000)	0.114*** (0.000)	0.084*** (0.000)	-0.014 (0.384)	-0.043 (0.459)	0.037 (0.354)	0.012 (0.592)
Obs.	125	125	125	125	125	125	125	125	125	125	125	125
Instruments	20	24	22	22	22	28	28	28	26	30	30	30
AR(1) [p-value]	[0.241]	[0.240]	[0.257]	[0.212]	[0.253]	[0.172]	[0.123]	[0.118]	[0.220]	[0.213]	[0.125]	[0.189]
AR(2) [p-value]	[0.231]	[0.259]	[0.224]	[0.274]	[0.213]	[0.324]	[0.512]	[0.264]	[0.285]	[0.397]	[0.612]	[0.300]
Hansen Test [p-value]	[0.228]	[0.449]	[0.171]	[0.348]	[0.253]	[0.514]	[0.536]	[0.743]	[0.547]	[0.854]	[0.880]	[0.762]

Notes for Table 3(b): ***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in the parenthesis. B.E ≡ Baseline Equation

Table 3(c): Total Factor Productivity two-step system GMM regressions of equation (6)

	Entire Sample 31 nations												
$(1-\alpha)\ln A_{it}$	B.E	*Low, Low-Middle, Upper Middle Income, Openness*										*Interaction terms*	
Contribution of TFP(-1)[§]	1.09*** (0.000)	0.947*** (0.000)	1.03*** (0.000)	1.11*** (0.000)	1.06*** (0.000)	1.03*** (0.000)	0.926*** (0.000)	0.859*** (0.000)	1.01*** (0.000)	0.979*** (0.000)	0.968*** (0.000)	0.881*** (0.000)	0.958*** (0.000)
Remittance	0.044*** (0.001)	0.016 (0.104)	0.042*** (0.001)	0.052*** (0.001)	0.043*** (0.002)	-0.002 (0.887)	0.010 (0.461)	0.020 (0.236)	-0.019 (0.271)	-0.005 (0.597)	0.012 (0.542)	0.050** (0.016)	-0.071 (0.425)
Remittance (-1)						0.044* (0.060)	0.004 (0.808)	0.024*** (0.005)	0.037* (0.086)	0.029* (0.097)	0.034*** (0.000)	0.012 (0.399)	0.016 (0.275)
FDI	0.078*** (0.000)	0.077*** (0.000)	0.065*** (0.000)	0.078*** (0.000)	0.072*** (0.000)	0.059*** (0.001)	0.069*** (0.000)	0.041*** (0.001)	0.071*** (0.000)	0.075*** (0.000)	0.064*** (0.000)	0.061*** (0.000)	0.057*** (0.000)
ODA	0.078*** (0.000)	0.054** (0.002)	0.073*** (0.000)	0.069*** (0.000)	0.067*** (0.000)	0.062*** (0.000)	0.043*** (0.001)	0.064*** (0.000)	0.030** (0.041)	0.056*** (0.000)	0.022* (0.051)	0.036*** (0.006)	0.029** (0.044)
Openness		0.006 (0.822)					0.001 (0.925)				-0.034 (0.534)	-0.013 (0.542)	0.009 (0.563)
Low-Income			-0.020 (0.557)					-0.072** (0.022)					
Low-Middle Income				-0.068* (0.068)					-0.075** (0.025)				
Upper-Middle Income					0.166*** (0.001)					0.240*** (0.000)			
*Remittances *Low-Income*								-0.072** (0.012)					
*Remittances*Low-Mid-Income*									0.028 (0.425)				
*Remittances*Upper-Mid-Income*										0.080* (0.086)			
Remittances FDI*											-0.020** (0.015)		
Remittances ODA*												-0.025*** (0.000)	
Remittances Openness*													0.012 (0.537)
Constant	-0.272*** (0.000)	-0.241* (0.086)	-0.227*** (0.000)	-0.221*** (0.000)	-0.260*** (0.000)	-0.215*** (0.000)	-0.189*** (0.001)	-0.137*** (0.000)	-0.137*** (0.002)	-0.240*** (0.000)	0.014 (0.950)	-0.097 (0.105)	-0.108 (0.400)
Observations Instruments	124 20	124 24	124 22	124 22	124 22	124 22	124 26	124 28	124 28	124 28	125 30	124 30	124 30
AR(1) [p-value] AR(2) [p-value]	[0.050] [0.104]	[0.042] [0.244]	[0.078] [0.126]	[0.056] [0.116]	[0.076] [0.150]	[0.049] [0.213]	[0.047] [0.339]	[0.281] [0.406]	[0.037] [0.547]	[0.074] [0.212]	[0.133] [0.580]	[0.228] [0.784]	[0.053] [0.844]
Hansen Test [p-value]	[0.333]	[0.173]	[0.372]	[0.337]	[0.530]	[0.173]	[0.215]	[0.479]	[0.450]	[0.520]	[0.490]	[0.750]	[0.659]

