Research Paper No. 2007/22

Remittances and the Macroeconomy

The Case of Small Island Developing States

Catalina Amuedo-Dorantes,[1] Susan Pozo,[2] and Carlos Vargas-Silva[3]

April 2007

Abstract

In this paper we examine how remittances relate to the exchange rate, natural disasters and foreign aid in developing economies. By using panel VAR methods we are able to compensate for both data limitations and endogeneity among variables. We find that while foreign aid tends to appreciate the real exchange rate, remittances do not have the same impact. We also detect an inverse relationship between the real exchange rate and remittance amounts, with real exchange rate depreciation increasing remittance inflows. Of particular interest is the observation that the small island developing states subsample of countries behave differently from the full sample of developing countries in a number of ways. Of note is the differing impact of disaster shocks on the real exchange rate and on the level of remittances across the two samples.

Keywords: remittances, natural disasters, small island developing states, migration

JEL classification: F24, O19

[1] San Diego State University, San Diego, email: camuedod@mail.sdsu.edu; [2] Department of Economics, Western Michigan University, Kalamazoo, email: susan.pozo@wmich.edu; [3] Department of Economics, University of Vermont, email: cvargass@uvm.edu

This study has been prepared within the UNU-WIDER project on Fragility and Development, directed by Mark McGillivray and Amelia Santos-Paulino.

UNU-WIDER gratefully acknowledges the financial contributions to the project by The Australian Agency for International Development (AusAID), the Finnish Ministry for Foreign Affairs, and the UK Department for International Development—DFID.

UNU-WIDER also acknowledges the financial contributions to the research programme by the governments of Denmark (Royal Ministry of Foreign Affairs), Norway (Royal Ministry of Foreign Affairs), and Sweden (Swedish International Development Cooperation Agency—Sida.

ISSN 1810-2611 ISBN 92-9190-961-0 ISBN 13 978-92-9190-961-2

Acknowledgements

We are grateful to the participants at the UNU-WIDER project meeting on Fragility and Development, Suva, Fiji, for their comments and suggestions for improving this study.

Acronyms

DC developing countries
IFS *International Financial Statistics*
IRFs impulse response functions
IOM International Organization for Migration
SIDS small island developing states
VDCs variance decompositions
WDI *World Development Indicators*

UNU World Institute for Development Economics Research (UNU-WIDER)
Katajanokanlaituri 6 B, 00160 Helsinki, Finland

Typescript prepared by Liisa Roponen at UNU-WIDER

1 Introduction

In 1970, about 2.2 per cent of the world's population lived in a country other than their country of birth. In contrast, by 2000, the foreign-born accounted for close to 3 per cent of the world's population (IOM 2005: 379). International migration has spurred public interest not only on account of its continued growth, but also due to observed changes in its spread; in the geographic origin and socioeconomic status of migrants (Williamson 2006). This has lead to spirited discussions of the economic impact of immigration for in-migration areas.

But a parallel discussion is now taking place that focuses on the various ways in which out-migration affects migrant-sending regions of the world. Some of these impacts are thought to be negative, whereas others are deemed positive. For example, brain drain may disadvantage migrant-sending regions by reducing the availability of high-skill human capital where it is sorely needed, thus questioning the domestic effectiveness of public expenditures on higher education (Haque and Kim 1995). However, monetary inflows remitted by migrants to their families and friends back home may make up for these downsides, providing needed infusions of financial capital in poor areas of the world (Lucas 2007). Moreover, in the last decade, international remittances have grown at a faster pace than their respective migration flows. While worldwide remittance inflows amounted to US$68 billion in 1990, this sum increased by about three and a half times to US$232 billion by 2005 (World Bank 2006). In contrast the total world stock of migrants rose by only 23 per cent—from 155 million to 190 million over the same timeperiod (see UN 2005).

A secular decline in transportation and telecommunication costs is likely partly responsible for the upward trends that we observe in both migration and in monetary remittances. If migrants can visit home more frequently and if they can more easily keep in touch with their families in their communities of origin, they may remit more often, in greater amounts and for longer periods of time. This observed rise in transnationalism prompted by technological innovations in transportation and telecommunications is likely to enhance the importance of continued out-migration and remittance inflows to migrant sending communities.

Another factor that has sometimes been mentioned as a potential reason for rising migration and its accompanying financial flows is a rise in the effects of extreme events around the globe. It is not an increased incidence of natural disasters that lies behind the growing importance of extreme events, but rather the growth in the number of individuals affected by such disasters (see EM-DAT). Small island developing states (SIDS) are, in particular, more vulnerable to natural disasters for a number of reasons, including the geographic concentration of their populations in coastal areas (UNESCO/World Bank 2003). This increased vulnerability may contribute toward increased out-migration and remittance inflows.

Despite these hypotheses regarding the causes behind the observed increase in remittances, very little is known about SIDS out-migration and remittance-receiving patterns. This paper explores the effects of migratory patterns on migrant-sending communities via the impacts of subsequent remittance inflows. In particular, we trace how workers' remittances are linked to other macroeconomic variables, assumed either to determine or be driven by remittance inflows, specifically natural disasters, official foreign aid flows, and the real exchange rate.

We focus on SIDS due to the well-documented economic and environmental vulnerabilities of these economies. In this regard, Briguglio (1995) reports that SIDS vulnerabilities stem from their small size, lack of product diversification, economic openness, import dependence and remoteness. Their small size curtails diversification and the attainment of economies of scale in the production of goods and services. Their vulnerability to natural disasters, coupled with their small size, usually makes these economies more import-dependent. They are more susceptible to outside shocks—a characteristic further emphasized by their remote location and relatively high transportation costs.

In such a context, it is important to evaluate the impact of remittances on these economies and, in particular, their potential for reducing the economic vulnerability of SIDS. Remittances can positively impact economic development by serving as a source of foreign exchange. For instance, remittances can be used to finance business investments (Amuedo-Dorantes and Pozo 2006a; Woodruff and Zenteno 2007) and the acquisition of human capital via the increased schooling of children (Edwards and Ureta 2003; Hanson and Woodruff 2003; Gitter and Barham 2005). However, remittances have the potential to impact negatively on recipient nations. Inflows of foreign exchange can appreciate the real exchange rate, potentially putting export industries at a disadvantage in world markets. Alternatively, remittances can create work disincentives (Funkhouser 1992, Amuedo-Dorantes and Pozo 2006b). These concerns parallel those expressed in the macroeconomic literature on official aid and its effectiveness on economic growth (e.g., Dollar and Burnside 2002, as well as Pavlov and Sugden 2006 for the Pacific islands).

