PRELIMINARY DRAFT
FINAL PAPER PUBLISHED IN THE BOOK:
The Making of National Economic Forecasts
Edward Elgar Publishing.

Mexico, Current Quarter Forecasts

Alfredo Coutiño

June 2007
(Revised [4]: February 2008)

I. The Mexican Economy

Mexico is a relatively open economy, but with some degree of regulation, particularly in sectors considered strategic by the government. The country has made important efforts in its transition from a state-regulated to a more open market economy in the past two decades. However, even though the benefits of the changes implemented have been evident, the pace of structural reform has been slow in the past ten years.

The country set out on its openness path just a few years after the last episode of nationalization measures occurred in 1982, undertaken in connection with the arrival of the world debt crisis. The financial and economic collapse, and its devastating effects, left the country with few options other than the path of economic openness and deregulation, in order to deal with the stubborn inflation and persistent economic imbalances. The first step in that direction was taken at the middle of the 80s, with the country joining the General Agreement on Tariffs and Trade (GATT). A few years later, that measure was followed by an intensive process of privatization of state-owned companies, including the previously nationalized banking system. The next step was the deepening of economic openness through the implementation of the North American Free Trade Agreement (NAFTA) in 1994, followed by a series of bilateral trade agreements. At the end of the 90s, the banking system openness was accelerated by allowing foreign investors to

participate more in the financial sector. Other minor reforms were also undertaken in the decade of the 90s, including the political area, with the reform of the electoral system.

Undoubtedly, all these changes gave the Mexican economy more flexibility and removed important bottlenecks. Economic performance improved significantly, and society increased its participation under an environment of more political openness. The economy was less regulated, but not totally deregulated. The external sector developed to become one of the main engines of growth; exports diversified; and the country's dependence on oil output was reduced. However, the link between Mexico and the U.S. strengthened to the extent of making the Mexican business cycle highly dependent on U.S. economic performance, for better or worse. On one hand, Mexico benefited from the partnership with the U.S. not only when the northern neighbor was in expansion, but also when the U.S. could provide financial rescue for the Mexican economy when there was a case of potential default during the peso crisis at the end of 1994 and beginning of 1995[1/]. On the other hand, it was adversely affected by the U.S. recession in 2001.

Tourism has been an important source of foreign income for the country not only because of its closeness to the U.S. but also because of its competitive prices. In fact, since the implementation of a more flexible exchange rate system in 1995, the depreciation of the peso has made the country more attractive to foreign tourists. But also the trade agreement in 1994 gave an extra impulse to the country as a vacation destiny. Thus, tourism revenues multiplied by 150% during the first ten years of NAFTA, and doubled up from 1993 to 2006, giving the country a positive net balance that increased by 4 times during those 13 years.

[1/] Also known as the tequila crisis. Details can be found in Klein and Coutino (1996).

Another important feature of Mexico during the fourteen years of NAFTA has been the increasing role gained through remittances sent home by Mexican workers abroad. During the first ten years of NAFTA alone, remittances multiplied by 4.5 times, surpassing the amount of foreign direct investment in 2003. Thus, since 2003, remittances became the second source of foreign income for Mexico, after oil revenues. Since most of the remittances are received by low-income families in Mexico, with a marginal propensity to consume close to one, this explains the strong dynamic reported by household consumption and also the marginal effects on domestic saving. The increase in remittances reflects not only the efficiency gained by the banking sector and authorities in tracking those financial activities, but also the important contribution of those income flows to the whole economy[2/].

In general, it is possible to say that the Mexican economy has benefited greatly from the openness measures undertaken in the last two decades of the 20th century. The openness of trade and capital accounts generated not only a boom in Mexican exports but also an enormous increase of capital flow into the country, particularly in the form of foreign direct investment. Foreign investors brought more financial resources for Mexican partners but also provided better technology to Mexican industry, thus making production processes more efficient. With NAFTA, physical investment also increased in the form of new plants, buildings, and construction activity. In order to take advantage of the trade agreement, not only local industries had to expand and modernize but also foreign companies established in the country, particularly U.S. subsidiaries. Thus, Mexico had to increase investment in infrastructure.

[2/] For a detailed analysis on remittances see Coutino (2005A)

In this way, the accumulation of capital increased and multifactor productivity advanced. As a result, the country gained some ground in international competitiveness. Mexican exports gained market share in the U.S., and the country's surplus, with its main trade partner, increased significantly. Mexican consumers found not only a wider supply of goods but also access to less costly merchandise. Mexico restored its international reputation and respect by showing macroeconomic discipline and paying off its debt (from the financial rescue package) in advance of the original maturity. Mexico gained qualification as an investment-grade country for the first time.

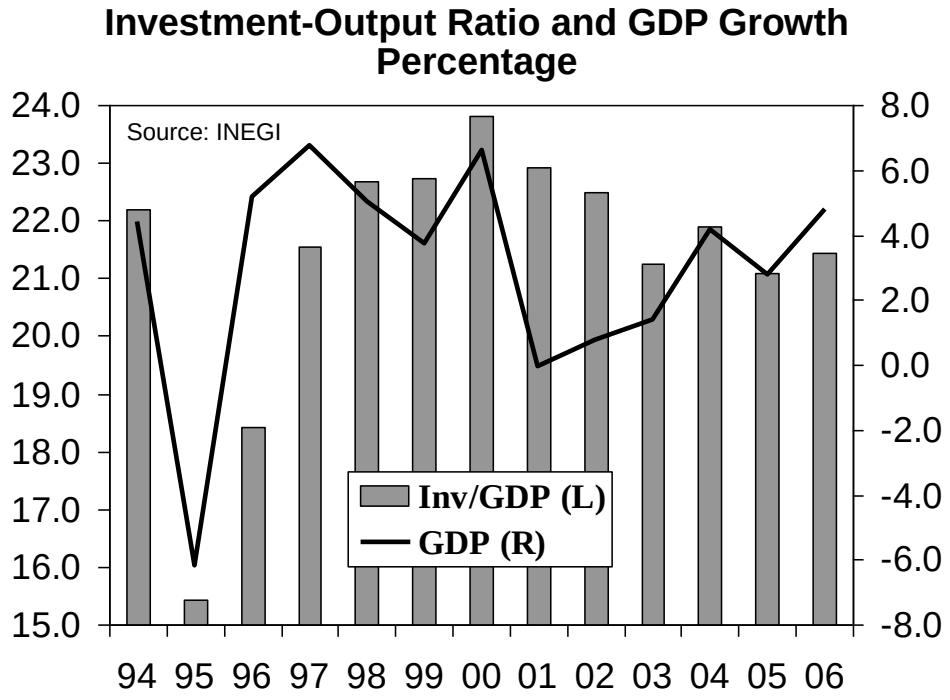
Unfortunately, in the past six years (2001-2006) the country did not continue deepening the structural reforms. The arrival of the first government from an opposition party (PAN), after 71 years of the PRI in power, introduced a pause in the process of structural change. The lack of political leadership made the new government fail to get the approval of main reform proposals sent to Congress. By then, the country was in need of a second round of reforms such as fiscal, labor, energy, pensions, and state[3/]. It was also necessary to reinforce public policies to reduce poverty and promote social progress. Given the lack of political skills of the new government, those measures were not implemented and the country lagged behind international competitors.

