

WORKING PAPER

The Case of Mexico

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The Monetary and Fiscal History of Mexico 1960-2016*

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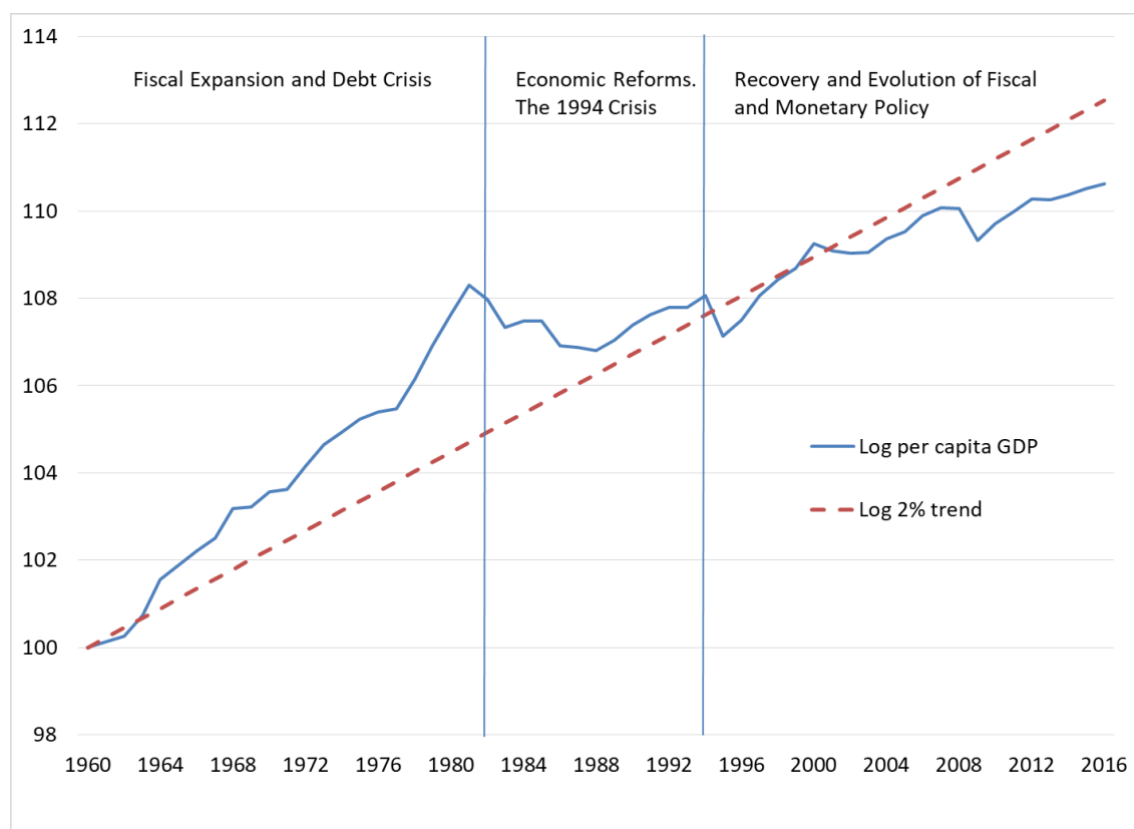
Abstract

The objective of this paper is to analyze the monetary and fiscal history of Mexico using a model of the consolidated budget constraint of the Mexican government as the framework. I assume a small open economy in which the government exports oil. I study the period 1960-2016. I evaluate the ability of the model to explain the crises of 1982 and 1994, and while the model can explain the 1982 debt crisis, it cannot explain the 1994 crisis. A constitutional change in the relationship between the federal government and Banco de México, and policy choices made in the aftermath of the 1994 crisis, are consistent with a transition from fiscal dominance to an independent Central Bank. Inflation fell persistently after 1995, reaching values of 3% per year in mid-2016. That number is the target of the Central Bank. After a long transition following the 1982 crisis, Mexico succeeded in controlling inflation. I discuss forces that reduced inflation over time: a long sequence of primary surpluses, the constitutional change that gave independence and a goal to the Central Bank, and the current inflation targeting regime. On the fiscal side, I observe a change in the downward trend of the total debt-to-GDP ratio, as it fell from the 1980s to 2009, the year in which it started growing persistently until 2016.

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1 Introduction

Mexico is a country that went from a period of rapid per capita growth to the 1982 crisis, and then through important reforms, the 1994 crisis, and finally a period of macroeconomic stability, interrupted by the international financial crisis of 2008. In Figure 1 I plot the natural logarithm of real GDP per capita and compare it to the natural logarithm of a trend that grows at 2% per year.

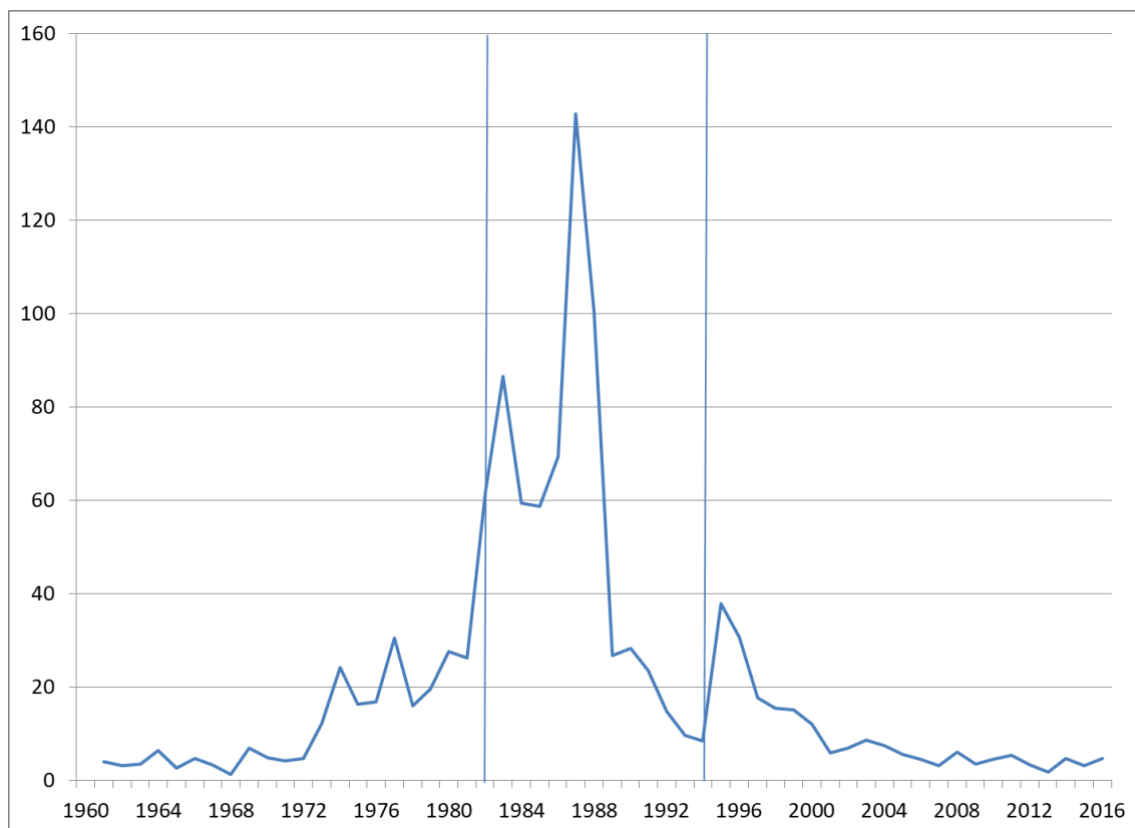


Source: Author's calculations with data from INEGI and World Bank.

Figure 1. Natural Logarithm of GDP per Capita at 1993 pesos 1960-2016, and Natural Logarithm of a 2% Yearly Trend, Indexes 1960=100

I divided the sample into three periods, which I will analyze in detail below. The 1982 crisis was clearly a turning point in Mexico's history. The growth rate of real GDP per capita between 1960 and 1982 was 3.3%. The growth rate between 1982 and 2016 was 0.7%. Taking into account the entire sample, the average growth rate has been 1.7%.

This change in the growth rate had a substantial impact on Mexico's catch-up with the world economic leader, the US. The real GDP per capita of the US grew on average at approximately 2% between 1875 and 2010.¹ Between 1960 and 1981 Mexico was growing faster than the US, closing the per capita income gap between the two economies. Between 1982 and 1994 Mexico stagnated completely, while the US kept growing. Therefore, the gap between the two countries became larger. Finally, between 1995 and 2016 Mexico grew at a slightly stronger pace, but still below the rate at which the US has been growing. In short, in this dimension by 2016 Mexico had not recovered from the 1982 debt crisis.²



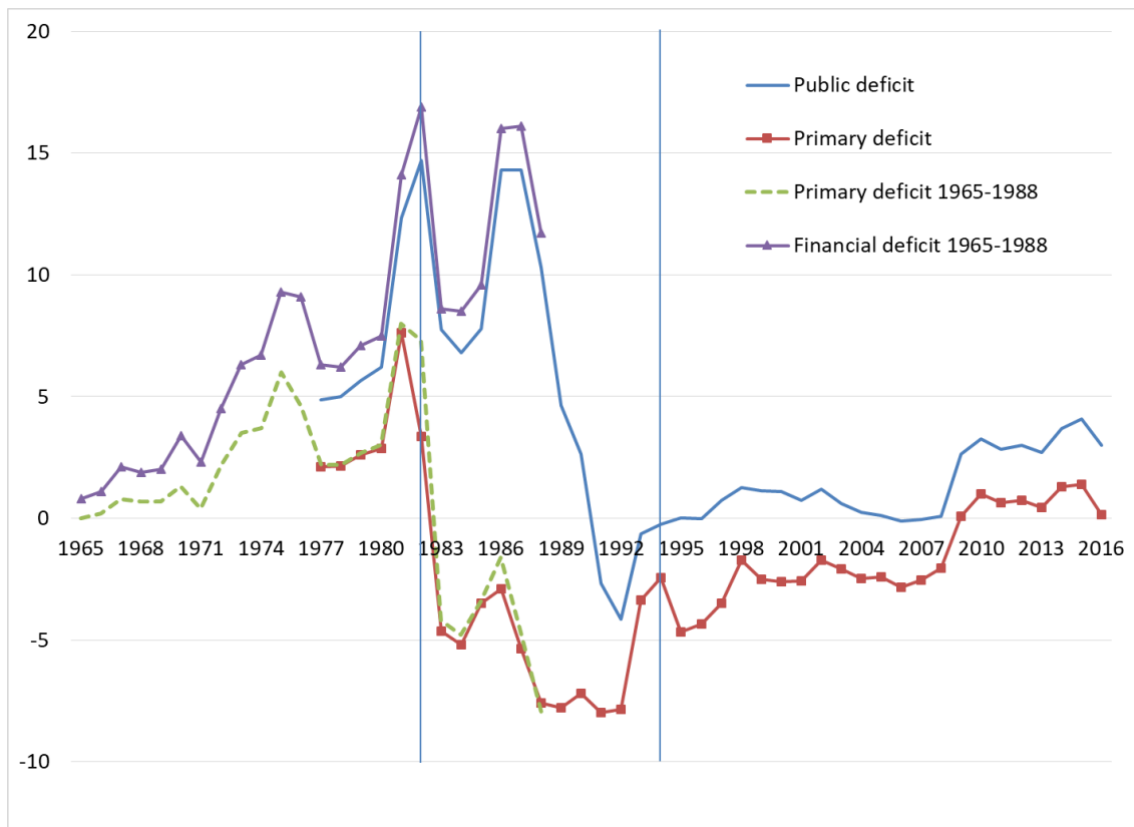
Source: Author's calculations with data from INEGI.

Figure 2. Annual Inflation Rate Calculated with GDP Deflator, in %

¹ This is clear when looking at the figure in Timothy J. Kehoe's main webpage.

² I also looked at this phenomenon using data from the Maddison Project Database. This dataset reports GDP per capita in 2011 US dollars. Up to 1982 Mexico was catching up with the US. Between 1960 and 1980 the gap closed from 20% to 40%, i.e., real GDP per capita in Mexico in 1980 was 40% of the one in the US. After the 1982 debt crisis Mexico started lagging behind the US. There was again a period of catch-up starting in 1997, and until 2011. Finally, between 2012 and 2016 Mexico stagnated relative to the US, at a level of 30%.

Figure 2 shows another crucial variable for the Mexican economy: the yearly inflation rate. Clearly Mexico had low inflation up to 1972, when the rate was 4.6%. Between 1973 and 1981 inflation increased to a new level of 20% on average. Then in 1982, the year of the debt crisis, it reached 61.8%. In the second period, 1983-1994, there are two stages: first, clearly Mexico had difficulties controlling inflation, as it reached a historical maximum of 142.8% in 1987. Afterward it falls, having a value of 8.5% in 1994. In fact, except for the impact of the 1994 crisis, inflation had a downward trend from 1988 until 2006. Between 2007 and 2016 inflation remained stable, having an average value of 4%. A final point I want to make here is that Mexico has never had hyperinflation according to the classic Cagan definition of 50% per month.³



Source: Author's calculations with data from INEGI, SHCP and Banco de México.

Figure 3. Different Measures of the Deficit of the Public Sector, % of GDP

Figure 3 reports several measures of the deficit of the public sector. “Public sector” is a broad definition of the government that includes the federal government plus other institutions such as the national oil company PEMEX, for example. Below I go into

³ That monthly rate implies an annual inflation close to 13000%.

further detail on the components of the public sector. The data marked “1965-1988” come from a document by the Secretaría de Hacienda y Crédito Público (SHCP). The SHCP is Mexico’s Secretariat of Finance and Public Credit. The rest of the deficit data come from the website of the Banco de México. Obviously “public deficit” is the primary deficit plus interest payments on debt.⁴ “Financial deficit 1965-1988” has the same definition as “public deficit,” plus the financial intermediation deficit coming from development banks. Notice that “primary deficit” and “primary deficit 1965-1988” come from different sources, yet they have very similar values. Notice that “financial deficit” is slightly larger than “public deficit.” This is likely due to the fact that “financial deficit” includes the financial intermediation deficit of development banks.

Figure 3 shows that Mexico had a very small primary deficit up to 1971. Starting in 1972 it grows reaching a local maximum of 6% of GDP in 1975. As I will show below, this increase was financed with seigniorage and with foreign debt. The growth in the deficit was not sustainable. Mexico devalued the peso in 1976 for the first time in twenty-two years. Afterward there is a reduction and stabilization of the primary deficit in levels close to 3%. In the late 1970s Mexico discovered a giant oil field at the same time as the international oil price rose. These events led to a new increase in the primary deficit. In 1981 it reached its historical maximum of 8%. This increase was again financed with seigniorage and foreign debt. The new indebtedness was unsustainable. In 1982, Mexico declared it could not pay part of the debt, starting the debt crisis.

It is very clear that a very important root of macroeconomic instability and crises is a growing primary deficit. Of course, as Mexico borrowed to pay for part of the larger deficits, the public deficit, which includes the financial cost of the debt, also increased. The historical maximum of the public deficit was reached in 1982 with a value of 15% of GDP.

In the years after 1982, particularly between 1983 and 1994, Mexico made a gigantic effort to reduce the burden of the debt. This is why Mexico had large primary surpluses starting in 1983. As the debt-to-GDP ratio fell, the financial cost of the debt also started falling. In 1991 Mexico had a public surplus of 3% of GDP. Then the 1994 crisis hit the

⁴ In the data source the financial cost of the debt is called *costo financiero*.

economy. The origin of this crisis does not lie in a large primary deficit. I will discuss theories and evidence below. The reaction to the 1994 crisis and the clear goal of achieving macroeconomic stability led to primary surpluses between 1995 and 2008, and to small deficits in the same period. I will later discuss how macroeconomic stability became a valuable asset of the Mexican economy post-1995.

The previous graphs lead to many questions. Clearly the 1982 debt crisis and the 1994 crisis had a profound impact on the economy. What policy choices led to these events? What external exogenous shocks hit the economy? What are the similarities and differences between the two crises?

The objective of this paper is to analyze the monetary and fiscal history of Mexico using a model of the consolidated budget constraint of the Mexican government. I assume a small open economy in which the government exports oil. I want to verify whether important events can be understood according to predictions of the model. I evaluate the ability of the model to explain the crises of 1982 and 1994.

What does the model say about fiscal crises? The main prediction of the model is that, under certain assumptions, at a given point in time the public is not willing to finance a growing stock of public debt, which will lead to higher inflation. The reason is that the deficit is financed by the Central Bank via bigger seigniorage. The main assumptions are: (a) the primary deficit is larger than sources of financing including seigniorage, other than public debt; (b) at some date the level of interest-bearing government debt reaches a limit imposed by the financial market; and (c) if public debt is not enough to finance the deficit, the monetary authority will finance it via seigniorage, i.e., there is fiscal dominance. Under these assumptions, the stock of debt grows over time, until it reaches the limit the market is willing to finance. At that point the monetary authority finances the deficit with bigger seigniorage, which leads to higher inflation.

In terms of measurement, I describe how I calculate empirical counterparts of the theoretical components of the consolidated government's budget constraint. By consolidated I mean putting together the Treasury and the Central Bank.

The model describes well the events before and after the 1982 debt crisis. There was a large increase in the primary deficit before 1982. The Mexican government announced in 1982 that it could not fulfill the scheduled debt payments. There was a large increase in inflation and in the inflation tax, as the government received credit from the Central Bank, the Banco de México, leading to a large increase in the monetary base.⁵

On the other hand, the model *cannot* account for the 1994 crisis, in particular if thinking of Mexico described by fiscal dominance. One fact that does not fit the premises of the model is that before the 1994 crisis Mexico had primary surpluses. A second fact that does not fit well is that the debt-to-GDP ratio was not growing. However, it is true that the crisis occurred when a particular kind of debt, the Tesobonos, reached its historical maximum. In terms of post-crisis events, again the predictions of the model do not fit the data because the inflation tax remained at historically low values.

Analyzing the 1994 crisis, I conclude that the change in legislation that granted independence to the Banco de México in 1993 represented a credible change from fiscal to monetary dominance. The fact that the inflation tax remained low, compared to historical values, is consistent with such change. Inflation fell persistently after 1995, reaching values of 3% per year in mid-2016. That number is the target of the Central Bank (+/-1 percentage point). The transition of Mexico from fiscal dominance to an independent Central Bank has been successful.

On the fiscal side I observe a change in the downward trend of the total debt ratio, as it fell between the 1980s and 2009, the year in which it started growing persistently until 2016, the end of my sample.

The rest of the paper is divided into the following sections. Section 2 describes briefly the choices made when calculating empirical counterparts of theoretical variables. Section 3 analyzes the events leading to the 1982 debt crisis and asks if the model can explain it. Section 4 describes the period of reforms that took place after 1982, and analyzes the 1994 crisis. Section 5 describes the recovery post-1995 and the evolution of public debt, monetary policy, and inflation until 2016. This period includes the international financial

⁵ Throughout the paper I measure inflation using the growth rate of the GDP deflator, unless stated otherwise.

crisis that started in 2008 and led to a large contraction of economic activity in Mexico in 2009. Section 6 discusses forces behind what I call the great reduction of inflation in Mexico. Section 7 explores the presence, dynamics, and source of a transfer implicit in the government budget constraint. Section 8 concludes.

2 Measurement

In this section I provide information on the measurement of the components of the theoretical consolidated government budget constraint.

2.1 The model

The model I use is a version of the one presented in Chapter 2. The theoretical budget constraint comes from consolidating the budget constraints of the fiscal branch of the government (i.e., the Treasury) and of the Central Bank, and using an equation that says that, for each kind of debt, total debt issued by the government B_G is equal to a part bought by the Central Bank, B_B , and a part bought by the public, B . Therefore $B_G = B_B + B$.

I include the international reserves of the Central Bank when doing the consolidation, because reserves are an asset for the consolidated government. A simpler analysis would not use international reserves to calculate net debt. I took reserves into account because the model includes foreign debt, therefore for consistency one should consider the role of international reserves as an asset. Of course, it is possible to construct the consolidated budget constraint in the model and in the data excluding international reserves.

It is important to note that I am obviously not saying that the Treasury can use the international reserves of the Central Bank at its discretion. In the model the budget constraint of the government includes receipts from the Central Bank (RCB). “Receipts from Central Bank” is the label used by Walsh (2003) for receipts from the Central Bank to the fiscal branch of the government. In the US the Federal Reserve turns over to the Treasury most of its interest earnings from government debt. In the case of Mexico, the Central Bank, after determining its earnings and following rules specified legally, transfers resources to the Treasury. This is the Remanente de Operación de Banco de México.

Another component of the model is that I add to the Treasury's resources the revenue from selling oil. I make this addition because of the importance of PEMEX, Mexico's national oil company, for public finances. In 1938 the Mexican oil industry was nationalized, and PEMEX had a monopoly on all activities related to the oil industry: exploration, extraction, exporting, refining, distribution, and sales to consumers.⁶ Mexico became a large exporter of oil in the late 1970s after an increase in the international oil price and the discovery of a giant oil field. These exports provided a cash flow to PEMEX. The Mexican Treasury has historically taxed PEMEX to obtain revenue from oil sales. In fact, PEMEX has historically provided a large fraction of all income of the public sector, as I will show below. In terms of the model in the Appendix I show how I add oil revenue to the basic budget constraint. I assume that the source of revenue is oil exports, excluding all other possible sources, such as domestic sales of refined products like gasoline. For simplicity I do not model the particulars of the different ways in which the federal government has taxed PEMEX over time.

I exclude debt indexed to inflation from the model. The reason for doing this is that the raw data I use do not report it separately. The data I use is divided into two categories only: foreign and domestic. There has been indexed debt issued by the Treasury in the past, and today it sells Udibonos. In the data, this kind of debt is included in domestic debt.

I omit the presentation of the mathematical expressions of the model, which is available in the Appendix. In lieu of the equations I present the budget constraint verbally. When I plot the data I present the same variables relative to GDP. The consolidated budget constraint is

$\begin{aligned} &\text{Primary deficit excluding oil revenue} + \text{interest domestic debt} + \text{interest foreign debt} - \\ &\text{interest received on international reserves} = \\ &\text{Oil revenue} + \text{issuance of domestic debt} + \text{issuance of foreign debt} - \text{international reserve} \\ &\text{accumulation} + \text{seigniorage} \end{aligned}$

⁶ This changed with the energy reform of 2013. Today foreign and domestic investments are allowed in the oil industry along the production and distribution chain. This is one of the major structural changes that has taken place in recent years.

I now construct empirical counterparts of these theoretical variables. I keep this discussion brief to continue a review of the data.

2.2 The data

I work with a broad definition of government. This means working with data from the federal government, but also with data from the national oil company, PEMEX; the national electricity company, CFE; and the national social security institute, IMSS. These entities are important for Mexico, plus other firms and institutions. Since the 1980s the government has compiled statistics for the public sector. I describe its components based on SHCP (2010).⁷

Table 1 shows a summary of the structure of the public sector, in Spanish. The public sector is A+B. In turn, Part A has two main components, the federal government (A.1) and certain institutions and government firms (A.2). Part B has two main components, a financial and a nonfinancial one. The financial component (B.1) is the set of development banks. I exclude more detail, including in Table 1 the components of the government that are more relevant in terms of revenue and spending.⁸

A. Sector público de control presupuestario directo		B. Sector público de control presupuestario indirecto
A.1 Gobierno Federal	A.2 Organismos y empresas de control presupuestario directo:	Organismos y empresas de control presupuestario indirecto
	PEMEX CFE IMSS ISSSTE	B. 1 Financieros: Bancomext Bansefi Banobras Nafin SHF Other B. 2 No financieros

Source: SHCP (2010).

Table 1. Summary of Components of the Public Sector

⁷ In particular, see p. 9.

⁸ In 2013, as part of the energy reform that allowed the private foreign and domestic sectors to participate in the energy industry, PEMEX and CFE were assigned the category Empresas Productivas del Estado.

To carry out the analysis I choose three periods. The first one goes from 1960 to 1982, ending in the year of the debt crisis. The second starts in 1983 and ends with the 1994 crisis. The third starts in 1995 and ends in 2016.

I chose these periods based on the mechanism of the theoretical model. If the deficit plus transfers are larger than the sum of seigniorage and oil revenue, the consolidated government will have to issue a growing amount of debt, until it hits an exogenous limit set by financial markets, and there will be a fiscal crisis. This chain of events describes well the period 1960-1982, and this is the reason why I settled on those years for the first period. The choice for the second period 1983-1994 is that it also ends in a large crisis. I want to know if the workhorse model can also account for the 1994 crisis. The last period, 1995-2016, includes the response to the 1994 crisis, as well as important changes in fiscal and monetary policy. It includes the impact and the response to the international financial crisis. It also shows a change in the behavior of the debt-to-GDP ratio, which had fallen and remained stable for many years, until it started growing in 2009.

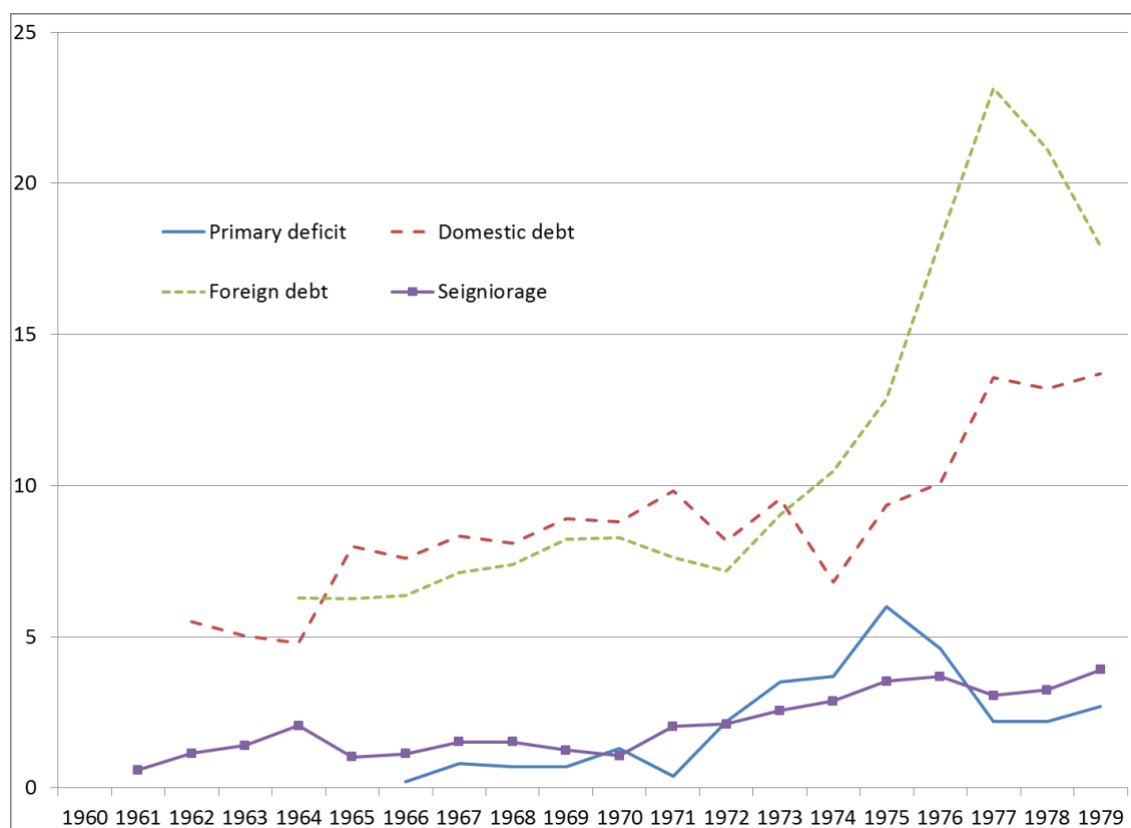
In the Appendix I provide detail on my sources and on how I constructed empirical counterparts of theoretical variables. Having constructed the dataset, I go on to analyze the data.

3 1960-1982: low primary deficit, the fiscal expansion of the 1970s, and the debt crisis of 1982

In Figure 4 I plot the data for 1960-1979. The figure shows that the primary deficit was very small, practically zero, in 1966. As I will discuss below, this period starts with relatively low and stable levels of debt. But the fiscal situation would deteriorate toward the second half of the 1970s. It would become even worse in the early 1980s, when the debt crisis took place. I do not have 1960-1979 data on oil revenue. Therefore, I do not decompose the primary deficit into the deficit excluding oil revenue, and with oil revenue. When computing seigniorage in this figure and in the rest of the paper I use the monetary base.⁹ I focus the discussion mainly on the last two presidential terms, 1970-1976 and

⁹ I constructed a historical time series for the monetary base using INEGI and Banco de México data. In the Appendix I compare seigniorage and the inflation tax implied by the series I constructed and the ones

1976-1982, as those are the years for which I have more data. In this section and in the rest of the text my main historical reference is Cárdenas (2015).



Source: Author's calculations with data from Banco de México, INEGI, SHCP, and Gurría (1993).