While remittances have the potential to influence household behaviour in ways that will affect the performance of the economy, detailed microeconomic data useful for testing these propositions are often lacking for SIDS. For this reason, we focus our attention on the determinants and impacts of remittances at the macroeconomic level. Specifically, we address three sets of questions. First, we ask: what factors drive remittance inflows? How responsive are remittances to natural disasters? How responsive are remittance senders to ongoing foreign aid flows? How do private and public transfers compare? Do remittances respond more quickly to the needs of individuals in the homeland following a natural disaster? Second, we focus on how remittances relate to other macroeconomic variables. Since remittances have become an increasingly important source of global development finance (e.g., Terry and Wilson 2005), some have suggested that these monetary inflows may substitute for official foreign aid.[1] Therefore, we ask whether official donors consider remittance receipts when deciding on official aid amounts. Finally, we inquire about the impact of remittance inflows on the real exchange rate and ask whether remittances cause 'Dutch disease'. Do remittances appreciate the real exchange rate thereby disadvantaging the export industries that compete in world markets?

In what follows, we provide a description of the data sources. Subsequently, we discuss the methodology employed in our analysis and our findings for SIDS and for a wider

---

1 For example, Adelman (2003) claims that remittances should be added to official development assistance flows to get a more accurate picture of a nation's foreign aid generosity with respect to the rest of the world.

range of economies. A final section summarizes our results and provides suggestions for further research.

2 Data

In order to address the aforementioned questions, we work with panel data on workers' remittances, natural disasters, official foreign aid, and the real exchange rate. The data run from 1990 through 2003. Annual data on workers' remittances and official development assistance (both in US current dollars) were obtained from *World Development Indicators* (WDI). Disaster costs (in current US dollars) were downloaded from the disaster database EM-DAT.[2] Multilateral real effective exchange rates were acquired from *International Financial Statistics* (IFS). Unfortunately, IFS publishes only real effective exchange rate indexes for less than half of the countries used in the analysis. The remaining effective index series were obtained from various other sources as specified in the data appendix. For countries lacking a real effective exchange rate index, we construct one by determining the top trading partners of the country in question and then computing an un-weighted average real exchange rate index.[3] Finally, remittances, foreign aid, and disaster costs—all in current US dollars—are standardized by dividing each by its GDP expressed in current US dollars (also obtained from WDI).

One concern is whether the remittances series that we employ are reliable. Since most central banks and national statistical agencies have viewed these inflows as minor, they tended to place less effort in accurately tracking them. As a result, it is generally understood that the time series of remittances underreport true flows. We do not have a good solution to this mismeasurement data problem. We recognize that while mismeasurement in dependent variables is less problematic, mismeasurement of explanatory variables can seriously compromise and bias one's estimates. However, the use of panel methods with country fixed effects may lessen these issues as long as the underreporting pattern is constant over time within each country.

On account of data availability, only 19 of the 37 SIDS are included in the analysis.[4] These are Barbados, Belize, Cape Verde, Comoros, Dominican Republic, Haiti, Jamaica, Kiribati, Maldives, Mauritius, Papua New Guinea, Samoa, Seychelles, Solomon Islands, Suriname, Tonga, Trinidad and Tobago, and Vanuatu. For the most part, lack of data on workers' remittances is what prevented us from including the other island states. For the group of SIDS studied in this paper, aid as a share of GDP runs at about 10 per cent, while workers' remittances account for almost 5 per cent of GDP.

---

2 This is the OFDA/CRED International Disaster Database (www.em-dat.net) of Université Catholique de Louvain, Brussels, Belgium.

3 See the data appendix for details regarding the source and method of derivation of the exchange rate index by country. For 'dollarized' economies, real exchange rates are constructed as domestic to foreign price ratios.

4 The total member list is available at www.un.org/special-rep/ohrlls/sid/list.htm

3 Data transformation and methodology

We face two additional challenges in conducting the empirical analysis. First, macroeconomic data on SIDS are scarce. There are no long macroeconomic timeseries for these countries and the data are typically reported at relatively low frequencies (i.e., annually). A second challenge, common to most macroeconomic studies, is endogeneity. Most macroeconomic series are endogenous, making it difficult to accurately discern causal relationships. To overcome these two challenges we estimate panel data vector autoregressive models (panel VARs).

The use of a panel VAR addresses the endogeneity problem as the methodology treats all the variables in the system as endogenous. Moreover, the panel VAR also helps us overcome the data limitation problem by stacking the data from various countries. An added advantage of the panel VAR is that it allows us to take into account unobserved country specific heterogeneity. This is extremely important in our analysis, given the diversity of countries in our sample with regards to location and size, among other characteristics. As such, the use of panel VARs seems appropriate for our analysis. In fact, Holtz-Eakin, Newey and Rosen (1988) show that panel data are perfectly fitted for VARs as few years of data are required to estimate such models. This is possible because the sampling properties depend on the number of countries (*i*) and not on the number of years (*t*). Some authors even argue that the asymptotic results are easier to derive for panel data than for timeseries data (see Gilchrist and Himmelberg 1998). In what follows, we provide a short description of the methodology used in this analysis.[5]

The ℓ th equation of a 1 lag panel VAR can be written as:

$$y_{it}^{\ell} = \alpha_i^{\ell} + \gamma_t^{\ell} + x_{it}^{'} b^{\ell} + e_{it}^{\ell}, \qquad (1)$$

where α_i^{ℓ} is the country specific effect, γ_t^{ℓ} is the year specific effect, x_{it} is an $\ell x1$ vector of lagged endogenous variables, b^{ℓ} is an $\ell x1$ vector of slope coefficients, and e_{it}^{ℓ} is the idiosyncratic error. In order to eliminate year and country fixed effects, we make two transformations. First, we express all variables in the model as deviations from year specific means to remove year specific effects (i.e., the data are time demeaned). Second, we transform all variables in the model to deviations from forward means (Helmert's transformation) to remove fixed effects. Since country specific effects are correlated with the regressors (x_{it}) by virtue of the lag dependent variable, the mean differencing procedure commonly used to eliminate these fixed effects will create biased coefficients (Love and Zicchino 2006). To avoid this problem, we use forward mean differencing (see Arellano and Bover 1995). Let $\overline{y}_{it}^{\ell}$, $\overline{x}_{it}$ and $\overline{e}_{it}^{\ell}$ denote the means constructed from the future values of y_{it}^{ℓ}, x_{it} and e_{it}^{ℓ}. Then, our transformations are given by:

$$\widetilde{y}_{it}^{\ell} = \delta_{it}(y_{it}^{\ell} - \overline{y}_{it}^{\ell}), \qquad (2)$$

$$\widetilde{x}_{it} = \delta_{it}(x_{it} - \overline{x}_{it}), \qquad (3)$$

---

5 The empirical analysis is conducted using the package provided in Love (2001).

and

$$\widetilde{e}_{it}^{\ell} = \delta_{it}(e_{it}^{\ell} - \overline{e}_{it}^{\ell}), \tag{4}$$

where $\delta_{it} = \sqrt{(T_i - t)/(T_i - t + 1)}$ and T_i denotes the last year of data available for a given country series. We are not able to calculate this transformation for the last year of data, since there are no future values for the construction of the forward means. Accordingly, we lose this observation. The final transformed model is thus given by:

$$\widetilde{y}_{it}^{\ell} = \widetilde{x}_{it}^{'} b^{\ell} + \widetilde{e}_{it}^{\ell}. \tag{5}$$

