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Trade, investment, and capital flows: Mexico's macroeconomic adjustment to the Great Recession

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Abstract

After decelerating for two years, in 2009 the Mexican economy suffered a contraction only matched, in its modern history, by the one recorded in 1995, in the wake of the peso crisis of December 1994. As in the latter crisis, the economy immediately bounced back, posting positive growth in 2010. Compared with the sharp rebound of exports, though, the overall recovery was weak, with GDP and industrial production surpassing (barely, in the latter case) their pre-crisis levels only in 2011. Motivated by these observations, the paper studies the transmission channels behind the 2009 recession in Mexico, the reasons for the weakness of the 2010–2011 recovery, and —based on that analysis— some of the risks the country faces for sustaining stronger economic growth in the future.

Keywords: Great Recession, manufacturing exports, trade balance, vertical specialization, capital flows, investment, real exchange rate, monetary policy, Mexico.
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1. Introduction

After decelerating for two years, in 2009 the Mexican economy suffered a contraction only matched, in its modern history, by the one recorded in 1995, in the wake of the peso crisis of December 1994. The economy immediately bounced back —as happened in the earlier crisis— posting positive growth in 2010. The recovery was weak, however, in the sense that, while manufacturing exports strongly rebounded, GDP and industrial production surpassed their pre-crisis levels only in 2011. Motivated by these observations, the paper studies the transmission channels behind the 2009 recession in Mexico, the reasons for the relative weakness of the 2010–2011 recovery, and —based on that analysis— some of the risks the country faces for sustaining stronger economic growth in the future.

In addition to this Introduction and the Conclusions, the paper is organized in three main sections. Section 2 studies how the global crisis was transmitted to the Mexican economy. While there was a retreat of foreign capital inflows, a more important channel was the negative effect on private investment caused by the reduction of manufacturing exports and industrial production. To show this effect, the section estimates an equation for private investment in Mexico. The estimations —which follow the so-called bounds testing approach of Pesaran et al. (2001)— use quarterly series for the post-liberalization period 1988–2010. The investment channel helps to explain the paradox of a sharp contraction in GDP while net exports and the current account balance remained relatively stable.

Section 3 delves into the recovery. It centers on the puzzling observation of a strong rebound in manufacturing exports, on one hand, and the weakness of recovery in GDP and industrial production on the other. The analysis stresses the real exchange rate's role in the export rebound, the influence of the so-called vertical specialization of production on the weak transmission of exports to industrial production and therefore investment, and the consequent limited absorption of foreign capital inflows during the recovery.

Section 4 examines some of the risks Mexico faces for sustaining faster economic growth in the future. A first risk stems from the mix of slow economic growth and low interest rates likely to persist in developed countries, a mix that may "push" large amounts of foreign capital to countries like Mexico and in that way appreciate the currency in real terms. The appreciation affects negatively not only exports but also investment —as shown by the investment equations presented in Section 2— thus compromising growth in the medium term. A second, related risk is that the single focus of monetary policy on reducing the inflation rate becomes an additional, "pull" factor for capital inflows and real currency appreciation. Here the analysis includes a detailed look at the management of monetary policy in Mexico during the crisis and recovery, particularly as reflected in the behavior of interest rate differentials.

A final risk as a result of vertical specialization and the tight link between exports and intermediate imports, the real exchange rate may become a less effective tool of external adjustment —a risk that could

materialize if future growth comes to depend not only on exports but also on a stronger expansion of domestic demand. The analysis is supported by the estimation —again following the bounds testing approach— of trade balance equations for Mexico. The equations test for a reduction in the effect of the real exchange rate on the trade balance in the more recent period, after the enactment of NAFTA.

2. The 2009 recession

2.1 Exports and GDP

Closely tracking the evolution of the US economy, Mexico began to decelerate in 2007, with GDP growth falling from 5.0% in 2006 to 1.4% in 2008. The process culminated in the recession of 2009, when GDP fell by 4.7% —and which represents, together with the Tequila crisis of 1995, the largest single-year drop experienced by Mexico in its recent history (Table 1).[1]

The Mexican economy was hit by two major external shocks (Ros, 2011; Schwellnus, 2011; Sidaoui et al., 2010). One was the retreat of foreign capital inflows. As measured by the financial account balance in the balance of payments, *net* capital inflows (that is, foreign capital inflows minus domestic capital outflows) fell from close to 4% of GDP during 2008, to 1.5% in the year to mid-2009. The fall in *foreign* capital inflows was larger —from a peak of 8.2% of GDP in 2007 to 1.1% of GDP in the year to mid-2009 (Table 2).[2]

The second shock was a strong fall in manufacturing exports. A relevant observation, though, is that while exports fell by about 13% in real terms during 2009, their effect on net external demand was minimal. In fact, although exports fell by about 2 percentage points of GDP, the trade balance actually *increased*, from a deficit of 2.3% of GDP in 2008 to a deficit of only 0.3% in 2009. The reason, of course, is that the fall in exports was more than offset by a fall in imports. *Intermediate* imports, in particular, fell from 21.5% of GDP in 2008 to 18.6% in 2009 (Table 1).

Table 1
Economic activity

	2006	2007	2008	2009	2010	2011	2012-14 ^b
GDP growth rat≤e ^a	5.0	3.1	1.4	-4.7	5.1	4.0	2.5
IPI growth rate	4.4	1.5	-0.5	-6.2	4.6	3.4	1.4
MPI growth rate	4.5	1.0	-1.0	-8.4	8.5	4.6	2.9
% of GDP ^a							
Trade balance	0.0	-0.6	-2.3	-0.3	-0.3	-0.2	0.0
Total exports	28.5	28.7	27.9	25.8	29.6	30.8	32.0
Manufacturing exports	20.7	21.3	21.4	19.6	23.2	24.7	26.2
Total imports	28.5	29.3	30.2	26.1	29.9	31.1	32.1
Intermediate imports	20.3	20.8	21.5	18.6	22.2	22.7	23.1
Fixed investment	21.7	22.3	23.1	22.0	21.2	22.0	21.7
Private fixed investment	17.0	17.6	17.5	16.1	15.6	16.8	17.4
Public fixed investment	4.7	4.7	5.6	5.9	5.6	5.2	4.3
US GDP growth rate	2.7	1.8	-0.3	-2.8	2.5	1.6	2.3
US IPI growth rate	2.2	2.5	-3.4	-11.3	5.7	3.3	3.6
US MPI growth rate	2.5	2.7	-4.7	-13.6	6.1	3.4	3.4

IPI: Industrial production index; MPI: Manufacturing production index, both base 2008.
^a The GDP shares and growth rate are based on National Accounts data in real terms, base 2008.
^b Annual averages.
Sources: National Institute of Statistics (INEGI) for Mexico's National Accounts data, IPI and MPI; US BEA for US GDP; and US Federal Reserve for US IPI and MPI.

The close link between exports and imports, and thus the subdued effect of exports on the trade balance, is a consequence of the intensive use of intermediate imports in export production in Mexico (Cardero and Galindo, 2005; Moreno-Brid et al., 2005; Ibarra, 2011a, 2011b; Blecker and Ibarra 2013; Ibarra and Blecker 2015). One reason is the large share of so-called maquila goods in manufacturing exports, which according to balance of payments data increased from 51% in 1993 to 61% in 2006 —the latest year with official statistics about maquila exports.

As is well known, maquila consists of the assembly of intermediate imports, with little value added, for resale in the export market —an extreme example of the so-called vertical specialization of export production

1. The specific figures for GDP growth and its composition vary depending on whether National Accounts data based on the years 2003 or 2008 are used. While a previous version of this paper used 2003-based data, the present version uses 2008-based data.

2. Despite the eruption of the global financial crisis, foreign capital inflows were particularly high in 2007. As noted by several authors, in the first stage of the crisis capital tended to flow from developed to developing countries, a movement that was later reversed, as the crisis deepened (Cetorelli and Goldberg, 2011; Milesi-Ferretti and Tille, 2010).

Table 2
Balance of payments and real exchange rate indices

	2007	2008	2009Q2 ^c	2009	2010	2011	2012-2014
% of GDP ^a, b							
Financial account balance	2.8	3.9	1.5	2.1	5.6	5.4	5.8
Foreign capital inflows	8.2	4.7	1.1	4.5	11.2	6.5	9.5
Foreign direct investment	4.1	3.3	3.0	2.2	3.0	2.4	2.9
Foreign portfolio investment	1.7	0.5	-0.7	1.9	4.5	4.3	6.0
Other foreign investment	2.3	0.9	-1.3	0.3	3.7	-0.2	0.6
Domestic capital outflows	5.4	0.8	-0.5	2.4	5.6	1.1	3.7
Errors and omissions (outflow)	-0.4	0.6	1.2	0.5	2.7	1.1	1.7
Reserve accumulation	1.4	0.9	-1.6	0.6	2.4	2.9	1.6
Current account deficit	1.9	2.3	1.9	1.0	0.6	1.4	2.4
Trade deficit	2.3	3.0	3.2	1.9	1.6	1.6	1.5
Exports	37.1	35.8	32.7	30.8	36.6	37.7	40.8
Manufacturing exports	28.1	26.7	25.1	23.9	28.7	28.7	32.2
Imports	39.4	38.8	35.9	32.7	38.2	39.3	42.2
Intermediate imports	26.3	25.6	23.5	21.5	26.8	27.2	29.2
Net (capital) factor payments	3.0	2.3	1.7	1.9	1.5	2.1	3.3
Net transfers received	3.4	2.9	3.0	2.7	2.5	2.4	2.3
Real exchange rate indices, 2007=100							
Real effective exchange rate	100.0	104.5	112.4	118.4	109.1	110.8	106.3
Relative unit labor cost, RULC	100.0	99.8	108.9	114.1	105.6	n.a.	n.a.
RULC including maquila sector	100.0	98.1	109.2	115.1	107.2	104.3	102.8

^a To avoid measurement biases due to variations in the real exchange rate, the original series for the nominal GDP in pesos was transformed to US dollars using a nominal exchange rate that keeps the level of the Bank of Mexico's real effective exchange rate index constant.
^b From 2011 to 2014 the BOP does not add up to zero due to relatively large valuation gains (not shown).
^c Last four quarters.
Sources: Bank of Mexico for BOP data in current US dollars and real effective exchange rate; INEGI for nominal GDP in pesos (base 2008) and RULC; and author's calculations of the nominal exchange rate.