Figure 4. Fiscal and Monetary Variables 1960-1979, % of GDP

During the presidential term of Gustavo Díaz Ordaz, 1964-1970, there was a small deficit. The data show primary deficits close to zero, and an increase to 1.3% of GDP in 1970, the last year he was in power (see Figure 4).

The term of Luis Echeverría, 1970-1976, showed the first signs of public finance instability. It had a large increase in the primary deficit ratio, partially due to intervention of the government in the economy. This was a time in which it bought private firms that were bankrupt or had financial problems. This policy of rescuing failing firms was a continuation from the 1960s, and by 1975 these firms, known as *empresas paraestatales*, had grown in number and industry scope.

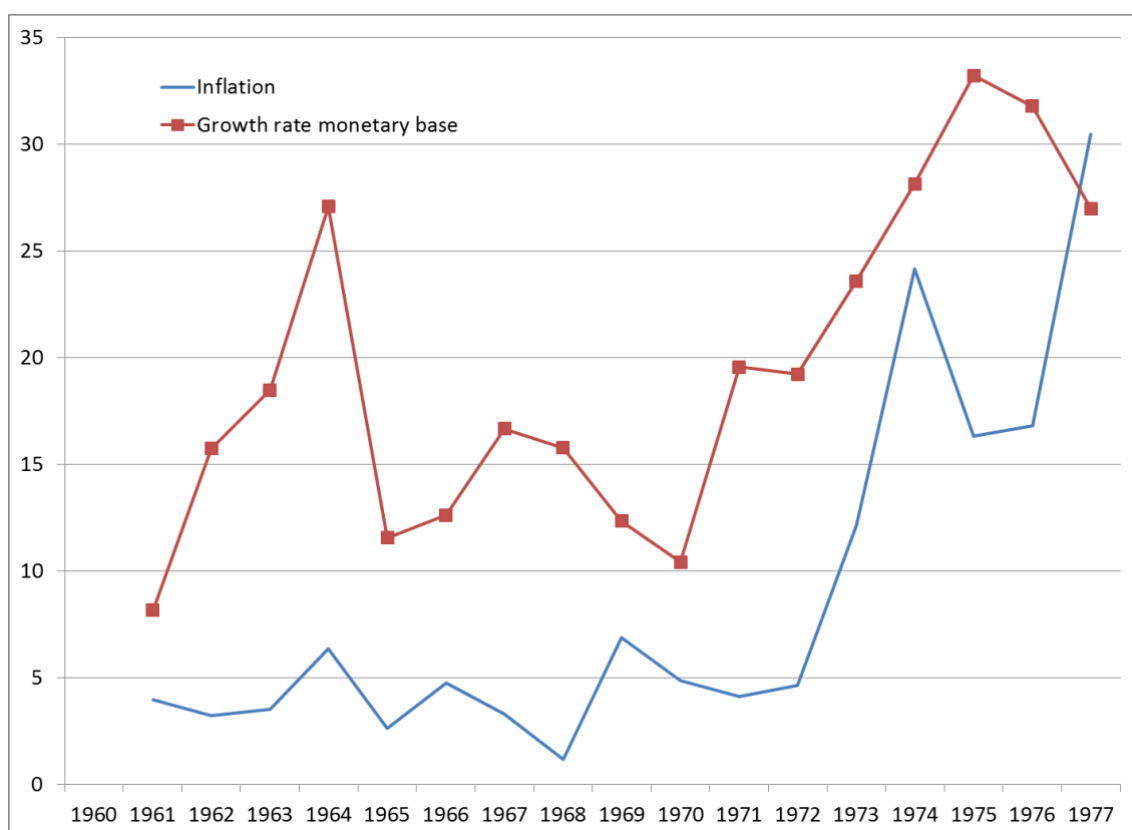
using only Banco de México data. The conclusion is that seigniorage is basically the same. The inflation tax does show a difference for some years.

The government borrowed in international markets to pay for the deficit, and there was an increase in the foreign debt ratio. Figure 4 shows that the deficit ratio spiked in 1975 to a value of 6%. This administration ended in 1976 with the first devaluation of the peso in twenty-two years.

Mexico under Bretton Woods: The 1976 crisis

The events just described deserve some further analysis. The world went through important changes in the 1970s, including the collapse of the Bretton Woods System in the first years of that decade.¹⁰ As mentioned earlier, the peso had a fixed nominal exchange rate with the dollar from 1954 to 1976. In 1976 it went from 12.5 pesos per dollar in August to 19.4 in September, a devaluation of 55.2%. In terms of macroeconomic statistics, as mentioned above, the primary deficit reached a local maximum of 6% in 1975, the highest value in the sample before 1981. Inflation and the growth rate of the monetary base had a correlation of 71.8% between 1961 and 1977. Figure 5 shows the two variables. The most striking feature is the simultaneous increase that took place between 1972 and 1973. Inflation jumped from 4.6% to 12.1%; the growth rate of the monetary base increased from 19.2% to 23.6%.

¹⁰ Mexico participated in the Bretton Woods Conference in 1944.



Source: Author's calculations with data from Banco de México and INEGI.

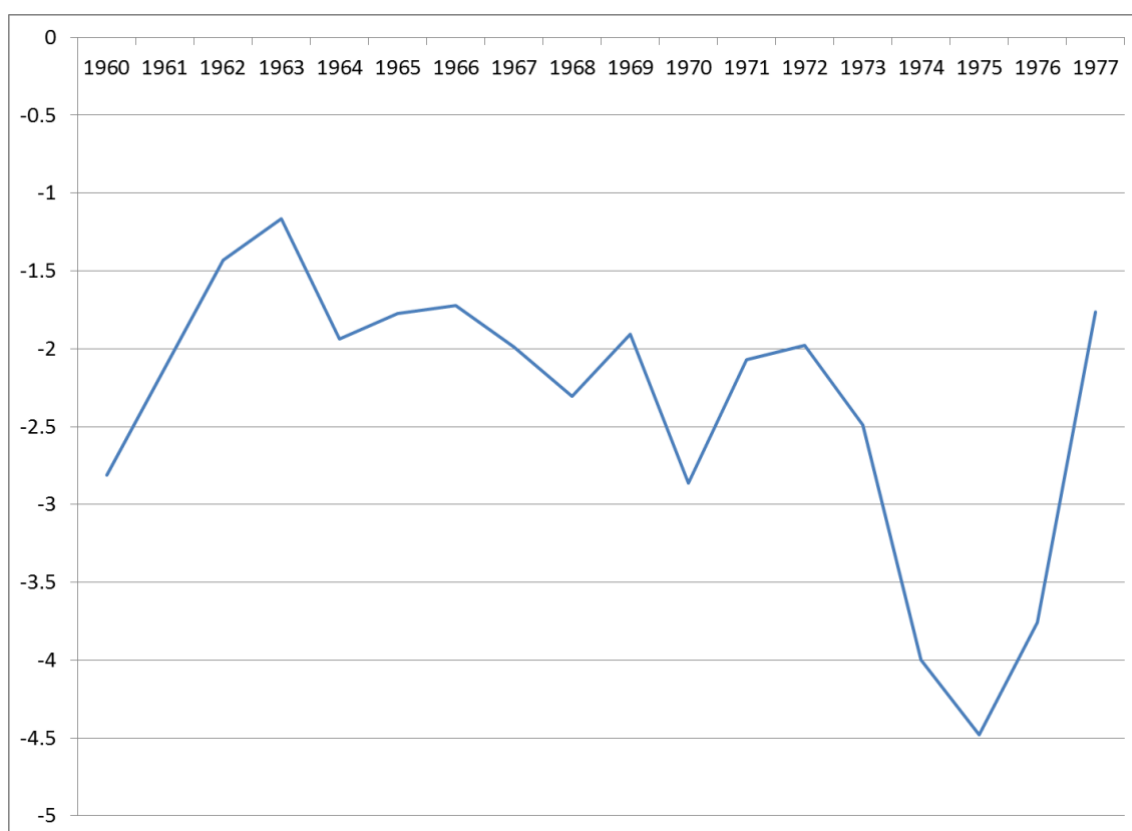
Figure 5. Inflation and Growth Rate of Monetary Base, in %

In terms of the external imbalance, Figure 6 shows the current account as a percentage of GDP. Between 1960 and 1973 there was a deficit of on average 2.1% of GDP. In 1974 the deficit increased to 4% and reached a local maximum of 4.5%, the highest value in the sample before 1982. In 1976 and 1977 the deficit fell, reaching a value of 1.8%. Even though the current account does not reverse its sign (even looking at data at quarterly frequency), it is clear that there was a large adjustment. The economy could not attract the capital flows necessary to maintain its level of expenditure.

These were years of fiscal dominance. The Banco de México financed fiscal spending with money emission during the term of President Luis Echeverría. This process started in 1972 when the primary deficit increased, as shown in Figure 4.

The summary of 1970-1976 is that a fiscal expansion was financed via monetary policy and external borrowing. External borrowing reached a limit and as a consequence Mexico

suffered a balance of payments crisis in 1976, and the first devaluation of the peso in twenty-two years. This is an example of a first-generation balance of payments crisis.



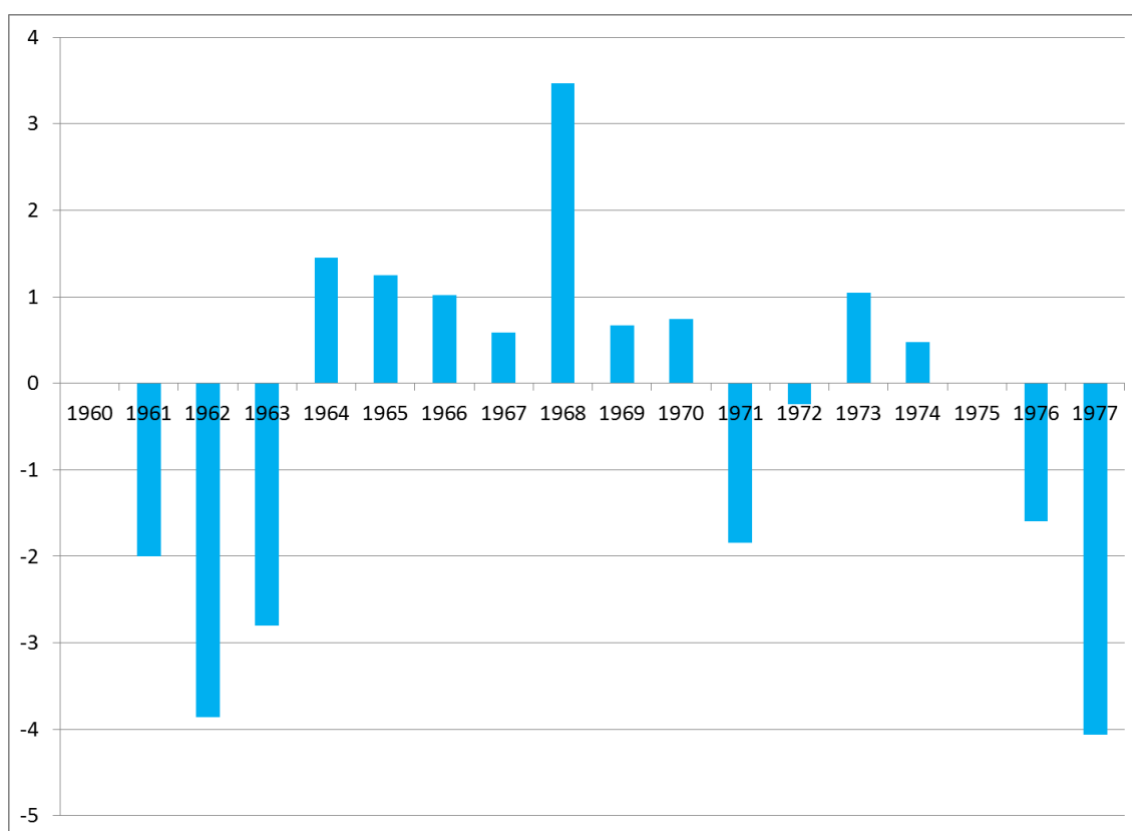
Source: Author's calculations with data from INEGI.

Figure 6. Current Account, % of GDP

What was the impact on the real economy? The main point that I want to highlight is that there was a large contraction in 1977 relative to the *trend* of the economy. In Figure 1 there is no large fall in real GDP per capita in 1977. That may be surprising, as this episode was the beginning of a sequence of balance of payments crises that would hit the economy in 1976, 1982, a big adjustment in 1987, and the 1994 crisis. All these events coincide with the end of presidential terms, except for 1987, which took place a year in advance of the beginning of the term of President Carlos Salinas de Gortari. There were large contractions in the *level* of real GDP per capita in those years.

To make the point I first calculated a simple geometric trend by calculating the average growth rate of real GDP per capita between 1960 and 1975, and then computed a series for GDP that grew according to that trend. Second, I calculated the logarithmic difference

between the trend and data. I report the difference in Figure 7. In 1977 real GDP per capita was 4.1% below trend.¹¹



Source: Author's calculations with data from INEGI and World Bank.

Figure 7. Deviation of Real GDP per Capita from 1960-1975 Geometric Trend, in %

Figure 1 had already shown that 1977 was a bad year for the Mexican economy. In that figure I compared Mexican growth in real GDP per capita to the average per capita growth rate of the US. Between 1976 and 1977 Mexico grew at 0.6%, much lower than 2%. In 1977 Mexico grew 1.4 percentage points below the US trend; thus, by that metric there was also a contraction of economic activity after the 1976 crisis.

¹¹ The large negative deviations in 1962 and 1971 coincide with episodes described in Cárdenas (2015). The large positive deviation in 1968 may be due to government spending as the Olympic Games took place in Mexico City.

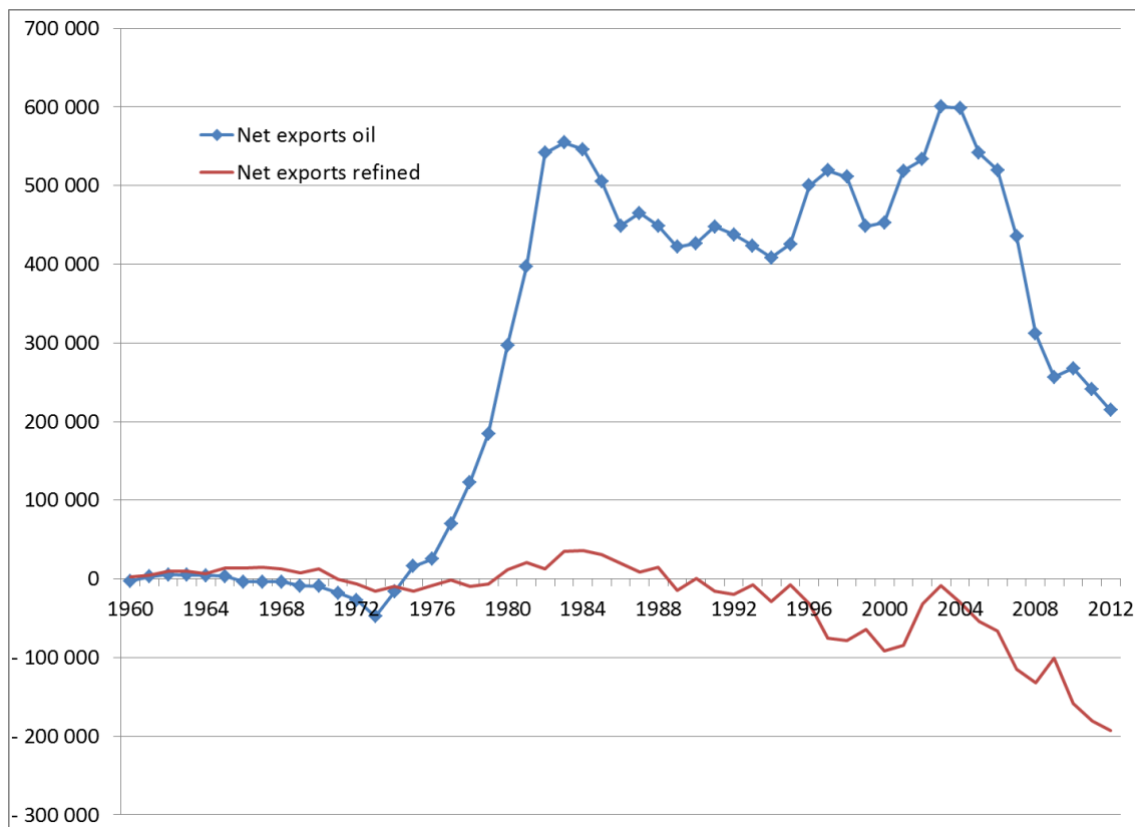
The oil crisis of 1973 and Mexico as a net exporter of oil

In this period, one event was a key driver of Mexico becoming a net exporter of oil: the oil crisis of 1973. Mexico had stopped exporting oil in 1968. The oil crisis generated an increase of 70% in the international oil price to reach 5.11 dollars per barrel (dpb). The price reached 12 dpb in 1974. At that price Mexico started exporting again. My interpretation is that it was not profitable to extract enough oil to export until the price reached 12 dpb. Also, it is important to recall that the oil industry was under control of the government since 1938, when it was nationalized by President Lázaro Cárdenas. The national oil company PEMEX was the only firm allowed to operate in each stage of oil production and refined products, from extraction to sales to consumers. The impact of the oil crisis on Mexico was that it allowed PEMEX to start exporting again.

The context pre-1982 debt crisis

The 1982 debt crisis would occur in the last year of the administration (1976-1982) of José López Portillo. A crucial event during his term was the discovery of the massive oil field Cantarell, which was discovered in 1976. Proven oil reserves increased 151.2% between 1977 and 1978. Oil extraction started in 1979, and the government decided to invest in the infrastructure of the oil industry. Figure 8 shows net exports of oil and refined oil. Net exports are basically zero until the two events mentioned happen in sequence: first the increase in the oil price, and second the discovery of Cantarell. These two events allowed Mexican oil exports to grow very rapidly until 1982. Getting ahead of myself, the oil price fell in 1982. In that year the growth of exports stopped. Oil was very important for the Mexican economy, and today it remains very important for the Mexican government. Figure 8 shows that the volume of net exports remained constant for decades, until falling sharply in 2008. The other point that the graph makes is that the volume of net exports of refined oil has been zero and trending towards negative. Clearly Mexico has historically had a low capacity to export refined oil products.

It is important to highlight that the discovery of Cantarell led to more access to international financial markets. To interpret this event in terms of a simple dynamic model, the discovery of Cantarell increased the permanent wealth of the economy. Therefore, it could borrow more from abroad. That is exactly what the Mexican government did.



Source: Author's calculations with data from INEGI.

Figure 8. Net Exports of Oil and Refined Oil, Thousands of Barrels

Other features of these years include an expansion of investment in health and in education. Elementary school coverage and access to medical services increased significantly. The government created important policy tools, such as the value-added tax (IVA, *Impuesto al valor agregado*) and the short-term bonds named CETEs (for *certificados de la tesorería de la federación*).

The administration of López Portillo is famous for the phrase “to manage abundance,” or in Spanish, *administrar la abundancia*. The increase in oil reserves was seen as leading to times of a booming Mexican economy. However, the opposite would come true. I have mentioned some potentially productive investments made by the government in this administration. At the same time, there was a large increase in public spending unrelated to the oil industry. Total government spending increased from 30.9% of GDP in 1978 to 40.6% in 1981. Out of those approximately 10 percentage points, 7.3 came from increasing non-oil industry-related spending. Besides, the productivity of projects on which these resources were spent was doubtful.

Figure 9 below shows that the deficit ratio reached 7.6% in 1981. The figure also shows increases of the domestic debt-to-GDP ratio, and in particular of the foreign debt ratio. In 1982 this administration would default on payments to the principal of foreign debt, though it would still pay interest. The government blamed capital leaving Mexico on Mexican banks, and chose to take control of them. Banks were nationalized toward the end of the presidential term of José López Portillo. For approximately nine years, banks would be managed by the government.

Zooming in on the 1982 crisis: what touched off the (partial) default?

Figure 9 shows the debt-to-GDP ratios starting in 1980. The sum of domestic and foreign debt was equal to 31.2% of GDP in 1981, the year before the debt crisis. Why did Mexico default even though the amount of debt was relatively small? What touched off the default? To be more precise, recall that Mexico stopped making payments to the principal of the debt, making payments only on interest.

To answer these questions, I first present a chronology of events. In 1981 the two main problems of the economy were the growing fiscal and current account deficits. Interest rates in the US had increased because of the contractionary monetary policy that had the goal of reducing inflation. International banks reduced the amount of lending and shortened the maturity of loans. The oil price fell. Oil revenue was very important for the government; therefore, this fall deteriorated public finances. Note that this is certainly true when we think of the Mexican government's financial position in dollars vis-à-vis the rest of the world. In pesos, oil revenue could have increased depending on the behavior of the exchange rate. The lack of fiscal adjustment led to higher devaluation expectations and capital outflows. New debt could only be obtained at shorter maturities.

In 1982 the international reserves of the Banco de México had reached a low level. On February 5 President López Portillo gave a speech, promising to defend the value of the peso. On February 17 the peso suffered a devaluation of 80%. Afterward unions demanded wage increases, which were implemented. There was no fiscal adjustment because 1982 was a year of presidential elections. On April 18 the peso lost approximately 75% of its value. During the first half of 1982, foreign short-term debt had grown by \$20 billion. International banks made lending more and more restrictive. After receiving a

credit on June 30 from a group of international banks, Mexico suffered a total lack of access to more credit. By the end of July, with Central Bank reserves at a very low level, for the first time in the history of Mexico capital controls were imposed. A system of dual exchange rates was created. On August 20 the Secretario de Hacienda (Secretary of the Treasury), Jesús Silva Herzog, announced in New York that Mexico did not have the resources to pay the principal of debt due in the rest of the year. Importantly, the moratorium was negotiated with international banks. It was not a unilateral decision, and interest payments continued. The stock of foreign debt reached a level of \$84 billion, of which 68.4% was public, 21.8% was private (excluding banks), and 9.7% was bank debt.

The two questions posed above are interrelated. My analysis yields the following answer: Mexico suffered important shocks in 1981. One was the higher level of interest rates in the US, which increased the opportunity cost of lending to Mexico. A second shock was the fall in the oil price, which was a crucial source of revenue for the government, in particular when deciding to repay debt in dollars. These two shocks made international banks reduce their lending to Mexico and shorten the maturity of the debt. Therefore, the fiscal imbalance became worse and in 1982 the government had to devalue the peso. The cumulative devaluation was an astounding 266% between 1981 and 1982. The burden of foreign debt on GDP increased dramatically, to the point that in August 1982 the government announced it would continue making interest payments, having negotiated a moratorium on payments of principal of foreign debt. The foreign debt-to-GPD ratio increased from 20.1% in 1981 to 57.6% in 1982. The moratorium would last until successive future rounds of renegotiation of the principal in years post- 1982.

Interpreting these events in terms of a simple dynamic model, first the government increased expenditure and borrowing due to the discovery of the Cantarell oil field. However, in 1981 two shocks combined to make this borrowing unsustainable. The oil price fell and, therefore, the permanent wealth of the economy decreased. Second, the international interest rate went up, increasing the opportunity cost of lending to Mexico. These two shocks led to the 1982 debt crisis.¹² I would add as a third factor the lack of financial planning by the government. There was obviously no guarantee in 1980 that the

¹² In terms of theory my framework is the dynamic endowment economy in Ljungqvist and Sargent (2004), chap. 10. The comments I received from Manuel Ramos-Francia led me to analyze this episode with this tool.

oil price would remain high, or that international interest rates would remain low. The economy did suffer two very important exogenous shocks, but the lack of anticipation and financial planning contributed to making the situation even worse.

Analyzing the 1982 crisis through the lens of the consolidated budget constraint model

I now analyze events leading to the 1982 debt crisis through the lens of the model. There are two possible arrangements between the fiscal and the monetary branches of the government. One is fiscal dominance, in which when the Treasury loses access to debt markets, the Central Bank has to adjust and create enough seigniorage to finance the gap in the government budget. The other arrangement is monetary dominance, in which it is the Treasury that adjusts in times of crisis, rather than the Central Bank.

In the case of Mexico, at least throughout 1970-1982 the Banco de México was dominated by the government. There were episodes in 1972 and in 1981 in which the Banco de México expanded the monetary base to finance growing deficits.

A prediction of the model is that the debt-to-GDP ratio increases when seigniorage is not enough to finance the primary deficit. Between 1965 and 1973 the domestic and foreign debt ratios were roughly constant. This is consistent with the fact that seigniorage was approximately equal to the primary deficit.

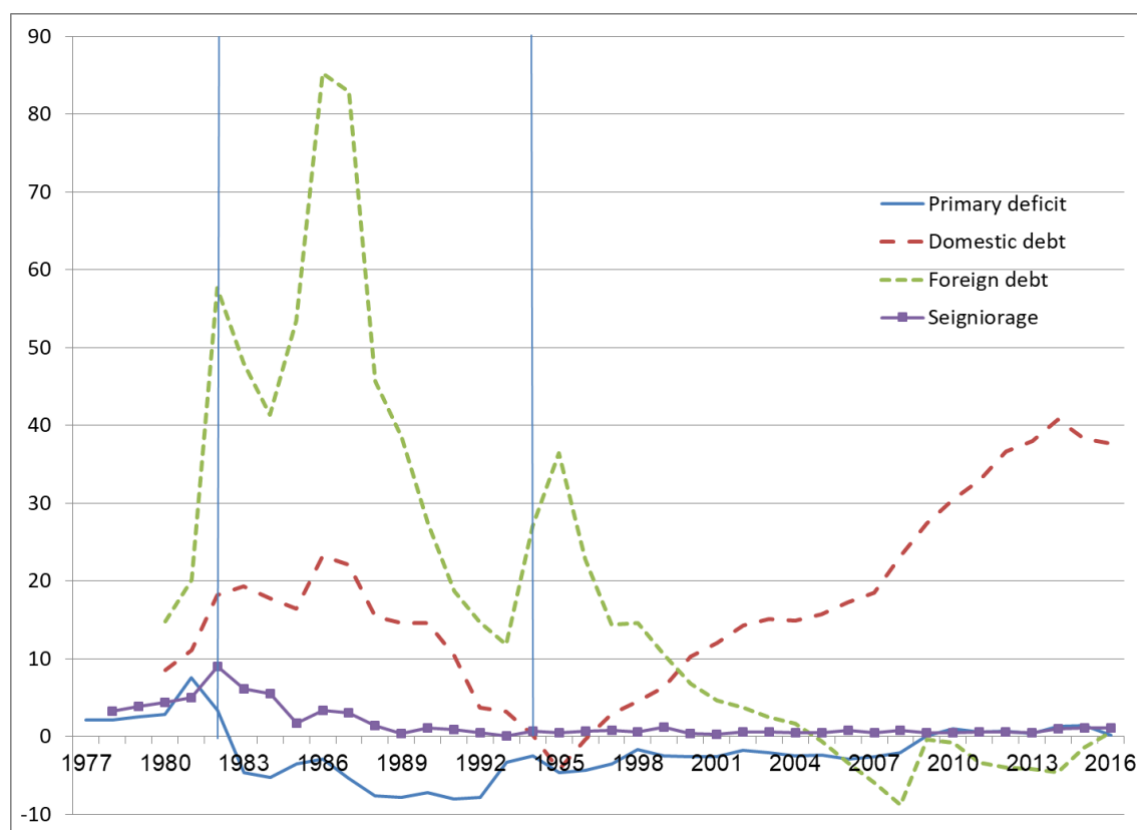
In 1975 there was a spike in the primary deficit, as it jumped to 6% of GDP. At the same time, it became larger than seigniorage. The government had to issue more debt, leading to an increase first in the foreign debt ratio to 12.9%, and in the subsequent years in the domestic debt ratio. Before 1980 the maximum values of the foreign and domestic ratios were 23.1% and 13.6% in 1977, respectively.

Between 1977 and 1979 there was an effort to reduce the growth of the debt ratios. The primary deficit ratio had a smaller value of 2.2% in 1977. Additionally, seigniorage became larger than the primary deficit, reaching a value of 3.9% in 1979. The debt ratios stopped growing. In 1979 the foreign debt ratio actually fell to 17.9%, and the domestic debt ratio stabilized around 13.7%.

From this point on I use the data that start in 1977, and that are much richer. Figure 9 shows the variables for 1977-2016. For now, let me focus on the 1977-1982 period.

The fiscal situation deteriorated before 1982, as there was an increase in the primary deficit to 7.6% of GDP in 1981. In that year the primary surplus became larger than seigniorage, and the government had to increase its borrowing. There were increases in both domestic and foreign debt between 1980 and 1981.

Finally, the debt crisis took place in 1982. On August 20, 1982, the government announced that it was unable to pay the principal of the short-term debt that was due in those days. A significant event was the large increase in the foreign debt ratio: from 20.1% to 57.6% from 1981 to 1982.



Source: Author's calculations with data from Banco de México and INEGI.