Thus, we use an orthogonal deviation, in which we express each observation as a deviation of average future observations. We weight each observation to standardize the variance. If the original errors are not autocorrelated and have a constant variance, the transformed errors should exhibit similar properties. Thus, this transformation preserves homocedasticity and does not induce serial correlation (Arellano and Bover 1995). Additionally, we use lagged regressors as instruments in our GMM estimation. To the extent that the instruments are lagged values of x_{it}, they remain uncorrelated with the transformed error term—that is, $E\left[x_{it-s}\widetilde{e}_{it}^{\ell}\right] = 0$ for all $s \geq 0$ (Holtz-Eakin, Newey and Rosen 1988; Gilchrist and Himmelberg 1998).

Once we have estimated all coefficients of the panel VAR, we proceed to estimate variance decompositions (VDCs) and impulse response functions (IRFs). VDCs inform us on the portion of the forecast error variance for each variable that is attributable to its own innovations and to innovations from the other variables in the system. The IRFs further inform on the sign and time trajectory of the impact of a one standard deviation shock to one of the variables in the system on the outcome of interest.

We initially estimate the model for the small sample of SIDS mentioned earlier. However, we also work with a large sample of countries that includes the SIDS as well as 92 developing economies, giving us a sample containing 111 countries. We label this second sample: the DC sample. The rationale for obtaining this second sample rests with the limited number of observations that we have for the SIDS sample which in turn prevents us from computing confidence intervals for the IRFs. With the DC sample, we can compute a two standard deviation confidence interval band for the IRFs. These are obtained using 1,000 Monte Carlo simulations. This estimation provides us with additional information for assessing how the macroeconomic variables relate to one another.

Finally, a few words regarding the ordering of the series in our model is in order. In order to compute VDCs and IRFs, the residuals must be orthogonalized. We use a recursive ordering to orthogonalize the residuals. The assumption behind such ordering is that the series listed earlier in the ordering can impacts on other variables contemporaneously, while the series listed later in the ordering impacts those listed earlier only with lags. Consequently, variables listed earlier in the ordering are considered to be more exogenous. In our case, it is natural to list the disaster series at the beginning of the ordering. Natural disasters can have immediate impacts on foreign aid, the real exchange rate and remittances, but natural disasters are not likely to be propagated by *contemporaneous* shocks to these same variables. Next in the ordering is foreign aid, typically responsive to ongoing disasters. The real exchange rate index

follows. Remittances are placed last in the ordering. The rationale for listing the real exchange before remittances is that remitters appear to be cognizant and responsive to current exchange rate movements, factoring in ongoing exchange rate conditions when remitting home (e.g., Faini 1994; Hysenbegasi and Pozo 2007). While it is also possible that the real exchange rate responds to remittance inflows as posited in models of Dutch disease, those responses take place with a lag.[6] As such, the final ordering is: disaster costs, foreign aid, the real exchange rate index and remittances.

4 Results

We report on two sets of results using two samples of data: the DC and SIDS samples. We can make inferences about the dynamic relationships among the variables in our VAR systems from VDCs and IRFs. The VDCs for each of the samples are displayed in Table 1. The top panel of Table 1 contains the VDCs for the larger sample of DC countries. Up to 22 per cent of the forecast error variance of remittances is explained by innovations to the real exchange rate, disaster and foreign aid series when we use the DC sample. Furthermore, remittances explain about 14 per cent of the forecast variance of each of the other variables in the system. Using the smaller sample of SIDS (lower panel of Table 1), we find that after 10 periods, only 2.4 per cent of remittances' error forecast variance can be explained by innovations in the real exchange rate, foreign aid and disaster costs. Yet, remittances explain as much as 27.5 per cent of foreign aid's error forecast variance. This suggests that remittances can play an important role in affecting the macroeconomies of SIDS and developing economies in general. These findings underscore the need to gain a better understanding of the determinants and impact of remittances in SIDS and DC countries. Therefore, we also examine the IRFs from the VAR models using the two samples.

Table 1

Variance decompositions after 10 periods

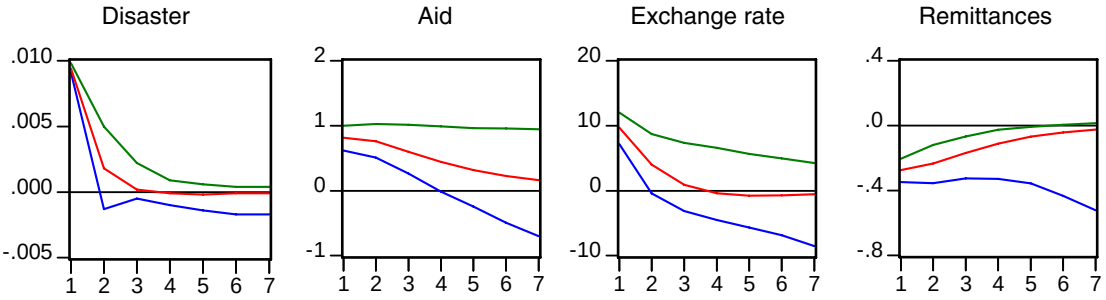
	Percentage of the variance explained by:			
Variables	Disaster	Aid	Exchange rate	Remittances
	(A) DC sample			
Disaster	85.11	0.22	0.86	13.81
Foreign aid	4.41	78.53	2.19	14.86
Exchange rate	3.10	1.56	81.02	14.32
Remittances	5.44	8.41	8.33	77.82
	(B) SIDS sample			
Disaster	87.53	0.13	0.34	12.00
Foreign aid	5.21	66.35	0.96	27.48
Exchange rate	0.08	0.46	97.31	2.15
Remittances	0.96	1.35	0.12	97.58

6 The mechanism by which remittances might affect the real exchange rate is via their differential impact on spending on traded versus non-traded goods in the recipient economy. For example, if remittances are mainly spent on non-traded goods, domestic prices will eventually be bid up, causing an appreciation of the real exchange rate. However, it is likely that prices exhibit some stickiness resulting in a lag between spending changes and real appreciation.

