

## **Are Remittances Inflationary? Let's Ask the Central Bank\***

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## **Are Remittances Inflationary? Let's Ask the Central Bank**

### *Abstract*

Worker's remittances have the potential to impact the macroeconomic variables of the receiving country. This impact, however, may not be observable empirically (or be less pronounced) if the receiving country's central bank adjust its monetary policy stance to account for these inflows. Thus, in order to gain knowledge about the real impact of remittances we should examine the reaction of monetary policy to these transfers. We study the reaction of Mexico's Central Bank to inflows of worker's remittances. Mexico has the largest inflow of remittances in Latin America. Our results indicate that Mexico's Central Bank tightens its monetary policy stance after shocks to remittances. This finding, combined with Mexico's Central Bank commitment to fight inflation, suggests that remittances are perceived as inflationary by Mexico's Central Bank.

**JEL Classification Number:** E52, F22

**Key words:** remittances; capital inflows; monetary policy

## 1. Introduction

Each day thousands of immigrant workers in developed countries send money to their families in developing countries. The amounts of the individual transfers are not usually large. It is just a few hundred dollars here and a few hundred dollars there. But the total sum of these flows can reach enormous dimensions. According to the World Bank, annual remittances flows have reach up to 230 billion U.S. dollars (World Bank, 2006). It would be hard to imagine that government authorities in developing countries have not noticed the immensity of these flows. As such, it may be the case that authorities are taking these flows into account when developing new policies and adjusting existing ones. Our intend is to understand whether and how central banks in receiving countries respond to these flows of money. Do central banks in remittance receiving countries take these flows into account when choosing their monetary policy stance?

Remittances are an important source of external financing and foreign exchange for developing countries (Yang, 2006). Given the shortage of external financing in developing countries, these inflows are welcomed as means to promote investment and stimulate economic growth. Remittances also provide a source of foreign exchange to finance imports and relax balance of payment constraints.

At the same time, receiving countries may worry about the potential negative consequences of these inflows. A large fraction of remittances is spent on consumption (Zarate-Hoyos, 2004). Accordingly, remittances are capable of increasing the price of non-tradables in the receiving country, producing inflationary pressures. Furthermore, given that the price of tradable goods is basically exogenous in small open economies, remittances could increase the ratio of the price of non-tradable goods to tradable goods,

appreciating the country's currency (Amuedo-Dorantes and Pozo, 2004; Bourdet and Falck, 2006). This in turn will decrease the export competitiveness of the country.

Thus, remittance inflows present a difficult choice to receiving countries because they may exert contradictory effects on several conflicting policy objectives (external financing, inflation, export competitiveness, among others). In order to minimize the possible detrimental impact of remittances, receiving countries can use changes in fiscal policy, monetary policy and/or exchange rate sterilization. For example, the government may decide to impose a tax on remittance inflows or to set a quantitative restriction on the transferred amount.

In this article we concentrate on the reaction of monetary policy to remittances inflows. There is an extensive literature about the reaction of central banks to other capital inflows (e.g. Lee, 1996; Reinhart and Smith, 1998; Schadler *et al.*, 1993; Spiegel, 1995), but empirical studies on the response of monetary policy to increases in remittances have been absent from the literature.<sup>1</sup> Information about the reaction of monetary policy to remittances will provide us, among other things, with an understanding of the impact of remittances in the receiving country.

Imagine, for instance, that remittances are truly inflationary and that the central bank is committed to fight inflation. In such a case, we may not observe the inflationary impact of remittances because, after increases in these flows, the central bank tightens its monetary policy stance to avoid the inflationary pressure. As a result, by just looking at remittances and the receiving country macroeconomic variables alone we may miss the true impact of remittances. We therefore need to examine the reaction of the central bank to remittances inflows.

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<sup>1</sup> Chami *et al.* (2006) provides a discussion of optimal monetary policy in the presence of remittances.

In the empirical section of this article we study the case of Mexico. The Mexican experience represents one of the best cases for studying the impact of remittances on monetary policy for at least two reasons. First, Mexico has a huge inflow of remittances (largest inflow in Latin America). Mexico received about 37 percent of the total remittances inflows in Latin America or about 20 billion U.S. dollars in the year 2005 (Inter-American Development Bank, 2006). Furthermore, for the period under consideration in this article (1997 – 2006) remittances have grown at an average of 19 percent per year. Second, during the last decade Mexico's Central Bank adopted an inflation-targeting system, combined with a flexible exchange rate. Thus, at least in theory, we have a central bank with a clear policy objective.

