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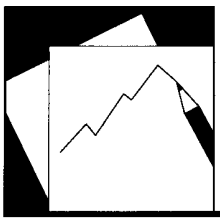

IMF Working Paper

Rainfall, Financial Development, and Remittances: Evidence from Sub-Saharan Africa

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Rainfall, Financial Development, and Remittances: Evidence from Sub-Saharan Africa

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Abstract

We use annual variation in rainfall to examine the effects that exogenous, transitory income shocks have on remittances in a panel of 42 Sub-Saharan African countries during the period 1960-2007. Our main finding is that these income shocks have a significant positive effect on remittances, but that the effect is significantly decreasing in the share of domestic credit to GDP. So much so, that at high levels of credit to GDP transitory increases in income had a significant negative effect on remittances. Our findings are consistent with the view that remittances take advantage of unexploited domestic investment opportunities that can exist due to domestic credit market frictions. Our findings also support the view that when barriers to financial flows are low, remittances effectively provide insurance against transitory income shocks.

JEL Classification Numbers: F24, F30, O10

Keywords: Transitory Income Shocks, Remittances, Financial Development

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I. INTRODUCTION

For many developing countries and most importantly for Sub-Saharan African countries, remittances constitute a significant source of foreign exchange and income. According to the World Bank, "tens of millions of African migrants scattered around the world could mobilize more than $100 billion a year to help develop the impoverished continent". The World Bank says "there's around $40 billion a year in officially recorded remittances -- cash sent by migrants back to their home countries -- and an estimated $50 billion in diaspora savings that could be leveraged for low-cost project finance".[2] Given the economic significance of remittances to the developing world, the causes of remittances to these countries is an issue of key importance for both academics who study the determinants of economic growth in the developing world and economic policy makers. In particular, for the economic policy response to transitory income shocks it is key to understand whether the response of remittances to transitory income shocks is positive, negative, or zero.

Obtaining an estimate of the causal effect that transitory income shocks have on remittances is complicated by a possible reverse causal effect of remittances on income. Remittances may have a positive effect on income if they are used to increase investment, yet they could equally have a negative income effect if they are spent to finance consumption (inducing a real exchange rate appreciation) or lead to a reduction in labor supply because of positive wealth effects.[3] The empirical literature on remittances is well aware of this simultaneity problem and has addressed it using instrumental variables techniques.[4] However, a second key issue when dealing with identifying the causal relationship between transitory income shocks and remittances that has not received sufficient attention in the literature is whether the transitory change in income is due to a transitory change in productivity, or whether it is due to a transitory but abrupt change in the capital stock that could be the consequence of events such as natural disasters or wars. The reason why this distinction matters is that basic economic theory tells us that beyond the transitory change in income, it is the marginal product of capital that is relevant for the decision to send remittances if these remittances are driven by an investment motive. If the remittances are on the other hand driven by an

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2 See http://www.smartmoney.com/news/on/?story=on-20110330-000243.

3 See for example Amuedo-Dorantes and Pozo (2006), Bansak and Chezum (2009), or Acosta et al. (2009).

4 See for example Yang (2007) and Yang and Choi (2007).

insurance motive, then it is solely the transitory nature of the income shock that matters. At the macroeconomic level, there are events (for example, natural disasters or wars) where a decrease in income may be associated with an increase in the marginal product of capital. Observing an average within-country relationship between transitory income changes and remittances does not allow to distinguish, therefore, whether at the macroeconomic level remittances are driven by an investment, an insurance motive, or both.[5]

The starting point of our empirical analysis of Sub-Saharan African countries is that year-to-year variation in rainfall is a shock to agricultural productivity. According to the World Development Indicators (2010), the average share of agriculture in value added is about one third in the Sub-Saharan African countries. Hence, year-to-year variation in rainfall can have large effects on aggregate incomes per capita and on the return to capital, that go in the same direction, through rainfall's effect on productivity. Moreover, year-to-year variation in rainfall is a plausibly exogenous shock to Sub-Saharan African economies that is of highly transitory nature: the sample average AR(1) coefficient on rainfall is about 0.18 and a distributed lag model shows that the significant effect on income per capita vanishes after about one year.