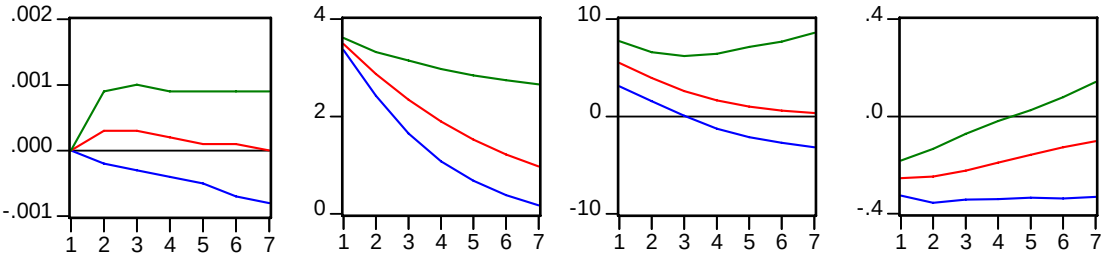
Panels A through D in Figure 1 display the IRFs corresponding to the panel VAR model estimated for the DC sample of countries. Subsequently, we restrict our analysis to SIDS and display those results in Figure 2. As noted earlier, we are no longer able to compute confidence interval bands for the IRFs in the SIDS subsample due to the limited sample size.

Figure 1
DC Sample

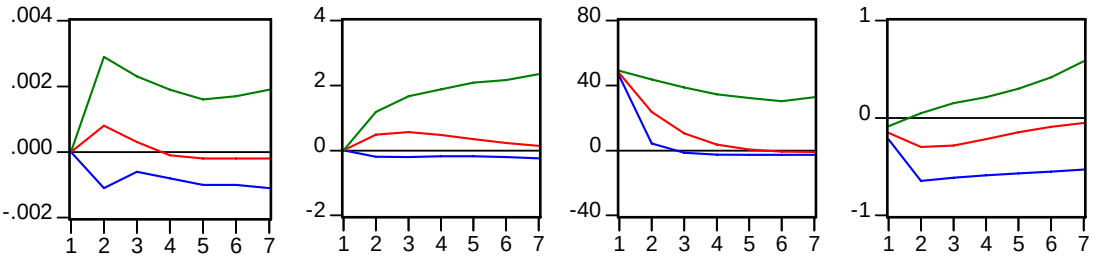
Variables included: disaster, aid, exchange rates and remittances



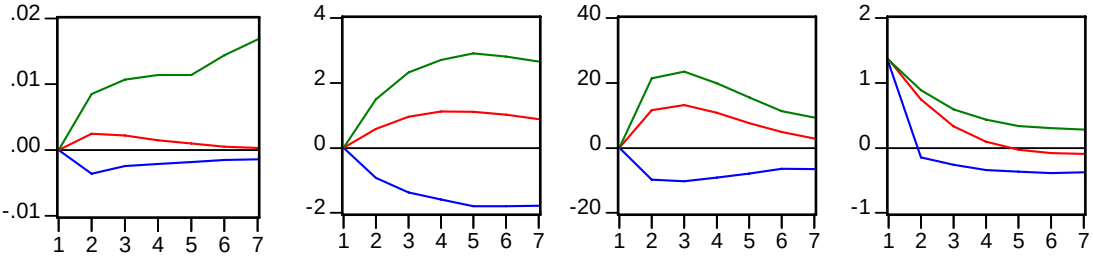
Panel A: Response to a shock in disaster



Panel B: Response to a shock in aid



Panel C: Response to a shock in the exchange rate



Panel D: Response to a shock in remittances

Note: Confidence intervals are computed via Monte Carlo simulation with 1,000 draws. Ranges represent two standard deviation confidence intervals. The shock corresponds to one standard deviation.

What are the major findings from our analysis? Focusing on the DC sample first, the figures in Panel A, Figure 1, show how a one standard deviation shock to the disaster series results in a significant and long-lasting increase (4 years) in foreign aid flows. Likewise, a disaster shock is accompanied by a real exchange rate appreciation, perhaps owing to the pressure placed on domestic prices following disasters. Yet, the real exchange rate seems to quickly adjust (by year 2) to its long-run equilibrium value. In contrast with what we observe for foreign aid and the exchange rate, remittance inflows drop following a disaster. Such behaviour is interesting and could be explained by interruptions to the regular money transfer channels through which migrants send money home. Alternatively, migrants may choose to take a 'wait and see' attitude before remitting funds home to fully assess the situation and needs of family following disasters.

Panel B in Figure 1 displays the response of all variables to a one standard deviation shock to foreign aid. According to these plots, there is evidence of foreign aid flows causing 'Dutch disease' as the real exchange rate appreciates following a shock to the foreign aid series. The impact on the exchange rate dissipates three years after the shock. Additionally, it is interesting to note how remittance inflows drop following an increase in foreign aid. In this regard, migrants appear to be factoring in public aid flows to their remitting patterns, reducing private flows when there is an increase in public money flows to their home economies. Why might remittances respond in this way? One possibility is that shocks to foreign aid take place during periods of major political and economic crisis. During periods of turmoil, non-altruistic remitters may cut back on their flows to the home community, not because they are reacting directly to increased flows by international organizations and governments, but rather because they may view the time as inopportune for additional investments in the home community. Indeed, if one's objective in remitting is to build a portfolio of assets in the home community, periods of economic crisis back home are not likely to invite such investments. Instead, individuals are more likely to remit when exposure to economic risks are smaller.

How do changes in the exchange rate impact remittances? There is some evidence that remitters respond to depreciation in exchange rates by remitting more (Faini 1994; Hysenbegasi and Pozo 2007; Vargas-Silva and Pozo 2006). Exchange rate depreciations permit the remitter to buy more home currency with a given level of host currency. If the altruistic remitter cares about her/his family receiving a specific lump-sum of money in the home currency, s/he will be able to accomplish that goal with a smaller remittance outflow of money in host country currency. This income effect, however, is counteracted by a substitution effect according to which depreciation lowers the relative price of goods in the home country, driving the remitter to send more in order to take advantage of the difference in relative prices. Hence, whether the remitter remits more or less boils down to whether the income versus the substitution effect dominates. In this analysis, it appears that the substitution effect is greater as we observe remittances increasing (decreasing) following exchange rate depreciation (appreciation) in Figure 1, Panel C.

Figure 2 displays the IRFs using the SIDS subsample. Owing to the reduced number of observations, we are unable to compute confidence interval bands for the IRFs. Yet, by comparing the figures to those obtained using the larger sample of countries, we are able to make some inferences regarding the similarities and dissimilarities between SIDS and other economies. Panel A of Figure 2 shows the impact of a one standard

deviation shock to the disaster variable on foreign aid, the real exchange rate and remittances. As with the larger sample, foreign aid rises sharply during the first year following a disaster shock, declining thereafter. However, the real exchange rate, which used to appreciate briefly in response to a disaster shock with the larger sample of countries, now seems to depreciate. This behavioural response is interesting and may be reflecting capital flight or loss of confidence in the longer-run economic wellbeing of the island, leading to a weakening of the home currency. Finally, unlike what we found with the larger sample of countries, remittances now rise following a disaster shock. In this regard, emigrants from SIDS appear to be more altruistic.

