

**KEYWORDS**

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# The impact of remittances on macroeconomic stability: the cases of Mexico and Central America

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**T**he present study uses the monetary approach to the balance of payments and a macroeconomic model of the Mundell-Fleming type to analyse the effects of family remittances on economic growth in Mexico and the countries making up the Central America region. The methodology employed is based on the application of a panel data model to quarterly balance-of-payments series for the 1990-2005 period. The study findings suggest that the repercussions of inward remittances are different in each country and depend on monetary policy. The econometric estimates also indicate that, when an upsurge in remittances occurs, its contribution to economic growth is smaller in countries where remittances tend to produce an overvalued exchange rate, reinforcing macroeconomic stability in the context of an open economy.

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# I

## Analytical framework

Remittances represent a capital inflow whose contribution to economic growth in the countries depends on how they align with other macroeconomic variables driving the autonomous factors of aggregate demand. As with any type of outside capital, there are a variety of mechanisms available for channelling these resources towards growth, and it is upon the interaction of these, i.e., upon economic policy, that their economic effects will depend.

Remittances are recorded in the transfers sub-account of the balance-of-payments current account. The balance of the latter is a consolidation of the trade balance (including the transfers sub-account) and the capital account, and this goes to make up international reserves.

When the balance-of-payments model is followed, analysis of the relationship between remittances and economic growth is limited to two aspects: the link between remittances and the exchange rate, and the relationship between remittances and international reserves, the money supply and domestic credit.

There is no one factor in this set of variables that can be pointed to, hypothetically and theoretically, as a driver of economic growth. In an open economy with free capital movement, the exchange rate acts as a regulator of external competitiveness and thus has a direct link to net exports. In an equilibrium situation, these rise or fall depending on the behaviour of economic activity, since imports depend on the level of output. Thus, exchange-rate appreciation may lead to a drop in exports because the country loses external competitiveness, but the decline in output causes imports to fall, re-establishing the earlier level of net exports.

It is possible that remittance inflows may lead to an autonomous increase in aggregate demand. As is explained later on, however, standard macroeconomic theory states that it is only in closed economy conditions that higher demand can lead to economic growth via the multiplier effect. In an open economy, the autonomous shift in demand may lead to higher interest rates, counteracting or reducing its expansionary effects on economic growth.

### 1. Objectives of the study

The present study analyses the effects of family remittances on economic growth in Mexico and the

countries making up the Central America region, where they have increased dynamically over the past decade because of the steady emigration of workers, particularly to the United States.

The working hypothesis we seek to demonstrate is that the effects of remittance income in these countries differ depending on the size and economic importance of currency inflows of this type and on the monetary policy regime followed in each. It is also argued that these repercussions are highly sensitive to monetary and exchange-rate policy because of the mechanisms whereby nominal variables are transmitted to the real sector of the economy.

The starting point is that remittances have made a major contribution to the balance-of-payments current account, helping to mitigate or remove external constraints on economic growth as postulated by structuralist theory, even if this improvement has not translated into greater economic dynamism. External constraints on growth are a subject from the Keynesian tradition, which attributes a pivotal role in economic activity to effective demand. The main constraint on the growth of any economy at an intermediate level of development is the trade deficit, which post-Keynesian studies treat as structural in character (Loría, 2001). According to the structuralist approach derived from the works of Prebisch (1949), Myrdal (1957) and Pinto (1991), among others, the currency balance limits economic growth by provoking recurrent balance-of-payments crises. The empirical demonstration of this regularity is what has come to be called Thirlwall's Law, which relates to external constraints on growth in developing countries. Moreno-Brid and Pérez (1999) discuss these constraints in the case of the Central American countries.

### 2. An income determination model covering trade in goods, market equilibrium and the balance of payments

The present study is based on a simple model of aggregate demand encompassing trade in goods, market equilibrium and the balance of payments. The behaviour of external trade is framed by the IS/LM model, with a given price level and elastic supply; later on the assumption of fixed prices can be removed without the model terms changing much.

As in any open economy, some domestic production is sold abroad and some consumer spending goes on imports. Consequently, domestic output depends on the proportion of consumer spending taken by domestically produced goods plus the export demand generated by external markets.

Spending by residents abroad is:

$$A \equiv C + I + G \quad (1)$$

where consumption is  $C$ , investment  $I$ , public spending  $G$  and spending on domestically produced goods

$$A + XN = (C + I + G) + X - Q = (C + I + G) + XN \quad (2)$$

where  $X$  represents the level of exports,  $Q$  the level of imports and  $XN$  the surplus of the goods and services trade balance.

It is assumed that domestic spending depends on interest rate  $i$  and income  $Y$ , so that  $A = A(i, Y)$ , and that export demand is given by  $\bar{X}$  and import demand depends only on income, so that  $Q = Q(Y)$ .

If income increases, some goes on imports and the rest is spent on domestic goods or saved. Thus, the trade balance is:

$$XN \equiv X - Q = \bar{X} - Q(Y) \quad (3)$$

Given these assumptions, the trade balance is only a function of the income level, so that if it is in equilibrium, a further rise in income will lead to a trade deficit.

If prices and the exchange rate are kept constant and the open economy model is limited to trade in goods, the trade balance will depend only on the given level of exports and the level of income.

$$XN = XN(Y, \bar{X}, \dots) \quad (4)$$

Equilibrium is attained in the market for goods when the quantity produced matches demand and output is equal to income, which is given by:

$$Y = A(Y, i) + XN(Y, \bar{X}) \quad (5)$$

Any autonomous increase in spending ought to lead to an increase in equilibrium income and output. But when income increases, the trade balance will deteriorate because imports grow in line with income.

Now, let us assume that exports and thus domestic income increase. This further increase in income will raise imports once again, making the trade balance uncertain. It is possible to predict that the result will be an improvement, since the increase in imports will offset the rise in the trade surplus, but not cancel it out completely.

According to the monetary approach to the balance of payments, international reserves constitute the balance of the monetary authority (the central bank), which uses them to expand or contract the monetary base ( $B$ ) or domestic credit ( $DC$ ), in accordance with the following equation:

$$\Delta AFN = \Delta B - \Delta DC \quad (6)$$

International reserves are represented here as the variation in foreign assets ( $FN$ ). The monetary base directly affects the interest rate, and domestic credit can be used to finance the public-sector deficit or for private lending. The effects on economic growth, in whatever proportion net external assets are allocated, will depend on the use they are put to. If the public-sector deficit is due to excessive public spending, it is possible that they may have fewer repercussions on economic growth if this spending is not applied to the production of goods and services and that the rise in the deficit may ultimately drive up prices because of the expanding money supply. At the same time, the growth effects of higher spending driven by private credit that is underpinned by a large build-up of net foreign assets will depend on whether private lending is used to make viable productive investments that have a high impact on productivity and employment or to support private consumption growth. If this were the case, the repercussions on economic growth could be expected to be modest if consumption were oriented towards domestic goods and smaller still if it were oriented towards imports.