Our panel fixed effects analysis that uses the within-country variation in remittances and rainfall yields two main results. First, year-to-year variations in rainfall have a significant positive effect on remittances to Sub-Saharan African countries: a 10 percent increase in rainfall increased the inflow of remittances over the 1960-2007 period by about 2.5 percent

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5 To see this formally, consider an economy operating under a simple constant returns to scale production function $Y = AK^{\alpha}L^{1-\alpha}$, with 0<α<1. In this economy average income per capita

$$y \equiv \frac{Y}{L} = A\left(\frac{K}{L}\right)^{\alpha}$$

decreases if, say, due to a natural disaster there is a decrease in the capital stock *K* that decreases the capital labor ratio. Notice that this reduction in *K* increases the marginal product of capital

$$MPK \equiv \frac{\partial Y}{\partial K} = A\left(\frac{K}{L}\right)^{\alpha-1}$$

and hence the incentives to send remittances in order to exploit higher returns. A positive average response of remittances to negative changes in income can therefore be consistent with both, an insurance and an investment motive. However, an estimation approach that uses an exogenous variable which affects both income and the return to capital in the same way can overcome this problem. This is the reason why we focus in this paper on year-to-year variations in rainfall since this variable unambiguously affects income and the marginal product of capital in the same way (through its impact effect on *A*).

on average. This result is robust to controlling for country and year fixed effects, the exclusion of extreme rainfall observations (i.e. droughts and floods), a distributed lag model that allows to distinguish short-run from medium/long-run responses, and a dynamic panel data model that controls for adjustment dynamics in remittances.

Our second main finding is that the marginal effect of transitory rainfall driven income shocks on remittances significantly varies across Sub-Saharan African countries' credit to GDP ratios. This difference in marginal effects is so strong that at high levels of credit to GDP transitory increases in income had a significant negative effect on remittances. Hence, while in countries with thin domestic financial markets remittances responded significantly positively to transitory income shocks, in countries where financial markets were relatively well developed the remittances response was significantly negative.

These findings are consistent with both, an insurance and an investment motive of remittances. The reason is that when domestic financial markets are thin, credit-constrained investors will have difficulties to obtain finance for high-return projects in the presence of positive rainfall shocks that transitorily increase the return to capital. A remittance inflow can then help slacken finance constraints and take advantage of the transitory high returns to capital. On the other hand, when financial markets are relatively well developed, investors will find it relatively easy to obtain finance domestically. Hence, the investment return for remittances will be relatively low in countries with relatively thick financial markets.

There exist several papers on the determinants of remittances that are related to our study. Using a sample of middle and low income countries and focusing on cross-country variation Freund and Spatafora (2008) show that remittances are significantly lower in countries where transaction costs are higher. Sayan (2006) investigates the business-cycle behavior of remittances for 12 developing countries and fails to find strong evidence for a significant average countercyclical relationship. Sayan's study does not use exogenous, transitory rainfall shocks to examine the effects that within-country changes in income have on remittances however. On the other hand, Yang (2007) documents that exogenous income shocks due to hurricanes lead to a significant increase in workers' remittances to poor countries.

Yang's (2007) study and focus on hurricanes is closely related to our focus on rainfall driven income shocks. This is because hurricanes, like rainfall, are a transitory shock to income. However, a crucial difference between rainfall and hurricanes is that the later has a large

negative (destruction) effect on the economy's capital stock. This means that an analysis that uses hurricanes as an exogenous, negative transitory income shock to examine the insurance motive of remittances is problematic because the response can also be consistent with an investment motive since the hurricane may be associated with a higher, transitory return to capital. A further key difference between our study and Yang (2007) is that Yang (2007) does not focus on the role of cross-country differences in financial development. In light of our focus on these cross-country differences, it is important to note that the negative relationship between rainfall and remittances, that Yang and Choi (2007) document in their micro-data study of the Philippines during July 1997 to October 1998, is consistent with our second main finding that at relatively high levels of financial development the relationship between rainfall and remittances is significantly negative.[6] In the next section we explain our estimation strategy and data. In the section thereafter we present and discuss our empirical results in detail. In the last section we conclude our paper with a summary of the main results.