Panel B of Figure 2 further indicates the effect that foreign aid shocks may have on remittances and the real exchange rate. The real exchange rate appreciates following an increase in foreign aid flows. Therefore, we encounter further evidence of a possible Dutch disease-like effect of aid with the smaller sample of SIDS. Additionally, as with the larger sample of countries, migrants appear to reduce their remittance flows home following an increase in foreign aid. Nonetheless, unlike earlier, this reduction in remittance flows only seems to accentuate—instead of vanishing—over time, possibly reflecting the greater vulnerability of SIDS economies, which take longer to recover from economic crises.

Panel C of Figure 2 displays how exchange rates affect the variables in our system. Appreciation of the real exchange rate reduces remittances (or depreciation encourages remittances). Therefore, it appears that remitters in SIDS behave similarly to those from the overall set of DC economies. The substitution effect overrides the income effect causing remittances to fall (rise) with appreciation (depreciation).

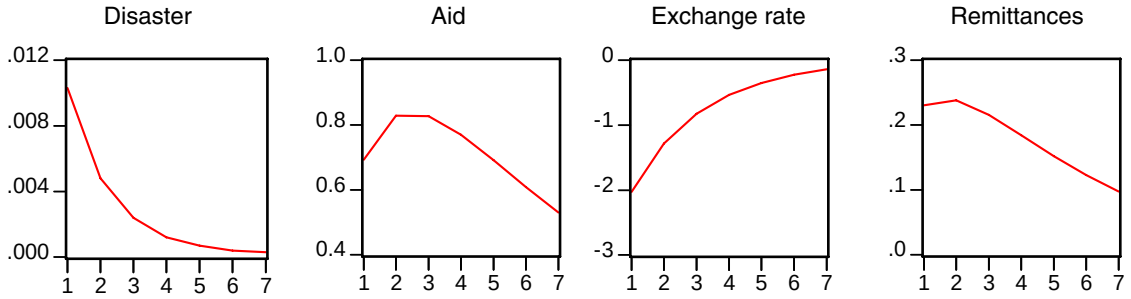
Finally, Panel D of Figure 2 presents the macroeconomic impact of remittance inflows in the case of SIDS. While the absence of confidence interval estimates prevents us from determining whether the responses are statistically different from zero, it is interesting to note that an increase in remittance inflows seems to be causing depreciation of the real effective exchange rate with recovery after a period of three years. The possibility exists that remittances are primarily consumed on traded versus non-traded goods in the case of SIDS, raising the relative price of traded goods and causing a depreciation of the real exchange rate.

In sum, remittance inflows do not seem to be as responsive as foreign aid flows to disaster shocks. While foreign aid flows always increase following a disaster, remittances decrease for a short timeperiod when the DC sample of countries is used. Yet, migrant remittances rise after a disaster shock among SIDS, perhaps signalling the lesser disruption of money transferring channels in these economies. Alternatively, remittances may be more stable in SIDS, owing to greater family dependence on these monetary flows and a greater degree of altruism among migrants from these economies. In any case, it is worth noting that in both the DC and SIDS samples, remitters appear to be responding to other sources of aid, reducing their monetary transfers in the event of an increase in foreign aid. In these cases, it may be that remitters are actually responding to overall economic conditions back home, which happen to be correlated to aid flows. Finally, while remittances do not seem to have much of an impact on the real exchange rate when the larger sample of countries is used, they may cause real exchange rate depreciation among SIDS. The decline in the real exchange rate following a remittance shock could be due to the manner in which the inflows are used by the receiving families. If families are using remittances to consume traded goods, we

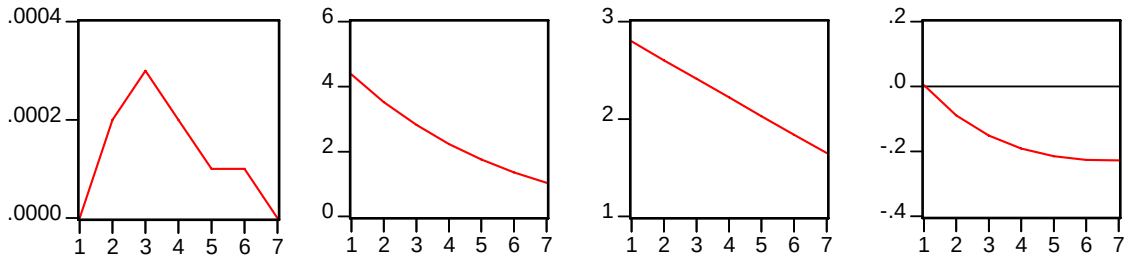
could observe a relative increase in the price of traded versus non-traded goods, resulting in real exchange rate depreciation. In this regard, only foreign aid flows seem to cause a Dutch disease-like real exchange rate appreciation.

Figure 2
SIDS sample

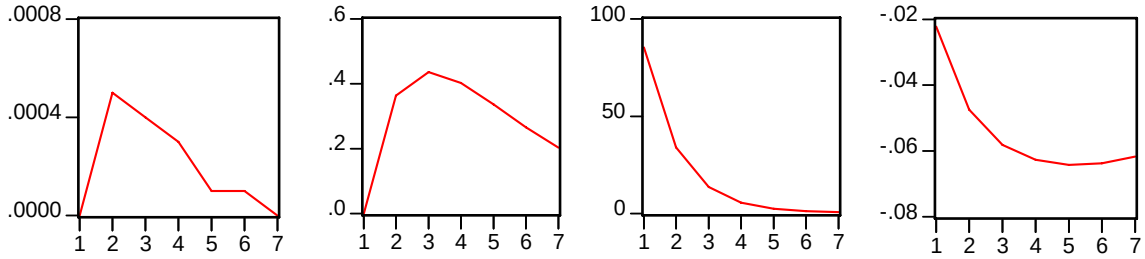
Variables included: disaster, aid, exchange rate and remittances