The goal of macroeconomic stability implies that the balance of payments must be compatible with monetary policy and domestic credit growth. If it is, the external account balance is coordinated with the amount of money in circulation (i.e., the monetary base) and the fiscal discipline needed to achieve stable economic growth.

### 3. The balance of payments

Family remittances are recorded in the transfers section of the balance-of-payments current account.

Although this includes transfers of other kinds, such as pensions paid in other countries to people resident in Mexico, the importance of remittances has increased in recent years: from 79.6% of all transfers received in 1980, their share rose to 97% in 2004.

A necessary step towards clarifying the role of remittances in economic growth is to understand the function they perform in the countries' monetary circuit. Being unilateral transfers from abroad, remittances form part of national income, but not of national product. In a closed economy, it is easy to understand that the latter is equivalent to the former, but this equivalence does not hold in an open economy that receives unilateral transfers from other countries.

Let us consider three sub-accounts of the current account: the trade balance, consisting of exports ( $X$ ) minus imports ( $M$ ), the factor services balance ( $Fs^{mi}$ ) and the transfers balance ( $T^{mi}$ ). Whether the current account is in deficit or surplus will then depend on the debit or credit position of these sub-accounts:

$$C_i = (X - M) - (Fs_i^{im} - Fs_i^i) - (T_i^{im} - T_i^i) \quad (7)$$

## II

### Remittances and economic growth

The economic stagnation of the Central America region over recent decades has led to a prolonged period of temporary, transitory and sometimes permanent emigration, as a result of which family transfers or remittances recorded in the balance of payments have grown exponentially. Countries whose economic growth since the 1980s has been low or unstable, such as El Salvador, Guatemala, Honduras, Mexico and Nicaragua, have experienced an explosive increase in inward remittances. Conversely, those like Belize, Costa Rica and Panama that have seen more stable economic growth have recorded only a moderate rise in remittances (table 1).

In Mexico, for example, the amount of remittances sent by emigrants doubled in the decade from the early 1980s to the early 1990s. The same happened in other countries such as Costa Rica, from a substantially lower starting point, but growth was even greater in the remaining Central American countries. A decade on, from the early 1990s to the early 2000s, the growth in

To balance its current account, a remittance-receiving country that records a trade deficit and a factor services deficit will depend on transfers from abroad. If we make  $Td = (X - M)$ , when  $M > X$ , and if we have  $DFs = (Fs_{rm}^i - Fs_{rm}^m)$ , when  $Fs_{rm}^m > Fs_{rm}^i$ , then:

$$CA = Td + DFs + T \quad (8)$$

Whether the current account is in deficit or surplus will depend solely on the amount of transfers. Since these are composed primarily of remittances, when the trade and factor balances are in deficit the deficit or surplus of the balance-of-payments current account will depend on the remittance flows entering the country.

The balance-of-payments current account reflects variations in a particular country's consolidated external wealth. A current-account deficit can only be sustained by receiving external loans, as it means that the country concerned is obtaining more goods than it produces; conversely, a position of surplus means that the country is financing other countries, as it is not using up the whole of its domestic production.

remittances became explosive. From this evidence, it is possible to establish a link between migration due to the closing off of opportunities resulting from the region's low economic growth<sup>1</sup> and the volume of remittances to family members. As Desruelle and Schipke (2007) recognize, the Central America region has now made substantial progress with macroeconomic stability and with the globalization and regional integration

<sup>1</sup> According to data from the International Monetary Fund (IMF), Belize was the region's best-performing economy in the 1980-2005 period, followed by Panama and Costa Rica, which averaged growth of 3.5% over the period. The results for the other countries in the area were poorer, with Guatemala and Mexico averaging the lowest growth (2.5%). Where per capita output is concerned, however, taking the average from the first half of the 1980s to the first half of the 2000s, only three of these countries succeeded in trebling it (Costa Rica, Belize and Mexico). Other than El Salvador, where per capita output was 2.5 times as great as in the 1980s, all the remaining countries showed signs of economic stagnation. In Honduras, for example, per capita GDP in the early part of the 2000s was just 32% of its early 1980s level.

TABLE 1

**Mexico and Central America: average transfers, 1980-2005**  
(Millions of constant dollars, 2000)

Years	Mexico	Costa Rica	Nicaragua	Honduras	Guatemala	El Salvador	Panama	Belize
1980-1985	1 989.0	70.7	–	8.1	10.0	220.9	143.1	33.7
1986-1990	3 204.8	156.7	10.3	30.4	61.8	494.6	183.9	32.8
1991-1995	3 984.8	173.9	71.1	74.7	264.8	1 162.0	224.8	35.9
1996-2000	6 002.4	202.6	283.7	332.4	656.5	1 563.2	197.9	44.2
2000-2005	13 176.1	329.7	694.8	1 504.9	2 936.0	2 284.1	290.7	54.9
<b>Gross domestic product</b>								
<i>(Millions of each country's monetary unit)</i>								
1980-1985	3 451 158.7	2 269 550.6	–	52 388.5	88 936.1	52 229.6	6 575.2	527.8
1986-1990	3 632 688.9	2 727 762.5	–	61 278.1	93 410.6	54 850.0	6 734.1	827.3
1991-1995	4 256 032.6	3 492 780.6	36 663.4	72 663.0	113 264.7	85 252.3	8 464.3	1 189.0
1996-2000	4 953 020.5	4 443 204.4	45 513.4	84 721.8	138 601.4	108 371.6	10 697.9	1 412.1
2000-2005	5 696 519.7	5 436 267.2	54 062.7	98 481.4	160 797.6	121 411.9	12 369.2	1 909.8

Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

process. However, the challenge of raising growth to reduce poverty and vulnerabilities, particularly those associated with the integration process, still remains. Other than Costa Rica, the Central American countries have yet to surpass the per capita output levels of the 1970s. If we treat low economic growth and general impoverishment as determinants of migration, then remittance growth can be attributed primarily to family ties in the form of mutual caring, as described by Johnson and Whitelaw (1974) and Lucas and Stark (1985), a precept established in studies of remittance economics even before the new economics of labour migration arose.

Although a number of studies have touched on the countercyclical character of remittances (Chami, Fullenkamp and Jahjah, 2005; World Bank, 2006), in order to establish the specific situation of the countries in the central part of the American continent, table 2 shows the relationship between the problem of emigration and the transfer of money to families in the home country and the economic behaviour of the latter. The expansion of remittances is linked to cycles of low growth or economic crisis. In Mexico, for example, annual remittance growth averaged 21.7% in the 1986-1990 period after the economy had grown by an average of 1.9% a year in the early part of the 1980s; in 1996-2000, remittance growth was 12.75% following a period in which economic growth had averaged 0.9% in the wake of the near-6% decline in output experienced in 1995.