In 1994 Mexico, suffered the so-called "peso crisis." This crisis brought a large depreciation of the Mexican peso, which sent inflation soaring and set off a severe recession (Whitt, 1996). As a response to the crisis, Mexico's Central Bank adopted a free-floating exchange rate system. In other countries where remittances play a minor role, these flows are not expected to have a large impact on monetary policy decisions. If flows are not large and/or not significant given the total size of the economy, then their impact on variables like inflation and exchange rates will be minimal. But in Mexico, the largest remittance receiver in Latin America, it is possible for remittances to have a strong influence on monetary policy decisions.<sup>2</sup>

In fact, Mexico's Central Bank has been acknowledging the role of remittances in its yearly monetary program. For example its 2006 monetary program states that:

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<sup>2</sup> Arguably, the impact of remittances on monetary policy decisions in smaller countries with large remittances inflows (e.g. Dominican Republic, El Salvador, Nicaragua) may be stronger. Unfortunately, long time series at the monthly frequency are not available for these countries. Mexico has been collecting monthly data on remittances, at least since the mid 1990s.

“Just like in 2004, during 2005 the performance of domestic expenditure and economic activity benefited from the significant increase in Mexico’s oil trade balance surplus and by revenues from workers’ remittances. Workers’ remittances have become very important for private consumption expenditure as confirmed by the total inflow of remittances received in 2005, which was equivalent to one third of wage earnings in the formal sector of the economy. In some states, workers’ remittances exceeded formal wage earnings”, (Banco de Mexico, 2006 Monetary Program, p.12).

Similar remarks can be found in previous monetary programs. Mexico’s Central Bank seems to be aware of the large inflow of remittances. If remittances are perceived as inflationary, then we would expect Mexico’s Central Bank to adopt a more restrictive monetary policy stance after shocks to remittances.<sup>3</sup>

The article is organized as follows. Section 2 uses a simple macroeconomic framework to show an example of how remittances, even if really inflationary, may not stimulate inflation if the central bank adjusts its monetary policy stance in order to account for these inflows. In Section 3 we describe the implementation of monetary policy in Mexico. Section 4 introduces the methodology and discusses the selection of the monetary policy variable. Section 5 presents the data. Section 6 discusses the empirical results. Finally, Section 7 presents the main conclusions of the article.

## **2. Remittances, inflation and monetary policy: some intuition**

In this section we specify a simple macroeconomic framework in which we assume that remittances are inflationary. We show that remittances may not bring inflationary pressures if the central bank adjusts its monetary policy stance in order to account for these flows. We do not intend to propose a monetary policy rule in the

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<sup>3</sup> The claim is made that an important portion of the recent growth in remittances is due to increased efforts to account for these flows and not due to growth in the volume of remittances (Terry, 2005). The increase effort in tracking remittances may hint that central banks around the world are becoming more interested in these flows. See Acosta et al. (2006) for more on the reliability of macroeconomic remittances data.

presence of remittances, but rather to provide an example of how central bank intervention could offset the impact of remittances.

Consider a simple central bank loss function with a flexible inflation target (see Walsh, 2003), like the case of Mexico. Assume that the loss function of the central bank increases with deviations of output ( $y$ ) from equilibrium output ( $y_n$ ) and deviations of inflation ( $\pi$ ) from the inflation target ( $\pi^T$ ). Letting  $E[.]$  be the expectation indicator, the central bank loss function ( $L$ ) can be characterized as

$$L = \frac{1}{2}\alpha E[(y - y_n - k)^2] + \frac{1}{2}hE[(\pi - \pi^T)^2], \quad h \geq 0, \alpha \geq 0, k \geq 0. \quad (1)$$

Where  $h$  measures the weight placed by the central bank on deviations of inflation from its target,  $k$  is a scalar and  $\alpha$  measures the weight given by the central bank to deviations of output from its trend. Assume also that output is given by a Lucas-type aggregate supply curve:

$$y = y_n + a(\pi - \pi^e) + \eta, \quad a \geq 0. \quad (2)$$

In this case  $a$  is a constant,  $\pi^e$  is the expected inflation and  $\eta$  is the supply shock. The public does not observe the supply shock before forming their expectations, but the supply shock is observed by the central bank before conducting monetary policy. The intuition behind Equation (2) is straightforward. If inflation is above expected inflation, then output will be above its trend.

In the standard macroeconomic model, inflation is given by  $\pi = \Delta m + v$ . In this case  $\Delta m$  is the growth rate of the money supply and  $v$  is the velocity disturbance (not observed by the public and not observed by the central bank before conducting monetary

policy). We can include remittances in this framework by expressing inflation in the economy as

$$\pi = \Delta m + \Delta r + v, \quad (3)$$

where  $\Delta r$  is the growth rate of remittances. In this simple framework we are assuming that remittances increase inflation directly. Of course we know that in reality the impact of remittances is much more complicated. As we mentioned above remittances may impact many macroeconomic variables in the receiving country. Our purpose is just to give some intuition about how central bank intervention can offset the impact of remittances.