Notes for Table 3(c): ***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in the parenthesis. §:TFP ≡ Total Factor Productivity; B.E ≡ Baseline Equation

Table 4: Remittances and Institutions (Democracy): two-step system GMM regressions of equation (6)

	Entire Sample 31 nations											
	$\alpha \ln\left(\frac{K}{L}\right)_{it}$				$(1-\alpha)\emptyset(E_i)$				$(1-\alpha)\ln A_{it}$			
Dependent Variable (-1)	0.827*** (0.000)	0.817*** (0.000)	0.865*** (0.000)	0.850*** (0.000)	0.989*** (0.000)	1.00*** (0.000)	0.974*** (0.000)	0.980*** (0.000)	1.06*** (0.000)	1.09*** (0.000)	1.02*** (0.000)	1.02*** (0.000)
Remittances	-0.002 (0.512)	-0.001 (0.844)	0.001 (0.827)	-0.015*** (0.004)	-0.001 (0.495)	-0.001 (0.492)	-0.002* (0.075)	-0.010*** (0.003)	0.023*** (0.008)	0.022** (0.027)	0.016** (0.027)	-0.017 (0.339)
Remittances(-1)				0.019*** (0.003)				0.011*** (0.000)				0.037*** (0.0.009)
FDI					-0.004* (0.056)	-0.002 (0.378)		-0.002 (0.254)	0.062*** (0.000)	0.049*** (0.000)		0.029*** (0.000)
ODA	-0.012*** (0.000)	-0.014*** (0.000)	-0.017*** (0.000)	-0.018*** (0.000)	0.001 (0.932)	0.002 (0.285)	-0.001 (0.419)	-0.002 (0.435)	0.036*** (0.000)	0.041*** (0.000)	0.011 (0.285)	0.018* (0.069)
Openness			0.018** (0.026)	-0.005 (0.462)			0.014*** (0.007)				0.011 (0.717)	
Polity2	0.001 (0.104)	0.001 (0.538)	0.001* (0.056)	0.002*** (0.004)	-0.001*** (0.002)	-0.001*** (0.003)	-0.001 (0.732)	0.001 (0.103)	0.005** (0.036)	0.008*** (0.000)	0.007** (0.000)	0.006*** (0.001)
Remittances Polity2*		-0.002*** (0.000)	-0.000 (0.965)	-0.001 (0.258)		0.001 (0.410)	0.001** (0.050)	0.001 (0.123)		-0.001 (0.371)	-0.004*** (0.000)	-0.001 (0.902)
Constant	0.355*** (0.000)	0.199*** (0.000)	0.221*** (0.000)	0.356*** (0.000)	0.064*** (0.000)	0.053*** (0.000)	0.010 (0.618)	0.072*** (0.010)	-0.170*** (0.000)	-0.160*** (0.000)	-0.101 (0.495)	-0.088*** (0.000)
Observations	133	133	133	133	125	125	134	134	124	124	132	124
Instruments	20	24	28	30	24	28	28	30	24	28	28	30
AR(1) [p-value]	[0.220]	[0.097]	[0.225]	[0.790]	[0.289]	[0.315]	[0.378]	[0.231]	[0.071]	[0.153]	[0.265]	[0.095]
AR(2) [p-value]	[0.204]	[0.218]	[0.178]	[0.337]	[0.187]	[0.207]	[0.137]	[0.375]	[0.207]	[0.195]	[0.223]	[0.332]
Hansen Test [p-value]	[0.546]	[0.788]	[0.627]	[0.915]	[0.468]	[0.704]	[0.455]	[0.760]	[0.336]	[0.540]	[0.481]	[0.621]

