1. Introduction

This chapter investigates one aspect of the sustainability of fiscal policy in Mexico. It focuses on the response of fiscal policy to the business cycle, and, through the lens of simple Keynesian models, examines the role fiscal policy plays in determining output.\(^1\)

We look at these issues for a number of reasons. In the post World War II period fiscal policy, in industrial economies, has played the role of cyclical stabilizer. Fiscal policy has been designed to *lean against the wind*. That is, the structure of fiscal policy creates a stimulus to output when the economy moves into recession and is contractionary when an expansion broadens. This is usually accomplished in two ways. The first way is by having components in the budget that respond automatically to the business cycle, such as tax revenues (which respond positively) or unemployment benefits (an expenditure item that responds negatively). The second way is by using discretionary components in the budget to provide a stimulus during bad times. A fiscal policy designed in this way leads to a strongly procyclical budget balance.

Generally speaking, Mexico’s fiscal policy has not leaned against the wind. We will show that in the 1980–2003 period the budget balance has been quite strongly countercyclical, so that fiscal policy leans with the wind. The automatic stabilizers in place are weak, and are further weakened by the tendency of another automatic component of the budget, oil-based revenue, which responds sensitively to exogenous world oil prices, to move countercyclically.

\(^1\) This chapter builds on the results in Burnside (1999), which provided a similar analysis of fiscal policy in Mexico for the 1980-98 period.
Furthermore, the discretionary component of the budget surplus also tends to move countercyclically.

If fiscal policy simply did not matter, then whether or not it leaned with or against the wind would be of little consequence. However, in Mexico, as in many other countries, fiscal policy does matter. Our analysis suggests that an increase in the discretionary fiscal balance of 1 percent of GDP causes GDP to decline by 0.6 percent in the following year. Our analysis also suggests that when other contractionary shocks hit the economy, the fiscal policy response to these shocks is also contractionary.

The results imply that Mexico’s fiscal policy lacks a design that makes it a stabilizing feature of the economy. Furthermore, it has not been designed to render itself more sustainable. With procyclical fiscal policy (i.e., a countercyclical fiscal balance), debt accumulates during economic expansions, and when the economic expansion inevitably ends, this debt suddenly becomes costly to service. To finance it, the government must either take drastic discretionary fiscal measures, or it must finance the debt by borrowing at high real interest rates, or by printing money and inducing inflation. No matter which action the government takes, the implications are similar: a worsening of the economic downturn.

We begin the next section by looking at the data. The sample period studied here—1980 through mid-2003—spans several interesting episodes in Mexican economic history. Our choice of period was largely driven by the availability of data. Quarterly national accounts data for Mexico are available from 1980 onward, while monthly fiscal accounts are available from 1977 onward. We identify trends and cycles in national accounts measures of real GDP. Similarly, with GDP-based definitions of the business cycle in mind, this section describes the trends and cyclical fluctuations observed in various components of the public sector’s fiscal accounts.

Section 3 examines a preferred definition of the cyclically adjusted budget surplus for Mexico. The discussion is based on the concepts and methods introduced in Chapter 5.

Section 4 moves on to a more complex analysis of the data. Rather than working with simple indicators of the stance of fiscal policy, this section builds a simple vector autoregressive model of the Mexican economy that isolates several important features, namely: (i) the nature of the feedback rule that implicitly determines fiscal policy, including the effects of economic activity on the budget, (ii) the exogenous shocks to the budget and (iii) the short- and medium-run effects of these shocks on economic activity. The main purpose of
such a model is that the summary measures presented in Section 3 are typically useful in the context of a narrowly defined economic model. Furthermore, those summary measures are generally used to describe the effects of current policy on current activity. As such, given the lags with which fiscal policy is implemented and its effects are felt, the more forward-looking analysis of Section 4 is important.

2. Perspectives on Mexico’s Fiscal Accounts from 1980-2003

This section examines quarterly data on Mexico’s fiscal accounts from 1980 through mid-2003. While monthly budget data are available dating back to 1977, high-frequency data on GDP are only available from 1980 on. This section starts by defining the business cycle in Mexico with reference to quarterly data on real GDP from the national accounts. It then divides the fiscal accounts into their revenue and expenditure components and looks at trends in revenue and expenditure.

2.1. The Business Cycle in Mexico

Figure 1 illustrates the behavior of real GDP in Mexico from 1980 through 2003. The raw data show a clear pattern of seasonality. Overlying the general upward trend and cycles is a pattern that indicates relatively low production in the first and third quarters and relatively high production in the second and fourth quarters. To identify these underlying features in the data, a seasonal adjustment filter was applied to the data.\(^2\)

Figure 2 shows the seasonally-adjusted data. This figure also delineates recessions using shading. Several episodes are worth noting namely:

- The recession of 1982 through mid-1983 associated with the debt crisis.
- The period of slow and erratic growth thereafter, followed by the recession of late 1985 and 1986.
- The implementation of the stabilization program in 1988, with an initial, slightly recessionary, year.
- The expansion of 1989-94.

\(^2\)The X11 algorithm implemented by Estima was used to seasonally adjust the data.
• The short and intense recession of 1995 associated with the peso crisis and the subsequent recovery.

• A shallow but long recession beginning at the end of 2000, and ending, apparently in early 2003.

One can notice, with reference to Figure 2, that all expansions and all contractions of Mexican economy during the period under consideration are not alike. For example, the downturn after the peso crisis of December 1994 was much sharper and deeper than the ones experienced during the previous and subsequent recessions. It involved a cumulative decline in output of 9.7 percent, versus 6.8, 4.7, and 0.8 percent in the previous recessions and 0.4 percent in the most recent recession. It lasted two quarters, compared with six, five, and three quarters in the previous recessions, and 10 quarters for the most recent recession. The economic expansion that followed the 1995 recession was also more rapid than any of the previous expansions.

Chapter 5 describes several methods used in the literature to measure a business cycle. The results of their application to the Mexican GDP series are presented below.

**Piecewise Linear Trend**  Figure 3(a) illustrates a piecewise linear trend fit to real GDP, with a break point at 1989Q2. This trend represents the fitted values from the regression

\[ y_t = a_0 + a_1 d_t^* + b_0 t + b_1 t d_t^* + \epsilon_t \]  \hspace{1cm} (2.1)

where \( y_t = \ln Y_t, \) \( Y_t \) is real GDP, \( d_t^* = 1 \) for \( t \geq t^* \), and \( d_t^* = 0 \) for \( t < t^* \), and \( t^* \) represents 1989Q2. This date was chosen as the break date because it maximizes the t-statistic for the estimated coefficient, \( b_1 \). As Chapter 5 cautioned, searching for breaks in this way implies that the small sample distribution of the maximized t-statistic deviates considerably from a standard normal. The estimates of (2.1) are displayed in Table 1.

Searching for further breaks in the pre-1989 and post-1989 period identified only one other possible break in trend, at the beginning of the 2001-03 recession. It seems too early to assign this date as a true break in trend.

The deviations from trend implied by the piecewise linear trend are illustrated in Figure 4(a). The typical pattern is that a peak of GDP relative to trend corresponds to the end of an expansion period. Recessions move GDP from these peaks to below-trend troughs.
With each expansion, for example 1980, 1989–94 and 1996–2000, the series slowly rises from a trough, and reaches another peak.

**The Hodrick-Prescott Filter**  Figure 3(b) illustrates the trend defined by the Hodrick-Prescott (HP) filter, discussed in Chapter 5. As that chapter explains, the trend is the series \( \{y_t^*\}_t \) that minimizes the objective function:

\[
\sum_{t=1}^{T} (y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*)]^2.
\]  \(2.2\)

The conventional value for the smooth parameter for quarterly data is 1600, and is used here. As Figure 3 indicates, the HP trend turns out to be quite similar to the piecewise linear trend. Consequently, the deviations from trend, illustrated in Figure 4(b), are highly correlated with those obtained using the piecewise linear trend (see Table 2). Note that all the recessions marked in Figure 2 correspond to points at which there is a rapid change of sign in the deviations of GDP from the piecewise linear and HP trends.

**The Baxter-King Filter**  We do not consider the Baxter-King (BK) approximate band-pass filter discussed in Chapter 5, due to the loss of data it implies. With our somewhat small sample of 94 quarters, we would end up with only 70 observations, since the method uses a symmetric 25-quarter moving average of the raw data to compute the cyclical component. We can report, however, that the correlation between the BK and HP cyclical components is 0.94 over the period 1983Q1–2000Q2, and visually, it is very difficult to distinguish between the two definitions of the cycle.