The absence of new reforms not only restricted the country's potential, but it also reduced production capacity. Mexico lost attractiveness for foreign investors. Investment from abroad did not stop, but did not increase significantly. The national private sector preferred either to send its savings abroad or choose speculative investments. Hence, the country suffered a disinvestment process. In fact, the fundamental sources of growth weakened during those six years. The investment-output coefficient fell from 24% of

[3 /] More details in Coutino (2006A).

GDP in 2000 to 22% in 2006; productivity advanced at only a modest rate, and technological change was practically absent. Thus, Mexican exports lost ground in the U.S. market and the country lost steps in world ranking. All these factors explain the poor performance of the Mexican economy during the 2001-2006 period, with growth averaging only 2.3%.

In fact, the past administration (2001-2006) was not able to sustain the growth path at rates similar to those at the end of the previous administration (6%), precisely because of a disinvestment process occurred. President Fox was not able to fulfill one of its main economic promises: growth of 7.0%. During his campaign and at the beginning of the administration, his economic team proposed an average growth rate of 7% during the six-year term. Later on, and after repetitive failure in Congress with rejection of various fiscal proposals, the administration recognized the economy's difficulties and switched the 7% growth target to the end of the period, which, at the end, was also unattained. It was clear for a small group of analysts, with respectable econometric models, that the Mexican economy was not going to be able to expand at rates above 5% during the period, since the fundamental sources of permanent growth were weakening instead of strengthening.



At present, Mexico is certainly a wide-open economy, but it is not deregulated enough. There still exist some rigid markets and sectors that are becoming obstacles to economic progress. The degree of competition is still too low in some strategic sectors, because either there is government protection or monopoly power of big corporations. Thus, state-monopoly still exists in the energy sector; there is some monopoly power in telecommunications, and oligopoly in the banking system. Certainly, the country has made some progress in structural change, but it has been insufficient. Monetary policy is highly independent of the executive authorities, with an autonomous central bank. Fiscal policy has been immunized from populism, and fiscal discipline has been institutionalized[4/]. One component of the government pension system has been recently reformed, but this is not the case of pensions in other public institutions[5/]. A minimal tax

[4 /] A detailed analysis in Coutino (2006).
[5 /] See Coutino (2007).

reform was also approved in 2007[6/]. However, a more profound fiscal reform is still needed, as well as the openness of the energy sector to private participation. The labor market needs to be more flexible in order to allow labor mobility. Political and justice institutions need to be reinforced and respected with stricter law enforcement.

Thus, the lack of reforms in the previous six years made the Mexican economy less competitive and a weaker player in the international league. The road to reform is still long for the country, but it will become even longer if Mexico continues to be unable to deepen structural change[7/]. In that regard, the present administration (Calderón 2007-2012) has recognized the structural weakness of the Mexican economy, and consequently proposed more modest economic growth for its presidential period.

Under these circumstances, the process of modeling and forecasting the Mexican economy will continue to include some challenges, since market behavior is not fully guided by free competition, and the flow of information is not yet totally efficient. In this situation, markets can sometimes react in a way quite different from the predictions of economic theory. Some prices would behave in such a way that would not lead to optimal resource allocation in the economy. Other than that, given the well-defined structure of the Mexican economy and the development of a national system of statistics, the economy can be modeled in great detail, not only by a structural model but also by a high-frequency model. This is precisely our methodology for the analysis of the Mexican economy through our high-frequency forecasting model.

[6/] See Coutino (2007B), and Coutino (2007C).
[7/] See Coutino (2007B).

II. The High-Frequency Forecasting Model

The development of a quarterly system of National Accounts and the publication of monthly strategic indicators related to production activity, financial markets, and prices allow us to develop a system of high-frequency forecasts in order to anticipate the quarterly GDP well in advance of official publication. It also allows us to respond more efficiently to an increasing user demand for short-term forecasts. The main purpose of the High-Frequency Forecasting (HFF) model is to provide analysts with an anticipation of the current quarter GDP by replicating, as close as possible, the methodology used by the statisticians in charge of the National Accounts, but executed earlier. The model for Mexico[8/] follows the methodology developed at the University of Pennsylvania for the Current Quarter Model of the U.S. economy[9/].

The HFF model predicts the quarterly GDP using monthly information on economic activity, financial market transactions, and readings on futures, forwards and expectations. The methodology combines the use of high-frequency indicators, time series equations, and regression analysis. The GDP forecast is generated by three different approaches: through production (supply), expenditure (demand), and a canonical form (principal components)[10/] of many advance indicators. Since the model is a purely econometric forecasting system, it does not rely on personal adjustment. It is automatically re-estimated every month (weekly for the U.S. and China models), when new pieces of information are publicly available and incorporated into the system. The

[8 /] This model constitutes the first high-frequency forecasting model for the Mexican economy, and it was developed by the author as his doctoral dissertation under the supervision of Lawrence R. Klein. See Coutino (2004), and Klein and Coutino (1999).
[9 /] Klein and Park (1993), and Klein and Park (1995).
[10 /] Coutino (2004), and Coutino (2005).

three different approaches generate three independent forecasts of GDP, which are averaged to produce a single quarterly estimate.

