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Macroeconomic effects of foreign aid and remittances: Implications for aid effectiveness studies

by

Kurt Annen
Department of Economics & Finance, University of Guelph
kannen@uoguelph.ca

Michael Batu
Department of Economics, University of Windsor
michael.batu@uwindsor.ca

Stephen Kosempel
Department of Economics and Finance, University of Guelph
kosempel@uoguelph.ca

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Macroeconomic effects of foreign aid and remittances: Implications for aid effectiveness studies

Kurt Annen [a], Michael Batu [b*], Stephen Kosempel [a]

[a] *Department of Economics & Finance, University of Guelph, Guelph, ON N1G 2W1, Canada*
[b] *Department of Economics, University of Windsor, Windsor, ON N9B 3P4, Canada*

Abstract

In this paper we quantify the impact of wealth transfers such as remittances and foreign aid using a DSGE-RBC model. We calibrate and simulate the model using data from 85 recipient countries. We show that positive wealth transfer shocks have a lagged positive response on output provided that persistence is sufficiently low, but these effects are small in comparison to other aggregate shocks. In fact, our calibration and simulation results suggest that wealth transfer shocks would need to be around nine times as large in order to produce the GDP volatility created by productivity shocks. The policy implications of our work primarily consist in providing guidance for research that tries to empirically estimate the aid-growth relationship.

Keywords: Foreign aid, remittances, volatility, growth

JEL: F24, F35, F44

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1. Introduction

It is well known that aid and remittance receiving economies are substantially more volatile than their richer counterparts. It is also well known that wealth transfers, such as aid and remittances, are an important source of income for many countries, and that those wealth transfers are highly volatile (Buffie et al., 2010; Bulir and Hamann, 2008; Hudson and Mosley, 2008; Pallage and Robe, 2001). Aid volatility in our sample is more than nine times the volatility of GDP, and aid amounts to about 5% of GDP on average. The same is true for

∗Corresponding author. Tel.: +1-519-253-3000 Ext. 2380
Email addresses: kannen@uoguelph.ca (Kurt Annen), michael.batu@uwindsor.ca (Michael Batu), kosempel@uoguelph.ca (Stephen Kosempel)

remittances. Yet, we can show that volatility in wealth transfers can explain only a very small part of the GDP volatility observed in these countries. Productivity shocks easily dominate wealth transfer shocks. In fact, our calibration and simulation results suggest that wealth transfer shocks would need to be around nine times as large in order to produce the GDP volatility created by productivity shocks.

We use a Dynamic Stochastic General Equilibrium (DGSE) model – specifically the Real Business Cycle (RBC) model – to quantify and study the impact of wealth transfers on GDP per capita growth for economies that face productivity shocks and wealth transfer shocks. The RBC model is useful because it predicts how agents will respond to exogenous aggregate shocks, which is what foreign aid and other wealth transfers such as remittances can be classified as. Furthermore, RBC theory is very good at explaining how consumption and savings decisions are made, and this is particularly useful because in order for wealth transfers to have a positive effect on GDP they must be invested. Finally, using a calibration and simulation approach we can isolate the effects of wealth transfer shocks from other aggregate shocks, and this is difficult to do using regression techniques.

We believe that our analysis has important implications for aid-effectiveness studies. The dominance of productivity shocks over wealth transfer shocks may explain the difficulty in establishing robust findings regarding the aid-growth relationship.[1] Our analysis suggests that if we observe a positive relationship between wealth transfers and growth, we will more likely observe one in the short- rather than in the long-run, and we will more likely observe an effect when using lagged rather than current wealth transfers. This insight is consistent with the finding in Rajan and Subramanian (2008), who conclude that there is no relationship between aid and growth focusing on long-run cross-sectional analysis, and the conclusion in Clemens et al. (2012), stating that aid causes some degree of growth in recipient countries

[1] This difficulty has been observed many times (see Rajan and Subramanian (2008) and Clemens et al. (2012) for aid; and Barajas et al. (2009) for remittances).

when using short-run panel regressions and when using lagged aid instead of contemporary aid.