Notes for Table 4: ***significant at 1 percent; ** significant at 5 percent; * significant at 10 percent; p-values are in the parenthesis

Improvement in institutional quality has often had a positive impact on economic outcomes. Roland (2014) affirms that institutions help to reduce translation costs. Due to lack of longtime series data on institutional variables, such as those used by Osabuohien and Efobi (2013) from the World Governance Indicators[3], we use polity2 to investigate whether institutions have enhanced the degree of responsiveness of the contributions of physical capital, human capital, and total factor productivity to output per worker. According to Cooray and Mallick (2010)**, "**Remittance flows depend on a country's investment opportunities and social welfare systems, which in turn depend on its institutional development. Moreover, migrants from a country with oppressive institutions prefer to settle permanently in the host country and as a result remit less to the home country. We use the 'polity2' score as a proxy for institutions. This variable captures the regime authority spectrum on a 21-point scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). It examines concomitant qualities of democratic and autocratic authority in governing institutions, rather than discreet and mutually exclusive forms of governance."

Table 4 reports the interactions between institutions and remittances. The effects from the current and lagged remittances on the factor inputs remain consistent with what we find in Tables 3(a), 3(b) and 3(c). We find that an improvement in institutions increases the contributions of physical capital, human capital, and total factor productivity to output per worker in general, and in particular, an interaction between polity2 and remittances makes remittances more effective in increasing human capital productivity. Above all, polity2 in our SSA sample and time period averages negative at -0.81, implying that there is still substantial political risk in SSA, which can limit the responsiveness of economic outcomes to interventions. Fosu (2008) suggests that at lower levels of democracy, the growth impact of electoral competitiveness tends to be adverse, that is, have a negative intermediate-democracy effect. With greater democratic advancement, however, these reforms can raise growth, that is, have a positive advanced-democracy effect. Our study finds that the effect of polity2 though largely positive, its effects are inconclusive since it still has some statistically significant negative effects on human capital.

5. Discussion

The focus on the SSA and the application of a production function framework to investigate the direct and indirect effects of remittances on output per worker has provided us with unique insights into the economic significance of foreign financing to SSA. As observed from Fig.1, while all three are on an all-time high and increasing, the volume of remittances has outpaced FDI and ODA. At the same time, we know that the utilizations of REMI, FDI and ODA are different. While FDI is for investment, REMI and ODA are between consumption, crisis management, and investment. The utilization differences will affect the direction and strength of impact on the economy of each type of external finances. For this reason, we wanted to know their economic importance by estimating their direct and indirect contributions to output per worker.

Taking a synopsis of the three main forms of foreign financing, their economic importance varies from country to country. Specifically, their patterns of flow are uneven across the sample, and so is their relative importance in terms of their shares of the GDP of recipient countries. Our findings indicate that FDI has a significant positive contribution to total factor productivity. ODA has a positive contribution towards total factor productivity but it is inversely related to capital per worker and human capital. As nations grow and acquire more and more physical and human capital stock, they graduate from aid. REMI has ambiguous effects between current and lagged. Where institutions are improving, REMI increases human capital. Overall, lagged REMI increases both physical and human capital while both current and lagged REMI have their most consistent positive effects on total factor productivity.

Our findings lead to three policy implications result from the study. First, REMI should be considered as a complement and not a substitute to ODA and FDI. Above all, of the three foreign financing variables, REMI would be the most elusive to policy. Second, it is possible that the negative effects of brain drain can be balanced by growing remittances (Ngoma and Ismail, 2013; Osabuohien and Efobi, 2013). Third, remittances that are invested in education directly increase worker income. This improves the policy recommendations of Nyarko and Gyimah-Brempong (2011), who have concluded that in the long run, education could become a more important mechanism for social protection than remittances. While policymakers should aim at minimizing emigration, they can at the same time encourage REMI and promote the

institutional environment in which not only REMI but all forms of both foreign and domestic financing would become more productive.