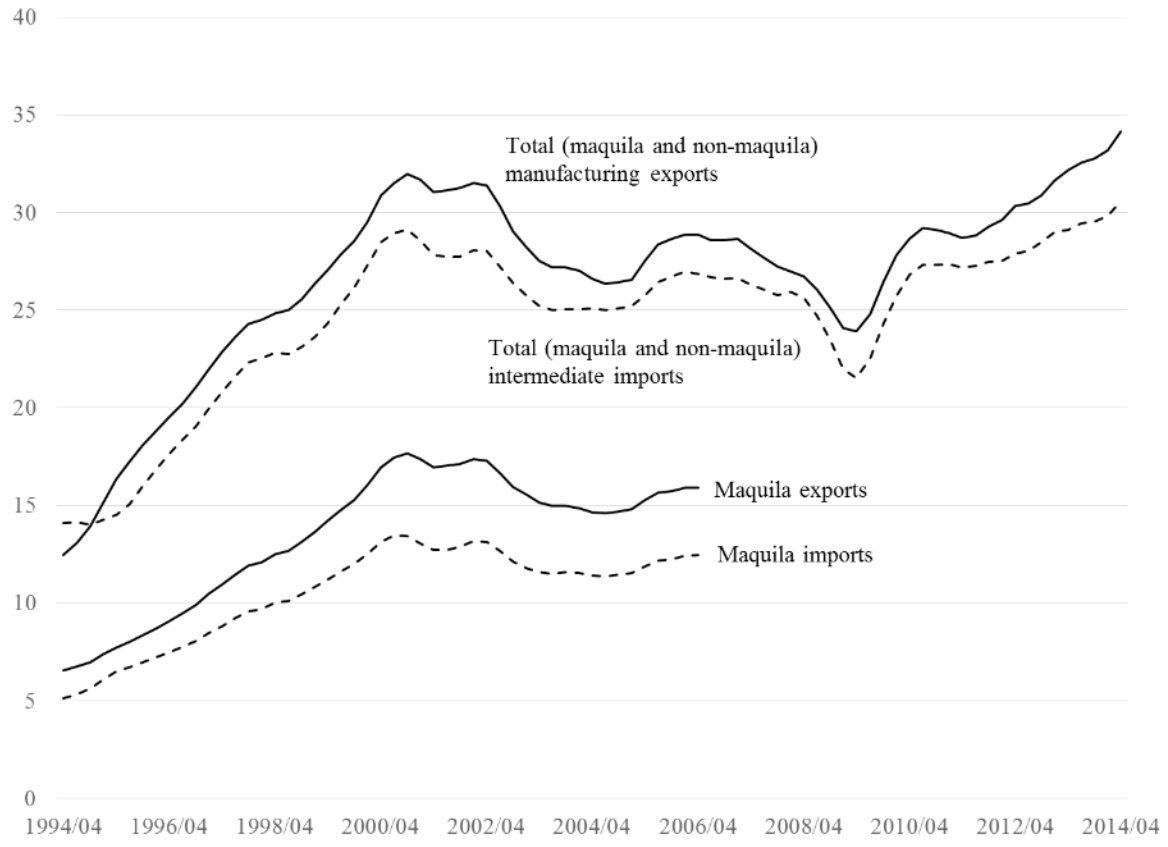
(Feenstra, 1998; Hummels et al., 2001). The average ratio of intermediate imports to gross production (that is, basically exports) in the maquila sector rose from 0.75 in 1993 to 0.88 in 2006. But the use of imports is intensive also in the main non-maquila, export-oriented manufacturing industries. This is the case, for example, of the automobile assembly and production industry, which in the early 2000's accounted for more than 40% of non-maquila manufacturing exports, and in which imports accounted for at least 50% of intermediate goods (Buitelaar and Padilla, 2000; Ibarra, 2011a). As shown in Figure 1, the tight link between manufacturing exports and intermediate imports characterizes not only the maquila sector, but the respective total flows as well.

Vertical specialization implies that changes in exports are matched by automatic changes in intermediate imports, with a muted effect on net exports. For this reason, their effect on value added is limited (UNCTAD, 2002). Because of these characteristics, the collapse in manufacturing exports cannot explain *directly* the large fall in GDP observed in 2009. What were then the *indirect* channels?

2.2 Transmission channels

A first observation is that the fall in exports was soon accompanied by a strong reduction in investment (gross fixed capital formation). Thus, while GDP was falling by 4.7%, as already mentioned, investment as a share of GDP dropped from 23.1% in 2008 to 22.0% in 2009. This

Figure 1. Mexico: Manufacturing exports and intermediate imports



Notes: 1) 1994Q1–2014Q4. 2) Averages from last four quarters. 3) Trade flows from BOP in current dollars, as % of GDP; see note in Table 2 for the calculation of the GDP in dollars.
Source: Bank of Mexico for imports and exports, and INEGI for GDP..

reflected a contraction of 12.5% in *private* investment, which more than offset a (counter-cyclical) increase in public investment.

In principle, the reduction in investment could be explained by the other shock affecting the Mexican economy, namely, the retreat of foreign capital. Lower inflows may force a downward adjustment in the current account deficit. But since the latter equals the excess of investment over domestic saving, the lower inflows may end up forcing a reduction in investment (which of course may be accompanied also by a decrease in consumption and increase in saving).

This specific channel, though, seems to have played a relatively minor role in the transmission of the global financial crisis to investment in Mexico. First, the reduction in net capital inflows was small while foreign capital inflows fell from 8.2% of GDP in 2007 to 1.1% through mid-2009, and then partially recovered to 4.5% in 2009, net capital inflows fell by much less, due to a parallel reduction in domestic capital outflows.[3] In the end, net capital inflows, as mentioned, fell from a peak of 3.9% of GDP in 2008 to 2.1% in 2009.

Second, not only did the fall in foreign capital inflows have a reduced impact on net inflows, but initially this had no counterpart in the evolution of the current account deficit, which remained relatively stable at around 2.0% of GDP in the year to mid-2009. In the end, the current account deficit did fall, to 1.0% of GDP in 2009, but this adjustment seems too small to have

3. Domestic capital as a component of net capital flows became important in Mexico (and other countries like Chile) in the second half of the 2000s (Forbes and Warnock, 2011).

forced a major reduction in investment (Table 2). More generally, we will see below that the transfer of capital inflows to investment (capital formation) in Mexico, during both the crisis and recovery periods, was relatively minor —a phenomenon that has characterized Mexico over the medium term, and which suggests that investment in the country has been limited not by the availability of saving but by other factors affecting its profitability (Bulir and Swiston, 2006; Ibarra, 2008, 2011c; Ize, 2010; Trigueros, 1998).

The reduction in investment, instead, appears to be related to the negative impact of the export contraction on gross industrial production.[4] The impact of exports on industrial production was strong —which is not surprising, given the increasingly outward orientation of industrial production in Mexico after the liberalization of trade in the mid-1980s. Thus, industrial production growth decelerated from 4.4% in 2006 to practically zero in 2008, and *minus* 6.2% in 2009.[5]

To study the effect of industrial production on investment, Table 3 presents estimated equations for private investment in Mexico. The estimations follow the so-called bounds testing approach of Pesaran et al. (2001), which offers several advantages. First, it produces estimates of persistent, "long-run" effects based on data in levels (instead of the short-run, more transitory effects associated to first-differenced data). Second, the estimation method corrects for possible regressor endogeneity, thanks to the lag structure of an underlying autoregressive distributed lag (ARDL) equation (see Pesaran and Shin 1998). Third, the approach is flexible enough to incorporate a relatively large number of regressors and combine stationary and non-stationary variables—specifically, variables integrated of order zero or one, which is a feature of our data (see the results of unit root tests in Appendix Table A1).

Bounds testing estimation involves several steps. The starting point is the estimation of an ARDL equation in error-correction form,

$$(1)\quad \Delta PI_t = \sum_{j=1}^{n} a_j \Delta PI_{t-j} + \sum_{i=1}^{k}\sum_{j=0}^{n} b_{i,j}\Delta Z_{i,t-j} + \sigma PI_{t-1} + \sum_{i=1}^{k} d_i Z_{i,t-1} + d_0$$

where PI stands for the natural log of private investment, posited to depend on k potential determinants Z_i, Δ indicates the first difference of the corresponding variable, while $-\sigma$ measures the speed of adjustment (or error correction) of PI toward its long-run equilibrium, as defined by equation (2) below.

Equation (1) includes both the lagged levels and the current and lagged first differences of all the variables, where the lag length of the first differences can be determined by Akaike's criterion. Importantly, the estimated coefficients on the lagged levels are used to calculate the long-run coefficients, as explained below. To ensure that they are statistically valid, the estimated equations must pass diagnostic tests for normality, serial correlation, ARCH residuals, and mis-specification error. In our case, to pass the normality test it was necessary to control for a number of outlier observations, as detailed in Table 3.

