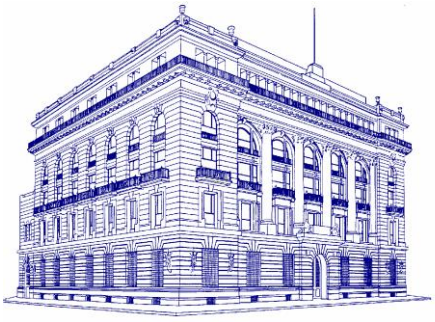
Inflation Report

October – December 2010



BANCO DE MÉXICO

FEBRUARY 2011

INFLATION REPORT

This report analyzes the development of both inflation and the economy in Mexico, as well as different domestic economic indicators, in compliance with Article 51, last section, of Banco de México's Law.

FOREWARNING

This text is provided for the reader's convenience only. Discrepancies may possibly arise between the original document and its translation to English. The original and unabridged Inflation Report in Spanish is the only official document.

Unless otherwise stated, this document has been prepared using data available as of February 8, 2011. Figures are preliminary and subject to changes.

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1. Introduction

The world economy's growth prospects for 2011 have improved. This reflects the recovery of diverse indicators of the major advanced economies, registered during the last months, and the continued strong growth in emerging economies. In the former, the improvement is to a great extent a response to the effect of the fiscal and monetary stimuli. Despite the improvement in the short-term prospects, structural factors persist in a considerable number of advanced economies indicating that these economies will continue presenting relatively low growth rates in the next years.

During the fourth quarter of 2010, central banks of the major advanced economies maintained their policy rates close to zero and expanded their quantitative easing programs, responding to the weakness of the economic activity and employment. Furthermore, in the case of the United States, new fiscal stimulus measures were approved. Nevertheless, this has generated greater concern about the consequences that these measures will have in the medium term. In particular, there is uncertainty with respect to the sustainability of private spending recovery, once the process of withdrawing supportive measures starts. This process also entails important risks that may result in elevated costs in terms of future growth.

At the end of 2010, moderate increases in headline inflation were observed in the major advanced economies due to the rise in commodity prices. However, core inflation remained low, with the exception of the United Kingdom. Because of this, as well as the reduced anticipated levels of installed capacity utilization, no inflationary pressures are expected for a certain time. In contrast, in some emerging economies which showed strong growth, mainly in Asia and Latin America, an increase in the inflation rates and their expectations has been registered, as a result of higher demand pressures and the increase in commodity prices, mainly food prices.

In general, financial markets improved during the fourth quarter of the year, although they again experienced nervousness caused by the concerns about the fiscal sustainability and banking system's solvency in some European countries. This concern became more pronounced given the possibility of a compulsory participation of debt holders in future bailouts. Trying to avoid contagion to other markets, a financial support package for Ireland was announced and the strengthening of the European Financial Stability Facility (EFSF) was agreed on. Similarly, the European Central Bank moderately increased its sovereign debt purchases.

The improvement of emerging economies' fundamentals and the search for higher yields by investors, attributable to the environment of high global liquidity driven by the accommodative monetary policy of the major advanced economies, has continued to induce important capital flows towards emerging countries. The magnitude and speed of these flows have been a reason of concern in some cases. In particular, currencies of some countries with flexible exchange rate regimes have appreciated considerably, which could have an impact on their export competitiveness. There is also fear that an excessive credit expansion might occur, leading to the formation of asset price "bubbles." Finally, the experience from past episodes suggests the possibility that the volume of foreign

capital inflows can expose these economies to disruptive effects caused by sudden capital flow reversals.

It is worth mentioning that various economies, mainly emerging ones, whose currencies are appreciating significantly and whose aggregate demand is increasing at high rates, face a monetary policy tradeoff. On the one hand, the concerns caused by the appreciation could induce the authorities of those countries to try to discourage capital inflows by means of interest rate reductions. Nevertheless, this could lead to an even stronger expansion of consumption and investment spending. On the other hand, strong aggregate demand growth generates inflationary pressures, which requires interest rate increases to offset them. However, this could induce higher capital flows.

In this context, the problem of global imbalances has become more urgent as current account balances in the deficit countries have declined slowlier than expected. In particular, considering that at least part of their exchange rate appreciation is due to monetary factors, some emerging economies have responded with diverse measures trying to slow down this appreciation. It is important to emphasize that a policy generalized among countries, focused on sustaining economic recovery based on real exchange rate depreciations, is not a viable solution for the world economy. In this sense, an increased international coordination, that allows maximizing the global growth and ensuring sustainability in the medium term, is necessary.

Regarding economic activity in Mexico, during the last quarter of 2010, aggregate demand continued presenting an upward trend. Indeed, although goods and services exports had been showing a gradual slowdown during the previous quarters, in the fourth quarter they seem to have resumed an upward path. In turn, domestic demand showed a relatively more noticeable and generalized recovery as compared to the previous quarters, which led to maintaining an upward trend in productive activity levels. Consequently, the output gap has been closing. Nevertheless, during the last quarter of 2010 no demand-related pressures on utilization, and thus, neither on main input prices, nor on country's external accounts were observed.

During the fourth quarter of 2010, annual headline inflation rebounded, being on average 4.25 percent (during the third quarter it was 3.67 percent). In contrast, annual core inflation declined in the fourth quarter of 2010 with respect to the previous quarter. So, the rebound experienced by headline inflation was mainly due to the performance of the non-core component. It should be noted that the result of annual headline inflation for the fourth quarter of 2010 was located in the lower limit of Banco de México's forecast interval for this period (4.25 to 4.75 percent), interval which was revised downwards by 0.50 percentage points in the previous Inflation Report.

The foreseen trajectory for headline inflation considers that, during the next two years, it will register levels below the ones presented in 2010. In particular, it is estimated that during the first two quarters of 2011, annual average headline inflation will lie between 3 and 4 percent (this implies a downward revision of the first quarter's forecast whose previous interval was 3.75 to 4.25 percent). From the third quarter of 2011 onwards, headline inflation is projected to converge towards levels congruent with the permanent 3 percent inflation target, considering the variability interval of +/- 1 percent.

The fading of diverse disturbances on supply that affected the annual inflation during 2010, such as those related to the fiscal adjustments and fare increases authorized by local governments, will also contribute to the aforementioned. On the other hand, it is also worth mentioning that, given the closing output gap, the economy will gradually be less able to absorb the effects on prices of unforeseen rises in commodity price quotes or other disturbances on prices. Finally, the inexistence of a negative output gap could imply demand-related pressures on prices. This is not imminent, but it is a risk factor.

Considering the abovementioned, the Board of Governors decided to maintain the Overnight Interbank Interest Rate unchanged during the last quarter of 2010, as well as during January of this year. It will continue to monitor the performance of inflation expectations, output gap, public prices, particularly grain prices, as well as other inflation determinants that might signal unexpected and widespread pressures on prices. All of this so that, in such eventuality, the Central Institute adequately adjusts the monetary policy stance in order to reach the 3 percent permanent inflation target.

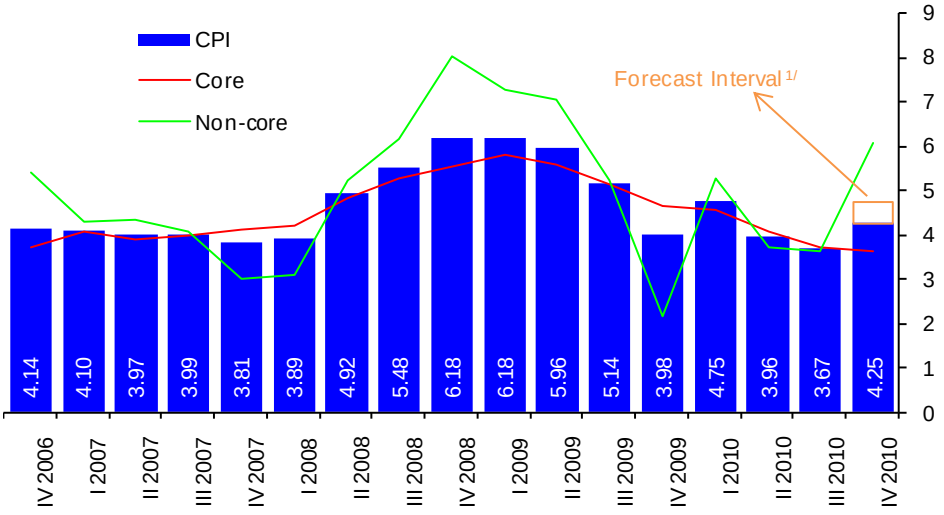
2. Recent Developments in Inflation

2.1. Inflation

In the fourth quarter of 2010, annual average headline inflation was 4.25 percent (Graph 1 and Table 1). In the previous quarter this figure was 3.67 percent. The increase registered by headline inflation was a result of higher incidence of the non-core component, especially highlighting the increases observed in the price quotes of a reduced number of agricultural products (Table 1).

The increase exhibited by headline inflation during the analyzed period was anticipated by Banco de México in the Addendum to the Inflation Report, July-September 2009. The forecast presented in the referred Addendum was revised downwards by 0.50 percentage points in the Inflation Report, July-September 2010. Even so, annual average headline inflation of the analyzed quarter was located in the lower limit of the revised forecast interval (4.25 to 4.75 percent, Graph 1).

Graph 1
Consumer Price Index
Annual average change in percent



Source: Banco de México.
1/ This forecast was originally published in the Inflation Report, July-September 2010.

Annual average core inflation decreased during the fourth quarter of 2010 as compared to the previous quarter. In this period the average of this indicator was 3.61 percent, presenting a reduction of 0.09 percentage points in comparison to the figure of the third quarter (Graph 1 and Table 1). This decline was mainly driven by the lower growth rate of the services price subindex, whose annual average change rate was 3.54 percent (in the third quarter this figure was 3.81 percent, Graph 2a and Table 1).

Table 1
Consumer Price Index and Components
Annual average change per quarter in percent

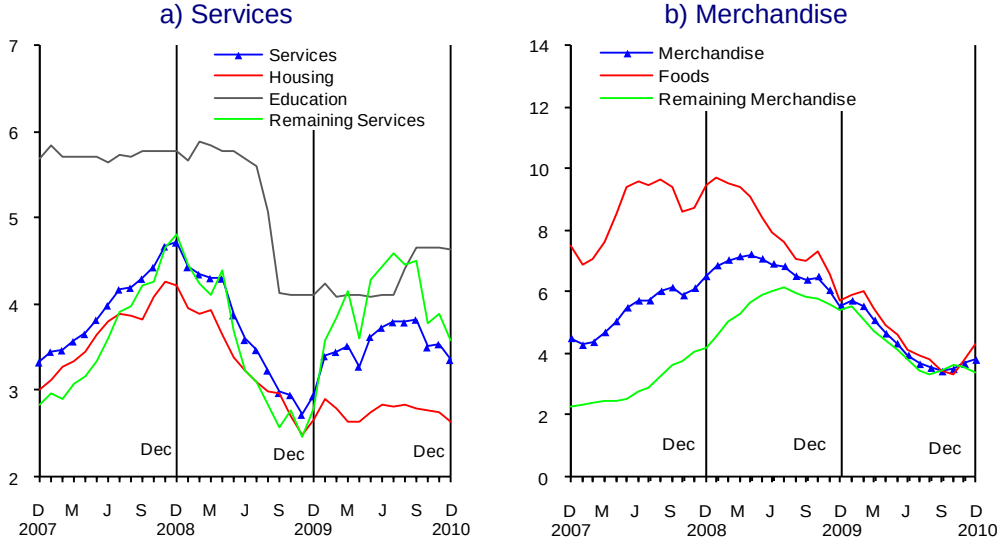
	Annual Average Change Percent		Average Incidence[1/]		Difference
	III-Q 2010	IV-Q 2010	III-Q 2010 (a)	IV-Q 2010 (b)	(b-a)
CPI	**3.67**	**4.25**	**3.67**	**4.25**	**0.58**
Core	**3.70**	**3.61**	**2.72**	**2.65**	**-0.07**
Merchandise	**3.57**	**3.68**	**1.29**	**1.32**	**0.03**
Food, Beverages and Tobacco	3.77	3.84	0.62	0.63	0.01
Remaining Merchandise	3.41	3.54	0.67	0.69	0.02
Services	**3.81**	**3.54**	**1.44**	**1.33**	**-0.11**
Housing	2.82	2.72	0.47	0.45	-0.02
Education	4.41	4.65	0.28	0.29	0.02
Remaining Services	4.70	4.01	0.69	0.59	-0.10
Non-core	**3.60**	**6.03**	**0.95**	**1.60**	**0.65**
Agricultural	**-1.27**	**5.21**	**-0.12**	**0.48**	**0.60**
Fruit and Vegetables	-3.81	9.37	-0.14	0.34	0.48
Tomato	-30.30	13.58	-0.18	0.07	0.26
Lemon	-1.23	68.44	0.00	0.07	0.07
Avocado	-4.24	23.57	-0.01	0.04	0.05
Papaya	19.47	76.04	0.02	0.07	0.05
Livestock Goods	0.44	2.50	0.02	0.14	0.11
Eggs	-11.57	-6.32	-0.10	-0.05	0.05
Administered and Regulated	**6.32**	**6.46**	**1.07**	**1.12**	**0.05**
Administered	5.79	6.69	0.49	0.60	0.11
Regulated	6.84	6.22	0.58	0.52	-0.06

1/ The incidence refers to each CPI component's contribution (in percentage points) to headline inflation. It is calculated using the weights of each CPI subindex, as well as relative prices and their respective changes. In some cases, the sum of the components of a certain group of subindices may not add up due to rounding.

The reduction presented by core services inflation in the fourth quarter of 2010 was the result of the lower growth rate exhibited by the housing and remaining services groups, excluding education. The annual average changes registered by the referred groups were 2.72 and 4.01 percent, respectively (during the third quarter of 2010 they registered 2.82 and 4.70 percent, Graph 2a and Table 1). In the last group stands out the lower incidence on inflation of those items related to tourism.

In contrast, in the period studied in this Report, the annual growth rate of the core merchandise subindex increased. On average, this rate was 3.68 percent during the fourth quarter of 2010, implying an increase of 0.11 percentage points as compared to the previous quarter (Graph 2b and Table 1). This increase was partly influenced by the rise observed by the end of the year in prices of products derived from wheat and corn, as well as in cigarette prices. The price increase in products derived from grains largely responds to the dynamics that international prices of these commodities have exhibited. With respect to cigarette prices, the increase is associated to the fact that retailers partially anticipated the increment related to the revision of the Excise Tax (*Impuesto Especial sobre Producción y Servicios*, IEPS) on tobacco, which came into force in January 2011.