Finally, since total factor productivity is a multifactor variable, the individual channels through which REMI increase output per worker might still be undisclosed. According to Perkins et al. (2013), total factor productivity is a combination of so many factors not measured by physical capital and human capital, and which this analysis cannot disentangle: better trade policies, reduction in corruption, management, and technology. In practice, it also captures the net effect of all errors and omissions in data. Following Moses Abramovitz (1956) we can infer that it is a measure of our ignorance about the growth process and /or the individual channels through which remittances impact output per worker in SSA.

6. Conclusion

This paper has examined the channels through which remittances affect output per worker in Sub-Saharan Africa (SSA) using a production function framework. It has tackled two main questions. First, do remittances increase output per worker in SSA? Second, what are the channels through which remittances might boost output per worker? We have investigated the direct and indirect effects of remittances on incomes using fixed effects and two-step GMM on 31 SSA countries from 1980-2010. The direct effects have been examined via an extended production function while the indirect effects via the factor inputs into a Cobb-Douglas production function. We find that remittances have multiple positive, but mostly indirect, effects on output per worker, especially when lagged and/or complemented by education. We also find that remittances have increased the total factor productivity in SSA although the results are still sensitive to specification.

On the direct effects, remittances have a negative effect on per worker output; the interaction between remittances and schooling on the dependent variable is positive or complementary, and the interaction of remittances and FDI has a negative or substitution effect. The following findings have been established about the indirect effects of remittances on output per worker through physical capital per worker, human capital and total factor productivity. First, on the capital per worker mechanism, while the 'individual effect' of remittance on the dependent variable is insignificant with an ambiguous sign, the 'interactive effect' of remittance with FDI is significantly negative. Second, on the human capital channel, the 'individual effect'

of remittances is negative while the 'interaction effect' with foreign aid and openness are positive. This implies that development assistance and openness have a positive complementary effect in mitigating the baseline negative incidence of remittances. Third, concerning the total factor productivity mechanism, it is established that the 'individual effects' of FDI, foreign aid and remittances are positive on the dependent variable, whereas the 'interaction effects' of remittances with FDI and foreign aid are negative. This implies a substitution effect between remittances and the other financial flows (FDI and foreign aid) in the effect on total factor productivity. Justifications for the nexuses have been discussed.

Notes

1.The data for remittances does not include the unrecorded flows through formal and informal channels. This suggests that total remittances are a lot higher than reported.

2. Fosu (2012) applies a Cobb-Douglas production function but does not examine the effects of external financial flows on output.

3. Data for institutional variables such as Voice and Accountability, Rule of Law, Regulation Quality, Political stability and Control of corruption starts in 1996. Our approach using a production function with human capital has averaged all variables by 5 years. Doing the same averaging on institutional variables from The World Governance Indicators leaves us with very few data points to work with. Hence we decided to use polity2.

References

Abramovitz, M. (1956). Resources and Output Trends in the United States since 1870. *American Economic Review* 46, 5-23.

AEO (2013). Foreign investment, aid, remittances and tax revenue in Africa. *African Economic Outlook*, Retrieved from http://www.africaneconomicoutlook.org/en/outlook/financial_flows/

Adams, R. & Page, J. (2005). Do International Migration and Remittances Reduce Poverty in Developing Countries?*World Development*, 33 (10), 1645–1669.

Ahortor, C. R., &Adenutsi, D. E. (2009).The Impact of Remittances on Economic Growth in Small-Open Developing Economies.*Journal of Applied Sciences*, *9*(18): 3275-3286.

Asongu, S. A., (2012). On the effect of foreign aid on corruption.*Economics Bulletin*, 32(3), 2174-2180.

Asongu, S. A. (2013a). On the effectiveness of foreign aid in institutional quality.*European Economic Letters*, 2(1), 12-19.

Asongu, S. A. (2013b). Globalization and Africa: implications for human development. *International Journal of Development Issues*, 12(3), 213-238.

Asongu, S. A. (2014). The questionable of development assistance in Africa: hot-fresh evidence. *The Review of Black Political Economy*: Forthcoming.

Asongu, S. A. & Aminkeng, G. A. A. (2013). The economic consequences of China-Africa relations: debunking myths in the debate. *Journal of Chinese Economic and Business Studies*, 11(4), 261-277.

Asongu, S. A., &Jellal, M. (2013). On the channels of foreign aid to corruption.*Economics Bulletin*, 33(3), 2191-2201.