The central bank's problem is to minimize

$$\underset{\{\Delta m\}}{\text{Min}} L = \frac{1}{2} \alpha E[(y - y_n - k)^2] + \frac{1}{2} h E[(\pi - \pi^T)^2] \quad (4)$$

subject to

$$\begin{aligned} y &= y_n + a(\pi - \pi^e) + \eta \\ &\text{and} \\ \pi &= \Delta m + \Delta r + v. \end{aligned}$$

Solving this problem we find that optimal money supply growth will be given by

$$\Delta m = \pi^T + \left(\frac{a\alpha}{h}\right)k - \left(\frac{a\alpha}{h+a^2\alpha}\right)\eta - \Delta r. \quad (5)$$

As we would expect, the optimal growth rate of money depends on the inflation target, but it is also adjusted for three factors  $k$ ,  $\eta$  and  $\Delta r$ . If the central bank wants to maintain output above its trend (positive  $k$ ), there will be a higher growth rate of money. If the central bank wants to respond to a positive supply shock ( $\eta$ ) then there will be a lower growth rate of money. From Equation (5) we see that after an increase in remittances a lower growth rate of money is necessary to achieve a given inflation target.

Finally, let's think about inflation. Substituting Equation (5) into  $\pi = \Delta m + \Delta r + v$  we get that inflation will be given by

$$\pi = \pi^T + \left(\frac{a\alpha}{h}\right)k - \left(\frac{a\alpha}{h+a^2\alpha}\right)\eta - \Delta r + \Delta r + v$$

or

$$\pi = \pi^T + \left(\frac{a\alpha}{h}\right)k - \left(\frac{a\alpha}{h+a^2\alpha}\right)\eta + v. \quad (6)$$

The remittances terms cancel because the central bank is adjusting its monetary policy stance to account for these inflows. Thus, empirically we may not observe an impact of remittances on inflation (even if remittances are inflationary), because the central bank is offsetting the inflationary effect of remittances. The same can be said about other macroeconomic variables if the central bank offsets the impact of remittances on those variables.

### **3. Monetary policy in Mexico: crisis, inflation targeting and *cortos***

Eichengreen (2001) defines an inflation-targeting regime as one with the following four characteristics. First, there needs to be an institutional commitment to price stability. Second, there should be mechanisms to render the central bank accountable for obtaining the monetary policy goal. Third, the central bank should announce an inflation target at the beginning of each period. Finally, there must be a clear explanation from the central bank behind the rationale of its decisions. Since 1995, Mexico's monetary policy has moved towards a system with these four characteristics. We can, therefore, classify Mexico as an inflation-targeting country.

Not everyone will fully agree with the classification of Mexico as an inflation-targeting country. Calvo and Reinhart (2000), for instance, argue that Mexico among

many other countries, exhibits “fear of floating.” That is, Mexico’s Central Bank claims to be pursuing an inflation target and domestic policy goals, but it is also intervening indirectly to manipulate the exchange rate (see also Reinhart, 2000). However, Edwards (2002) argues that even though there is some “fear of floating”, these countries behave like floaters. He further argues that, in general, most countries are not clean floaters and that limited intervention is a practice of “optimal flotation.” More recently, Ball and Reyes (2004), reviewed the analysis of Calvo and Reinhart (2000) for the specific case of Mexico. They find that Mexico is in fact an inflation-targeting country that has occasionally misbehave and is not really a country with “fear of floating.” Thus, it seems safe to assume that Mexico’s Central Bank principal goal is to fight inflation, even if it has occasionally deviated from this goal.

Figure 1 shows the inflation level and the inflation objective announced by Mexico’s Central Bank each year during the 1997 – 2006 period. It is clear that although Mexico’s Central Bank was not able to reduce inflation to its target at the beginning of the period, it has been gradually moving closer to the specified goal. It is also important to note the large reduction on inflation that has taken place in Mexico. Inflation decreased from 15.7 percent in the year 1997 to 3.3 percent in the year 2005. In what follows we provide a short description of the implementation of monetary policy in Mexico.

<< Figure 1 >>

Before the year 1995 Mexico operated under a crawling peg exchange rate system. There was a narrow target band for the nominal exchange rate (Mexican pesos *vis-à-vis* the U.S. dollar). The upper limit of the band was raised slightly each day by a preannounce amount. This allowed for a gradual depreciation of the Mexican peso (see

Whitt, 1996). At the end of 1994 Mexico underwent an exchange rate and financial crisis. As a result of the crisis the credibility of Mexico's Central Bank was severely damaged. The main criticisms were the lack of transparency in the conduction of monetary policy, the lack of dissemination of information, and insufficient determination to restrict monetary policy (Martinez *et al.*, 2000). This crisis forced Mexico's Central Bank to adopt a floating exchange rate during the year 1995. Mexico's Central Bank started using the accumulated balances of credit institutions in their Central Bank current accounts as their main policy tool.