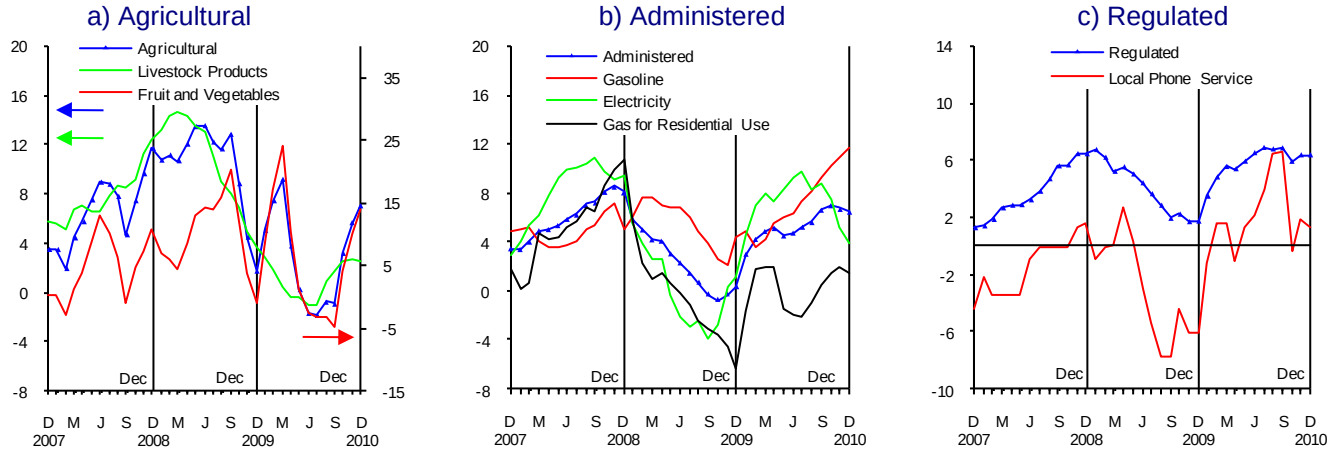
Graph 2
Core Merchandise and Core Services Subindices
Annual change in percent



Source: Banco de México.

Annual non-core inflation rebounded in the fourth quarter of 2010, being on average 6.03 percent (previous quarter's figure was 3.60 percent, Graph 1 and Table 1). The performance exhibited by this indicator was to a great extent the consequence of the increment observed in the annual change rate of the subindex of agricultural product prices, which during the analyzed period reached an average of 5.21 percent (in the third quarter it was -1.27 percent, Graph 3a and Table 1). It is noteworthy that five agricultural products account for nearly three quarters of the increase in annual average non-core inflation (tomato, lemon, avocado, papaya and eggs, Table 1).

Graph 3
Non-core Price Subindices
Annual change in percent



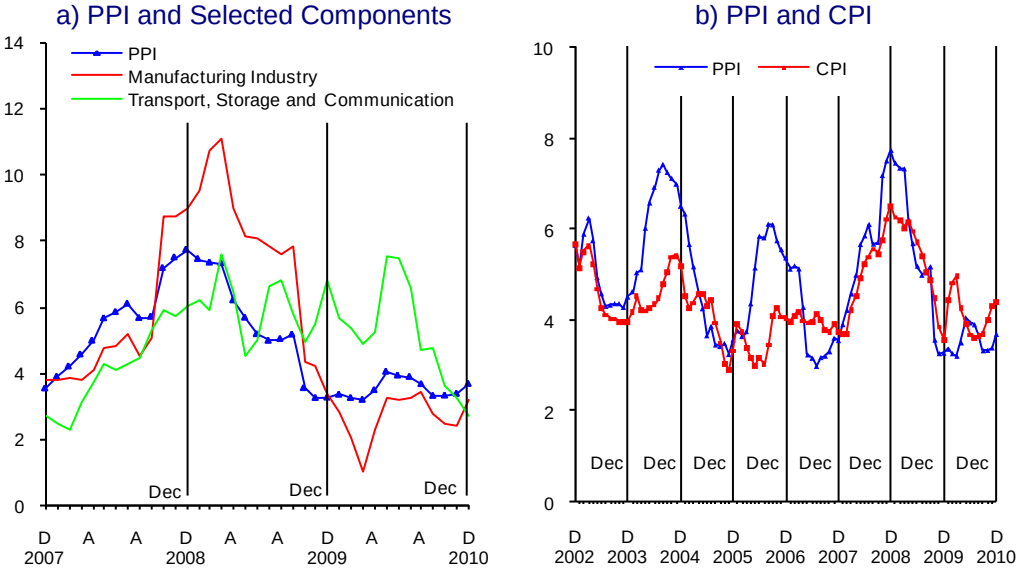
Source: Banco de México.

With respect to the subindex of administered and regulated goods and services prices, the annual average change registered during the fourth quarter of 2010 was 6.46 percent (in the third quarter it was 6.32 percent).[1] This increase resulted from the raise observed in the prices of the administered group, in particular those corresponding to gasoline (Table 1 and Graph 3b). On the contrary, the annual change rate of the regulated goods and services group decreased, largely due to the lower contribution of the local telephone services item (Graph 3c).

2.2. Producer Price Index

During the fourth quarter of 2010, the annual average change of the Producer Price Index (PPI) of finished goods and services, excluding crude oil, declined. This indicator was 3.49 percent (in the third quarter this figure was 3.65 percent). This resulted from the lower growth rates observed in the prices of some products of the manufacturing sector (automobiles, sugar, trucks, beverages and computers), and the transport, storage and communication sector (passenger air transport and cellular phones, Graph 4a).

Graph 4
Consumer and Producer Price Indices
Annual change in percent



Source: Banco de México.

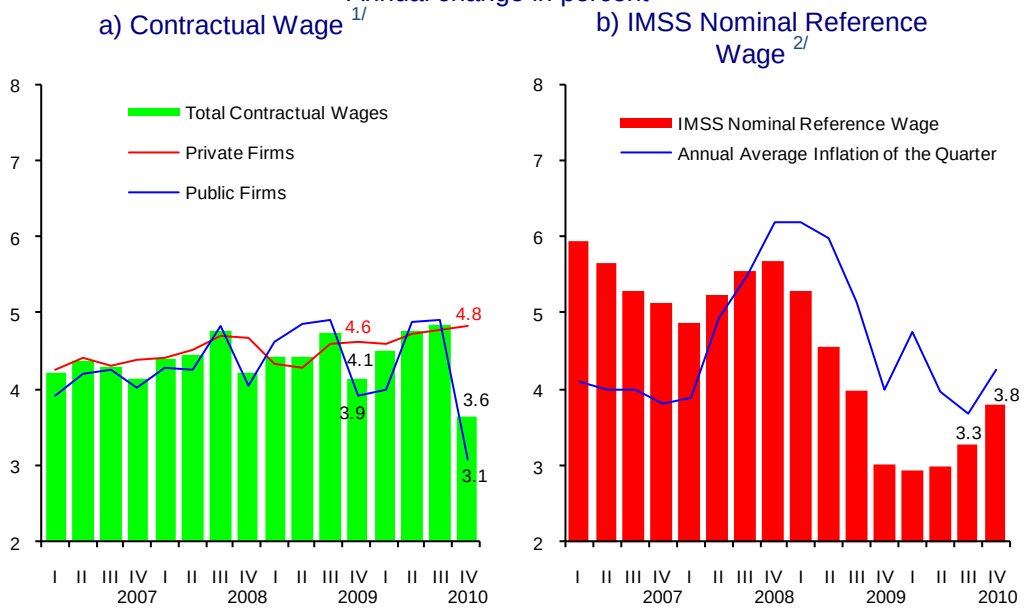
2.3. Wages

The recent development of the wage indicators suggests the absence of labor cost-related pressures on inflation. It is noteworthy that this has contributed to an accelerated increase in employment. On the one hand, the contractual wage increase, on average valid for a 1-year period, negotiated by firms under federal jurisdiction, was 3.6 percent, while in the same period of the previous year this

[1] The denomination of the subindex of administered and regulated goods and services prices was modified since the publication of the CPI results corresponding to the first fortnight in January 2011, now being denominated subindex of energy and prices approved by government.

figure was 4.1 percent (Graph 5a).[2] On the other hand, although the annual growth rate of the IMSS nominal reference wage increased during the analyzed period, reaching an average of 3.8 percent (third quarter's figure was 3.3 percent), this rate is lower than the one observed before the crisis (Graph 5b). In addition to the aforementioned, since January 1, 2011 the minimum wage was increased by 4.1 percent in the three geographic areas, as compared to 4.85 percent granted in the previous year (Table 2).

Graph 5
Wage Indicators
Annual change in percent



Source: Calculated by Banco de México with data from IMSS, STPS.
1/ The number of workers in firms under federal jurisdiction that annually report their wage increases to the Secretary of Labor and Social Welfare (*Secretaría del Trabajo y Previsión Social,* STPS) equals to approximately 1.9 million.
2/ During the fourth quarter of 2010 an average of 14.7 million of contributors were registered in IMSS.

Table 2
Minimum Wages
Pesos per day and annual change in percent

Period	Pesos per day				Annual change in percent			
	Average	Geographic Region			Average	Geographic Region		
		A	B	C		A	B	C
2006	47.05	48.67	47.16	45.81	4.00	4.00	4.00	4.00
2007	48.88	50.57	49.00	47.60	3.90	3.90	3.90	3.90
2008	50.84	52.59	50.96	49.50	4.00	4.00	4.00	4.00
2009	53.19	54.80	53.26	51.95	4.62	4.20	4.51	4.95
2010	55.77	57.46	55.84	54.47	4.85	4.85	4.85	4.85
2011	58.06	59.82	58.13	56.70	4.10	4.10	4.10	4.10

Source: National Minimum Wage Commission (*Comisión Nacional de los Salarios Mínimos*, CONASAMI).

[2] Contractual wages include only the direct increase in the reference wage rate negotiated by the workers of the firms under federal jurisdiction and have validity for the following twelve months. It is noteworthy that the monthly composition of this indicator is combined by the information of the firms' wage revision usually conducted in the same period of the year, thus giving it a seasonal pattern. Taking the abovementioned into account, the relevant comparison of this indicator is interannual.

3. Economic and Financial Environment

3.1. External Conditions

3.1.1. World Economic Activity

The recovery of the world economy in the last quarter of 2010 was stronger than expected and the growth prospects for 2011 have been revised upwards. The main advanced economies, except for Japan, registered an improvement in different indicators, partly, in response to fiscal and monetary stimuli. Emerging countries continued exhibiting high growth rates, supported by the strength of domestic demand.

However, the outlook for the global economic activity in the medium term will remain affected by a series of structural factors. In particular, in the United States, a slow improvement of the labor market, the process of deleveraging of households and the precarious situation of the real estate sector will continue limiting its domestic demand growth. Besides, fears about the banking situation and the sustainability of public finances in many advanced economies, especially in the Euro zone, and the current fragility of the world financial system, immersed in a process of reduction of its risk exposure, also suggest that growth rates of the world economy in the next years will remain lower than before the crisis. In contrast, many emerging economies face increasing demand pressures and higher inflation.

US economic activity has recovered in the last quarter of the year, although this has not resulted in a significant reduction of unemployment. According to preliminary information, the GDP grew 3.2 percent in annualized quarterly terms during the fourth quarter of 2010, which was higher than the third quarter figure of 2.6 percent, mainly due to a rebound in private consumption and a positive contribution of net exports (Graph 6a).[3] Nevertheless, consumption still remains limited by households' lower net wealth and high debt levels (Graph 6b), the slow recovery of both employment and disposable personal income, as well as by the reduced credit availability. In turn, lower inventory accumulation negatively affected the output growth, which can probably in part explain the significant drop in the imports of goods observed in the fourth quarter.

Expenditure on equipment and software kept expanding in the fourth quarter, particularly owing to high corporate profits. In contrast, investment in non-residential construction, as well as residential construction spending remained weak, the latter due to a still high number of vacant houses and to the fading impact of the fiscal credit to buy houses. In turn, goods and services exports were supported by the strong growth of emerging economies and the continuous dollar depreciation.

Industrial production registered a new rebound at the end of the year as its monthly growth rate accelerated, while the leading indicators point to a continuous expansion in the following months (Graph 6c).[4] The recovery of

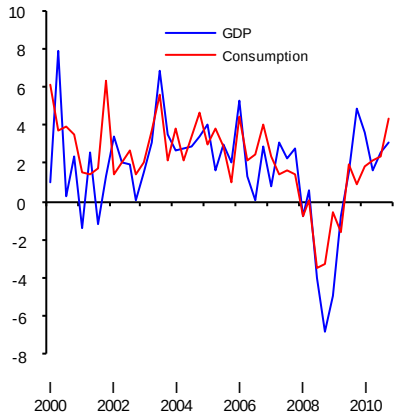
[3] For the entire 2010, GDP expanded 2.9 percent after registering a drop of 2.6 percent in 2009.

[4] The ISM manufacturing index located at 60.8 points in January 2011, as compared to 58.5 and 55.3 points last December and September, respectively, which was the highest since May 2004. In turn, the ISM non-

industrial production seems to be the result of strengthened domestic demand, as the initial boost coming from the inventory replenishment ongoing since the second quarter of 2009 appears to have concluded.[5]

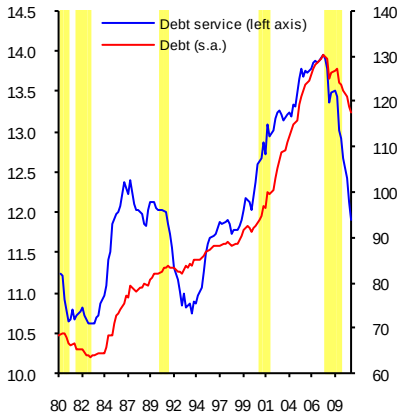
Graph 6
US Economic Activity

a) Real GDP Growth
Annualized quarterly percentage change



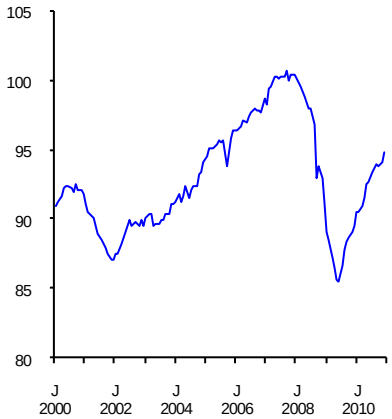
Source: BEA.

b) Household Debt Service and Total Debt
In percent of Disposable Personal Income



Note: The shaded areas correspond to recession periods according to NBER.
s. a. / Seasonally adjusted figures.
Source: U.S. Federal Reserve.

c) Industrial Production
Index 2007=100, s. a.



s. a. / Seasonally adjusted figures.
Source: U.S. Federal Reserve.

The labor market situation kept showing significant weakness, only recovering 0.9 million at the end of 2010 of the total of 8.7 million employments lost during the recession. In seasonally adjusted terms, the unemployment rate decreased from 9.6 percent at the end of the third quarter to 9.4 percent at the end of the year. However, this drop seems to be mainly the result of a reduction in the work force participation (Graph 7b).[6] Besides, the proportion of workers unemployed for at least six months has remained at levels close to the maximum of the postwar period (Graph 7c). Long-term unemployment, by eroding workers' capacities and their links with the labor market, could become structural.

Slow employment recovery has motivated additional measures of the authorities aimed to stimulate US economic activity. In November, the U.S. Federal Reserve Bank announced a second program of quantitative monetary easing (QE2). Likewise, in December the U.S. Congress approved new fiscal measures with an estimated cost of approximately USD 858 billion, principally intended to give an additional impulse during 2011 and 2012. This package,

manufacturing index also registered an improvement in January, for the fifth consecutive month, locating at 59.4 points (as compared to 57.1 and 53.9 in December and September, respectively).

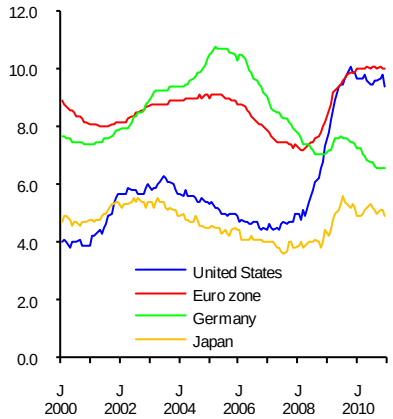
[5] Nonetheless, the industrial production index is still almost 6 percent below the level it had at the beginning of the recession and the installed industrial capacity utilization level is still 5 percentage points below its historical average.