II. DATA AND ESTIMATION STRATEGY

We examine the reduced-form effects that rainfall has on real workers' remittances per capita by estimating the following model:

$$\ln(Remittances_{i,t}) = \alpha_i + \beta_t + \eta \ln(Rainfall_{i,t}) + u_{i,t}$$

where α_i are country fixed effects and β_t are year fixed effects. $u_{i,t}$ is an error term that is clustered at the country level.

As a baseline regression, we estimate the average marginal impact effect η that rainfall has on remittances and examine lagged effects of rainfall on remittances by using a distributed lag model that includes lags of rainfall on the right-hand side of the estimating equation. We check the robustness of our results to dynamics in workers' remittances by including the lagged dependent variable on the right-hand side of the estimating equation.

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6 According to WDI (2010), the average ratio of credit to GDP in the Philippines during the 1997-1998 period was 0.58. Plugging this value into our estimates yields a negative relationship between rainfall and remittances that is significant at the 5 percent level. Thus, our macro panel data results are consistent with the micro panel data evidence that is provided by Yang and Choi (2007) on rainfall and remittances in the Philippines.

We examine how the marginal effect of rainfall on remittances varies as a function of cross-country differences in financial development by estimating an interaction model of the form:

$$\ln(Remittances_{i,t}) = a_i + b_t + c\ln(Rainfall_{i,t}) + d\ln(Rainfall_{i,t})*FD_i + e_{i,t}$$

where FD_i is a measure for cross-country differences in financial development. Following common practices in the finance literature, we use the average share of domestic credit to the private sector in GDP over the 1960-2007 period as our main proxy for financial development. We note that our measure of financial development is time-invariant and therefore we do not need to control for this variable in the country fixed effects regression (the reason is that the direct effect of financial development on remittances is already accounted for by the country dummies a_i).

Under the exclusion restriction that rainfall affects remittances through its effect on incomes, we can estimate the effect that a transitory change in income per capita has on remittances:

$$\ln(Remittances_{i,t}) = f_i + g_t + h\Delta\ln(GDP_{i,t}) + i\Delta\ln(GDP_{i,t})*FD_i + j_{i,t}$$

We use the change in real GDP per capita rather than the level of real GDP per capita because the time-series property of GDP per capita is very persistent (the AR(1) coefficient is about 0.95). In fact, as Table 2 shows, the Fisher panel unit root test cannot reject the null hypothesis of a unit root in the level of GDP per capita while it rejects a unit root in the level of the other series at the 1 percent level. The two-stage least squares estimate of equation (3) should therefore be interpreted as capturing the effect that a transitory, rainfall driven change in income per capita has on remittances in Sub-Saharan Africa. Our data sources for the estimation of the above equations are as follows. The annual rainfall data are from Terrestrial Air Temperature and Precipitation: 1900-2006 Gridded Monthly Time Series, Version 1.01 (Matsuura and Willmott, 2007). These rainfall data come at a high resolution (0.5°x0.5° latitude-longitude grid) and each rainfall observation in a given grid is constructed by interpolation of rainfall observed by all stations operating in that grid. The rainfall data are then aggregated to the country level by assigning grids to the geographic borders of countries. The annual real per capita GDP data are from the Penn World Tables, version 6.3 (Heston et al. 2009). The data on the share of domestic private credit in GDP and workers' remittances are from WDI (2010). Summary statistics on these variables are provided in Tables 1 and 2.

III. MAIN RESULTS

Table 3 presents our estimates of the average reduced-form effect that rainfall has remittances to Sub-Saharan African countries. Column (1) shows estimates where the control variables are country fixed effects only. These estimates are positive in sign but statistically insignificant. In column (2) we include in the regression year fixed effects in order to account for Africa-wide shocks. This has the consequence that the size of estimates on rainfall increase, and that the lagged effect of rainfall on remittances becomes significant at the 10 percent level. When we add lagged remittances to take into account dynamics in the log-level of remittances the estimates of the average marginal effect of rainfall become significant at the 5 percent level (see columns (3) and (4)). The findings in Table 3 therefore suggest that remittances responded significantly positively on average to transitory within-country rainfall variations.