A similar situation was seen in Costa Rica in the second half of the 1980s following the economic decline

of the first half, and the same happened in Nicaragua in the 1996-2000 period. In Honduras, low economic growth has led to a steady rise in remittances, while in Guatemala they increased by an annual average of 47.1% in the second part of the 1980s, following negative GDP growth of –1.1% in the 1985-1990 period. El Salvador presents a fluctuating pattern of high and low remittances, but Panama and Belize do not seem to fit this pattern of economic stagnation followed by rising remittances.

In Central America and Mexico, there is a clear relationship between declining per capita output and rising remittances.<sup>2</sup> Table 3 shows the annual change in remittances, per capita output and GDP in the countries studied. Looking at what has happened with per capita output, we can understand why emigration and remittances have behaved as they have. Per capita GDP in Mexico fell between 1980 and 1995, for example, as GDP growth averaged less than 2% a year while the population grew more quickly than that.

As a result of this general impoverishment, remittances increased by 13 times as much as per capita output. Mexico is obviously an emblematic case here, but if we look at the multiplication of

<sup>2</sup> Applying tests of this correlation to the series referred to did not, however, yield significant results concerning the possible link between GDP growth and migrants' remittances. This can be explained by the fact that emigration and the ensuing transfer of money back to family members left behind in the home country are variables that lag economic dynamism.

TABLE 2

**Mexico and Central America: average annual rates of inward remittance and gross domestic product growth**  
(Percentages)

Country		1980-1985	1986-1990	1991-1995	1996-2000	2000-2005
Mexico	Transfers	12.2	21.7	7.3	12.7	21.1
	GDP	1.9	3.1	0.9	6.9	1.8
Costa Rica	Transfers	8.2	7.6	5.8	3.3	15.4
	GDP	0.3	4.4	6.3	6.2	4.1
Nicaragua	Transfers	–	–	5.1	44.9	18.3
	GDP	–	–	2.3	6.3	3.1
Honduras	Transfers	13.1	32.3	27.9	53.6	29.4
	GDP	1.7	3.7	3.6	3.8	3.6
Guatemala	Transfers	-27.9	47.1	26.3	24.3	38.3
	GDP	-1.1	3.6	4.4	5.0	2.5
El Salvador	Transfers	22.3	16.1	19.4	4.9	7.3
	GDP	-1.9	2.2	9.2	3.8	1.8
Panama	Transfers	15.4	9.6	-7.5	2.8	8.7
	GDP	3.4	-1.7	5.7	5.8	3.6
Belize	Transfers	–	-1.0	7.7	10.1	-100.0
	GDP	–	14.8	3.8	7.6	5.8

Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

TABLE 3

**Mexico and Central America: relationship between transfers, per capita GDP and total GDP, 1980-2005**  
(Average annual percentage changes)

Year	Mexico	Costa Rica	Nicaragua	Honduras	Guatemala	El Salvador	Panama	Belize
Per capita transfers								
1980-1985	10.7	5.6	–	10.2	-34.0	34.4	13.0	17.6
1986-1990	11.3	9.6	–	17.8	77.4	18.1	8.7	-4.9
1991-1995	-2.4	1.9	150.7	4.4	14.4	16.6	-7.9	2.9
1996-2000	8.4	0.3	34.9	24.9	8.2	2.2	0.4	6.7
2000-2005	19.8	13.7	16.0	17.5	29.0	6.2	7.4	-4.2
1980-2005	9.6	6.2	67.2	15.0	19.0	15.5	4.2	1.2
Per capita gross domestic product								
1980-1985	-0.24	-2.34	–	-1.43	-3.51	-2.53	1.29	-0.86
1986-1990	-0.22	1.88	–	0.08	0.59	0.48	-2.42	10.46
1991-1995	-0.27	2.95	-0.17	0.62	1.93	9.36	4.29	0.68
1996-2000	3.82	2.43	2.91	0.36	1.62	0.97	2.59	3.49
2000-2005	0.47	2.10	1.01	1.23	0.08	-0.08	1.75	3.50
1980-2005	0.7	1.4	1.3	0.2	0.1	1.6	1.5	3.5
Gross domestic product								
1980-1985	2.0	0.4	–	1.8	-1.1	-1.8	3.5	1.7
1986-1990	1.8	4.6	–	3.2	2.9	1.9	-0.4	13.4
1991-1995	1.6	5.5	2.3	-0.2	4.3	11.6	6.4	3.6
1996-2000	5.5	5.0	5.0	2.9	4.0	3.1	4.6	6.1
2000-2005	1.8	4.1	3.1	1.0	2.5	1.8	3.6	5.8
1980-2005	2.6	3.9	3.6	3.0	2.5	3.3	3.6	6.1

Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

remittances and the growth of per capita GDP in the other countries over the 1980-2005 period, there is a marked disproportion between the two variables: remittances increased by 49 times as much as per capita output in Nicaragua, 134 times in Guatemala and 87 times in Honduras. Figure 1 shows the relationship between the multiplication of remittances and the rise in per capita output.

The ratio between annual remittance growth and GDP is presented in the charts of diagram 1, where we can see once again that poor economic performance leads to higher remittances. When this situation is reversed, remittances stabilize or decline.

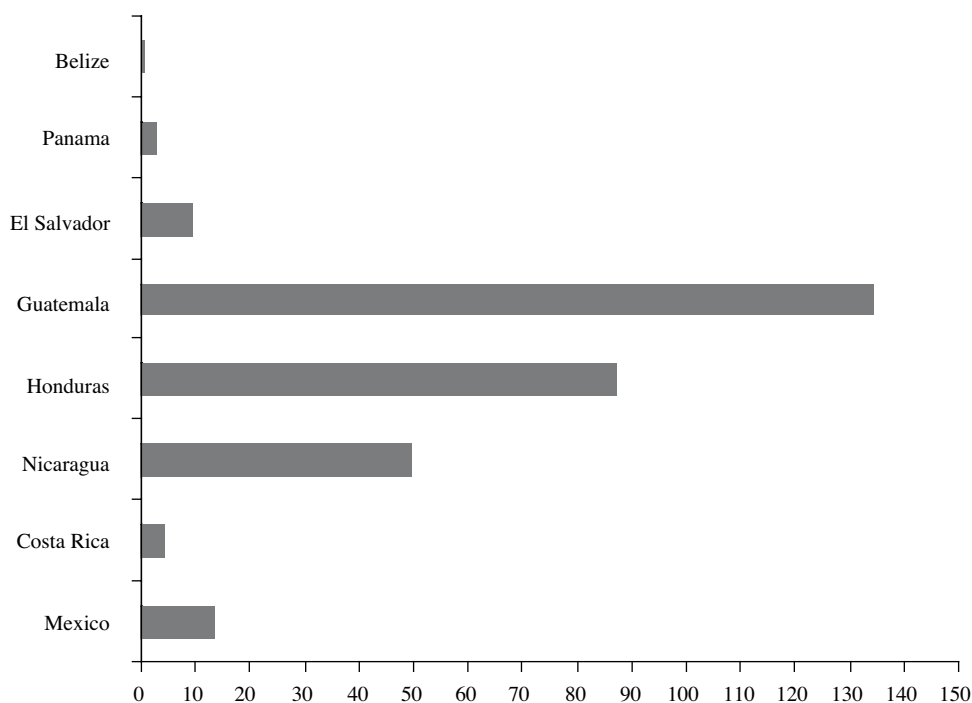
This happened in Mexico in the early 1980s and again in 1985, causing remittances to rise in the following years; also in Costa Rica in the 1980s,

although the volume of remittances later stabilized thanks to the country's good economic performance, and in Nicaragua, where the costs of a war economy and the ensuing instability led to an enormous rise in remittances. The situation of Honduras better illustrates the inverse relationship in the oscillatory behaviour of the two variables, as does that of Guatemala and El Salvador. The 1988 crisis in Panama led to a rise in remittances in 1990, while the economic difficulties of the mid-1990s in Belize spurred remittance growth in 2000.