[6] In January 2011, employment increased by only 36 thousands positions. However, the unemployment rate dropped to 9.0 percent, partly due to a new decrease in the labor participation rate (the lowest since March 1984).

besides extending some provisions originally set to expire after 2010, introduces new measures destined for supporting domestic demand.[7]

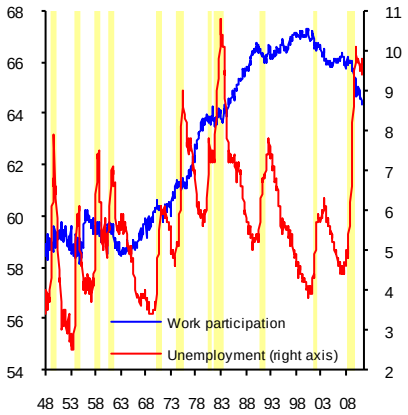
Graph 7
Labor Market in Major Advanced Economies

a) Unemployment Rate
In percent, s. a.



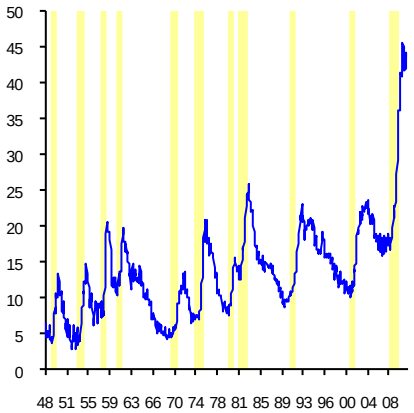
s.a. / Seasonally adjusted figures.
Source: BLS, Eurostat and Statistics Bureau of Japan.

b) U.S.: Unemployment Rate and Work Force Participation
In percent, s. a.



Note: The shaded areas correspond to recession periods according to NBER.
s. a. / Seasonally adjusted figures.
Source: BLS and Federal Reserve Bank of St. Louis.

c) U.S.: Persons Unemployed for at least Six Months
In percent of unemployed, s. a.



Note: The shaded areas correspond to recession periods according to NBER.
s. a. / Seasonally adjusted figures.
Source: BLS.

The policies of monetary and fiscal stimulus have contributed to an upward revision of the growth prospects for 2010 and 2011 in the United States. Nevertheless, concern about repercussions of the abovementioned stimuli in the medium term persists among economic agents. For instance, it is uncertain if the recovery based on the strength of private spending will hold once the effects of the aforesaid public policies on the economy fade away. The eventual reversal of these stimuli could provoke negative consequences on the international financial markets' stability. Thus, given the magnitude of the government debt, a credible commitment to fiscal consolidation is required in order to avoid an eventual significant increase in long-term interest rates. Additionally, given the significant growth and change in the composition of the central bank's balance sheet, there is concern that once the monetary stimulus is withdrawn, considerable volatility in interest rates might be observed. This could generate losses in the financial system and aggravate the fiscal problem in the United States.

During the last months of the year, GDP growth in the Euro zone continued recovering, which reflects, to a great extent, the performance of the German economy, where both consumption and investment have rebounded. However, growth in some of the region's economies was limited by the implementation of fiscal adjustment programs, a greater concern about the sustainability of public debt and the weakness of the financial system. As will be

[7] This package was approved as a law on December 17 under "Tax Relief, Unemployment Insurance Reauthorization and Job Creation Act of 2010" initiative. Among the measures stand out the following: (i) extension for two years of tax cuts introduced by President Bush Administration in 2001 and 2003; (ii) extension for two years of the alternative minimum tax indexation; (iii) extension for 13 months of unemployment benefits; (iv) reduction for one year of the payroll tax paid by employees from 6.2 to 4.2 percent; and (v) increase in the percentage of accelerated depreciation of investments in machinery and equipment from 50 to 100 percent for 2011.

described below, high losses in the banking sector and their fiscal repercussions precipitated the crisis in Ireland and accentuated the vulnerabilities of other European economies, such as Spain, Portugal and Belgium. Unemployment in the Euro zone remained high, although in Germany it showed a decreasing trend (Graph 7a). During the following quarters, the strength of the recovery will largely depend on the impact of the measures adopted to tackle fiscal and financial problems in the region's economies.

The growth of the Japanese economy significantly weakened in the fourth quarter (after an expansion of 4.5 percent in annualized quarterly terms in the third quarter). This is accounted for, on the one hand, by the end of the fiscal incentives of support to consumption, and, on the other hand, by the drop in the net exports caused by the continuous appreciation of the yen.[8] The Tankan survey of the fourth quarter registers a deterioration of business conditions, particularly among manufacturing firms.

Emerging economies continued their expansion, in general, at a pace higher than that of advanced ones, showing in some cases symptoms of overheating. During the fourth quarter, China's GDP grew 9.8 percent in annual terms (as compared to 9.6 percent in the third quarter), while India's industrial production expanded 7.0 percent in annual terms.[9] In the case of Latin America, the information available for the fourth quarter suggests a growth rate slightly higher than that of the previous quarter.

3.1.2. Commodity Prices

International commodity prices registered a marked upward trend in the last quarter of the year (Graph 8a). This tendency was more pronounced in the case of agricultural goods (Graph 8b), which increased 27.2 percent with respect to the end of the third quarter. In turn, crude oil prices rose 14.3 percent and those of industrial metals, 13.0 percent (Graph 8c).

The behavior of the international price quotes of commodities was driven by both supply and demand factors. As to the former, the most significant was the impact on agricultural production by adverse climatic conditions.[10] With regard to demand, stand out the following:

i. Better growth prospects for the world economy, in particular for China and India.

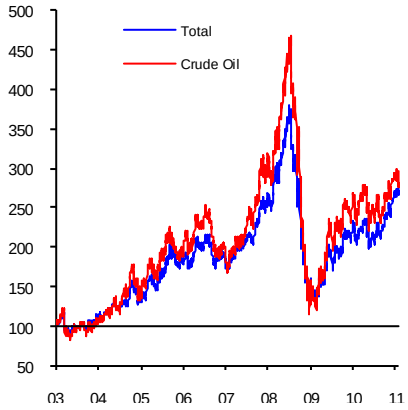
ii. Greater participation of some emerging countries, such as China, in manufacturing processes, which has increased the demand for commodities as production inputs.

iii. The situation of high global liquidity caused by the monetary stimulus in advanced economies, which, among other factors, has increased the demand for commodity-based financial products.

[8] The yen effective exchange rate appreciated 6.6 and 1.1 percent in the third and fourth quarter of 2010, respectively.
[9] In the case of India, it refers to the average of October-November 2010.
[10] This is the particular case of corn, because of the decrease in production forecasts due to persistent drought affecting some of the principal producing areas.

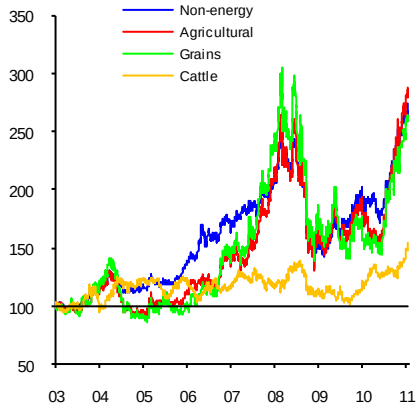
Graph 8
Commodity Prices
Index December 31, 2002=100

a) Total and Crude Oil



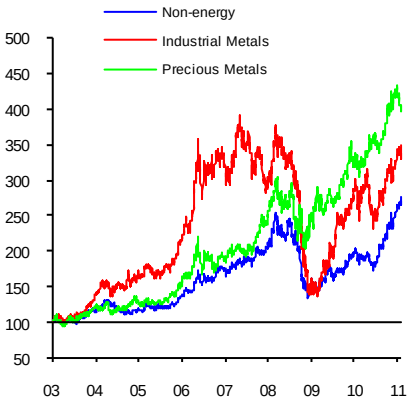
Source: S&P GSCI.

b) Non-energy and Agricultural



Source: S&P GSCI.

c) Non-energy and Metals



Source: S&P GSCI.

3.1.3. World Inflation Trends

Major advanced economies registered a certain rebound of headline inflation at the end of the fourth quarter of 2010, reflecting increases in commodities prices. However, core inflation remained low, which was partly owing to the ample slack in installed capacity. Even though the possibility of a deflation scenario seems to have decreased considerably, it still remains a risk factor.

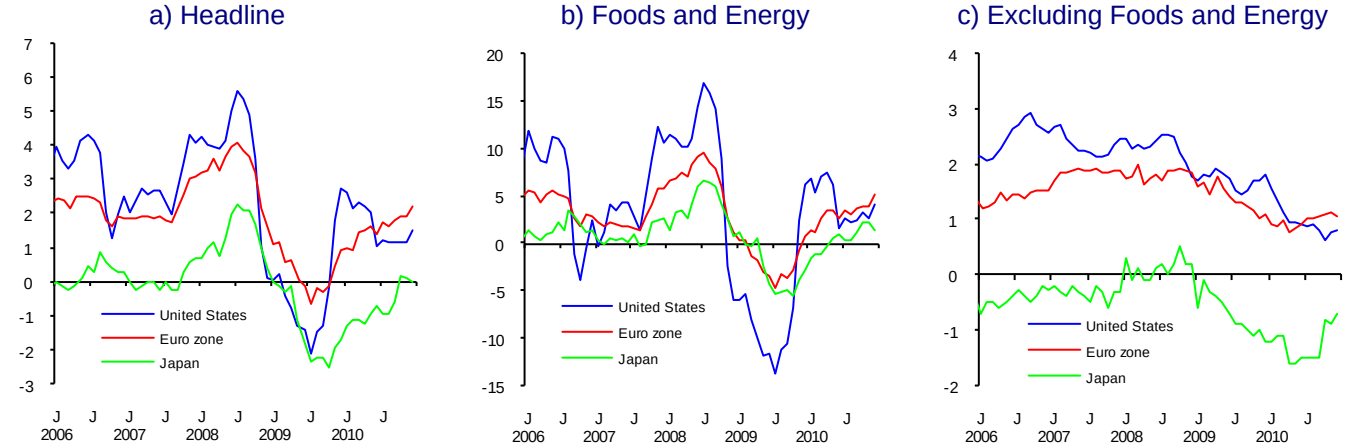
In the United States, annual headline inflation was 1.5 percent in December (Graph 9a), the highest figure since May, due to the impact of higher energy and food prices (Graph 9b and Graph 9c). Annual core inflation, still subject to downward pressures because of idle capacity and high unemployment, reached a new historical minimum of 0.6 percent in October, but afterwards increased slightly to 0.8 percent in November and December. Under these conditions, the U.S. Federal Reserve maintained the interval of 0 to 25 basis points for its policy rate. In the announcements of the Federal Open Market Committee (FOMC) it was reasserted that the observed inflation levels were incompatible with an environment of price stability in the long term and that the recovery pace was still slow. During November, the U.S. Federal Reserve announced the purchase of Treasury securities for a total of USD 600 billion (mainly for terms between 2 to 10 years) at a pace of 75 billion a month and that it would reinvest between USD 250 to 300 billion of their earnings from previous investments at maturity.[11]

In the Euro zone, the annual headline inflation rate increased from 1.9 percent in October and November to 2.2 percent in December, influenced by energy and food price increments. Core inflation, in turn, located at 1.1 percent during the fourth quarter. The European Central Bank (ECB) left its policy interest rate unchanged at 1.0 percent during this quarter, although at the beginning of December it announced that it would extend its unconventional liquidity measures

[11] On August 10, 2010 the Federal Open Market Committee announced its decision to reinvest principal payments of agency debts and mortgage-backed securities in long-term Treasury securities. Additionally, the abovementioned Committee pointed out that it would continue to renovate its Treasury securities holdings at maturity.

for three months and emphasized that its program of purchasing sovereign debt securities (Securities Markets Program, SMP) would remain in force.[12]

Graph 9
Inflation in Advanced Economies
Annual change in percent



Source: BLS, Eurostat and Statistics Bureau of Japan.

Source: BLS, Eurostat and Statistics Bureau of Japan.

Source: BLS, Eurostat and Statistics Bureau of Japan.

In Japan, although the annual headline inflation rate was positive in the fourth quarter, driven by food prices and the new tobacco tax impact, core inflation remained negative. In this context and in view of the deterioration of the recovery prospects for economic activity, the Bank of Japan maintained its policy of interest rates close to zero[13] and announced unprecedented quantitative easing measures of JPY 5 trillion. These measures consist in purchasing government bonds and other financial assets with a relatively higher risk profile. For the first time these asset purchases by the central bank include commercial paper, corporate bonds, instruments associated to the real estate market and other investment instruments negotiated in the securities market.

The increase in commodity prices has had an impact on consumer price inflation in the majority of economies, particularly, in the emerging ones (Graph 10a, Graph 10b and Graph 10c), although this impact has varied depending on local conditions. Inflation grew more in those countries where rapid growth has reduced or eliminated the output gap, for example, in Brazil, China and India.[14] In the economies that have registered a significant appreciation of their currencies, the financial authorities had to face a monetary policy tradeoff: reducing interest rates to discourage capital inflows or increasing them to offset the strong growth of aggregate demand and higher inflationary pressures. In this context, the central banks of many emerging countries have chosen a combination of policies that

[12] At the beginning of December, the ECB announced that it would continue conducting its main refinancing operations (MROs) as 3-month fixed-rate tender procedure with full allotment, as long as necessary, and at least until April 12, 2011. This procedure was also extended for special-term refinancing operations.

[13] On October 5, the Bank of Japan modified its policy rate from a level of approximately 0.1 percent to a range of between 0 and 0.1 percent.

[14] In China, annual inflation was 5.1 percent in November, which was the highest in 28 months, although in December it dropped to 4.6 percent. Food prices, which represent one third of the weight of the index, increased at an annual rate of 9.6 percent in December (11.7 percent in the previous month). Inflation in India grew to 8.4 percent in December (7.5 percent in November). In Brazil, inflation rose from 5.6 percent in November to 5.9 percent in December.

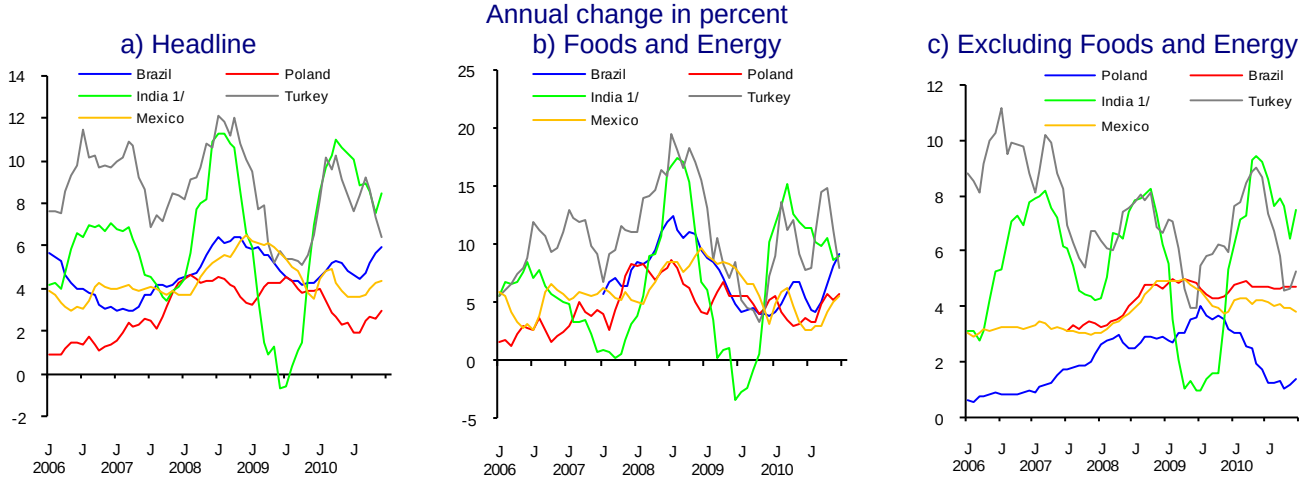
includes, besides increasing interest rates, increments in the minimum reserve requirements and stricter prudential measures (Table 3).