In order to examine the role of cross-country differences in financial development that could significantly affect the marginal effect of year-to-year variation in rainfall on remittances we present in Table 4 estimates of an interaction model where in columns (1)-(3) the log of rainfall is interacted with countries' average share of domestic credit in GDP. In columns (4)-(6) we also report estimates where we discretize the credit to GDP ratio into 4 equal quartiles to reduce attenuation bias from measurement error in the credit to GPD ratio.[7]

There are two main results worth noting. First, the interaction between rainfall and the credit to GDP ratio is negative and statistically significant at the 5 percent level. Second, the estimates imply that at high levels of credit to GDP the relationship between rainfall and remittances is significantly negative. Taking partial derivatives of the estimates reported in column (1) yields:

$$\frac{\partial(\text{Remittances})}{\partial(\text{Rainfall})} = 0.39 - 1.38(\frac{\text{Credit}}{\text{GDP}})$$

Hence, at zero private credit to GDP ratios the estimates predict a positive impact response of remittances to rainfall but a negative and significant impact response at high credit to GDP

7 The discretized credit to GDP variable takes on the value of 1 in the 0-25 percentile, 2 in the 26-50 percentile, 3 in the 51-75percentile, and 4 in the 76-100 percentile

ratios. Specifically, at the sample maximum credit to GDP ratio the reduced form estimates yield that a one percent increase in rainfall reduced remittances by about 0.9 percent.

Table 5 shows that importantly the estimates reported in Table 4 do not change significantly when we exclude extreme rainfall observations that fall in the bottom/top 5 percentile of the within-country rainfall distribution (i.e. droughts or floods).[8] Thus, Table 5 provides reassuring evidence that the estimates in Table 4 are driven predominantly by smooth within-country variations in rainfall and not by extreme weather events that could lead to an atypically large influx of remittances.

Previous studies of the effects of rainfall in Sub-Saharan African countries have documented a significant effect of rainfall on political institutions and civil war (e.g Miguel et al. 2006; Bruckner and Ciccone, 2011). To document that the effects of rainfall on remittances are robust to controlling for these within-country variations in political institutions and civil war, Table 6 reports estimates that include the Polity2 score and a civil war incidence indicator variable on the right-hand side of the estimating equation.[9] The main result is that the effects of rainfall and the interaction between rainfall and financial development continues to be significant while these additional control variables turn out to be insignificant.

A further issue is whether the interaction estimates between rainfall and financial development are robust to controlling for an interaction between rainfall and cross-country differences in GDP per capita and the share of agricultural value added. GDP per capita and the agricultural value added share are positively correlated with financial development in the cross-section of countries. Hence, reporting results where interactions between rainfall and GDP per capita and agricultural value added are included as additional regressors is an important robustness check on our results. Table 7 shows that our main finding of a significant negative interaction effect between rainfall and financial development survives the control for these additional interactions. The estimates show that at low levels of financial development improved rainfall conditions have a positive effect on remittances while at high

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8 We have also repeated this exercise for excluding the top/bottom 1 percentile and the 10 percentile of the within-country rainfall distribution. This yielded similar results to those reported in Table 5. These results are not reported here for space purposes but are available from the authors upon request.

9 We obtain the Polity2 variable from the Polity IV database and the civil war incidence indicator variable from the PRIO/UPSALLA database.

levels of financial development the relationship between rainfall and remittances is significantly negative. Moreover, the interactions between rainfall and GDP per capita and rainfall and the agricultural value added share turn out to be insignificant in these regressions.