Banks in Mexico are allowed to have a negative balance in their current accounts with the Central Bank, provided that during a 28 day period the negative balances are offset with positive balances. If any credit institution has a negative balance after 28 days, then Mexico's Central Bank penalizes this institution. The penalty is equal to an interest rate that exactly doubles the market rate (28-day Cetes interest rate). Of course, banks in Mexico do not want to keep positive accumulated balances in their current accounts in the Central Bank neither. Each dollar of excess reserves is costly in terms of the foregone interest. In a perfect world, banks in Mexico would like to have a net average of zero in their Central Bank current accounts.

Each day the Mexican monetary authority announces the target level of accumulated balances for the next day. A neutral monetary policy stance for Mexico's Central Bank is one in which banks have a zero balance in their current accounts. In this case, the total demand for base money is satisfied at market interest rates. That is, Mexico's Central Bank would be providing the necessary resources so that no bank is

forced to incur in overdrafts or to accumulate undesired positive balances at the end of the holding period (Martinez *et al.*, 2000).

A tightening of the monetary policy stance of Mexico's Central Bank would involve banks having negative accumulated balances in their current accounts. The penalty for the negative balances is twice the market interest rate, and therefore banks would like to avoid the penalty by obtaining resources from the money market. Consequently, interest rates in Mexico would rise. This is what Mexico's Central Bank calls a "short" or *corto* in Spanish. Mexico's Central Bank is satisfying a portion of the demand for base money by inducing an overdraft in the banks' current accounts.

Using the "short", Mexico's Central Bank is able to send a signal to the market that it has assumed a restrictive monetary policy stance, without the need to choose a specific level interest rate. Figure 2, shows how the "short" influences interest rates in Mexico. In this case, Mexico's Central Bank conducts open market operations with a negative accumulated balances objective in mind. Observe that a tightening of the monetary policy stance does not mean that the Central Bank fails to meet the demand for base money, but rather that a fraction of the demand is satisfied at higher interest rates.

<< Figure 2 >>

At least since 1997, Mexico has seemed to comply with the four characteristics of an inflation-targeting regime that were suggested by Eichengreen (2001). Moreover, in 1997 Mexico's Central Bank in addition to announcing an inflation objective for that year, also announced an inflation objective for the following years. In our empirical analysis we used data from 1997 to 2006 to study the reaction of Mexico's monetary policy to remittances during this inflation-targeting regime.

#### 4. Methodology and monetary policy variable

We use impulse response functions (IRFs) and variance decompositions (VDCs) derived from a vector autoregressive model (VAR) to estimate the impact of remittances on monetary policy in Mexico. IRFs show the predictable response of one variable after a shock to other variable in the system. For example, if the IRF of the monetary policy variable to a shock to remittances shows a positive response, then presumably the monetary policy variable will respond positively to innovations in remittances. VDCs show 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.

It is possible that remittances and monetary policy respond to the same set of variables. For instance, it can be argued that if remittances are altruistic payments from migrants to their families in Mexico, then remittances will decrease after increases in income in Mexico. But increases in income will also most likely lead to a tighter monetary policy to avoid inflationary pressure. This implies that by including only remittances and monetary policy in the estimation we could reach a misleading conclusion. In order to obtain adequate inferences, we need to include a series of control variables to account for Mexico's economic activity, inflation and exchange rate, among others.<sup>4</sup>

But before discussing the additional variables included in the estimation, we need to select a monetary policy variable. As explained above, the main policy tool for Mexico's Central Bank are the accumulated balances of banks in their current accounts. But the impact of the changes in the accumulated balances on the interest rate (which is

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<sup>4</sup> It is also obvious that these macroeconomic variables from Mexico are endogenous. The VAR used in the empirical estimation takes into consideration potential simultaneous relationships among endogenous variables.

determined by the market) is what matters for policy applications. Two “shorts” of the same amount might impact the interest rate in different ways, depending on the prevailing economic conditions in each situation. So, it is possible that interest rates are reflecting monetary policy better than the accumulated balances of credit institutions (see Schwartz and Torres, 2000). In fact, various previous studies about Mexico have used the interest rate as the monetary policy variable (e.g. Ball and Reyes (2004) and Martinez *et al.* (2000)).

In our analysis we present both alternatives. We use a seven variable model that includes U.S. real interest rates (*usi*), Mexico’s output gap (*ygap*), Mexico’s inflation gap (*pgap*), Mexico’s exchange rate gap (*qgap*), the accumulated balances of banks in their current accounts with Mexico’s Central Bank (*b*), Mexico’s real interest rate (*i*) and remittances (*r*).<sup>5</sup> In this case, Mexico’s interest rate and the accumulated balances of banks in their current accounts are the two possible monetary policy variables.

The gap for output and the exchange rate is constructed as:  $GAP_t = VARIABLE_t - TREND_t$ . In the case of inflation, we subtract the trend of the inflation objectives and not the trend of inflation. The trends are obtained using the Hodrick and Prescott (1997) filter.