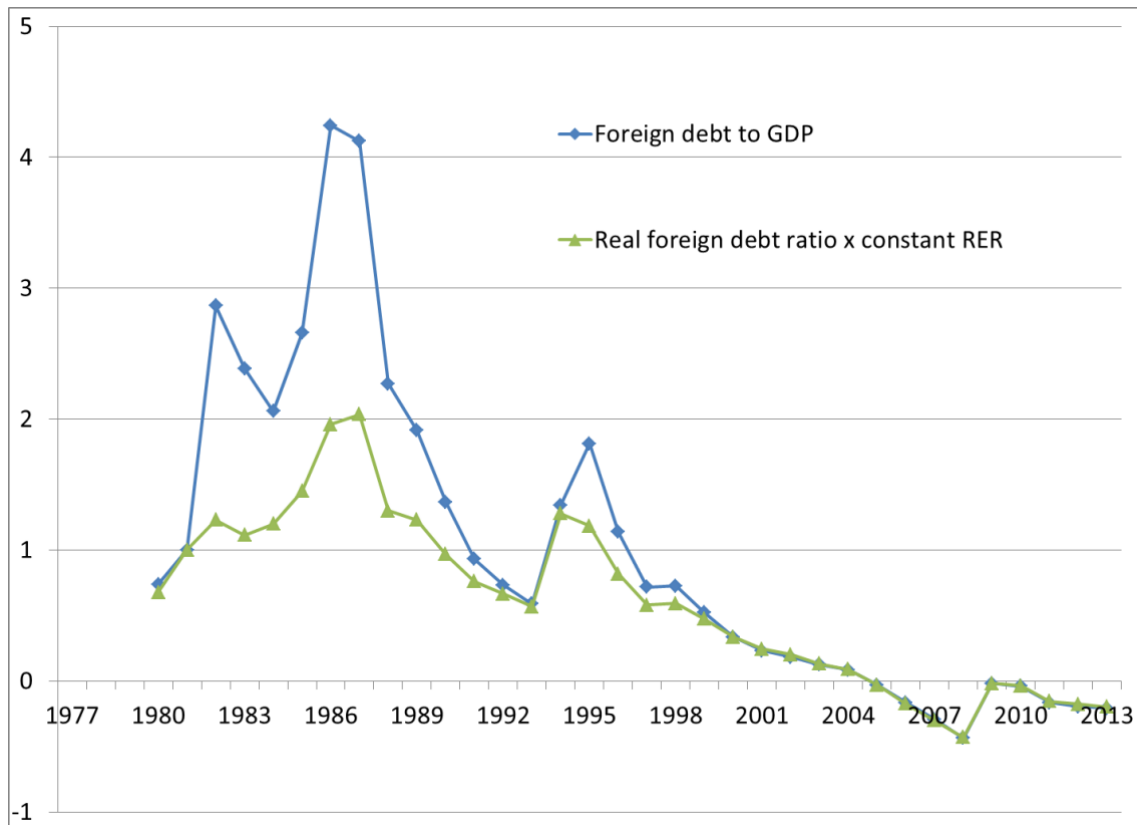
Figure 9. Fiscal and Monetary Variables 1977-2016, % of GDP

Devaluations of the peso and spikes in the foreign debt ratio

An important force behind this increase was the large devaluation of the peso in 1982. In the data the nominal exchange rate is defined as pesos per dollar. The currency devalued (i.e., the exchange rate increased) by 266.1%. In fact, the correlation between changes in the foreign debt ratio and the percentage change in the value of the peso is large throughout the rest of the sample.

To make this point starker, in Figure 10 I use the model to decompose changes in the foreign debt-to-GDP ratio. “Foreign debt to GDP” is the same variable as in Figure 9. I decompose this variable into the real amount of foreign debt, relative to GDP, and the real exchange rate (RER). “Real foreign debt ratio x constant RER” keeps constant the value of the RER over time.¹³ I am plotting indexes of these variables, making their values in 1981 equal to 1. Notice the large difference between “Foreign debt to GDP” and “Real foreign debt ratio x constant RER” in 1982. The main source of the increase in the foreign debt ratio in 1982 is the devaluation of the peso. The story is different for the large increase in 1986. There is a sizable jump in the foreign debt ratio at constant prices. Therefore, in that year the positive change in the real amount of debt is quantitatively important to explain the increase. This is also the case for 1994. The increase in the real amount of debt accounts for almost all of the change in the foreign debt ratio.

¹³ The notation “x” stands for multiplication. One important point is that I am using the assumption that the domestic price index is a function of the price of domestic goods and of foreign goods. Therefore I needed an empirical counterpart of the dollar price level of traded goods consumed in the country. I chose a historical import deflator provided by INEGI.



Source: Author's calculations with data from Banco de México and INEGI.

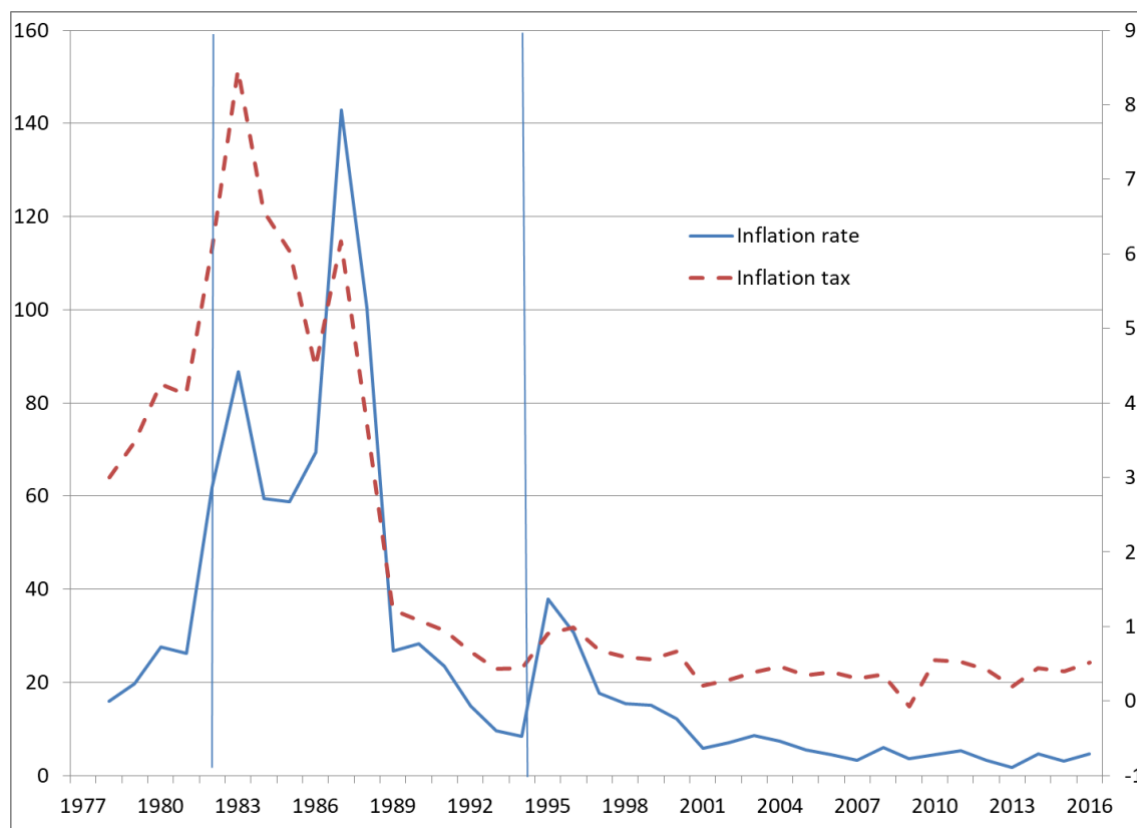
Figure 10. Decomposition of Foreign Debt-to-GDP Ratio Keeping Real Exchange Rate Fixed, 1981=1

The monetary side: inflation and inflation tax

Another aspect I want to analyze is the monetary side. The consequences of the debt crisis parallel the predictions of the model regarding seigniorage. The model predicts that when the government cannot issue debt, then it has to resort to inflation. This is what I observe in the data. In Figure 11 I plot the inflation rate and the inflation tax. To be more precise I should say the “inflation tax revenue” in the theoretical consolidated budget constraint. I am plotting the *tax base*, i.e., the monetary base demand relative to nominal output, lagged, then multiplied by the *tax rate*, which is an increasing function of inflation and of the growth rate of real GDP.

There was a large increase in inflation and in the inflation tax between 1981 and 1983. Inflation went from 26.3% to 86.6%. The inflation tax as a percentage of GDP went from 4.1 to 8.5. Consistently with these findings, Aspe (1993) reports an increase in the inflation tax in the beginning of the 1980s. Figure 11 shows a strong correlation between

inflation and the inflation tax between 1977 and 2000. It is interesting to note that after 2000 both series become very stable, take low values, and show a smaller correlation.



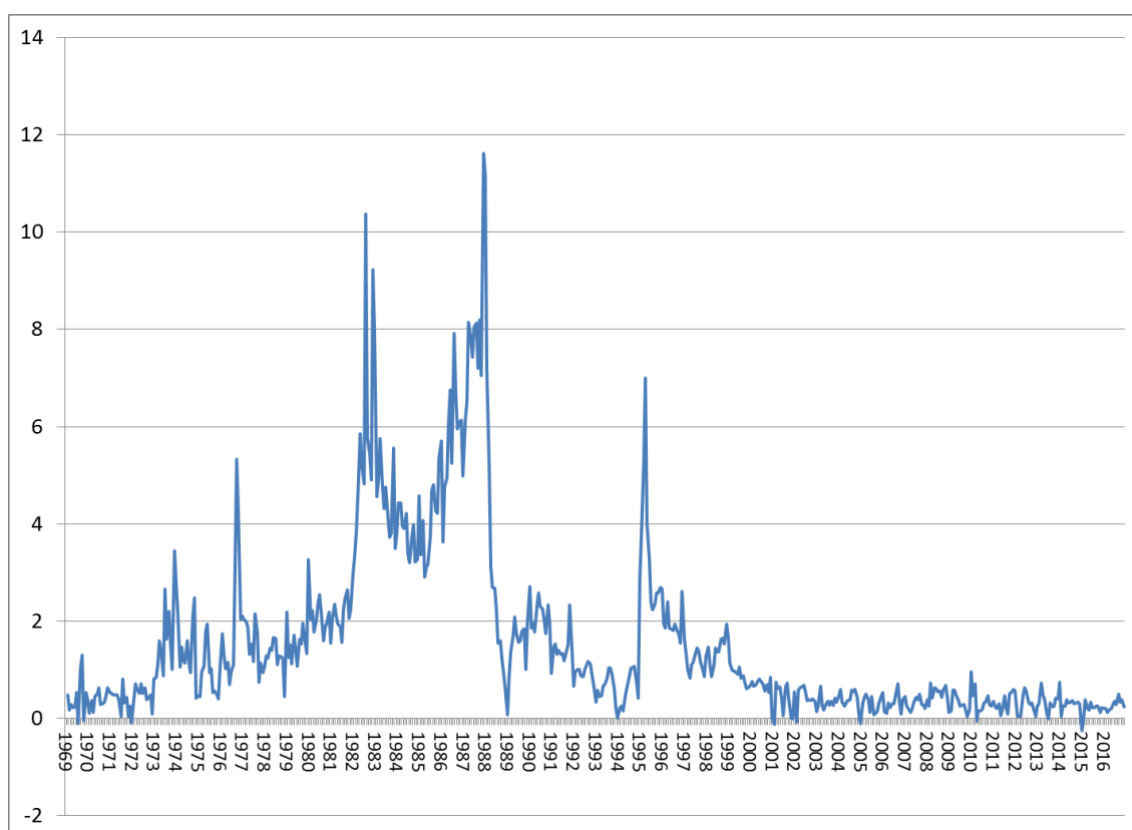
Source: Author's calculations with data from Banco de México and INEGI.

Figure 11. Inflation Rate in % (left axis), and Inflation Tax as % of GDP (right axis)

Taking a closer look at the inflation tax

It is useful to take a closer look at the inflation tax. Previously, I showed yearly data for the inflation tax revenue, the calculation plotted above. I make two changes. First, I use monthly data. Second, I use data that start in 1969. The goal is to have a more precise and broader view of the behavior of the inflation tax. I faced some data limitations, as I was unable to find monthly data on the monetary base before 1985.¹⁴ Therefore, I decided to calculate only the inflation tax rate, the fraction of the purchasing power of real liquid balances that is lost due to inflation. It is equal to $1 - \frac{1}{\pi_t}$, where π_t is the inflation factor between periods t and $t-1$. The data I used is the consumer price index (previously I used the GDP deflator).

¹⁴ These data may exist in a physical, not electronic, document from Banco de México, but I have been unable to find it.



Source: Author's calculation with data from Banco de México, adjusted for seasonality

Figure 12. Inflation Tax Rate, in %

Figure 12 highlights several points. First, the inflation tax rate was low between 1969 and 1973. Second, its average level increased between 1973 and 1979. This period overlapped with the second half of the presidency of Luis Echeverría (1970-1976). As mentioned before, this was a period of deterioration of the fiscal stance of the public sector that ended with the devaluation of the peso in 1976, the first one in twenty-two years. Third, the inflation tax rate increased rapidly starting in 1980, reaching a local maximum in 1982 at the end of the presidency of José López Portillo, which as mentioned earlier culminated in the 1982 debt crisis. I analyze the remaining years in the rest of the paper. For now I will be very brief. The inflation tax rate was difficult to reduce during the presidency of Miguel de la Madrid (1982-1988), as it reached a global maximum at the end of 1987. There was a very sharp decrease in the end of 1988, at the beginning of the presidential term of Carlos Salinas (1988-1994). Afterward there was a downward trend, which was interrupted at the end of that presidency with the 1994 crisis. Following the crisis, the inflation tax fell persistently, and reached stable low levels in 2001-2016. Toward the end

of the paper, I will specify the factors that led to the great reduction of inflation in Mexico, which has also been very persistent.

The role of exogenous shocks: oil price and US interest rates

Here I explore in more detail additional forces that may have contributed to the origin of the 1982 crisis. Two obvious candidates are the international oil price and the interest rates in the US. A lower oil price increased the primary deficit. A higher opportunity cost of lending to Mexico exposed Mexico to higher interest rates on foreign debt.

There was indeed a large fall in the international oil price that Mexico produces, the Mezcla Mexicana. Focusing on the period 1980-1982, there were large falls in the price between 1981 and 1982. The percentage yearly change in January 1982 was -14%, followed by -15% in February. Such a fall put pressure on public finances. At the same time, it is important to say that by simply looking at the data I cannot measure the contribution of the oil price shock to the origin of the 1982 crisis. I can say that it was a contributing factor.

I can make additional important points by looking at the oil price in real terms. Using the model as a guide, the oil price that appears in the budget constraint is the *real* price. By real I mean the international price in dollars multiplied by the exchange rate, then divided by the Mexican price index. This real, or relative, price depends on the three underlying variables. Between 1980 and 1981 this price fell by approximately 10%. Therefore, the Mexican government had fewer real resources to spend abroad and domestically. Between 1981 and 1982 this price increased. It did so because even though the dollar price fell, the exchange rate had a very large devaluation in 1982, and the domestic price level did not increase as rapidly. The punch line of this discussion is the following. The fall in the international oil price in 1982 reduced the income in dollars of the Mexican government, therefore reducing its ability to repay foreign debt. At the same time, given that the peso lost so much value, oil revenue in pesos rose; therefore, this represented an extra source of revenue to spend on domestic goods.

In the case of US interest rates, they took historically large values, and were very volatile, between 1978 and 1982. I looked at data for the three-month Treasury bill secondary market rate. Focusing on 1960-1982, there were high and volatile rates as Paul Volcker,

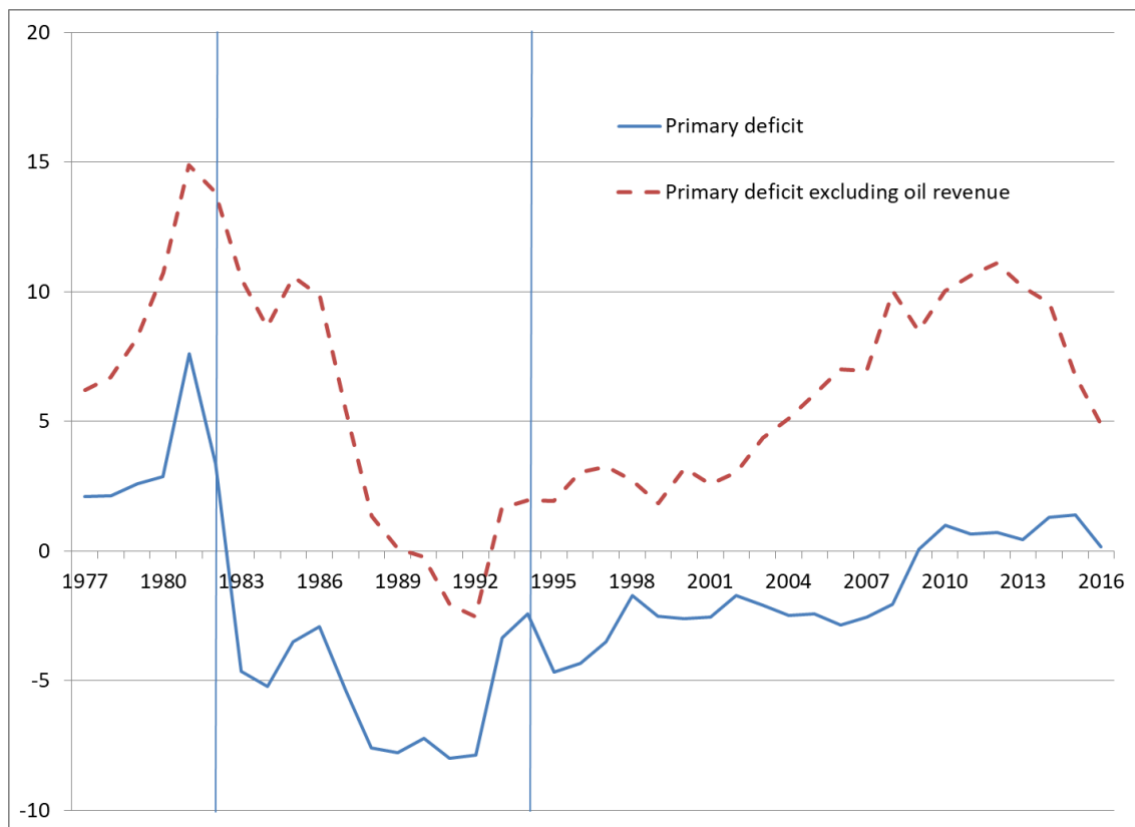
chairman of the Board of Governors of the Federal Reserve System of the US, implemented tighter monetary policy to reduce inflation. Volcker focused on targeting the growth of reserves. There is an issue about timing, as the large increase in interest rates took place before 1982. that is, the largest absolute yearly increase in interest rates took place between June 1980 and June 1981, when the rate went from 7.1% to 14.7%. The large increase in interest rates, especially during 1981, increased the cost of external funding for Mexico. It is important to say by simply looking at the data I cannot measure the contribution of international interest rates to the origin of the 1982 crisis. I can say that they were likely a contributing factor.

To make this point slightly more precise I did a back-of-the-envelope calculation of the real interest rate in the US. I took the time series above and subtracted yearly inflation. I did this in two ways: first, with inflation in the previous twelve months, and alternatively with inflation twelve months ahead. The message is the same: real interest rates in the US jumped from values around zero in 1980 to very high values between 1981 and 1986. The average value was, using both measurements, 4%. The values in this sample are the highest between 1960 and 2016. This increase in the real opportunity cost of investing in Mexico must have certainly put pressure on the ability to repay and roll over foreign debt.¹⁵

The important role of oil revenue

It is well-known that oil revenue is very important for Mexican public finances. Figure 13 shows the previous measure of primary deficit. It compares it to the same variable, excluding oil revenue. Clearly oil revenue is a large contributor to having lower deficits, and achieving surpluses. Focusing on the 1977-1982 period, the deficit would have been much higher without the revenue coming from oil sales. In fact, the deficit excluding oil revenue reached its highest value in that period, and in the entire sample 1977-2016, in 1981, attained a value of 15% of GDP.

¹⁵ Notice that this rough calculation is not an exact match to the real interest rate that appears in the budget constraint. Having said that, given the sharp increase in the nominal interest rate I would expect the real interest rate consistent with the model to increase post-1980.

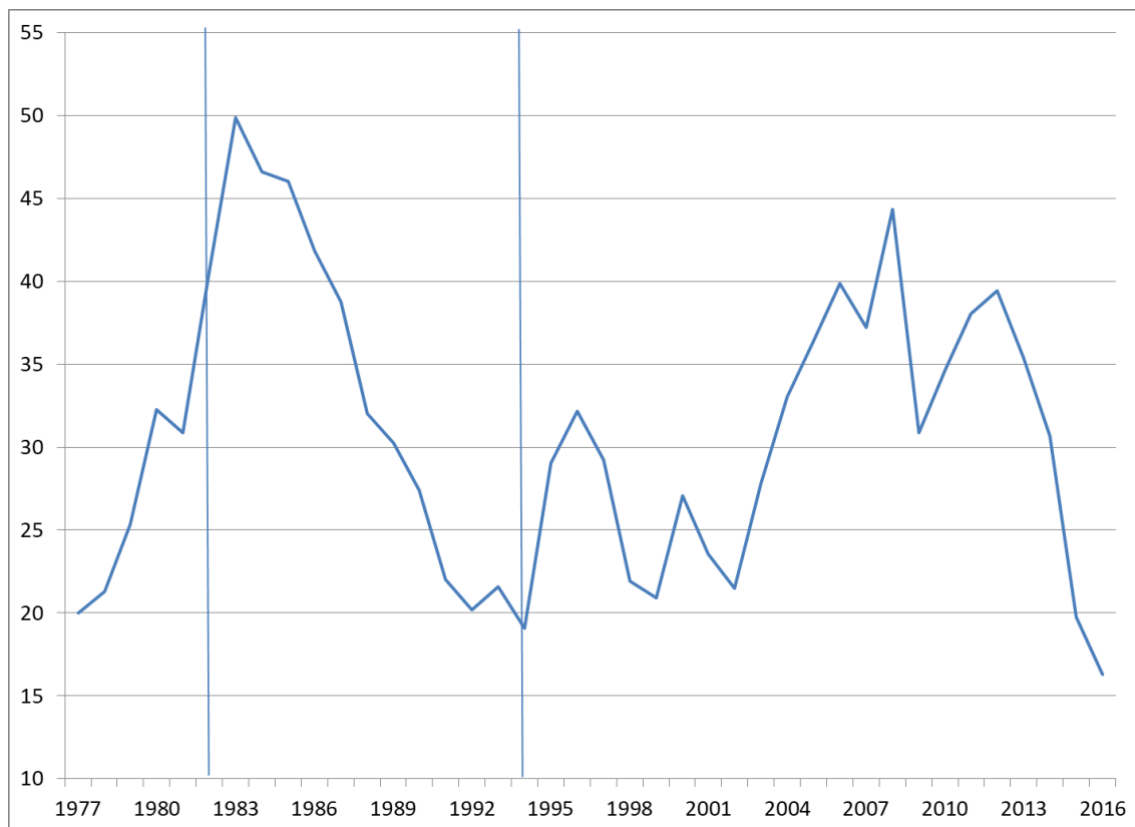


Source: Author's calculations with data from Banco de México and INEGI.

Figure 13. Primary Deficit, and Primary Deficit Excluding Oil Revenue, % of GDP

A complementary way to show the important role of oil revenue is to measure it with respect to total revenue. Banco de México reports the series Ingresos Presupuestales del Sector Público, or Budgetary Revenue of the Public Sector (BRPS).¹⁶ This variable is the sum of oil revenue and non-oil revenue. The latter is in turn the sum of tax collection by the federal government, nontax income from the federal government, and revenue from other institutions and firms under government control. In Figure 14 I plot the ratio of oil revenue to BRPS.

¹⁶ To see the precise composition of this variable, see: <http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=9&accion=consultarCuadro&idCuadro=CG8&locale=es>.



Source: Source: Author's calculations with data from Banco de México and INEGI.

Figure 14. Oil Revenue, % of Budgetary Revenue of the Public Sector

Focusing on 1977-1982, the ratio shows a large increase. This is the result of a combination of higher oil revenue, and a drop in other sources of revenue. It may be surprising that oil revenue increases as the oil price falls. Even though I do not present an algebraic decomposition of changes in oil revenue, a simple reason why it increased in this period is the peso devaluation. Even if oil loses value in international markets, the devaluation of the peso may be larger, therefore increasing the ratio of oil revenue relative to other sources of income. Another point that I make is that in the entire sample 1977-2016 the average value of this ratio is 31%, which reflects the importance of oil for Mexico's public finances. This series is very volatile and is correlated with changes in the international oil price.

The political factor

Why did Mexican crises happen every six years, at the end of a presidential term, given that Mexico was not a democracy and there was no uncertainty regarding the newcomer? I refer to the fact that the same political party, the PRI or Partido Revolucionario

Institucional, ruled Mexico from the late 1920s until 2000. Each president handpicked his successor, who was part of the administration. Therefore, there was in fact little uncertainty about the characteristics of the newcomer.

This political cycle started in 1976 and ended in 1994. As mentioned earlier, 1976 was the year in which the peso was devalued after twenty-two years fixed. In 1982 Mexico suffered the debt crisis, and in 1994 it would go through the 1994 crisis. In 1988 there was no large crisis, but there was indeed a large devaluation of the peso in 1987.

I will discuss in the next section that the political factor was very important generating the 1994 crisis, as a presidential candidate was murdered.

For now, I will focus on the political factor regarding the 1982 crisis. Even though President Luis Echeverría did handpick his successor, Miguel de la Madrid, this process was not exempt from political division. Most importantly, it may have contributed to the origin of the 1982 crisis. The key participants in 1981 were Miguel de la Madrid who was the *secretario* of the Secretaría de Programación y Presupuesto (SPP), David Ibarra Muñoz in charge of the SHCP, José Andrés de Oteyza who led the Secretaría de Patrimonio y Fomento Industrial (SEPAFIN), and Gustavo Romero Kolbeck who was director general of the Banco de México. The issues were the following. First, the SPP reported a deficit of 9% of GDP; whereas, the SHCP calculated 12%. Second, there was disagreement on the reduction of the deficit. The SHCP and the Banco de México wanted to reduce its growth. The SEPAFIN opposed. Second, there was disagreement on whether or not Mexico should devalue the peso. The SHCP and the Banco de México wanted to devalue to reduce the current account deficit. The SEPAFIN opposed, proposing instead restricting imports of consumption goods. The SPP mediated between the two sides. Perhaps for electoral reasons, as there was a competition to become the presidential candidate of the PRI in the elections of 1982, the choice was made not to adjust the deficit. The exchange rate remained fixed. Restrictions on imports were imposed to reduce the current account deficit.

The main point of this discussion is that in 1981 there was a reluctance to reduce the deficit because the 1982 election approached. This political factor likely contributed to the origin of the 1982 crisis.

4. 1983-1994: economic reforms post-1982; the 1994 crisis

Part of the response of the government to the 1982 debt crisis was a sequence of primary surpluses. The presidential term of Miguel de la Madrid started in late 1982, and ended in 1988. Figure 9 shows that the government responded with a primary surplus of 4.6% of GDP in 1983, and an even larger one the following year. In fact, Mexico had primary surpluses throughout the entire period under analysis, 1983-1994.

Another crucial part of the response was the control of inflation, although this goal was difficult to accomplish. Figure 11 shows a high and volatile inflation rate during 1983-1988. The inflation rate in 1987 was 142.8%.

Figure 9 also shows downward trends in the foreign and domestic debt ratios, as well as a fall in seigniorage, although in the case of foreign debt the reduction is interrupted by devaluations of the peso. The reduction in debt ratios is consistent with the sequence of primary surpluses. This is a basic lesson of the model. A government can reduce the debt ratio by reducing the primary deficit, to the point of having surpluses. Simultaneously, the figure shows that the government reduced its use of seigniorage. The fall in seigniorage, which went from 9% of GDP in 1982 to 1.5% by 1988, is consistent with the goal of reducing inflation. This is also a basic lesson of this model, and of other monetary models. A government can obtain revenue through seigniorage, but at the same time inflation will increase.

A distinguishing feature of economic policy in the 1980s in Mexico is the use of *pactos*, literally pacts, or agreements between the government and different economic agents. In December 1987 the government of de la Madrid created the Pacto de Solidaridad Económica, which had the goal of reducing inflation. The government insisted on consensus-building (*concertación*) to achieve it. The government committed to a reduction in spending and a reduction in the number of government-owned firms (the *empresas paraestatales*). Workers committed to reducing wage increases in negotiations with business owners, and business owners committed to reducing price increases and increase productivity. This *pacto* had limited success, as inflation was 100% in 1988.