Table 8 documents that rainfall has a highly significant positive impact effect on incomes per capita in our sample. Column (1) shows this controlling for country fixed effects and including on the right-hand side of the estimating equation the log-level of rainfall in year *t*. The result is a significant positive coefficient on rainfall that is significant at the 1 percent level. Columns (2)-(3) show that in this country fixed effects regression rainfall at *t*-1 has also a significant positive effect on incomes per capita but that the effect of *t*-2 rainfall is quantitatively small and statistically insignificant. Column (4) in turn shows that if we also control for year fixed effects (which are significant at the 1 percent level) that the effect of *t*-1 rainfall turns insignificant while the impact effect of rainfall on incomes per capita remains positive and highly statistically significant. Thus, we conclude that rainfall has a positive and highly significant transitory effect on average incomes in Sub-Saharan African countries.

Under the exclusion restriction that rainfall only affects remittances through its effect on incomes, we can estimate the effects of transitory changes in incomes per capita on remittances. We believe that this is a reasonable and much weaker exclusion restriction than studying the effects that rainfall driven changes in incomes per capita have on civil war or political institutions.[10] For example, while rainfall could have an effect on civil war because of its effect on road flooding (and hence troop mobility) it is unclear why this should affect the inflow of remittances to Sub-Saharan Africa countries since there is no significant correlation between remittances and civil war in our sample.

With the above issues in mind, we report in Table 9 two-stage least squares estimates that use rainfall as an instrumental variable for within-country changes in incomes per capita. The main result is that these two-stage least squares estimates broadly confirm the reduced-form estimates reported in the previous tables: transitory income shocks significantly affect remittances and the marginal effect varies as a function of cross-country differences in financial development. For example, the estimates reported in column (4) of Table 9, where the control variables are both country and year fixed effects as well as lagged remittances,

10 See here Miguel et al. (2004), Bruckner and Ciccone (2011), and Ciccone (2011).

imply that at a zero credit to GDP ratio a one percent transitory increase in income per capita significantly increased remittances by almost 7 percent. On the other hand, at sample maximum credit to GDP ratios a one percent transitory increase in income per capita significantly reduced remittances by over 29 percent. These two-stage least squares estimates reflect the effect that a transitory rainfall driven change in income per capita has on remittances; and, because rainfall primarily affects incomes through its effect on agricultural productivity these two-stage least squares estimates reflect the effect of a transitory, productivity-driven income shock. We note that the quality of the instruments (rainfall and rainfall interacted with the credit to GDP ratio) is also reasonable since with the exception of column (3) we can always reject at the 5 percent significance level that, according to Stock and Yogo (2005), the maximal IV size distortion of our two-stage least squares estimates is larger than 20 percent.

IV. SUMMARY

We examined in this paper the effects that exogenous, transitory income shocks, which are due to year-to-year variation in rainfall have on remittances in a panel of 42 Sub-Saharan African countries during the period 1960-2007. Our main finding was that these income shocks have a significant positive effect on remittances, but that the effect is significantly decreasing in the share of domestic credit to GDP. So much so, that at high levels of credit to GDP transitory rainfall-driven increases in income had a significant negative effect on remittances to Sub-Saharan African countries.

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Table 1. Descriptive Statistics

	Mean	Std. Dev.	Min	Max
Share of Remittances in GDP	0.04	0.13	0.01	0.63
Share of Agricultural VA in GDP	0.31	0.13	0.05	0.55
Share of Domestic Credit in GDP	0.19	0.16	0.04	0.92
GDP p.c.	2257	1912	558	8473

Table 2. Time-Series Properties

	AR(1) Coefficient	P-Value Fisher Panel Unit Root Test
Ln(Rainfall)	0.18	0.000
Ln(Remittances)	0.75	0.000
Ln(GDP p.c.)	0.95	0.192
ΔLn(GDP p.c.)	0.09	0.000