We want to emphasize that these insights are crucial in defining better and more effective research strategies for empirical work studying the relationship between aid and growth. This paper, in our view, contributes to a better understanding of why it may be difficult to detect a positive causal relationship between aid and growth. Thus, the policy implications of our work primarily consist in providing guidance for research that tries to empirically estimate the aid-growth relationship. First, we show that the specification of period length, i.e. short-term panel vs. long-term cross-section structure, matters. We are more likely to see an effect in the short-run than in the long-run suggesting that short-run panel regressions with appropriate controls for productivity shocks would be the optimal research framework. In a recent empirical paper, Feeny and Fry (2014) show by using a one-year panel framework that the impact of aid on growth is indeed short lived. This finding goes a long with our finding, and we believe that this insight matters for empirical aid effectiveness studies. Note that short run growth effects are desirable. These growth effects are simply the result of consumers optimally smoothing their consumption over time in response to a temporary influx of wealth. We have to keep in mind that ultimately, wealth transfers increase welfare levels, no matter whether these transfers are temporary or not. Second, we show that one should use lagged wealth transfers instead of current ones as in our model output drops initially but then rebounds within a few years provided that the permanency of the transfers is sufficiently low.

In that we study the impact of wealth transfers using calibration and simulation techniques our paper is related to the work of Arellano et al. (2009); Acosta et al. (2009); Agenor et al. (2008); Moreira and Bayraktar (2008); Chatterjee and Turnovsky (2007, 2005); Acosta (2006); and Chatterjee et al. (2003). The current paper distinguishes itself from the other papers in several respects. First, labor supply in Arellano et al. (2009) is inelastic, whereas here agents alter their labor-leisure choice optimally in response to incoming wealth transfer flows. With endogenous labor supply, a positive wealth transfer shock generates an income effect that initially lowers both employment and output.[2] This part of the model explains why using lagged instead of contemporary wealth transfers may make a difference in aid-growth regressions. Second, in Arellano et al. (2009), Chatterjee and Turnovsky (2005), and Chatterjee et al. (2003) the persistence of wealth transfers is set somewhat arbitrarily. In contrast, we estimate the persistence parameter using data for wealth transfer recipients and include a sensitivity analysis. We show that the persistence of the wealth transfer shock has effects on the dynamic response of output in the short and medium run. Third, studies like Acosta et al. (2009), Agenor et al. (2008), Moreira and Bayraktar (2008), and Acosta (2006) calibrate their models for a single wealth transfer recipient country, whereas in the current paper we calibrate the model using data from 85 wealth transfer recipient countries and we show how sensitive the results are for sample outliers.[3] Fourth, the papers of Agenor et al. (2008), Moreira and Bayraktar (2008), and Chatterjee and Turnovsky (2007) consider only permanent changes in the flow of aid, whereas in this paper we show that distinguishing between permanent and temporary changes in wealth transfers is important. Finally, a common feature in Chatterjee et al. (2003) and Chatterjee and Turnovsky (2007) is that their main focus is on transfers that are tied to public infrastructure projects, whereas the current paper focuses exclusively on untied transfers.

Our analysis focusses on wealth transfers that are assumed to affect the resource constraint in recipient economies. In fact, in our model we assume that transfers go to households. This would be certainly true for remittances, but in the case of foreign aid, households would benefit indirectly only then when aid leads to lower taxes or the provision of public goods.[4] If invested, wealth transfers could affect output. Our simulation results show that higher transfers of wealth lead to higher consumption, but these consumption levels are not sustainable and cannot be maintained when donor funding is withdrawn. Note

[2] For empirical evidence linking labor supply decisions to income transfers see Lucas (2005) or Acosta (2006).

[3] Acosta et al. (2009) and Acosta (2006) have calibrated their models to El Salvador, whereas Agenor et al. (2008) and Moreira and Bayraktar (2008) calibrated their models to Ethiopia, and Niger, respectively. Notable is that the average share of wealth transfers to GDP for El Salvador is 16% (1960-2010) which is in the high range in our sample of wealth transfer recipient countries.

[4] For an analysis of government decisions regarding aid allocations see Schwalbenberg (1998).

that this finding applies only to untied transfers of wealth. There are other forms of international assistance, that we have not studied in this paper, that may affect recipient economies through channels other than the resource constraint. For example, Annen and Kosempel (2009) show that technical assistance affects technology rather than the resource constraint of recipient economies.