Table 3
Macro-Prudential and Monetary Policy Measures in Selected Emerging Countries*

Brazil	Increase of 50 basis points (bp) in the Selic interest rate in January 2011, locating it at 11.25 percent. In December, increase in the reserve requirements for time deposits from 15 to 20 percent, the additional reserve requirements in both demand and time deposits from 8 to 12 percent and the capital requirements for credit operations from 11 to 16.5 percent.
Chile	Increases of 25 bp in October, November and December in the monetary policy interest rate, locating it at 3.25 percent.
China	Increase in the one-year benchmark loan rate from 5.31 percent to 5.56 percent in October, to 5.81 percent in December and to 6.06 percent in February. Increments in the reserve requirements ratio from 17 to 18 percent in November, to 18.5 percent in December and to 19 percent in January. In January, the China Banking Regulatory Commission requested the banks to transfer into their balances CNY 1.66 trillion in off-balance-sheet assets concerning bank-trust wealth management cooperation.
India	Increases of 25 bp in November and January in the policy rates (the repo rate and the reverse repo rate), locating them at 6.5 and 5.5 percent, respectively. In November, the Central Bank limited the exposure of the Urban Co-operative Banks (UCBs) to the real estate sector at 10 percent of total assets. Likewise, in December it was determined, among other measures, that the housing loan-to-value ratio should not exceed 80 percent, and that the risk weight for residential housing loans should be raised.
Hungary	Increases of 25 bp in November, December and January in the base interest rate, locating it at 6.0 percent.
Poland	Increase of 25 bp in the reference interest rate in January, locating it at 3.75 percent. An increase of the required reserve rate from 3 to 3.5 percent in October.
Russia	Increase of 25 bp in the one-month deposit auction interest rate in December, placing it at 3.15 percent. In January the required reserve ratio for non-resident corporate entities increased from 2.5 to 3.5 percent, and for private individuals and others from 2.5 to 3.0 percent.
South Africa	Decrease of 50 bp in the repo rate in November, locating it at 5.5 percent.
Thailand	Increase of 25 bp in the one-day repurchase rate in December and January, locating it at 2.25 percent.
Turkey	Decreases of 50 bp in the one-week repo rate in December and of 25 bp in January, locating it at 6.25 percent. In December a differentiation in required reserve ratios according to the liabilities term was announced and those of short-term were increased in January.

*Adopted starting from October 2010.
Source: Central Banks.

Graph 10
Inflation in Emerging Economies
Annual change in percent



1/ Referring to inflation of wholesale prices.
Source: Country's Statistics Bureaus.

1/ Referring to inflation of wholesale prices.
Source: Country's Statistics Bureaus.

1/ Referring to inflation of wholesale prices.
Source: Country's Statistics Bureaus.

3.1.4. World Financial Markets

During the fourth quarter of 2010, world financial markets in general showed an improvement. However, fears about fiscal sustainability and vulnerability of the banking systems of some European countries became more pronounced, particularly in the case of Ireland. The sovereign risk spreads of certain European countries have increased significantly during the third quarter, due to announcements that the losses of Irish banks, guaranteed by the government, would be considerably higher than anticipated.[15] In October and November, doubts as to the capacity of the Irish government to back its banking system and declarations of the European authorities about the possible compulsory participation of debt holders in any future bailout, aggravated this uncertainty.

In November, in order to avoid a further contagion to other European countries, among other reasons, the European Union (EU) and the International Monetary Fund (IMF) announced a fiscal package for Ireland for EUR 85 billion.[16] In turn, the European Central Bank increased its sovereign debt purchases. It was also agreed to establish a permanent mechanism to provide liquidity once the European Financial Stability Facility (EFSF) closes down in June 2013.[17]

Despite these measures, financial markets tensions persist, as there are still doubts about the capacity of countries, such as Portugal, Spain and recently Belgium, to cover their financial needs. The sovereign spreads of these countries remain high in view of fears over the sustainability of their debts and a possible restructuring of these.

As pointed out, in the United States, the Federal Reserve Bank announced new purchases of Treasury securities with the purpose of reducing long-term interest rates. Initially these decreased, but later they by far exceeded their levels before the announcement. This increase was mainly due to the growth of real interest rates, in the light of improved growth prospects (Graph 11a).

Long-term interest rates in major advanced countries registered an increase during the fourth quarter, after reaching minimum levels in October, when there was higher uncertainty about the world economic recovery. Despite the episodes of unrest caused by fiscal and financial problems in some European countries, most world stock and corporate bonds markets observed a good performance, reflecting an improvement in economic prospects and lower risk aversion.

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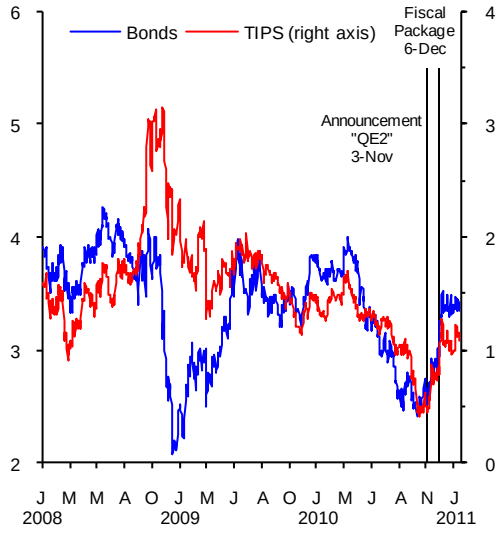
[15] The estimated cost of the government intervention in the Irish banking system is expected to increase to approximately EUR 50 billion, that is, about one third of Ireland's GDP. One of the measures to calm the nervousness was extending guarantees to savers' deposits till the end of 2011.

[16] The European Union will contribute with EUR 22.5 billion by means of the European Financial Stability Mechanism (EFSM), the International Monetary Fund will contribute with EUR 22.5 billion and the Irish government, EUR 17.5 billion. The remaining EUR 22.5 billion will be granted by the European Financial Stability Facility (EUR 17.7 billion), the United Kingdom (EUR 3.8 billion), Sweden (EUR 600 million) and Denmark (EUR 400 million).

[17] To back these measures and to avoid contagion to other countries, in December the European Commission announced new stress tests for the European financial system. The goal of these tests, to be carried out in February 2011, will be the strengthening of supervision credibility, including revisions of the liquidity criteria and not only of capital requirements.

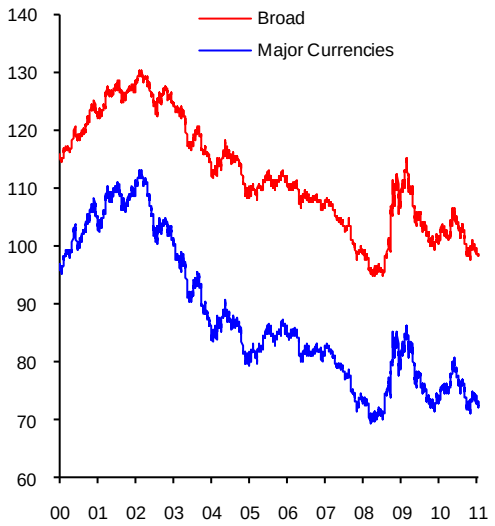
Graph 11
U.S.: Interest Rates and Exchange Rate

a) Nominal and Real Yield of 10-year Treasury Bonds
In percent



Source: U.S. Federal Reserve.

b) Index of Effective USD Exchange Rate [1/]



1/ Broad Index Jan-97=100 and major currencies Mar-73=100. An increase of the index equals an USD appreciation.
Source: U.S. Federal Reserve.

The US dollar continued depreciating in effective terms during the fourth quarter of 2010 (0.9 percent), although to a lesser extent than in the third quarter (4.8 percent). The principal reasons for the relative dollar stability against the major currencies were the improvement in growth prospects for the United States and its use as "safe haven" given the nervousness caused by the abovementioned problems in some European economies (Graph 11b).

The solid macroeconomic situation in emerging economies, and large spreads of policy interest rates with respect to advanced economies have attracted considerable capital inflows to emerging countries. The flows of funds dedicated to these economies reached the highest levels in 2010 for at least the last 10 years, although in November this process was temporarily interrupted, in the same way as in May, by an increase in risk aversion coming from the fiscal and financial problems in the Euro zone.[18] During the last weeks, these capital inflows have registered a new rebound. During the fourth quarter, the securities markets of the majority of emerging countries obtained considerable gains (Graph 12b), nominal exchange rates appreciated (Graph 12c) and sovereign spreads registered an additional reduction.

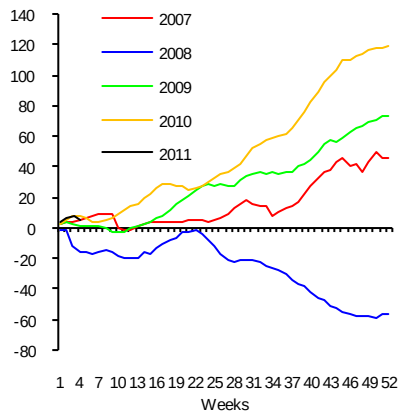
Nonetheless, there are concerns associated to these capital inflows: (i) appreciation of local currencies in the countries with flexible exchange rate, and its effects on net exports and economic activity; (ii) excessive credit expansion and possible formation of speculative "bubbles"; and (iii) risk that the magnitude of foreign capital inflows can leave recipient economies vulnerable to unexpected

[18] As a proportion of emerging countries' GDP, private capital net flows still do not reach their maximum pre-crisis levels.

capital flights, in particular in view of the possible renewed volatility in world financial markets.

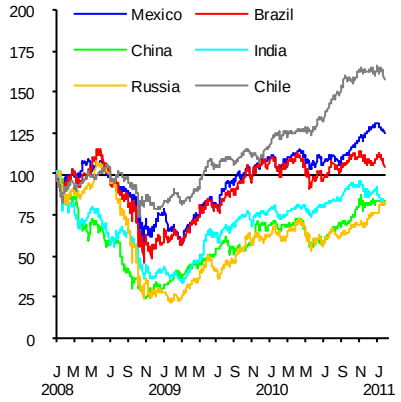
Graph 12
Financial Indicators in Emerging Economies

a) Accumulated Flows to Emerging Economies (Equity and Bonds)[1/]
USD Billion



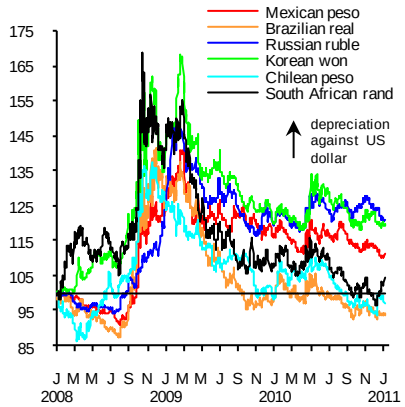
1/ The sample covers funds used for the purchase-sale of equity and bonds of emerging economies, registered in advanced economies' markets. Flows exclude portfolio yields and exchange rate fluctuations.
Source: Emerging Portfolio Fund Research.

b) Stock Markets in Selected Emerging Economies
Index 01/01/2008=100



Source: Bloomberg.

c) Exchange Rates in Selected Emerging Economies
Index 01/01/2008=100



Source: Bloomberg.

It should be pointed out that in the case of exchange rate appreciation in most emerging countries, it has appeared as a result of both monetary factors, for example, global excess liquidity, and fundamental factors, terms of trade improvement among them. However, the former tend to affect export competitiveness. For this reason, some emerging countries, when perceiving that part of the appreciation of their currencies can be caused by monetary factors, have responded with measures to contain it.

The intervention of the financial authorities of some emerging countries in the exchange market can also be interpreted as a strategy to boost export-led growth. In this sense, these exchange rate interventions have been one of the central elements in the global imbalances problem. In particular, these policies avoid the full functioning of the price adjustment mechanism in order to correct trade deficits. Thus, in the present context of global imbalances and interventions in exchange markets, it is important to emphasize that a policy widespread among countries, focused on sustaining economic activity based on real depreciations of their exchange rates ("competitive depreciations"), is not a viable solution for the world economy (see Box 1). On the contrary, greater international coordination, that allows maximizing global growth and ensuring its sustainability in the medium term, is necessary.

Box 1
Competitive Devaluations

Introduction

The term competitive devaluation refers to the adoption of an exchange rate policy focused on depreciating the exchange rate in order to obtain a competitive advantage over other economies, which allows stimulating growth through export promotion. These measures are considered as predatory policies to the extent to which they seek to boost economic activity and employment in one economy at the expense of other economies (Corsetti et al., 2000). Once an economy decides to depreciate its currency, incentives for its competitors and trade partners to do the same appear, since not doing so would be to their disadvantage. However, the generalized adoption of exchange rate policies directed at depreciating the exchange rate tends to generate a situation in which in the end no one wins.[1]

In this context, an important point to consider is that the policy actions implemented in an economy, such as the exchange rate interventions in order to maintain the exchange rate depreciated, affect other economies, i.e., there are externalities (Meyer et al., 2002). Nevertheless, when policy makers do not consider the positive or negative effects on the third party, they neither obtain all the benefits, nor do they assume all the costs of their actions. This provokes that the collective outcome of individual actions might not be optimal (Cooper, 1985; Corden, 1985).

This box first analyzes the factors that can lead to an episode of competitive devaluations in the current international environment, to describe later on the monetary agreements that were adopted in the past, which can be useful for illustrating the way in which cooperation in multilateral topics, for example, avoiding competitive devaluations at the present time, can be reached.

1. Competitive Devaluations in the Current Environment

The risk of an episode of competitive devaluations mainly stems from the following factors: (i) adoption of export-led growth strategies by various emerging and some of the advanced economies, in a context of weak global demand; and (ii) abundant liquidity in the global economy which, together with the improvement in the prospects for emerging economies, has favored an episode of important capital flows towards these economies, which has tended to appreciate their currencies.

1.1 Export-led Growth Strategies

Regarding the first point, diverse emerging economies, like China and other Asian nations, as well as some advanced economies, such as Germany and Japan, have based their growth on export promotion. An important part of this growth strategy has been to maintain a depreciated exchange rate. However, it is noteworthy that this strategy has limitations (Blecker, 1999). For instance, not all economies can adopt this growth model at the same time. In particular, it requires that some economies consume more than they produce, so that there is demand for the goods and services of those economies that attempt to grow through export promotion.

In the period before the international financial crisis, this demand came from the advanced economies, mainly the United States and also some European economies, which experienced asset price "bubbles" and considerable expansions in their domestic spending, especially consumption, incurring large current account deficits. Nevertheless, since the international crisis the need to adjust private and public domestic spending patterns to sustainable levels in the long term in advanced economies, such as United States and various Euro zone countries, became evident (see Box 1 of the Inflation Report, July-September 2010).