Table 3. Rainfall and Remittances

	ln(Remittances)			
	(1)	(2)	(3)	(4)
	LS	LS	LS	GMM
ln(Rain)	0.09	0.05	-0.04	0.04
	(0.44)	(0.24)	(-0.27)	(0.34)
ln(Rain), t-1	0.17	0.35*	0.24**	0.22**
	(1.04)	(1.78)	(2.20)	(2.18)
ln(Rain), t-2	0.24	0.32	0.06	0.04
	(1.33)	(1.12)	(0.39)	(0.29)
ln(Remittances), t-1			0.62***	0.56***
			(9.40)	(5.88)
ln(Remittances), t-2			0.15**	0.07
			(2.90)	(0.81)
Country FE	Yes	Ye	Yes	Yes
Year FE	No	Yes	Yes	Yes
Observations	926	926	827	827
Countries	42	42	42	42

Note: The dependent variable is the log of real remittances per capita. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 4. Rainfall, Financial Development, and Remittances

	ln(Remittances)					
	Credit to GDP Ratio			Credit to GDP Ratio Quartiles		
	(1)	(2)	(3)	(4)	(5)	(6)
	LS	LS	GMM	LS	LS	GMM
ln(Rain), t	0.39*	0.20	0.22	1.11***	0.80*	1.08**
	(1.69)	(1.00)	(1.22)	(2.69)	(1.95)	(2.16)
ln(Rain), t-1	0.45*	0.07	0.06	0.69	-0.30	-0.21
	(1.90)	(0.44)	(0.31)	(1.44)	(-0.75)	(-0.42)
ln(Rain), t-2	0.29	-0.01	-0.02	0.73	0.09	-0.06
	(0.84)	(-0.01)	(-0.08)	(0.93)	(0.17)	(-0.11)
ln(Rain), t*Financial Development	-1.38***	-0.96**	-0.93**	-0.37**	-0.28**	-0.37**
	(-2.68)	(-2.16)	(-1.96)	(-2.19)	(-2.06)	(-2.19)
ln(Rain), t-1*Financial Development	-0.52	0.52	0.51	-0.13	0.17	0.13
	(-1.21)	(1.20)	(1.03)	(-0.75)	(1.27)	(0.81)
ln(Rain), t-2*Financial Development	0.08	0.33	0.37	-0.17	-0.01	0.03
	(0.12)	(0.82)	(0.92)	(-0.58)	(-0.08)	(0.17)
ln(Remittances), t-1		0.63***	0.54***		0.63***	0.54***
		(9.27)	(5.71)		(9.12)	(5.60)
ln(Remittances), t-2		0.15**	0.05		0.15***	0.05
		(2.79)	(0.69)		(2.76)	(0.69)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	926	824	824	926	824	824
Countries	42	42	42	42	42	42

Note: The dependent variable is the log of real remittances per capita. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 5. Rainfall, Financial Development, and Remittances
(Robustness to Excluding Extreme Rainfall Observations)

	ln(Remittances)					
	Credit to GDP Ratio			Credit to GDP Ratio Quartiles		
	(1)	(2)	(3)	(4)	(5)	(6)
	LS	LS	GMM	LS	LS	GMM
ln(Rain), t	0.69	0.53	0.61*	2.35***	1.81**	1.37*
	(1.40)	(1.14)	(1.91)	(2.99)	(2.00)	(1.90)
ln(Rain), t*Financial Development	-2.56**	-2.11**	-1.78**	-0.81**	-0.63**	-0.42*
	(-2.29)	(-2.27)	(-2.19)	(-2.37)	(-2.47)	(-1.90)
ln(Remittances), t-1		0.58***	0.55***		0.57***	0.55***
		(8.13)	(6.25)		(8.01)	(6.23)
ln(Remittances), t-2		0.18***	0.09		0.19***	0.09
		(3.77)	(1.56)		(4.05)	(1.52)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	819	727	727	819	727	727
Countries	42	42	42	42	42	42