In a second step, F and t tests are applied to the estimated ARDL equation to determine whether the null of no long-run relationship can be rejected, where the nulls are $\sigma=0$ (t test), and $\sigma=d_1=d_2=\ldots=d_k=0$ (F test). Rejecting the null requires the t (in absolute value) and F statistics to lie above the upper critical values (or upper bounds) specifically calculated for these tests. If this condition is met, then the null can be rejected irrespective of whether the variables are integrated of order zero, one, or a combination. Given the relatively small samples (consisting of either 82 or 92 quarterly observations) used in the estimations, the F tests reported below use the small-sample critical values calculated by Narayan (2005); the t tests, on the other hand, must use the asymptotic critical values calculated by Pesaran et al. (2001), as small-sample values are not available.

If the null is rejected, in a third step the lag structure of the estimated equation can be simplified, by removing the longest non-significant lags of each first-differenced variable. Finally, after the lag simplification, the long-run coefficients can be calculated as $\delta_i = -d_i/\sigma$, leading to the long-run equation,

$$(2)\quad PI_{LR} = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \cdots + \delta_k Z_k$$

Regarding the Z_i determinants, in addition to the industrial production index, the equations include government investment (to control for possible complementary

4. Some authors have argued that the instability of global financial markets contributed to a reduction in domestic demand —particularly consumption— because of a tightening in domestic credit conditions (Schwellnus, 2011).

5. Since manufacturing exports correspond to gross production (rather than value added alone) sold abroad, they can have a large effect on total (gross) industrial production in outward-oriented economies like Mexico's, even if their effect on industrial value added is small. According to the Annual Manufacturing Survey, carried out by Mexico's National Institute of Statistics (INEGI) following the North American Industrial Classification System (NAICS, version 2007), during the period 2009 to 2012 exports represented about 25% of total (gross) manufacturing production.

or substitution effects), the broad money supply M2 as an indicator of credit levels, and the real interest rate decomposed into the nominal interest rate and the inflation rate as an indicator of the cost of credit. The equations also include alternative measures of the real exchange rate —namely, the Bank of Mexico's CPI-based multilateral rate; the relative unit labor cost in the manufactures between the US and Mexico; and the bilateral, CPI-based rate. An increase in any of these measures means a real depreciation of the peso. Finally, following the literature on the aftermath of financial crises (Reinhart and Tashiro 2013, Chari and Henry 2014), the estimations control for the persistent falls in private investment levels that took place in Mexico in the wake of

Table 3

Private investment equations

Dependent variable: Private investment

Long-run coefficients from error-correction ARDL equations

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
Speed of adjustment, σ	-0.629	-0.712	-0.388	-0.574	-0.615	-0.518
Industrial production index	2.63 (0.00)	2.88 (0.00)	2.57 (0.00)	3.03 (0.00)	2.40 (0.00)	2.86 (0.00)
Government investment	-0.30 (0.00)	-0.28 (0.00)	-0.42 (0.00)	-0.34 (0.00)	-0.27 (0.00)	-0.22 (0.00)
Nominal interest rate	-0.59 (0.00)	-0.57 (0.00)	-0.95 (0.00)	-0.78 (0.00)	-0.53 (0.00)	-0.63 (0.00)
Annual inflation rate	0.32 (0.00)	0.33 (0.00)	0.35 (0.04)	0.33 (0.03)	0.32 (0.00)	0.41 (0.00)
Broad money supply, M2	0.67 (0.08)	–	1.30 (0.05)	–	0.93 (0.02)	–
Real effective exchange rate	0.46 (0.00)	0.47 (0.00)				
Bilateral real exchange rate			0.98 (0.00)	0.90 (0.00)		
Relative unit labor cost					0.24 (0.00)	0.29 (0.00)
Adjusted R-squared	0.942	0.934	0.934	0.925	0.945	0.917
Jarque-Bera	0.937	0.842	0.717	0.374	0.581	0.399
Breusch-Godfrey (4 lags)	0.608	0.469	0.683	0.605	0.382	0.523
ARCH (1 lag)	0.617	0.910	0.376	0.460	0.083	0.278
RESET (sq. fitted values)	0.300	0.495	0.378	0.904	0.401	0.943
Bounds *t*-stat	-4.53 **	-5.54 ***	-3.01	-4.04 *	-4.52 **	-3.73
Bounds *F*-stat	9.41 ***	10.28 ***	6.56 ***	6.75 ***	10.01 ***	8.08 ***
Estimation period	1988Q1–2008Q2	1988Q1–2010Q4	1988Q1–2008Q2	1988Q1–2010Q4	1988Q1–2008Q2	1988Q1–2010Q4
Number of observations	82	92	82	92	82	92

For illustrative purposes, p- values for the d_i coefficients from equation (1) (see main text) are shown in parenthesis next to the long-run coefficients.

Data: Private and government investment (from real National Accounts data), the industrial production index, and the three real exchange rate indices are in natural logs (times 100). The bilateral real exchange rate is equal to the CPI ratio between the US and Mexico. The annual inflation rate (based on the CPI index) and the nominal interest rate (91-day Treasury bills, annualized) are in percentage. M2 is measured as a percentage of GDP, both in nominal terms. The relative unit labor cost was lagged one year.

Diagnostics: The null hypotheses are that residuals are normally distributed (Jarque-Bera), and that there is no serial correlation of up to 4th order (Breusch-Godfrey), no ARCH errors, and no mis-specification error (Ramsey's RESET). The table reports the tests' p-values.

Bounds tests: ***, **, *: Rejects the null of no level relationship at 1%, 5%, 10%. The t test uses the asymptotic critical values calculated by Pesaran et al. (2001), while the F test uses the small-sample (n=80) critical values calculated by Narayan (2005).

Other notes:

1) All the equations were initially estimated with 3 lags. They include a 0-1 intercept dummy for the post-Tequila crisis period, 1995Q1-2008Q4. The equations in (3.2), (3.4) and (3.6) also include a similar dummy for the Lesser Depression period, 2009Q1-2010Q4.

2) In columns (3.2), (3.4), and (3.6), M2 was removed from the long-run segment of the model due to lack of significance, but was kept in the short-run segment, where it was significant (not shown).

3) To pass the normality test, the following quarter outlier dummies were included in the equations: 1996Q4 in (3.1) and (3.3); 1996Q4, 2008Q2, and 2008Q3 in (3.2) and (3.4); 2003Q4, 2004Q4, and 2008Q2 in (3.5); and 2003Q4, 2008Q2, and 2008Q3 in (3.6).

Source: Author's estimations.

the 1995 (Mexican) and 2008 (global) crises; this is done by including separate 0-1 dummies for the periods 1995-2008 and 2009-2010.[6]

The estimation sample begins in the first quarter of 1988 —after major trade liberalization was completed, and private investment had become the main component of capital formation in Mexico. One set of estimations ends on the second quarter of 2008, before the impact of the global crisis was felt in the country, while a second set is extended until the final quarter of 2010, in order to explore whether the crisis and initial recovery had an effect on the estimated coefficients.

Both bounds tests support the existence of a long-run equation for investment. More specifically, the *F*-test rejects the null of no relationship in all cases at 1% of significance, while the *t*-test also tends to reject the null, although it fails to do so in two specifications (columns 3.3 and 3.6). Similarly, the speed of adjustment coefficient (or error-correction coefficient) is always negatively signed, as expected, indicating that investment tends to move toward its equilibrium level. Finally, the results of the diagnostic tests are satisfactory, except for the ARCH test (at 10%) in column (3.5).

The estimates show that a rise in M2 or a fall in the real interest rate (in the latter case, through either a lower nominal rate or higher inflation) increases private investment. Somewhat unexpectedly (although see Pérez, 2004 for a similar result), government investment appears to reduce private investment. This may reflect an outright case of crowding out, or alternatively it may be capturing a negative correlation created by the privatization of public assets in the country —that is, the retreat of government from economic activity and its replacement by private investment. Finally, in both samples and with the three alternative indicators, the estimations show a positive effect of the real exchange rate on investment —in other words, that a real appreciation of the peso tends to decrease private investment— a result to which we will return.

For the moment, though, we may focus on the results concerning the industrial production index. The estimated coefficient is always highly significant in statistical terms, and shows an elasticity of about 2.5 in the pre-crisis sample. Once the sample is extended, the estimated coefficient increases to about 3, indicating that the sensitivity of private investment to industrial production increased after the eruption of the crisis.[7]

To have an idea about economic significance, consider that, between the year to mid-2008 and 2009, manufacturing exports fell by 41.5 billion dollars. The effect on net external demand was negligible, as we saw, because of the parallel fall in intermediate imports. The contraction in manufacturing exports, however, did affect industrial production, which fell by 7.0% in 2009 from its peak in the year to mid-2008. The fall in industrial production tended to have a large negative effect on investment. Using the estimated elasticity of 2.63 in column (1) of Table 3 —that is, excluding the crisis and rebound period— this predicted a contraction of about 18.4% in private investment. For comparison, the actual contraction was 14.1%.

3. The 2010–11 Recovery

3.1 Exports and GDP, again

Despite its severity, the recession was short-lived and recovery began in early 2010. The GDP growth rate rose from *minus* 4.7% in 2009 to 5.1% in 2010. The recovery was led by exports, which increased to 29.6% of GDP in 2010 from 25.8% the previous year. At the same time, foreign capital inflows rose from 1.1% of GDP in the year to mid-2009, to 11.2% of GDP in 2010, while net capital inflows did it from 1.5% to 5.6% of GDP (Tables 1, 2).