**Beveridge-Nelson Decomposition**  The Beveridge Nelson (BN) decomposition, also discussed in Chapter 5, decomposes a series into permanent and transitory components using an estimated ARIMA model. To compute the BN decomposition, a model of the form

\[
\Delta y_t = \mu + \alpha_1 (\Delta y_{t-1} - \mu) + \cdots + \alpha_p (\Delta y_{t-p} - \mu) + \epsilon_t + \theta_1 \epsilon_{t-1} + \cdots + \theta_q \epsilon_{t-q}
\]  \(2.3\)

was estimated by maximum likelihood. The orders of the autoregressive terms, \( p \), and the moving average terms, \( q \), were chosen according to the Schwarz criterion, which selected \( p = 2 \) and \( q = 0 \). The trend, or permanent component, of the level of the series is its current value plus any predicted stochastic growth:

\[
y_t^* = y_t + E_t (\Delta y_{t+1} - \mu + \Delta y_{t+2} - \mu + \cdots),
\]  \(2.4\)
which can, of course, be computed given estimates of the $a_i$s and $\theta_q$s in (2.3).

The resulting trend estimates are plotted in Figure 3(c). A notable aspect of the trend, in this case, is that it closely tracks the original series. This is a function of the fact that the growth rate of GDP in Mexico is not very persistent. If $\Delta y_t$ were a random walk with drift, so that $\Delta y_t = \mu + \epsilon_t$, the BN trend, or permanent component, would simply be $y_t$. As is stands the estimated model for Mexico’s GDP growth is $\Delta y_t = 0.0027 + 0.11\Delta y_{t-1} + 0.22\Delta y_{t-2} + \epsilon_t$, indicating that there is only limited persistence in Mexico’s GDP growth rate.

The deviations from trend are plotted in Figure 4(c). These are defined as $y^c_t = y_t - y^*_t$. The deviations from trend are much smaller, and behave differently than those identified using the piecewise linear trend and the HP filter (see also Table 2). Again, this is a function of the fact that the growth rate of GDP is not very persistent. If $\Delta y_t$ were a random walk with drift, the BN cyclical component would simply be $\epsilon_t$.

**Peak-to-peak Trend** In this case, trend lines were used in an ad-hoc way to connect the peaks in 1981Q4, and 1994Q4 and 2000Q3 as illustrated in Figure 3(d). With the trend specified in this way, output never lies above the trend. The deviations from trend are plotted in Figure 4(d). They are highly correlated with the deviations from trend defined by the HP filter and the piecewise linear trend (see Table 2).

Given the similarity between the deviations from trend defined by the piecewise linear, HP and peak-to-peak trend lines, subsequent sections will focus on deviations from trend defined using the HP filter.

**2.2. Trends and Cycles in Mexico’s Fiscal Accounts**

In this subsection, we examine Mexico’s fiscal accounts using a similar approach to the one used in the previous subsection. As in the analysis of output, the definition of trend and cycle we use to analyze the fiscal accounts is the one implied by the HP filter. We treat data from the fiscal accounts as we treated the GDP data; i.e. we convert them into real terms by dividing by the GDP deflator and, because many of the resulting series display seasonal patterns, they are further processed to remove seasonal components.

The public sector accounts we use are those provided by Banco de México. Included in the definition of the public sector are the federal government and public sector enterprises. State governments are only considered to the extent that federal government transfers to them are included as expenditure items.
Table 3 presents summary figures. These show that Mexico moved from a position of large fiscal deficits in the early 1980s to a position of small fiscal deficits in the 1990s and into the new century. The primary deficit was narrowed in the mid-1980s in response to the debt crisis. This occurred through a drastic reduction in noninterest expenditure, which now represents about 20 percent of GDP, in contrast to between 25 and 30 percent of GDP in the early 1980s. Total expenditure also declined after the 1988 stabilization, with interest expenditure beginning to fall in line with the decline in inflation. Since 1991 interest has represented 5 percent or less of total expenditure, whereas in 1987 it peaked at nearly 19 percent of total expenditure.

**Revenue** It is also interesting to consider a more detailed breakdown of the public sector accounts. On the revenue side, several of the available series are displayed in Figure 5. Figure 5(a) shows total revenue, in real terms, which displays a very different pattern than GDP. Unlike GDP, public sector revenue grew rapidly through 1985, declined in the 1986 recession, and remained roughly constant in real terms until the mid 1990s. After 1995, real revenue rose rapidly. As Tables 3 and 4 indicate, overall revenue represents a declining share of GDP. In the 1980–88 period, revenue averaged 28.3 percent of GDP. After 1988, revenue has averaged only 23.2 percent of GDP.

Figure 6(a) displays the deviations of total revenue and GDP from their HP trends. As Table 5 indicates, the cyclical movements of total revenue are not that highly correlated with output, with a correlation of only 0.23. Revenue was also somewhat more volatile than output, with a standard deviation of 4.2 percent (representing about 1.1 percent of GDP), as opposed to 2.6 percent for GDP.

A different picture emerges once components of revenue are considered. Federal tax revenue, shown in Figure 5(b), grew substantially during 1980–2003, and its trend is much more consistent with that of GDP: slow growth in the early to mid-1980s, followed by accelerated real growth which was interrupted by the 1995 recession. Overall, as Table 4 indicates, tax revenue has risen slightly as a percentage of GDP, and represents a much larger percentage of total revenue than it used to: 46.5 percent of revenue in 1989–2002, as opposed to 36.2 percent of revenue in 1980-88. Also, tax revenue, as indicated by Table 5, is more highly correlated with real activity than overall revenue—the correlation of the HP cycle in tax revenue with that of GDP is 0.56.

Within tax revenue, the trends and cycles across various tax categories exhibit some
interesting differences. Figures 5(c–f) show the most important components of tax revenue: income tax, value added tax (VAT), excise taxes, and taxes on international trade, which are mainly taxes on imports.

As Table 4 indicates, income taxes and VAT have become increasingly important parts of revenue, rising from a combined 25.6 percent of revenue in the 1980–88 period to a combined 33.9 percent of revenue in the 1989–2002 period. In fact by 2002, income taxes and VAT represented 22.6 and 15.5 percent of all revenue, respectively, versus just 12.4 and 9.5 percent of all revenue in 1985. Excise taxes have also risen in importance since 1995, with most of this attributable to increased gasoline taxes. Meanwhile, trade taxes, which increased in importance into the early 1990s, have been cut substantially: in 2002 they represented less than 2 percent of overall revenue. The declining reliance on import duties, and the slow expansion of income taxation and VAT as sources of revenue are typical of countries at Mexico’s stage of industrialization.

As concerns cyclical properties, Figures 6(c–f) show the cyclical components of the components of tax revenue. Income taxes are clearly highly procyclical (Table 5 indicates that the correlation with the cyclical component of GDP is 0.57), though clearly more volatile than the business cycle itself. VAT and excise taxes are not particularly procyclical, their correlations with the cyclical component of GDP being just 0.08 and 0.06 respectively. Revenue from trade taxes is highly procyclical—the correlation with GDP is 0.59—reflecting the highly procyclical nature of imports.

While real nontax revenues displayed an upward trend in real terms, they have remained at a fairly stable share of overall revenue (about 20 percent). Table 4 indicates that most nontax revenues are derived from oil rights, though these have declined somewhat in importance as a source of revenue. As Table 5 indicates, nontax revenue is the most volatile source of income for the government—the standard deviation of its cyclical component is 21 percent. Table 5 also indicates that nontax revenue is roughly acyclical. The volatility and acyclical nature of nontax revenue is largely a reflection of the fact that oil prices are volatile, and roughly uncorrelated with Mexico’s overall business cycle.

The remaining source of public sector revenue is the revenue of public sector enterprises. The single largest public sector enterprise is PEMEX, the state oil company, whose revenue represented about 11 percent of overall revenue in 2002, but almost 25 percent of revenue in the mid 1980s. As indicated by Table 4, revenue from other public sector enterprises has also
declined over time as a share of GDP and overall revenue. PEMEX’s revenues are roughly uncorrelated with the cyclical component of GDP, reflecting, again, the fact that oil prices are roughly uncorrelated with Mexico’s overall business cycle. As Table 5 indicates, revenue from other public sector enterprises is moderately procyclical.