In Mexico, the quarterly GDP is computed by the National Institute of Statistics and Geography (INEGI) using the production side. It says, GDP is estimated as the value added of production sectors. The official release is announced six weeks after the end of each quarter. GDP by the demand side is released one month later (it means ten weeks after the end of each quarter), but it does not include revisions of the total since the discrepancy is always part of inventory change. INEGI does not produce quarterly figures for GDP by the income side. Thus, the first two approaches in our HFF model for Mexico include the production and the expenditure sides. The third approach is built using the principal component methodology, which is also called the aggregative approach. The first two methods try to estimate quarterly GDP using monthly indicators similar to those INEGI uses to compute the quarterly National Accounts aggregates. For example, the volume of retail sales is one of the relevant indicators to compute private consumption from the National Income and Product Accounts (NIPA). The quarterly private consumption aggregate is then linked to the monthly retail sales indicator through a bridge equation, as explained later in this chapter.

The first approach in our model is the production side. INEGI collects information on the value added of production for all types of economic activities, and then computes the corresponding sector aggregate. Thus, the monthly information on production of each of several industrial activities generates the quarterly industrial GDP. The same occurs with agriculture and services. Hence, in order to replicate what INEGI does, we could survey the industrial sector, and then compute the aggregate industrial

value added. Fortunately, we do not have to do that, since INEGI already does it. Thus, every month, INEGI computes the approximate value added of agriculture, industry, and services. With this sectoral information, it also computes an aggregate index of production for the whole economy, which is called General Index of Economic Activity (IGAE). The IGAE represents a little more than 85% of the total production of goods and services in the economy, including agriculture, industry and services. In this sense, the IGAE is considered a measure of the monthly GDP.

The existence of the monthly IGAE makes our life much easier, since we can use it as the best single monthly indicator to predict the quarterly GDP by the production side analysis. The IGAE is published six weeks after the end of each month. For example, by the middle of March we know the observed GDP for January; by the middle of April we know the observed GDP for February, and so on. Hence, the first approach (production side) generates the quarterly GDP through two basic equations: the quarterly IGAE based on the monthly IGAE, and the bridge equation.

$$IGAE\%qt = pch\ (IGAEqt) \quad (1)$$

$$GDP\%qt = f\ (IGAE\%qt) \quad (2)$$

where IGAE%qt is the annual percentage change of the quarterly IGAE; pch(IGAEqt) is the annual percentage change of the 3-month average of monthly IGAE; GDP%qt is the annual percentage change of the quarterly GDP, with q=1,2,3,4 representing the quarter of the year, and t=1,2,…..n, indicating the year. Thus, equation (1) computes the quarterly IGAE using the 3-month average of the monthly IGAE, while equation (2) estimates the quarterly GDP as a function of the quarterly IGAE, both equations in percentage changes.

The OLS estimation of equation (2), using a sample from the first quarter of 1993 to the last quarter of 2006, is as follows:

Total GDP by production:

$$GDP\%qt = -0.01015 + 1.0054 * IGAE\%qt \quad (3)$$
$$(0.6) \quad (175.5)$$

$$R^2 = 0.99, \quad DW=2.75$$

Since the intercept is not statistically significant, the quarterly GDP is almost fully explained by the quarterly IGAE, in terms of percentage changes.

In addition, we also estimate GDP for the three main production divisions: primary, secondary, and tertiary. Equations for primary and tertiary GDP (agriculture and services) are estimated as functions of the General Index of Economic Activity, as shown below.

Meanwhile, the equation for secondary GDP (industry) comes from the principal components section as an ARIMA (autoregressive integrated moving average) equation. In this case, we use the bridge equation linking the quarterly industrial production (IPI%qt) to the 3-month average of the monthly indicator (IPIqt) obtained from the ARIMA equation, both variables in percentage changes.

Primary Sector GDP:

$$GDP1\%qt = 5.22 - 0.23 * IGAE\%q_{t-1} - 0.22 * IGAE\%q_{t-4}$$
$$(3.0) \quad (1.1) \qquad\qquad (2.9)$$

$$- 0.23 * GDP1\%q_{t-1} - 0.021 * GDP1\%q_{t-2}$$
$$(1.4) \qquad\qquad (0.1)$$

$$- 0.16 * GDP1\%q_{t-3} - 0.48 * GDP1\%q_{t-4}$$
$$(0.7) \qquad\qquad (2.9)$$

$$R^2 = 0.55, \quad DW=1.98$$

Tertiary Sector GDP:

$$GDP3\%qt = \underset{(0.8)}{0.30} + \underset{(18.5)}{0.88} * IGAE\%qt$$

$$R^2 = 0.98, \quad DW=1.85$$

Secondary Sector GDP:

$$IPI\%qt = pch\,(IPIqt)$$

Since these three divisions of GDP (by the production side) are only for distributional purpose, then the discrepancy between the total GDP obtained from them and the total from equation (3) is called taxes and subsidies.

The second approach computes GDP through the estimation of the quarterly aggregates of domestic demand linked to the corresponding monthly indicators similar to those used by INEGI. Here, we also use the two basic equations: the monthly indicator linked to its quarterly figure and the bridge equation.

$$N\%qt = pch\,(Nqt) \tag{4}$$

$$DA\%qt = f\,(N\%qt) \tag{5}$$

where N%qt stands for the annual percentage change of the quarterly indicator, pch(Nqt) is the annual percentage change of the 3-month average of the monthly indicator, and DA%qt is the quarterly demand aggregate as a function of the quarterly indicator, both in percentage changes.