Adjustment of these advanced economies' spending represents a risk for all those economies that based their growth on export promotion. In this scenario, given the weak demand in some developed economies, the growth of emerging economies requires strengthening of their domestic markets, i.e., global demand patterns need to be re-balanced. Nevertheless, this implies the implementation of structural reforms, which can be politically difficult to adopt due to the resistance of those groups that have benefited from the export-led growth model.

In this context, there is a risk that these economies seek to depreciate their currencies even more with the purpose of obtaining a higher proportion of the reduced global demand for their exports and thereby, continuing to stimulate economic activity through exports. However, this would happen at the expense of reducing the demand for competitors' exports even more. So, an economy deciding to depreciate its currency can provoke that other economies do the same and finally it would lead to a situation where none of these economies' position improves.

Even more, it is worth mentioning that policies aimed at devaluating the nominal exchange rate intending to reach a real depreciation, in general, only have temporal effects, since in the long run domestic goods prices, especially non-tradable goods and services prices, tend to rise. So, given the increase in these products' prices, the depreciation of the real exchange rate possibly begins to reverse.

In the light of the difficulty of permanently depreciating the real exchange rate through nominal exchange rate adjustments, the economies can also try to reach a real depreciation through measures aimed at reducing or at least moderating increase in non-tradable goods prices. To do so, they could contain wage increases; however, it should be pointed out that these policies could have an adverse effect on the population's welfare.

1.2 Lax Monetary Conditions in the World Economy

Together with the aforementioned, the phenomenon of competitive devaluations could be exacerbated due to the abundant liquidity currently prevailing in the global economy. Indeed, as a response to the financial crisis and the recession, world's central banks relaxed their monetary policy stance. In the particular case of diverse advanced economies, the policy rates were close to levels approaching zero. Given the impossibility of implementing additional reductions of this rate, some of these economies adopted unconventional monetary policy measures through changes in the size and composition of their balance sheets.

Even more, US authorities recently decided to adopt a series of additional unconventional monetary policy measures. Partly, this last decision could be driven, among other factors, by the resistance of some trade partners of the United States to permitting greater flexibility in their exchange rates which complicated the adjustment of the US economy.

These accommodative policies in developed economies have given rise to lax monetary conditions in the international economy, which, together with the improvement of emerging economies prospects, has contributed to a new episode of capital flows to these economies. Low interest rates prevailing in advanced economies have favored a process of search for yield among international investors, which seem to borrow from advanced economies taking advantage of the low interest rates in order to invest in assets that promise higher yields, such as those from emerging economies.

The magnitude and speed with which this capital has flown to emerging economies have generated diverse challenges for them. In general, considerable pressures on exchange rate appreciation have been observed in these economies. Given this, several of these

[1] In this sense, competitive devaluations can be compared to the prisoner dilemma where the incentives are such that the individual actions of the players lead to a collective outcome where all participants are worse off. For a detailed analysis of the prisoner dilemma, see Gibbons (1992).

countries have adopted various measures aiming at avoiding their currencies appreciation, such as exchange rate interventions, to influence the exchange rate and capital controls. It is noteworthy that these measures frequently remained unsuccessful.

Nevertheless, it should be noted that these measures tend to impose distortions in the economies that implement them, which can affect their medium- and long-term performance. Together with the before mentioned, these policy actions also have consequences for the international economy. In particular, they hold back the rebalancing of the global demand which is necessary to boost the global economic activity, and as mentioned before, they do not always work.

2. Institutional Agreements

In this environment, a higher degree of coordination and cooperation among diverse economies, both advanced and emerging, is indispensable, to the end of avoiding the adoption of predatory policies, such as the competitive devaluations, which seem to favor situations where no country ends up winning, but which generate great distortions in the world economy. For the purpose of analyzing how this cooperation and coordination could be reached, it is convenient to describe diverse agreements through which international cooperation in multilateral topics has been achieved. In particular, the Bretton Woods agreement, after the World War II, as well as the Plaza and Louvre Accords in the 80s are described.

2.1 Bretton Woods

Bretton Woods was designed as an international agreement that would allow a new international monetary order in the post-war era. The goal of this order was to avoid repetition of the mistakes of the economic policy that world leaders had committed in the 1930s during the Great Depression and that had contributed to a great financial instability, low or even negative economic growth rates, high unemployment levels, depressed world trade and deflation in the major world economies. The measures that, according to the world leaders, contributed to this economic debacle in the period between the wars are: i) sudden exchange rate fluctuations (after the end of the gold standard) due to speculative capital flows, ii) competitive devaluations in order to promote exports and iii) trade restrictions and discriminative treatment of bilateral trade in order to protect domestic markets causing considerable decline in trade, investment and capital flows (Bordo, 1993).[2]

In this way, in July 1944 an agreement among 45 countries was reached in the American city of Bretton Woods, New Hampshire. This pact would establish the guidelines of the international monetary and economic cooperation for the following two and a half decades. The primary objective of Bretton Woods was to gain commitment to international monetary cooperation among the signatory nations in order to have exchange rate stability with the purpose of providing certainty to commercial and financial transactions, under an orderly system of international payments. This would allow to boost international trade, and, therefore, economic growth.

It is important to remember that the United States emerged as the hegemonic power of the Western hemisphere after the World War II and was trying to secure adequate conditions to continue exporting its manufactures to European and Japanese markets that were devastated at the time. In this way, the American dollar established as the reserve currency and the United States implemented reconstruction assistance programs for the war-torn economies (Marshall Plan) and negotiated reductions in trade barriers. The signatory nations committed themselves to maintaining the exchange rate tied to the dollar (or gold) within a band of plus/minus 1 percent of its gold parity, which would only be modified to correct fundamental imbalances in the balance of payments upon approval of the International Monetary Fund (IMF), which was created in the same agreement (see below) (Bordo, 1993). Thus, the dollar would be the reserve currency backed by gold (at a parity of USD 35 per ounce).

Bretton Woods also meant establishing two international bodies existing up to date: the International Monetary Fund and the International Bank for Reconstruction and Development (later changed its name to the World Bank). While the original role of the IMF consisted in supervising the fulfillment of Bretton Woods agreements, as well as in granting credits to the countries facing problems in their balance of payments, the goal of the World Bank was financing development projects. Initially, the results of the agreement were successful, since trade and economic growth figures reached historical levels (Taylor and Obstfeld, 2002).

Nevertheless, despite the initial success, in the 1960s the system shows signs of exhaustion, since the United States suffered a high external deficit, as well as a deficitary fiscal and expansionist monetary policy due to the need of financing the war in Vietnam. This generated abundance of dollars in the international markets and, hence, doubts as to this currency's convertibility with gold. Thus, by 1971, dollar devaluation expectations led to a flight of capital from the United States, and besides several countries made sure to convert their reserves of dollars into gold. Because of this pressure on the American currency, the President Richard Nixon devaluated the dollar by 10 percent and imposed import tariffs to contain the trade deficit. Thus, in order to preserve the international monetary order, the G10 member countries signed the Smithsonian Agreement in 1971, which established the dollar devaluation against gold, other currencies revaluation, suspension of convertibility of dollar into gold and flexibilization of the fluctuation band from 1 percent to 2.25 percent. However, the dollar remained subject to various pressures, and by 1973, the parities were set to float freely, putting an end to the Bretton Woods regime.

2.2 The Plaza and the Louvre Accords

The stagflation that affected the United States in the 1970s forced the Federal Reserve to increase interest rates which caused capital inflows to the United States, generating dollar overvaluation. This implied that American manufacturing exports lost competitiveness in the international markets, apart from creating a bubble in the financial markets (Krugman, 1985). As a consequence, the US current account deficit rose to a level of about 3 percent of GPD, which was to a large extent financed by Germany and Japan that faced great current account surpluses.

In response to these global imbalances, Germany, the United States, Japan, the United Kingdom and France agreed in 1985 to actively intervene in the exchange market in order to depreciate in an orderly manner the value of the dollar (principally, against the Japanese yen and the German mark). This agreement became known as the Plaza Accord. As a consequence, the dollar depreciated improving the trading position of the United States with Europe, but not with Japan.

In 1987 the same countries that signed the Plaza agreement, joined by Canada and Italy, gathered in Paris to sign the Louvre Accord[3], in order to slow down the slide of the dollar and to bring stability to the international currency markets. In particular, it was agreed that the dollar relative price should remain stable close to the levels of 1987. Although this agreement did not explicitly stipulate a range within which the exchange rate should remain, it was revealed, much later, that the abovementioned range was indeed agreed upon (Funabashi, 1988).

The Louvre Accord entailed a coordination of fiscal and monetary policy among all its adherents. France agreed to reduce its fiscal deficit by 1 percent of GDP. Japan would reduce its trade surplus and

[2] Bordo (1993) showed that these reasons justified the design of Bretton Woods although more recent evidence indicates that not all of these perceptions were true. For instance, Friedman (1953) arguments that changes in the economic policy in the countries explain the sudden changes in the exchange rates better than speculative flows. In turn, Eichengreen and Sachs (1985) find that the observed depreciations in the decade of the thirties were not aimed at increasing countries' competitiveness. Finally, Eichengreen (1993) arguments that it was precisely due to the adherence to the gold standard that complicated the world recovery after the Great Depression and that contributed to the international transmission of deflation.

[3] The only country that did not sign the Louvre Accord was Italy.

its interest rate. Germany, the United States and the United Kingdom would reduce taxes, public spending and their interest rates. All the countries agreed to coordinate their efforts to maintain the exchange rates stable.

However, the prolonged contraction of the German monetary policy and the high interest rates of 1989 forced the United States to increase their reference interest rate to 7 percent which led to treasury bond yields of 10.25 percent. This provoked great losses in the international financial markets, particularly, in the United States. The introduction of new taxes in Germany in 1989 and the fiscal problems associated with the reunification, marked the end of the Louvre Accord in 1992 (McKinnon, 1993).

Conclusions

The possibility of an episode of competitive devaluations represents a risk for the global economy recovery. Thus, it is indispensable to make progress in the establishment of international agreements that would allow more cooperation and coordination among countries, with the purpose of avoiding the problems associated with the competitive devaluations.

In particular, it is fundamental that the abovementioned agreements should take into account the externalities generated by the policies implemented in each country. In this sense, not only the participation of the economies that have followed an export-led growth model is required, but also of those advanced economies, such as the United States, that have adopted monetary policies that have contributed to a situation of abundant liquidity in the global economy.

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3.2. Developments in the Mexican Economy

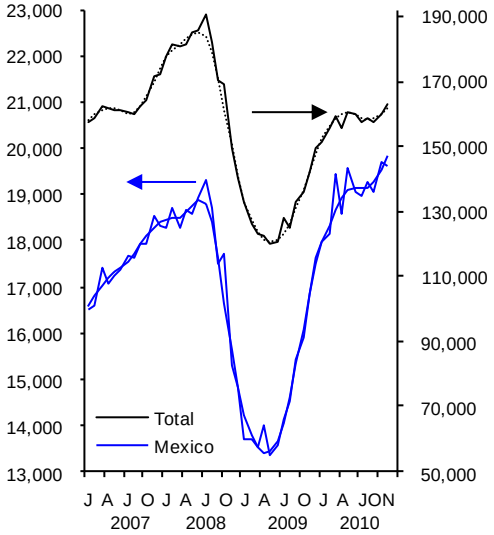
3.2.1. Economic Activity

During the fourth quarter of 2010, the aggregate demand continued showing a positive trend. Indeed, although external demand had been registering a slowdown during the year, in the last quarter it seemed to have resumed an upward path. In turn, the domestic demand showed a relatively more noticeable and widespread expansion as compared to the previous quarters.

More timely information suggests that the boost to Mexican exports caused by a higher external demand appeared to be increasing. In particular, US imports of Mexican goods were more dynamic in the last months of 2010, despite the fact that the total US foreign purchases remained relatively stagnant (Graph 13a). Reflecting the abovementioned, the participation of Mexican goods in total US imports changed from 11.29 percent in the period January-November 2009 to 12.06 percent in the same period of 2010. In the same way, a renewed impulse to manufacturing exports destined for the non-US market has been observed in the last months (Graph 13b). It is noteworthy that the previous performance partly reflects that Mexican manufacturing exports have been favored by the real exchange rate depreciation as compared to the pre-crisis levels.

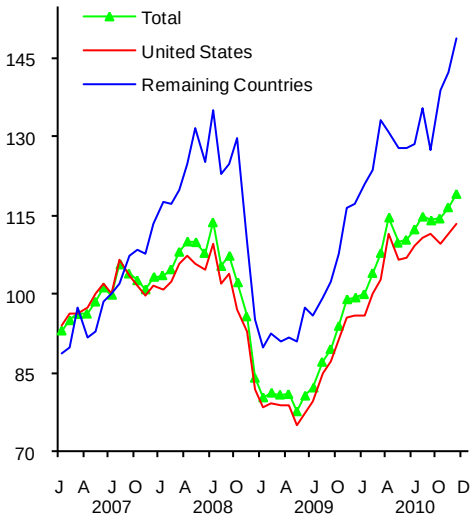
Graph 13
Foreign Trade Indicators

a) U.S.: Total Imports and Imports of Mexican Products
USD Million;
Seasonally adjusted and trend data



Source: Census Bureau, U.S. Department of Commerce.

b) Value of Manufacturing Exports by Region of Destination
Index 2007=100;
Seasonally adjusted data



Source: Banco de México.

As to the domestic demand, the available information shows that during the fourth quarter of 2010 it demonstrated a more favorable evolution than in the previous quarters. In particular, the most recent indicators of private consumption suggest that this aggregate continued its recovery in the last quarter of 2010 (Graph 14a). In turn, although investment is still at levels lower than the ones observed before the global crisis, in the last months it also presented a positive trend (Graph 14b).

The evolution of domestic spending reflects the fact that several of its determinants have shown a favorable trend. In particular:

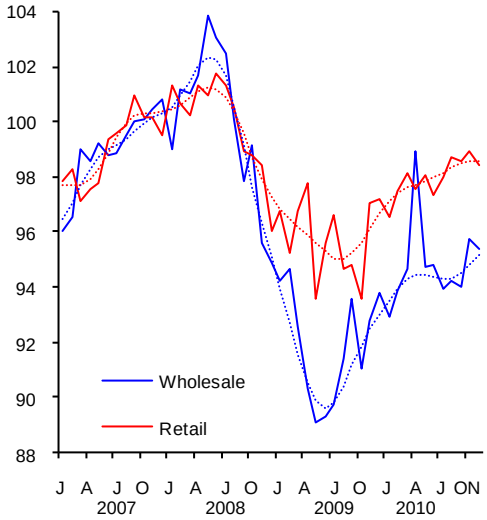
I. The real wage bill of the formal sector of the economy has shown a considerable recovery, principally reflecting higher employment levels in this sector (Graph 15a).

II. Commercial banks' financing for consumption registered the ninth consecutive positive monthly change in December 2010 (Graph 15b). In the same way, bank financing to firms has also started a reactivation process, although at moderate rates.

III. Finally, producers' and consumers' confidence indicators continue demonstrating an improvement, although located at levels lower than the ones observed before the crisis (Graph 15c).