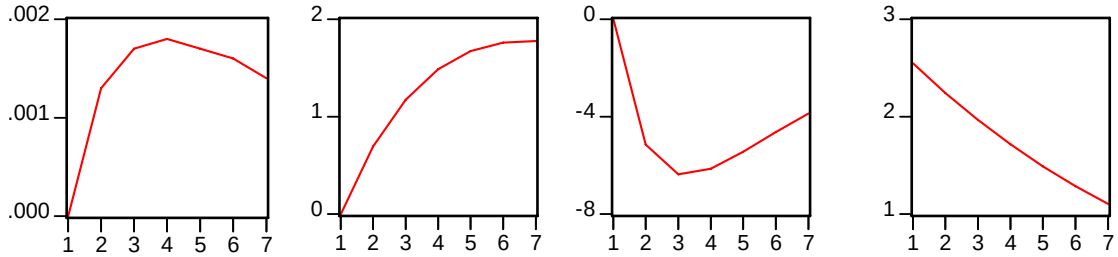
Panel A: Response to a shock in disaster



Panel B: Response to a shock in aid



Panel C: Response to a shock in the exchange rate



Panel D: Response to a shock in remittances

5 Robustness checks

As in any macroeconomic analysis, we are faced with making decisions regarding the appropriate variables to use in the analysis. One might, therefore, wonder whether the results would differ if alternative series of macroeconomic variables were used instead. In particular, it is not unreasonable to be sceptical of the results on account of using estimated US dollar damages as our variable for tracking the intensity of natural disasters. While these dollar figures are scaled by the GDP of the recipient nation,[7] questions can still arise regarding the methodology involved in deriving those annual dollar values, as they are necessarily estimated. Do those values truly measure the magnitude of disaster? We have therefore estimated our model again using an alternative variable, one that tracks the number of persons affected by the natural disaster. This variable is scaled by the population of that country at that time. The IRFs from the estimations using the number of persons affected are nearly identical to the ones derived using the US dollar damages scaled by GDP.[8] Foreign aid increases and the real exchange rate appreciates when there is a shock to the numbers of persons affected by a natural disaster, while remittances decrease for a period of time following the natural disaster shock. Examination of all the other relationships captured by the panel VAR remain unaffected by the change in the disaster variable. Shocks to aid appreciate the real exchange rate, while at the same time depressing remittances in the full sample. Exchange rate depreciation, on the other hand, is found to encourage remittances, as before.

Another robustness check involves the real exchange rate. In an attempt to preserve as many observations as possible, we construct a real exchange rate indexes for countries lacking published series. We used information regarding main trading partners along with bilateral exchange rates and price indexes to construct these series.[9] For a number of countries, however, information on trading partners was not available, preventing us from using this methodology to obtain a real effective index. In these cases (19 countries in total) we simply construct real bilateral exchange rates *vis-à-vis* the US dollar. To assess the suitability of this substitution, we re-estimate our VARs for the full sample using only countries for which an effective real exchange rate was available or could be constructed from available data. This reduces the number of countries in our sample to 92 from 111. IRFs in the smaller sample of DCs are similar to the results in the larger sample of DCs. Only one difference is detected—the impact on remittances stemming from a shock to the disaster series. In the larger (111 countries) sample, we find that remittances fall. In the smaller (92 countries) sample, remittances still fall with shocks to the disaster series, but the confidence interval is too wide to conclude that the fall is statistically different from zero. It is possible that the smaller sample size contributes to the finding of a lack of significance. However, overall, we conclude that our results appear fairly robust to differing dataseries.

---

7 Recall, we divide the US dollar damages series by the GDP of the country to account for the relative magnitude of the disaster series.

8 These IRF plots are available upon request from the authors.

9 See the data appendix.

6 Summary and questions for future research

A number of conclusions can be drawn from this study. First, there is some evidence that the macroeconomic behaviour of SIDS economies differs from those of overall DC economies. This conclusion is derived from comparisons of VDCs and IRFs from the full sample and the SIDS subsample of countries included in our analysis. One area of future research would be to examine the sources of these differences, possibly related to the fact that remittances account for about 5 per cent of GDP in the SIDS subsample, while they account only for about 2.5 per cent of GDP in the DC sample.

A second noteworthy finding is that remittances do not cause Dutch disease in our sample of countries. We do not observe appreciation of the real exchange rate in response to remittance inflows. This is interesting in light of the finding by Amuedo-Dorantes and Pozo (2004) with respect to a group of Latin American economies where Dutch disease appears to be the norm. Instead, we find that, in the overall DC sample, remittances have no impact on the real exchange rate, while they seem to depreciate the real exchange rate in the SIDS subsample.[10] Perhaps remittances are used differently in SIDS versus non-SIDS countries. Differences in spending patterns may result in a differential impact on the real exchange rate owing to the impact on the relative prices of tradables and non-tradables. Therefore, in order to get a better understanding of the long-term (and short-term) impacts of migration and remittances, it is important to uncover whether there are differences in spending patterns across recipient nations on account of these inflows. Microeconomic studies can help quantify whether those differences exist and, in that manner, contribute towards a better understanding of the long-term impacts of remittances.

We find it interesting that remittances respond to foreign aid, while foreign aid does not respond to remittances. The fear that official donors will stem back on their contributions on account of observations that private funds are flowing in, is not borne out in these data. We do note, however, that private donors do appear to 'hold back' on remitting in response to increases in official foreign aid. It is not clear why this should be the case. If shocks to foreign aid flows are propagated by natural and extreme economic events, it may be that individual remitters are unable to remit due to interruptions in money transfer mechanisms, underscoring the need for public transfers that do not depend on those channels to get resources to needy areas. An alternative explanation rests with the recognition that remitters have various motives for sending money home. Some remit for altruistic purposes, to help support family back home, while others do so to attain specific 'investment goals'. It is conceivable that remittances fall in response to economic crises because investment-minded remitters stem their flows during these crisis periods. This could explain why remittances decline with foreign aid shocks, as these flows are likely to be propelled by economic crises. These possibilities deserve additional scrutiny. Microeconomic studies can help sort out these differences in behavioural responses.

Finally, disaster shocks elicit increases in remittances in the SIDS sample, whereas the opposite effect is observed in the case of the DC sample. There are various potential explanations for this finding. It could be that SIDS experience a lesser disruption of

---

10 Recall, since we cannot assign confidence interval estimates to the IRFs of the SIDS subsample, we do not know whether the finding of real depreciation is statistically significant in the SIDS subsample.

money transfers than the economies included in the DC sample. Alternatively, while the incidence of non-zero disaster costs is greater in the DC sample than in the SIDS sample (i.e., 25 per cent versus 12 per cent, respectively), it is possible that the impacts of such disasters are felt harder in the group of countries included in the SIDS sample than in their counterparts in the DC sample owing to the greater geographic isolation and vulnerability of these economies. As such, SIDS remitters appear more likely to respond to the disaster by raising their remittance flows. Finally, the purposes for which remitters are sending money back home may vary between the two samples. It is possible that the SIDS contains a larger number of migrants remitting money home for pure altruistic purposes, whereas in the DC sample a larger fraction of remitters are sending money back home for 'investment' purposes or to build a retirement nest-egg. It would be of interest to explore the validity of these various explanations in future research.