The renewed dynamism of exports originated in the manufacturing sector, whose exports rose from 19.6% of GDP in 2009 to 23.2% in 2010, reflecting a growth of 24.7% in real terms. This showed once more the high sensitivity of Mexican exports to US economic activity, whose GDP growth rate swung by more than 5 percentage points, to 2.5% in 2010, while the growth rate of the industrial production index did it by 17 points, to 5.7% in the same year.

But while easily explained in qualitative terms by the US economic recovery, the sharp rebound of exports is noteworthy because it occurred under conditions of

6. For a brief theoretical discussion of investment determinants, see Peltonen et al. (2011); and for alternative estimations of investment equations in Mexico that include the real exchange rate, see Blecker (2009), Lederman et al. (2003), Pérez (2004), and Ramírez (1994) —for macroeconomic equations— and Aguiar (2005) and Caglayan and Muñoz-Torres (2011) for studies using more disaggregated data.

7. The estimates suggest that private investment, intended by definition to expand production capacity, is related not necessarily to industrial value added itself, but more generally to gross production levels. This is an important observation, as large parts of the industrial sector in Mexico, particularly those oriented to export markets, may be characterized as being low value added activities; as mentioned in sub-section 2.1, this would reflect the presence of a high degree of vertical specialization of production, of which the maquiladora sector is a prime example.

weak external demand. In particular, by 2011 the US GDP was barely returning to the levels attained three years before, and both the industrial and manufacturing production indices were still significantly below that mark. In contrast, Mexico's manufacturing exports were 20.1% higher (Table 4).

What explains then the sharp rebound of exports? One likely factor is the real exchange rate. In the initial stages of the crisis, under a global flight to quality and declining inflows of foreign capital, the peso depreciated by a large proportion. Thus, the CPI-based real effective exchange rate index rose (that is, the Mexican peso depreciated) by nearly 20%, from 100 in 2007 to 118.4 in 2009. The same pattern is shown by alternative real exchange rate indicators, like the relative unit labor cost in the manufactures between the US and Mexico, which rose from 100 to 114.1 over the same period (Table 2).

Table 4
Recovery

				% Cumulative variation	
	2008	2010	2011	2010-2008	2011-2008
Billion 2008 pesos					
GDP	12,257	12,278	12,774	0.2	4.2
Exports	3,419	3,636	3,935	6.3	15.1
Manufacturing exports	2,624	2,854	3,152	8.8	20.1
Intermediate imports	2,639	2,720	2,895	3.1	9.7
Fixed investment	2,830	2,601	2,804	-8.1	-0.9
Fixed public investment	687	690	662	0.4	-3.7
Fixed private investment	2,144	1,911	2,143	-10.8	0.0
Billion 2009 dollars					
US GDP	14,830	14,784	15,021	-0.3	1.3
Indices 2008=100					
IPI	100.0	98.1	101.4	-1.9	1.4
MPI	100.0	99.5	104.0	-0.5	4.0
US IPI	100.0	93.7	96.9	-6.3	-3.1
US MPI	100.0	91.6	94.7	-8.4	-5.3

IPI: Industrial production index, MPI: Manufacturing production index.
Sources: INEGI for Mexico's National Accounts data, IPI and MPI; US BEA for US GDP; and US Federal Reserve for US IPI and MPI.

Currency depreciation made Mexican exports more competitive and undoubtedly contributed to their rapid post-crisis growth.

3.2 The transfer of capital flows

The export rebound helps to explain why —despite the difficulties faced by the US to return to pre-crisis production levels— in Mexico GDP and industrial and manufacturing production were by 2011 above that mark. Note, however, that while the rebound from their pre-crisis levels was strong in the case of manufacturing exports (20.1%), it was not so in the case of industrial production (1.4%), manufacturing production (4.0%), and GDP (4.2%; Table 4).

The weak recovery in GDP —or, in other words, the relatively low transmission of exports to GDP— involves several factors. One is the intensive use of intermediate imports in export production, a factor that as mentioned before cushioned the impact of the fall in exports on the trade balance during the recession, but that of course applied symmetrically during the recovery: the intensive use of intermediate imports reduced the multiplier effect of exports on aggregate demand.

A second factor is the failure of exports to trigger a strong recovery in investment: by 2011, both total and private investments were barely returning to their levels of 2008 (Table 4). The depressed levels of investment not only contributed to a weak recovery in GDP, but also hindered the transfer of foreign capital —which began flowing back after the crisis— to domestic capital formation. Instead, foreign capital inflows were mirrored by outflows of domestic capital and reserve accumulation.

To see the previous result, consider the balance of payments identity,

$$(3) \quad FCI = DCO + RAC + CAD$$

shows that, beyond any residual error, a larger inflow of foreign capital (*FCI*) must be matched by a combination of larger outflows of domestic capital (*DCO*), faster reserve accumulation (*RAC*), and a higher current account deficit (*CAD*).

Moreover, since the current account deficit must equal the gap between domestic investment and saving, we have,

$$(4) \quad FCI = DCO + RAC + (I - S)$$

Table 5
Transfer of foreign capital
(Billion US dollars)

					Variations		
	2007	2009Q2 ^a	2011Q2 ^a	2014	2009Q2-2007	2011Q2-2009Q2	2014-2009Q2
Balance of Payments							
Foreign capital inflow	63.9	8.6	92.3	84.4	-55.3	83.7	75.8
Domestic capital outflow	41.8	-3.8	29.4	28.5	-45.6	33.2	32.3
Error (outflow)	-3.4	9.7	24.7	13.1	13.1	15.0	3.4
Reserve accumulation	10.9	-12.6	28.3	15.5	-23.5	40.9	28.1
Current account deficit	14.7	15.3	10.3	26.5	0.6	-5.0	11.2
National Accounts							
Fixed investment	232.3	218.8	239.6	269.6	-13.5	20.8	50.8
Private fixed investment	184.4	160.4	177.7	218.0	-24.0	17.3	57.6
Public fixed investment	47.9	58.4	61.9	51.6	10.5	3.5	-6.8
Saving (residual)	217.6	203.5	229.3	243.1	-14.1	25.8	39.6

National Accounts data, in nominal terms, were converted to dollars at the market exchange rate.
Saving was calculated residually as the difference between the current account deficit and fixed investment.
BOP may not add up to zero due to the rounding of figures and small valuation gains (not shown).
^a Last 4 quarters.
Sources: Bank of Mexico for balance of payments, and INEGI for National Accounts data (base 2008).

Thus, depending on the actual factors constraining investment (see Hausmann et al., 2007), an inflow of foreign capital may have as counterpart a larger deficit in the current account due to higher levels of domestic investment (for example, if investment is constrained by the availability of external financing) or lower domestic saving, or instead the inflow may have as counterpart larger outflows of domestic capital or a faster accumulation of reserves (for example, if investment is constrained by low profitability, and thus does not respond to the greater availability of credit).

Table 5 presents some calculations based on equation (4). Foreign capital inflows rose from a low of 8.6 billion dollars in the year to mid-2009, to 92.3 billion dollars two years later (about 10% of GDP), for an increase of 83.7 billion dollars. The increase in foreign capital inflows had as counterpart larger outflows of domestic capital for 33.2 billion dollars (48.2 billion if the residual error is included) and faster reserves accumulation for 40.9 billion dollars. The current account deficit, in contrast, *fell* by 5.0 billion dollars. Thus, as mentioned above, there was no transfer to the current account and instead the inflow of foreign capital was used up in reserve accumulation and outflows of domestic capital.

Over the same period, total investment (domestic capital formation) increased —although remaining below its early-2008 peak— by 20.8 billion dollars, most of which corresponded to private investment. The figures imply that the investment recovery had as counterpart a rise in domestic saving (since the current account deficit remained mostly unchanged), with no role played by the inflows of foreign capital.[8]

4. Risks For Future Growth

4.1 Capital flows, currency appreciation, and investment

During the recovery, foreign capital inflows were not "transferred" to the current account deficit and there-

8. Similar qualitative conclusions are obtained if we extend the period until 2014: foreign capital inflows rose by 75.8 billion dollars, which were matched by reserve accumulation (28.1 billion), domestic capital outflows (35.7 billion, including errors), and a relatively small increase of 11.2 billion in the current account deficit. The deficit was the counterpart of an excess increase in private investment over domestic saving.

fore to domestic demand. As a positive aspect, this reduced the vulnerability of the Mexican economy to a possible reversal of capital inflows in the future, compared to a situation in which the current account deficit had undergone a *large* upward adjustment. Given the sluggish pace of growth of the Mexican economy, however, and the very low —and therefore manageable— inherited level of the current account deficit, perhaps a more important question is why the capital inflows were not translated into higher current account deficits and domestic demand levels.

Given their high sensitivity to industrial production, and the failure of exports to produce a strong recovery in the latter, the flat levels of investment are not surprising. As shown above in Table 4, by 2011 Mexico's industrial production index was only 1.4% above the level recorded three years before. Unsurprisingly, utilization rates remained below pre-crisis levels (Bank of Mexico, 2011). As long as industrial production and utilization rates remain depressed, it is difficult to expect a stronger recovery in private investment.