Fiscal stability and the control of inflation were goals of the 1988-1994 administration of Carlos Salinas. Figure 9 shows that the sequence of primary surpluses continued until 1994, as mentioned previously. The data used in the figure include revenue from privatizations of the national telephone company, TELMEX, and of the banks that had been nationalized in 1982. Additionally, there was progress in the control of inflation. Figure 11 shows a large fall in inflation in 1989 to 26.8%, and a value of 8.47% in 1994. The previously mentioned trends in debt ratios and seigniorage are even clearer in these years. Figure 9 shows the debt ratios falling almost continuously. It also shows seigniorage taking values under 1% of GDP during the early 1990s.

The Salinas government also used *pactos*. In December 1988 it created the Pacto para la Estabilidad y el Crecimiento Económico. The goal was to achieve one-digit inflation. This pact was again an agreement between the government, workers, and business owners. There was a large drop in inflation, to a level of 26.8%, in 1989, as mentioned earlier.

The Salinas administration had two other important features. The first one was a continuation of the process of opening the economy to the rest of the world (the Apertura). In 1986 Mexico joined the General Agreement on Trade and Tariffs. It was under President Salinas that Mexico signed the North American Free Trade Agreement (NAFTA) with the US and Canada, and which went into effect in January 1994. The second was to regain access to international financial markets, which Mexico had lost after defaulting on its debt in 1982. As mentioned in Kehoe and Meza (2011), the renegotiation of Mexican debt started in 1989. Negotiations with Mexico's creditors were successful, and in 1989 the US announced the Brady plan that allowed Mexico and other countries to return to international financial markets.

In the subsections that follow I want to focus on two important events that took place toward the end of the period under analysis: The independence of the Banco de México and the 1994 crisis. So far I have discussed the main trends in economic policy during 1983-1994. I now go into some detail regarding those events.

4.1 Independence of the Banco de México

I discuss a change in the law that made the Banco de México independent from the fiscal branch of the government. This change was part of the reforms that took place in the presidential term of Carlos Salinas. One important question that arises is, of course, was such independence credible? In my view the answer is clearly yes, given monetary and fiscal policies undertaken in the aftermath of the 1994 crisis. After 1995 inflation fell persistently in the entire sample up to 2016.

I have previously described possible arrangements between the government and the Central Bank: fiscal dominance or monetary dominance. I previously mentioned that in Mexico such a relationship was one of fiscal dominance in the decades before the term of Carlos Salinas.

In 1993 a constitutional reform specified the main task of the Banco de México and granted its independence from the government. Article 28 of the Constitution now included the protection of the purchasing power of the peso as its main task. This article also states that no authority can force the Banco de México to provide financing (in Spanish the phrase is *conceder financiamiento*).

In 1993 the Banco de México Law was signed, specifying the rules under which it would relate to the government.¹⁷ In particular, it specifies rules under which the Central Bank can give credit to the fiscal branch of the government.

The new independence of the Central Bank would be tested shortly after 1993: at the end of 1994 Mexico suffered a crisis. The monetary response had to be consistent with the goal of reducing inflation. I now describe and analyze the events related to this crisis.

4.2 The 1994 crisis

During 1994, several political and economic negative events took place in the months before the devaluation of the peso in December. This was the last year of the Salinas term. In January 1994 the Zapatista movement rose in southern Mexico. In March 1994 the

¹⁷ In Spanish, the law is the *Ley del Banco de México*. It can be downloaded from <http://www.banxico.org.mx/disposiciones/marco-juridico/ley-del-banco-de-mexico/ley-del-banco-mexico.html>.

ruling party's, the PRI, presidential candidate Luis Donaldo Colosio was murdered. Large capital outflows took place that put pressure on the exchange rate regime, which consisted of a predetermined band inside which the peso was allowed to fluctuate.

During 1994 the government issued a growing amount of short-term debt with nominal value denominated in dollars and payable in pesos, the Tesobono debt. It became the largest source of short-term borrowing for the federal government, surpassing the amount of short-term peso debt in circulation, the CETEs debt.

Toward the last quarter of 1994 the political situation worsened. The secretary general of the ruling party, José Francisco Ruiz Massieu, was murdered in September. Capital outflows continued during the rest of the year.

These events preceded the collapse of the exchange rate regime and a large contraction in economic activity. In late December 1994 the government abandoned the exchange rate regime. The peso devalued considerably. In early January 1995 the government had difficulties rolling over the Tesobono debt. During 1995 the economy suffered its worst yearly contraction since the 1930s. Between 1994 and 1995 GDP and private consumption per working-age person fell roughly 9% and 10%, respectively.

Analyzing the 1994 crisis through the lens of the consolidated budget constraint model

The question I will work on is whether the model can help us understand the origin of the 1994 crisis. That model has been the main theoretical framework throughout the paper.

One difficulty the model faces immediately when used to account for the 1994 crisis is that there was a primary surplus before this event happened. This can be seen in Figure 9. The surplus was 2.4% of GDP. The model cannot generate a growing path of debt unless there is a need for borrowing; therefore, there cannot be a crisis.

Another clear problem the model faces is that the paths of debt were not growing before 1994. Figure 9 shows that the ratio of foreign debt increased in 1994. However, the ratios of both kinds of debt were below historical maxima. In fact, both ratios had fallen continuously since 1986 and up to 1993. Obviously, the path of debt was not explosive.

In summary, it is not possible to explain this crisis with the model. I analyze alternative theories below. In the Appendix I summarize alternative forces discussed in previous important texts on the 1994 crisis written by Cárdenas (2015), Gil-Díaz and Carstens (1996), Gil-Díaz (1998), Kehoe (1995), and Serra Puche (2011). This list is not exhaustive, as this crisis led to a large amount of research on its origin. A seminal paper on the 1994 crisis is Calvo and Mendoza (1996), which analyzes the mismatch between short-term debt and international reserves.

Complementary theories based on the banking sector

I discuss two complementary theories of the origin of the 1994 crisis based on the banking sector. One theory is that the crisis happened because of *prospective deficits*. In this theory, the existence of implicit bailout guarantees to failing banking systems and the expectation that at least part of the bailout would be financed by seigniorage would lead to a collapse of the exchange rate regime. The reference is Burnside, Eichenbaum, and Rebelo (2001), who propose this theory to account for the 1997 Asian Financial Crisis. I would call this a classic, first-generation explanation for a balance of payments crisis. A second theory is that the crisis was *banking system self-fulfilling*, i.e., not based on public debt, but on the characteristics of the liabilities of the banking system. In this theory, if banks had liabilities in dollars, a devaluation of the peso would hurt their balances. Assuming a bailout guarantee, the cost of rescuing the banks would reduce the ability of the government to defend the exchange rate regime. This sketch of a model would be an example of a third-generation explanation of a balance of payments crisis, in which the interaction between the financial system and the bailout guarantee of the government play a crucial role.

First of all, it is important to recall the changes that were going on in the Mexican banking system. As mentioned earlier, banks were nationalized in 1982. As part of the reforms during the term of President Salinas banks were privatized. This happened between 1991 and 1992. At the same time the financial system was liberalized, allowing for foreign capital flows. By 1994 three phenomena had taken place. The first was a large increase in the foreign short-term debt of the banking system. It increased from \$8.6 billion in 1988 to \$24.8 billion in 1994, as mentioned in Gil-Díaz and Carstens (1996). Banks had a large exposure to exchange rate risk. Second, there was a large expansion of credit. From 1988 to 1994 bank credit had increased on average at a yearly rate of 25%. Third,

there was an increase in delinquency rates. Past due loans relative to total loans increased from 4.1% in 1991 to 7.3% in 1994.¹⁸ The problem was larger than reported with such statistic, as official accounting considered as a past due loan only the amount that had not been paid, and not the entire amount lent.

Was there a bailout guarantee in 1994-1995? Yes. First, banks requested the Banco de México to act as a lender of last resort to be able to pay their debt in dollars. The Banco de México created the Ventanilla de Liquidez, a mechanism through which it provided dollars to the banking system. It is important to note that the resources came from the financial aid provided by the US and the IMF. Second, Guillermo Ortiz, then Secretario de Hacienda in 1995, established three guiding principles. The financial system had to perceive determination from government authorities to solve the developing banking crisis. A sharp increase in real interest rates created in part a further increase in the ratio of past due loans from 7.3% in 1994 to 7.9% in 1995. It is very informative that for some banks there is no available information on that statistic. An additional principle was that the banking system was not going to be nationalized again, as in 1982. Finally, no saver should lose their deposits. There was an implicit unlimited deposit insurance.

Was there a fiscal cost of the bank bailout? Yes. In the next Section I will provide some detail on how the government eventually became officially indebted because of the bank rescue. For now, it is sufficient to say that the debt the government issued was equal to 11.7% of GDP in 1999.¹⁹ This point has several details. It is enough to say that in 1998 the government, for the first time, asked Congress to approve the transformation of debt issued to rescue banks into public debt. The total cost has been estimated at 13.3% of GDP by adding to the previous number the cost during 1995-1998.²⁰

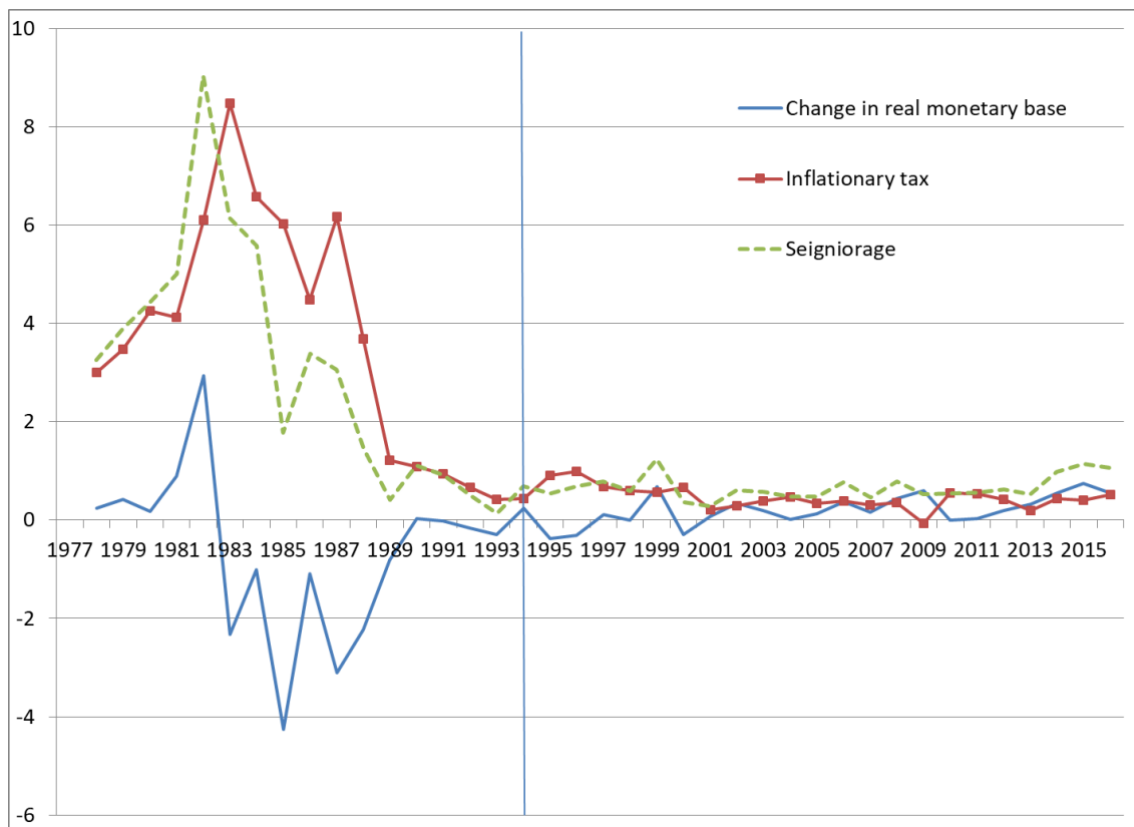
From the previous information it is clear that Mexico was exposed to both a prospective deficits crisis, and a banking system self-fulfilling crisis, as the elements of both theories are present. I look for evidence of the theory of prospective deficits. Burnside,

¹⁸ See Cárdenas and Espinosa Rugarcía (2011), vol. 5, Table I.67.

¹⁹ See Cárdenas and Espinosa Rugarcía (2011), vol. 5, Table II.18.

²⁰ Looking at Figure 9, there is a small increase in the domestic debt-to-GDP ratio from 4.6% in 1998 to 6.4% in 1999. Recall that the data plotted in that figure is debt consolidated with the Banco de México. I will later compare debt statistics that exclude or include this financial support, and without consolidation. Debt is significantly higher when this support is taken into account.

Eichenbaum, and Rebelo (2001) look for evidence in favor of their hypothesis by plotting the monetary base, M1 and M2 for several Asian countries after the 1997 crisis. They also calculate the ratios of monetary aggregates using the value in 1999 relative to the one in 1997. In their theory, there is no immediate increase in monetary aggregates after a crisis. The increase happens with a lag. In my opinion these tests are weak. A stronger test is to compute seigniorage and its components, the inflationary tax and the change in real monetary base. I plot them in Figure 15 relative to GDP. These are the empirical counterparts of theoretical variables in the consolidated budget constraint that I presented at the beginning. The vertical bar signals 1994.



Source: Constructed with data from Banco de México and INEGI.

Figure 15. Change in Real Monetary Base Demand, Inflationary Tax and Seigniorage, % of GDP

There is some evidence in favor of the theory. According to it, seigniorage should increase with a lag. The value in 1995 is very similar to the one in 1994. The inflationary tax goes up, as inflation went from less than 10% in 1994 to almost 40% in 1995. At the same time the change in real monetary base is negative. Seigniorage does have a local peak in 1999, the value being 1.2%. At that point it was the highest value since 1988. After 1999 it falls to persistently low levels.²¹ Notice that the peak is due to an increase in the change of real monetary base, not to an increase in the inflationary tax.

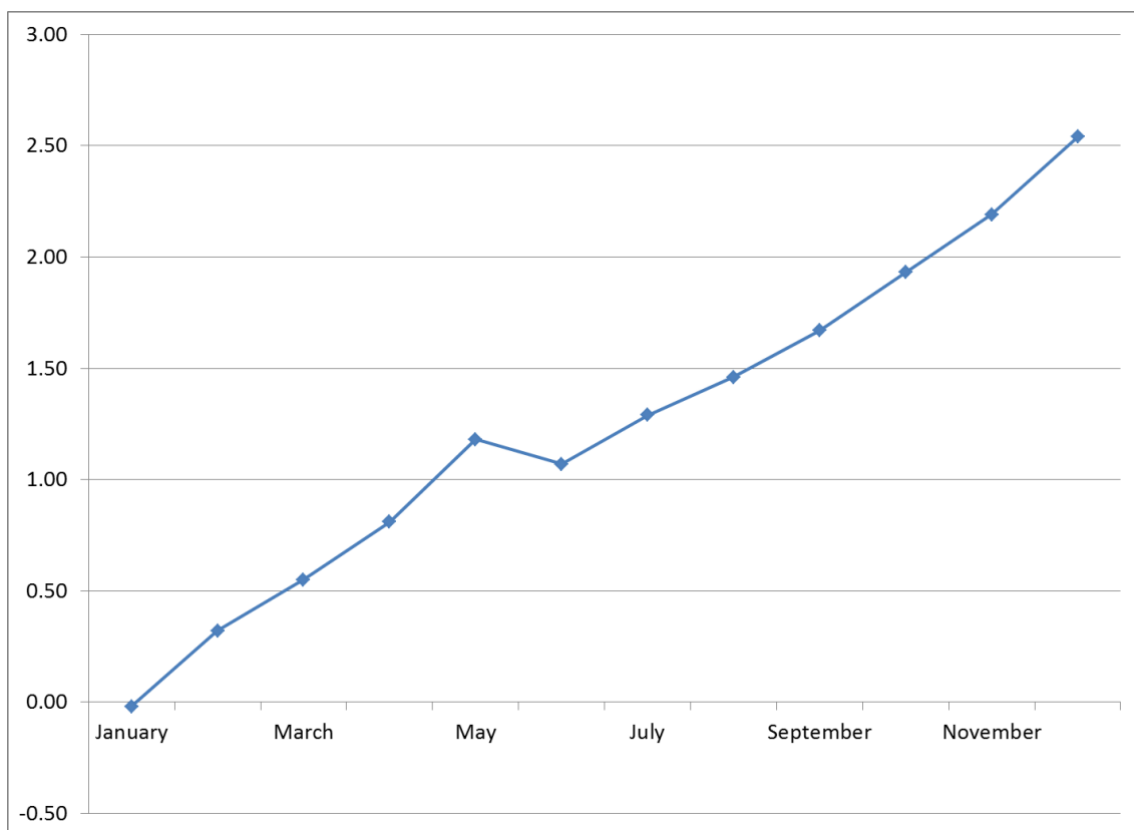
To finish this discussion, more work is needed to disentangle whether there is strong evidence in favor the prospective deficits theory. On the other hand, a specific model has to be chosen to test the predictions of a banking system self-fulfilling crisis.

The role of the oil price and international interest rates

²¹ The behavior changes at the end of the sample.

During 1994 there were some sizable fluctuations in the oil price. However, during most of the year and especially since June 1994 there were large increases in the price. The largest yearly drop of 21%, took place in February. By May the yearly change in price was approximately zero. Starting in June there were yearly increases, the largest one of 39.2% in December. The conclusion is that changes in the oil price were not a negative factor contributing to the crisis.

In the case of international interest rates, 1994 was a year of increases. The US Treasury bill rate rose throughout the year. One rather amazing fact is that the yearly absolute changes in interest rates were *growing* during the year. Figure 16 displays this fact. This continuous increase would have put pressure on public finances, as the international risk-free rate was increasing constantly.



Source: FRED, Federal Reserve Bank of St. Louis.

Figure 16. Absolute Yearly Change, 3-Month T-Bill Secondary Market Rate, 1994

The role of oil revenue

I now take a look at the role of oil revenue during 1994. I have discussed previously that oil revenue was very important for public finances. I have also just reported that there were increases in the oil price starting in mid-1994. Earlier, Figure 14 showed the behavior of oil revenue, as a percentage of the budgetary revenue of the public sector. In the period 1983-1994 there was an almost continuous fall in this fraction. This means that the public sector was less dependent on this source of revenue. Another interpretation is that the public sector was less exposed to changes in the international oil price. The fall in the share of oil revenue stabilized between 1992 and 1994. I do not consider that public finances were affected by shocks to the size of oil revenue, and therefore it is not a factor explaining the crisis.

Monetary and fiscal Response to the crisis

A crucial question at this point is whether Mexico went in practice from fiscal dominance to monetary dominance. Central Bank independence had become part of the Constitution in 1993. But what happened de facto? Fiscal and monetary policies were procyclical. The interpretation is that Mexico has had an independent Central Bank since 1993. The constitutional mandate of fighting inflation was the priority of the Banco de México during 1995. The fiscal branch of the government had to adjust public finances.

Fiscal policies undertaken in 1995 were procyclical. The primary surplus increased from 2.4% of GDP in 1994 to 4.7% in 1995, as Figure 9 shows. Additionally, the value-added tax was raised from 10 to 15% in early 1995. There was an increase in prices controlled by the government, mainly energy prices. Real government consumption per working-age person fell 3.9 percent.²²

Monetary policy focused on reducing inflation. According to Ramos-Francia and Torres García (2005), who provide details on the implementation of that goal, the objective of the Central Bank was to reduce inflationary pressures and to prevent a situation of fiscal dominance.

²² The contribution to the fall in GDP of some of these changes in policy is quantified in Meza (2008).

I want to highlight that having an independent Central Bank is one of the major institutional changes that Mexican policymakers have implemented. The devaluation of the peso at the end of 1994 and the beginning of 1995 slowed convergence to low inflation. Nevertheless, one of the main points of this text is that changes in the early 1990s, specifically the constitutional change of 1993, led Mexico from fiscal dominance and high inflation in the 1980s to Central Bank independence and eventually historically low levels of inflation in 2016.

In the next section I analyze the evolution of macroeconomic policy after 1994. I describe the behavior of fiscal variables. I also focus on how monetary policy changed toward the current scheme of inflation targeting, and on how inflation evolved over time.

5 1995-2016: recovery and the evolution of fiscal variables, monetary policy, and inflation

The main goal of the post-1994 policymakers was macroeconomic stability. This was the case of the administrations of Presidents Ernesto Zedillo (1994-2000) and Vicente Fox (2000-2006). It is important that the goal of stability was a constant throughout two presidential terms, with presidents who came from different parties, the PRI and the PAN (Partido Acción Nacional, the right-wing party). President Vicente Fox from PAN was the first opposition winner of a presidential election. There was an important change during the presidential term of Felipe Calderón (2006-2012, PAN) as Mexico reacted to the international financial crisis with expansionary fiscal policy. Finally, the first four years of the term of Enrique Peña (2012-2016, PRI) showed a persistent increase in the debt-to-GDP ratio.

Fiscal policy

On the fiscal side, I highlight two facts: a persistent primary surplus and a substitution from foreign to domestic debt, in the subperiod 1995-2006. Figure 9 shows that Mexico had primary surpluses from 1995 to 2006. It also shows that starting in 1995 the ratio of foreign debt fell while the ratio of domestic debt increased. In 2000 the ratio of domestic debt surpassed that of foreign debt for the first time since the 1970s.

An important force behind the drop in the foreign debt ratio is the accumulation of international reserves by the Central Bank. Recall that I have been working with consolidated government debt, i.e., I use data from the Banco de México that “nets out” assets and liabilities of the public sector and of the Central Bank. In the case of the foreign debt ratio there is a continuous drop since 1995, as Figure 9 shows. In fact, by 2006 the consolidated government has net assets, not net debt. The reason is the growth in international reserves of the Banco de México.²³ Ramos-Francia and Torres (2005) describe the policies leading to accumulation of reserves by the Banco de México after the 1994 crisis.

The two facts previously mentioned had two consequences: a reduction in the burden of debt and a lower exposure to changes in the nominal exchange rate. This can be seen in Figure 17. Starting in 1997 and until 2006 (and a few years beyond) the ratio of total debt to GDP is low, below 20%. The fact that Mexico had primary surpluses since 1983 contributes to the fall of the debt ratio. Additionally, the ratio is stable when compared with its behavior in the two periods analyzed before. Switching from foreign to domestic debt over time, toward more domestic debt, reduced the swings in the burden of the debt caused by sudden and large depreciations of the peso.

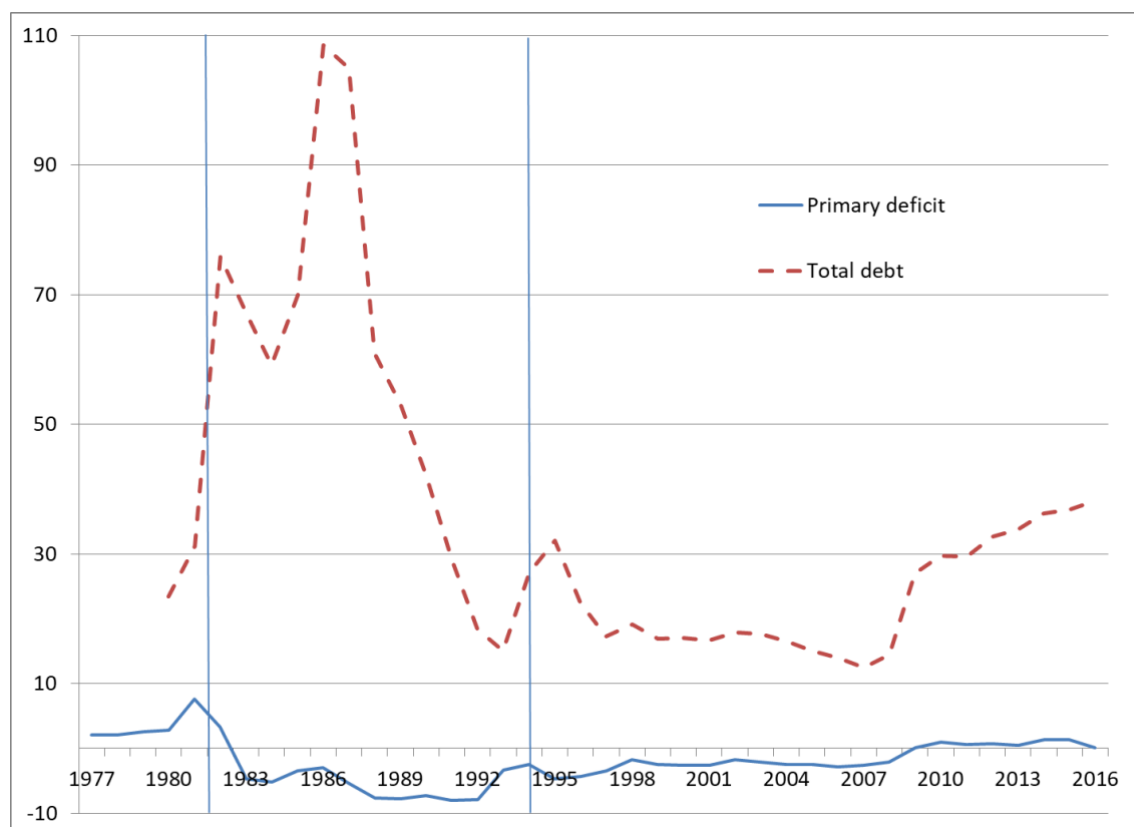
Another factor that reduced the volatility of the debt ratio is the regime change to a flexible exchange rate at the end of 1994. The spike in 1982 is correlated with the adjustment in Mexico’s fixed exchange rate regime. Notice that 1995-2006 is not exempt from large events in international financial markets. There was the 1997 Asian crisis, the 1998 Russian crisis and the dot-com crash of 2000-2002, and the exchange rate was volatile during those events. However, the total debt ratio showed a much smaller variation compared with previous years.

A final comment related to debt dynamics is that in comparing Figures 9 and 17 the main driver of changes in the total debt ratio was the foreign debt ratio from 1980 to 1995.

²³ Note that I am not saying the international reserves of the Central Bank can be used by the federal government, a point that I made clear earlier, and that has been clarified by the Banco de México in recent years. I am saying that if I consolidate the asset and debt position of the public sector and Banco de México, there is a net asset position.

The fiscal cost of the banking crisis

One important event in the Mexican economy was the banking crisis that took place after 1994. Both borrowers and banks received financial support from the government.²⁴ I go into some detail on the bank bailout.



Source: Author's calculations with data from Banco de México and INEGI.

Figure 17. Primary Deficit and Total Debt, % of GDP

Some important dates are the following. In 1990 the trust, Fondo Bancario de Protección al Ahorro (Fobaproa), was established in the Banco de México with contributions from banks to provide deposit insurance. At the beginning of 1995 high real interest rates produced an increase in past due loans. In 1995 the Programa de Capitalización y Compra de Cartera (PCCC) was created. Fobaproa would clean up the assets of the banking system by buying loans; in exchange, bank owners would provide new capital. The ratio was 2 pesos of loans per peso of capital. The loans would be bought with promissory notes

²⁴ The events regarding the rescue of the banking system after 1994 have been analyzed in exhaustive detail by Cárdenas and Espinosa Rugarcía (2011). These authors gathered a large amount of material on the privatization of nationalized banks starting in 1991, the impact of the 1994 crisis, and the subsequent rescue of the banking system.

(*pagarés*) issued by Fobaproa, and signed by the Subsecretario de Hacienda, the second highest ranking official in the SHCP, and the Tesorero de la Federación, the official in charge of the financial management of the resources and assets of the federal government. Fobaproa created several programs to provide financial support for different types of borrowers: small and large firms, for mortgages, for credit to the agricultural sector, for states and *municipios* (counties), and for others. In 1998 President Ernesto Zedillo sent Congress an initiative to approve the recognition of Fobaproa debt, the promissory notes it issued, as public debt, which represented 15% of GDP. There was very strong political opposition. At the end of 1998 the Instituto Bancario de Protección al Ahorro Bancario (IPAB) was created. Its goal was to complete the process of the bailout of the banking system. In 2005 after a long legal process the Fobaproa *pagarés* became public debt.

As mentioned earlier, debt originated by the rescue of banks and borrowers was 11.7% of GDP in 1999. This debt decreased steadily over time. In 2011 its value was 5.7% of GDP.²⁵ It is also important to say that this debt has been paid using three different sources: payoffs from loans bought from banks (as some bad loans produced payments), fees paid by banks, and government resources. The contribution of each source has changed over time. The cumulative contribution is 23.6% from loan payoffs, 15.8% from bank fees, and 60.6% from the government.²⁶

Did monetary dominance prevail in 1995?