To assess Mexico’s overall dependence on oil-based revenue, we can sum gasoline taxes, revenue from oil rights, and the revenues of PEMEX. As Table 4 indicates, Mexico’s dependence on oil revenue has declined over time. In the mid 1980s, oil revenue represented between 40 and 45 percent of total revenue. By 2002, it represented less than 30 percent of total revenue. As Table 5 indicates, the cyclical component of oil revenue is somewhat negatively correlated with the business cycle. This explains why Mexico’s overall revenue is less cyclically sensitive than the revenue of governments in economies at a similar stage of development that lack oil resources.

**Expenditure** On the expenditure side of the public sector budget, we distinguish between interest on public debt and other forms of spending, referred to as primary expenditure. Primary expenditure peaked at about 30 percent of GDP in 1981. Thereafter it fell steadily, and has remained below 20 percent of GDP since 1989, except in 1994 and 2002. The result of this fiscal contraction is that—despite the decline in overall revenue as a share of GDP—the public sector has moved to a stronger primary surplus position. The average primary balance in the 1980–88 period was 2.3 percent of GDP. After 1988 it was 3.8 percent of GDP.

Post-1988 there was also a substantial decline in interest expenditure as a share of GDP. In the 1980–88 period, rapid inflation and a significant stock of domestic debt implied an average interest burden of 11.7 percent of GDP. In the post-1988 period this declined to just 4.6 percent of GDP.

Interestingly, primary expenditure is highly procyclical, as indicated by Table 5. The correlation of its cyclical component with the cyclical component of GDP is 0.61, and it is substantially more volatile than GDP with a standard deviation of 7.4 percent. The procyclical behavior of expenditure actually offsets the procyclical behavior of revenue and tends to make the primary budget countercyclical. As a recent study by the Inter-American Development Bank indicates (Gavin, et. al. 1996), from a Keynesian perspective, the public sector thus acts much less as a stabilizer than it does in other economies of the Organization for Economic Cooperation and Development (OECD).

Once expenditure is divided into its components, an even clearer picture emerges. Wages
and salaries in the public sector, depicted in Figure 7(b), declined steadily in real terms from 1980 through 1996. Since then they have increased steadily, in real terms, and have stabilized at around 4 percent of GDP. Figure 8(b) and Table 5 indicate that wages and salaries have been highly procyclical. Most of this procyclical behavior is not due to the federal government wage bill, but is largely determined by the behavior of wages within public sector enterprises.

Expenditure on materials and supplies, as well as other non-transfer current spending, have declined sharply in importance, from 28.3 percent of revenue in the 1980–88 period, to just 20.1 percent of revenue in the post-1988 period. This pattern is confirmed by Figure 7(c). Materials and supplies expenditures are only slightly procyclical, as indicated by Figure 8(c) and Table 5. The correlation of their cyclical component with GDP is just 0.28.

Transfers have become an increasingly significant component of the overall public sector budget, as indicated by Figures 7(d–f). In 2002 they represented 58.6 percent of public sector revenue as opposed to just 41 percent in 1980. Although government transfers to public sector corporations have declined in importance, there have been substantial increases in social programs and revenue-sharing transfers to state governments.

The expenditure category “other transfers” is interesting because it represents transfers to households and the private sector, as opposed to transfers destined for state governments and public sector enterprises. While transfers to state governments might be expected to be procyclical, since they represent revenue sharing, it is, perhaps, surprising, that other transfers are also highly procyclical [see Table 5, and Figure 8(f)]. One might expect that these other transfers would include aid and social assistance, and that such spending would be countercyclical. As it turns out, only a relatively small fraction of the government’s transfer spending is on social programs with this characteristic.

The federal government shares a substantial portion of its revenue with states, and this revenue sharing has increased in importance, as indicated by Table 4. Not surprisingly, this expenditure is procyclical, its cyclical component having a correlation of 0.42 with the cyclical component of GDP. This is similar in magnitude to the correlation of overall tax revenue with GDP.

Capital expenditure has declined significantly: in real terms [Figure 7(g)] by about 75 percent from its peak in 1982; as a percentage of GDP, from a peak of 7.4 percent in 1981 to just 1.2 percent in 2002; and as a percentage of revenue, from a peak of 30.6 percent in 1981
to just 5.4 percent in 2002. Capital spending is quite procyclical, as indicated by Figure 8(g). Its cyclical correlation with GDP was 0.38 (Table 5) during 1980-2002.

The final expenditure item is interest, and is illustrated in Figure 7(h). Inflation effects are the driving force behind changes in the size of interest flows. Interest expenditure shot up in 1982 and 1986, not only because public sector debt increased, but mainly because inflation accelerated dramatically. High real interest rates in the stabilization period after 1988 kept interest expenditure at high levels, but declining debt stocks, and lower real interest rates eventually brought interest spending down. It again rose in significance in 1995 as inflation accelerated during the peso crisis, but by 1995 the public sector’s overall level of indebtedness was much lower than in the early 1980s. After the crisis, the interest burden once again moderated. Interest expenditure is countercyclical, its correlation with GDP being −0.35 (Table 5), largely because in Mexico inflation has tended to be highest during periods of recession.

Interest expenditure plays little role in our subsequent analysis, which focuses mainly on the primary budget balance: revenue minus primary expenditure.

3. Constructing the Cyclically-Adjusted Budget Surplus in Mexico

In this section we construct a historical time series for the cyclically-adjusted budget balance using the methodology described in Chapter 5.

For the purposes of this chapter, all revenue categories were considered for adjustment. In addition, transfers to the states, and other transfers were also considered for adjustment. We made all revenue categories candidates for adjustment since we think there are sound a priori reasons for expecting each of them to behave procyclically. In the case of transfer payments to the states, these are a form of revenue sharing, so we expect them to behave similarly to tax revenue. In a sense, they represent a reduction in the central government’s revenue that behaves much as revenue does. On the other hand, we expect other transfers to be countercyclical, under the assumption that the government has countercyclical social programs.

Estimates of the elasticities of these revenue and expenditure categories with respect to the cyclical component of output are found in Table 6. As Chapter 5 describes in more detail, these elasticities are estimated by running OLS regressions of the following form:

\[ r_t^c = ey_t^c + \epsilon_t. \]  

(3.1)
where \( r^c_t \) and \( y^c_t \) are, respectively, the cyclical components of a revenue category and real GDP, as defined by the HP filter.

As Table 6 indicates, we find that revenue from the income tax is significantly procyclical and that the elasticity of its cyclical component with respect to output’s is 2.19. Hence, we adjust income tax revenue in constructing the cyclically-adjusted budget balance. On the other hand, the low correlation between VAT revenues and output (see Table 5) ends up being reflected in an insignificant and small estimate of the elasticity of VAT’s cyclical component with respect to output’s. As a result, we do not adjust VAT revenue in constructing the cyclically-adjusted budget balance.

Excise tax revenue, like VAT revenue, is not highly correlated with aggregate activity (see Table 5). This also is reflected in a positive but insignificant estimate of its elasticity with respect to the cyclical component of output. Since gasoline taxes represent about two-thirds of excise tax revenue, we estimated an additional regression of the form:

\[
r^c_t = e_y y^c_t + e_p p^c_t + \epsilon_t, \tag{3.2}
\]

where \( p^c_t \) is the cyclical component of the relative price of oil defined by the HP filter.\(^3\) When we estimated (3.2), as Table 6 indicates, we still found no significant correlation with output, but, interestingly we found a significant negative correlation with the relative price of oil. To explore the data further we split the excise tax data into the non-gasoline tax and gasoline tax components, and ran separate regressions. As Table 6 indicates, the non-oil component of excise tax revenue remains uncorrelated with output. On the other hand, the gasoline tax continues to be significantly negatively correlated with the relative price of oil. As Figure 9(a) indicates, the overall negative relationship between gasoline taxes and the relative price of oil within our sample is not stable across time. In the 1980s, gasoline taxes tended to move with the oil price, but beginning in the 1990s, this pattern of correlation was reversed. Given our overall results, we do not adjust excise tax revenue with respect to output in constructing the cyclically-adjusted budget balance.