Over all the countries analysed, remittance growth averaged 21.7% a year in the 1980-2005 period and the median was lower than this (10.9%), indicating rapid expansion, while GDP growth averaged 3.55%, with a median close to the mean (3.59%).

FIGURE 1

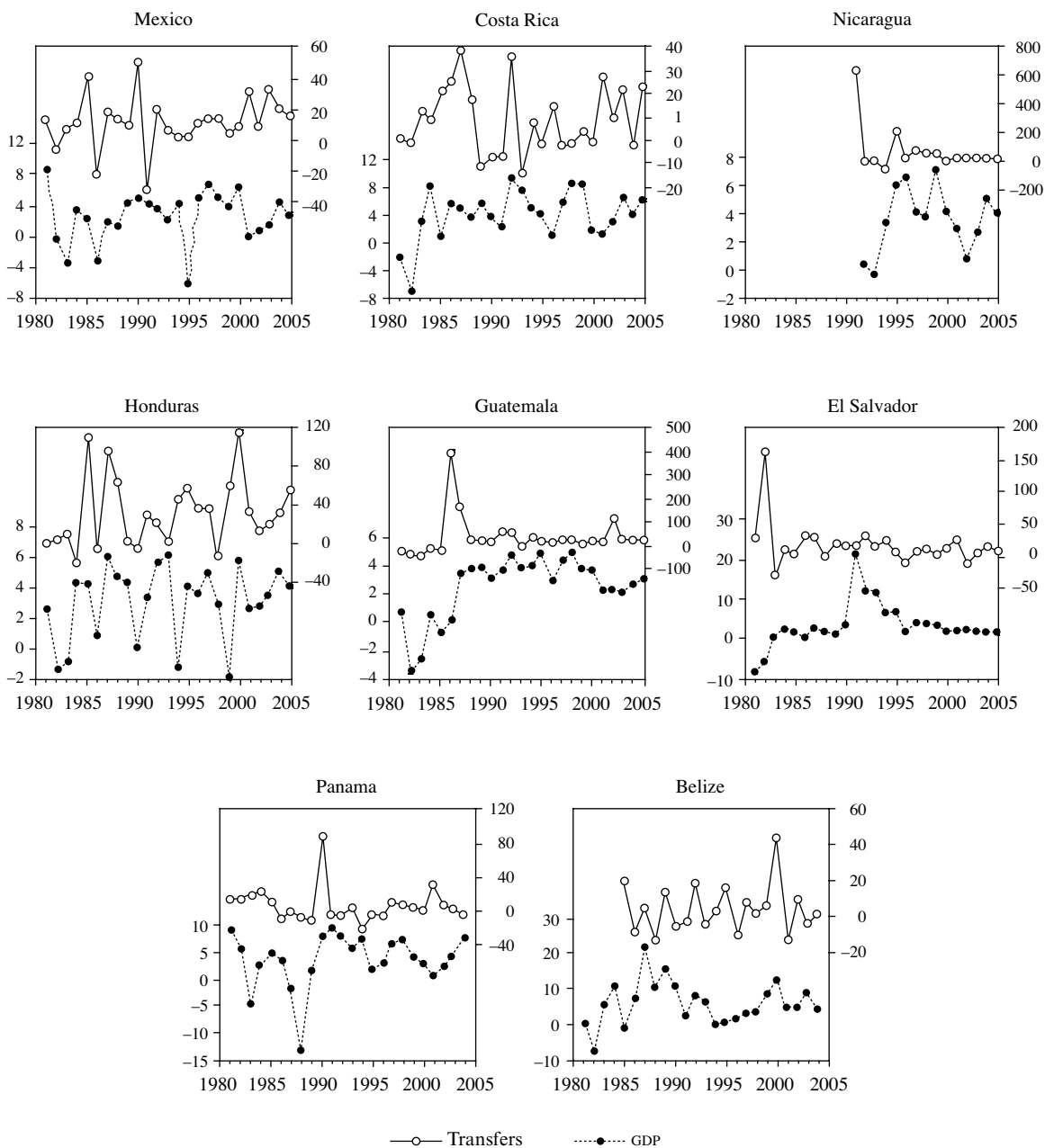
**Mexico and Central America: ratio between annual per capita remittance growth and per capita GDP, 1980-2005**



Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

DIAGRAM 1

**Mexico and Central America: relationship between GDP growth and transfer growth, 1980-2005**  
(Percentages)



Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.



### III

## Remittances and the exchange rate

Just as low economic growth has stimulated migration in Mexico and the countries of the Central America region, many recent studies have shown that family remittances do not seem to be promoting short- and medium-term economic growth, considering that one of their effects arises in the currency market, where they are associated with exchange-rate appreciation and thus with lost competitiveness and trade deficits in recipient countries.

To analyse this aspect, we used the real terms of trade (RTT), representing the exchange rate ( $e$ ) weighted by the price ratio between each country ( $i$ ) and its main trading partner ( $i^*$ ), in this case the United States, in each year of the period studied ( $t$ ).

$$RTT = e \left( \frac{p_{i^*t}}{p_{it}} \right) \quad (9)$$

The real terms of trade depreciate when the exchange rate does so because of a devaluation, for example, or when relative prices in the country concerned increase and the exchange rate remains stable. Conversely, they appreciate when the exchange rate does so and relative prices do not restore it to parity with its equilibrium level. In the first case, the country's competitiveness increases because its exports become cheaper abroad, while in the second case it declines because exports become dearer and imports become cheaper in the domestic market (Dornbusch, 1980; Krugman and Obstfeld, 2005).

The results are presented in diagram 2, which shows each country's real terms of trade on the left-hand vertical axis of the charts and the annual remittances total on the right-hand vertical axis, in thousands of constant 2000 dollars.