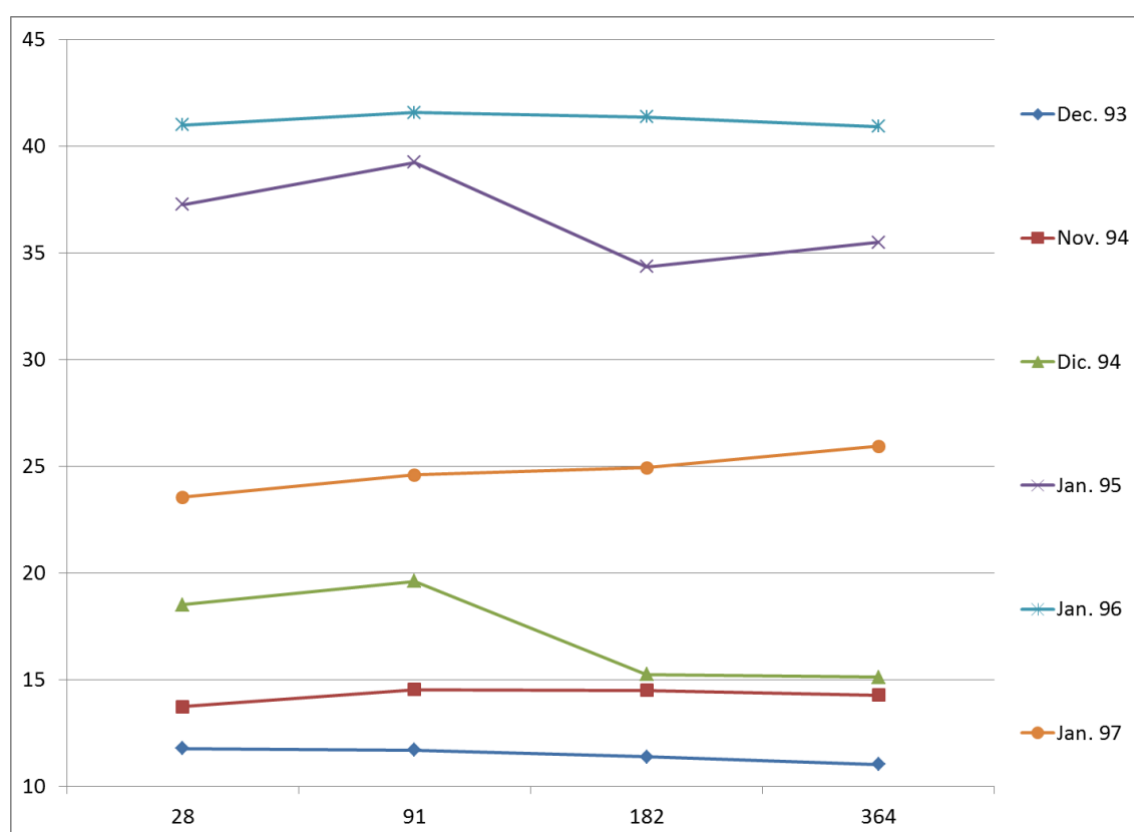
The 1994 crisis generated a temporary change in inflation. The goal here is to discern whether there is evidence that monetary policy was independent from fiscal policy during 1995 and beyond.

First I provide the strongest evidence in favor of that hypothesis. Figure 9 shows an increase in the primary surplus of the public sector in 1994-1995, from 2.4% to 4.7% of GDP. In fact Mexico had a primary surplus until 2008. The same figure showed that seigniorage had a small decrease from 0.7% to 0.5% of GDP. Therefore, fiscal policy was conservative during 1995 (and until 2008). There was no recourse to an increase in seigniorage to finance a deficit.

²⁵ See Cárdenas and Espinosa Rugarcía (2011), vol. 5, Table II.18.

²⁶ See Cárdenas and Espinosa Rugarcía (2011), vol. 5, Table II.17.

Second, I plot data on nominal interest rates for different maturities, providing more support in favor of the hypothesis. The goal is to look at the term structure of interest rates to see if medium-term rates went up by less than short-term ones. Such a behavior would be consistent with an expectation of higher inflation in the short run and lower inflation in the medium run. I use data on bonds called CETEs issued by the federal government. These bonds have historically been an important source of resources for the government. The data appear in Figure 18.



Source: Banco de México.

Figure 18. Nominal Interest Rates in % of *Certificados de la Tesorería de la Federación* (CETEs) at Maturities of 28, 91, 182 and 364 Days

First, I plot interest rates for December 1993. The goal is to infer what the economy expected regarding inflation. The yield curve is slightly downward sloping. This is consistent with the fact that markets expected lower inflation in the future, and that is what happened during 1994. I also plot the curve in November 1994, before Mexico abandoned the exchange rate regime in the last days of December. It changed, having a slightly humped shape, with a maximum at 91 days. The interpretation is that after all the

shocks that had taken place up to November 1994, there was an expectation of higher short-term inflation, but not in the medium term. Then I plot the curve in December 1994. There is a large change in the curve, and it is downward sloping. The interpretation is that markets expected significantly higher inflation in the short term, and lower in the medium term. The curve for January 1995 is above the previous one by several percentage points. It is also downward sloping, and has a similar shape compared to the previous one. Again, markets expected high inflation in the short term, and lower in the medium term. In January 1996 the curve flattens. In January 1997 there are two important changes in the curve. It is significantly lower than the previous one, and it is upward sloping. My interpretation is that the adjustment process in inflation was concluding, and the yield curve took a normal shape, with a positive slope. To conclude, the behavior of the yield curve before and after December 1994 shows that markets expected high inflation in the short term, and a decrease in the medium term. This is consistent with an expectation that public finances would be under control and that monetary dominance would prevail.

Third, I present evidence that is slightly more neutral with respect to that hypothesis. Exchange rate pass-through is a function of shocks that hit the economy. That is a prediction of a simple neo-Keynesian model. How much inflation changes after a change in the exchange rate depends on the presence and magnitude of monetary shocks.²⁷ If there is a monetary shock on the economy, one expects a pass-through from the nominal exchange rate to inflation. In the case of Mexico in 1995, there was indeed a significant pass-through. The peso devalued by 90.2% between 1994 and 1995. Inflation was 37.9% in 1995, a large increase when compared to the value of 8.5% that was reached in 1994. To compute the pass-through, I simply calculate the ratio of the inflation rate relative to the devaluation rate. The value is 42%. My theoretical framework requires a monetary shock to produce simultaneously a devaluation and an increase in inflation. However, as mentioned above, there is no evidence of a large expansionary monetary shock. My conclusion is that inflation increased in 1995 due to factors different from an expansionary monetary shock, for which there is not much evidence.

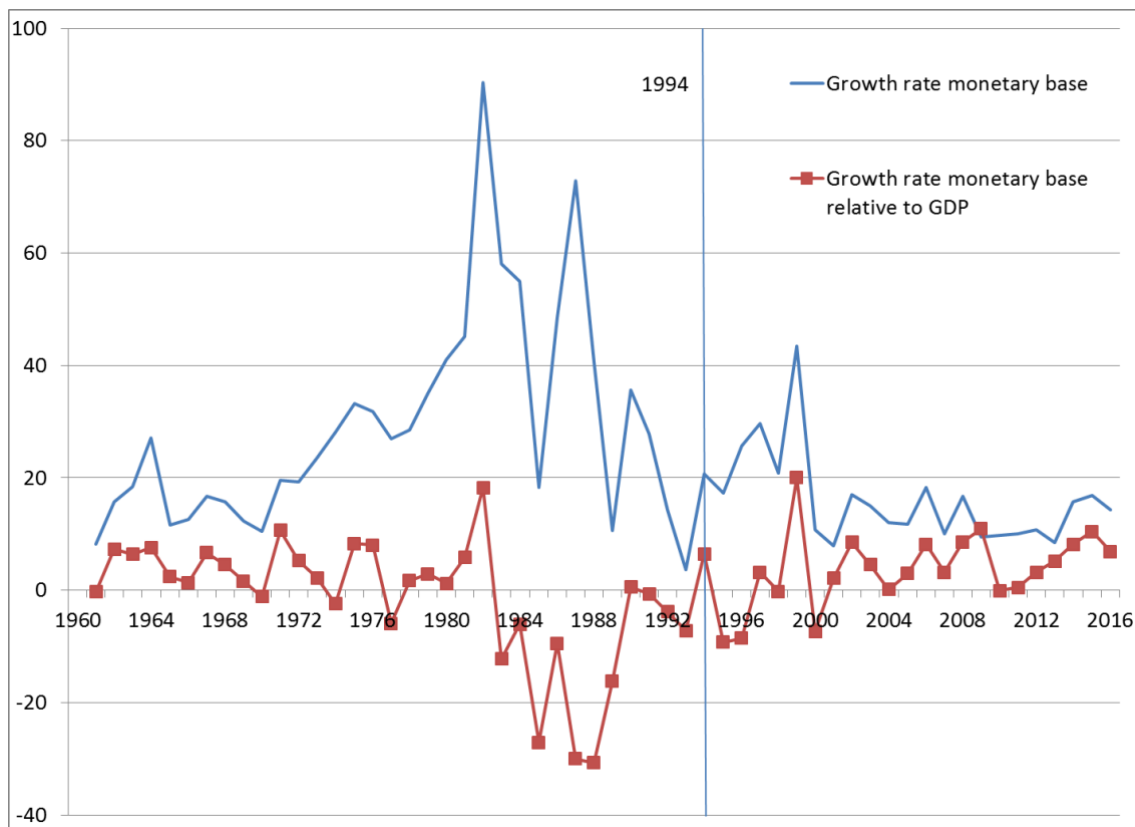
I will go back to the topic of the pass-through in a future section. For now, it suffices to say that after 1995 the peso depreciation rate fell faster than inflation. The inflation rate

²⁷ My framework is Urrutia (2017).

was more persistent, although it had a clear downward trend. Pass-through has fallen over time, as inflation in Mexico up to 2016 became low and very stable, unresponsive to exchange rate fluctuations. The reduction of inflation between 1995 and 1996 reflects in my opinion the absence of expansionary monetary shocks. In the 1970s and early 1980s the Central Bank was used to finance the government. That behavior became a thing of the past.²⁸

Fourth, now I present points against the hypothesis that monetary dominance prevailed. I have already mentioned the strongest observation against it when discussing the hypothesis that the 1994 crisis was a prospective deficits crisis. Seigniorage showed an increase, not on impact in 1995, but later, in 1999. This appeared in Figure 9 and in Figure 15. To further investigate Figure 19 reports growth rates of the monetary base. The growth rate of the monetary base shows very large values especially in the early 1980s, on the way to the 1982 debt crisis.

²⁸ This has been true up to 2018.



Source: Author's calculations with data from Banco de México and INEGI.

Figure 19. Growth Rate of Monetary Base, and Growth Rate of Monetary Base Relative to GDP, in %

What happened between 1994 and 1995? The growth rate fell from 20.6% to 17.3%. I also computed the growth rate of the monetary base relative to GDP. To interpret its fluctuations I would argue that given the low growth rate of real GDP, this growth rate basically depends on a race between growth in the monetary base versus inflation. Looking at this variable, there was a monetary contraction in 1995. The growth rate was 6.5% in 1994 and it became a *negative* 9.3% in 1995.

Up to this point this information supports the hypothesis that monetary dominance prevailed. However, not only seigniorage increased with a lag, having a higher value in 1999, as I mentioned before. Both growth rates in Figure 19 also show a local maximum in that year. I summarize this finding as evidence that the monetary base grew much faster than inflation in that year. Recall that in 1998 the government asked Congress to authorize the transformation of the bank bailout debt issued by Fobaproa into public sector debt.

The data I have reported suggest that there was a monetary expansion one year after that event.

To finish this discussion, in my opinion most of the evidence presented supports the hypothesis that a structural change happened in Mexico as monetary dominance prevailed after 1994. It is true that there was an increase in monetary variables in 1999, one year after the federal government asked Congress to authorize the transformation of Fobaproa debt into public sector debt. For future research it is important to look at the sources of the increase in the monetary base in 1999, in particular the changes in the components of credit of the Central Bank. Having said that, given the downward trend in inflation that started in 1996 and led to a low and stable process, I argue that monetary dominance prevailed in Mexico.

The evolution of monetary policy

The main feature I discuss is monetary policy evolution after the 1995 CrisisCrisis. It went through different stages until reaching the current regime of inflation targeting.

During the presidential term of Carlos Salinas, the nominal anchor was the nominal exchange rate. The exchange rate regime was not a simple fixed exchange rate. The peso was allowed to fluctuate within a band, and monetary policy had to be consistent with the goal of keeping the peso within that band. When Mexico abandoned the exchange rate regime December 22, 1994, choices had to be made regarding how to carry out monetary policy in a new environment with a floating exchange rate.

Starting in 1995 the Banco de México implemented monetary policy by affecting the cost of liquidity in the Mexican interbank market. This regime was informally known as El Corto, using the Spanish word for “short,” referring to the fact that one or more banks would become “short on liquidity.” The regime worked as follows. Private banks could borrow liquid resources from the Banco de México. The Central Bank chose a target for the cumulative (i.e., over a given number of days) balance of liquid funds provided to the banks. This target was called the Objetivo de Saldos Acumulados. A negative target meant that the Central Bank would carry out open market operations to reduce liquidity and cause one or more private banks to have a negative balance. The Central Bank would provide that liquidity, at an interest double the market rate. Banks would try to avoid

paying that penalty rate by raising interest rates on deposits or loans. A negative target implied a contractionary stance of monetary policy.

Starting in 1998 an important change in monetary policy was to provide more information to the public about decisions made by the Central Bank, i.e., a move toward more transparency. Changes in the *Corto* target were discussed in official, public documents, explaining the reasons behind them. This information strengthened the link between changes in the target and informing the public on the stance of monetary policy.

Important changes in terms of transparency and objectives were made in the following years. In 1999 the Banco de México announced that the medium-term goal for inflation was convergence to external inflation by 2003. This goal probably turned out to be too ambitious. Below I will compare inflation to the target announced in 2002. In 2000 the Central Bank started publishing quarterly inflation reports, including a detailed discussion of the sources of changes in inflation. The Central Bank also introduced core inflation to its discussion on inflation dynamics. 2001 is a crucial year, as the Banco de México announced it would implement an inflation targeting regime. In 2002 the inflation target was announced: 3% annual inflation $\pm 1\%$. Since 2003 there exists an official, public calendar of monetary policy decisions.²⁹ In 2005 the Central Bank started making policy announcements in terms of an interest rate. In 2008 the Banco de México announced it substituted the *Corto* with having an operational target for the short-term interbank interest rate.

Therefore since 2008 monetary policy has been carried out as in developed countries, in the sense that the Central Bank adjusts short-term interest rates. This is the current situation.

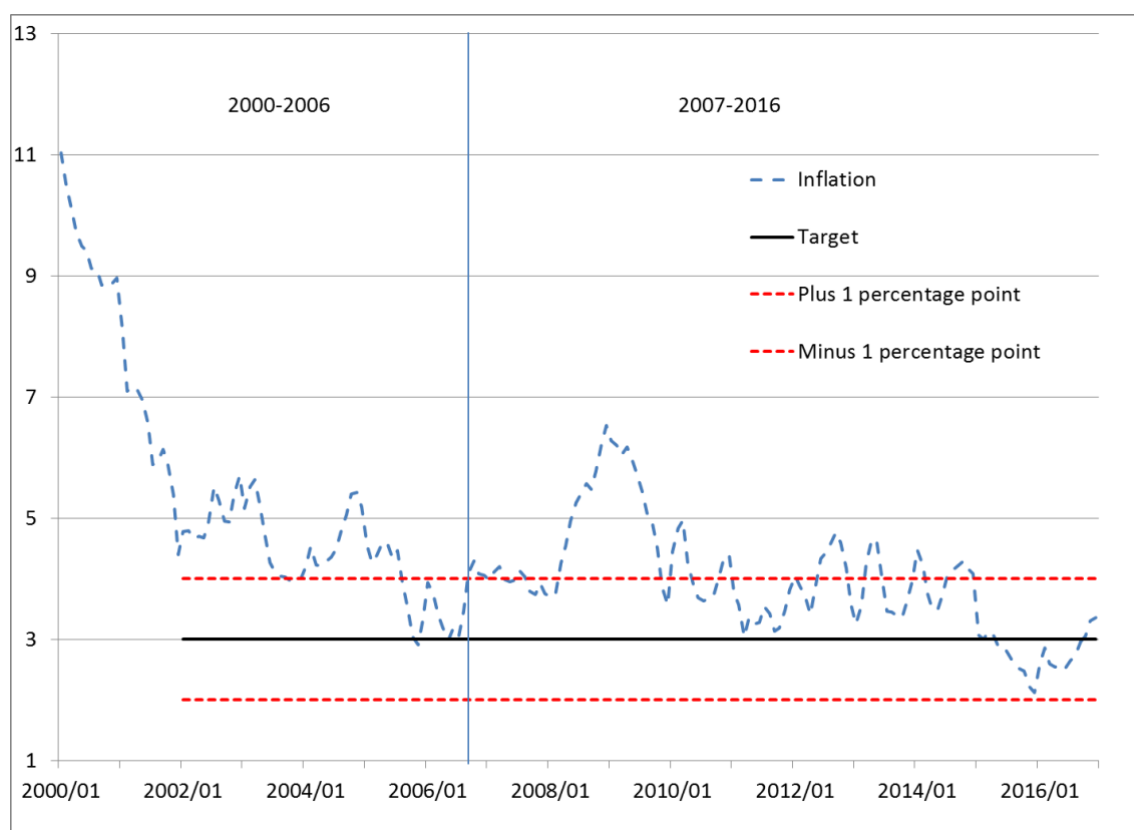
Low inflation achieved

In terms of outcomes, the persistent drop in inflation observed in Mexico since 1995 is the result of several factors, including two important ones: the adoption of an inflation targeting regime and monetary policy decisions consistent with the regime.

²⁹ Ramos-Francia and Torres García (2005) provide more detail on the evolution of monetary policy up to 2003.

The effectiveness of the current monetary policy regime can be judged in a simple way by comparing inflation to the target, which I do in Figure 20. I plot inflation measured with the consumer price index, which is what the Central Bank targets, and the 3% target and its band.

Two phenomena stand out: a sizable drop in inflation between 2000 and 2002, and inflation falling inside the band for most months starting in 2006. Therefore, there is a drop in inflation in the years in which the implementation of the targeting regime starts. Of course, it is not enough to have a target. The target would not be useful unless the Central Bank responds to increases in inflation or inflation expectations by tightening monetary policy.³⁰



Source: INEGI.

Figure 20. Annual Consumer Price Index Inflation versus Inflation Target with Band, in %, Monthly Data

³⁰ The Central Bank also considers the nature of shocks hitting the economy and their impact on inflation, i.e., whether it is a demand shock or a supply shock.

The conclusion is that the Central Bank has been successful controlling inflation. Among the many challenges faced by Mexican policymakers after the 1982 debt crisis and the 1994 crisis this is one in which there has been success. By 2006 inflation exhibited values within the range targeted by Banco de México.

In the rest of this section I analyze the subperiod 2007-2016.

Fiscal policy in response to the international financial crisis

This is a period of primary deficits and increases in domestic debt; Figure 9 shows these changes in fiscal variables. The first primary deficit took place in 2009. Deficits were persistent, reaching a maximum of 1.4% of GDP in 2015. There was a persistent increase in domestic debt and, at the same time, foreign debt remained stable at values close to zero. Recall that this is a measure of consolidated debts and assets of the public sector and of the Central Bank, with international reserves generating the value close to zero. Figure 17 shows total debt, which fell in the previous period. During 2007-2016 its behavior changes, showing a large increase in 2009, and a persistent positive trend afterward.

It is important to note that the implementation of a deficit in 2009 was a change regarding Mexico's fiscal response to an economic crisis. In the past, for example in 1995, the government reacted by increasing the primary surplus, as mentioned before. The response in this occasion was the opposite. The switch from surplus to deficit in 2009 was a result of countercyclical fiscal policies aimed at responding to the 2008 financial crisis in the US. One direct impact of the crisis in the US was the drop in Mexican exports of durable goods. Kehoe and Meza (2011) report that Mexico was the Latin American country hit the hardest by the financial crisis, most likely because of its very close interaction with the US. A specific goal of the Calderón administration was to increase aggregate demand by increasing investment in infrastructure. For more detail, see Banco de México (2009, 2010).

A large part of the increase in debt can be explained, besides the switch to surplus, by two facts. The first is the implementation of the Reform to the Ley del ISSSTE. The ISSSTE is the institution that provides health and other services to workers in the public sector. This institution had a pay-as-you-go pension system that was running into a financial

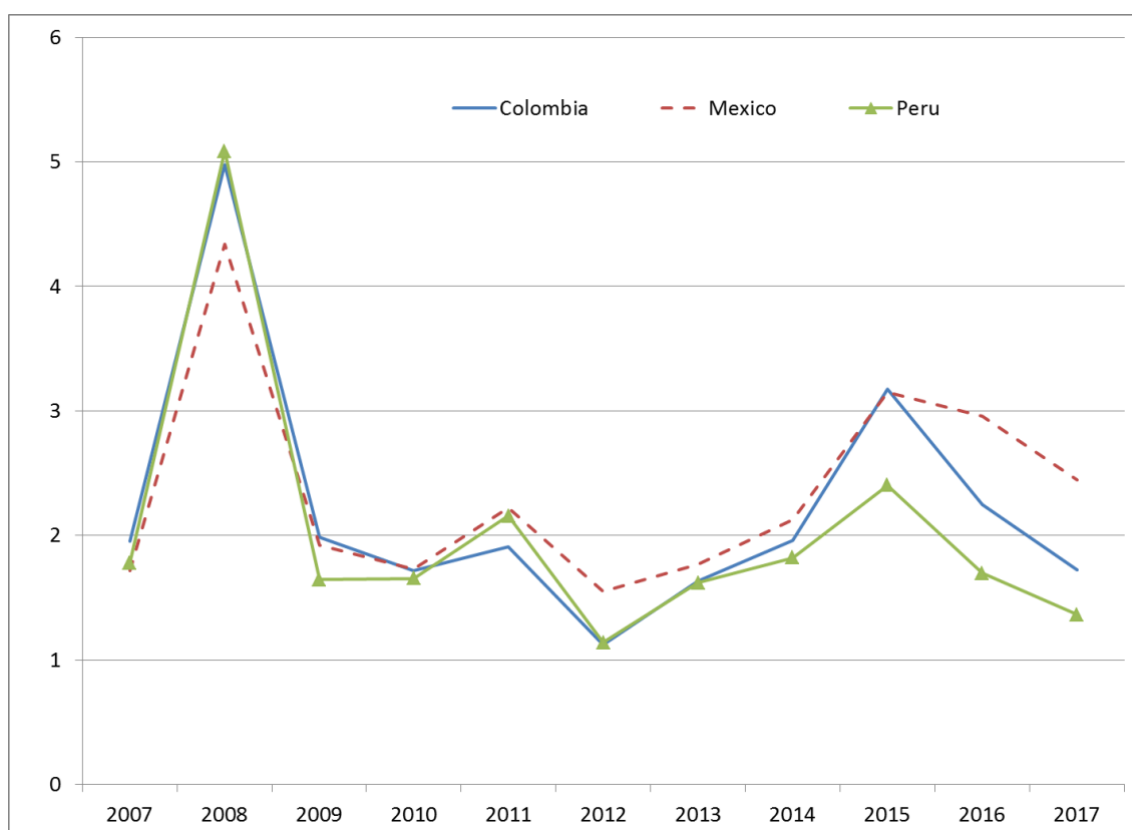
crisis. The federal government implemented a transition to a fully funded, individual account, system. and took charge of the pensions of the older ISSSTE workers. This cost represented 2.6 percentage points of the increase in total debt of 12.5 percentage points of GDP between 2008 and 2009. The second fact is the elimination of a special investment regime for PEMEX. This regime was called Pidiregas, which stands for *proyectos de inversion diferida en el registro del gasto*, or in English “investment projects with a differed expenditure registry.”³¹ The registry of some investment projects carried out by PEMEX was deferred in time. Once the liabilities related to these investment projects were included in total debt, the resulting increase accounted for 8.8 percentage points of the total increase in debt of 12.5 percentage points of GDP between 2008 and 2009. To conclude this point, the increase in the deficit contributed 1.1 percentage points.³²

The reaction of financial markets to the policy response

What was the reaction of financial markets to the increase in debt? Figure 21 shows the EMBI spreads for Colombia, Mexico, and Peru. I excluded data for other countries because the levels of the spreads were much higher in general.

³¹ That is my translation.

³² This means that the cost of the ISSSTE reform, the change in the accounting of Pidiregas liabilities, and the deficit add up to $2.6+8.8+1.1=12.5$ = increase in debt between 2008 and 2009. For a quick reference see:<http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=9&accion=consultarCuadro&idCuadro=CG7&locale=es>.



Source: Banco Central de la República Dominicana.

Figure 21. Emerging Markets Bonds Index Spreads, in %, End of Year

The comparison with other countries is important because Mexico and the rest of the world suffered the consequences of the international financial crisis of 2008. Therefore, it was not enough to look at Mexico to try to find evidence of a possible increase in the sovereign debt spread due to the increase in debt.

The result is that there is no evidence of Mexico behaving much different from Colombia or Peru in terms of the spreads during 2009 and 2010. There is a higher level of the Mexican spread relative to the other countries in 2012, but it is temporary. I interpret the data as saying that financial markets did not have a negative response in reaction to the increase in debt in Mexico.

It is in this sense that Mexico showed a remarkable achievement generated by years of macroeconomic stability. For the first time in its history there was a countercyclical fiscal policy, and at the same time there was no negative reaction from markets. Perhaps being too optimistic, I would say that fiscal policy evolved from relying on monetary policy

during bad times in the 1970s and early 1980s to having the flexibility of policy in developed countries.

Having said that, in 2016-2017 the Mexican spread was several basis points above those of Colombia and Peru. This higher level is correlated with the persistent increase in the debt-to-GDP ratio of Mexico after 2009. In 2016 credit rating agencies announced a change in the perspective on Mexican debt, lowering it from stable to negative. This event highlights the crucial importance of keeping this ratio stable.

Exogenous shocks: the oil price and international interest rates

In terms of exogenous shocks, the oil price has displayed historically large fluctuations. As I will point out below, oil revenue for the Mexican government is very highly correlated with changes in the oil price. There was a large increase that started pre-2007, reaching a maximum of 120 dpb in July 2008. Then the price fell sharply as the 2008 financial crisis developed. The price went up again, reaching a value of 110 dpb at the beginning of 2012. Finally, the price dropped persistently down to a value of 24 dpb at the beginning of 2016.

The interest rate on US three-month Treasury bills fell to zero during this period, as the Federal Reserve Board implemented expansionary monetary policy in response to the 2008 financial crisis. The value was 3% in 2007, and there was a large drop in 2009 to approximately zero. The interest rate remained at this value until the end of 2015, when the Federal Reserve Board started increasing the Federal Funds rate. Nevertheless, at the end of 2016 the interest rate remained at historically low values, at least since 1960.

The relative size of oil revenue for the public sector changed considerably over time, as shown in Figure 14. Recall that the figure reports oil revenue as a percentage of the budgetary revenue of the Public Sector. The share peaked in 2008 with a value of 44%, the highest since 1985. This share closely follows the oil price, which as I mentioned before peaked in July 2008. After 2008 the share goes up again tracking the oil price. Finally, and this is an important development, the share goes down simultaneously with the oil price to a value of 16.3% in 2016, the lowest since 1977. I will show below that, besides the effect of the drop in the oil price post-2012, the historically low value of the share is also related to a historical increase in non-oil revenue of the public sector.

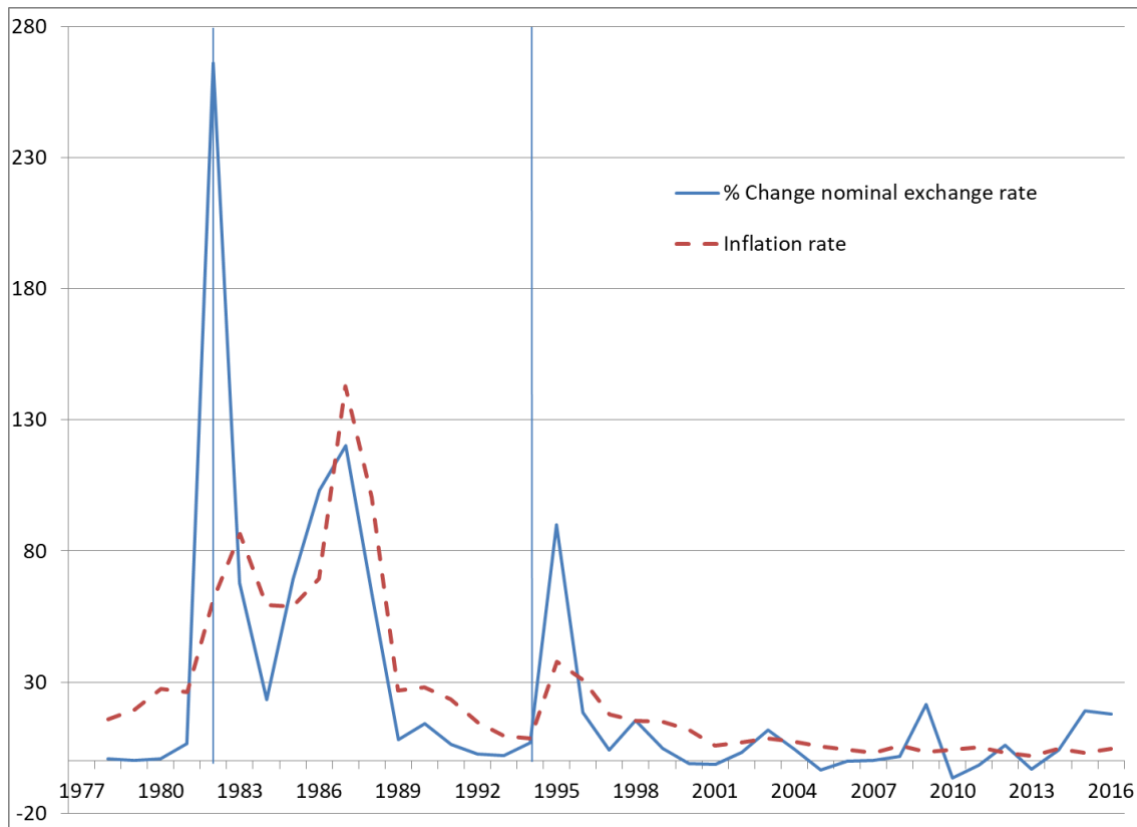
Given the increase in domestic debt and the stagnation of foreign debt, there is an increase in total debt. This is shown in Figure 17. There is a large increase in 2009, the year after which the total debt ratio grows continuously. It reached a value of 38.2% of GDP in 2016, the highest since 1990.