When we examined trade taxes, we found that these were significantly procyclical. Our estimate of the elasticity of trade taxes with respect to the cyclical component of output is 4.67. This result is not surprising given that most trade taxes are on imports, which

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\(^3\)We constructed a quarterly measure of the relative price of oil from the spot US dollar price of West Texas Intermediate crude oil (USD per barrel, from the FRED database of the Federal Reserve Bank of St. Louis) multiplied by the quarterly average peso/dollar exchange rate (from the IFS database) divided by the Mexican GDP deflator.
have a big investment and durable consumption component and are highly sensitive to business conditions. We adjust trade tax revenue in constructing the cyclically-adjusted budget balance.

When we examined other taxes, we found that these were slightly procyclical (see Table 5). Our estimate of the elasticity of other taxes with respect to the cyclical component of output is 0.98. Although this estimate is not significant at the 5 percent level, we adjust other tax revenue in constructing the cyclically-adjusted budget balance.

Nontax revenue is not highly correlated with aggregate activity, in fact it is slightly negatively correlated with real activity (see Table 5). This is reflected in a negative but insignificant estimate of its elasticity with respect to the cyclical component of output. Since oil royalties represent about two-thirds of nontax revenue, we also estimated regressions of the form (3.2). As Table 5 indicates, we still found no significant correlation with output but found a strong correlation with the relative price of oil. To explore the data further we split nontax revenue into its oil royalties and other components, and ran separate regressions. As Table 6 indicates, the non-oil component of nontax revenue is still not significantly positively correlated with output. Oil royalties, on the other hand, are highly significantly positively correlated with the relative price of oil. This relationship is shown to be stable over our sample, as Figure 9(b) indicates. Given our results, we do not adjust nontax revenues with respect to output in constructing the cyclically-adjusted budget balance.

Revenue from public sector enterprises is not highly correlated with aggregate activity (see Table 5). This is reflected in an insignificant estimate of its elasticity with respect to the cyclical component of output (see Table 6). Since revenue from PEMEX represents more than a third of this revenue, we also estimated regressions of the form (3.2). As Table 6 indicates, we still found no significant correlation with output and also found no significant correlation with the relative price of oil. To explore the data further we split the data into revenue from PEMEX and revenue from the other public sector enterprises, and ran separate regressions. As Table 6 indicates, revenue from the other public sector enterprises is significantly positively correlated with output, and has an estimated elasticity of 0.67 with respect to the cyclical component of output. The revenue of PEMEX is highly significantly positively correlated with the relative price of oil, with an estimated elasticity of 0.24. This relationship is shown in Figure 9(c). Given our results, we adjust the revenue of the non-PEMEX public sector enterprises with respect to output in constructing the
cyclically-adjusted budget balance.

On the expenditure side of the fiscal accounts we first considered transfers to the states. These transfers essentially deliver part of federal tax revenue to the state and local governments, and we might expect these transfers to be procyclical given the overall procyclical pattern of revenue. Indeed, this is what we found, with the estimated elasticity of transfers to the states being a highly significant 2.64. Hence, we adjust transfers to the states when constructing the cyclically-adjusted budget balance.

In addition to transfers to states, there are also transfers to public sector enterprises. Because we see no particular reason to think that these would be procyclical on structural grounds, we do not consider them for cyclical adjustment. As we discussed earlier, the remaining transfers, which presumably go to the private sector (either private firms or households), might be expected to be countercyclical. We might expect that there would be a variety of social expenditure programs which, due to their structure, would require larger government payouts during recessions. As Table 5 indicates, however, the pattern of correlation of these other transfers with the cyclical component of output is positive not negative. As Table 6 indicates, the elasticity of these transfers with respect to output is 1.39 and highly significant. Despite this being true, we do not adjust other transfers when constructing the cyclically-adjusted budget balance, because we see no compelling reason why transfer programs should display this behavior.

Finally, we considered an overall measure of oil-based revenue, which is the sum of gasoline tax revenue, oil royalties, and the revenue of PEMEX. As Table 4 indicates, in our sample, oil revenue represents about a third of the Mexican public sector’s revenue. There is some question as to whether the cyclically-adjusted budget measures should take into account the sensitivity of this portion of revenue to oil prices, which, as Table 6 indicates, is highly significant, with an estimated elasticity of 0.41. On the one hand, if one wants to make adjustments that purely reflect the business cycle’s effect on the budget, one would make no adjustments to oil-based revenue. On the other hand, if the purpose of estimating a cyclically-adjusted fiscal surplus is to isolate those components of the budget that are driven by the discretionary decisions of policy makers, correcting for oil prices seems justified. As a result, we present two alternative measures of the cyclically-adjusted budget surplus. One makes no adjustment for oil prices, while the other does.
The cyclically-adjusted primary budget balance is defined as

\[ \Delta_A^t = \Delta_t + \text{adjustment} = (R_t - X_t) - \left( \sum_{j=1}^{4} R_{jt}[1 - \exp(-\hat{e}_{Rj}y_{ct})] - X_{1t}[1 - \exp(-\hat{e}_{X1}y_{ct})] \right) \]  

(3.3)

where \( R_t \) is revenue, \( X_t \) is primary expenditure, \( \Delta_t = R_t - X_t \), \( R_{1t} \) represents income tax revenue, \( R_{2t} \) is trade tax revenue, \( R_{3t} \) is other tax revenue, \( R_{4t} \) is revenue from the non-PEMEX public sector enterprises, \( \hat{e}_{R1} \), \( \hat{e}_{R2} \), \( \hat{e}_{R3} \) and \( \hat{e}_{R4} \) are the corresponding output elasticities, \( X_{1t} \) is transfers to the states, and \( \hat{e}_{X1} \) is the corresponding output elasticity.

The oil and cyclically-adjusted primary budget balance is defined as

\[ \Delta_B^t = \Delta_A^t - R_{Ot}[1 - \exp(-\hat{e}_{Op}y_{ct})], \]  

(3.4)

where \( R_{Ot} \) is oil-based revenue, and \( \hat{e}_O \) is the elasticity of oil-based revenue with respect to the relative oil price.

Figure 10(a) presents data on the public sector’s primary surplus measured as a percentage of the HP trend of GDP. Note that in the early 1980s the public sector was in a large primary deficit position that it was forced to reverse as of 1982 with the onset of the debt crisis. Throughout the rest of the 1980s, the 1990s, and into the new century the government remained in a strong primary surplus position. From 1983 through 1992, the primary deficit was usually higher than 5 percent of GDP. As inflation was stabilized, and the government’s debt problems were gradually resolved, the government no longer needed to run such a large primary surplus and it was scaled back to less than 5 percent for most of the later period, apart from a period of fiscal austerity after the 1994 crisis.

The overall balance, which includes nominal interest payments, is illustrated in Figure 10(b). It paints a different picture, but as we argued above, the overall balance is deceptive, because during periods of high inflation interest flows largely reflect compensation for inflation rather than real income to the recipient. For this reason we do not make the overall balance the focus of our subsequent analysis.

The cyclically-adjusted primary balance is illustrated in Figure 10(c). At first glance, the cyclically-adjusted balance and the standard measure of the primary balance appear to be quite similar. The difference between the two measures is plotted in Figure 10(e), and at times it is substantial, though it is never larger than 1 percent of GDP in absolute value. Whenever it is positive, it indicates that fiscal policy was more contractionary than
indicated by the standard primary surplus. Whenever it is negative, fiscal policy was more expansionary than indicated by the standard primary surplus. Note, for example, that fiscal policy looks more contractionary during the 1995–96 period, when the adjusted budget figures are considered.

Adjustments for changes in oil prices can also be substantial. Oil-based revenue moves closely with the world oil price, which is highly volatile. Figure 10(f) shows that adjustments of revenue for exogenous movements in oil prices have amounted to as much as 2 percent of GDP. For example, oil revenue shot up in 1991 because of the Gulf War. Removing this effect from the data requires an adjustment in the amount of 2 percent of GDP. However, Figure 10(d) shows that the overall picture of the budget balance is changed only a little by taking into account movements in oil-based revenue due to changing oil prices. Other factors dominate movement in the primary balance.

4. Characterizing Fiscal Policy

Using the primary balance as a summary measure, we can characterize Mexico’s fiscal policy as procyclical for the following reasons. Countercyclical policy, or leaning against the wind, is usually described as running deficits during recessions and surpluses during expansions. In other words, policy is countercyclical when the budget surplus is procyclical. However, the correlation between Mexico’s primary surplus as a percentage of trend GDP and GDP’s cyclical component from 1980 through mid-2003 is $-0.30$. This indicates that Mexico has tended to run bigger surpluses during hard times and smaller surpluses or deficits during good times.