It can be observed that the real terms of trade tend to appreciate in countries where remittance

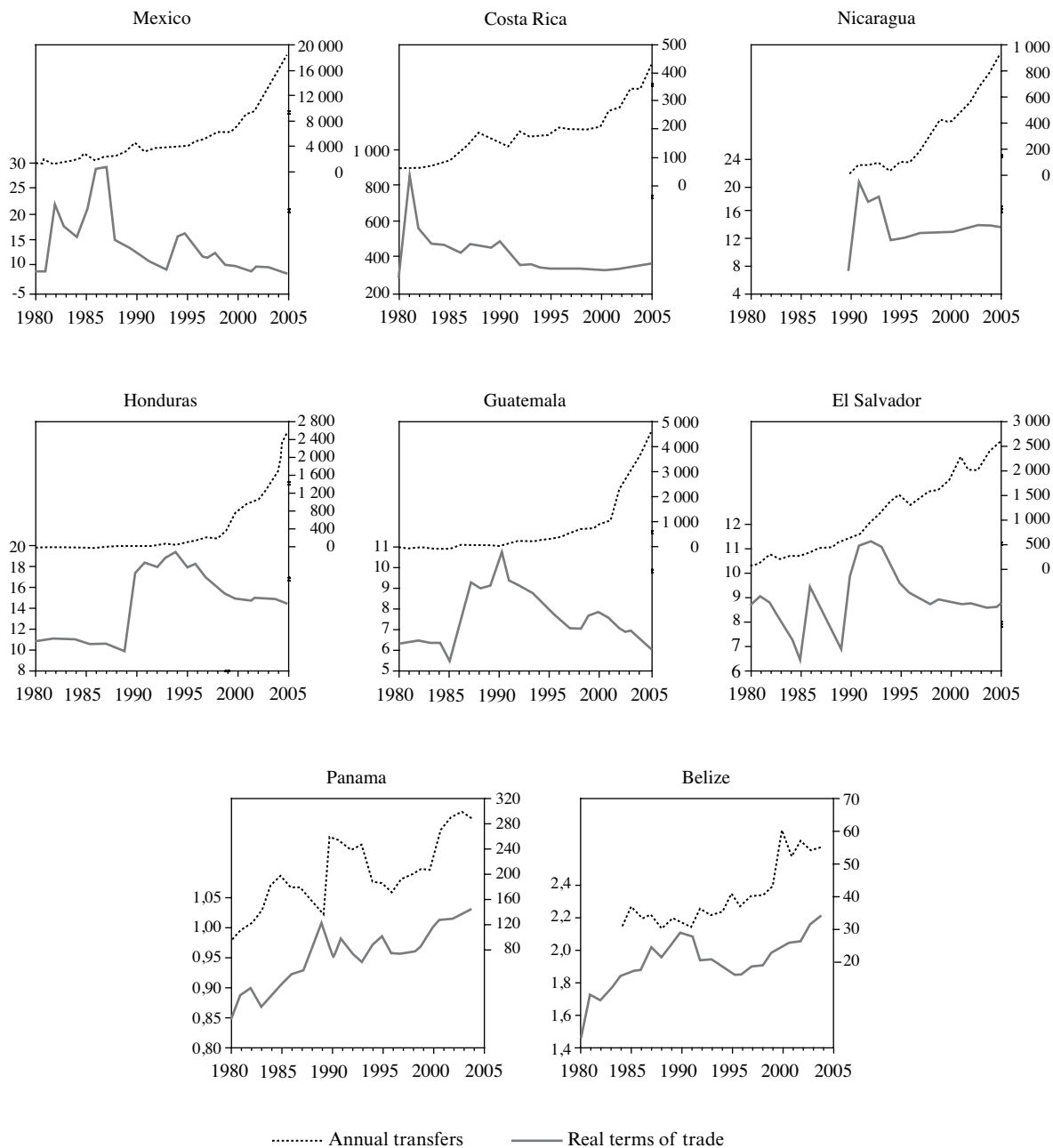
income rises strongly, leading to a loss of international competitiveness. This can be seen most clearly in the cases of Mexico, Honduras, Guatemala and El Salvador. The contrast between countries in receipt of substantial volumes of remittances and others such as Panama and Belize, where the remittance figures are measured dynamically or as a share of GDP, shows their effects on the behaviour of the exchange rate. In Panama and Belize, remittance inflows do not affect the exchange rate because their economies are tied to the dollar and have restricted monetary sovereignty.<sup>3</sup>

A given country's nominal exchange rate is adjusted for its real terms of trade by considering the price ratio between it and another country of reference in a particular base year (the year taken for this analysis is 2000). The result depends not just on the exchange-rate regime, whose main element will be the currency market when a policy of free flotation is followed, but also on the determinants of inflation which, supply or demand shocks aside, will be essentially monetary and nominal. This means that the real terms of trade will depend on the determinants of the money supply, including the fiscal policy of the country concerned (particularly the public-sector deficit), the domestic interest rate and the relationship between this and the international interest rate, which have not been incorporated into the present study. To sum up, the aim is not to show that there is a deterministic link between the terms of trade and cash remittances, since the former are influenced by a range of factors omitted from the analysis; nonetheless, the relationship between these variables is divergent in the medium term.

<sup>3</sup> Panama has a completely dollarized economy, with no central bank; it has its own coinage and unrestricted circulation of the dollar. Belize uses the Belize dollar, with an exchange rate of 2 to 1 against the United States dollar.

DIAGRAM 2

**Mexico and Central America: real terms of trade and annual transfers, 1980-2005**  
 (Constant 2000 dollars)



Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

## IV

### Methodology

For the panel data analysis, we used a functional form incorporating the equations of the macroeconomic model employed in the earlier sections, expressed as follows:

$$e = \beta_0 i + \beta_1 T_{ct} + \beta_2 Y_{ct} + \beta_3 i_{ct} + \beta_4 I + \beta_5 \chi + \mu_{ct} \quad (10)$$

For  $c = 1, 2, 3, \dots, 8$  and  $t = 1, 2, 3, \dots, 26$  where  $e$  is a given country's exchange rate, which is dependent upon or related to  $T$ , representing remittances or monetary transfers in the balance of payments of country  $c$  in period  $t$ ;  $Y$  is gross domestic product,  $i$  the difference between each country's interest rate and that of the United States,  $I$  foreign direct investment and  $\chi$  net exports or the difference between exports and imports.

The purpose of this model is to establish the main forces of supply and demand influencing the countries' currency markets. Remittance income is a flow of currency that increases the supply of dollars in the currency market and thus contributes to local currency appreciation. It is assumed that GDP does not have a specific relationship with the exchange rate, as the economic dynamic alters the latter's equilibrium level. It is also assumed that interest rate differentials in an open economy with free capital movement influence currency inflows and outflows, likewise affecting the exchange rate and exports. Foreign direct and portfolio investment also influence the currency market, the former because it increases the supply of currency and thus tends to cause exchange-rate appreciation, the latter because its greater volatility makes the exchange rate more unstable. Lastly, the trade balance represents a currency balance, as exports presumably bring foreign currency into the foreign exchange market and imports entail a demand for currency in the local market among producers and importers.