The following list shows the corresponding monthly indicators linked to the quarterly demand aggregates:

Quarterly Demand Aggregates (NIPA):	*Monthly indicators:*
Private consumption (Cp)	Retail sales volume (RSI)
Government consumption (Cg)	Primary Gov. spending (CGS)

Fixed investment (IF)	Gross fixed investment (GFI)
Export of goods and services (X)	Export of goods (EXP)
Import of goods and services (M)	Import of goods (IMP)
Inventory change (ΔS)	Lagged inventory change (ΔSt-i)

Estimation results are as follow, for a sample beginning in 1993 and ending in the last quarter of 2006. A dummy variable was included from 1994 to 2003 to capture the 10-year NAFTA effects on trade (DUM9403). No dummy variable was necessary for the peso crisis in 1995.

Private consumption:

$$Cp\%qt = \underset{(4.5)}{1.95} + \underset{(12.5)}{0.62}\ RSI\%qt \qquad (6)$$

$R^2 = 0.94$, DW=2.18

Government consumption:

$$Log\ (Cg)qt = \underset{(2.2)}{0.25}\ Log\ (CGS/PDGDP)qt - \underset{(1.9)}{0.15}\ Log\ (CGS/PDGDP)q_{t-4} + \underset{(250.2)}{0.92}\ Log\ (Cg)q_{t-4} \qquad (7)$$

$R^2 = 0.89$, DW=1.76

Fixed investment:

$$IF\%qt = \underset{(4250.3)}{0.99}\ GFI\%qt \qquad (8)$$

$R^2 = 1.00$, DW=1.67

Export of goods and services:

$$X\%qt = \underset{(2.2)}{5.65} + \underset{(7.5)}{0.72}\ EXP\%qt - \underset{(2.5)}{3.87}\ DUM9403 \qquad (9)$$

$R^2 = 0.98$, DW=1.58

Import of goods and services:

$$M\%qt = \underset{(2.6)}{-3.85} + \underset{(15.5)}{0.95}\ IMP\%qt + \underset{(2.6)}{5.75}\ DUM9403 \qquad (10)$$

$R^2 = 0.96, \quad SW=1.66$

Inventory change:

$$\Delta Sqt = \underset{(2.3)}{-0.24}\ \Delta Sq_{t-1} - \underset{(1.6)}{0.12}\ \Delta Sq_{t-2} - \underset{(1.4)}{0.11}\ \Delta Sq_{t-3} + \underset{(8.2)}{0.78}\ \Delta Sq_{t-4} \qquad (11)$$

$$+ \underset{(2.6)}{42550}\ DUM9403$$

$R^2 = 0.78, \quad DW=2.05$

At the end, total GDP is computed as the sum of all the demand components estimated with the previous equations:

Total GDP by expenditure:

$$GDP = Cp + Cg + IF + \Delta S + X - M \qquad (12)$$

The third approach is given by the principal components method. The first step is the selection of a set of strategic indicators known to be strongly related to GDP. These monthly indicators come from industrial activity, expenditure, financial and monetary sectors, labor, and trade. Then, we extract the main independent sources of variation from this set of 15 monthly indicators, which are called the principal components. These new mutually uncorrelated variables are used as independent variables in the explanation of the quarterly GDP[11/]. Hence, we regress the quarterly GDP on the 3-month average of the principal components. The following is the list of strategic monthly indicators selected:

Manufacturing Production Index (IMI)

Construction Industry Index (ICI)

[11 /] More references in Coutino (2004), and Coutino (2005).

Industrial Production Index (IPI)

Gross Fixed Investment Index (GFII)

Wholesale Sales Index (WSI)

Retail Sales Index (RSI)

Man-Hours Worked in Manufacturing (HOUR)

Real Average Wages in Manufacturing (RAW)

Employment Rate (EMR%)

Maquiladora Real Exports (RMAQ)

Volume of Crude Oil Exports (VOX)

Real Money Supply (RM1)

Real Interest Rate (RIR)

Real Exchange Rate (RER)

Real Tourism Balance (RTOU).

After removing seasonality and trend from those monthly series, we compute the principal components (PC), and then estimate the equation for the quarterly GDP as a function of the vector of independent sources of variation.

Total GDP by principal components:

$$\begin{aligned} GDPqt = {} & 0.98 + 0.028\,PC1 - 0.00035\,PC2 + 0.0022\,PC3 + 0.0024\,PC4 \\ & (850.5)\ (32.4)\qquad (0.8)\qquad\ (2.6)\qquad\ (2.8) \\ & + 0.0034\,PC5 - 0.0032\,PC6 - 0.0004\,PC7 + 0.006\,PC8 \\ & (1.8)\qquad\ (3.2)\qquad\ (0.9)\qquad\ (3.6) \end{aligned} \tag{13}$$

$R^2 = 0.99, \quad DW=1.94$

With equations (3), (12), and (13) we compute three different values for GDP, and then average them to get a single forecast for quarterly GDP. It is important to notice that

these three equations for total GDP generate three independent estimates of GDP, since they use different approaches and also different sets of source variables.

Finally, in order to compute the nominal value of GDP, we need to have an equation for the price deflator (PGDP). We build this equation using the principal components methodology again. We select a set of 10 monthly indicators and extract the main sources of variation. These indicators are different from those used previously for GDP estimation. Then, we estimate the equation for the quarterly GDP price deflator as a function of the principal components. We included the dummy for the NAFTA effect.