The cyclical adjustment of the primary surplus makes this fact stand out more. The correlation between the cyclically-adjusted primary surplus and GDP is $-0.36$. This suggests that discretionary policy, rather than leaning against the wind, seems to lean quite strongly with the wind.4

The finding here is consistent with the discussion in Gavin, et. al. (1996) and Talvi and Végh (2000). Gavin et. al. study a number of Latin American countries and find that in the typical country, fiscal policy is much more procyclical than in the OECD. Both revenue

4The further oil-price adjustment makes this correlation $-0.34$. Even if we exclude the 1980–82 period, which was an exceptional period of large primary deficits, the correlation of the primary balance with real activity remains negative ($-0.20$). The correlation for the cyclically-adjusted balance becomes $-0.32$, while for the oil-price and cycle-adjusted balance it is $-0.28$. 
and expenditure are typically much more sensitive to the business cycle than in the OECD, but the expenditure effect is stronger. Talvi and Végh’s findings are similar for a broader sample of 56 countries. They contrast fiscal policy in the G7 countries, where, consistent with Barro’s tax smoothing proposition, it appears to be countercyclical, and policy in industrializing countries, where spending and tax revenue are both highly procyclical.5

Interpretations of findings of procyclical policy vary. Gavin et. al. argue that during recessions the public sector in many Latin American countries faces a hard budget constraint. They argue that discretionary spending cannot be expansionary in the traditional sense because the government is liquidity constrained during recessions. But this begs the question: how did the government become liquidity constrained in the first place? Was procyclical fiscal policy itself the culprit?

A similar explanation of procyclical fiscal policy is offered by Caballero and Krishna-murthy (2004). They argue that the lack of financial depth in emerging markets is responsible for the cyclical behavior of government budgets. They suggest that if governments in emerging markets were to attempt to borrow in recessions, they would severely crowd private borrowers out of the already limited supply of foreign lending.

Talvi and Végh, in contrast, argue that the procyclicality of government spending is, itself, a function of the variability of government revenue. They suggest that tax revenues in industrializing countries are more variable, and more highly procyclical than in industrialized countries. As a result, the government faces political pressure to increase government spending during expansions. However, they do not account for the different pattern of behavior of government spending within the G7 and industrializing economies through differences in political pressure across countries. Instead, they argue that countries with more procyclical spending have more strongly procyclical revenue.

Does Talvi and Végh’s story work for Mexico? One problem, as Table 5 shows, is that public sector revenue is not that strongly procyclical in Mexico. The correlation between the cyclical components of revenue and output is only 0.23. Another problem is that primary expenditure is not only procyclical, it is much more strongly procyclical than revenue. The correlation between the cyclical components of expenditure and output is 0.61. A further problem with their theory is that when oil prices rise, and, as we have seen, revenues derived

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5 Barro’s (1979) tax smoothing argument is that for welfare reasons, governments are likely to desire relatively smooth paths for government spending and tax rates. Such behavior implies a pattern of procyclical budget surpluses.
from oil rise, primary expenditure tends to fall.6 This suggests that revenue windfalls from oil are used to retire debt, while increases in revenue associated with the business cycle are more than fully spent.

Consistent with the IMF’s methodology, described in more detail in Chapter 5, we calculated the discretionary primary budget balance for Mexico. If $\Delta$ is the primary balance, then the discretionary balance is defined as

$$\Delta^D = \Delta - (tY - xY^*)$$

(4.1)

where $t$ and $x$ are the sample averages of revenue and primary expenditure as fractions of GDP, $Y$ is real GDP and $Y^*$ is the HP trend of real GDP. Figure 11(a) displays the discretionary primary budget balance expressed as a percentage of the trend level of real GDP. Comparing this to the oil price and cycle-adjusted budget balance, which we also display in Figure 11(a), we see that the two series are highly correlated although they have a different level. In fact, the correlation between the two series is 0.979.7

As was mentioned in Chapter 5, the fiscal impulse, $\Delta^D_t - \Delta^D_{t-1}$, in some sense, measures the change in the stance of fiscal policy. Whenever it is positive, policy is moving toward a more expansionary position. Figure 11(b) shows the fiscal impulse calculated using the discretionary budget balance and the oil and cycle-adjusted budget surplus. Both series are expressed as backward-looking, four-quarter, moving averages, because the quarterly observations are extremely volatile. The two measures are very highly correlated, and both indicate that there is a tendency for fiscal policy to move toward a more contractionary stance during recessions.

5. The Impact of Fiscal Policy on Real Activity

Ideally, we would like to assess the impact of Mexico’s fiscal policy on real activity. From the perspective of Keynesian textbook theory, discussed in Chapter 5, we could do this quite easily. The negative correlation of Mexico’s cyclically-adjusted primary balance with real activity could be taken to indicate that fiscal policy creates an additional stimulus to real activity during expansions, and exacerbates downturns by reducing domestic demand

---

6 A regression of the cyclical component of primary expenditure on the cyclical components of output and the relative price of oil delivers the following results: the coefficient on output is 1.64, while the coefficient on the oil price is $-0.10$. Both coefficients are significant at the 5 percent level.

7 Even over the 1983–2003 subsample the correlation is 0.94.
during recessions. The Keynesian interpretation relies on two assumptions: (i) that we can treat all movements in the cyclically-adjusted primary balance as indicators of exogenous and discretionary policy decisions and (ii) that the Keynesian framework is the right one in which to assess the likely impact of changes in the budget balance.

Ideally we would prefer to measure the impact of fiscal policy on real activity without making reference to a particular theoretical framework; i.e. we would like to use a more data-based approach. Nonetheless, we cannot avoid the first point made above: even a data-based approach requires us to identify exogenous changes in the stance of fiscal policy. And it is not obvious that the cyclically-adjusted primary balance represents a measure of exogenous policy.

In this section we use a vector autoregressive (VAR) approach to assessing the impact of fiscal policy on output. In order to do this, we have to make identifying assumptions that isolate exogenous changes in policy. A large literature on the US economy has grappled with the question as to how to isolate exogenous shifts in fiscal policy using autoregressive or VAR models, and we do not deal with all the issues this literature has raised.\(^8\) However, we do point out what the issues are as they arise.

In this section we estimate a small VAR model of the Mexican economy to try to address the following questions. How does discretionary policy affect economic activity? What were the fiscal impulses to output in historical episodes? The next subsection describes the time series included in the VAR, and our identifying assumptions. The second subsection answers the two questions.

5.1. A Small VAR Model of the Mexican Economy

Here we specify a quarterly VAR model for a \(6 \times 1\) vector of time series, \(z_t\), where \(z_t\) consists of:

- The logarithm of the world price of oil (expressed in constant 1993 pesos per barrel)
- The logarithm of real GDP in the United States (measured in constant 1996 chained dollars)
- The U.S. federal funds rate (measured in percent per year)

• The oil- and cyclically-adjusted primary balance of the Mexican public sector (measured in percent of trend GDP),
• The logarithm of real GDP in Mexico (measured in constant 1993 pesos)
• The logarithm of the real Mexico-U.S. exchange rate.

The logarithm of the oil price, \( p_{Ot} \), is included not only because oil prices affect the public sector budget balance, but also because they largely determine Mexico’s terms of trade. They may therefore have an effect on economic activity as well as the real exchange rate. The logarithm of real GDP in the United States, \( y_{Ut} \), is included because it can be used as an exogenous indicator of the demand for Mexican exports. The U.S. Federal Funds rate, \( r_{Ut} \), is used as an indicator of monetary policy in the United States. Because Mexico’s ability to borrow funds might well depend on conditions in the world financial market, American monetary policy is likely to play some role in business cycle fluctuations in Mexico.

The oil- and cyclically-adjusted primary balance as a percentage of trend GDP, \( \delta_{t}^{B} \), is used as our indicator of fiscal policy in Mexico. The logarithm of Mexican real GDP, \( y_{t} \), is included to examine the feedback between the fiscal surplus and output. Finally, the logarithm of the real exchange rate, \( s_{t}^{*} \), is included, because it may be a useful indicator of other shocks affecting the Mexican economy, such as productivity shocks with wealth effects, as well as short- and medium-term changes in Mexican monetary policy. The logarithm of the real exchange rate is measured as \( s_{t}^{*} = \ln(S_{t}P_{t}^{*}/P_{t}) \), where \( S_{t} \) is the nominal exchange rate in pesos per dollar, \( P_{t}^{*} \) is the U.S. GDP deflator, and \( P_{t} \) is the Mexican GDP deflator.