Baliamoune-Lutz, M., &Ndikumana, L. (2008). Corruption and Growth: Exploring the Investment Channel. *Economics Department Working Paper Series,* Paper 33.
Beine, M., Docquier, F., &Rapoport, H. (2001). Brain drain and economic growth: theory and evidence. *Journal of Development Economics*, 64, 275–289.

Blundell, R., & S. Bond.(1998). Initial conditions and moment restrictions in dynamic panel data models.*Journal of Econometrics* 87: 115-143.

Chami, R., Fullenkamp. C., &Jahjah, S. (2003) Are Immigrant Remittances Flows a Source of Capital for Development? IMF Working Paper 03/189, Washington, D.C.: International Monetary Fund.

Chami, R., Gapen, M. &Cosimano, T. (2006).*Beware of Emigrants Bearing Gifts: Optimal Fiscal and Monetary Policy in the Presence of Remittances*, IMF Working paper 06/61, Washington, D.C.: International Monetary Fund.

Chami, R., Barajas, A., Cosimano, T., Fullenkamp, C., Gapen, M. &Montiel, P. (2008).*Macroeconomic Consequences of Remittances*, IMF Occasional Paper No. 259 Washington, D.C.: International Monetary Fund.

Chami, R., Fullenkamp, C., &Gapen, M., (2009a).*Measuring Workers' Remittances: What Should Be Kept In and What Should Be Left Out*, mimeo, Washington, D.C.: International Monetary Fund.

Chami, R., Hakura, D., &Montiel, P. (2009b). Remittances: An Automatic Output Stabilizer? IMF Working Paper 09/91, Washington, D.C.: International Monetary Fund.

Cooray, A., &Mallick, D., (2010)**.** International Business Cycles and Remittance Flows.*The B.E. Journal of Macroeconomics*. 13, (1), 515–547.

Devarajan,S., Easterly, W.R., & Pack, H., (2003). Low Investment Is Not the Constraint on African Development, *Economic Development and Cultural Change*, 51 (3), 547-571.

Djankov, S., Montalvo, J.G, & Marta Reynal-Querol, M., (2005).*The curse of aid*. Washington, DC: The World Bank.

Ebeke, C.H. (2012). Do Remittances Lead to a Public Moral Hazard in Developing Countries? An Empirical Investigation.*The Journal of Development Studies*, 48 (8), 1009-1025.

Frankel, J.A., & Romer, D. (1999).Does Trade Cause Growth?"*The American Economic Review*, 89 (3), 379-399.

Freeman, R.B., &Lindauer D.L. (1999). Why not Africa? NBER Working Paper No.6942.

Fosu, A.K. (2008). Democracy and growth in Africa: Implications of increasing electoral competitiveness. *Economics Letters*, 100 (3), 442-444.

Fosu, A.K. (2012). Growth of African Economies: Productivity, Policy Syndromes and the Importance of Institutions. *Journal of African Economies*, 0(0), 1-29.

Giuliano, P. & Ruiz-Arranz, M. (2009).Remittances, Financial Development, and Growth. *Journal of Development Economics*, 90 (1), 144–152.

Gupta, S., Pattillo, C.&Wagh, S. (2009).'Effect of Remittances on Poverty and Financial Development in Sub-Saharan Africa.*World Development*, 37(1), 104–115.

Hall, R, & Jones, C. (1999).Why do some countries produce so much more output per worker than others?*The Quarterly Journal of Economics*, February, 83-116.

Knack, S. (2001). Aid Dependence and the Quality of Governance: Cross-Country Empirical Tests. *Southern Economic Journal*, 68(2), 310-329.

Ngoma, A. L., & Ismail, N. W. (2013).The Impact of Brain Drain on Human Capital in Developing Countries.*South African Journal of Economics*, 81(2), 221-224.

Nyamongo, E., Misati, R., Kipyegon, L., &Ndirangu, L. (2012).Remittances, financial development and economic growth in Africa.*Journal of Economics and Business*, 24, 240-260.

Nyarko, Y., &Gyimah-Brempong, K. (2011). Social Safety Nets: The Role of Education, Remittances and Migration. *EUI Working Papers RSCAS* No. 2011/26.

Osabuohien, E., &Efobi, U. (2013).Africa's Money in Africa.*South African Journal of Economics*, 81(2), 292-306.