But over a longer term, after industrial production and utilization rate levels are back to normal, there is a risk that investment may be hindered by strong capital inflows and their effect on the peso's real exchange rate. In this respect, recent research shows that international capital inflows can strongly appreciate the peso, whether the inflows take the form of direct or portfolio investment (Ibarra, 2011d). And the mix of slow growth and low interest rates, currently observed and likely to persist in developed countries (including those in the Euro zone), may "push" significant amounts of foreign capital to middle-income countries like Mexico, as indeed began happening in the second half of 2009.[9]

Thus, as capital inflows gained speed in the second half of 2009, the real exchange rate began to reverse its initial, crisis-induced depreciation. After peaking at 118.4 in 2009, the ensuing appreciation reduced the real exchange rate index back to 110.8 in 2011, only 10% above its 2007 pre-crisis level. The reversal was even stronger in the case of the relative unit labor cost in the manufactures, which by 2011 was only 4.3% above its 2007 level. Thus, capital inflows can have a strong influence on the real exchange rate, even if the central bank leans against the wind and accumulates international reserves. These trends continued beyond the initial recovery period. During 2012-14, foreign capital inflows averaged 9.5% of GDP, while the real exchange rate index continued to fall, to an average of 106.3. In fact, by 2014 the real exchange rate was fully back at its pre-crisis, 2007 level.[10]

The effect of a real currency appreciation on investment is in principle ambiguous. The appreciation may be expansionary, for example because of balance-sheet effects or by reducing the local-currency cost of imported capital goods. But it can also be contractionary, for example by squeezing profit margins in the capital-intensive tradable goods sector (Bhaduri and Marglin, 1990; Blecker 2007; Gala, 2008; Levy-Yeyati and Sturzenegger, 2007; Rodrik, 2008; Ros and Skott, 1998; Ros 2014). For those reasons, the actual effect of the real exchange rate on investment may depend on the specific circumstances of each country and period (Bahmani-Oskooee and Hajilee, 2010).

For Mexico in the post-liberalization period, there is strong empirical evidence of a positive link between private investment and the level of the real exchange rate, which implies that an appreciation of the peso tends to reduce private investment (Ibarra 2008, 2010, 2011c).[11] Table 3 above illustrates the effect. As may be recalled, the table shows estimations of a private investment equation for Mexico, distinguishing between a pre-crisis sample (1988Q1–2008Q2), and an extended sample ending on 2010Q4. The estimations included different indicators of the real exchange rate as a potential determinant of private investment.

Whether measured by the Bank of Mexico's multilateral index, the bilateral CPI index, or the bilateral US/Mexico relative unit labor cost in the manufacturing sector, in every case the estimations show a real currency appreciation (a fall in the real exchange rate) reduces investment. Moreover, there is no evidence that extending the sample to the crisis and initial recovery period alters the sign or significance of this effect.

9. Bakardzhieva et al. (2010) and Saborowski (2011) study of the effect of capital flows on the real exchange rate, while Forbes and Warnock (2011) and Fratzscher (2011) consider the role of push versus pull factors in the determination of capital flows.

10. By definition, push factors tend to affect groups of similar countries rather than single economies; the recent tendency toward real currency appreciation therefore should not be expected to affect Mexico alone, but instead be part of a global phenomenon. Within this global tendency, however, there are significant differences among individual countries. Focusing on Latin America, by 2013 the real exchange rate was again close to its pre-crisis, 2007 level in the cases of Brazil, Chile, and Mexico, but in contrast showed an appreciation of more than 10% in Colombia and Peru (source: CEPALSTAT). These differences suggest that the specific circumstances of each country, presumably including differences in macroeconomic policies, condition the effect of global trends at the country level. A comparative analysis of this hypothesis, however, is beyond the scope of the present paper.

11. The effect may be less clear if the estimation sample is extended back to include pre-liberalization years (Blecker 2009).

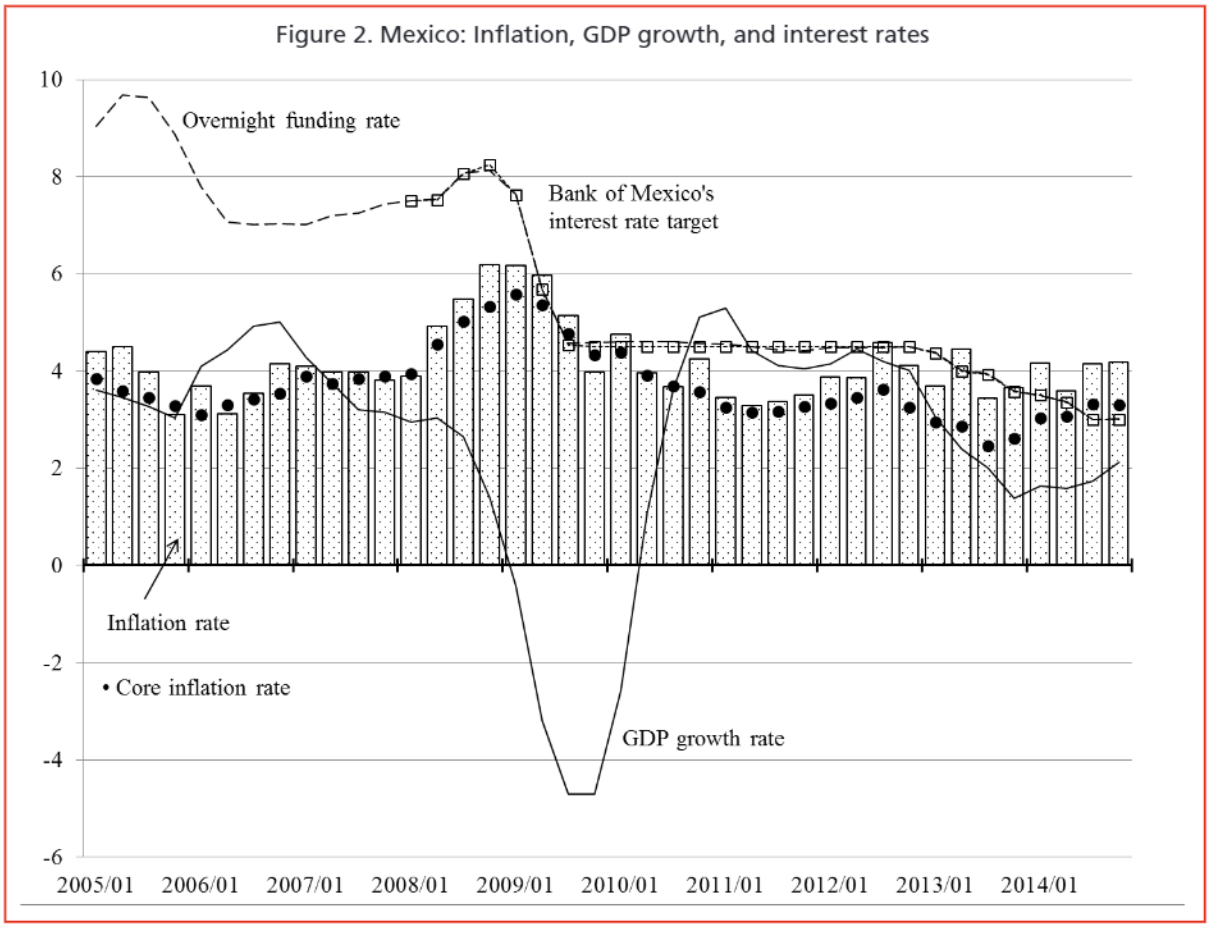
4.2 Monetary policy

The link between investment, capital flows, and the real exchange rate implies that the stance of monetary policy matters for the Mexican economy's medium-term outlook. Monetary policy can contribute to establishing a more favorable setting for growth —a setting with perhaps smaller capital inflows, but a more competitive real exchange rate and thus higher investment levels— or instead reinforce the effect on the peso's real exchange rate exerted by the capital inflows pushed from developed countries. The basic issues are illustrated by the way monetary policy was managed in Mexico during the crisis and initial recovery.

The early stages of the crisis posed a policy dilemma: while inflation increased, the growth of GDP decelerated and eventually became negative. Moreover, although the inflationary hike preceded the global crisis' impact on the peso's exchange rate, eventually the depreciation of the peso added to the inflationary pressures. The dilemma, assuming policy cared about output, was clear: while the annual inflation rate shot in a year from 3.8% in late 2007 to 6.2% —well above the Bank of Mexico's 4% upper target, and calling for monetary tightening— the GDP growth rate collapsed from 5.0% in 2006 to 1.4% in 2008 (Figure 2).

Following its inflation-focused mandate, the Bank of Mexico reacted by tightening its policy stance (Ros, 2011; Sidaoui et al., 2010). As a result, the commercial banks' overnight funding rate rose from 7% in early 2007 to 8.1% in late 2008. The Bank's explicit interest rate target, introduced in January 2008, followed the same path. The change in the policy stance was effective, in that inflation began to yield in the second quarter of 2009 —an outcome presumably helped by the severe economic contraction under way.

Figure 2. Mexico: Inflation, GDP growth, and interest rates



Notes: 1) 2005Q1-2014Q4. 2) All variables in %. 3) Inflation is the yoy change in the CPI index. 4) The GDP growth rate is the yoy rate, using 4Q-moving averages of the original GDP series.
Source: Bank of Mexico, INEGI, and US BLS.