We define

\[
\begin{pmatrix}
    x_{t} \\
    w_{t} \\
    z_{t}
\end{pmatrix} =
\begin{pmatrix}
    p_{Ot} \\
    y_{Ut} \\
    r_{Ut}
\end{pmatrix} \quad \text{and} \quad
\begin{pmatrix}
    \delta_{t}^{B} \\
    y_{t} \\
    s_{t}^{*}
\end{pmatrix}
\]

The vector \( z_{t} \) stacks the external variables, \( x_{t} \), above the internal variables, \( w_{t} \). We set up a “structural” VAR model of \( z_{t} \) that permits contemporaneous feedback among the variables:

\[
Bz_{t} = A(L)z_{t-1} + \epsilon_{t},
\]

where \( B \) is a nonsingular square matrix, \( A(L) = A_{1}L + A_{2}L^{2} + \cdots + A_{k}L^{k} \) is a \( k \)th-ordered polynomial in the lag operator, and \( \epsilon_{t} \) is a vector of mutually orthogonal serially uncorrelated shocks. Premultiplying (5.1) by \( B^{-1} \) one obtains

\[
z_{t} = C(L)z_{t-1} + u_{t},
\]

\[
\text{(5.2)}
\]

20
where \( C(L) = B^{-1}A(L) \) is a \( k \)th-ordered polynomial in the lag operator and \( u_t = B^{-1}\epsilon_t \) is a vector of potentially correlated error terms. The standard procedure for estimating VARs is to choose \( k \), and then simply run OLS regressions for each equation implicit in (5.1). Notice that our assumptions about \( \epsilon_t \) imply that its covariance matrix is some diagonal matrix \( D \). The covariance matrix of \( u_t \) is \( \Sigma = B^{-1}DB \). The matrix \( B \) can be backed out from an estimate of \( \Sigma \) if sufficient identifying restrictions are placed on \( B \).

Consistent with the partition of \( z_t \) into \( x_t \) and \( w_t \) we can write (5.1) as

\[
\begin{pmatrix}
B_{xx} & B_{xw} \\
B_{wx} & B_{ww}
\end{pmatrix}
\begin{pmatrix}
x_t \\
w_t
\end{pmatrix}
= 
\begin{pmatrix}
A_{xx}(L) & A_{xw}(L) \\
A_{wx}(L) & A_{ww}(L)
\end{pmatrix}
\begin{pmatrix}
x_{t-1} \\
w_{t-1}
\end{pmatrix}
+ \epsilon_t.
\]

Because we think the variables in \( x_t \) are arguably determined by factors outside the Mexican economy, we impose the following restrictions \( B_{xw} = 0 \) and \( A_{xw}(L) = 0 \). We normalize the diagonal elements of \( B_{xx} \) and \( B_{ww} \) to 1.

We think it is arguable that world oil prices are determined exogenously and do not depend on contemporaneous or lagged feedback from any of the other variables, so we also impose the restriction that the 1, 2 and 1, 3 elements of \( B_{xx} \) and \( A_{xx}(L) \) are 0.

As in Christiano, Eichenbaum and Evans (1999), we assume that the Federal Reserve observes current economic activity before setting its Fed Funds rate target. For this reason, we impose the restriction that the 2, 3 element of \( B_{xx} \) is 0.

Probably our most important identifying assumptions are the following ones. We assume that the oil- and cyclically-adjusted fiscal balance, \( \delta_t^B \), reacts contemporaneously to the external variables, \( x_t \), but not to the internal variables, i.e. the other elements of \( w_t \). We think this is a reasonable assumption, as we think it is unlikely that discretionary fiscal policy is able to respond to domestic economic conditions within a short time horizon (one quarter). This means we set the 1, 2 and 1, 3 elements of \( B_{ww} \) equal to 0. While we think these assumptions are reasonable, we are sensitive to the possibility that we have not have isolated strictly exogenous movements in the budget via these identifying assumptions. Finally, we impose the restriction that the real exchange rate responds contemporaneously to real output, but not vice versa. This means that we set the 2, 3 element of \( B_{ww} \) equal to 0. This last assumption is not very important for our results, as our main focus is on the effects of fiscal policy shocks.

Given our identifying assumptions the model can be estimated by OLS. The equations are estimated in levels, with a linear time trend included on the right-hand side of each equation.
5.2. Does Fiscal Policy Affect Real Activity?

Figure 12 presents impulse response functions with respect to a fiscal shock. These are computed by solving for the moving average representation of $z_t$ in terms of $\epsilon_t$:

$$z_t = [I - B^{-1}A(L)L]^{-1}B^{-1}\epsilon_t$$

$$= \Psi_0\epsilon_t + \Psi_1\epsilon_{t-1} + \Psi_2\epsilon_{t-2} + \cdots = \Psi(L)\epsilon_t. \quad (5.4)$$

The matrices $\Psi_k$ can be calculated once we estimate (5.1).

The response of the fiscal balance, $z_4$, to a fiscal shock, $\epsilon_4$, is given by $\partial E_t z_{4t+k}/\partial \epsilon_4 = \Psi_k(4,4)$. The response of output, $z_5$, to a fiscal shock, $\epsilon_4$, is given by $\partial E_t z_{5t+k}/\partial \epsilon_4 = \Psi_k(5,4)$. Notice, from Figure 12(a), that a shock to the fiscal balance of 1 percent of GDP has a persistent effect on the fiscal balance, but that the fiscal balance returns to its previous value after about two years. Figure 12(c) shows how output responds. It shows that within about three quarters of the shock’s occurrence, output falls by about −0.6 percent. This is a substantial decline, but after this output recovers and within about two years the effects of the shock on output are negligible. The response of output appears to be consistent with basic Keynesian theory.

In terms of policy design, not only does the response of output to unanticipated fiscal shocks matter, but how output’s response to other shocks is affected by the behavior of the fiscal surplus also matters. For example, does the fiscal surplus insulate output from the effects of other shocks? There is no simple way to address this issue, because it pertains to experiments on the feedback rule for fiscal policy. The VAR identifies one feedback rule prevailing during one sample period, but it cannot, strictly speaking, be used to answer questions about the possible impact of alternative feedback rules.

To expand on the non-insulating properties of fiscal policy we computed the response of the fiscal balance at period $t+k$ to each of the shocks at period $t$, $\partial E_t z_{4t+k}/\partial \epsilon_{jt}$, $j = 1, \ldots, 6$, and compared this to the response of output to the same shock, $\partial E_t z_{5t+k}/\partial \epsilon_{jt}$. When the response of output is positive, the shock is expansionary. If the response of the fiscal balance is also positive, one could think about this as policy leaning against the wind, because fiscal policy would be taking a contractionary stance in response to a shock that has an expansionary effect.

The VAR model includes six shocks, for which we computed the responses out to $k = 24$ (a 6 year horizon). Of course, this choice is arbitrary. Thus we have 150 responses of output
and the fiscal surplus (at 25 different dates to 6 different shocks). In only 31 of these cases
do the responses of output and the fiscal surplus have the same sign. In 119, or about 80
percent of the cases they move in opposite directions. This suggests a strong tendency of
fiscal policy to magnify, not dampen, the effect of shocks on output, given the presumption
that improvements in the fiscal balance are contractionary.

Another way to judge the importance of different shocks is the variance decomposition.
The variance decomposition breaks the forecast error for $z_t$, into components corresponding
to innovations in each element of $\epsilon_t$. If one were forecasting output $j$ periods ahead, the
forecast error $e_{t,t+j} = z_{t+j} - E_t z_{t+j}$ would be given by

$$e_{t,t+j} = \Psi_0 \epsilon_{t+j} + \Psi_1 \epsilon_{t+j-1} + \cdots + \Psi_{j-1} \epsilon_{t+1}.$$  

The variance decomposition of, say, $y_t$, at horizon $j$, would decompose the variance of the
5th element of $e_{t,t+j}$ into six components representing the contribution to the variance by
each of the 6 elements of $\epsilon_{t+1}, \epsilon_{t+2}, \ldots, \epsilon_{t+j}$.