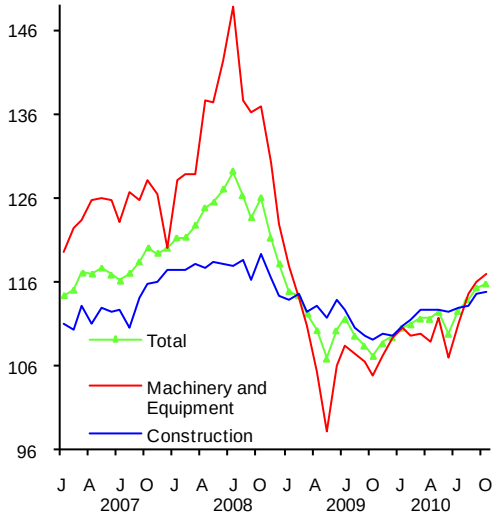
Graph 14
Domestic Demand Indicators

a) Commercial Establishments' Sales
Index 2008=100,
Seasonally adjusted and trend data



Source: Prepared by Banco de México with data from the Monthly Survey on Commercial Establishments (*Encuesta Mensual sobre Establecimientos Comerciales*). INEGI.

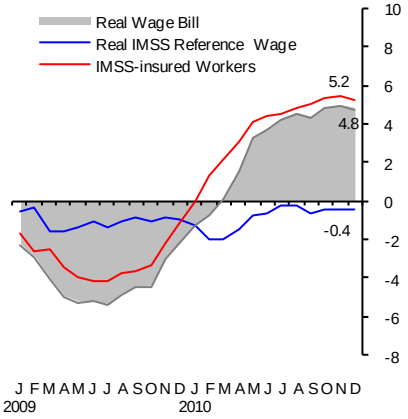
b) Investment and its Components
Index 2005=100
Seasonally adjusted data



Source: Prepared by Banco de México with data from Mexico's System of National Accounts. INEGI.

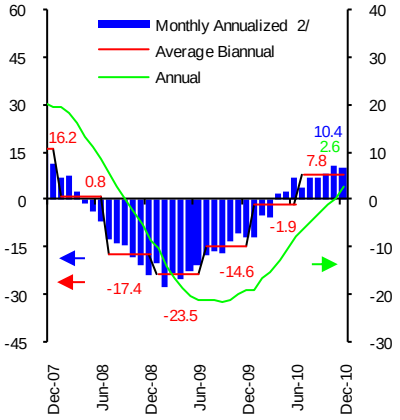
Graph 15
Real Wage Bill, Commercial Banks' Credit and Confidence Indicators

a) Formal Sector's Real Wage Bill
Annual change in percent



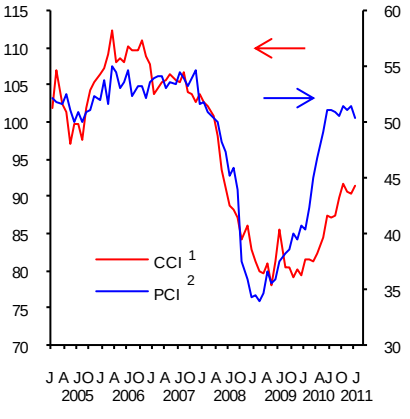
Source: Calculated by Banco de México with data from IMSS.

b) Commercial Banks' Performing Credit for consumption[1/]
Real change in percent



1/ Includes credit portfolio of credit-card regulated SOFOM: *Tarjetas BANAMEX, Santander Consumo, Ixe Tarjetas* and *Sociedad Financiera Inbursa*. From February 2009 onwards, figures are affected by the reclassification from consumer credit to credit granted to non-financial firms.
2/ Seasonally adjusted figures.
Source: Banco de México.

c) Consumer (CCI) and Producer (PCI) Confidence Indices



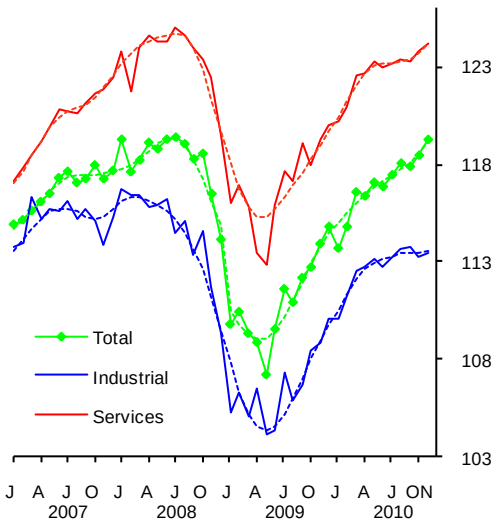
Source: National Survey on Consumer Confidence (*Encuesta Nacional sobre la Confianza del Consumidor)* and Monthly Survey on Business Opinion (*Encuesta Mensual de Opinión Empresarial)*; INEGI and Banco de México.
1/ Seasonally adjusted figures January, 2003=100.
2/ Indicator with 50 point reference; original series.

The evolution of aggregate demand has resulted in an increasing path of the productive activity levels (Graph 16a). In particular, manufacturing

production has continued being boosted by the dynamism of external demand. This, together with a more favorable trend of the construction activity, has given rise to higher levels of the industrial sector (Graph 16b). In turn, the reactivation of the domestic demand has favored that the services sector continued its growing trend in the reported quarter.

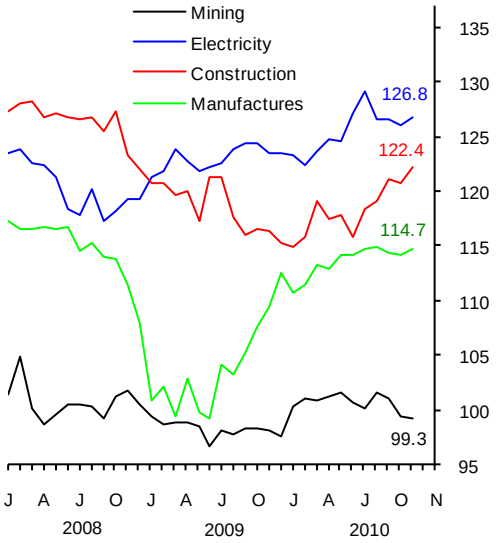
Graph 16
Economic Activity Indicators

a) Global Economic Activity Indicator (IGAE)
Index 2003=100
Seasonally adjusted and trend data



Source: Mexico's System of National Accounts. INEGI.

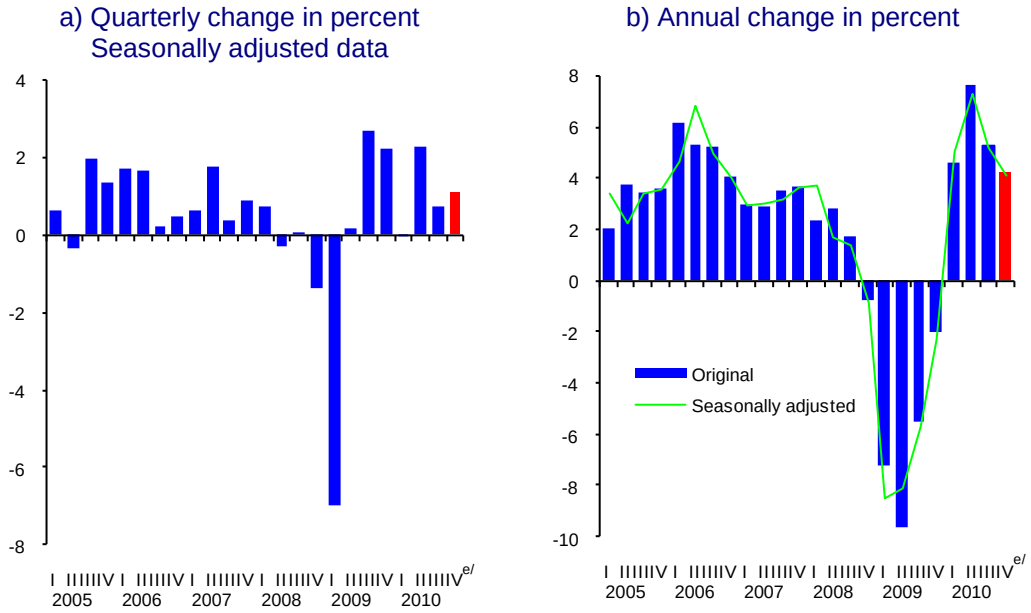
b) Industrial Activity
Index 2003=100;
Seasonally adjusted data



Source: Industrial Activity Indicators, Mexico's System of National Accounts. INEGI.

Thus, timely indicators suggest that in the fourth quarter of 2010 productive activity demonstrated a greater dynamism than the one registered in the previous quarter. In particular, GDP is estimated to have increased at a rate of 1.1 percent in quarterly seasonally adjusted terms in the last three months of 2010, which is compared with the variation of 0.7 percent in the period of July-September 2010 (Graph 17a). This result would imply that in the last quarter of 2010 the annual rate of GDP would have reached 4.3 percent (5.3 percent in the third quarter; Graph 17b). In turn, the abovementioned would imply a growth rate of approximately 5.4 percent for 2010 as a whole.

Graph 17
Gross Domestic Product



Source: Mexico's System of National Accounts. INEGI. Seasonal adjustment up to the fourth quarter of 2010 by Banco de México.
e/ Estimated by Banco de México.

3.2.2. Financial Saving and Financing in Mexico

The economy's flow of financial resources recovered during 2010, registering levels higher than those in 2009 (Table 4). This behavior was mostly due to the increase in foreign resources, as well as the recovery of domestic sources observed from the second quarter of 2010 onwards. Thus, the total annual flow of financial resources registered 9.0 percent of GDP by the third quarter, reaching the maximum level since the first records of these statistics (the fourth quarter of 2002).

Nevertheless, from the fourth quarter of 2010 on, the growth of financial resources tended to slow down (Graph 18a). This is due to the fact that residents' financial savings showed lower growth rates as compared to previous months (Graph 18b). The principal factor that explains this fall is the relative steepening of the yield curve that occurred from November onwards, when longer-term interest rates rose, reducing the value of assets. On the contrary, the non-residents' financial savings continued its expansion in the last quarter of 2010. In particular, the inflow of foreign resources was the result, among other factors, of the increase in liquidity at an international level, which boosted the search for higher yields worldwide, as well as the inclusion of the Mexican government long-term bonds into the World Government Bond Index (WGBI) (Graph 18c).[19]

[19] The incorporation of Mexico's government bonds into the WGBI increased these bonds' holdings by non-residents due to the fact that, among other reasons, a considerable number of investment funds worldwide use this index as a reference for their investment portfolios formation.

Table 4
Total Funding for the Mexican Economy (Sources and Uses)
Percentage of GDP

	Annual Flows						Stock 2010 III	
	2009 II	2009 III	2009 IV	2010 I	2010 II	2010 III	% GDP	Est. %
Total Sources	**4.2**	**3.8**	**4.0**	**5.5**	**7.8**	**9.0**	**77.7**	**100.0**
Domestic Sources 1/	5.1	4.7	3.3	3.0	4.1	5.0	55.5	71.4
Foreign Financing 2/	-1.0	-0.9	0.7	2.5	3.7	4.1	22.2	28.6
Total Uses	**4.2**	**3.8**	**4.0**	**5.5**	**7.8**	**9.0**	**77.7**	**100.0**
Public Sector	3.1	3.8	3.4	3.1	3.5	3.7	37.9	48.8
Public Sector (PSBR) 3/	2.8	3.3	2.6	2.2	2.6	3.1	35.6	45.8
States and Municipalities	0.3	0.5	0.8	0.9	0.9	0.7	2.4	3.1
International Reserves 4/	-1.3	-0.9	0.5	1.8	2.8	3.2	10.6	13.7
Private Sector	0.6	-0.4	0.0	0.7	1.5	2.0	31.3	40.3
Households	0.2	0.1	0.0	0.1	0.3	0.4	13.5	17.4
Consumption	-0.6	-0.6	-0.5	-0.3	-0.1	0.0	3.8	4.8
Housing 5/	0.8	0.7	0.5	0.4	0.4	0.4	9.7	12.5
Firms	0.4	-0.5	0.0	0.6	1.2	1.6	17.8	22.9
Domestic 6/	0.7	0.3	0.4	0.5	0.6	0.9	10.4	13.4
Foreign	-0.3	-0.8	-0.4	0.1	0.6	0.7	7.4	9.5
Commercial Banks' Foreign Assets 7/	0.2	0.1	-0.5	-0.3	-0.4	0.1	2.0	2.5
Other 8/	1.5	1.2	0.6	0.3	0.5	0.0	-4.1	-5.3

Source: Banco de México.
Note: Figures may not add up due to rounding. Figures expressed as a percentage of average GDP of the last four quarters. The information on revalued flows is stripped from the effect of exchange rate fluctuations.
1/ Includes monetary aggregate M4 held by residents. Annual revalued flows of Domestic sources exclude the effect of the reform to the ISSSTE Law on monetary aggregate M4. Information on the stock of Domestic sources includes the effect of this reform.
2/ Includes monetary aggregate M4 held by non-residents, foreign financing for the federal government, public institutions and entities, and foreign financed investment projects (PIDIREGAS), commercial banks' foreign liabilities, and financing to the non-financial private sector.
3/ Public Sector Borrowing Requirements (*Requerimientos Financieros del Sector Público*, RFSP or PSBR, for its acronym in English) and Public Sector Borrowing Requirements' historical stock (SHPSBR or SHRFSP, for its acronym in Spanish) as reported by the Ministry of Finance (SHCP). Figures of revalued flows exclude the impact of the reform to the ISSSTE Law on RFSP. Information on SHRFSP does include the effect of this reform on the public debt.
4/ As defined by Banco de México's Law.
5/ Total portfolio from financial intermediaries and from the National Housing Fund (*Instituto del Fondo Nacional de la Vivienda para los Trabajadores,* Infonavit), and from the ISSSTE Housing Fund (*Fondo de la Vivienda del ISSSTE*, Fovissste). Includes debt-restructuring programs.
6/ Total portfolio of financial intermediaries. Includes debt-restructuring programs.
7/ Includes assets from abroad and foreign financing.
8/ Includes capital accounts and results and other assets and liabilities of commercial and development banks, Banco de México, non-bank financial, intermediaries, and INFONAVIT, as well as non-monetary liabilities from IPAB, among others.

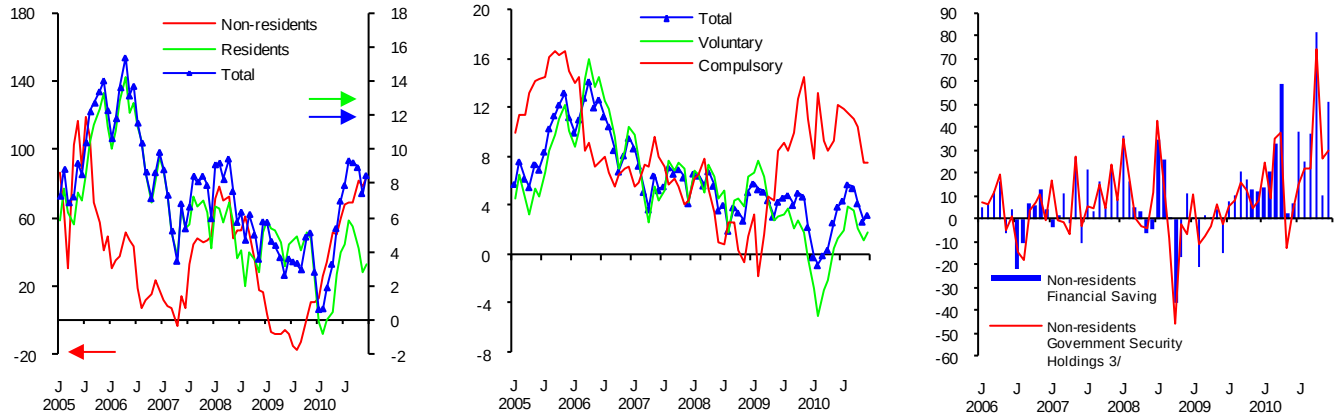
In the previous table it stands out that about two thirds of the available financial resources are channeled to the public sector and to international reserves accumulation. Indeed, the increased flows of financial resources registered by the third quarter of 2010 allowed the allocation of a considerable amount of these to international reserves accumulation, which has strengthened Mexico's position against the possibility of foreign shocks. Likewise, the public sector continued absorbing a significant amount of financial resources. In particular, the expansion of the public sector borrowing requirements (PSBR) during 2009 and 2010 reflects the countercyclical policy implemented by the Mexican Government to face the negative effects of the international crisis. In turn, the flow of financial resources to the private sector continued growing, mainly those channeled to financing firms, which is consistent with the positive trend shown by the aggregate demand (Table 4).