GDP Price Deflator:

$$\begin{aligned} PGDPqt = {} & 0.98 + 0.11\,PC1 + 0.0096\,PC2 + 0.018\,PC3 - 0.0032\,PC4 \\ & (202.4)\ (48.5) \quad (4.4) \quad (4.8) \quad (1.8) \\ & + 0.0082\,PC5 + 0.0036\,PC6 - 0.0063\,PC7 + 0.0038\,DUM9403 \\ & (2.8) \quad (2.0) \quad (2.6) \quad (1.4) \end{aligned} \tag{14}$$

$$R^2 = 0.99, \quad DW=2.06$$

III. Forecast Summary

The three different approaches generate three independent estimates of quarterly GDP, which are averaged to obtain only one quarterly result. The table below summarizes the forecast process. The forecast is made every month for the current quarter GDP and for the next three quarters. Thus, the first column in the table indicates the month in which the forecast was done. We usually compute the forecast at the beginning of the month, after all the indicators are collected in the previous month. Thus, the first number in the second column represents our GDP forecast of 3.8% for the first quarter of 2005, which was made at the beginning of November, 2004. It means, our first

forecast for the first quarter was made five months before the end of the first quarter, but seven months before the official release of GDP values by INEGI. Then, we keep forecasting the first quarter until the beginning of May, just two weeks before the official release is announced (middle of May). The official figure is indicated at the end of the third column in shaded brackets. We do the same for the second quarter GDP, with the first forecast made at the beginning of February 2005, seven months before the government releases the official figure at the middle of August. And so on.

TABLE 1
Monthly Forecasts of Quarterly GDP
(% change, year before)

	2005.I		2005.II		2005.III		2005.IV	
MONTH	Fcst.	Obsv.	Fcst.	Obsv.	Fcst.	Obsv.	Fcst.	Obsv.
Nov~04	3.8							
Dec~04	3.6							
Jan~05	3.8							
Feb~05	4.2		4.3					
Mar~05	3.8		4.1					
Apr~05	3.1		4.0					
May~05	2.8	[2.4]	3.9		3.4			
Jun~05			3.9		3.4			
Jul~05			3.6		3.4			
Aug~05			3.4	[3.1]	3.0		3.9	
Sep~05					2.5		4.0	
Oct~05					2.7		3.8	
Nov~05					2.8	[3.3]	3.8	
Dec~05							3.5	
Jan~06							3.1	
Feb~06							3.0	[2.7]

Note: Shaded numbers in brackets are official releases.

In Table 2, we summarize the same forecast process for the GDP price deflator, with the first forecast for the first quarter of 2005 made in November of 2004, seven months before the official release.

TABLE 2
Monthly Forecasts of GDP Price Deflator
(% change, year before)

	2005.I		2005.II		2005.III		2005.IV	
MONTH	Fcst.	Obsv.	Fcst.	Obsv.	Fcst.	Obsv.	Fcst.	Obsv.
Nov~04	5.6							
Dec~04	6.0							
Jan~05	5.6							
Feb~05	5.2		4.8					
Mar~05	5.5		5.0					
Apr~05	5.4		5.0					
May~05	5.4	[5.6]	5.1		4.8			
Jun~05			5.2		4.8			
Jul~05			5.4		4.9			
Aug~05			5.5	[5.9]	5.0		4.5	
Sep~05					5.2		4.6	
Oct~05					5.2		4.6	
Nov~05					5.2	[5.0]	4.7	
Dec~05							4.8	
Jan~06							5.0	
Feb~06							5.1	[5.4]

Note: Shaded numbers in brackets are official releases.

IV. Forecast Accuracy

In order to test the forecast accuracy, we perform repetitive forecasts for the first and second quarters of 2006, including the consecutive observed monthly information as it becomes available. Thus, we evaluate the precision of the forecast every month as we use more observed information, but we can also assess the convergence direction of the forecast to the official figure.

The official figures for the quarterly GDP are released six weeks after the end of each quarter. Thus, GDP for the first quarter of 2006 was released at the middle of May. Also, most of the monthly indicators, used in the computation of GDP by the three different approaches, are released between four to six weeks after the end of the month. Based on that lead time, we test the model accuracy by performing three repetitive forecasts for the same quarter in three consecutive months. The first forecast is generated

at the beginning of March of 2006, which includes observed monthly information up to January, the first month of the first quarter. The second forecast is generated at the beginning of April, with observed monthly information up to February, the second month of the first quarter. Then, the third forecast is performed at the beginning of May, with observed information up to the third month of the first quarter (March). We expect that the third forecast should be more precise and closer to the official figure, since it includes more relevant and complete information for the three months of the quarter.

In Table 3 we see that our first GDP forecast of 5.1%, for the first quarter of 2006, was generated at the beginning of March. This first forecast includes two types of information, observed monthly indicators for the first month of the quarter and estimated indicators for the second and third months. Then, the second forecast was done one month later, at the beginning of April, including two months of observed information (January and February) and estimated indicators for only the third month. The second forecast increases the estimate to 5.2%. The third forecast was done at the beginning of May (two weeks prior to the official release), and includes most of the observed information for the three months of the quarter. This third forecast raises the estimate to 5.3%. The official figure was released two weeks later, at the middle of May, and was 5.5% (as indicated by the third column), very close to our latest forecast.

TABLE 3
GDP Forecasts 2006
(% change, year before)

	2006.I		2006.II	
MONTH	Fcst.	Obsv.	Fcst.	Obsv.
Mar~06	5.1			
Apr~06	5.2			
May~06	5.3	[5.5]		
Jun~06			4.9	
Jul~06			4.9	
Aug~06			4.8	[4.7]

We do the same exercise for the second quarter of 2006, as illustrated by the fourth column of Table 3. The first forecast (generated at the beginning of June), with only one month of observed information for the second quarter, estimated the quarterly GDP growth at 4.9%. The second forecast, one month later, maintained the estimate at 4.9%, indicating that the new monthly information simply reconfirmed the previous forecast. Then, the third forecast (made two weeks before the official release) indicated that the new relevant monthly information for the third month of the second quarter suggested a downward revision of our previous estimate to 4.8%. The official figure announced two weeks later was 4.7%, even closer to our previous forecast.

These two exercises show a quite good degree of accuracy of our HFF model. The model generates not only reasonably precise forecasts but also a well-defined convergence. In both quarters, the forecast convergence is always from either below or above, but never erratically such as one time up and another down. In other words, the high-frequency forecast converges asymptotically to the official figure.

The same accuracy test is performed for the model of the GDP price deflator. The forecasts obtained are shown in Table 4. Again, the forecast precision is fairly good, and the convergence appears in both quarters of 2006.