In order to compute VDCs and IRFs, the residuals of the VAR must be orthogonalized. In this article a Cholesky decomposition is used to produce orthogonal residuals. The Cholesky decomposition imposes a recursive structure, so that variables higher in the ordering are not affected contemporaneously by shocks to variables lower in the ordering. The ordering of the variables in the model is *usi*, *ygap*, *qgap*, *pgap*, *b*, *i* and

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<sup>5</sup> Thus, our monetary policy equation is not that different from a typical open-economy Taylor rule:

$$i = usi + \beta_1(\pi - \pi^T) + \beta_2(y_t - y_n) + \beta_3(e_t - e_n).$$

*r*. This ordering assumes that innovations to U.S. interest rates are contemporaneously uncorrelated with innovations to the other variables. The ordering also assumes that Mexico's monetary policy is affected contemporaneously by shocks in U.S. interest rates, Mexico's output gap, the exchange rate gap and the inflation gap. If the accumulated balances of banks in their current accounts is taken as the policy variable, then monetary policy can affect the interest rate and remittances contemporaneously and all other variables with one lag. If the interest rate is taken as the monetary policy variable, then the ordering assumes that monetary policy affects all variables, except remittances, with one lag. We assume that remittances do not impact any of the monetary policy variables contemporaneously and impact all variables with one lag.

The VAR is estimated in levels. For robustness purposes we also conducted the estimation with the non-stationary variables in first differences. The main results did not change.<sup>6</sup> Akaike's criterion (AIC) is used to determine the optimal lag length. The AIC suggests the inclusion of 10 lags. Q-statistics are used to confirm the absence of serial correlation in each equation of the VAR.

## **5. Data**

The data used in the estimation are monthly and cover the period from January 1997 to July 2006. All the data from the U.S. comes from the Federal Reserve Bank of St. Louis. Mexican data are from Mexico's Central Bank.

One of the monetary policy variables included in the estimation is the accumulated balance of banks in their current accounts with Mexico's Central Bank. This variable is seasonally adjusted and expressed in real terms. The other monetary policy variable is Mexico's real interest rate. In our application we use Mexico's interest on one-

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<sup>6</sup> Results are available from the authors upon request.

month government bonds or 28-day Cetes as an interest rate. The Cetes (Certificados de la Tesorería de la Federación) are the Mexican counterparts of the U.S. Treasury bills.

Mexico's consumer price index (CPI) is used to construct the inflation series (and to transform the Mexican variables into real terms). The CPI is seasonally adjusted. We include Mexico's industrial production as a measure of economic activity in Mexico. This variable is seasonally adjusted. We also include Mexico's exchange rate in the estimation. The exchange rate is defined as Mexican pesos per U.S. dollars. We use the U.S. Federal Funds Rate to obtain the U.S. real interest rate.

Total family remittances to Mexico are included as a measure of Mexico's inward remittances. This variable is seasonally adjusted and expressed in real terms. Table 1 reports the dollar amount of remittances received by Mexico during the period of this study. From Table 1 we can see that remittances have been increasing constantly, with the exception of the year 2006 (which includes only seven months of information) the growth rate of remittances is always positive. From 1997 to 2005 remittances averaged more than 10 billion U.S. dollars and a growth rate of about 19 percent per year.

<< Table 1 >>

## **6. Empirical results**

The VDCs of Mexico's monetary policy variables are reported in Table 2 and Table 3. In both tables we report point estimates with standard errors in parentheses. The standard errors are calculated using 2,000 bootstrap simulations. Table 2 reports the VDC of the accumulated balances, while Table 3 reports the VDC of the interest rate.

Before discussing the impact of remittances on monetary policy, we need to check the plausibility of our model in identifying monetary policy actions. Thus, we want to

make sure that the responses of other variables in the system are in order. Given Mexico's Central Bank commitment to control inflation, we should be particularly interested in the percentage of the forecast error variance in monetary policy that is explained by the inflation gap. From the fourth column of Table 2 we see that the inflation gap consistently explains about 8 to 9 percent of the variance in accumulated balances.

We can also see the importance of the exchange rate in the third column of Table 2. The exchange rate explains from 11 to 13 percent of the variation in accumulated balances. In the inflation-targeting context the exchange rate may be capturing the fact that in an open economy the consumer's basket is composed of traded and non-traded goods and a depreciation can increase domestic prices.

It is also important to notice the large percentage of the variance in accumulated balances that is explained by the output gap. The output gap explains from 24 to 29 percent of the variance in accumulated balances. This suggests that Mexico's Central Bank also cares about output fluctuations (in addition to price changes) when conducting monetary policy.

However, our main interest is on the impact of remittances in monetary policy. The seventh column in Table 2 reports the percentage of the forecast error variance that is explained by remittances. Remittances seem to explain about 8 to 9 percent of the variance in accumulated balances.