Graph 18
Financial Saving

a) Total Financial Saving[1/ 2/]
Real annual change

b) Residents Financial Saving[2/]
Real annual change

c) Non-residents Financial Saving and Government Security Holdings
Monthly change in MXN billion



Source: Banco de México.
1/ Defined as monetary aggregate M4 minus the stock of banknotes and coins held by the public.
2/ Excludes the impact of the reform to the ISSSTE law on this aggregate.
3/ Holdings of government securities in nominal value. Figures available up to December 31, 2010.

Domestic financing to the non-financial private sector continued its recovery in the fourth quarter of 2010, presenting a moderate expansion.[20] The evolution of domestic financing to private firms was based both on commercial banks' credit and on debt issuance. With regard to this, in December 2010, the stock in real terms of domestic credit granted to firms reached the maximum level registered at the beginning of 2009, before the credit started to contract as a result of the international economic crisis (Graph 19a). Nonetheless, the recovery of the credit to firms does not seem to exert pressure on the aggregate demand, since it has been expanding at moderate rates and, in particular, below those observed prior to the outbreak of the international crisis (Graph 19b).

In turn, the total credit to households, which includes that granted by the banks and other non-bank financial intermediaries, continued demonstrating a gradual improvement. First, it should be pointed out that in November and December 2010, the commercial banks' performing credit for consumption registered positive real annual growth rates for the first time since September 2008 (Graph 19c). This behavior has responded, among other factors, to higher employment levels, as well as to the improvement observed in the quality of consumer credit portfolio (Graph 20a). In turn, the commercial banks' lending for home acquisition continued its expansion in real terms, although at a more moderate rate than the one registered in previous months (Graph 19c), while this portfolio delinquency rates have remained at low levels and continue to decrease (Graph 20b).

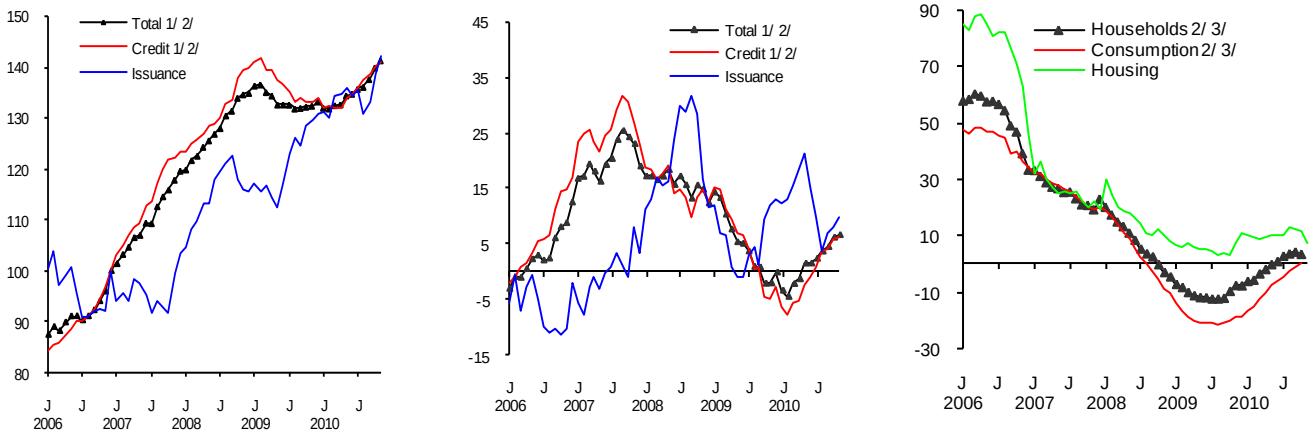
[20] Given that foreign direct financing statistics is obtained with a certain lag, some aspects regarding domestic and foreign financing by means of securities issuance will be highlighted below.

Graph 19
Domestic Financing to Non-financial Private Sector

a) Domestic Financing to Non-financial Private Firms
Seasonally adjusted stocks
(Real Index Dec2006=100)

b) Domestic Financing to Non-financial Private Firms
Real annual change in percent

c) Commercial Banks' Performing Credit to Households
Real annual change in percent

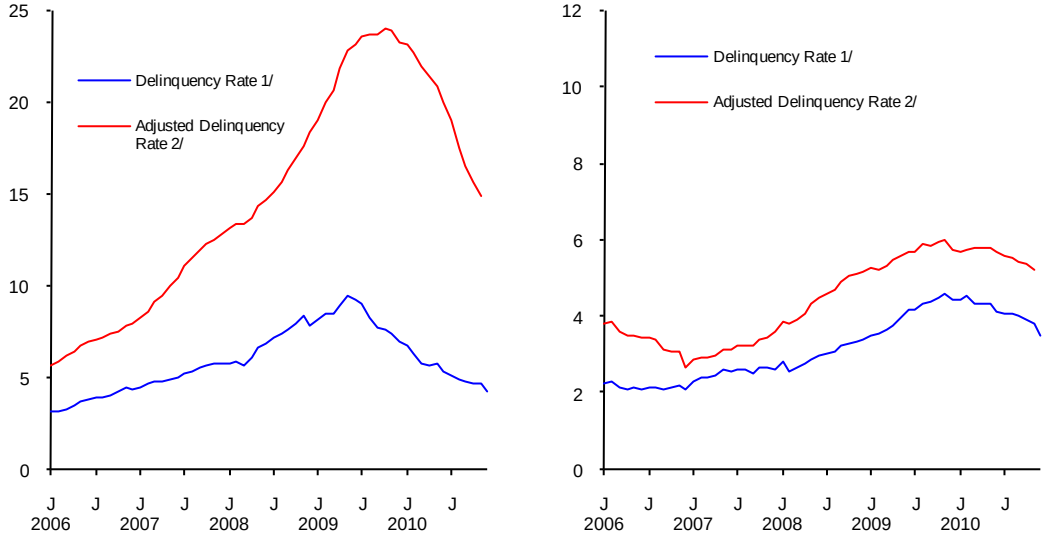


Source: Banco de México.
1/ These figures are affected by the disappearance of some non-banking financial intermediaries and its conversion to non-regulated Sofom.
2/ From February 2009 onwards, figures are affected by the reclassifying of credit granted to small- and medium-size firms (PyMES, for its acronym in Spanish) from consumer credit to credit granted to non-financial firms.
3/ Figures as of March 2008 include total consumer credit portfolio of commercial banks' subsidiaries Sofom E.R.

Graph 20
Delinquency Rates of Commercial Banks' Credit to Households

a) Delinquency Rate and Adjusted Delinquency Rate of Consumer Credit
Percent

b) Delinquency Rate and Adjusted Delinquency Rate of Housing Credit
Percent



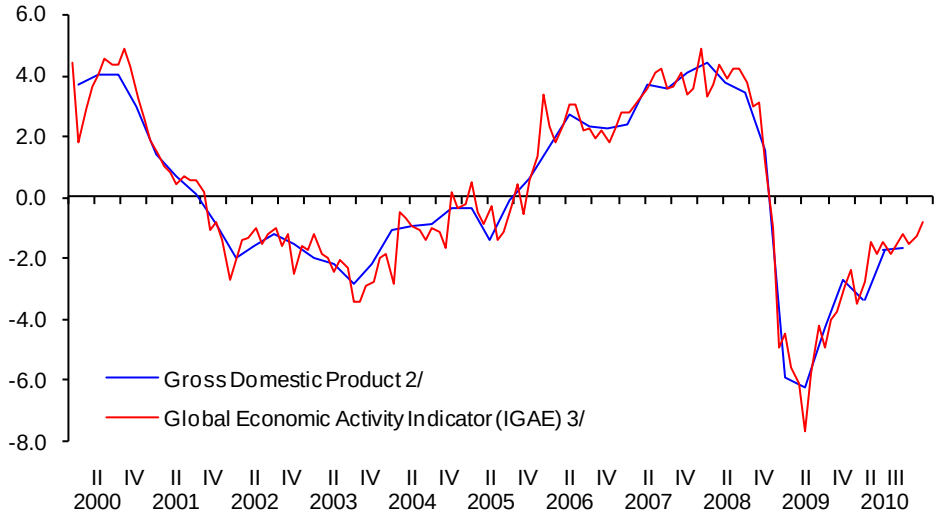
Source: Banco de México and CNBV.
1/ The delinquency rate is defined as non-performing portfolio divided by total loan portfolio.
2/ The adjusted delinquency rate is defined as the sum of non-performing loans plus any write-offs or losses recognized by banks during the twelve previous months divided by total loan portfolio plus the abovementioned write-offs or losses.

4. Inflation Determinants

As it has been previously described, during 2010 inflation reached levels lower than those expected at the beginning of the year, and, in this way, it significantly progressed in converging towards the 3 percent inflation target. This was achieved even in the presence of events adversely affecting inflation, such as, the tax reform, the increments in certain fares authorized by local governments at the beginning of the year, as well as the increase in the international price quotes of different commodities starting from the second half of 2010.

The abovementioned reflects the fact that several inflation determinants, for instance, the present phase of the economic cycle, and its effects on prices in the markets of inputs and finished goods, the exchange rate behavior, and, especially, the monetary stance, have been congruent with a reduction in inflation.

Graph 21
Output Gap[1/]
Percentage of potential output



Source: Banco de México.
1/ Estimated using the Hodrick-Prescott (HP) method with tail corrections; see Banco de México (2009), "Inflation Report, April-June 2009", p.69.
2/ GDP figures up to the third quarter of 2010.
3/ Figures up to November 2010.

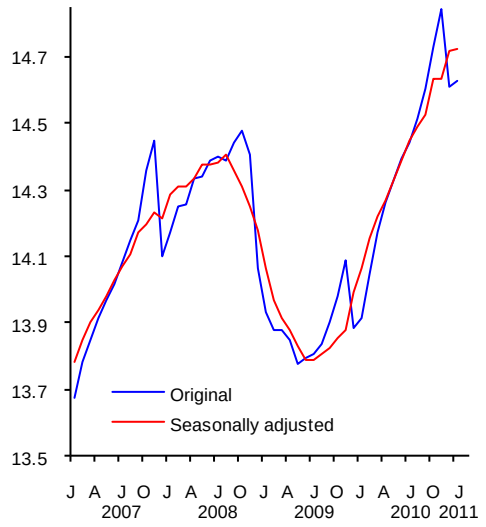
First of all, the current phase of the economic cycle affects the inflation behavior to a large extent through the impact that the aggregate demand has on the price formation process in the markets of inputs and finished products. In this sense, due to the more favorable evolution of the aggregate demand, described above, the output gap has been closing more rapidly than previously anticipated (Graph 21). Nevertheless, diverse indicators associated with the impact of these cyclical conditions on utilization, and accordingly, on main input prices, indicate that until the last quarter of 2010 no demand-related pressures on inflation were observed. In particular, stands out the following:

a) In the labor market, higher aggregate demand in the economy has resulted in a significant recovery of the formal employment levels (Graph

22a). Despite these dynamics, labor costs have not been a source of inflationary pressures. Indeed, the unemployment rates, as well as the informal sector employment have remained at relatively high levels (Graph 22b and c), which has contributed to moderating wage increases. In this sense, stands out the increase of 4.1 percent in the minimum wage stipulated for 2011 that, however, is consistent with an expected increase in the purchasing power of the minimum wage.

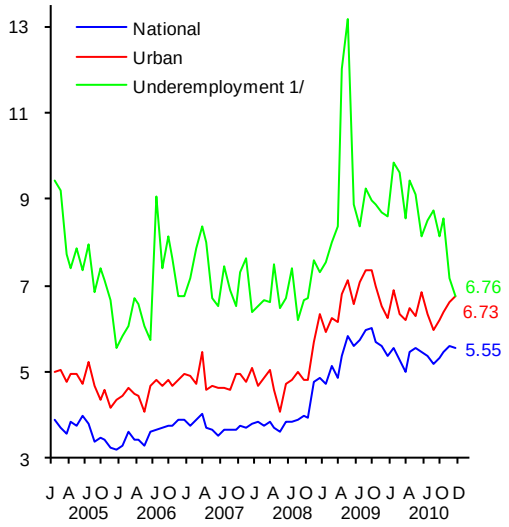
Graph 22
Labor Market Indicators

a) IMSS-insured Workers
Millions of persons



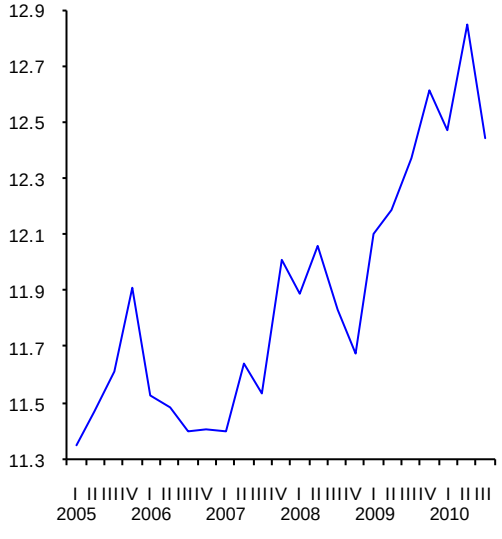
Source: Prepared by Banco de México with data from IMSS.

b) Unemployment and Underemployment Rate
Percent; seasonally adjusted data



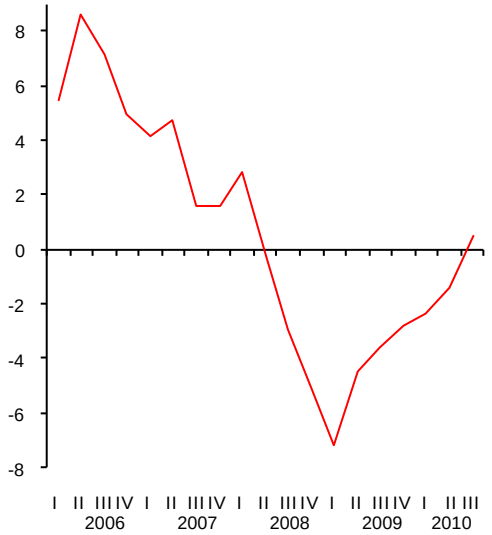
Source: National Employment Survey (*Encuesta Nacional de Ocupación y Empleo*), INEGI.
1/ Original Series.

c) Informal Sector Employment
Millions of persons



Source: National Employment Survey (*Encuesta Nacional de Ocupación y Empleo*), INEGI.