The rest of this paper is organized as follows: The model is outlined in section 2, and calibrated in section 3. The simulation results are presented in section 4 and a policy discussion in section 5 follows. Concluding remarks are in section 6.

2. The Model

The RBC framework developed by Kydland and Prescott (1982) provides a laboratory for investigating the economic effects of aggregate shocks, such as fluctuations in total factor productivity and wealth transfer levels. RBC theory assumes that there are two general types of tradeoffs that utility maximizing individuals face: (i) individuals decide how to allocate their income between consumption and savings, and (ii) individuals decide how to allocate their time between labor and leisure. In the baseline RBC model there is a single aggregate shock, a productivity shock, which affects individual decisions because it alters relative prices (wages and interest rates) and the profile of income across time. In this paper, we augment the baseline model by incorporating a second disturbance that takes the form of an untied transfer of wealth. Unlike productivity shocks, wealth shocks do not directly affect relative prices. However, wealth shocks do generate income effects, and therefore they will affect the savings and time allocation decisions in the model.

The artificial economy outlined below is the standard representation of the DSGE-RBC model, except for one thing: it has been modified to incorporate stochastic wealth transfer shocks.[5] The notation throughout the paper is to use upper case letters to denote per capita variables, lower case letters to denote variables that have been made stationary by

[5] For a detailed description of the standard RBC model and methodology see Prescott (1986), Cooley and Prescott (1995), or King and Rebelo (1999).

removing their deterministic trends, and a star superscript ($\star$) denotes a steady state value. Time is discrete and indexed by $t = 0, \dots \infty$.

The economy is populated by a large number of identical infinitely lived agents. The representative agent seeks to maximize his/her expected lifetime utility by choosing optimal sequences for consumption $\{C_t\}_{t=0}^{\infty}$, hours worked $\{L_t\}_{t=0}^{\infty}$, and the capital stock $\{K_t\}_{t=0}^{\infty}$, subject to a resource constraint, the law of motion for capital, the production technology, the stochastic processes, and initial endowments:

$$\max_{C_t, L_t K_{t+1}} E_0 \left\{ \sum_{t=0}^{\infty} \beta^t \frac{\left[C_t^{\omega}(1-L_t)^{1-\omega}\right]^{1-\gamma}}{1-\gamma} \right\}, \text{ subject to}$$

$$C_t + I_t = z_t K_t^{\alpha}(e^{gt} L_t)^{1-\alpha} + w_t e^{gt},$$

$$K_{t+1} = I_t + (1-\delta) K_t,$$

$$\ln z_t = (1-\rho_z) \ln z^{\star} + \rho_z \ln z_{t-1} + \varepsilon_{z,t}, \quad \varepsilon_z \sim N(0, \sigma_z^2),$$

$$\ln w_t = (1-\rho_w) \ln w^{\star} + \rho_w \ln w_{t-1} + \varepsilon_{w,t}, \quad \varepsilon_w \sim N(0, \sigma_w^2),$$

with k_0, w_0, and z_0 given. The notation used above is common to the macroeconomics literature, with the exception of the wealth transfer. Both the productivity variable and the wealth transfer variable are modeled as having a common structure: they have stationary components (z_t ,w_t) that are governed by AR(1) processes, and trend components ($e^{(1-\alpha)gt}, e^{gt}$) that are deterministic.[6] No analytical solution exists to the Representative Agent's dynamic optimization problem, and therefore the model will be simulated numerically following standard methodology.[7]

[6] The assumptions made regarding the specification of technology and preferences are consistent with balanced growth.

[7] The solution method we follow is described in detail by King et al. (1988).

3. Data and Calibration

3.1. Calibration

Before simulating the model, values must be assigned to its parameters:

Preferences: β, γ, ω,

Technology: δ, α, g, $z^{\star}$, ρ_z, σ_z, and

Wealth Transfer: $w^{\star}$, ρ_w, σ_w.

The calibration follows the standard procedure of setting values using evidence from the relevant literature, to achieve certain average annual values observed in the data, and to satisfy the restrictions imposed by the structure of the model.

The following values were selected on the basis of a priori information: Following Kocherlakota (1996), the coefficient of relative risk aversion γ is set equal to 3. Following Prescott (1986), capital's share of income α is set to 0.36; and the depreciation rate δ is set to 10% per annum.