The relative importance of the six shocks will vary depending on the forecast horizon.
If a shock is relatively important at short horizons, then it is a shock that has relatively
short-lived, but important, effects on output; however, if a shock is relatively important
at long horizons, then it has more of a long-run impact. Table 7 illustrates the variance
decomposition for Mexican GDP at different forecasting horizons. The table indicates that
fiscal shocks are an important source of fluctuations in GDP, especially at horizons of about
three to eight quarters, where they account for a maximum of 16 percent of the variance in
GDP. In our earlier study we found that fiscal shocks were even more important (Burnside,
1999), but that study only considered data up to 1998. This suggests one possibility, that
fiscal shocks have become smaller, or less important to the Mexican economy in the past five
years.

Another way to examine the importance of the budget for output is to compute a histori-
cal decomposition of fluctuations in GDP into their sources. This can be done quite easily
as a by-product of the VAR estimation. The decomposition divides all deviations of GDP
from a linear trend into seven components: a part due to conditions at the beginning of
the sample period, and six parts each due to the six different shocks in the VAR. Figure 13
plots the portion of GDP caused by fiscal shocks. Note that the fiscal shocks have typically
contributed a small portion of the variation in output, and that the fiscal shock component
tends to be positively correlated with the overall deviation of output from trend. However,
with the exception of the 1989-90 period there is no episode in which shocks to the fiscal balance itself appear to be the most important factor.

We conclude by arguing that innovations in the fiscal balance seem to have played a relatively small role in driving business cycle fluctuations in Mexico. However, shocks to the fiscal balance do appear to have important short-run effects on real activity consistent with Keynesian theory. Furthermore, and perhaps more importantly, fiscal policy appears not to lean against the wind. When output is affected by other shocks, fiscal policy tends to respond to those shocks in ways that intensify their effects on output.

6. Conclusions

This chapter has explored the cyclical properties of the budget balance in Mexico and has reached a number of conclusions.

First, Mexico’s fiscal policy tends to be procyclical as the cyclically-adjusted budget balance is negatively correlated with real activity. This reflects the strongly procyclical character of government spending, even when transfers to states are factored out of the analysis. In this way, Mexico resembles many countries in Latin America.

One explanation is that Mexico’s automatic stabilizers are weak. In most of the OECD, taxes and social programs act as natural stabilizers of the business cycle. Tax revenue, and, in some cases, even marginal tax rates, tend to accelerate during cyclical upturns. Spending on social programs such as unemployment insurance and welfare increases during cyclical downturns. These factors tend to make the fiscal surplus move with the business cycle, so that fiscal policy has a natural, and automatic, tendency to dampen business cycle fluctuations from the perspective of Keynesian theory. However, in Mexico these automatic stabilizers are weak. While income tax revenue, taxes on imports, and some other categories of tax revenue move procyclically, they represent only a fraction of the public sector’s revenue. Furthermore, transfer payments to the private sector are procyclical. This presumably reflects that little social assistance spending has cyclical sensitivity.

Not only are automatic stabilizers weak in Mexico, but the rest of the budget has tended to be strongly procyclical. Cyclical upturns are an opportunity to expand public sector investment and other forms of discretionary spending. Cyclical downturns bring austerity. We suspect that these effects exacerbate the business cycle.

Automatic stabilizers can be improved. Part of the problem for Mexico is that close
to one third of all revenue comes from petroleum in one form or another, and oil prices have tended to be countercyclical. Mexico is relying less and less on oil revenue, and has moved towards more broadly targeted taxation of economic activity. This has strengthened stabilizers on the revenue side. If transfer programs designed to soften the blow of cyclical fluctuations were enhanced this would also help.

Mexico could also improve its discretionary fiscal policy. Discretionary spending, especially the public sector wage bill and public investment, is highly volatile and highly sensitive to the business cycle.

References


### TABLE 1

**Estimates of a Piecewise Linear Trend in the Logarithm of Seasonally Adjusted Real GDP**

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>20.71</td>
<td>0.045</td>
<td>455</td>
</tr>
<tr>
<td>Post-1989Q2 dummy</td>
<td>-0.173</td>
<td>0.063</td>
<td>-2.76</td>
</tr>
<tr>
<td>Trend</td>
<td>0.0018</td>
<td>0.0018</td>
<td>1.03</td>
</tr>
<tr>
<td>Trend × post-1989Q2 dummy</td>
<td>0.0057</td>
<td>0.0019</td>
<td>3.02</td>
</tr>
</tbody>
</table>

*Note:* The estimates were computed using ordinary least squares. The standard errors and t-statistics are robust to heteroskedasticity and serial correlation. A Newey and West (1987) estimator with five lags was used to compute the standard errors. The t-statistics do not have a conventional small sample or asymptotic distribution. See Chapter 5.

### TABLE 2

**Correlations Among Various Measures of the Cyclical Component of GDP**

<table>
<thead>
<tr>
<th></th>
<th>Piecewise Linear</th>
<th>HP Trend</th>
<th>Peak-to-peak</th>
<th>BN Decomp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piecewise Linear Trend</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP Trend</td>
<td>0.955</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak-to-peak Trend</td>
<td>0.707</td>
<td>0.809</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BN Decomposition</td>
<td>-0.257</td>
<td>-0.324</td>
<td>-0.325</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note:* For definitions of the various measures of the cyclical component of GDP, please see the main text.
TABLE 3

SUMMARY BUDGET FIGURES, 1980–2002

<table>
<thead>
<tr>
<th>Budget category:</th>
<th>Overall surplus</th>
<th>Primary surplus</th>
<th>Revenue</th>
<th>Expenditure</th>
<th>Interest</th>
<th>Primary expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80–88</td>
<td>89–02</td>
<td>Full Sample</td>
<td>80–88</td>
<td>89–02</td>
<td>Full Sample</td>
</tr>
<tr>
<td>Overall surplus</td>
<td>−8.6</td>
<td>−1.3</td>
<td>−5.3</td>
<td>−33.4</td>
<td>−3.6</td>
<td>−15.2</td>
</tr>
<tr>
<td>Primary surplus</td>
<td>−4.9</td>
<td>2.5</td>
<td>3.3</td>
<td>7.1</td>
<td>15.8</td>
<td>12.4</td>
</tr>
<tr>
<td>Revenue</td>
<td>28.3</td>
<td>23.2</td>
<td>25.2</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Expenditure</td>
<td>37.7</td>
<td>24.0</td>
<td>29.3</td>
<td>133.4</td>
<td>103.3</td>
<td>115.1</td>
</tr>
<tr>
<td>Interest</td>
<td>11.7</td>
<td>4.6</td>
<td>7.4</td>
<td>40.5</td>
<td>19.4</td>
<td>27.7</td>
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<tr>
<td>Primary expenditure</td>
<td>26.0</td>
<td>19.4</td>
<td>21.9</td>
<td>92.8</td>
<td>83.9</td>
<td>87.4</td>
</tr>
</tbody>
</table>

Source: Banco de México and authors’ calculations.
<table>
<thead>
<tr>
<th>Budget category:</th>
<th>GDP</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>REVENUE 80–88</td>
<td>28.3</td>
<td>100.0</td>
</tr>
<tr>
<td>REVENUE 89–02</td>
<td>23.2</td>
<td>100.0</td>
</tr>
<tr>
<td>REVENUE Full Sample</td>
<td>25.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Federal tax revenue</td>
<td>10.2</td>
<td>36.2</td>
</tr>
<tr>
<td>Income tax</td>
<td>4.3</td>
<td>15.6</td>
</tr>
<tr>
<td>VAT</td>
<td>2.8</td>
<td>10.0</td>
</tr>
<tr>
<td>Excise tax</td>
<td>2.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Trade taxes</td>
<td>0.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Other taxes</td>
<td>0.3</td>
<td>1.0</td>
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<tr>
<td>Federal nontax revenue</td>
<td>5.5</td>
<td>19.2</td>
</tr>
<tr>
<td>Oil rights</td>
<td>4.5</td>
<td>15.7</td>
</tr>
<tr>
<td>Other</td>
<td>0.9</td>
<td>3.3</td>
</tr>
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<td>Revenue of PSEs</td>
<td>12.7</td>
<td>44.6</td>
</tr>
<tr>
<td>PEMEX</td>
<td>5.5</td>
<td>19.2</td>
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<td>7.2</td>
<td>25.4</td>
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<td>EXPENDITURE 80–88</td>
<td>37.7</td>
<td>133.4</td>
</tr>
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<td>EXPENDITURE 89–02</td>
<td>24.0</td>
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<td>EXPENDITURE Full Sample</td>
<td>29.3</td>
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<td>Primary expenditure</td>
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<td>Wages and salaries</td>
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<td>Materials and other</td>
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<td>Transfers to states</td>
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</tr>
<tr>
<td>Transfers to PSEs</td>
<td>2.7</td>
<td>9.7</td>
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<tr>
<td>Other transfers</td>
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<td>17.0</td>
</tr>
<tr>
<td>Capital expenditure</td>
<td>4.7</td>
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<tr>
<td>Interest</td>
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<td>40.5</td>
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**Memo item:** oil revenue 11.2 39.2