TABLE 4
GDP Price Deflator Forecasts 2006
(% change, year before)

	2006.I		2006.II	
MONTH	Fcst.	Obsv.	Fcst.	Obsv.
Mar~06	5.0			
Apr~06	4.8			
May~06	4.8	[4.7]		
Jun~06			5.8	
Jul~06			6.2	
Aug~06			6.6	[8.6]

Even though the estimates for the second quarter are less precise than those of the first quarter, the model shows a forecast improvement as soon as new relevant monthly information is added. Indeed, the forecast that was made two weeks prior to the official release is much more accurate than the forecast generated three months in advance. This suggests that any new single piece of information is relevant and adds some extra value, either to confirm or correct the forecast.

V. A High-Frequency Prediction for 2007

The High-Frequency Forecasting Model for Mexico has been actively in use since 2002, and the results are summarized in a monthly publication entitled ***"The Report on Mexico***"[12/], which is available at the website of Project LINK-United Nations at: www.chass.utoronto.ca/link/mexicocqm/mexicocqm.htm .

The latest version of the model generates forecasts for four quarters ahead. At the beginning of 2007, the model was used to forecast the four quarters of the year. Thus, since the end of 2006, the model was anticipating a slowdown of economic activity in Mexico for the calendar year 2007. Monthly economic indicators for the last quarter of 2006 already signaled slower activity, which was extrapolated to 2007 by using ARIMA equations for model input.

The main economic indicators at the end of 2006 were showing a slower Mexican economy, probably affected by a contractionary phase of the political business cycle. 2006 was a year of elections and 2007 the beginning of the new administration. The political business cycle has two well-defined phases every six years with the change of

[12 /] Monthly publication by the Center for Economic Forecasting of Mexico (CKF). See CKF (2007).

the presidential administration. The first is an expansionary phase, which covers the first six months of the last year of the outgoing government. In this phase, fiscal policy is used to spur the economy in order to produce a sentiment of well-being, which in turn might induce voters to maintain the status quo. The second is a contractionary phase, in which the fiscal stimulus is withdrawn after the election (beginning of July), and it extends until the first half of the first year of the new administration. Thus, the effects of the political cycle are reflected in both, an economic expansion in the last year of the outgoing government and a slowdown in the first year of the new government. This is precisely the case of 2006 and 2007. Thus, GDP strongly expanded 4.8% in 2006, with activity showing the two phases mentioned above: expansion in the first half and deceleration in the second half of the year.

Since the fiscal stimulus started to decelerate during the second half of 2006, and was expected to remain low during the first semester of 2007, monthly indicators were replicating that trend. This explains why the HFF model was anticipating an extended slowdown during the first half of 2007[13/]. Hence, our latest forecast for the first quarter of 2007 was estimated at the beginning of May, two weeks before the official release, and it indicated that GDP would grow 2.3%, a rate lower than 4.3% in the previous quarter and 5.5% one year before. This is illustrated in Table 5 in the row named "average real GDP". The forecast of 2.3% for the first quarter of 2007 is the average of the three estimates obtained by different approaches: 2.8% from principal components, 2.2% from production, and 1.8% from expenditure.

The model also anticipated that the economy would continue to decelerate in the second quarter, with growth falling to 1.0%. In the third quarter it was estimated that

[13 /] More details in Coutino (2007A).

economic activity would start to recover with growth of 1.9%, and then would continue to grow at a rate of 2.9% in the fourth quarter. Thus, the model predicted that the Mexican economy would report a deceleration in 2007, with growth of only 2.0% in the year after 4.8% in 2006.

Observed data showed that growth effectively decelerated to 2.6% in the first quarter, stayed decelerated at 2.8% in the second quarter, and started to recover in the third quarter (3.7%) precisely as the model predicted. Thus, even though growth did not continue to fall in the second quarter, the HFF model accurately anticipated that Mexico would not escape in 2007 from the traditional deceleration that characterizes the beginning of each new administration.

TABLE 5
GDP Forecasts 2007

	2006.I	2006.II	2006.III	2006.IV	2007.I	2007.II	2007.III	2007.IV
	observed				estimated			
REAL GDP (1993 billion pesos)								
Principal Components	1793.6	1851.7	1802.9	1900.9	1844.4	1876.8	1845.1	1964.2
(%) Change, Year Ago	5.5	4.9	4.5	4.3	2.8	1.4	2.3	3.3
Production Side	1793.6	1851.7	1802.9	1900.9	1833.8	1869.1	1836.1	1954.9
(%) Change, Year Ago	5.5	4.9	4.5	4.3	2.2	0.9	1.8	2.8
Expenditure Side	1793.6	1851.7	1802.9	1900.9	1825.2	1862.8	1828.7	1946.1
(%) Change, Year Ago	5.5	4.9	4.5	4.3	1.8	0.6	1.4	2.4
Average Real GDP	1793.6	1851.7	1802.9	1900.9	1834.4	1869.5	1836.6	1955.1
(%) Change, Year Ago	5.5	4.9	4.5	4.3	2.3	1.0	1.9	2.9
Model forecast (one month - before the official release)	5.3	4.8	4.4	4.2	-	-	-	-

Note.- Shaded numbers are official figures.

Finally, by the second quarter of 2006 the economy was showing signs of having reached its maximum growth (as shown in Table 5), then it was evident that the goal of 7% growth was unattainable. In fact, by then, the disinvestment process was confirmed.

But since 2004, our model was showing an economy facing capacity restrictions given the fall of the investment-output ratio to 21% at the end of 2003 from 24% in year 2000.

VI. The Forecast for 2008

At the end of 2007, information on Mexican trade (non-oil) started to reflect some weakness of the U.S. economy in the last quarter of the year. At the same time, Mexican economic activity was facing disruptions caused by supply restrictions generated by non-favorable weather conditions. Hence, some moderation of the Mexican economy could be expected not only for the end of 2007 but also for the beginning of 2008.

These preliminary pieces of information, incorporated in our model, generate forecasts that indicate moderation of growth for the beginning of the year. However, since monthly indicators on domestic absorption show a continuous strengthening, given the normalization of the fiscal stimulus and the materialization of private decisions on consumption and investment, the model also predicts an acceleration of growth for the second half of the year.