The estimates were obtained using a dynamic panel data model. The fixed effects regression method was used, on the assumption that the intersection of the different countries varies since exchange rates differ between themselves. The model also assumes that the

slope coefficient is constant in all the countries analysed. It is here that the model seeks to capture the effect of remittances on the exchange rate and the fact that, in simplified form, it is common to all the countries. It is also assumed that while the intersection may change in each country, it is invariable over time.

The functional form taken by the macroeconomic model presented earlier will now be described:

$$RTT = RTT_{ct}(-1) + Tr_{ct} + Tr_{ct}(-1) + ii_{ct} + tb_{ct} + \varepsilon_{ct} \quad (11)$$

For  $t = 1990, \dots, 2005$  and  $c = 1, \dots, 8$

The exchange rate is presented as the real terms of trade, corresponding to the exchange rate of country  $c$  adjusted by that country's price ratio vis-à-vis the United States and calculated from its lagged value ( $RTT(-1)$ ), remittances recorded in the balance of payments as transfers ( $Tr$ ) and  $Tr(-1)$  with a lagged value, the difference between each country's interest rate and that of the United States ( $ii$ ), the trade balance ( $tb$ ) calculated as exports minus imports and, lastly, an error term.

The monetary approach to the balance of payments is used and, with the help of a Mundell-Fleming type macroeconomic model, the methodology we follow is based upon a panel data model applied to the time series of the variables forming part of the balance of payments and other macroeconomic variables for the period between 1980 and 2005. The advantage of the monetary approach to the balance of payments is that it allows internal imbalances to be analysed using nominal variables of economic activity, but without restricting or assuming any particular behaviour in the other macroeconomic variables, such as the employment level. There are certainly no grounds for assuming full utilization of productive resources in the Central American economies or Mexico, particularly in an article analysing the problem of international labour migration driven principally by lack of jobs, concealed unemployment and the informal economy.

The balance-of-payments series of the International Monetary Fund (IMF) were used for this study.

## V

## Results of the estimates

We shall first present the estimates obtained for the exchange-rate determination model, using a panel data model estimated by means of ordinary least squares and a two-stage panel data model with instrumental variables. The two alternatives are shown in annex 1. As was to be expected, the dependent variable proved to be of low statistical significance, as it presented a high coefficient of determination and signs of correlation between the residuals, a characteristic of models in which mutually determining variables are combined, as in the particular case of the relationship between the interest rate and the trade balance and exchange rate. The most important feature of this estimate is the negative relationship between remittances and the exchange rate: the first arrangement shows that the percentage variation in remittances affects over 6% of the appreciation in the terms of trade, although this effect disappears when remittances are considered with an annual lag. In the second alternative, the lagged variable also has a negative effect on the real exchange rate, although it is possible that this might be due to the higher weighting of the lagged variables. In both estimates, however, the remittances variable maintains a negative relationship with the dependent variable, although this determination is of low statistical significance.

The preliminary findings indicate that in countries with large inflows of remittances, there is a positive relationship between these and the deterioration in the terms of trade, which are used as an indicator of the real exchange rate. Another convergent condition in this analysis is that countries displaying these results are characterized by having a flexible exchange-rate regime, allowing the exchange rate to adjust instantly to any sudden increase in the supply of dollars.

Confirming the results expected, neither GDP nor net export coefficients were significant. Conversely, the difference between the local interest rate and that prevailing in international markets proved highly significant for the evolution of the real exchange rate in the countries analysed, as did total foreign investment. The fragility of financial markets (particularly in Belize, El Salvador, Guatemala and Honduras) and the frequent appearance of negative real interest rates because of weak control over inflationary

pressures produce contrasting results as regards the true coefficient of determination of the exchange rate. However, countries whose economies are closely linked to the dollar, such as Belize and Panama, appear to be armoured against the effects of remittances on the exchange rate. It would thus seem that the outcomes of the two conditions, i.e., a flexible exchange-rate regime and a fixed exchange rate against the dollar, are decisive when it comes to isolating the repercussions of remittances on export behaviour.

The effects of remittances on each country's exchange rates do not become apparent immediately, since currency transactions take time to work their way through. This delay between the arrival of currency remittances and their effects on the exchange rate varies depending on the exchange-rate regime and the solidity of monetary sovereignty in the country concerned. For example, it is possible that in countries where the United States dollar normally circulates, such as Belize, El Salvador and Panama, currency inflows of this type may swell the volume of money in circulation rather than directly affecting the exchange rate. In countries like Mexico where the circulation of foreign currency is very restricted, however, dollars remitted by migrants will be absorbed more immediately and will enter the currency supply once they have completed the journey from the foreign exchange bureaux and commercial banks to the central bank. In all likelihood, the situation in the other Central American countries varies between the two extremes.

This is why a lag in the effects of remittances on the exchange rate was considered. Now, however many regressors are used, models of this type are hard to specify properly because, like many nominal variables, the current exchange rate depends on its level in the previous period. In other words, it is an autoregressive variable. The model to be estimated is thus a dynamic panel data model, since it includes a distribution of lags for the delayed-effect remittances variable  $Tr(-1)$ , but is also an autoregressive model because it includes the dependent variable itself, lagged one period, as an explanatory variable.

First of all, the model was estimated using an ordinary least squares method for panel data with White cross-section standard errors and covariance,

thus avoiding potential problems of heteroskedasticity in the cross-sectional dimension of the model (see annex 1, column (a)).

The results are not very consistent, but the differences can be minimized by taking only the Central American countries, despite the wide disparities between some economies like those of Costa Rica and Belize. In any event, the differences between this group of countries and Mexico are enormous, beginning with population size.

According to these results, the exchange rate does in fact have an autoregressive bias, in the sense that the current value relates positively to that of the previous year, and remittances have a negative effect on the exchange rate, although the coefficient has a statistical significance level of 90%. A year later, remittance inflows continue to act negatively on the exchange rate, although with a still lesser statistical significance, and their lagged value is within the margin of rejection. The annual percentage change in remittances negatively affects the exchange rate.

As for the difference between local interest rates and that of the United States, the exchange rate showed a positive and significant pattern of behaviour, although it must be realized that when measured by the real terms of trade it includes the United States price index, which is positively related to interest rates. The trade balance, meanwhile, does not seem to have a significant link with the real terms of trade, something that may be due to the gap between the surplus or deficit position of the trade balance and the real terms of trade, for which it is not possible to establish an immediate causal relationship. In other words, it is possible that situations of balanced trade and those of surplus or small, temporary deficits may both be compatible with an appreciation of the real terms of trade, depending on the price relationship between each country and the United States. The results are presented in annex 1, column (b).

This specification was also supplemented by a sensitivity analysis, involving estimation of a two-stage ordinary least squares model to take account of the effect of the time factor in determining the exchange rate. It is possible that this might vary over time because of historical events or circumstances that may affect its evolution, such as supply or demand shocks, runs on the currency, inflationary spikes, devaluations and so on, which have occurred in all the countries analysed over the past decade.