The next group of parameters will have their values set so that the model's properties match certain averages. For example, the share parameter in the utility function ω is set to 0.3807; so that in the model the average time spent working $L^{\star}$ is 1/3. In the RBC literature estimates for average hours worked varies from 1/5 to 1/3, and we choose the value at the high end of this range because hours work tend to be higher in developing countries (see Lee et al., 2007). The discount factor β is set to 0.9733, and implies an average annual real interest rate of 6.5%. The average rate of productivity growth g is set to 0.0204, which coincides with the average annual growth rate of GDP per capita of 2.04% in our sample of countries.

The remaining parameter values relate to the stochastic processes. In the wealth transfer process a sensitivity analysis will be performed on all parameters ($w^{\star}$, ρ_w, σ_w), but in the baseline calibration values are set to match sample averages. Conveniently, the time series averages for both foreign aid and remittances have similar properties, and therefore the simulation results to follow can be interpreted as representing either type of wealth transfer. For example, the average remittance-GDP ratio is 4%, whereas the corresponding value for aid is 5%. For the baseline calibration we set $w^\star$ to 0.0258, to produce a wealth transfer to GDP ratio of 5%. The autocorrelation coefficient in the stochastic process for the wealth transfer is set to 0.60, and this value will produce approximately the right amount of persistence, regardless of whether the transfer is intended to represent remittances or aid or both combined.[8] Finally, the data reveals that remittances and foreign aid are equally volatile. We therefore set σ_w to 0.4006, so that wealth transfers in the model have the same volatility as observed in the data.

The steady state value of the productivity shock $z^\star$ only affects the scale of the economy and can therefore be normalized to 1. The value of the autocorrelation coefficient in the technology process ρ_z is set to 0.81, which is the annual equivalent to 0.95, used for quarterly series by Prescott (1986). Finally, the standard deviation of the innovations in the stochastic process for technology (σ_z) is set to 0.0369 so that output volatility in the model matches the average from our sample of countries.

3.2. Data and sources

In this paper we focus our calibration exercise to wealth transfers in the form of remittances and foreign aid. Our definition of foreign aid follows Annen and Kosempel (2009). In particular, aid is defined as grants plus ODA loans minus debt forgiveness, technical assistance, food aid, humanitarian aid and rescheduled debt. We obtain the aid measures from the aggregate aid statistics provided by the OECD. We follow the World Bank definition of remittances, which contains two main items: personal transfers and net compensation of employees. Personal transfers include all current transfers in cash or in kind between resident and non-resident individuals. Net compensation of employees refers specifically to the labor 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 non-

[8] For aid recipients, our regression results for ρ_w has a sample mean value of 0.55, a minimum value of 0.03 and a maximum value of 0.88. For remittance recipients, ρ_w has a sample mean of 0.64, minimum value of -.10 and maximum value of 0.88.

Table 1

Permanent Changes in the Wealth Transfer-GDP Ratio

	Wealth Transfer to GDP Ratio				
Steady State Values	0%	1%	5%	10%	20%
Consumption/GDP	0.7369	0.7469	0.7869	0.8369	0.9369
Investment/GDP	0.2631	0.2631	0.2631	0.2631	0.2631
GDP	0.5399	0.5351	0.5170	0.4960	0.4586
Hours Worked	0.3481	0.3450	0.3333	0.3198	0.2957
Disposable Income	0.5399	0.5404	0.5428	0.5456	0.5503

resident entities. Data for worker remittances was obtained from the World Development Indicators database. Time series data for other macroeconomic aggregates such as real GDP per capita, consumption and investment series were sourced from the Penn World Tables.

4. Simulation Results

4.1. Long-term effect from permanent changes in transfer flows

Table 1 reports the effects of permanent changes in the wealth transfer-GDP ratio. When wealth transfers increase, the investment rate remains the same, and the propensity to consume rises by one percentage point for each percentage point increase in the transfer-GDP ratio, which implies that permanent increases in wealth transfers are consumed rather than invested. An increase in wealth transfers produces a positive income effect, and since leisure is a normal good, hours worked fall and this causes a reduction in output. In the model, each one percentage point increase in the long run wealth transfer ratio reduces GDP per capita by approximately 1%. As a result, the net impact of permanent wealth transfers on disposable income is approximately zero.