<< Table 2 >>

Table 3 reports the VDC of the interest rate. Contrary to the accumulated balances, for which Mexico's Central Bank sets a specific objective, the interest rate is

determined by the market. By adjusting the accumulated balances, Mexico's Central Bank only sends a signal to the market that it would like to see a higher or lower interest rate. Thus, it is not surprising that the inflation gap explains a smaller fraction of the forecast error variance in the interest rate than the case for the accumulated balances. On the other hand, we still have an important percentage of the variance being explained by the output gap. With respect to remittances, we see that these flows explain a significant percentage of the variance in interest rates. Remittances explain 7 to 11 percent of the forecast error variance in interest rates.

While VDCs are informative, they do not provide us with information about the direction of the impact of remittances in monetary policy. The IRFs can provide that information. The IRFs of Mexico's monetary policy variables after a shock to remittances are reported in Figure 2 and Figure 3. In both figures the upper and lower bounds represent a two-standard deviation confidence interval. The confidence interval is computed via Monte Carlo simulation with 2,000 draws. Figure 2 shows the response of the accumulated balances to a shock in remittances, while Figure 3 shows the same for the interest rate. The shock corresponds to one standard deviation of remittances.

If Mexico's Central Bank sees remittances flows as inflationary, then it should tighten its monetary policy stance after shocks to remittances. Results in Figure 2 and Figure 3 suggest that monetary policy tightens after shocks to remittances. Remittances seem to impact negatively the accumulated balances of banks with Mexico's Central Bank (restrictive monetary policy stance), while the impact on the interest rate is positive. The impact on accumulates balances is immediate and lasts for about 5 months. The impact also becomes significant in other periods ahead. The impact on the interest rate

seems to occur more in the long-run. In specific the first time that the impact on the interest rate is significant is 5 months after the initial shock.

## **7. Concluding remarks**

This article has examined the reaction of Mexico's Central Bank to inflows of workers' remittances. Since the year 1995 Mexico's Central Bank has been committed to fight inflation and maintain a flexible exchange rate. If Mexico's Central Bank is worried about inflation and sees these international transfers as bringing inflationary pressure then it should tighten its monetary policy stance after shocks to remittances. Our estimations indicate that Mexico's Central Bank tightens its monetary policy stance after shocks to remittances. In response to the question "*Are Remittances Inflationary?*" it seems that according to Mexico's Central Bank they are inflationary.

However, it is necessary to reiterate that our results need to be interpreted with caution. There is controversy about the main goal of developing countries that adopt inflation-targeting regimes (including Mexico). It is often argued that these countries also look at other variables when conducting monetary policy (e.g. exchange rate gap, output fluctuations). Thus, we can only conclude for certain that Mexico's Central Bank is responding to remittances flows. The real motivation behind the response is subject to debate.

Remittances are a great tool for development as they provide a much needed external source of financing for developing countries. But remittances do not come without a cost. At the macroeconomic level remittances may increase prices, appreciate the exchange rate and transmit international shocks. It seems that at least one central bank is aware of these flows and their possible macroeconomic consequences.

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**Table 1. Remittances during the last decade in billions of U.S. dollars.**

Year	Total Remittances	Growth Rate
1997	4.9	15.2
1998	5.6	15.7
1999	5.9	5.0
2000	6.6	11.2
2001	8.9	35.3
2002	9.8	10.3
2003	13.4	36.5
2004	16.6	24.0
2005	20.0	20.6
2006 (up to July)	13.4	-33.2
Average (excluding 2006)	10.2	19.3
Standard Deviation (excluding 2006)	5.4	10.9

Note: These numbers were calculated by the authors using the information published by Mexico's Central Bank. The amount reported for the year 2006 includes data until July only.

**Table 2. Variance decomposition of accumulated balances of credit institutions.**

Horizon	<i>usi</i>	<i>ygap</i>	<i>qgap</i>	<i>pgap</i>	<i>b</i>	<i>i</i>	<i>r</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
12	7.4 (5.8)	28.6 (8.3)*	12.1 (5.7)*	10.7 (5.2)*	21.3 (5.4)*	11.7 (4.6)*	8.2 (3.3)*
18	15.7 (7.1)*	24.5 (7.3)*	11.1 (5.2)*	11.3 (5.1)*	16.7 (4.5)*	11.2 (4.3)*	9.4 (3.5)*
24	15.5 (6.8)*	24.2 (6.9)*	12.3 (5.2)*	12.9 (5)*	15.3 (4.1)*	10.4 (4)*	9.4 (3.4)*
30	15.6 (6.7)*	23.6 (6.8)*	13.2 (5.2)*	13.3 (4.9)*	14.5 (3.9)*	10.4 (3.9)*	9.3 (3.3)*
36	15.8 (6.8)*	23.8 (6.9)*	13.2 (5.2)*	12.9 (4.8)*	14.2 (3.9)*	11 (3.8)*	9.1 (3.3)*