Hence, the high-frequency forecasts for 2008 indicate GDP growth of 2.9% in the first quarter, followed by 2.8% in the second quarter, 3.8% in the third, and 4.3% in the last quarter, as shown in Table 6. In this way, the model is predicting growth of 3.5% for 2008, indicating that the Mexican economy will be back to the expansion path, after leaving behind the traditional deceleration in the first year of the new administration (2007) and overcoming the potential weakness of the U.S. economy in the first half of 2008.

Table 6 also contains the estimates generated by the model for the different aggregates of GDP (production and demand sides), GDP price deflator, and nominal GDP for 2008.

In Table 7, we present the forecasts for the main monthly indicators used in the three approaches of the HFF model. These are generated by ARIMA equations.

TABLE 6

Quarterly Aggregate Forecasts

	2007.I	2007.II	2007.III	2007.IV	2008.I	2008.II	2008.III	2008.IV
	observed				estimated			
REAL GDP (1993 billion pesos)								
Principal Components	1839.4	1903.6	1870.5	1982.6	1901.9	1968.3	1950.9	2077.8
(%) Change, Year Ago	2.6	2.8	3.7	4.3	3.4	3.4	4.3	4.8
Production Side	1839.4	1903.6	1870.5	1973.1	1890.9	1955.0	1939.7	2056.0
(%) Change, Year Ago	2.6	2.8	3.7	3.8	2.8	2.7	3.7	4.2
Expenditure Side	1839.4	1903.6	1870.5	1967.4	1883.6	1949.3	1932.2	2042.2
(%) Change, Year Ago	2.6	2.8	3.7	3.5	2.4	2.4	3.3	3.8
Average Real GDP	1839.4	1903.6	1870.5	1974.4	1892.1	1957.5	1940.9	2058.7
(%) Change, Year Ago	2.6	2.8	3.7	3.9	2.9	2.8	3.8	4.3
REAL GDP BY SECTORS (1993 bp)								
Total GDP (Production Side)	1839.4	1903.6	1870.5	1973.1	1890.9	1955.0	1939.7	2056.0
(%) Change, Year Ago	2.6	2.8	3.7	3.8	2.8	2.7	3.7	4.2
Primary Sector	88.3	96.7	82.6	109.3	90.2	99.6	85.8	114.0
(%) Change, Year Ago	0.2	3.8	5.3	2.8	2.2	3.0	3.8	4.3
Secondary Sector	445.2	465.0	469.4	471.8	457.7	476.6	486.3	492.5
(%) Change, Year Ago	0.6	0.8	1.8	3.2	2.8	2.5	3.6	4.4
Tertiary Sector	1157.5	1188.2	1167.8	1232.8	1190.3	1220.7	1211.3	1283.5
(%) Change, Year Ago	3.5	3.5	4.4	4.1	2.8	2.7	3.7	4.1
REAL GDP BY DEMAND (1993 bp)								
Total GDP (Expenditure Side)	1839.4	1903.6	1870.5	1967.4	1883.6	1949.3	1932.2	2042.2
(%) Change, Year Ago	2.6	2.8	3.7	3.5	2.4	2.4	3.3	3.8
Private Consumption	1323.0	1414.5	1466.8	1449.7	1373.2	1473.9	1531.3	1522.2
(%) Change, Year Ago	3.5	4.6	5.0	4.8	3.8	4.2	4.4	5.0
Public Consumption	146.0	172.0	137.8	197.3	149.5	176.8	142.2	204.8
(%) Change, Year Ago	-3.9	-1.6	0.7	1.8	2.4	2.8	3.2	3.8
Gross Fixed Investment	405.4	422.7	428.9	448.8	434.2	449.7	458.1	479.8
(%) Change, Year Ago	4.9	6.9	6.0	8.1	7.1	6.4	6.8	6.9
Exports	737.2	778.7	808.6	840.9	760.8	798.2	839.3	875.4
(%) Change, Year Ago	4.3	3.6	7.4	5.8	3.2	2.5	3.8	4.1
Imports	789.8	885.3	927.6	944.8	816.7	919.0	987.9	1012.8
(%) Change, Year Ago	5.6	7.5	9.8	6.5	3.4	3.8	6.5	7.2
GDP PRICE DEFLATOR (1993=100)								
GDP Deflator	511.9	507.0	511.4	515.5	538.5	532.3	533.9	537.2
(%) Change, Year Ago	4.2	-1.1	3.1	4.5	5.2	5.0	4.4	4.2
NOMINAL GDP (billion pesos)								
Total GDP	9415.0	9650.6	9566.3	10178.0	10188.5	10420.2	10363.4	11058.1
(%) Change, Year Ago	6.9	1.7	7.0	8.5	8.2	8.0	8.3	8.6

Note.- Shaded numbers are official figures.