Table 2

Business Cycle Statistics of Wealth Transfer Recipients

	Standard Deviation	Correlation of GDP with	
Variable x	(%)	$x(t-1)$	x
GDP	3.01	0.11	1.00
Consumption	4.23	0.13	0.56
Investment	12.48	0.07	0.48
Transfers:			
Remittance	27.64	0.09	0.07
Foreign aid	28.28	0.01	0.03
Ratios:		Average	
Remittance/GDP		0.04	
Foreign aid/GDP		0.05	
(Remittance+ Foreign aid)/GDP		0.09	

Notes: Annual data were expressed in logs and detrended using HP filter. The smoothing parameter was set to λ= 6.25 as suggested by Ravn and Uhlig (2002).

4.2. Short term effects from temporary changes in transfer flows

Table 2 reports the standard deviations and cross serial correlations of output and other aggregate time series data for wealth transfer recipients. Investment and wealth transfers are highly volatile. Consumption is slightly more volatile than output, which suggests difficulty in consumption smoothing, a feature typically observed in many developing countries (Rand and Tarp, 2002). Consumption and investment are procyclical. Foreign aid and remittances are acyclical on average.[9] In fact, the acyclicality of the wealth transfer is consistent with the majority of countries in our sample (66%).

[9] Following Pallage and Robe (2001), correlation is judged to be non-different from zero if it lies in the interval (-0.29,0.29).

Table 3

Model Economy Business Cycle Statistics

Variables	Standard Deviation	Correlation of GDP with
Productivity and wealth transfer shocks		
GDP	3.01	1.00
Consumption	1.40	0.93
Investment	8.02	0.86
Hours Worked	1.17	0.96
Wealth Transfer	28.00	-0.10
Wealth Transfer (lag one period)	n.a.	0.02
Wealth Transfer (lag two periods)	n.a.	0.04
Productivity shock only		
GDP	2.99	1.00
Consumption	1.37	0.99
Investment	7.36	0.99
Hours Worked	1.10	0.99
Wealth transfer shock only		
GDP	0.34	1.00
Consumption	0.32	-0.73
Investment	3.23	-0.95
Hours Worked	0.41	0.93
Wealth Transfer	28.00	-0.95
Wealth Transfer (lag one period)	n.a.	0.25
Wealth Transfer (lag two periods)	n.a.	0.42

Notes: In the model economy 1 period correspond to 1 year. Each simulated series was logged and detrended using the same procedure applied to the data.

Table 3 reports annual business cycle statistics for the artificial economy. Statistics generated by the model with both shocks present are consistent with the main business cycle stylized facts from Table 2: investment and consumption are procyclical, investment is much more volatile than output and consumption, and wealth transfers are acyclical.

Business cycle statistics have also been generated while removing from the model one source of volatility. Notice that the macroeconomic effects of a productivity shock easily dominate those of a wealth transfer shock. In fact, switching off the productivity shock while keeping the wealth transfer shock reveals how small the impact of wealth transfers is to output volatility. With only the wealth transfer shock present, there remains some amount of investment volatility but output and consumption volatility are quite low. In fact, in order to produce the benchmark output volatility of 3.01 in the absence of productivity shocks, the wealth transfer volatility (σ_w) would need to be set to 3.56 which is 8.9 times the benchmark level. The explanation for the predictions relating to wealth transfer shocks in Table 3 follows standard macroeconomic intuition based on the permanent income hypothesis: The income effect created by a positive wealth shock causes hours to fall leading to an initial drop in output. As a result, wealth transfers are strongly counter cyclical when productivity shocks are absent. However, to maintain a smooth consumption profile, investment must rise. The rise in investment has a positive effect on output, but this happens with lags.

4.3. Sensitivity Analysis

Table 4 reports the results of the sensitivity analysis on the parameters $w^\star$, ρ_w and σ_w. Values of $w^\star$ were reset to 0.0517 and 0.1034 such that the transfer to GDP ratio in the model is 10% and 20%, respectively. We find that doubling the transfer to GDP ratio from 5% to 10%, or even quadrupling it to 20%, produces very little effect on output volatility. Similarly, changing ρ_w or σ_w has some effect on investment volatility, but the effect on output is mild. Overall, results from these numerical experiments confirm our earlier finding that wealth transfer shocks are dominated by productivity shocks and this will be true even for countries that have parameter values that differ from the norm.