Lucas, R.E. (1988). On the mechanics of economic development.*Journal of Monetary Economics* 22(3), 3–42.

Perkins, D. Radelet. S., D. Lindauer& S. Block.(2013). *Economics of Development*. New York: W.W. Norton & Company.

Pradhan, G., Upadhyay, M., &Upadhyaya, K. (2008).Remittances and Economic Growth in Developing Countries.*The European Journal of Development Research*, 20 (3), 497-506.

Rao, B., & Hassan, G. (2012). Are the Direct and Indirect Growth Effects of Remittances Significant.*The World Economy*, 35(3), 351-372.

Roland, G., (2014). *Development Economics*, New York: Pearson.

Roodman, D. 2009. How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal* 9(1): 86-136.

Singh, R.J., Haacker, M., Lee, K., & Goff, M. L. (2011). "Determinants and Macroeconomic Impact of Remittances in Sub-Saharan Africa", *Journal of African Economies,* 20 (2): 312-340.

Yang, D. (2008). International Migration, Remittances and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks. *The Economic Journal*, 118 (528), 591-630.

Yang, D. (2011).Migrant Remittances.*The Journal of Economic Perspectives*, 25 (3), 129-151.

Woodruff,C., &Zenteno, R. (2007). Migration networks and microenterprises in Mexico.*Journal of Development Economics,* 82 (2), 509-528.

Apendix A

Table 5: World Bank Income Classification of SSA countries

Country	World Bank Classification	Country	World Bank Classification
Benin	Low income	Mozambique	Low income
Botswana	Upper middle	Namibia	Upper middle
Burundi	Low income	Niger	Low income
Cameroon	Lower middle	Rwanda	Low income
Central African Republic	Lower middle	Senegal	Lower middle
Congo, Dem. Rep.	Low income	Sierra Leone	Low income
Congo, Rep.	Lower middle	South Africa	Upper middle
Cote d'Ivoire	Lower middle	Sudan	Lower middle
Gabon	Upper middle	Swaziland	Lower middle
Gambia, The	Low income	Tanzania	Low income
Ghana	Lower middle	Togo	Low income
Kenya	Low income	Uganda	Low income
Lesotho	Lower middle	Zambia	Lower middle
Liberia	Low income	Zimbabwe	Low income
Malawi	Low income		
Mali	Low income		
Mauritius	Upper middle		

Appendix B

Table 6: Variables

Variable	Source	Definition
GDP per worker	World Bank	The natural logarithm of average Gross Domestic Product per worker.
Physical Capital	Authors' computation and World Bank	The natural logarithm of average remittances received as a percentage of Gross Domestic Product. Computed using the perpetual inventory method on the gross fixed capital formation from the World Bank.
Human Capital	World Bank	Barro-Lee Average years of schooling for the people of 15 year and over.
Remittances (REMI)	World Bank	The natural logarithm of average remittances received as a percentage of Gross Domestic Product.
Foreign Direct Investment (FDI)	World Bank	The natural logarithm of average Foreign Direct Investment as a percentage of Gross Domestic Product.
Official Development Assistance (ODA)	World Bank	The natural logarithm of average net Official Development Assistance as a percentage of Gross Domestic Product.
Openness	World Bank	the natural logarithm of average openness (sum of exports and imports) as a percentage of Gross Domestic Product
Institutions: Polity2	Polity IV Project	Polity2 captures the regime authority spectrum on a 21-point scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). It is also a measure of political risk.
Low-Income; Lower-Middle-Income; and Upper-Middle-Income	World Bank	Low-income economies are those in which 2012 GNI per capita was $1,035 or less; Lower middle income group aggregate. Lower-middle-income economies are those in which 2012 GNI per capita was between $1,036 and $4,085; Upper middle income group aggregate. Upper-middle-income economies are those in which 2012 GNI per capita was between $4,086 and $12,615.
$\alpha \ln \left(\frac{K}{L}\right)_{it}$	Authors' computation	The contribution of physical capital to GDP per worker.
$(1-\alpha)\emptyset(E_i)$	Authors' computation	The contribution of human capital to GDP per worker.
$(1-\alpha)\ln A_{it}$	Authors' computation	The contribution of Total Factor Productivity capital to GDP per worker.