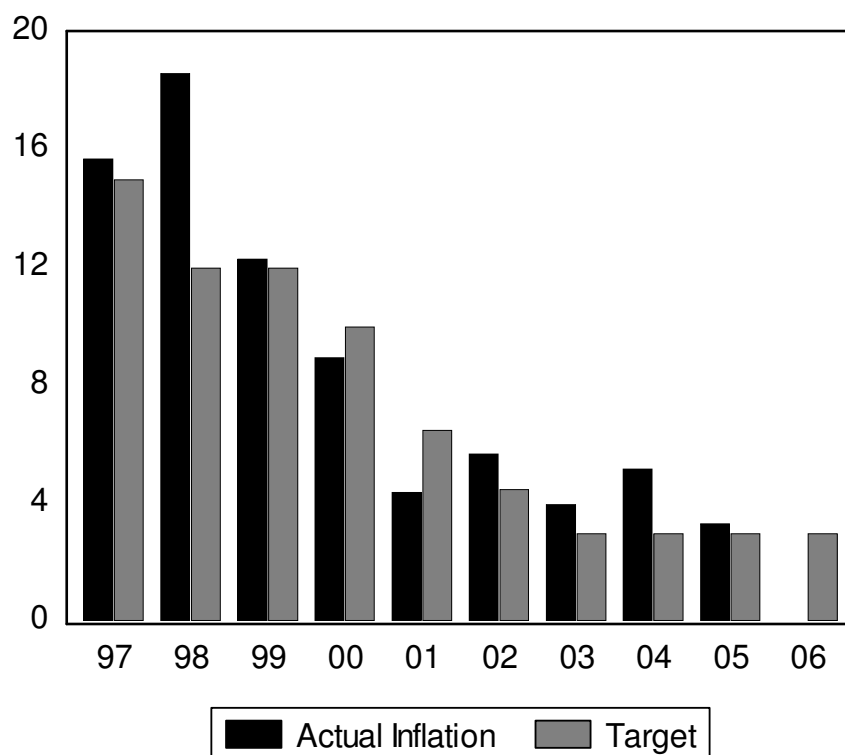
Note: These numbers are point estimates and standard errors are in parenthesis. 2,000 bootstrap simulations are used to construct the standard errors. A \* indicates that the point estimate is at least twice as large as its standard error.

**Table 3. Variance decomposition of Mexico's interest rates.**

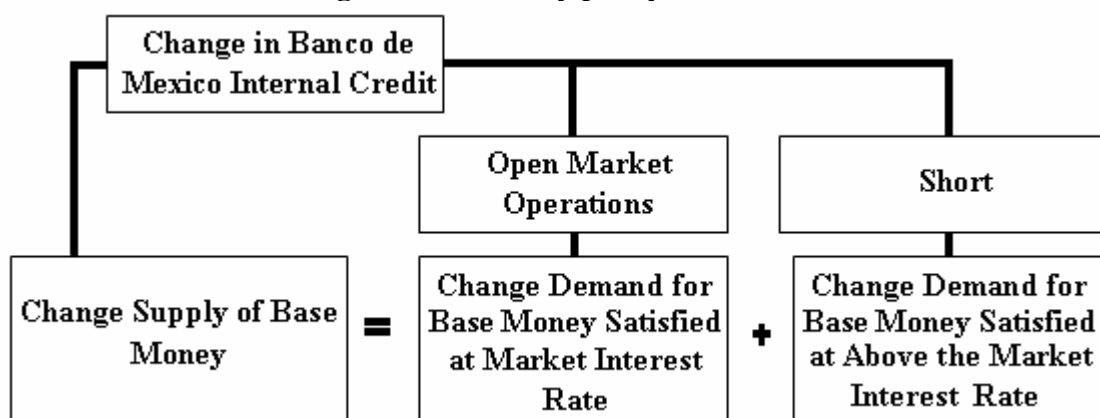
<b>Horizon</b>	<i>usi</i>	<i>ygap</i>	<i>qgap</i>	<i>pgap</i>	<i>b</i>	<i>i</i>	<i>r</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>12</b>	14.7 (10.4)	51.6 (11.7)*	3.8 (7.1)	6.6 (4.5)	1.5 (3.8)	14 (5.1)*	7.7 (4.3)*
<b>18</b>	19 (10.2)	42.6 (10.4)*	4.8 (7.2)	6.7 (4.4)	4.3 (4.6)	15.5 (5.3)*	7.1 (3.8)*
<b>24</b>	17.8 (9.5)	35.6 (9.7)*	9.8 (7.8)	7.7 (4.5)	4.7 (4.5)	14.3 (5.1)*	10.1 (3.9)*
<b>30</b>	16.3 (9.7)	30.4 (9.6)*	13.8 (8.2)	10.2 (4.9)*	4.5 (4.5)	14.3 (5.5)*	10.5 (3.9)*
<b>36</b>	15.3 (9.6)	29 (9.5)*	14.3 (8.3)	10.8 (5)*	4.7 (4.6)	15 (5.7)*	10.9 (4)*

Note: These numbers are point estimates and standard errors are in parenthesis. 2,000 bootstrap simulations are used to construct the standard errors. A \* indicates that the point estimate is at least twice as large as its standard error.