When the time aspect is taken into account, the effects of remittances on the exchange-rate parity

become less significant, but still continue to operate as a factor for exchange-rate appreciation. Likewise, incorporating the time aspect resulted in a diminution of the serial correlation presented by the model prior to this change.

Nonetheless, the remittances coefficient is not significant, being in fact unlikely to differ from zero. Conversely, the Durbin-Watson (DW) statistic is higher and  $R^2$  lower than in the other alternative. Although this finding is less consistent than the previous one, it does illustrate the difficulty of assessing the structural importance of a variable, remittances, that has a temporary character as compared to other determinants of the exchange rate with a markedly structural component. What this finding does not reveal, quite apart from its degree of significance, is that while remittances may be a factor in exchange-rate appreciation in the countries studied, they are not responsible for macroeconomic instability or the recurrent crises that have arisen in the past 15 years. What these indicate is that, together with other concurrent factors, a permanently appreciated exchange rate will lead at some point to severe economic difficulties.

Lastly, after analysing the inconsistencies in the parameters that prevented us from reaching a more robust conclusion, we decided to reformulate the model and directly link the real terms of trade (autoregressively again) to the remittances variable, this time taking the logarithmic first difference of all the variables and the 2000-2005 subperiod, when remittances grew most rapidly, or at least were most reliably recorded. We used logarithms for all the variables to calculate elasticities. As well as estimating the fixed effects in the cross-sections (i.e., in each of the countries) to assess their reaction to the general parameter obtained, we differentiated the equations in time to eliminate the unobservable effect on the real terms of trade. This allowed us to form an appreciation of events such as sudden exchange-rate shocks, alterations in relative price levels and so on that might be influencing the variation in the real terms of trade. The findings are shown in annex 2, column (a).

In summary, taking the group of dummy variables for each country (cross-section) and a set period (years) made it possible to control for national trends in exchange-rate variations and for the passage of time.

By using dummies to evaluate the specific results for the different countries, it was possible to differentiate the fundamental conclusions of the estimation. Remittances were found to have a significant

influence on exchange-rate appreciation in countries receiving large volumes of them, such as Mexico, Guatemala and El Salvador. However, in those that have a long tradition of migration, receive a smaller proportion of family transfers and, most importantly, have exchange rates tied to the dollar (principally Belize, Costa Rica and Panama, and to a lesser extent Honduras and Nicaragua), remittances appear to have less influence on exchange-rate appreciation and may even have no effect at all, particularly in the first three countries. This conclusion, which seems obvious, tends to reaffirm the validity of the hypothesis with which the present investigation began and indicates that labour migration and remittances to families have become increasingly important as determinants of the currency market in these countries. As will now be seen, the effects can vary depending on the exchange-rate regime adopted in each.

Given that the series is positive to the White test for heteroskedasticity, the model was estimated once again to correct for standard errors and covariance. The result was an increase in the confidence interval of the remittances coefficient, with the same value being retained for the regressor controlled for. This confirmed the previously estimated magnitude of the influence of remittances on the real exchange rate, but this time with a 95% confidence interval, reaffirming the hypothesis that the value of the remittance quotient is other than zero (see annex 2, column (b)).

Setting out from this result, we wished to estimate whether remittances would have long-term effects on the terms of trade, and to this end we formulated a distributed lags model to include the remittances variable with one lag.

The estimates proved compatible with the behaviour expected. The self-lagged variable is the most useful for forecasting the current exchange rate, but the remittances coefficient also predicts that with a 1% rise in remittances, the real terms of trade or real exchange rate will appreciate by 0.04%. This finding

is significant at a confidence level of just over 85%. Certainly, the model is incomplete when R2 is low, but then again the value of the DW statistic allows the hypothesis of serial correlation between the residuals to be statistically rejected.

It was also found that remittances did not have a cumulative effect on the exchange rate, since when a lag was used in the previous model the coefficient was no different from zero. The new coefficient has the opposite sign, which means that remittances do not result in currency appreciation, but the confidence interval is too weak for us to discard the hypothesis that its value is different from zero (see annex 2, column (c)).

This indicates that remittances do not affect the exchange rate in the long run, suggesting that in future the greatest pressures on the stability of the real terms of trade in the countries studied will come from increases in the volumes of money sent, and not from the events of the past. The effects on the dummies represented by the countries are the same as in the previous result.

To evaluate the effects of time on the result obtained, the countries' dummy variables were replaced by variables representing the periods considered in the analysis (see annex 2, column (d)). The time aspect is important because these countries have been through stages of great macroeconomic instability, sometimes as the effect and sometimes as the cause of acute exchange-rate volatility.

Although the DW statistic of this model was lower, the results indicate that the negative effects of remittances on the exchange rate have intensified in recent years, particularly in the 2004-2005 period. In this variant incorporating the time factor, the value of the remittances coefficient is even higher and its consistency, measured by the value of the t-statistic, more robust. If we control for time, the negative effects of remittances on the real terms of trade are more conclusive. When the percentage of remittance income increases, the terms of trade appreciate by 0.063%.

## VI

### Conclusions

The present study analyses the effects of remittances on the exchange rate, output and external trade in Mexico and the Central American countries on the

basis of a macroeconomic income determination and external trade equilibrium model for a small, open economy with free capital movement. The econometric

analysis was undertaken using a panel data model applied to these countries' statistical series.

The findings indicate that the exchange rate is affected by inward remittances, which are exogenously generated resources in the economies of the countries analysed. It is also concluded that exchange-rate regimes or monetary policy are crucial in determining not just the scale of the effects of remittances on the exchange rate but also the way they feed through to the real sector of the economy.

The current economic performance of the Central American countries, whose economic growth is still below potential, suggests that their tendency to expel population is unlikely to be halted, let alone reversed. Given that conditions in these countries' economies are still conducive to the creation of surplus labour as discussed by Lewis (1954), the likelihood is that the migration flows originating there will continue.

In the case of Mexico, exchange-rate flexibility was adopted as a formula to reconcile economic opening with control of inflation by way of an inflation targeting monetary policy, and the same policy is followed, with certain variations, in the other countries that receive large volumes of remittances. If the countries analysed continue to expel labour and the proportion of remittances in the exogenous variables of this model increases, it is possible that exchange-rate regimes might have to adapt to a future situation in which currency flows are dominated by migrants' remittances to their families rather than inflows of foreign investment.

In the past two decades, Mexico and the Central American countries have experienced a sharp rise in labour emigration to the United States, first as a result of economic crises and warfare and, more recently, because of a macroeconomic adjustment process oriented towards trade liberalization and economic opening that has resulted in a growth rate too low to absorb an expanding workforce.

These are countries where the process of economic and political change has given rise to an unanticipated movement of workers to other countries and the emergence of remittances as a no less unexpected source of external financing. The issue of remittances is absent from the economic transformation agenda and the policies applied.