Table 4

Model Economy Sensitivity Analysis (Standard Deviation, %)

	GDP	Consumption	Investment	Wealth Transfer
Wealth Transfer/GDP:				
5%	3.01	1.40	8.02	28.00
10%	3.10	1.46	9.76	28.00
20%	3.39	1.71	14.97	28.00
Persistence (ρ_w):				
0.30	2.99	1.38	8.28	28.00
0.60	3.01	1.40	8.02	28.00
0.90	3.05	1.56	7.47	28.00
Volatility (σ_w):				
0.40	3.01	1.40	8.02	28.00
0.80	3.08	1.52	9.83	56.00

Notes: In the model economy 1 period correspond to 1 year. Each simulated series was logged and detrended using the same procedure applied to the data.

Figure 1 displays the impulse responses of GDP to a +1-percent wealth transfer shock for different values of ρ_w and $w^\star/gdp^\star$. Setting ρ_w and $w^\star/gdp^\star$ to 0.90 and 0.20, respectively, represents the upper limit of our econometric estimates, but similar values have been used previously in the literature.[10] As persistence or wealth transfer to output ratio rises, the income effect of the shock is amplified, and this has the effect of lowering hours worked and output initially. In addition, as persistence rises, the intertemporal consumption smoothing effect is reduced, making investment and future output less responsive. Our results confirm the findings in Table 4 that for the average country (ρ = 0.6 and $w^\star/gdp^\star$

[10] Arellano et al. (2009) use 0.9 to match the persistence of their technology shock. Acosta (2006) calibrated their model at remittance to GDP ratio of 16% to match the data for El Salvador.

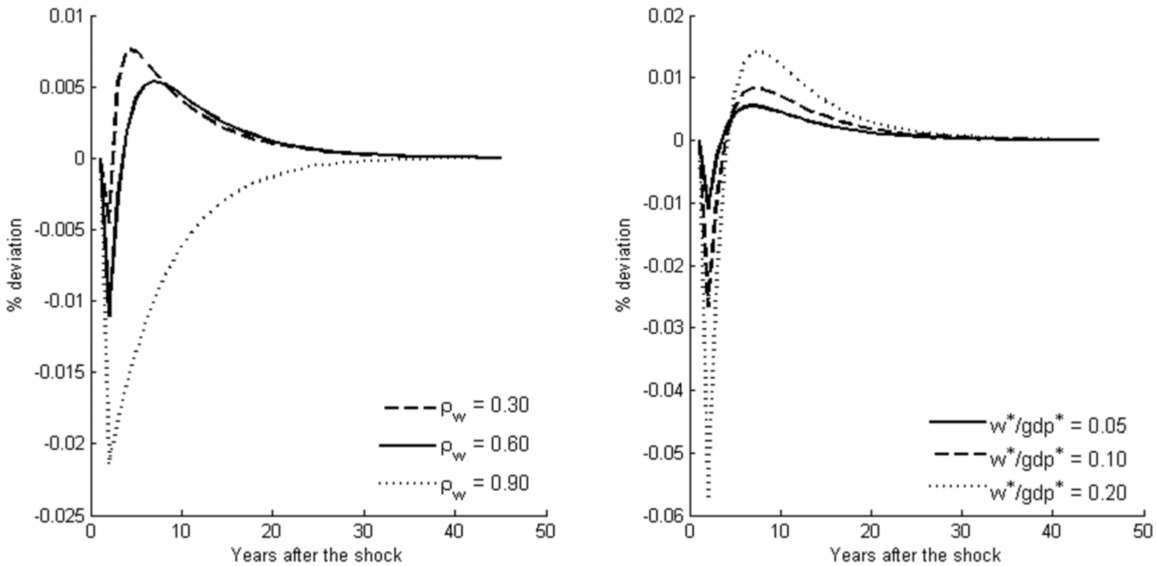

Figure 1: Impulse response of GDP to a +1-percent wealth transfer shock

= 0.05), wealth transfer shocks will lower current output but raise it in the future.