**Figure 1. Actual inflation level and inflation target.**

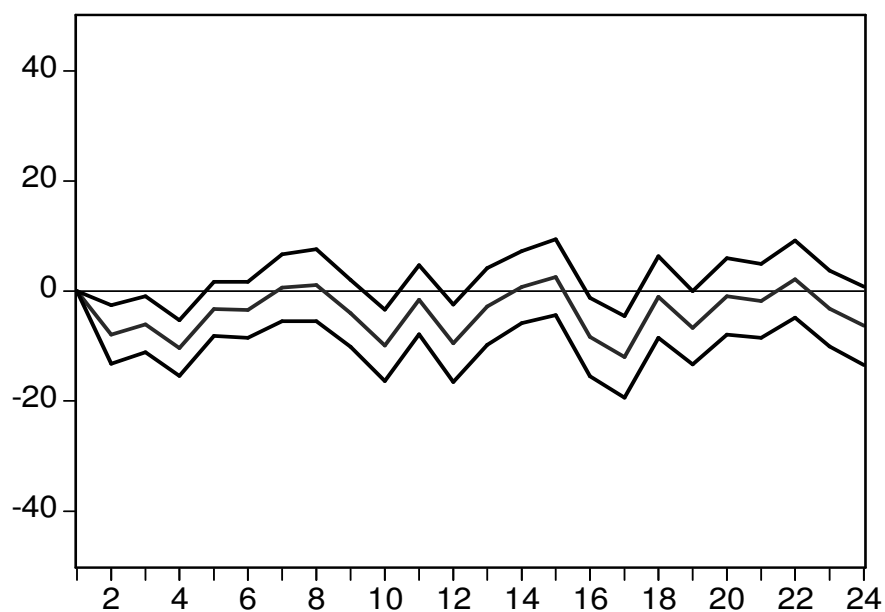


**Figure 2. Monetary policy in Mexico.**



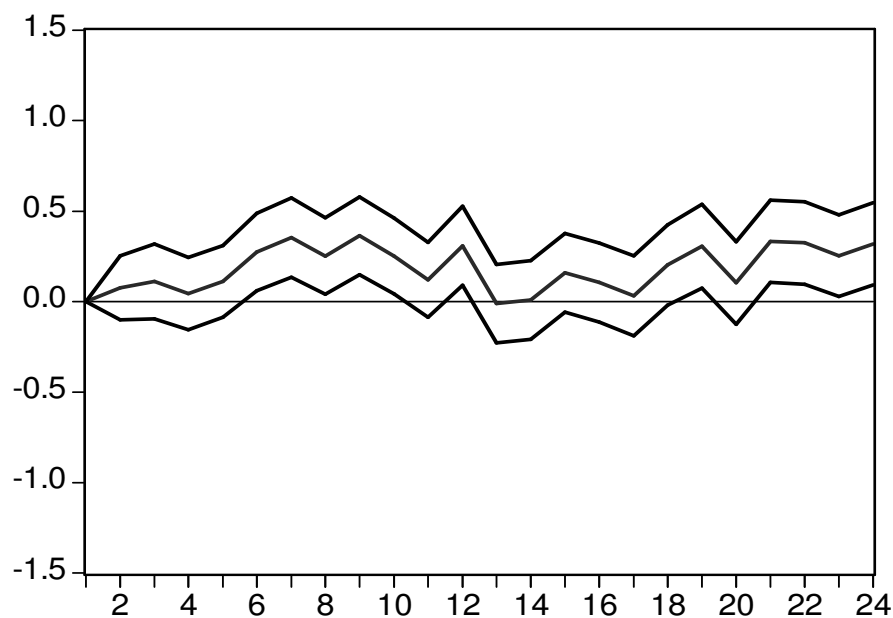
Note: This figure is constructed using the discussion and figures included in Schwartz and Torres (2000).

**Figure 3. Response of the accumulated balances of credit institutions to a shock in remittances.**



Note: Confidence intervals are computed via Monte Carlo simulation with 2,000 draws. Ranges indicated a two-standard deviation confidence interval. A negative response of the accumulated balances of credit institutions and a positive response of the interest rate indicate a tightening of Mexico's monetary policy.

**Figure 4. Response of the Mexico's interest rate to a shock in remittances.**



Note: Confidence intervals are computed via Monte Carlo simulation with 2,000 draws. Ranges indicated a two-standard deviation confidence interval. A negative response of the accumulated balances of credit institutions and a positive response of the interest rate indicate a tightening of Mexico's monetary policy.