Inflation and the reduction in exchange rate pass-through

Regarding inflation, during this period it remained mostly within the range targeted by Banco de México, as shown in Figure 20. There is a deviation from this range in the aftermath of the 2008 financial crisis. The main reason is that the peso lost value, and there was a certain amount of exchange rate pass-through. Inflation went up to 6.5% at the end of 2008. Afterward, inflation went back to the range.

An important change that appears clearly in this period is the decline in the exchange rate pass-through. Figure 22 shows the comovements between the percentage change in the nominal exchange rate and the inflation rate.³³ Between 1977 and 1994 there were large increases in inflation as the peso lost value in large devaluations. During 1995-2006 the correlation between the two variables seems to fall, although right after the 1994 crisis there was a spike in inflation after Mexico adopted a flexible exchange rate regime. During 2007-2016 it is clear that despite large changes in the nominal exchange rate, inflation has become much less volatile.

³³ Here I measure inflation calculated with the GDP deflator. The figure is similar if I use CPI inflation.



Source: Banco de México and INEGI.

Figure 22. Change in Nominal Exchange Rate, in %, and Inflation.

A simple statistic that reinforces the fall in the pass-through is the ratio of inflation to the depreciation rate, multiplied by 100. It was 42% in 1995, 16.5% in 2009, and 16% in 2015.³⁴ There were large depreciations in those years: 1995 is of course the year after December 1994 when Mexico had to float the peso; 2009 is the year in which the subprime crisis in the US led to the international financial crisis; 2015, in December, was the first time the Federal Reserve increased interest rates in nine years. The pass-through was large in 1995, as the exchange rate market produced the new equilibrium value. It was much smaller in 2009, despite the historical magnitude of the international financial crisis. It was also much smaller in 2015, compared to 1995 when markets adjusted expecting an increase in US interest rates.

In a previous section I mentioned that my theoretical framework to analyze monetary events is a simple neo-Keynesian model. In that model an expansionary monetary shock

³⁴ To calculate inflation I am using the GDP deflator. It would be important to calculate this statistic using the CPI.

produces a depreciation of the peso and an increase in inflation. Therefore, the model predicts a certain pass-through after an expansionary monetary shock. The fact that the pass-through in Mexico has fallen could be accounted for by smaller monetary shocks.

The Banco de México has had a clear anti-inflationary stance ever since 1995. Therefore the fall in pass-through can be its consequence. Previously I described the evolution of monetary policy post December 1994. First the Banco de México had the Corto and a clear anti-inflationary stance. Then it had an inflation target of 3%, starting in 2002. Finally in 2008 its main policy tool became the adjustment of the short-term interbank interest rate. The consistency between the announced goal of the Central Bank and its adjustments to policy tools has produced low and stable inflation, and therefore a lower pass-through. In my opinion monetary policy in Mexico became credible in its goal of low and stable inflation in 2002. Starting that year, inflation has remained either within the band targeted by the Banco de México, or deviations have been temporary and caused mainly by exogenous international and domestic shocks.³⁵ Monetary policy in Mexico has become as credible as any in developed countries. This is a major structural change.

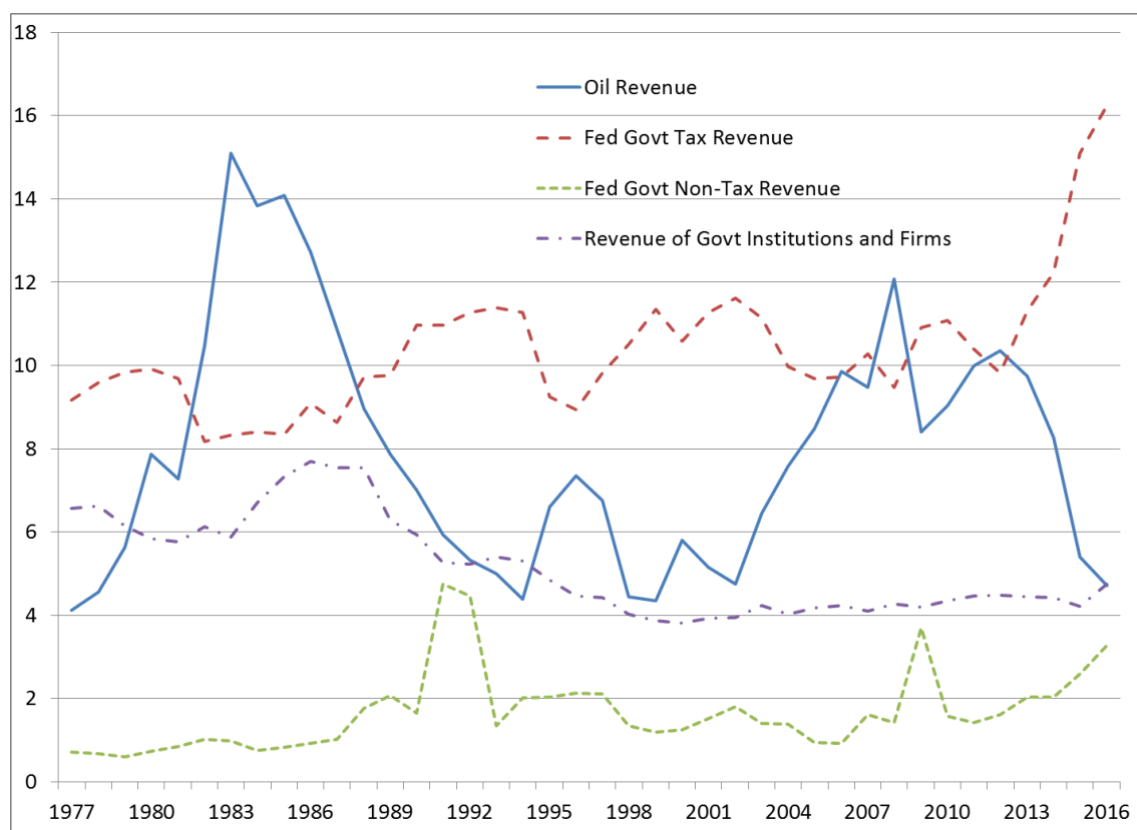
Fiscal reform and increase in non-oil revenue of the public sector

One of the last points I want to make is the recent increase in the size of the non-oil revenue of the public sector, especially tax revenue. In Figure 23 I plot both oil revenue and the three components of non-oil revenue, as a percentage of GDP. These components are tax revenue, non-tax revenue of the federal government, and revenue of government institutions and firms. Notice the fall in oil revenue after 2012, which is correlated with the decline in the oil price. Notice also the large increase in tax revenue. Between 2012 and 2016 it gained 6.4 points of GDP. In 2016 it reached the highest level in history, 16.2% of GDP. This historical increase in tax collection is related to the fiscal reform of 2014 undertaken by the Peña Nieto administration.

This Reform included several changes in taxation; however, it is beyond the scope of this paper to determine which change contributed the most to the increase in tax revenue. The set of changes included:

³⁵ An example of the latter is adjustments to energy prices, which have been managed by the government.

1. A limit on certain tax deductions that firms can make when paying the corporate income tax.
2. Elimination of the fiscal regime that allowed firms belonging to a business group to file taxes jointly. With the reform, each firm files its taxes separately.
3. A tax on capital gains was added to personal income taxation.
4. A limit on tax deductions allowed when filing the personal income tax.
5. An increase in marginal tax rates for high-income earners.
6. The creation of a tax regime designed to attract workers/entrepreneurs in the informal sector. They were offered tax discounts and incentives such as access to the financial system and credit.
7. The creation of taxes on carbon emissions, and on sweetened beverages and high calorie-content food.
8. In Mexico states collect a tax based on the value of real estate. States were given an incentive to put effort into collecting this tax by keeping a share, the rest going to the federal government. For more detail see Gobierno de la República (undated).



Source: Banco de México and INEGI.

Figure 23. Oil Revenue of Public Sector, and Sources of Non-oil Revenue, % of GDP

In this text I have been analyzing fiscal data, in particular debt. In the Appendix I repeat part of my analysis looking at alternative debt data provided by the Banco de México and the SHCP. The dynamics are similar. One important difference is that in the benchmark data the foreign debt ratio falls, while with alternative data that excludes international reserves of the Central Bank as assets for the consolidated government, it increases towards the end of the sample.

6 The great reduction of inflation

I discuss the sources of the persistent decline in inflation pre-2000, and on the low level reached afterward. In August 2016 I published a blog in *Foco Económico* (Meza 2016).³⁶ The topic was a discussion about which forces had generated the drop in inflation in Mexico between 1982 and 2016. The possible answers to that question are very close to a summary of the recent monetary and fiscal history of Mexico, and it shows the linkages between fiscal and monetary policy.

The first force is the sequence of primary surpluses that started in 1983 and lasted for decades. This sequence is consistent with an objective of reducing the burden of the debt, and thus with a goal of eliminating the possibility of fiscal crises. In short, this fiscal policy was a step toward moving from fiscal dominance to Central Bank independence. The lesson from the 1982 debt crisis was that public finances had to be kept in check.

The second force is the constitutional change of 1993. For the first time in the history of Mexico it was written in the law that no one (“no authority,” as written in the Constitution) can force the Central Bank to provide financing. Plus, a clear goal was established for the Central Bank: low inflation. What happened in practice? The 1994 crisis was a test for this institutional change. During 1995 both fiscal and monetary policies were contractionary. There was an objective of preventing markets from having the perception that there would be fiscal dominance. The Banco de México focused on the control of inflation.

³⁶ It can be read at <http://focoeconomico.org/2016/08/22/la-gran-reduccion-de-la-inflacion-en-mexico-el-factor-institucional/>.

The third force is the implementation of an inflation targeting regime since 2002. One benefit of this regime is that the goal of the Banco de México is very simple, and it is very easy to evaluate whether the monetary authority is achieving the target or not. Again, what happened in practice? The data in this paper showed inflation converging to the target. This phenomenon shows that the adoption of the inflation targeting regime has been a success. Of course, it is not enough to have such a regime. The Central Bank has to react in a consistent way when inflation and inflation expectations are increasing.

Compared to my blog, here I list one more force, the *Pactos*. The fourth force consists of the negotiations between the government, workers, and business owners, the *Pactos* of the late 1980s. They have been pointed to as important factors behind the fall in inflation after in the late 1980s and before the 1994 crisis. The model I used as the theoretical framework is not designed to analyze their contribution, so this is an interesting line for future research.

Having discussed the forces that contributed to the reduction of inflation, the next question would be to determine the quantitative contribution of each. This decomposition would require a model with possibly many ingredients: a fiscal-monetary connection, a government that bargains with union and business leaders (to represent the *Pactos*), and the adoption of an inflation targeting regime. I do not have such a model, but here I discuss some related quantitative findings.

There have been a few econometric estimations that try to find structural breaks in the stochastic process that inflation follows. The structural break consists either in a lower mean, or in inflation becoming a stationary process. This line of work is represented by Capistrán and Ramos-Francia (2009) and Chiquiar, Noriega, and Ramos-Francia (2007). Using data at quarterly frequencies for 1980-2007, Capistrán and Ramos-Francia (2009) find evidence of structural changes in the mean of inflation in 1984Q2 (increase), 1988Q2 (decrease), 1999Q1 (decrease). Using monthly data for 1995-2006, Chiquiar et al. (2007) find evidence of the process of inflation changing from a unit root to stationary in December 2000.

The main result is that the structural changes in inflation are found close to when certain important events took place. The first one is Pacto de Solidaridad Económica, signed on

December 1987 by the de la Madrid administration. Inflation did fall between 1987 and 1988 from 143% to 100%, but the level remained high. The second is the Pacto para la Estabilidad y el Crecimiento Económico, signed in December 1988 by the Salinas administration. Inflation fell between 1988 and 1989 from 100% to 27%, a large decrease. The third is the announcement in 2001 of a future inflation targeting regime that would be implemented in 2002.

There is no econometric evidence that the constitutional change of 1993 led to, or was correlated with, a fall in inflation. This is likely due to the 1994 crisis, which created a spike in inflation in 1995. Having said that, even if econometric techniques cannot detect a correlation, the goal and response of the Banco de México in 1995 and afterward are indicative that the Central Bank committed to the constitutional mandate of keeping inflation low.

A point I want to make here is that expectations may have played an important role in the fall in inflation. Notice that the dates of structural changes found by econometric studies do not coincide with the dates of events that may have reduced inflation. In the case of Capistrán and Ramos-Francia (2009) the structural change they find in 1988Q2 takes place between the two Pactos. The first one does not seem to be very successful, as inflation remained high in 1988, although there was in fact a reduction in price changes. The second one was more successful, as inflation fell almost 75 percentage points. A hypothesis is that inflation dropped in 1988 in anticipation of a new administration that was willing and capable of achieving a large fall in the growth of prices.

A similar point can be made regarding the detection of structural breaks in 1999Q1 by Capistrán and Ramos-Francia (2009), and in December 2000 by Chiquiar et al. (2007). The changes in the process of inflation occur before Banco de México announced in 2001 the future implementation of an inflation targeting regime, which happened in 2002. A hypothesis is that inflation fell in 1999-2000 in anticipation of future credible policies aimed at the reduction of inflation.

Having said that, notice that one thing lacking in the model I have used as benchmark is precisely the role of expectations. The model is useful, but too simple in an important way.

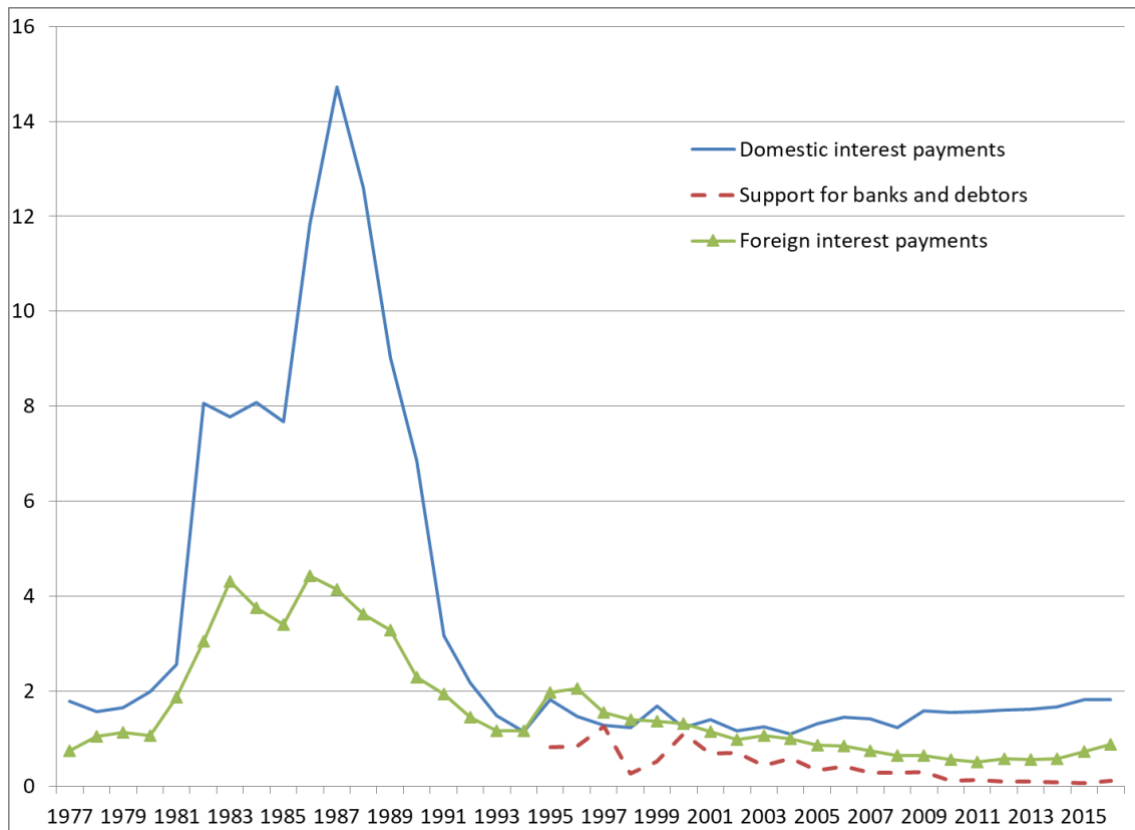
In connection to that comment, recently Sargent, Williams, and Zha (2009) have combined a framework similar to Sargent and Wallace (1991) with a real balances demand equation with expectations, as in the classic work of Cagan. They have used this model to analyze the reduction in inflation in several South American countries. Their main result is that structural changes in the deficit, as opposed to “cosmetic” ones, have produced large and persistent declines in inflation.

The analysis of Sargent et al. (2009) has been applied to Mexico by Ramírez Aguilar de Wille (2017). He used this model to analyze the relation between deficits and inflation in Mexico. His main result is that the fall in the deficit during 1989-1992 led to a fall in inflation, and to a persistent low level.

7 Implicit transfer in the budget constraint

The main tool in the project of the monetary and fiscal history of Latin America is the consolidated budget constraint. One question is whether the budget constraint holds after plugging in the empirical counterparts of the theoretical variables. It is possible that the answer is negative and, therefore, there is a residual. The existence of this residual could be due to particular transfers implemented in times of crises, transfers that might not be registered completely or accurately in the data sources.

I measure this transfer implicit in the budget constraint for the Mexican case. I need to collect more data to carry out this measurement. Interest payments are part of the budget constraint and so far I have not gathered that data. The government reports data on the “financial cost” it faces. It includes data on payments on domestic debt, payments on foreign debt, and resources allocated to the rescue of banks and debtors after the 1994 crisis. Figure 24 shows their behavior.



Source: Author's calculations with data from Banco de México and INEGI.

Figure 24. Interest Payments and Support for Banks and Debtors, % of GDP

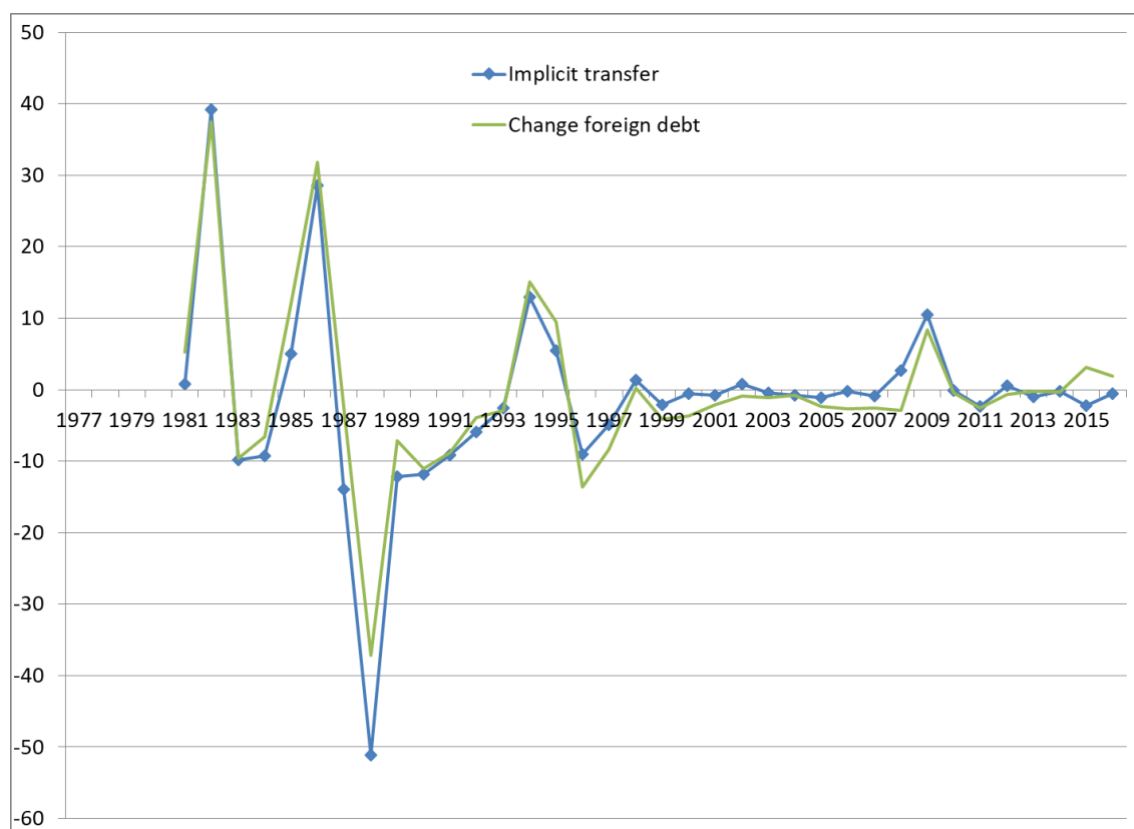
Financial costs were initially low in the late 1970s, approximately 3 percentage points of GDP. Then they become large starting with the 1982 debt crisis. For almost a decade they remain at high values. By 1993 financial costs recover the value they had at the beginning of the sample. Domestic and foreign interest payments increase with the 1994 crisis, but by a small amount. Starting in 1995 there is the additional cost of the support for banks and debtors. The trend afterwards is stability for domestic interest payments, a fall in foreign interest payments, and a decrease in the resources allocated to support banks and debtors. Finally, the three variables increase towards the end of the sample.³⁷

Next I take the budget constraint and solve for the implicit transfer. To make this clearer I present a simplified version of the budget constraint and rearrange it.

³⁷ The large value of domestic interest payments relative to GDP in the 1980s is likely due to high inflation. Ljungqvist and Sargent (2004) show how the real values of the interest component of the real and nominal deficits are related.

$$\text{Implicit transfer} = \text{Issuance of domestic debt} + \text{issuance of foreign debt} - \text{international reserve accumulation} + \text{seigniorage} - \text{interest domestic debt} - \text{interest foreign debt} - \text{primary deficit}$$

Before showing its behavior, I make two comments. The first is to recall that by “issuance” I mean the change in debt, i.e., accumulation or de-accumulation. The second is that to be fully consistent with my accounting I would need to compute as a source of revenue the interest received on the international reserves of the Central Bank. This comes from the fact that I use data that consolidate the public sector and the Banco de México. Now, before looking at the data, notice that the interpretation of the sign of this transfer is the following. A positive sign means that there is an extra source of spending. A negative sign would mean savings. Figure 25 plots the implicit transfer together with the change in the foreign debt-to-GDP ratio.



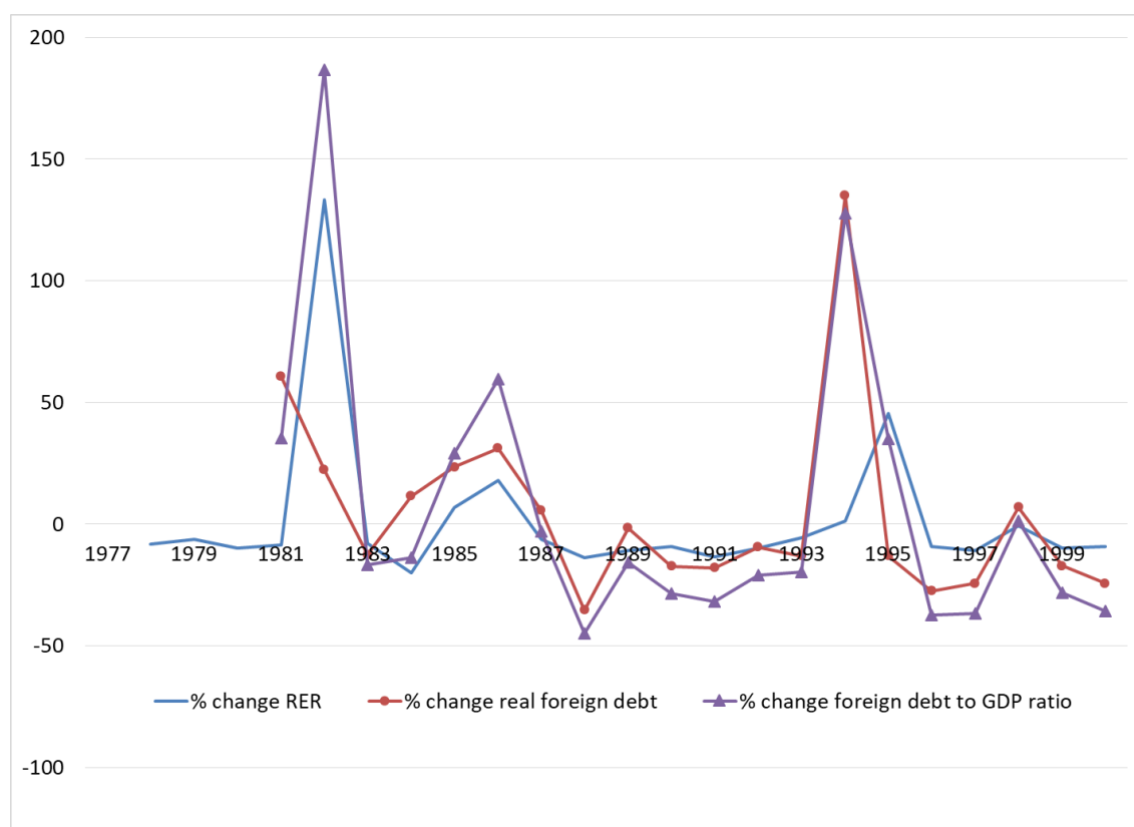
Source: Author’s calculations with data from Banco de México and INEGI.

Figure 25. Implicit Transfer, and Change in Foreign Debt-to-GDP Ratio

In times of macroeconomic stability, the transfer is small and fluctuates around zero. This is the case for the periods 1998-2007 and 2010-2016.

The transfer is volatile in times of instability. This is particularly the case for the periods 1982-1989 and 1994-1996. What is behind this behavior? The answer is the change in the foreign debt-to-GDP ratio. In turn, as I have shown before, that ratio depends on variations in the real exchange rate, and in the real amount of debt.

To determine which force is more important I present the following decomposition. The percentage change in the foreign debt-to-GDP ratio is equal to the percentage change in the real exchange rate plus the percentage change in real foreign debt minus the percentage change in real domestic GDP.³⁸ Figure 26 shows this decomposition. I ignore the percentage changes in real domestic GDP because they are small compared to the other ones.



Source: Author's calculations with data from Banco de México and INEGI.