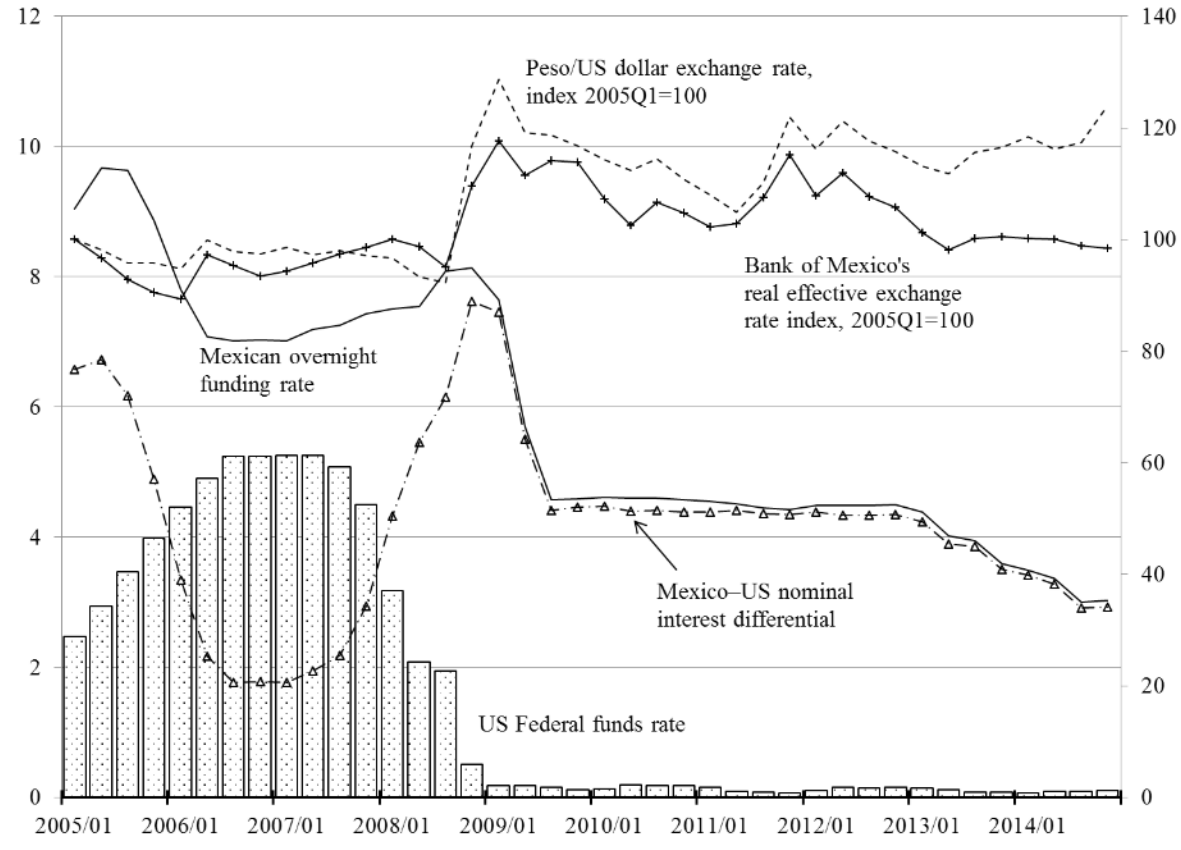
Monetary tightening in Mexico took place even as developed countries, facing a recession, were moving in the opposite direction (Ros 2011; Blecker 2011). The asymmetry led to a widening interest rate differential in favor of the peso. More specifically, while the Bank of Mexico was adopting a tighter stance, the US Federal Reserve lowered its target rate from 5.3% in mid-2007 to 0.5% in late 2008, and later further down toward zero. The peso–dollar interest differential, as a result, shot from 1.8 percentage points in early 2007 to 7.6 points in late 2008 (Figure 3).

As inflation fell —and the exchange rate stabilized— the Bank of Mexico changed track and began lowering its interest rate target in early 2009. The interest rate differential narrowed over the following quarters. The Bank, however, stopped reducing its rate in late 2009, settling at a peso–dollar interest differential of about 4.4 points. At the time, the level of the interest differential roughly corresponded to the inflation gap between Mexico and the US —but the situation changed afterwards.

Under a loose notion of purchasing power parity, investors may consider the inflation gap as a rough and ready guide to the future depreciation of the peso. Thus, if it merely covers the difference in inflation, a positive interest differential need not create expectations of extraordinary returns. Since late 2009, though, the inflation gap narrowed to less than 3 points, and by mid-2011 it had practically gone back to zero (Figure 4). As a consequence, although the nominal interest differential remained constant, the *real* differential rose from about 2 points during 2010 to more than 4 points by mid-2011.

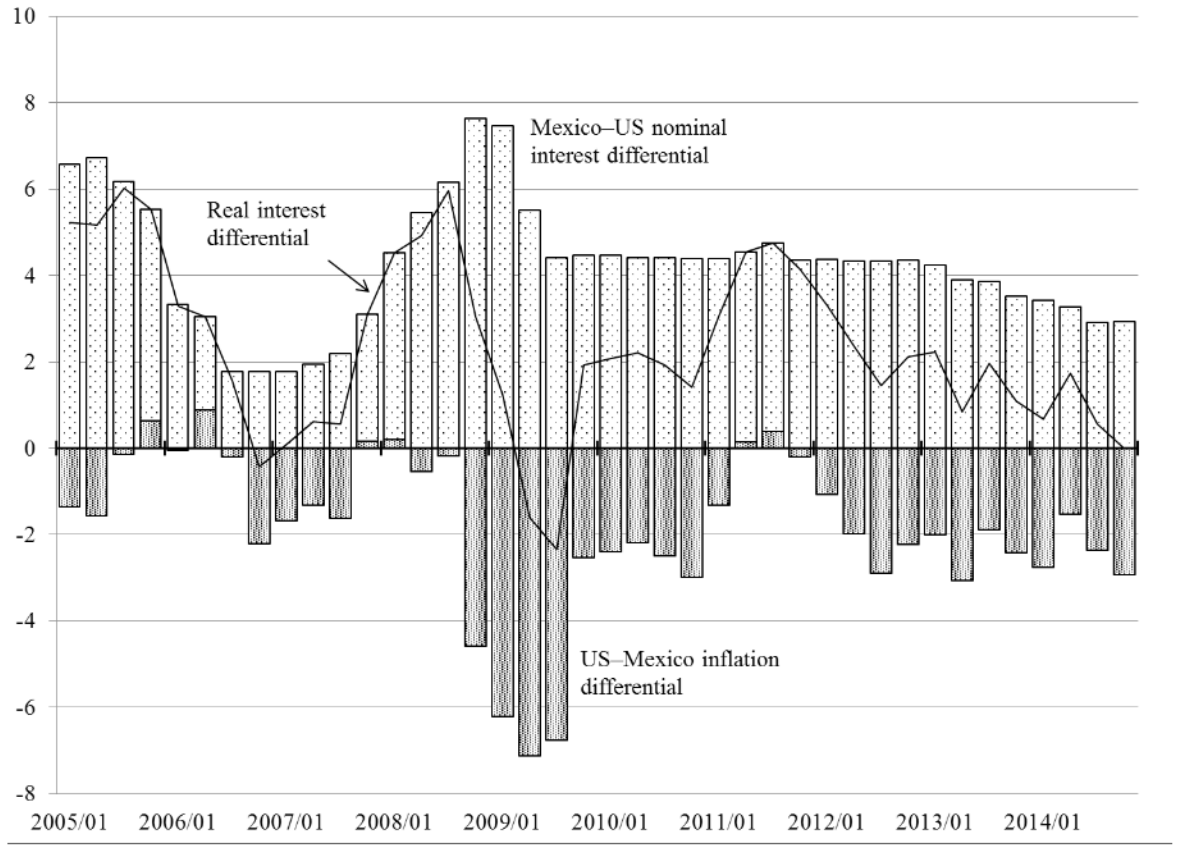
The presumption that investors interpreted the real interest rate differential as an opportunity for extraor-

Figure 3. Exchange rate and nominal interest rate differential



Notes: 1) 2005Q1-2014Q4. 2) All variables in %, except the exchange rate indices.
Source: Bank of Mexico and US Federal Reserve.