TABLE 7

Monthly Indicator Forecasts

	2	0	0	7		2	0 0	8
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
PRODUCTION ACTIVITY									
General Indicator of Eco.Act.	152.0	151.8	146.2	157.1	158.9	155.9	149.7	146.2	152.2
(%) Change, Year Ago	4.5	4.3	2.7	4.7	3.8	3.2	3.0	3.0	2.7
Industrial Production Index	149.9	155.5	148.6	155.7	153.7	147.7	148.0	142.5	154.0
(%) Change, Year Ago	2.2	2.8	0.2	3.0	3.2	3.7	3.2	3.3	3.2
Gross Fixed Investment	186.9	192.1	172.7	189.3	188.3	199.8	192.8	175.8	189.8
(%) Change, Year Ago	7.7	7.5	2.7	8.3	8.2	7.9	7.1	7.8	6.3
Wholesale Sales Index	115.3	118.9	113.5	123.9	127.9	126.9	112.9	107.9	121.9
(%) Change, Year Ago	1.7	0.4	-0.9	7.6	6.9	6.6	5.9	6.0	4.3
Reatail Sales Index	117.6	119.7	113.8	119.4	122.4	154.9	121.9	110.9	116.9
(%) Change, Year Ago	4.2	3.7	2.8	4.1	4.6	4.8	3.9	3.9	2.8
EMPLOYMENT AND WAGES									
Open Unemployment Rate (% of AEP)	3.95	3.92	3.87	3.93	3.46	3.31	3.89	3.95	3.80
Real Wages in Manufacturing	98.4	100.2	96.8	98.8	99.1	131.1	98.1	97.1	101.1
(%) Change, Year Ago	1.1	1.7	0.9	2.4	2.3	2.0	1.9	2.0	1.8
PRICES (1994=100)									
Consumer Price Index	122.2	122.7	123.7	124.2	125.0	125.6	126.6	127.2	127.7
(%) Change	0.42	0.41	0.78	0.39	0.71	0.41	0.79	0.49	0.38
Producer Price Index	122.5	123.6	124.9	125.4	126.4	126.2	126.9	127.4	127.8
(%) Change	0.71	0.90	1.02	0.37	0.80	-0.09	0.56	0.38	0.26
Oil Price Mex. Mix (dlls)	64.54	63.04	67.32	71.78	80.05	77.77	78.59	73.59	68.77
(%) Change	7.6	-2.3	6.8	6.6	11.5	-2.9	1.1	-6.4	-6.6
FINANCIAL SECTOR									
Exchange Rate (peso/$)	10.80	11.04	11.05	10.84	10.87	10.85	10.93	10.98	11.01
(%) Change	-0.3	2.2	0.1	-1.8	0.2	-0.2	0.7	0.5	0.3
Interest Rate (Cetes 28)	7.19	7.20	7.21	7.20	7.44	7.44	7.50	7.50	7.50
Stock Exchange Index	31703	29486	30406	31908	29298	30043	30164	30109	30074
EXTERNAL SECTOR									
Exports (billion dlls)	22.632	24.462	23.097	26.135	24.415	22.569	20.411	21.378	23.045
(%) Change, Year Ago	14.1	7.1	12.7	12.7	17.1	12.2	7.4	9.0	6.4
Imports (billion dlls)	23.405	25.644	23.809	27.782	25.175	23.813	21.295	22.171	23.874
(%) Change, Year Ago	15.9	8.6	8.3	13.3	12.0	11.9	2.9	10.7	8.2
Trade Balance (billion dlls)	-0.773	-1.182	-0.713	-1.647	-0.760	-1.244	-0.884	-0.793	-0.829

Note.- Shaded numbers are official figures.

VII. Conclusion

We can see the HFF model as a valuable and important economic instrument not only to anticipate the current quarter GDP but also to adjust the short-term forecasts of larger-scale econometric models by providing initial values for projections from the latter. Each single piece of new high-periodicity information is extremely relevant to correct the short-term forecast. In the case of Mexico, the importance of the HFF model is demonstrated not only by its six years of use but also by its accuracy and prediction power.

This new generation of HFF models has the virtue of automatic re-estimation of coefficients, as soon as a new piece of information becomes available, which also represents an advance with respect to the generation of structural models. In addition, the high-frequency forecast is useful since it is the result of repetitive forecast analyses through time.

Finally, since these new econometric models are mechanical systems, they avoid forecast manipulation or subjective data adjustment. Professor Klein has said: **"economists are not musicians to tune up econometric models"**. Hence, the high-frequency forecast is the result of the interaction and power of economic information and not the output of the economist's mind. In this sense, the HFF methodology teaches that *"the wind should not be an explanatory variable in the econometric model; therefore, the forecast should not change with the wind direction"*.

VIII. References

CKF (2007). *The Report on Mexico*. Center for Economic Forecasting of Mexico (CKF), May 2007. Philadelphia, PA. www.ckf-forecasting.com.

Coutino, A. (2004). *A High-Frequency Forecasting Model for the Mexican Economy*. Ph.D. dissertation. University of Madrid.

Coutino, A. (2005). On the use of high-frequency economic information to anticipate the current quarter GDP: A study case for Mexico. *Journal of Policy Modeling*, 27, pp. 327-344.

Coutino, A. (2005A). Remittances: a new source of income for Mexico. *Dismal Scientist: LatAm*, June 2005, Moody's Economy.com.

Coutino, A. (2006). Mexico's new law ensures fiscal discipline. *Dismal Scientist: LatAm*, March 2006, Moody's Economy.com.

Coutino, A. (2006A). An economic strategy for Mexico (2007-2012). *Dismal Scientist: LatAm*, December 2006, Moody's Economy.com.

Coutino, A. (2007). Winds of potential reforms in Mexico. *Dismal Scientist: LatAm*, April 2007, Moody's Economy.com.

Coutino, A. (2007A). On the accuracy of our forecast for Mexico. *Dismal Scientist: LatAm*, May 2007, Moody's Economy.com.

Coutino, A. (2007B). Can reform succeed in Mexico? *Dismal Scientist: LatAm*, June 2007, Moody's Economy.com.

Coutino, A. (2007C). The relevance of Mexico's fiscal reform. *Dismal Scientist: LatAm*, August 2007, Moody's Economy.com.

Klein, L.R. , & Park, J.Y. (1993). Economic forecasting at high-frequency intervals. *Journal of Forecasting*, 12, pp. 301-319.

Klein, L.R., & Park, J.Y. (1995). The University of Pennsylvania model for high-frequency economic forecasting. *Economic and Financial Modeling*, pp. 95-146.

Klein, L.R., & Coutino, A. (1996). The Mexican financial crisis of December 1994 and lessons to be learned. *Open Economies Review*, 7, pp. 501-510. Reprinted in: *The collapse of exchange rates regimes: Causes, consequences and policy responses*. Edited by G. Tavlas (1997). The Netherlands: Kluwer Academic Publishers.

Klein, L.R., & Coutino, A. (1999). A High-Frequency Model for the Mexican Economy". Ciemex-Wefa, Inc. July 1999. Reprinted in: *Essays on Macroeconomic Aspects of Mexico*. Instituto Lucas Alamán de Estudios Económicos. Mexico. November 2000.