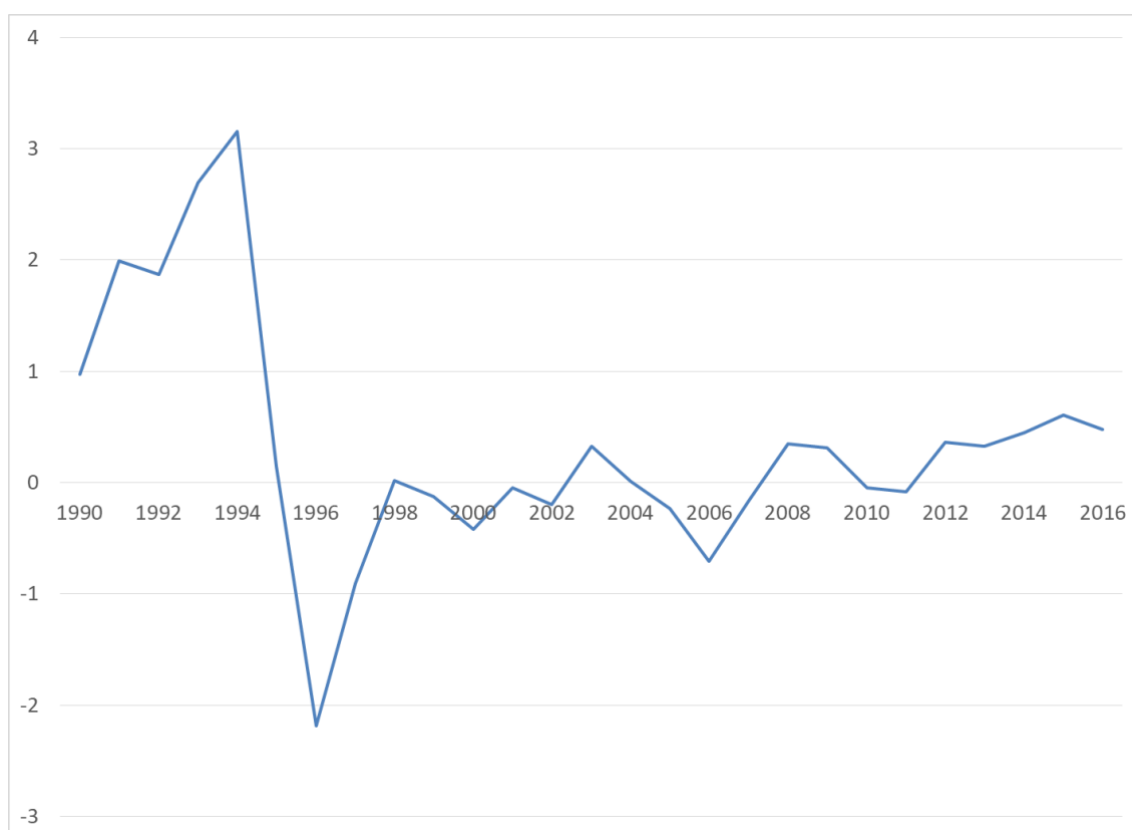
Figure 26. Decomposition of Percentage Changes in Foreign Debt-to-GDP Ratio

³⁸ I constructed the real exchange rate consistent with the model, as for Figure 10.

The results of this decomposition are the following. Recall that I am accounting for the sources of the residual via the changes in the foreign debt ratio. I focus on data up to 2000 to analyze more closely the crises in 1982 and 1994. First, the foreign debt ratio spikes in 1982 because of the large real exchange rate devaluation. Second, the spike in 1986 is not due mainly to a devaluation, but to an increase in the real amount of foreign debt. The real exchange rate plays a secondary role. Third, the large fall in 1988 is due mostly to a decrease in the real amount of debt. Fourth, the spike in 1994 is also due to a jump in the real amount of debt.

In summary, except for the event in 1982, when the real depreciation led to a large increase in the debt ratio, in other important years the source of changes in the foreign debt ratio is the variation in the real amount of debt. I would like to point out that the increase in the real amount of debt in 1986 is surprising. This was a year in which Mexico was out of international financial markets, after the default in 1982. An important topic for future research is to get a deeper understanding of the increase in foreign debt in 1986 recorded in the data.

There is one item that I have left out of the accounting: the deficit due to financial intermediation of the development banks. The size of this deficit has been pointed out in the past as a force that deteriorated public finances in 1994, in particular. Gil-Diaz and Carstens (1996) reject this idea. The deficit is due to the interest rate differential between the interest rate at which these banks obtain resources and the interest rate at which they lend. Figure 27 shows the behavior of the financial intermediation deficit of development banks. The existing data start in 1990; therefore, I cannot redo the accounting for the entire sample. A positive value represents a deficit.



Source: Author's calculations with data from Banco de México and INEGI.

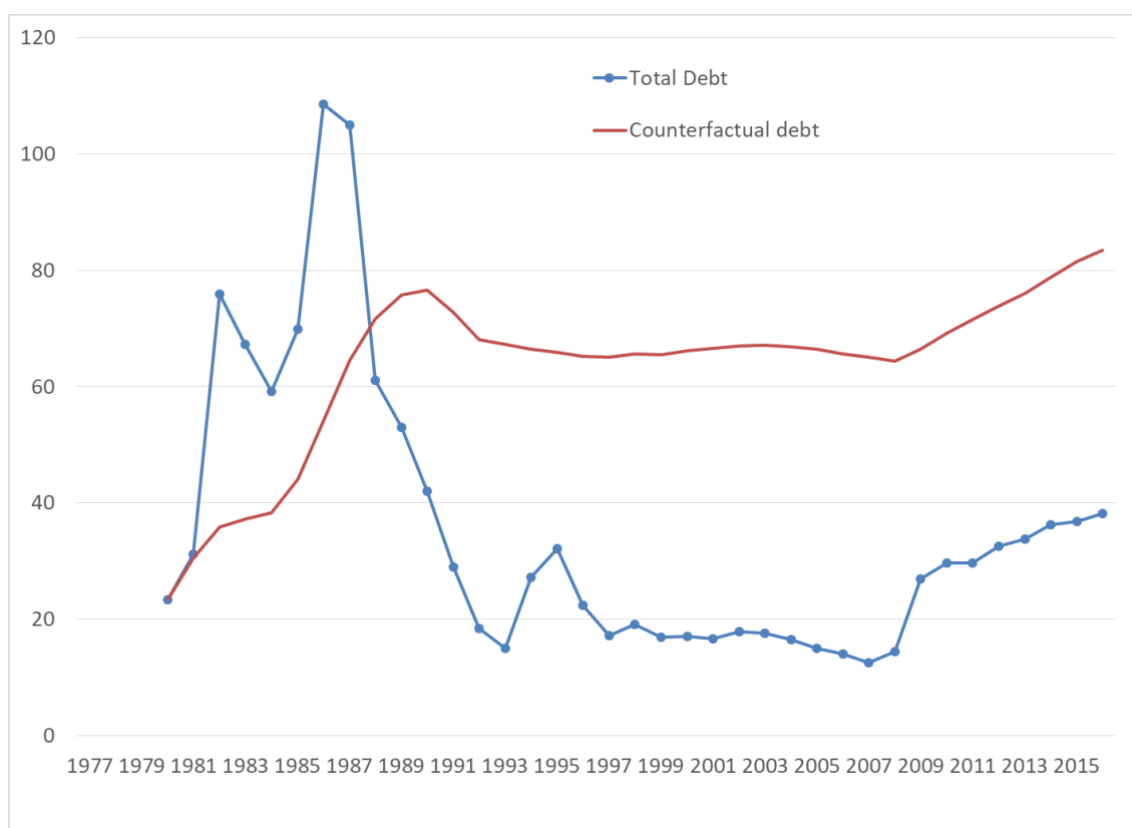
Figure 27. Financial Intermediation Deficit of Development Banks, % of GDP

This deficit reached a maximum of 3.2% of GDP in 1994. It became a surplus in the aftermath of the 1994 crisis. During the governments of Fox and Calderón, 2000-2006 and 2006-2012, respectively, the choice was to reduce the importance of these banks. The deficit shows values fluctuating around zero in those years. In the government of Peña Nieto starting in 2012 development banks were once again seen as a tool for policy. Correspondingly, the deficit shows a small trend upward.

I recalculated the transfer implicit in the budget constraint taking into account this deficit. Compared to Figure 25 there was no important change in the transfer. The exception is 1994. Taking into account the financial intermediation deficit reduces the size of the residual transfer (i.e., the size of the “black box”) I calculated.

To finish this section, I plot the debt sequence implied by the model if the implicit transfer had been zero every period. The goal of Figure 28 is to show, counterfactually, how debt would have evolved had this transfer been null. The initial value of this counterfactual

debt and the observed one are the same. In the subsequent periods debt fluctuates according to the budget constraint with the transfer equal to zero.



Source: Author's calculations with data from Banco de México and INEGI.

Figure 28. Total Debt and Counterfactual Debt, % of GDP

In 1982 the Mexican government devalued repeatedly, which as I have said before, led to an increase in the burden of foreign debt. The counterfactual debt, by annulling the transfer previously calculated that was linked precisely to the real exchange rate, grows more slowly. As mentioned earlier, in the following years the main source of variation in the residual is changes in the real amount of foreign debt. The counterfactual debt ignores the large increase in foreign debt in 1986. Therefore, the counterfactual series does not have a spike in that year. The following main event is a decrease in the real amount of debt in 1988. The counterfactual series does not include that event, which leads to this variable to stay relatively constant instead of falling. Finally, the counterfactual series ignores the spike in real foreign debt in 1994. As a consequence, it remains flat.

8 Conclusions

I find that the 1982 debt crisis can be accounted for with the model. In the theory and in the data a higher primary deficit leads to growth in debt that reaches a limit. At that point, under fiscal dominance, the Central Bank adjusts its policy to satisfy public finances. In the data this led to higher inflation.

On the other hand, the model cannot account for the 1994 crisis. Mexico had a primary surplus and the debt-to-GDP ratio was falling. I discussed whether there is evidence in favor of a crisis generated by a prospective bank bailout, or in favor of a self-fulfilling crisis created by the banking system's vulnerabilities. There are data that support those complementary hypotheses.

Another important finding is that there is evidence that the constitutional change of 1993, granting a goal and independence to the Central Bank, was actually a change from fiscal dominance to an independent Central Bank. Fiscal policy in 1995 was procyclical. The Banco de México had as its main goal a rapid control of inflation. There was no persistent high level of inflation in the late 1990s, as happened throughout the 1980s after the debt crisis.

The benchmark data consolidating the public sector and the Banco de México showed three facts. First, there is a decline in the foreign debt ratio since the mid-1980s. Second, there is a fall in the domestic debt ratio until 1994, and then the trend changes. Third, after many years of reductions, total debt starts to increase in 2008-2009.

When looking at alternative series of debt I find that the first fact is sensitive. This happens because the benchmark series of foreign debt takes into account international reserve accumulation, which is a powerful force that pushes this debt downward. However, when I looked at measures of debt that exclude this force, foreign debt increases toward the end of the sample.

The change in the mix of debt from foreign to domestic reduced the volatility of total debt. The total debt ratio is very stable after 1995. In the period 1995-2007 there were

several large events abroad, such as the crises in Asia in 1997 and Russia in 1998, and the dot-com crash of 2000. But those crises do not seem to affect the volatility of Mexico's foreign and total debt ratios. Another factor in this reduction in volatility is the adoption of a flexible exchange rate regime.

To conclude, I comment on the current and future outlook of the Mexican economy. I analyzed data up to the end of 2016. The statistics I analyzed showed an increase in the debt-to-GDP ratio. My main data throughout the paper was from the Banco de México, which I used because the sample is the longest, starting in 1980. In the Appendix I compare those series with data from the SHCP, the Saldo Histórico de los Requerimientos Financieros del Sector Público (SHRFSP), or Historic Balance of the Financing Needs of the Public Sector. That series does not consolidate data of the Banco de México and of the SHCP. Its main drawback is that it starts in the 1990s. On the positive side, it includes some items that the Banco de México data exclude. The SHRFSP is the debt series that gets most media and analyst attention in Mexico.

Economists recently pointed to an upward trend in the ratio of SHRFSP to GDP. In 2016 the SHCP received the mandate of achieving a primary surplus in 2017 to reduce debt. The SHRFSP reached a historical maximum of 46% of GDP. In 2017 the value fell to 44%. In my opinion this was extremely relevant. It has taken Mexico many decades to achieve macroeconomic stability. Policies aimed at keeping public finances in check are necessary to have low inflation. And perhaps more importantly, macro stability is necessary to pursue other policy goals, such as growth, poverty reduction, and redistribution.

To give an example, the lack of sustained per capita growth has been linked in previous research to the lack of credit, as in Kehoe and Meza (2011). In the Seminario de Perspectivas Económicas 2017 that took place at the Instituto Tecnológico Autónomo de México, Luis Robles, the president of the Bankers Association, talked about the recent growth in the private credit-to-GDP ratio, after years, actually decades, of stagnation (except briefly before the 1994 crisis). His statement was that this growth was possible because of the large progress in macro stability, and he insisted on the need to preserve it. My conclusion is that sound public finances and an independent Central Bank are important, necessary for other crucial goals, and should be sustained.

The main challenges the Mexican economy faces in mid-2018 are the following: first, achieve a reduction and long-term stabilization of the SHRFSP. In 2009 Mexico carried out a countercyclical fiscal policy for the first time in modern history. Financial markets did not react negatively, as the EMBI spread for Mexico did not show an increase compared with similar countries. Mexico must reduce the debt ratio to be able to keep fiscal policy as a countercyclical tool.

Second, analyze the impact of the December 2017 corporate tax reform in the US and propose possible policy responses. A superficial look at the current account-to-GDP ratio does not show a large outflow of capital. Research is needed to decompose changes in the current account into the effects of the fiscal reform in the US, and of other forces. Until June 2018 there had been no clear policy response from the Mexican government.

Third, successfully conclude the renegotiation of NAFTA and analyze the impact of any changes, or of a breakup. In June 2018 the prospects of a successful renegotiation that would modernize this treaty and benefit all its members are bleak. President Donald Trump basically declared a trade war against China, and against US Western allies, including Mexico. Specifically, Trump put tariffs on Mexican steel. Mexico retaliated by putting tariffs on American steel, pork, some fruits, and some cheeses. The probability of a breakup of NAFTA is at an all-time high.

Fourth, take inflation back to the Banco de México range after the large spike at the end of 2017. On this point there has been success, as inflation is declining. The Banco de México has increased interest rates to achieve that goal.

Fifth, consider the results of the Mexican presidential election. In July 2018 Andrés Manuel López Obrador was elected president of Mexico by a large margin. I analyzed his proposals in Meza, Sánchez Tello, and Zamarripa (2018). López Obrador said in a letter to a financial newspaper that he wants to raise revenue equal to 4.6 percentage points of the 2017 (1 trillion pesos) GDP by “fighting corruption.” There is no empirical support for this figure. His economic team plans to save 2 percentage points of GDP out of current government expenditure by reducing inefficiencies in spending and by fighting corruption. I have concerns about the feasibility of that goal. In terms of spending, López

Obrador wants to increase a federal transfer to the elderly; create a program to keep students in schools and provide more access to jobs; increase government investment; keep the price of gasoline fixed in real terms, which would likely lead to a subsidy; offer a subsidy to certain small-plot farmers; and build one or two oil refineries to make Mexico self-sufficient in gasoline. I expect the net effect of these policies to be an increase in the primary deficit and an increase in the debt-to-GDP ratio. Mexico has a small margin regarding an expansion of debt, as international interest rates are rising. A deterioration of public finances would lead to markets demanding a higher premium on sovereign debt. This is worrisome. From my point of view the next government of Mexico should have a bias toward a conservative fiscal stance, at least temporarily. On the monetary side, Central Bank independence has to be respected, which López Obrador and this team have insisted they would. The bias on monetary policy should be toward bringing down and keeping inflation within the target range of the Central Bank for sustained periods.

Macroeconomic stability became an asset of the Mexican economy post-1994, as the evidence in this text shows. Future policymakers should sustain it.

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10. Appendix

10.1 The model

The Treasury's budget constraint, expressed in pesos, says that the primary deficit plus transfers plus interest payments can be financed by issuing more debt and with receipts from the Central Bank, RCB_t :

$$B_{Gt} + b_{Gt}^* E_t + RCB_t = (D_t + T)P_t + B_{Gt-1}R_{t-1} + b_{Gt-1}^* r_{t-1}^* E_t$$

where

B_{Gt} is the stock of debt in pesos issued in period t

b_{Gt}^* is the stock of dollar-denominated debt

E_t is the nominal exchange rate

D_t is the primary deficit, in real terms

T_t includes all transfers, in real terms; this term represents for example transfers that might occur in times of crisis.

R_{t-1} is the gross nominal interest rate on debt in pesos issued in $t-1$

r_{t-1}^* is the gross dollar interest rate on debt in dollars.

P_t is the price level in pesos.

I exclude debt indexed to inflation from the model because my main data do not report it separately.

The primary deficit, measured in real terms, is defined as

$$D_t = G_t - NOR_t - OR_t$$

where

G_t is government expenditures

NOR_t is non-oil revenue

OR_t is oil revenue.

I assume for simplicity that oil revenue comes from oil sales in the international market.³⁹

Therefore

$$OR_t = \frac{P_t^* O_t E_t}{P_t}$$

where

P_t^* is the international price, in dollars, of oil

O_t is the quantity of oil sold.

The Central Bank budget constraint, expressed in pesos, says that the RCB_t and purchases of government debt can be financed with the interest payments received and with an increase of the monetary base

$$M_t - M_{t-1} + B_{Bt-1} R_{t-1} + b_{Bt-1}^* r_{t-1}^* E_t + IR_{t-1} r_{Rt-1}^* E_t = RCB_t + B_{Bt} + b_{Bt}^* E_t + IR_t E_t$$

where

M_t is the monetary base

IR_t stands for international reserves

r_{Rt-1}^* is the gross dollar interest rate on international reserves.

The consolidated government (CG) budget constraint is

$$B_t + M_t + (b_t^* - IR_t) E_t = (D_t + T_t) P_t + B_{t-1} R_{t-1} + M_{t-1} + E_t (b_{t-1}^* r_{t-1}^* - IR_{t-1} r_{Rt-1}^*).$$

This equation takes into account that international reserves are an asset for the CG. International reserves receive a gross interest rate r_{Rt-1}^* different than the one that the Treasury pays on foreign debt r_{t-1}^* . The equation says that the primary deficit plus transfers plus interest payments to the public can be financed with more debt and with an increase in the monetary base.

³⁹ In reality things are obviously more complex. Historically the taxation of PEMEX has many details.

The previous equation can be written in terms of debt-to-GDP ratios. Dividing by nominal GDP, the budget constraint is

$$\theta_t^N + \theta_t^* + (m_t - m_{t-1}) + m_{t-1} \left(1 - \frac{1}{g_t \pi_t} \right) = d_t + \theta_{t-1}^N \frac{R_{t-1}}{g_t \pi_t} + \frac{E_t(b_{t-1}^* r_{t-1}^* - IR_{t-1} r_{Rt-1})}{P_t y_t}$$

where

θ_t^N is the nominal debt-to-GDP ratio

θ_t^* is foreign debt net of international reserves, relative to GDP

m_t is the monetary base relative to GDP

g_t is the growth factor of real GDP

π_t is the growth factor of the GDP deflator

d_t is the primary deficit plus transfers, relative to GDP.

The first term in parenthesis on the left-hand side is the change in the monetary base ratio. The subsequent term is the inflationary tax. The sum of these two terms is seigniorage. On the right-hand side the second term represents gross interest payments on nominal debt. The subsequent term represents gross interest payments on foreign debt net of gross interest received on international reserves. One important comment on notation: the symbol θ_t^* represents net foreign debt relative to GDP. I could have used an alternative notation to split the foreign debt-to-GDP ratio into real foreign debt relative to real domestic output, and the real exchange rate. I prefer to write the budget constraint without using explicitly the real exchange rate, as the available data are an index, and the base year would affect the magnitude of the variable.

To separate the role of oil revenue, I substitute the definition of the primary deficit into the previous two equations:

$$B_t + M_t + (b_t^* - IR_t)E_t = (G_t - NOR_t - OR_t + T_t)P_t + B_{t-1}R_{t-1} + M_{t-1} + E_t(b_{t-1}^* r_{t-1}^* - IR_{t-1} r_{Rt-1}^*).$$

and

$$\theta_t^N + \theta_t^* + (m_t - m_{t-1}) + m_{t-1} \left(1 - \frac{1}{g_t \pi_t} \right) + or_t = dEOR_t + \theta_{t-1}^N \frac{R_{t-1}}{g_t \pi_t} + \frac{E_t(b_{t-1}^* r_{t-1}^* - IR_{t-1} r_{Rt-1})}{P_t y_t}$$

where

$dEOR_t$ is the primary deficit excluding oil revenue, relative to GDP

or_t is oil revenue relative to GDP, that is,

$$or_t = \frac{OR_t P_t}{P_t y_t} = \frac{P_t^* O_t E_t}{P_t y_t}.$$

These equations are straightforward. A higher primary deficit $dEOR_t$ or higher interest payments can be financed with oil-related revenue. Oil revenue relative to GDP increases when the international oil price is higher. It goes up when the peso loses value, as each dollar sold abroad could then buy more pesos.

10.2 The data

1960-1979

I use data from several sources, including the SHCP and the Instituto Nacional de Estadística y Geografía (INEGI), the national statistics institute. The debt data do not consolidate the public sector with the Banco de México. I did a calculation by hand of dollar-denominated debt net of international assets of the Central Bank.⁴⁰ Given the heterogeneity in sources and characteristics of the data, when constructing the dataset I specified whether each variable refers to the federal government or to the public sector.

Here are some important points regarding data in this period. Debt data sources do not indicate whether data are at face value or market value. It is most likely debt at face value. I keep track of two types of debt, domestic and foreign. Data sources do not include debt indexed to inflation, as there was none in this period. For some variables I could add more observations. But the data for a crucial variable, domestic debt ends in 1979. I decided to use that year for the end of this sample.

1977-2016

The main source is Banco de Mexico. It reports debt and primary deficit statistics for the public sector. I first describe the debt data, and second, I talk about primary deficit data.

Importantly, Banco de México consolidates the debt of the public sector with its own assets and liabilities, as I did above in the model, reporting consolidated debt. The name of these data is Deuda Neta Consolidada con Banco de México (DNCBM), meaning “net debt consolidated with Banco de México.”

Important points regarding DNCBM are the following. Banco de México reports domestic and foreign debt (*interna* and *externa*, respectively, in Spanish). External debt

⁴⁰ The data for international reserves in the Banco de México webpage start in 1985. For historical data the source is *Estadísticas Históricas* of INEGI. That source reports data for *Activos Internacionales*, not *Reservas Internacionales*. The printed publication *Indicadores Económicos* of Banco de México also reports data on *Activos Internacionales*. This is why I use the word “assets,” not “reserves.”

is net of the international reserves of Banco de México. The data have a drawback. The DNCBM measures debt at market value.⁴¹ It would be better to do it at face value, because then I would be measuring the “burden” of the debt, i.e., the amount that the government promised to pay. I do not use in the analysis debt indexed to inflation. The raw data do not present it separately. In the 1980s there were Ajustabonos, and after 1995 there are Udibonos. Both are included in domestic debt. Tesobonos, the debt that grew significantly during 1994 and was denominated in dollars and paid in pesos, is included in domestic debt.

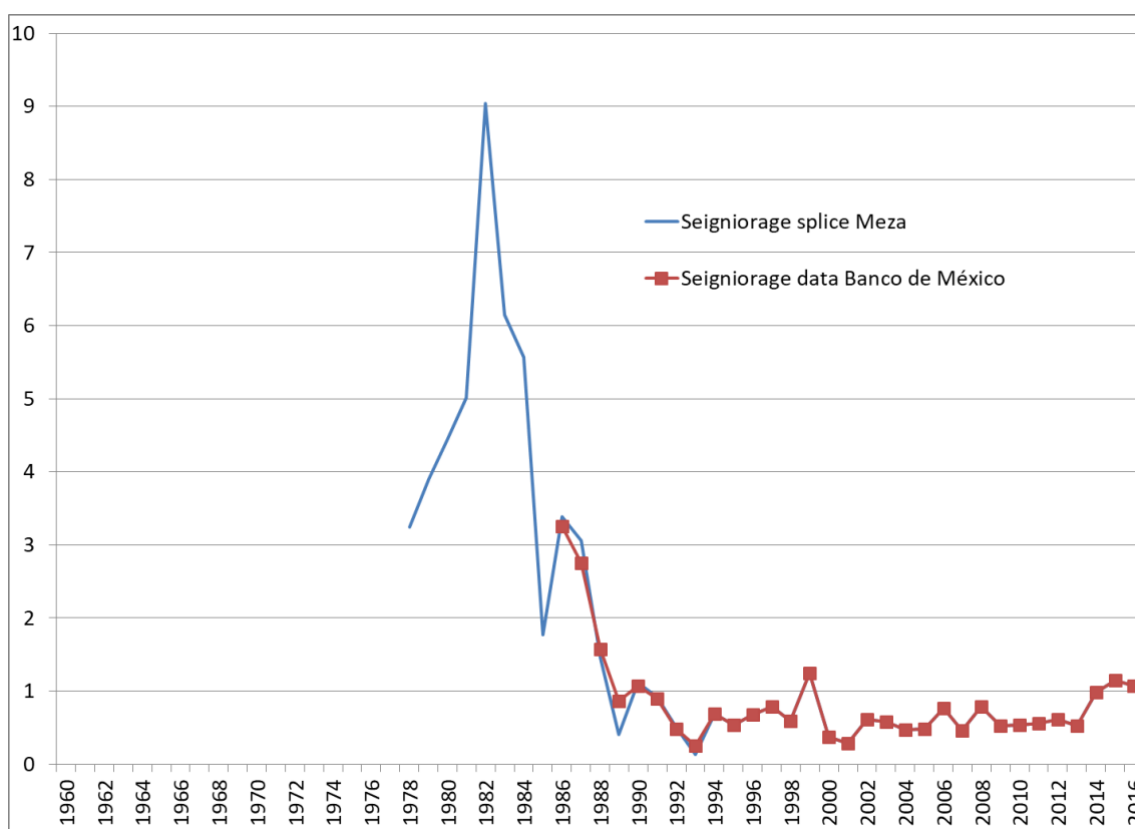
Another possible source of data on debt for a broad definition of the government is a series computed by the SHCP. The series is called *SalDOS HistóRICOS de los Requerimientos Financieros del Sector Público* (SHRFSP), or Historic Balance of the Financing Needs of the Public Sector. The main drawback of that series is that it starts in the 1990s. In Appendix 10.5 I compare the DNCBM with the SHRFSP in terms of what components of the government are included in each one.

In the case of the primary deficit, Banco de México reports it for the public sector, as defined above. It includes revenue from the privatizations of the national phone company, TELMEX, and of banks in the early 1990s. These banks were private until 1982, when they were nationalized after the debt crisis.

⁴¹ This is done whenever possible.

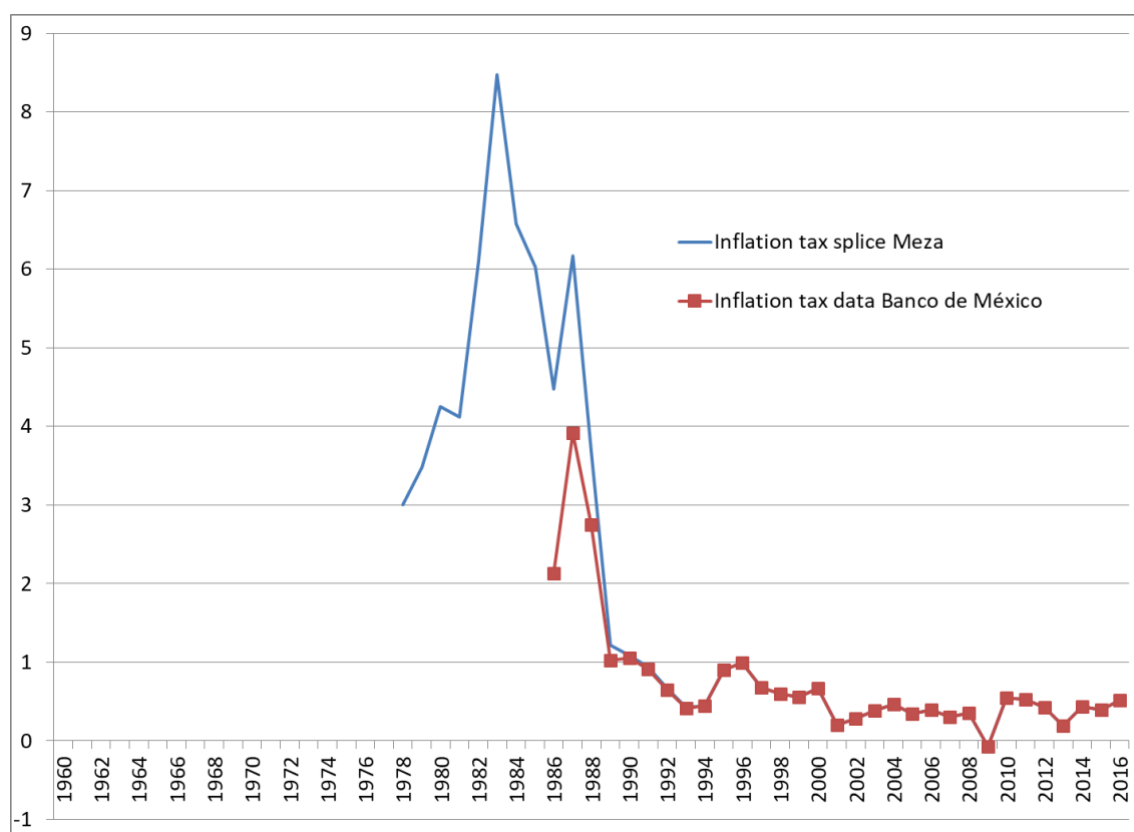
10.3 Construction of the Monetary base historical series

For 1960-1992 I used the *Estadísticas Históricas*, version 2014, of INEGI. For 1993-2016 I used data from the Banco de México. The INEGI series goes from 1960 to 1996. The Banco de México series starts in 1985 because there were changes in the measurement methodology. The samples overlap. They show different levels, with the INEGI series being above Banco de México during the period 1985-1988. Starting in 1989 they have similar values, with a small difference. In 1993 they become identical. I compared the values of seigniorage and of the inflation tax of each series separately. The conclusion is that seigniorage is very similar independently of using one series or another. On the other hand, the inflation tax shows a significant difference. The components of seigniorage, i.e., the change in the demand for real monetary base and the inflation tax, change depending on the series used, at the same time as there is practically no change in its total value.