Figure 4. Real interest rate differential

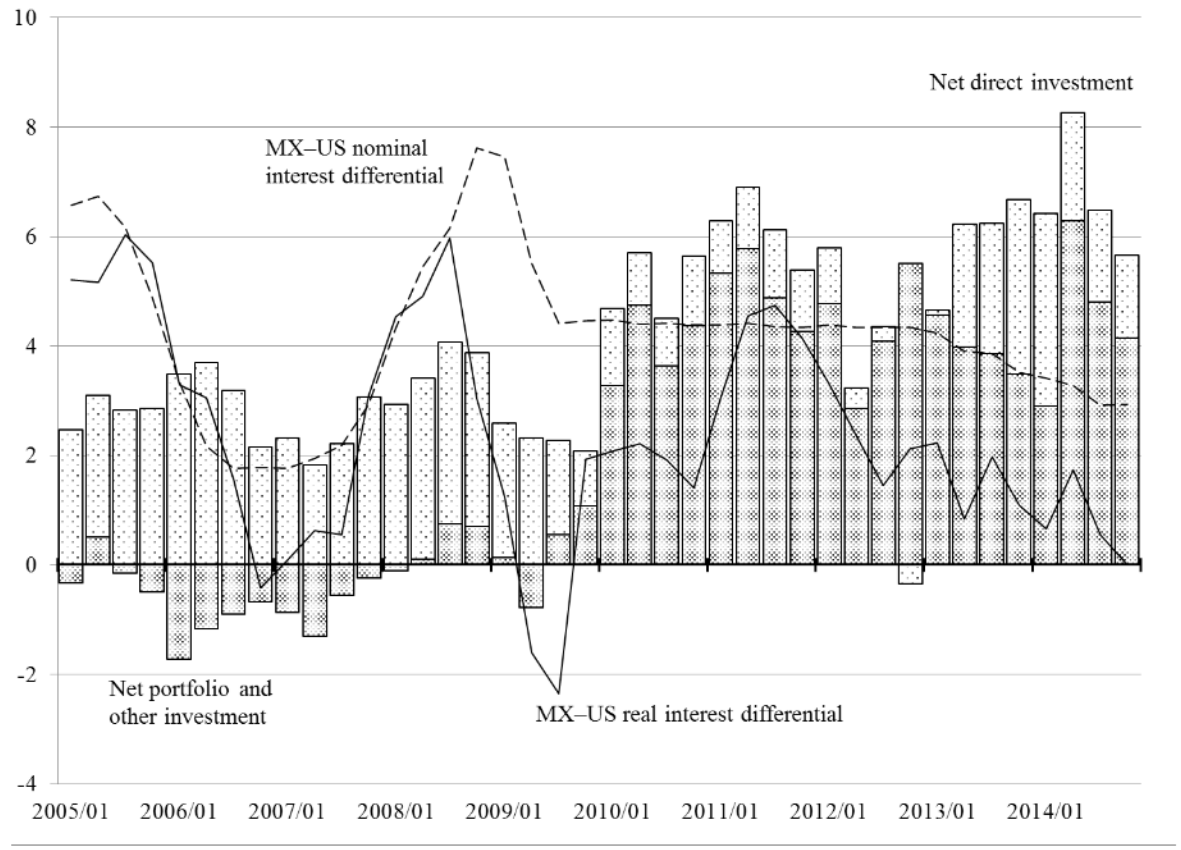


Notes: 1) 2005Q1-2014Q4. 2) All variables in %. 3) Nominal interest differential=Mexican overnight funding rate–US Federal funds rate.
Source: Bank of Mexico and US Federal Reserve.

dinary returns (rather than as a premium for country or currency risk) is reinforced by the evolution of capital flows. In particular, beginning in the second half of 2009, capital inflows surged. Rather than FDI, the surge was led by *portfolio* investments —similarly to what had happened before the peso crisis of 1994–1995. In fact, practically the entire increase of 4 percentage points of GDP from mid-2009 to 2011 in net capital inflows was accounted for by net portfolio inflows (Figure 5). That the capital surge was led by portfolio inflows, which in contrast to FDI may be more sensitive to interest differentials, suggests that monetary policy contributed to the surge and to the reversal of the initial depreciation of the peso —a depreciation that had been the basis of Mexico's export-led recovery.

In recent years, as GDP growth slowed and inflation remained most of the time below its 4% target ceiling, the Bank of Mexico began to lower its target interest rate, which was reduced from 4.5% in late 2012 to 3% in late 2014. As a result, the Mexican-US nominal interest differential fell from more than 4 percentage points to about 3 points, while the real interest differential fell to zero by late 2014. Thus, there was a gradual loosening in the Bank's policy stance. The policy loosening was not enough, however, to eliminate the incentive for capital inflows. As mentioned above, foreign capital inflows averaged 9.5% of GDP during 2012-14, while net capital inflows reached 6% of GDP during the same period. At the same time, the real exchange rate index returned to its pre-crisis level, eliminating the positive effect of a depreciated currency on investment and growth.

Figure 5. Capital inflows and interest differentials



Notes: 1) 2005Q1-2014Q4. 2) 4Q cumulative inflows, equal to the difference between foreign capital inflows and domestic capital outflows, in % of GDP; see note in Table 2 for the calculation of the GDP in dollars.
Source: Bank of Mexico, INEGI, and US Federal Reserve.

4.3 Trade balance and the real exchange rate

By leaning against capital inflows, monetary policy could attempt to shield investment from the threat of currency appreciation. Resisting appreciation may also be crucial as economic growth in Mexico gains speed —particularly if growth shifts to a more balanced mix of exports and domestic demand. Contrary to purely export-led growth, an acceleration jointly led by domestic demand could result in steeply rising current account deficits and an eventual tightening of the external constraint on growth. A competitive real exchange rate level may be the difference between a potential rather than a binding external constraint.

But besides the threat posed by surges in capital inflows —and by the overriding commitment to a disinflationary policy stance— a further hurdle for real exchange rate management arises from the tight link between manufacturing exports and intermediate imports —that is, from vertical specialization. Because of the tight link, specialization weakens the effect of the real exchange rate on intermediate imports, which instead tend to follow exports —thus explaining the paradox of a possible rise in imports when the currency depreciates (Ibarra 2011b). In other words, while the real exchange rate may affect exports in the expected way, it may not affect *net* exports —or do so, but with less rather than more intensity (Kharroubi, 2011[12]).

To examine this issue, Tables 6a and 6b show estimations of an equation for the trade balance in Mexico,

12. Most of the recent research has focused on the effect of vertical specialization on income rather than exchange rate elasticities; see for example Chinn (2010).

following the ARDL bounds testing approach introduced earlier for the analysis of investment. The theoretical basis is the so-called imperfect-substitutes model, in which trade flows are assumed to depend on relative prices and activity levels (Chinn 2006 and Bayoumi, 1999; Bahmani-Oskooee and Hegerty, 2009 and Fullerton and Sprinkle, 2005 present applications to Mexico). Accordingly, the trade balance —measured as a percentage of GDP in real pesos— was estimated as a function of the growth rates of GDP in the US and Mexico, and the real exchange rate (corresponding alternatively to the CPI-based multilateral index or the bilateral relative unit labor cost in the manufacturing sector).

The estimations rely on quarterly data from 1986 to pre-crisis 2007. We focus on the response of the trade balance to the real exchange rate, and specifically on whether the response has weakened over time. The motivation, as mentioned above, is the deepening of vertical specialization that may have occurred after the enactment of NAFTA in 1994. With that goal in mind, the sample was split into two equally sized sub-periods of 44 quarters each, from 1986 to 1996 (the "early" sample), and from 1997 to 2007 (the "late" sample). In addition, the equations were estimated over an "extended late" sample ending in 2010. Because of limitations in the availability of data, the sample in the equations including the relative labor cost begins in the last quarter of 1986.

As a preliminary step, the first column in the tables shows equations estimated with the complete series from 1986 to 2010. The estimated coefficients are signed as expected, with a negative sign for those on the speed of adjustment and on Mexico's economic growth, and a positive sign for those on US economic growth and the real exchange rate. While the equations' fit varies, most coefficients are statistically significant. Some of the

Table 6a

Trade balance equations, I

Dependent variable: Trade balance, as % of GDP

Long-run coefficients from error-correction ARDL equations

	Entire sample, 1986Q1-010Q4	**Early sample, 1986Q1-1996Q4**	**Late sample, 1997Q1-2007Q4**	**Extended late sample, 1997Q1-2010Q4**
	(6a.1) ^a	**(6a.2)** ^b	**(6a.3)** ^c	**(6a.4)** ^d
Speed of adjustment, σ	-0.158	-0.521	-0.360	-0.298
Mexico's GDP growth rate, in %	-0.82 (0.00)	-0.67 (0.00)	-0.26 (0.03)	-0.42 (0.00)
US GDP growth rate, in %	0.97 (0.00)	0.44 (0.14)	0.47 (0.04)	0.45 (0.04)
100*ln(Real effective exchange rate)	0.12 (0.02)	0.17 (0.00)	0.11 (0.02)	0.13 (0.00)
Adjusted R-squared	0.721	0.699	0.650	0.655
Jarque-Bera	0.901	0.976	0.982	0.787
Breusch-Godfrey (4 lags)	0.229	0.891	0.580	0.581
ARCH (1 lag)	0.779	0.324	0.905	0.179
RESET (squared fitted values)	0.000	0.616	0.197	0.881
Bounds *t*-stat	-3.94 **	-5.50 ***	-4.16 **	-3.74 *
Bounds *F*-stat	5.44 **	10.72 ***	7.18 ***	7.87 ***
Number of observations	100	44	44	56

For illustrative purposes, *p*-values for the di coefficients from equation (1) (see main text) are shown in parenthesis, next to the long-run coefficients.

The trade balance, as % of GDP, was calculated with National Accounts data in real terms.

See Table 3 for an explanation of the diagnostic tests.

Bounds tests: ***, **, *: Rejects the null of no level relationship at 1%, 5%, 10%. The *t* test uses the asymptotic critical values calculated by Pesaran et al. (2001), while the *F* test uses the small-sample critical values calculated by Narayan (2005).

All equations were estimated with 2 lags, before simplification, and an intercept (not shown).

^a Includes quarter outlier dummies for 1986Q1, 1989Q3, 1990Q2, and 1994Q1.

^b Includes an outlier dummy for 1994Q1. ^c Includes an outlier dummy for 2004Q1.

^d Includes outlier dummies for 2004Q4 and 2008Q2.

Source: Author's estimations.