5. Policy Discussion

We believe that our analysis has important implications for aid-effectiveness studies and the policy discussion that is informed by these studies. As pointed out earlier, we believe that the policy implications of our research primarily consist in providing guidance for research that tries to empirically estimate the aid-growth relationship. The fact that empirical studies have not found a robust finding related to the aid-growth relationship may have reasons that need better understanding. Our research contributes to this understanding. We have shown that the dominance of productivity shocks over wealth transfer shocks may explain the difficulty in establishing robust findings regarding the aid-growth relationship. But this does not mean that there is no causal relationship between aid and growth. For example, Rajan and Subramanian (2008) show that there is no relationship – positive nor negative – between aid and growth mainly focusing their analysis on long-run cross-country regressions. They then conclude: “Our findings suggest that for aid to be effective in the future, the aid apparatus will have to be rethought." In contrast, Clemens et al. (2012) find that aid causes some degree of growth focusing their analysis on short-run panel regressions when using lagged instead of contemporary aid. These two divergent view points on aid effectiveness are consistent with our analysis, which suggests that if we observe a positive relationship between aid and growth, we will more likely observe such an effect in the short- rather than in the long-run, and we will more likely observe an effect when using lagged rather than current aid. Rajan and Subramanian (2008) point out correctly that the practice of estimating aid-growth regressions in a panel framework over four-year periods, as done in many papers in this literature, makes these regressions prone to be affected by cyclical factors. Our calibration results clearly confirms that productivity shocks easily dominate wealth transfer shocks, which may make the detection of short-run effects in growth regressions difficult. However, our analysis shows that if aid in the form of wealth transfers has any effect on growth, this effect occurs in the short- rather than in the long-run. Nonetheless, short run growth effects are desirable. These growth effects are simply the result of consumers optimally smoothing their consumption over time in response to a temporary influx of wealth. We have to keep in mind that ultimately, wealth transfers increase welfare levels, no matter whether these transfers are temporary or not.

Finally, it is important to recognize that different forms of aid may affect recipient economies differently. The study here focussed on aid (and remittances) as wealth transfers. We assumed in our model, that these transfers affect the resource constraint of an economy. However, other forms of aid may impact recipient economies in a different way. For example, in Annen and Kosempel (2009) we argue that technical assistance affects recipient economies not via the resource constraint but by changing technology. This has implications for the growth predictions of these two forms of aid. Most empirical studies use Official Development Assistance (ODA) as their aid measure. The research here suggests that that measure should be de-composed into different forms of aid as they affect recipient economies differently, which has different implications related to the aid-growth relationship.

6. Conclusion

This paper studied the impacts of wealth transfers in the form of foreign aid and remittances using data from 85 recipient countries. An RBC model with endogenous labor supply was used to quantify the dynamic response to permanent and temporary shocks to the level of wealth transfers. There were three main results: First, the income effect generated by a permanent increase in wealth transfers can lead to a reduction in output in the long run. Second, only temporary shocks in wealth transfers were found to have positive effects on investment and output. Although output responds positively to a temporary change in wealth transfers, the dynamic response happens with a lag and the magnitude of the response depends positively on the wealth transfer ratio and negatively on the persistence of the shock. Third, the effects that wealth transfer shocks have on output are small in comparison to other aggregate shocks. In fact, virtually all of the volatility in macroeconomic aggregates are explained by the productivity shock and this is true even for countries that have parameters in their wealth transfer process that differ significantly from the norm.

References

Acosta, P. (2006). Labor Supply, School Attendance, and Remittances from International Migration: The Case of El Salvador. WP-3903, The World Bank.

Acosta, P. A., E. K. Lartey, and F. S. Mandelman (2009). Remittances and the Dutch disease. *Journal of International Economics* 79 (1), 102–116.

Agenor, P.-R., N. Bayraktar, and K. El Aynaoui (2008). Roads Out of Poverty? Assessing the Links Between Aid, Public Investment, Growth, and Poverty Reduction. *Journal of Development Economics* 86 (2), 277–295.

Annen, K. and S. Kosempel (2009). Foreign Aid, Donor Fragmentation, and Economic Growth. *The B.E. Journal of Macroeconomics* 9 (1), 1–32.