Source: Author's calculations with data from Banco de México and INEGI

Figure 10.3.1. Seigniorage in % of GDP, Computed with Spliced Data, and Computed with Raw Data from Banco de México



Source: Author's calculations with data from Banco de México and INEGI.

Figure 10.3.2. Inflationary Tax in % of GDP, Computed with Spliced Data, and
Computed with Raw Data from Banco de México

10.4 Previous studies of the 1994 crisis

The 1994 crisis led to a large amount of research on its origin. Table 10.4.1 summarizes some of the papers written in relation to this crisis. The list is not by any means exhaustive. I focused mainly on papers written by top-level ex-policymakers. This is the case of the papers by Gil-Díaz and Carstens (1996), Gil-Díaz (1998), and Serra Puche (2011). Francisco Gil-Díaz and Agustín Carstens worked at the Banco de México. Gil-Díaz was subgobernador of the Banco de México between 1994 and 1997, and secretary of the Treasury during 2000-2006. Carstens was secretary of the Treasury during 2006-2009, and governor of the Banco de México during 2010-2017. Jaime Serra was secretary of Trade during the Salinas administration and was the leading negotiator of NAFTA. He was secretary of the Treasury at the beginning of the 1994-2000 administration of President Ernesto Zedillo. I add to this list one of the first papers evaluating the origin of the crisis, Kehoe (1995). I also include the analysis of Cárdenas (2015).

To summarize the information, in Table 10.4.1 the rows represent factors explaining the 1994 crisis. I marked with symbol *** the factors for which there is consensus in the sense that all authors mention the factor as key.

A first result is that there is consensus that two factors were key: the exchange rate regime and. the political shocks.

	Kehoe (1995)	Gil-Díaz and Carstens (1996)	Gil-Díaz (1998)	Serra Puche (2011)	Cárdenas (2015)
Exchange rate regime***	Was a factor	Was a factor	Was a factor	Was a factor	Was a factor
Debt, short term/indexed to Exchange rate (Tesobonos)	Was a factor	Not a factor	Was a factor	Was a factor	Was a factor
Political shocks***	Was a factor	Was a factor	Was a factor	Was a factor	Was a factor
Banking and financial liberalization, and expectations of good performance	Not mentioned	Was a factor	Was a factor	Was a factor	Was a factor
High US interest rates	Was a factor	Not mentioned	Was a factor	Was a factor	Not mentioned
Reluctance to respond to crisis	Was a factor	Not mentioned	Not mentioned	Was a factor	Was a factor

Note: The symbol *** means consensus across papers that the factor was key.

Source: Papers cited.

Table 10.4.1. Papers on Origin of 1994 Crisis, Main Factors

Even though there is consensus that the exchange rate regime was key, the reasons behind its importance vary across authors. As mentioned earlier, the exchange rate regime was a predetermined band in which the peso per dollar exchange rate was allowed to fluctuate. The upper bound of the band grew at a known rate. Kehoe (1995), Serra Puche (2011), and Cárdenas (2015) argue that policymakers put a lot of weight on using the exchange rate as a nominal anchor to reduce inflation. A devaluation of the peso, say in mid-1994,

would have caused not only higher inflation but also a loss of credibility. Therefore, policymakers were reluctant to devalue the peso in the months after the murder of Luis Donaldo Colosio. Gil-Díaz and Carstens (1996) put emphasis on the fact that there had been a transformation of international financial markets since the beginning of the 1990s, as capital flows grew and moved rapidly in and out of markets. This transformation made economies more vulnerable to changes in international portfolios. Additionally, they mention that even developed countries were not exempt from speculative attacks on currencies, as shown by the 1992 events in Europe in which many countries had to devalue.

There is also consensus that political shocks were crucial. The most important one was the murder of presidential candidate Luis Donaldo Colosio. Figure 10.4.1 shows the path of international reserves of the Central Bank during 1994. At the beginning of 1994 the Banco de México had a historically large amount of reserves, above \$25 billion. Today it does not sound like a large quantity, but it was then. After the murder of Colosio in late March, reserves fell dramatically to approximately \$17 billion in April. Then reserves stabilized throughout most of the year. In the final months of 1994 political events may have also had an impact. Gil-Díaz and Carstens (1996) mention reports on renewed activity by the Zapatista movement in early December, later found to be exaggerated, which had a negative effect on the peso.

Let me discuss briefly the contribution of other factors to the 1994 crisis. Figure 10.4.1 shows the growth of a particular kind of debt, the Tesobonos, which had a face value in dollars but were payable in pesos according to the current exchange rate. Kehoe (1995), Serra Puche (2011), and Cárdenas (2015) stress that this growth made the economy more vulnerable. Investors realized that a devaluation of the peso would instantly multiply the burden of this kind of debt, assuming the government paid. Another possibility was some kind of default, as Kehoe (1995) and Serra Puche (2011) mention. From my point of view, the benefit of issuing Tesobonos was to offer investors an asset protected against devaluations, thus guaranteeing the flow of funds to the government. The cost was precisely that in the event of devaluation, investors would worry about payment, thus exchanging pesos for dollars and reallocating funds abroad. Gil-Díaz (1998) points to the issuance of Tesobonos as one source of the growth in the indebtedness of the Mexican economy during 1994 that contributed to the crisis.

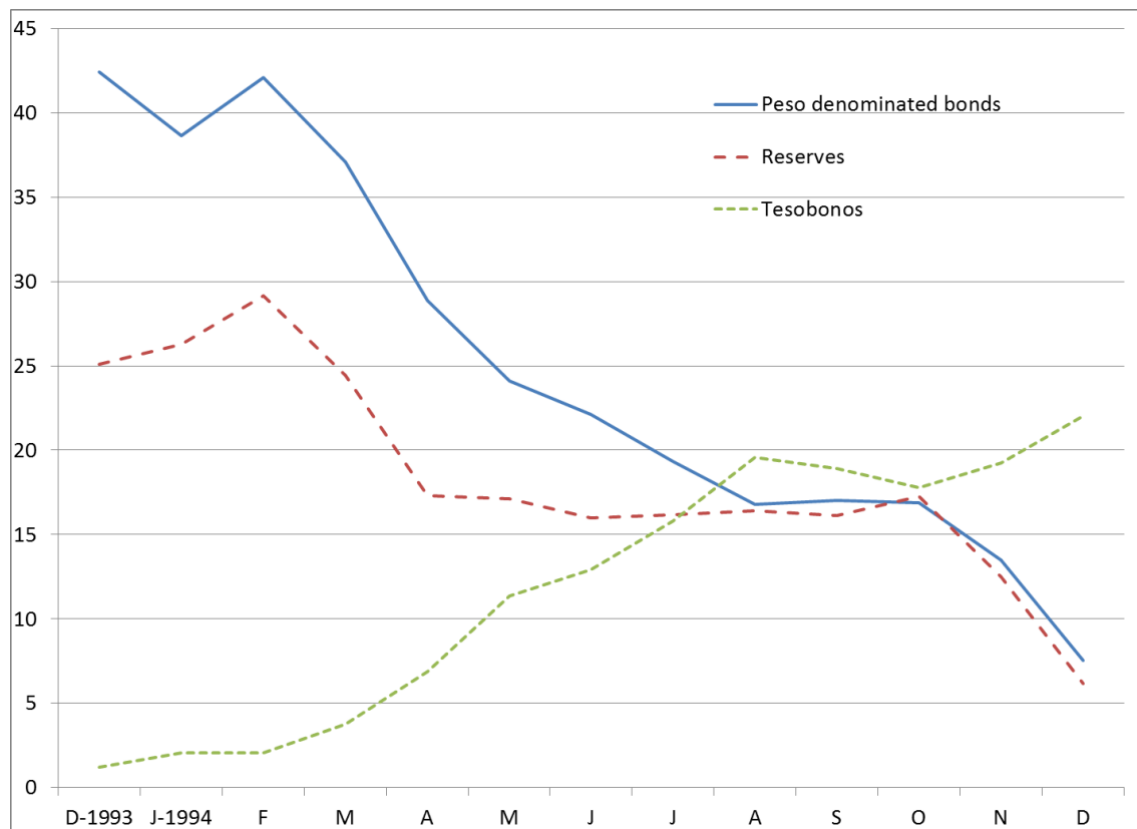
Serra Puche (2011) includes an atmosphere of financial euphoria, a disconnect between expectations and the state of the economy, as a contributor to this crisis. Gil-Díaz (1998) and Cárdenas (2015) emphasize the banking and financial liberalization of the early 1990s in Mexico as a crucial factor generating the 1994 events. They both argue that the privatization of banks that took place in 1991 was flawed. The opening of the economy to trade in goods and assets created a large inflow of foreign capital that was channeled through the banking sector to households and firms. The growth in lending was massive, with the bank credit-to-GDP ratio reaching levels not seen since the 1970s. Kehoe and Meza (2011) report that ratio. Regulators could not keep up with the growth in loans and were unable to monitor the risk features of the loan portfolios. Notice that there was a currency mismatch, as Mexican banks had liabilities in dollars and assets in pesos. This made banks very vulnerable to a devaluation.

Kehoe (1995), Gil-Díaz (1998), and Serra Puche (2011) point to a simple, but in my opinion, powerful force that contributed to the crisis: the increase in interest rates in the US during 1994. Figure 16 in the main text shows the absolute change in the US three-month Treasury bill rate, comparing the value in each month of 1994 with the same month in 1993. The change is positive and increasing. This means that during 1993 the interest rate was basically flat, and that it grew almost continuously during 1994. The interest rate in December 1994 was 250 basis points above its December 1993 level. The increment is large. Obviously the fact that when interest rates increase in the US that represents a larger opportunity cost of investing in Mexico. The opportunity cost became higher during 1994, putting pressure on the peso.

The final factor was reluctance to respond to the ongoing worsening of the financial situation. Kehoe (1995), Serra Puche (2011), and Cárdenas (2015) argue that the exchange rate regime could have been adjusted at a time when the Banco de México had a relatively large amount of reserves. This hypothetical adjustment would have taken place in the months that followed the death of Luis Donaldo Colosio. As mentioned earlier, reserves had stabilized by April 1994. In fact this point is closely related to the previous discussion on the contribution of the fixed exchange rate regime. One of the government's most important goals was the reduction of inflation. The Salinas administration had been successful achieving an inflation of 10% per year at the

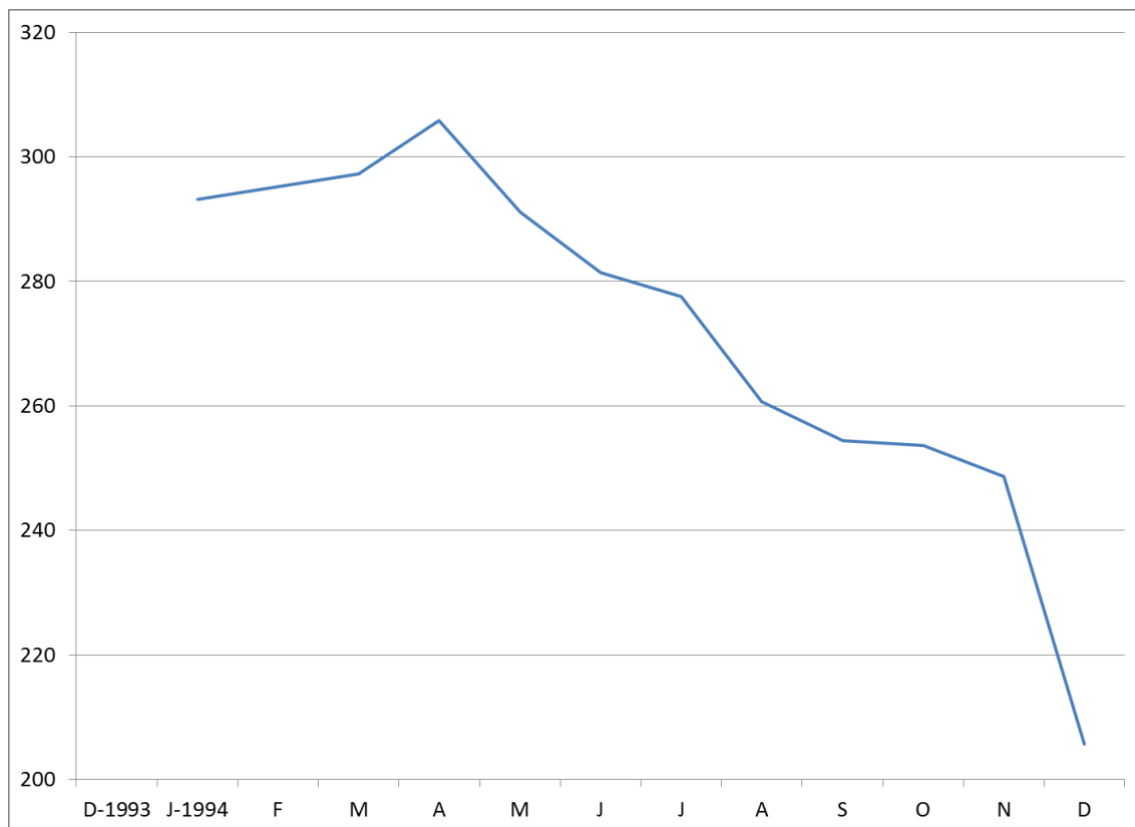
beginning of 1994. The government had set the goal of low inflation as part of the Pactos mentioned before. It would have lost credibility facing powerful union and business leaders. Therefore the government did not devalue in mid-1994 because the subsequent inflation would have undermined its bargaining power, and the goal of controlling inflation would have been postponed.

Given that the workhorse model cannot account for the crisis, I discuss one alternative hypothesis: the characteristics of the Tesobono debt. This debt grew rapidly during 1994, having two consequences, as Cole and Kehoe (1996) point out. First, it increased the ratio of dollar-indexed debt to international reserves. Second, it reduced the average maturity of government debt. The first point can be seen in Figure 10.4.1, which I took from Cole and Kehoe (1996). By August 1994 the Tesobono debt was larger than international reserves: \$20 billion versus \$16 billion, respectively. The figure also shows how the Mexican government carried out a substitution of peso-denominated debt (CETEs, Bondes and Ajustabonos) to dollar-indexed Tesobonos. The second point appears in Figure 10.4.2, also taken from Cole and Kehoe (1996). Through 1994 there is a large decline in the average maturity of Mexican government bonds from approximately 300 days in January 1994 to 200 days in December of that year. Therefore the need to go to the market to sell new debt became more frequent. Cole and Kehoe (1996) also report the yield of Tesobonos during December 1994 and January 1995. There is a large increase from 8.39% on December 6, 1994, to 24.98% on January 31, 1995. The interpretation is that there was an increase in the probability of default perceived by investors.



Source: Constructed with data in Cole and Kehoe (1996).

Figure 10.4.1. International Reserves and Government Bonds, in Billions of US Dollars



Source: Constructed with data from Cole and Kehoe (1996).

Figure 10.4.2. Average Maturity of Government Bonds, in Days

In the main text I discussed that the benchmark model cannot explain this crisis. I consider another model. Cole and Kehoe (1994) construct a model of self-fulfilling crises. This is a quantitative model designed to produce predictions that can be compared directly to data. An outcome of the model is a crisis zone for values of government debt that depends on the maturity of debt. A shorter maturity implies the crisis zone is larger, including low levels of debt. If the level of debt is in that interval, the government finds it optimal to repay if it can sell new debt. If the government cannot sell new debt it is optimal not to repay. If the debt level is in the interval, a crisis may or may not occur, depending on the realization of a random variable, called a sunspot.

The interpretation of the facts at the end of 1994, seen through the lens of the Cole-Kehoe model, is the following. Mexico had a low level of debt. At the same time, it had reduced its maturity. This reduction may have increased the zone for values of the debt in which a self-fulfilling crisis could take place. The work of Cole and Kehoe (1991) shows that Mexico was in the crisis zone in 1994.

However, that does not imply that a crisis had to occur necessarily. In the model the fact that default takes place depends also on the realization of a random variable, which is not directly observable in the real world. We have a theory that helps us analyze the effects of a fundamental, shorter maturity of Mexican debt during 1994, but it does not go as far as determining why the 1994 crisis took place.

Toward the end of December 1994 Mexico abandoned its exchange rate regime and let the peso float. The financial situation of the government was dire. At the same time, it is important to say that the Mexican government did not default. A factor in how events developed during 1995 was the financial aid program, a credit line, led by the US and the International Monetary Fund (IMF). Mexico received \$50 billion. Out of that amount, \$20 billion came from the US under the presidency of Bill Clinton. The remaining funds came from the IMF, the World Bank, the Bank for International Settlements, and other institutions.

10.5. Facts on debt dynamics and a comparison of alternative measures of debt

I highlight three facts on debt dynamics from the main analysis. There is a decline in the foreign debt ratio since the mid-1980s. There is a fall in the domestic debt ratio until 1994, and then the trend changes. After many years of reductions, total debt starts to increase in 2008.

The goal of this section is to verify if these dynamics are similar when looking at alternative measures of debt. Both the Banco de México and the SHCP calculate statistics on debt issued by a broad definition of the government. The SHCP calculates the *Saldo Histórico de los Requerimientos Financieros del Sector Público* (SHRFSP). This measurement includes the federal government, plus several firms and institutions that are part of the public sector. Banco de México calculates two statistics. One is the *Deuda Económica Amplia* (DEA), which is similar to the SHRFSP in the sense that it takes into account a large definition of the government. The second is the DNCBM, which is the one I have been using as raw data.

A difference in coverage between the SHRFSP and the DEA is that the second one excludes *Organismos y empresas del Sector Público*. This is a set of heterogeneous institutions. One example is the social security institute, IMSS, which I mentioned in Table 1. Another example is Mexico's postal service (*Servicio Postal Mexicano*), which would be inside group B.2 in Table 1.

A second difference in coverage is that the SHRFSP includes the following set of items: Pidiregas, FARAC (FONADIN), *Programa de Apoyo a Deudores*, and IPAB.⁴² FARAC refers to a rescue program of privately built highways. *Programa de Apoyo a Deudores* and IPAB refer to the rescue programs of debtors and banks after the 1994 crisis.

The DNCBM is the same as the DEA, plus it takes into account assets and liabilities of the Central Bank.

⁴² I have already mentioned Pidiregas. PEMEX and CFE used this instrument, in which the private sector carried out an infrastructure project and would be paid to after its completion. Liabilities on the side of PEMEX or CFE were registered only after completion of the project.

Table 10.5.1 below gives more detail on coverage for each measure of debt. The SHRFSP includes more components of government compared to the DEA and the DNCBM. That is one advantage for the analysis of the fiscal and debt situation of the government.

I worked with the DNCBM in the main text for two reasons. The first one is that such data series starts in 1980; whereas, the SHRFSP starts later, in the 1990s. The Banco de México provides two time series for the SHRFSP. One is a yearly ratio of SHRFSP to GDP starting in 1994. Another is a quarterly time series of the level of the SHRFSP starting in the last quarter of 2000. The second reason I choose the DNCBM is that it consolidates the fiscal branch of the government with the Central Bank, as in the model.

There are other dimensions in which the statistics compiled by the SHCP and the Banco de México differ. One is whether debt is valued at face or market value. Each kind of measurement provides different information. Debt at face value is an indicator of the burden of the debt, as it is the amount that the government promised to pay. Debt at market value takes into account the willingness of financial markets to buy government debt. For example, if markets have doubts about repayment, the price of debt will go down and this will reduce the value of debt.

One advantage of the statistics of the Banco de México is that they include long-term debt. I could not find more detail on this point. But it is of course desirable to include debt of all maturities when analyzing the indebtedness position of the government.

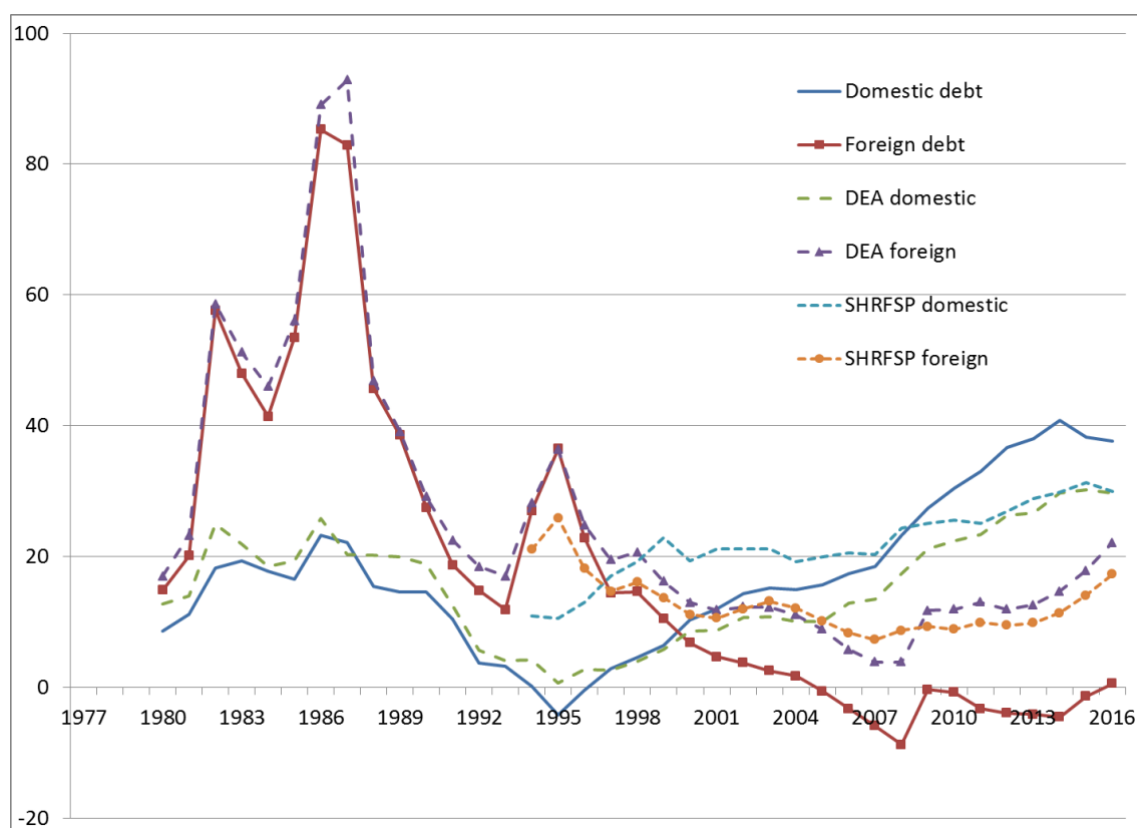
	SHRFSP	DEA	DNCBM
Includes:			
Gobierno Federal	Yes	Yes	Yes
Empresas productivas del estado (PEMEX, CFE)	Yes	Yes	Yes
Organismos y empresas del Sector Público	Yes	No	No
Banca de desarrollo	Yes	Yes	Yes
Fondos y fideicomisos de fomento	Yes	Yes	Yes
Pasivos Adicionales por Pidiregas, FARAC (FONADIN), Programa de Apoyo a Deudores, IPAB	Yes	No	No
Activos de Banco de México	No	No	Yes
Pasivos de Banco de México	No	No	Yes
Valuation:	Face value	Market value (if possible)	Market value (if possible)
Short or long term:	Short	Short and long	Short and long
Frequency:	Quarterly (level), yearly (% of GDP), as reported by Banco de México	Monthly	Monthly
Domestic and foreign:			
Domestic debt (<i>deuda interna</i>)	Yes	Yes	Yes
Foreign debt (<i>deuda externa</i>)	Yes	Yes	Yes

Table 10.5.1. Comparison of Measures of Net Debt of Broad Definition of Government

Figure 10.5.1 shows the evolution of different measures of debt split into domestic and foreign. “Domestic debt” and “Foreign debt” are the time series shown in Figure 9. Recall that those series consolidate the public sector with the Banco de México. “DEA domestic” and “DEA foreign” are the debt series described in Table 10.5.1, calculated by the Banco de México. These series represent a measure of public sector debt. “SHRFSP domestic” and “SHRFSP foreign” are series calculated by the SHCP, and represent a different measure of debt.

The first fact listed at the beginning of this section does not hold, given what happens towards the end of the sample. Compared to the benchmark series, both foreign DEA and foreign SHRFSP show an upward trend starting in 2010.

The second fact holds, as the three measures of domestic debt show an increase starting in 1995.



Source: Author's calculations with data from Banco de México and INEGI.

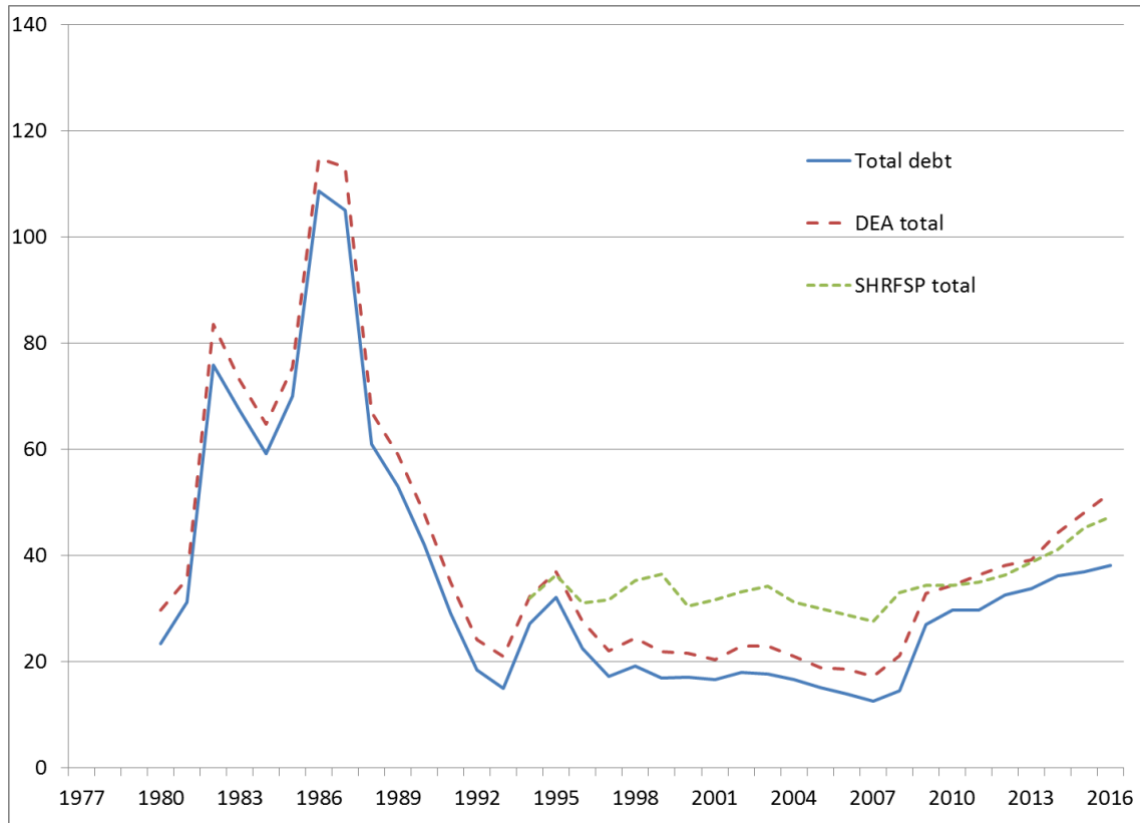
Figure 10.5.1. Measures of Foreign and Domestic Debt 1977-2016, % of GDP

Figure 10.5.2 shows the evolution of total debt. “Total debt” is the series I used in previous sections. “DEA total debt” is calculated by the Banco de México. “SHRFSP total debt” is calculated by the SHCP.

The third fact listed also holds. The three debt series show persistent increases starting in 2008.

An important observation is that the level of the SHRFSP is about 10 percentage points higher between 1995 and 2007. Table 10.5.1 shows that a source of this higher level is the fact that the SHRFSP includes additional items compared to the Banco de México data: the first one is *Organismos y empresas del Sector Público*, and the second one is the *Pasivos Adicionales*, or “Additional Liabilities” coming from Pidiregas, FARAC

(FONADIN), *Programa de Apoyo a Deudores*, and IPAB. Obviously, it would be interesting to get deeper into the data and find out which one of these items produces the difference in levels, as it is sizable. It is very likely that the main source of the difference is the expenditure on the rescue programs of debtors and banks after the 1994 crisis.



Source: Author's calculations with data from Banco de México and INEGI.

Figure 10.5.2. Measures of Total Debt 1977-2016, % of GDP