Given the far-reaching process of economic opening embarked upon by these countries, the exchange rate has become one of the fundamental variables upon which the new economic architecture is being constructed. However, this architecture is based on a management approach which, while conducive to macroeconomic

stability (compatible with balanced public finances, control of the money supply and high interest rates), was not designed for migration economies sustained by external financing in the form of remittances. The difference in results between countries with fixed exchange rates against the dollar and those with free-floating exchange rates indicates that the right exchange-rate regime can allow better use to be made of funds sent by migrant workers, since in practice they help to reduce external constraints on growth. In open economies, however, it is too risky to maintain a fixed exchange rate, at least over a long period, owing to the macroeconomic imbalances that tend to build up as a result, leading to large devaluations.

The results obtained by analysing the behaviour of exchange rates led us to two contradictory conclusions about the economic model, with one indicating a tendency to strengthen its workings and the other to weaken it or call it into question. The effects on the economics of migration are also different.

According to the theory of interest rate equivalence as a determinant of exchange-rate parity in open economies (Krugman and Obstfeld, 2005), exchange-rate appreciation leads to a rise in interest rates and this in turn produces an increase in portfolio investment. Countries with a better economic performance will have larger or growing foreign investment flows, although their effects on the economy will be subject to the Marshall-Lerner condition.<sup>4</sup> In this case, the macroeconomic contribution of remittances will apparently be confined to improving profitability conditions for foreign investment and the outcome will be a build-up of international reserves.

The other effect is more immediate. Exchange-rate appreciation causes relative prices to rise and makes exports dearer and imports cheaper, i.e., it undermines the exporting capacity of these countries at a time when they have yet to complete their transition to an open economy whose development is based on exports. In this case, the contribution of remittances is manifested in an increased capacity to consume imported goods and in a constraint on the export economy which, in the long run, may diminish these economies' production capacity.

<sup>4</sup> Applying the Marshall-Lerner condition to foreign investment suggests that exchange-rate appreciation leads to a rise in foreign capital flows, but convertibility of these currencies into the local currency will cause the contribution of foreign investment to the financing of gross investment to decline, something that has been seen in Mexico over the last five years.

Lastly, the limitations of this study should be noted. Remittances in Mexico and the Central American countries are too recent an economic phenomenon for their interaction with nominal variables to be analysed. Although there are systematic statistical records going back a couple of decades, the effects on the major monetary aggregates only become apparent from early 2000. This means that research has to be confined to this period if mutually important relationships are to be identified, which in turn limits the scope

for drawing long-term conclusions. The passage of years and improvements in accounting records on these monetary transfers will help to improve future studies on the subject.

A subsequent analysis will have to approach the model with a vector regression method to test the hypothesis of the effects of exchange-rate behaviour on external trade, something that could not be developed in this study but has been intuitively and theoretically touched upon



## ANNEX 1

Dependent variable: real terms of trade (rtt)  
 Sample: 1990-2005

Variable	Ordinary least squares panel	Two-stage ordinary least squares panel		
	Coefficient (a)	Instruments: C RTT (-2) DLOG(TR) DLOG(TR (-2)) II TB		
		Coefficient (b)		
RTT (-1)	0.752754	0.949171		
Standard error	0.048082	0.021605		
t-statistic	15.65568	43.93214		
p-value	0	0.0000		
DLOG (TR)	-6.43599	-5.352284		
Standard error	3.873639	7.220646		
t-statistic	-1.661484	-0.741247		
p-value	0.0994	0.4602		
DLOG (TR(-1))	-2.047644	-51.72577		
Standard error	2.93291	61.08807		
t-statistic	-0.698161	-0.846741		
p-value	0.4865	0.3991		
II	0.331905	0.307396		
Standard error	0.099148	0.169867		
t-statistic	3.347552	1.809633		
p-value	0.0011	0.0733		
TB	-1.06E-08	2.11E-07		
Standard error	2.56E-07	3.86E-07		
t-statistic	-0.041575	0.54726		
p-value	0.9669	0.5854		
C	12.76444	9.053761		
Standard error		2.899724		
t-statistic		4.401948		
p-value		0		
R <sup>2</sup>	0.995316	0.984727		
Adjusted R <sup>2</sup>	0.99481	0.981733		
Durbin-Watson statistic	1.730978	1.903043		
CROSSID	Effects	Time weighting	Effects	Effects
Mexico	-9.935486	01-01-90	5.476935	2.679366
Costa Rica	63.90299	01-01-91	-6.91579	-2.596104
Nicaragua	-5.296154	01-01-92	-9.41384	1.565508
Honduras	-5.202476	01-01-93	3.734615	3.334237
Guatemala	-7.266488	01-01-94	-4.92468	4.307524
El Salvador	-11.0064	01-01-95	-7.21474	2.526217
Panama	-14.23802	01-01-96	5.493353	0.830112
Belize	-13.34384	01-01-97	-3.49645	4.342867

Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

## ANNEX 2

Sample: 2000-2005

Number of cross-sections: 8 Total panel observations (unbalanced): 46 Dependent variable: real terms of trade (rtt)					
Variable	Ordinary least squares panel	Ordinary least squares panel with White cross-section standard errors and covariance		Ordinary least squares panel with White cross-section standard errors and covariance	
	(a)	(b)	(c)	(d)	
DLOG (RTT(-1))	0.282	0.282	0.307	0.379	
Standard error	0.111	0.117	0.050	0.040	
t-statistic	2.551	2.404	6.122	9.423	
p-value	0.015	0.022	0.000	0.000	
DLOG (REM)	-0.043	-0.043	-0.038	-0.063	
Standard error	0.028	0.018	0.014	0.024	
t-statistic	-1.528	-2.453	-2.721	-2.655	
p-value	0.135	0.019	0.010	0.012	
DLOG (REM(-1))			0.027		
Standard error			0.020		
t-statistic			1.359		
p-value			0.183		
C 0.003	0.003	-0.002	0.007		
Standard error	0.006	0.008	0.004	0.004	
t-statistic	0.554	0.423	-0.414	1.844	
p-value	0.583	0.675	0.682	0.073	
		Country dummies (cross-section)		Dummies for specific years (time series)	
Mexico	-0.0131	-0.0131	-0.0119	2000	0.00052
Costa Rica	0.0174	0.0174	0.0192	2001	-0.00142
Nicaragua	0.0054	0.0054	0.0050	2002	0.01861
Honduras	0.0042	0.0042	-0.0016	2003	0.01319
Guatemala	-0.0302	-0.0302	-0.0340	2004	-0.01554
El Salvador	-0.0025	-0.0025	0.0005	2005	-0.02045
Panama	0.0088	0.0088	0.0111		
Belize	0.0138	0.0138	0.0164		
R <sup>2</sup>	0.505353	0.505353	0.518816	0.51289	
Adjusted R <sup>2</sup>	0.382	0.382	0.381	0.42316	
Durbin-Watson statistic	2.030	2.030	2.052	1.73305	

Source: prepared by the author on the basis of data from the International Monetary Fund (IMF), *International Financial Statistics*.

(Original: Spanish)

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