Arellano, C., A. Bulir, T. Lane, and L. Lipschitz (2009). The Dynamic Implications of Foreign Aid and its Variability. *Journal of Development Economics* 88 (1), 87–102.

Barajas, A., R. Chami, C. Fullenkamp, M. Gapen, and P. Montiel (2009). Do Workers Remittances Promote Economic Growth? *IMF Working Paper* WP–09–153.

Buffie, E. F., S. A. O'Connell, and C. Adam (2010). Fiscal Inertia, Donor Credibility, and the Monetary Management of Aid Surges. *Journal of Development Economics* 93 (2), 287–298.

Bulir, A. and A. J. Hamann (2008). Volatility of Development Aid: From the Frying Pan into the Fire? *World Development* 36 (10), 2048–2066.

Chatterjee, S., G. Sakoulis, and S. J. Turnovsky (2003). Unilateral Capital Transfers, Public Investment, and Economic Growth. *European Economic Review* 47 (6), 1077–1103.

Chatterjee, S. and S. J. Turnovsky (2005). Financing Public Investment through Foreign Aid: Consequences for Economic Growth and Welfare. *Review of International Economics* 13 (1), 20–44.

Chatterjee, S. and S. J. Turnovsky (2007). Foreign Aid and Economic Growth: The Role of Flexible Labor Supply. *Journal of Development Economics* 84 (1), 507–533.

Clemens, M. A., S. Radelet, R. R. Bhavnani, and S. Bazzi (2012). Counting Chickens when they Hatch: Timing and the Effects of Aid on Growth. *The Economic Journal* 122 (561), 590–617.

Cooley, T. F. and E. C. Prescott (1995). Economic growth and business cycles. In T. F. TCooley (Ed.), *Frontiers of business cycle research*, Chapter 1, pp. 1–37. Princeton University Press.

Feeny, S. and T. R. Fry (2014). How sustainable is the macroeconomic impact of foreign aid? *Journal of Policy Modeling* 36 (6), 1066 – 1081.

Hudson, J. and P. Mosley (2008). The Macroeconomic Impact of Aid Volatility. *Economics Letters* 99 (3), 486–489.

King, R. and S. Rebelo (1999). Resuscitating real business cycles. In J. B. Taylor and M. Woodford (Eds.), *Handbook of Macroeconomics* (1 ed.), Volume 1, Part B, Chapter 14, pp. 927–1007. Elsevier.

King, R. G., C. I. Plosser, and S. T. Rebelo (1988). Production, Growth and Business Cycles : I. The Basic Neoclassical Model. *Journal of Monetary Economics* 21 (2-3), 195–232.

Kocherlakota, N. R. (1996). The Equity Premium: It's Still a Puzzle. *Journal of Economic Literature* 34 (1), 42–71.

Kydland, F. and E. Prescott (1982). Time to build and aggregate fluctuations. *Econometrica* 50 (6), 1345–70.

Lee, S., D. McCann, and J. Messenger (2007). *Working Time Around the World: Trends in Working Hours, Laws and Policies in a Global Comparative Perspective*. London, UK: Routledge.

Lucas, R. (2005). *International Migration and Development*. Cheltenham, UK: Edward Elgar.

Moreira, E. P. and N. Bayraktar (2008). Foreign Aid, Growth and Poverty: A Policy Framework for Niger. *Journal of Policy Modeling* 30, 523–539.

Pallage, S. and M. A. Robe (2001). Foreign Aid and the Business Cycle. *Review of International Economics* 9 (4), 641–72.

Prescott, E. C. (1986). Theory Ahead of Business-Cycle Measurement. *Carnegie-Rochester Conference Series on Public Policy* 25 (1), 11–44.

Rajan, R. G. and A. Subramanian (2008). Aid and Growth: What Does the Cross-Country Evidence Really Show? *The Review of Economics and Statistics* 90 (4), 643–665.

Rand, J. and F. Tarp (2002). Business Cycles in Developing Countries: Are They Different? *World Development* 30 (12), 2071–2088.

Ravn, M. O. and H. Uhlig (2002). On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations. *The Review of Economics and Statistics* 84 (2), 371–375.

Schwalbenberg, H. M. (1998). Does foreign aid cause the adoption of harmful economic policies? *Journal of Policy Modeling* 20 (5), 669 – 675.