**Source:** Banco de México and authors’ calculations.
<table>
<thead>
<tr>
<th>CYCLICAL PROPERTIES OF PUBLIC SECTOR REVENUE AND EXPENDITURE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cyclical component of</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>REVENUE</td>
</tr>
<tr>
<td>Federal tax revenue</td>
</tr>
<tr>
<td>Income tax</td>
</tr>
<tr>
<td>VAT</td>
</tr>
<tr>
<td>Excise tax</td>
</tr>
<tr>
<td>Trade taxes</td>
</tr>
<tr>
<td>Other taxes</td>
</tr>
<tr>
<td>Federal nontax revenue</td>
</tr>
<tr>
<td>Oil rights</td>
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<td>Other</td>
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<tr>
<td>Revenue of PSEs</td>
</tr>
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<td>PEMEX</td>
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<tr>
<td>Other</td>
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<tr>
<td>EXPENDITURE</td>
</tr>
<tr>
<td>Primary expenditure</td>
</tr>
<tr>
<td>Wages and salaries</td>
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<td>Materials and other</td>
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<tr>
<td>Transfers to states</td>
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<tr>
<td>Transfers to PSEs</td>
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<tr>
<td>Other transfers</td>
</tr>
<tr>
<td>Capital expenditure</td>
</tr>
<tr>
<td>Interest</td>
</tr>
</tbody>
</table>

*Memo item: oil revenue* 10.8  0.9  −0.25

*Source:* Banco de México and authors’ calculations.

*Notes:* PSEs indicates public sector enterprises.
<table>
<thead>
<tr>
<th>Revenue/expenditure category</th>
<th>Estimated Elasticities</th>
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<tr>
<td></td>
<td>All revenue</td>
</tr>
<tr>
<td></td>
<td>Output</td>
</tr>
<tr>
<td>Income tax</td>
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<tr>
<td></td>
<td>(0.33)</td>
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<tr>
<td>VAT</td>
<td>0.27</td>
</tr>
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<td></td>
<td>(0.34)</td>
</tr>
<tr>
<td>Excise tax</td>
<td>0.40</td>
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<td></td>
<td>(0.73)</td>
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<td>Trade taxes</td>
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<td>(0.67)</td>
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<tr>
<td>Other taxes</td>
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<td></td>
<td>(0.74)</td>
</tr>
<tr>
<td>Nontax revenue</td>
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</tr>
<tr>
<td></td>
<td>(0.88)</td>
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<tr>
<td>PSE revenue</td>
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<tr>
<td></td>
<td>(0.32)</td>
</tr>
<tr>
<td>Oil revenue</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Transfers to states</td>
<td>2.64*</td>
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<tr>
<td></td>
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<tr>
<td>Other transfers</td>
<td>1.39*</td>
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<tr>
<td></td>
<td>(0.31)</td>
</tr>
</tbody>
</table>

Notes: The estimates were computed using ordinary least squares. *-statistics in parentheses. * indicates significance at the 5 percent level. Source: Authors’ calculations.
TABLE 7  
VARIANCE DECOMPOSITION OF OUTPUT  
(percentage of the variance of the forecast error)

<table>
<thead>
<tr>
<th>Forecast horizon (quarters)</th>
<th>Oil prices</th>
<th>US GDP</th>
<th>Fed Funds Rate</th>
<th>Fiscal Balance</th>
<th>GDP</th>
<th>Real exchange rate</th>
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<td>1</td>
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<tr>
<td>3</td>
<td>4.9</td>
<td>11.3</td>
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<td>∞</td>
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<td>30.4</td>
<td>8.3</td>
<td>20.0</td>
<td>21.4</td>
</tr>
</tbody>
</table>

*Source:* Authors’ calculations.
FIGURE 1
REAL GDP IN MEXICO, 1980–2003

Source: INEGI. Sistema de Cuentas Nacionales de México.

FIGURE 2
SEASONALLY-ADJUSTED REAL GDP IN MEXICO, 1980–2003

Source: Authors’ calculations.
FIGURE 3
TRENDS IN REAL GDP

Notes: Trends are indicated by dotted lines.
Source: Authors’ calculations.
FIGURE 4
DEVIATIONS FROM TREND IN REAL GDP

(a) Dev. from Piecewise Trend

(b) Deviations from HP Trend

(c) Deviations from BN Trend

(d) Dev. from Peak-to-Peak Trend

Source: Authors’ calculations.
FIGURE 5
PUBLIC SECTOR REVENUE IN MEXICO, 1980–2003

(a) Total Revenue  
(b) Federal Tax Revenue  
(c) Income Tax  
(d) VAT  
(e) Excise Tax  
(f) Trade Taxes  
(g) Federal Nontax Revenue  
(h) Public Sector Enterprises

Source: Authors’ calculations. Each series is measured in billions of 1993 pesos. Dotted lines indicate the HP trend of each series.
FIGURE 6
CYCLICAL COMPONENTS OF PUBLIC SECTOR REVENUE, 1980–2003

(a) Total Revenue
(b) Federal Tax Revenue
(c) Income Tax
(d) VAT
(e) Excise Tax
(f) Trade Taxes
(g) Federal Nontax Revenue
(h) Public Sector Enterprises

Source: Authors’ calculations. Deviations from trend are measured in percent (left axis) Dotted lines indicate the cyclical component of real GDP (right axis).
FIGURE 7
PUBLIC SECTOR EXPENDITURE IN MEXICO, 1980–2003

Source: Authors’ calculations. Each series is measured in billions of 1993 pesos. Dotted lines indicate the HP trend of each series.
FIGURE 8
CYCLICAL COMPONENTS OF PUBLIC SECTOR EXPENDITURE, 1980–2003

Source: Authors’ calculations. Deviations from trend are measured in percent (left axis). Dotted lines indicate the cyclical component of real GDP (right axis).
FIGURE 9
CYCLICAL COMPONENTS OF OIL-BASED REVENUE IN MEXICO, 1980–2003

(a) Excise Tax on Gasoline

(b) Oil Royalties

(c) Revenue of PEMEX

Source: Authors’ calculations. Deviations from trend are measured in percent (left axis). Dotted lines indicate the cyclical component of the relative price of oil (right axis).
FIGURE 10
MEASURES OF THE CYCLICALLY-ADJUSTED BUDGET BALANCE IN MEXICO, 1980–2003

(a) Primary Balance
(b) Overall Balance
(c) Cyclically-Adjusted Primary Bal.
(d) Oil and Cycle-Adjusted Pr. Bal.
(e) Cycle Adjustment
(f) Oil Price Adjustment

Source: Authors’ calculations. All variables are measured in percent of the trend level of GDP.
FIGURE 11
THE DISCRETIONARY BALANCE AND THE FISCAL IMPULSE

(a) Alternative Measures of the Primary Balance

(b) The Fiscal Impulse

Source: Authors’ calculations. All series are measured in percent of the trend level of GDP.
FIGURE 12
IMPULSE RESPONSE FUNCTIONS

Impulse Response of the Oil- and Cycle-Adjusted Primary Balance to

(a) Fiscal Shock

(b) Output Shock

Impulse Response of Output to

(c) Fiscal Shock

(d) Output Shock

Note: The output shock is an unanticipated 1 percent increase in Mexico's output. The fiscal shock is an unanticipated 1 percent of GDP improvement in the oil- and cyclically-adjusted fiscal surplus.

Source: Authors' calculations.
FIGURE 13
DEVIATIONS OF OUTPUT FROM TREND, AND THE ESTIMATED COMPONENT DUE TO FISCAL SHOCKS

Source: Authors’ calculations.