Table 6b
Trade balance equations, II
Dependent variable: Trade balance, as % of GDP
Long-run coefficients from error-correction ARDL equations

	Entire sample, 1986Q4-2010Q4	Early sample, 1986Q4-1996Q4	Late sample, 1997Q1-2007Q4	Extended late sample, 1997Q1-2010Q4
	(6b.1) ^a, b	**(6b.2)** ^a	**(6b.3)** ^c	**(6b.4)** ^c, d
Speed of adjustment, σ	-0.222	-0.747	-0.140	-0.097
Mexico's GDP growth rate, in %	-0.58 (0.00)	-0.33 (0.00)	-0.70 (0.04)	-0.81 (0.03)
US GDP growth rate, in %	0.46 (0.07)	0.13 (0.42)	2.03 (0.00)	0.25 (0.68)
100*ln(Relative unit labor cost)	0.09 (0.04)	0.15 (0.00)	-0.09 (0.00)	-0.01 (0.68)
Adjusted R-squared	0.682	0.676	0.540	0.648
Jarque-Bera	0.637	0.289	0.384	0.560
Breusch-Godfrey (4 lags)	0.548	0.228	0.511	0.472
ARCH (1 lag)	0.852	0.210	0.227	0.689
RESET (squared fitted values)	0.000	0.376	0.252	0.724
Bounds *t*-stat	-3.62 *	-4.84 ***	-3.33 *	-2.99
Bounds *F*-stat	5.43 **	6.87 ***	5.58 **	5.37 **
Number of observations	97	41	44	56

See general notes in Table 6a.
^a Estimated with 2 lags and intercept (not shown).
^b Includes quarter outlier dummies for 1989Q3, 1990Q2, and 1994Q1.
^c Estimated with 1 lag and no intercept. ^d Includes outlier dummies for 2002Q2 and 2005Q1.
Source: Author's estimations.

results indicate, however, that estimation over the entire sample may not be appropriate: while as mentioned most of the coefficients are statistically significant and correctly signed, adjustment is slow and the mis-specification RESET test fails.

The next columns, therefore, present estimations for the split samples. They uncover, as expected, a weakening in the response of the trade balance to the real exchange rate. When measured by the CPI-based index, the estimated coefficient on the real exchange rate falls from 0.17 to 0.11 or 0.13, depending on the specific estimation period; when measured by the relative labor cost, the coefficient falls from 0.15 to practically zero in the extended sample.[13]

13. The disconnection between the trade balance and the real exchange rate appears to have continued in the most recent years. Thus, while the real exchange rate showed a large appreciation during 2012-14 (see Figure 3), the trade deficit remained stable at about 1.5% of GDP (see Table 2). The observed increase of 1 point in the current account deficit during this period was entirely due to a higher deficit in factor payments. Ibarra and Blecker (2015) present estimates that show a reduced effect of the real exchange rate on the trade balance in Mexico after the enactment of NAFTA, and argue that alternative measures of the real exchange rate (for instance, giving a greater weight to China) may have become more relevant for the determination of Mexican trade flows.

The results suggest that a shift to a more balanced pattern of growth between exports and domestic demand may be challenged by the weak response of the trade balance to variations in the real exchange rate. If the weak response persists, then faster, more balanced growth in the future may demand a larger adjustment in the real exchange rate than what was necessary in the past.

5. Conclusions

The paper studied the transmission channels behind the 2009 recession in Mexico, the reasons for the weakness of the 2010–2011 recovery, and —based on that analysis— some of the risks for sustaining faster growth in the future. Mexico was double-shocked by the retreat of foreign capital and a sharp fall in manufacturing exports. How the shocks were transmitted to GDP, however, is not self-evident. First, the retreat of capital did not force a strong adjustment in the current account deficit, and thus in domestic demand. And second, due

to vertical specialization —the intensive use of intermediate imports in export production— the export fall had a minor effect on *net* external demand.

But although it left the trade balance largely untouched, the fall in exports strongly affected gross industrial production and, through that channel, private investment (fixed capital formation). Following the so-called bounds testing approach, the paper estimated equations for private investment in Mexico in the post-liberalization period. The equations show a large effect of industrial production on private investment —an effect that can account for the actual decline in investment observed during the recession.

Recovery began in 2010, with positive GDP growth, a rebound in manufacturing exports, and a surge in foreign capital inflows. The export rebound was quite strong, and by 2011 exports were about 20% higher than their level in 2008. Since in the US —Mexico's main export market— GDP and industrial production remained depressed, the export rebound presumably reflects the beneficial effect of the depreciation —of between 15 and 18% in real terms, depending on the indicator— the peso experienced in the initial stages of the global crisis.

But in contrast to the strong rebound of exports, total activity in Mexico barely returned to its pre-crisis levels. One reason is vertical specialization: the intensive use of intermediate imports diluted the positive effect of exports on GDP, in the same way that it had cushioned the impact of the export fall during 2009. Another reason is the weakness of investment, an outcome of the persistently depressed levels of industrial production and capacity utilization in the country. With weak investment, the surge in capital inflows was not absorbed by the economy through a higher current account deficit, and instead was mirrored by large outflows of domestic capital and reserve accumulation.

The current and foreseeable mix of low interest rates and slow economic growth in developed countries may "push" large amounts of capital to middle-income countries like Mexico. While the inflows may support growth by loosening the potential external constraint on investment, they may also have the unwelcome effect of appreciating the currency. Indeed, in recent years the initial, crisis-induced depreciation of the Mexican peso has largely been reversed. A risk for future growth is that —by squeezing profit margins in the tradable sector — an appreciated currency become a depressing factor for investment. The estimated equations for private investment, referred to above, show that the effect from the appreciation can be very significant.

The capital surge —and parallel currency appreciation— directs attention to the conduct of monetary policy, and how a disinflationary stance, rather than resisting them, may become an additional, "pull" factor for capital inflows. The Bank of Mexico's stance, as set by its policy rate and the resulting *nominal* interest differential with the US Fed rate, remained unchanged since the mid-2009. Given the basic facts of the Mexican economy —relatively large inflows of capital, low levels of private investment, and a basically unchanged current account balance— the nominal interest differential may have settled at too high a level. The path of inflation reinforces the conclusion. As the inflation gap between Mexico and the US narrowed, the *real* interest differential became positive in late 2009, and began rising in early 2011.

If the real differential merely offset rising country or currency risk, it would play no "pull" role for capital inflows; portfolio inflows, however, surged. The surge suggests that the unchanged nominal interest differential did *not* stand for a neutral policy stance, but rather one that was pulling capital in and adding to currency appreciation. While the policy stance presumably helped in cutting inflation below the Bank of Mexico's 4% upper target, it may also contribute, by the real appreciation of the peso, to a slow recovery of growth and investment in the country.

In the most recent period, the Bank of Mexico loosened its policy stance, bringing by late 2014 the real interest rate differential to zero. This however has not been enough to prevent large inflows of foreign capital and the appreciation of the currency. A stronger shift in policy by the central bank would be necessary to avoid these outcomes.

Post-crisis growth proceeded slowly, with a small current account deficit, steady accumulation of reserves, and a reversal of the initial depreciation of the currency. But faster growth —particularly if featuring a stronger role by domestic demand— could create larger trade deficits. Again, this calls attention to the importance of keeping a competitive level of the real exchange rate to avoid a tightening of the external constraint. In this respect, the estimation of trade balance equations for Mexico after trade liberalization confirmed the potential role of the real exchange rate in external ad-

justment: they showed that, besides responding to economic growth in Mexico and the US, the trade balance responds in the expected direction to variations in the real exchange rate.

A source of concern, however, is that the vertical specialization of exports may reduce the response of intermediate imports —and hence the trade balance— to variations in the real exchange rate. The concern is bore by the estimations. They show that, in trade balance equations estimated for split samples, the value of the real exchange rate coefficient declined in the more recent sub-sample, after the enactment of NAFTA. This trend has continued in the most recent years, when the trade deficit remained stable despite relatively large variations in the real exchange rate. The disconnection implies that the real exchange rate may have become a less effective tool in the process of external adjustment, and thus that a more depreciated level of the real exchange rate than in the past may be necessary to avoid a tightening of the external constraint on growth.

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Appendix

Table A1
Unit root tests

	Augmented Dickey-Fuller		Phillips-Perron	
	Level	First difference	Level	First difference
Private investment equations (*sample 1988Q1-2010Q4, n=92*)				
Private investment, ln	-1.66	-3.87 ***	-2.20	-15.91 ***
Industrial production index, ln	-1.82	-6.04 ***	-1.67	-5.04 ***
Government investment, ln	-0.43	-6.20 ***	-6.28 ***	-25.47 ***
Nominal interest rate, %	-4.99 ***	-9.62 ***	-5.36 ***	-10.15 ***
Inflation rate, %	-5.16 ***	-4.60 ***	-4.97 ***	-4.99 ***
Broad money supply M2, % GDP	-0.13	-6.21 ***	0.09	-20.81 ***
Real effective exchange rate, ln	-3.16 **	-4.12 ***	-2.90 **	-8.84 ***
Bilateral real exchange rate, ln	-3.56 ***	-4.54 ***	-3.49 **	-9.60 ***
Relative unit labor cost, ln	-2.66 *	-3.76 ***	-2.43	-9.43 ***
Trade balance equations (*sample 1986Q1-2010Q4, n=100*)				
Trade balance, % GDP	-2.47	-9.39 ***	-2.64 *	-9.38 ***
Mexico's GDP growth rate, %	-2.92 **	-8.86 ***	-2.46	-10.18 ***
US GDP growth rate, %	-2.50	-7.40 ***	-2.92 **	-5.75 ***
Real effective exchange rate, ln	-2.97 **	-4.18 ***	-1.99	-8.63 ***
Relative unit labor cost, ln ^a	-2.37	-3.89 ***	-2.20	-9.70 ***

Notes: ***, **, *: The unit root hypothesis is rejected at 1%, 5%, 10%.
The ADF tests include intercept, with lag length determined by Akaike (max. lag=4).
The PP tests include intercept, with Bartlett kernel and Newey-West bandwidth.
Both sets of tests use MacKinnon critical values.
^a Sample 1986Q4-2010Q4.
Source: Author's calculations.