Overall, our findings point to the need for continued research into understanding the economic relationships that exist between remittances and other macroeconomic variables. While we do observe certain patterns, our methods are limited in their ability to capture the basis for these patterns. Microeconomic methods could be put to use to clarify what lies behind these patterns. We also detect differences in the relationships across SIDS and DC economies. Once again, alternative methodologies need to be employed to sort out the basis for those variations in behaviour. Finally, we need to acknowledge that data improvements could go a long way toward resolving some of the ambiguities in our results.

Bibliography

Adelman, C. C. (2003). 'The Privatization of Foreign Aid: Reassessing National Largesse'. *Foreign Affairs*, 82 (6): 9-14.

Amuedo-Dorantes, C., and S. Pozo (2004). 'Workers' Remittances and the Real Exchange Rate: A Paradox of Gifts'. *World Development*, 32 (8): 1407-17.

Amuedo-Dorantes, C., and S. Pozo (2006a). 'Remittance Receipt and Business Ownership in the Dominican Republic'. *World Economy*, 29 (7): 939-56.

Amuedo-Dorantes, C., and S. Pozo (2006b). 'Migration, Remittances and Male and Female Employment Patterns'. *American Economic Review*, 96 (2): 222-6.

Arellano, M., and O. Bover (1995). 'Another Look at the Instrumental Variable Estimation of Error Component Models'. *Journal of Econometrics*, 68 (1): 29-51.

Briguglio, L. (1995). 'Small Island Developing States and their Economic Vulnerabilities'. *World Development*, 23 (9): 1615-32.

Carment, D., S. Press, and Y. Samy (2006). 'Assessing the Fragility of Small Island Developing States'. In L. Briguglio, G. Cordina, and E. J. Kisanga (eds), *Building the Economic Resilience of Small States*. Valletta: Islands and Small States Institute, Foundation for International Studies.

Edwards, A. C., and M. Ureta (2003) 'International Migration, Remittances, and Schooling: Evidence from El Salvador'. *Journal of Development Economics*, 72 (2): 429-61.

EM-DAT (International Disaster Database). Available at: www.em-dat.net/

Faini, R. (1994). 'Workers Remittances and the Real Exchange Rate: A Quantitative Framework'. *Journal of Population Economics*, 7 (2): 235-45.

Funkhouser, E. (1992). 'Migration from Nicaragua: Some Recent Evidence'. *World Development*, 20 (8): 1209-18.

Gilchrist, S., and C. Himmelberg (1998). 'Investment, Fundamentals and Finance'. NBER Working Paper No. 6652. Cambridge, MA: National Bureau of Economic Research.

Gitter, S. R., and B. L. Barham (2005). 'Credit, Natural Disasters, Coffee, and Education Attainment in Rural Honduras'. Working Paper. Madison: Department of Agricultural and Applied Economics, University of Wisconsin.

Haque, N. U., and S.–J. Kim (1995). 'Human Capital Flight: Impact of Migration on Income and Growth'. *International Monetary Fund Staff Papers*, 42 (3): 577-607.

Hanson, G. H., and C. Woodruff (2003). 'Emigration and Educational Attainment in Mexico'. San Diego: University of California. Mimeo.

Holtz-Eakin, D., W. Newey, and H. S. Rosen (1988). 'Estimating Vector Autoregressions with Panel Data'. *Econometrica*, 56 (6): 1371-95.

Hysenbegasi A., and S. Pozo (2007). 'Workers' Remittances and Currency Crises'. *Well-being and Social Policy Journal/Bienestar y Política Social*, forthcoming.

IOM (International Organization for Migration) (2005). *World Migration Report 2005: Costs and Benefits of International Migration.* Geneva: International Organization for Migration, 379.

Love, I. (2001). Estimating Panel-data Autoregressions. Package of Programs for Stata. New York: Columbia University. Mimeo.

Love, I., and L. Zicchino (2006). 'Financial Development and Dynamic Investment Behaviour: Evidence from Panel VAR'. *The Quarterly Review of Economics and Finance*, 46: 190-210.

Lucas, R. E. B. (2007). 'International Migration and Economic Development in Low Income Countries: Lessons from Recent Data'. In S. Pozo (ed.), *International Migrants and their International Money Flows.* Kalamazoo, MI: Upjohn Institute for Employment Research.

Pavlov, V. and C. Sugden (2006). 'Aid and Growth in the Pacific Islands'. *Asian-Pacific Economic Literature,* 20 (2): 38-55.

Terry, D. F., and S. R. Wilson (eds) (2005). *Beyond Small Change: Making Migrant Remittances Count.* Washington, DC: Inter-American Development Bank.

UNESCO/World Bank (2003). 'Small States: Meeting Challenges in the Global Economy'. Report of the Commonwealth Secretariat/World Bank Joint Task Force on Small States. Available at: www.thecommonwealth.org/Shared_ASP_Files/UploadedFiles/03D192EA-CCF2-4FA2-96B3-F7DA64AD245B_taskforcereport.pdf

Williamson, J. G. (2006). 'Global Migration'. *Finance and Development*, 43 (2).

Woodruff, C., and R. Zenteno (2007). 'Migration Networks and Microenterprises in Mexico'. *Journal of Development Economics*, 82 (2): 509-28.

World Bank (2006). *Global Economic Prospects,* 2006: *Economic Implications of Remittances and Migration.* Washington, DC: World Bank.

Younger, S. D. (1992). 'Aid and the Dutch Disease: Macroeconomic Management when Everybody Loves You'. *World Development*, 20 (11): 1587-97.

Vargas-Silva, C., and S. Pozo (2006). 'Do Immigrants and Their Remittances Respond to the Exchange Rate?' Burlington: University of Vermont. Mimeo.

United Nations (2005). World Migrant Stock: The 2005 Revised Population Database. Available at: www//esa.un.org/migration/. New York: United Nations Population Division.

Data appendix

Samples	Description	N Obs	N Countries
SIDS	Small island developing states	176	19
DC	Developing countries	1023	111

Master database

All countries classified as low income, lower middle income and upper middle income in the 2005 *World Development Indicators* (WDI) database were considered to be of interest. WDI classifies 154 countries as such and all are listed in the table below. Data from 1990 through 2004 for workers remittances, GDP, and official development assistance were extracted from WDI. Next, data from EM-DAT: the International Disaster Database was appended detailing the total estimated US dollar value of disasters taking place in each of the years. Finally, if a real effective exchange rate index was available, it was merged into the master database.