Note: The dependent variable is the log of real remittances per capita. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 6. Rainfall, Financial Development, and Remittances
(Robustness to Controlling for Within-Country Changes in Civil War and Democracy)

	ln(Remittances)					
	Credit to GDP Ratio			Credit to GDP Ratio Quartiles		
	(1)	(2)	(3)	(4)	(5)	(6)
	LS	LS	LS	LS	LS	LS
ln(Rain), t	0.55*	0.31	0.34	1.51***	1.10*	1.20*
	(1.80)	(0.94)	(1.00)	(3.09)	(1.83)	(1.89)
ln(Rain), t*Financial Development	-1.67**	-1.38**	-1.49**	-0.48**	-0.38*	-0.42*
	(-2.11)	(-2.17)	(-2.08)	(-2.60)	(-1.84)	(-1.93)
Civil War, t	-0.37		-0.38	-0.39		-0.39
	(0.82)		(-0.83)	(-0.86)		(-0.86)
Democracy, t		0.002	0.002		0.002	0.002
		(0.99)	(0.96)		(0.90)	(0.86)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	926	837	837	926	837	837
Countries	42	42	42	42	42	42

Note: The dependent variable is the log of real remittances per capita. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 7. Rainfall, Financial Development, and Remittances
(Robustness to Interactions with Agricultural GDP Share and GDP Per Capita)

	ln(Remittances)					
	Credit to GDP Ratio			Credit to GDP Ratio Quartiles		
	(1)	(2)	(3)	(4)	(5)	(6)
	LS	LS	LS	LS	LS	LS
ln(Rain), t	1.38**	0.66**	0.93	2.43***	1.67***	2.09**
	(2.10)	(2.24)	(0.90)	(3.07)	(3.30)	(2.05)
ln(Rain), t*Financial Development	-2.44**	-2.62**	-2.66**	-0.56***	-0.56*	-0.58***
	(-2.32)	(-2.22)	(-2.27)	(-2.91)	(-2.76)	(-2.87)
ln(Rain), t*Share of Agricultural Value Added	-2.38		-0.84	-2.42*		-1.25
	(-1.58)		(-0.29)	(-1.85)		(-0.45)
ln(Rain), t*GDP Per capita		0.525	0.39		0.48	0.28
		(1.31)	(0.54)		(1.43)	(0.41)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	926	926	926	926	926	926
Countries	42	42	42	42	42	42

Note: The dependent variable is the log of real remittances per capita. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 8. Rainfall and Income

	Δln(GDP p.c.)			
	(1)	(2)	(3)	(4)
	LS	LS	LS	LS
ln(Rain), t	0.055***	0.051***	0.050***	0.034***
	(5.79)	(5.15)	(5.07)	(3.00)
ln(Rain), t-1		0.024**	0.024**	0.017
		(2.33)	(2.37)	(1.61)
ln(Rain), t-2			0.0006	0.007
			(0.05)	(0.52)
Country FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	Yes
Observations	926	926	926	926
Countries	42	42	42	42

Note: The dependent variable is the change in the urbanization rate. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.

Table 9. Transitory Income Shocks, Financial Development, and Remittances

	ln(Remittances)							
	Credit to GDP Ratio				Credit to GDP Ratio Quartiles			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Δln(GDP p.c.), t	36.26***	11.97***	17.29*	6.97**	23.55**	11.23**	23.07**	9.66*
	(3.49)	(2.90)	(1.87)	(2.25)	(2.06)	(1.97)	(2.28)	(1.72)
Δln(GDP p.c.), t* Financial Development	-209.36***	-60.95***	-92.08	-39.80*	-7.94*	-3.51*	-8.25	-3.67*
	(-3.18)	(-3.17)	(-0.91)	(-1.65)	(-1.74)	(-1.83)	(-1.48)	(-1.71)
ln(Remittances), t-1		0.77***		0.75***		0.77***		0.75***
		(19.32)		(19.40)		(19.89)		(19.18)
First-Stage F-Statistic	5.00	5.95	1.31	4.30	12.28	12.27	4.59	6.23
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	No	No	Yes	Yes
Observations	926	873	926	873	926	873	926	873
Countries	42	42	42	42	42	42	42	42

Note: The dependent variable is the log of real remittances per capita. T-values in parentheses are based on Huber robust standard errors that are clustered at the country level. The method of estimation is two-stage least squares. The instrumental variable is the log of rainfall. *Significantly different from zero at the 10 percent significance level, ** 5 percent significance level, *** 1 percent significance level.