Real effective exchange rate index

The International Monetary Fund's *International Financial Statistics* (IFS) was consulted for series on real effective exchange rates (REER). These were merged onto the master dataset when available. For those countries without an REER in IFS, other sources were consulted. The table below specifies those sources for countries lacking REER in IFS. When a real effective exchange rate series could not be found either in IFS or elsewhere, the authors constructed a REER series on their own. Bilateral real exchange rates for each country's major trading partners were averaged together to compute a series. The final column of the table below details the sources for the information on trading partners necessary to construct an effective real exchange rate series. In cases where it was not possible to obtain trading partner information, a real US dollar/local currency bilateral exchange rate index was substituted. The bilateral exchange rates and price series required to construct the indexes were obtained from IFS and WDI, respectively.

Appendix Table
Sources for countries in the SIDS and DC samples

Country	In SIDS sample	In DC sample	Source for REER or information regarding trading partners
Antigua and Barbuda			
Bahamas, The			
Belize	x	x	IFS
Cape Verde	x	x	UN (for trade partners)
Comoros	x	x	
Cuba			
Dominica			

Appendix Table continues

Appendix Table (con')
Sources for countries in the SIDS and DC samples

Country	In SIDS sample	In DC sample	Source for REER or information regarding trading partners
Dominican Republic	x	x	IFS
Fiji			
Grenada			
Guyana	x	x	IFS
Haiti	x	x	UN (for trade partners)
Jamaica	x	x	IFS
Kiribati	x	x	www.focuseconomics.com.au
Maldives	x	x	UN (for trade partners)
Marshall Islands			
Micronesia, Fed. Sts.			
Mauritius	x	x	UN (for trade partners)
Palau			
Papua New Guinea	x	x	UN (for trade partners)
Samoa	x	x	IFS
Sao Tome and Principe			
Singapore			
St Kitts and Nevis			
St Lucia			
St Vincent and the Grenadines			
Seychelles	x	x	UN (for trade partners)
Solomon Islands	x	x	IFS
Suriname	x	x	UN (for trade partners)
Timor-Leste			
Tonga	x	x	UN (for trade partners)
Trinidad and Tobago	x	x	IFS
Vanuatu	x	x	www.focuseconomics.com.au
Guinea-Bissau			
Barbados	x	x	www.utal.org
Afghanistan			
Albania		x	
Algeria		x	IFS
American Samoa			
Angola		x	
Argentina		x	www.utal.org
Armenia		x	IFS
Azerbaijan		x	UN (for trade partners)
Bangladesh		x	ADB (for trade partners)
Belarus			
Benin		x	UN
Bhutan		x	ADB (for trade partners)
Bolivia		x	IFS
Bosnia and Herzegovina			
Botswana		x	UN (for trade partners)
Brazil		x	www.utal.org
Bulgaria		x	IFS
Burkina Faso		x	UN (for trade partners)
Burundi		x	IFS
Cambodia		x	ADB (for trade partners)
Cameroon		x	IFS
Central African Republic		x	IFS
Chad		x	
Chile		x	IFS
China		x	IFS
Colombia		x	IFS
Congo, Dem. Rep.			

Appendix Table continues

Appendix Table (con')
Sources for countries in the SIDS and DC samples

Country	In SIDS sample	In DC sample	Source for REER or information regarding trading partners
Congo, Rep.		x	
Costa Rica		x	IFS
Cote d'Ivoire		x	IFS
Croatia		x	IFS
Czech Republic			
Djibouti			
Ecuador		x	IFS
Egypt, Arab Rep.		x	
El Salvador		x	www.utal.org
Equatorial Guinea			
Eritrea			
Estonia		x	
Ethiopia		x	UN (for trade partners)
Gabon		x	IFS
Gambia, The		x	IFS
Georgia		x	
Ghana		x	IFS
Guatemala		x	www.utal.org
Guinea		x	IFS
Honduras		x	www.utal.org
Hungary		x	IFS
India		x	
Indonesia		x	
Iran, Islamic Rep.		x	IFS
Iraq			
Jordan		x	
Kazakhstan		x	UN (for trade partners)
Kenya		x	
Korea, Dem. Rep.			
Kyrgyz Republic		x	
Lao PDR		x	
Latvia		x	Eurostat
Lebanon			
Lesotho		x	IFS
Liberia			
Libya			
Lithuania		x	Eurostat
Macedonia, FYR		x	IFS
Madagascar		x	UN (for trade partners)
Malawi		x	IFS
Malaysia		x	IFS
Mali		x	UN (for trade partners)
Mauritania		x	UN (for trade partners)
Mayotte			
Mexico		x	Banco de Mexico
Moldova		x	IFS
Mongolia		x	UN (for trade partners)
Morocco		x	IFS
Mozambique		x	UN (for trade partners)
Myanmar			
Namibia			
Nepal		x	ADB
Nicaragua		x	IFS
Niger		x	UN (for trade partners)
Nigeria		x	IFS

Appendix Table continues

Appendix Table (con')
Sources for countries in the SIDS and DC samples

Country	In SIDS sample	In DC sample	Source for REER or information regarding trading partners
Northern Mariana Islands			
Oman		x	
Pakistan		x	IFS
Panama		x	www.utal.org
Paraguay		x	IFS
Peru		x	www.utal.org
Philippines		x	IFS
Poland		x	IFS
Romania		x	IFS
Russian Federation		x	IFS
Rwanda		x	UN (for trade partners)
Saudi Arabia		x	IFS
Senegal		x	UN (for trade partners)
Serbia and Montenegro			
Sierra Leone		x	IFS
Slovak Republic		x	IFS
Somalia			
South Africa			
Sri Lanka		x	
Sudan		x	
Swaziland			
Syrian Arab Republic		x	
Tajikistan			
Tanzania			
Thailand		x	
Togo		x	IFS
Tunisia		x	IFS
Turkey		x	Eurostat
Turkmenistan			
Uganda		x	IFS
Ukraine			
Uruguay		x	IFS
Uzbekistan			
Venezuela, RB		x	IFS
Vietnam			
West Bank and Gaza			
Yemen, Rep.		x	UN (for trade partners)
Zambia		x	IFS
Zimbabwe		x	UN (for trade partners)

Notes: UN represents *World Statistics Pocketbook*, *Small Island Developing States*, New York: UN (2003) or *World Statistics Pocketbook*, *Least Developed Countries*, New York: UN (2003). These sources were consulted to obtain information on trading partners in order to compute an effective exchange rate index. In addition to trading partner information, we used exchange rate data from IFS and price series from WDI.

IFS: *International Financial Statistics*, International Monetary Fund. If this source is listed, we are using REER as reported/constructed by the IMF.

www.focuseconomics.com.au, Eurostat, www.utal.org, Banco de Mexico are sources for published real exchange rate data.

ADB represents *Key Indicators, Asian Development Bank*, and was used to get trading partner information . http://www.adb.org/Documents/Books/Key_Indicators/2006/default.asp