d) Total Economy's Real Wage Bill
Annual change in percent



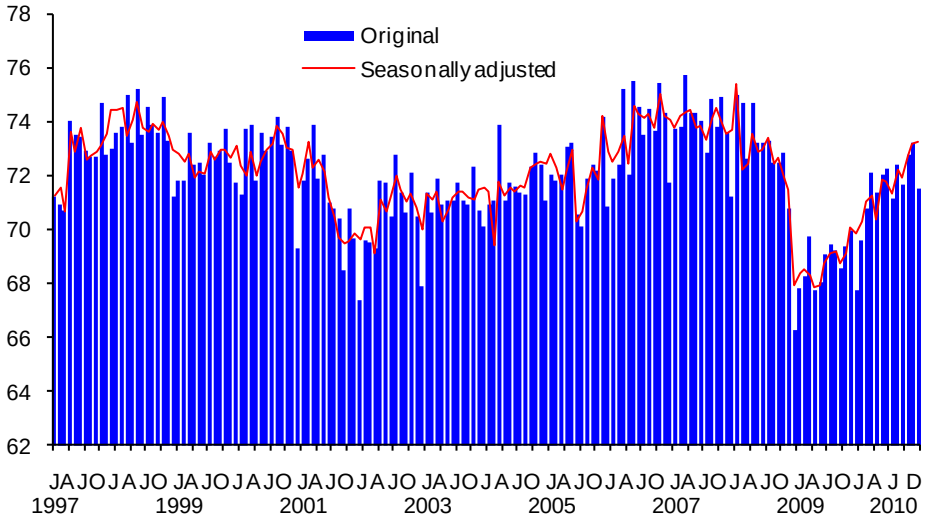
Source: Prepared by Banco de México with data from National Employment Survey (*Encuesta Nacional de Ocupación y Empleo*), INEGI

The consequence of the abovementioned was also the fact that, in spite of the recovery in employment levels, the total wage bill of the economy has shown a relatively slow reactivation, registering in the third quarter of 2010 the first positive annual change (0.5 percent), after nine consecutive quarters with negative annual changes (Graph 22d).[21] This has contributed to avoiding inflation pressures, by moderating the private consumption recovery rate.

b) Regarding the credit market, although commercial banks' financing to the private sector continued its gradual recovery and positive growth rates were registered in the analyzed quarter, it has not rebounded significantly. In particular, the credit granted by the commercial banks to the non-financial private sector is presently at relatively low levels. This seems to reflect the reduced demand for investment credit, stemming from the moderate reactivation of private consumption. This has also been influenced by the fact that, although the use of installed capacity in the manufacturing industry has continued its growth (Graph 23), it is still lower than the levels achieved before the 2008 crisis.

Thus, the recent evidence of the loanable funds' markets suggests that granting a credit is not a factor that could generate widespread pressures on prices in the foreseeable future.

Graph 23
Installed Capacity Utilization: Manufacturing Sector
Percent



Source: Monthly Manufacturing Business Tendency Survey (*Encuesta Mensual de Coyuntura en el Sector Manufacturero*). Banco de México.

c) Other indicators that allow evaluating to what extent the evolution of aggregate demand is consistent with the productive capacity of the economy are the ones relative to the external sector's evolution. Indeed, to the extent to which aggregate spending does not result in excessive deficit in external accounts, no pressures on the exchange rate that could result in higher inflation will be observed.

[21] In the particular case of the formal sector, taking as a reference the number of IMSS-insured workers, the real wage bill shows an annual rate of 4.9 percent in the fourth quarter of 2010.

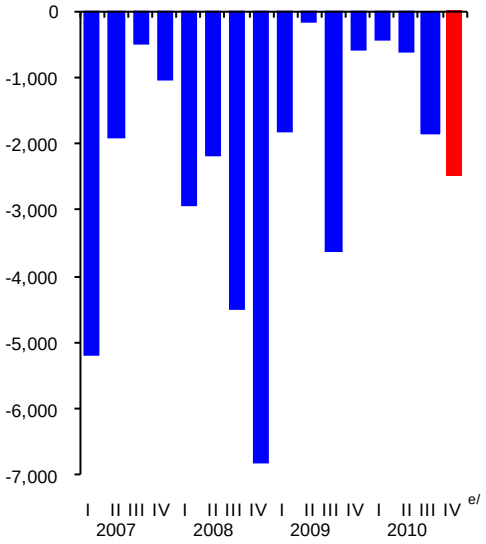
Available information suggests that the current account deficit maintained at moderate levels during the fourth quarter of 2010 (approximately USD 2.5 billion, an amount equivalent to 0.9 percent of GDP; Graph 24a). In particular, the observed increase in imports can still be explained mainly by foreign purchases of intermediate goods, which is a consequence of higher export levels. Instead, imports destined for the domestic market have exhibited more moderate dynamics, and, particularly, in the case of capital goods imports a change in the trend is still not evident (Graph 24b).

In turn, during the analyzed quarter, Mexico continued receiving significant amounts of foreign inflows, which allowed full financing of the current account deficit. The capital account (including errors and omissions) is estimated to have registered a surplus of around USD 7.8 billion during the reference quarter, which mainly reflects foreign investment (both direct and portfolio) and public and private sector's net foreign financing.

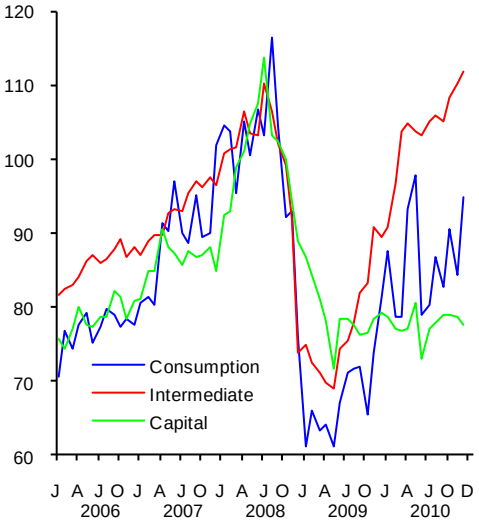
All the abovementioned contributed to the exchange rate appreciation.

Graph 24
Imports of Goods and Current Account

a) Quarterly Current Account
USD Million



b) Imports of Consumer, Capital and Intermediate Goods
Seasonally adjusted data;
Index 2008=100



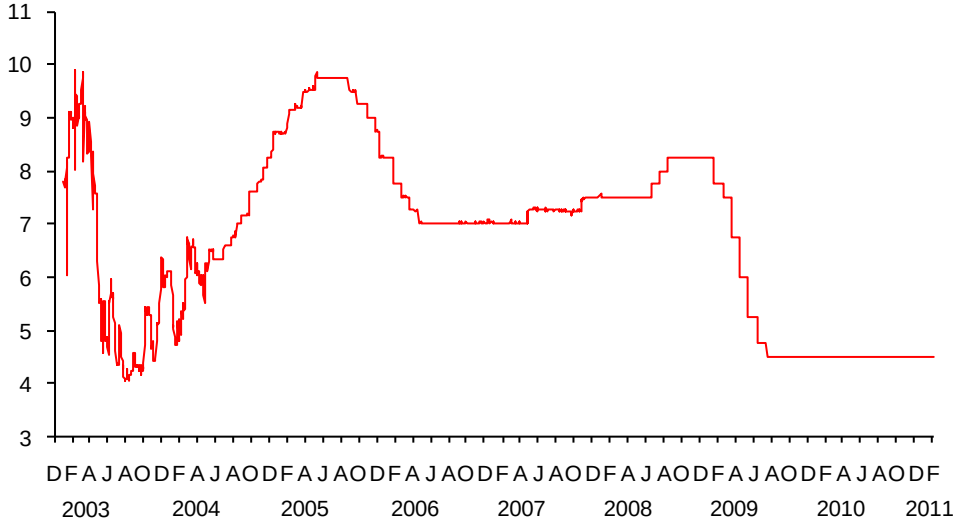
Source: Banco de México.
e/ Estimate.

In turn, international commodities prices registered an upward tendency, accentuated in the case of grain prices, in the last quarter of the year. The impact of these increases has affected, on the domestic level, consumer prices of foods derived from wheat and corn. It is noteworthy, however, that it has not spread on the rest of foods. In the same way, it is relevant to point out that, in general, the appreciation demonstrated by the national currency partially cushioned the impact of the increase in the external commodities prices on their equivalents in the national currency.

In the light of the observed behavior of different inflation determinants, Banco de México's Board of Governors decided to maintain its Overnight Interbank Interest Rate at 4.5 percent during 2010 and January 2011 (Graph 25).

The monetary stance influenced inflation through its effects on inflation expectations, exchange rate and aggregate demand. Indeed, the adopted monetary policy prevented that the price formation process in the economy was contaminated by the shocks suffered by inflation at the beginning of the year, and thus, favored that inflation during 2010 was lower than initially expected. In particular, it contributed to: i) inflation expectations remaining relatively anchored (although above its 3 percent target); ii) the fact that, in combination with favorable external conditions for receiving financial resources, the exchange rate evolution compensated for the pressures derived from the recent behavior of international commodities prices; and, iii) the economy's transition towards the high phase of the economic cycle without hindering its recovery, but also without allowing aggregate demand pressures on inflation.

Graph 25
Overnight Interbank Interest Rate[1/]
Percent annual



1/ The target for the Overnight Interbank Interest Rate is shown since January 21, 2008.

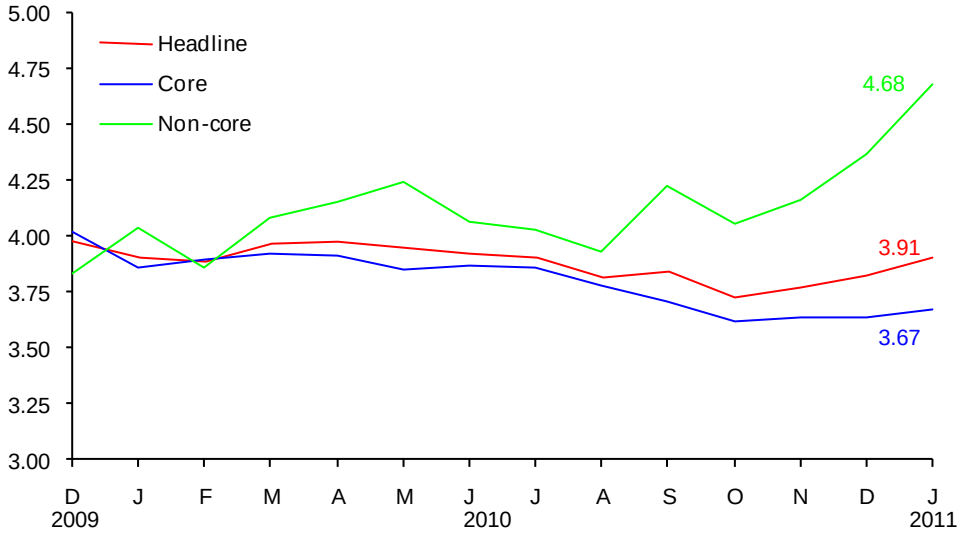
Regarding inflation expectations, it is noteworthy that headline inflation registered rates lower than those expected by market analysts from April to September 2010. As a consequence, during the year inflation expectations for the end of 2010 were revised downwards, while the ones corresponding to the end of 2011 have remained relatively stable.

1 In the first case, these started registering an average of 4.9 percent in Banco de México's survey in January, decreased to 4.6 percent in the July survey, and, despite the close end of the year, in December they demonstrated an additional drop to 4.4 percent.[22]

[22] In the Infosel survey of September 24, the expectation for the fourth quarter average of 2010 was 4.24 percent, while in the survey of December 17 it was 4.25 percent.

2 As to the ones corresponding to the end of 2011, these have maintained relatively stable around 3.91 percent. Nevertheless, core inflation expectations for 2011 have shown a slight downward tendency, locating at 3.67 percent in the January survey, while the ones corresponding to non-core inflation have demonstrated increments reaching 4.68 percent in the same survey (Graph 26).[23]

Graph 26
Headline, Core and Non-core Inflation Expectations for 2011
Percent annual



Source: Banco de México Survey.

In turn, inflation expectations for longer-term horizons have remained relatively anchored, although above the permanent target of 3 percent. In the case of expectations for 2012, they have maintained around 3.8 percent during the last months (Graph 27a). Additionally, the average inflation expectations for the following 4 years and the average for the period of 5 to 8 years have remained at levels close to 3.6 and 3.5 percent, respectively (Graph 27b).

As to the compensation for inflation and inflationary risk indicator (that represents inflation expectations plus a risk premium), which is obtained from the difference between the nominal yield on 10-year bond and the real yield of the same term indexed debt instruments (*Udibonos*), it is located around 4.2 percent (Graph 27c).[24]

During the last quarter of 2010 and the first week of February 2011 the exchange rate has shown a tendency to appreciate, changing from a level of 12.60 pesos per dollar at the end of the third quarter of 2010 to a level close to 12.00 pesos per dollar during the first days of February. This was due to a number of factors, among which stand out the following: i) better prospects of US industrial production growth; ii) better prospects of domestic spending in Mexico; and, iii) abundant liquidity in the international financial markets as a consequence of the

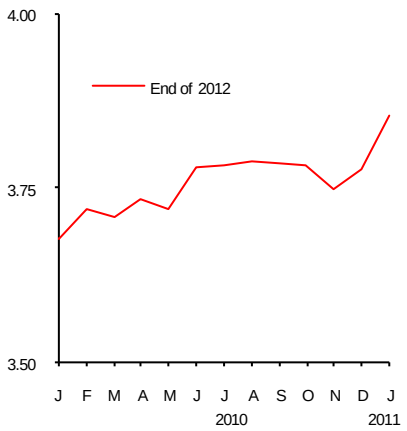
[23] The average of inflation expectations reported in the Infosel survey of February 4 for the end of 2011 was 3.90 percent.

[24] Because of their nature, these indicators tend to be affected by changes of the liquidity conditions prevailing in the money market. Therefore, they should be interpreted carefully given the volatility commonly observed in their behavior.

monetary policy adopted in the major advanced economies, in particular, the United States. The first two elements are considered to have had higher incidence on the evolution of the exchange rate parity recently, which is why the nominal exchange rate changes have possibly been more associated with a prospect of a real currency appreciation.

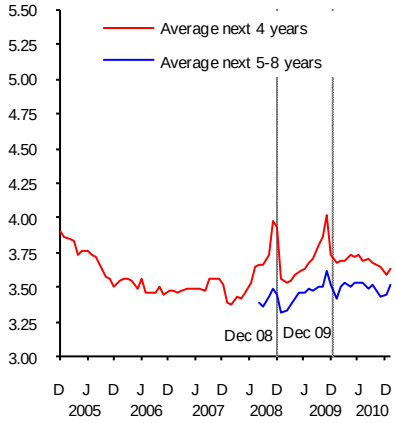
Graph 27
Annual Headline Inflation Expectations and Compensation for Inflation and Inflationary Risk on Long-term Bonds
Percent annual

a) Annual Headline Inflation Expectations for 2012



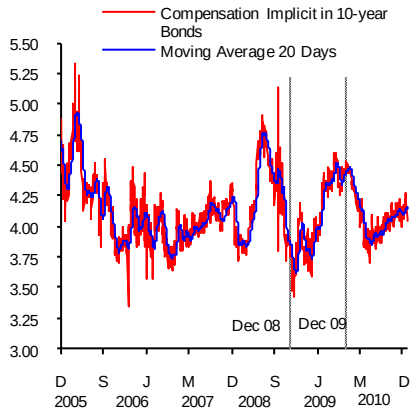
Source: Banco de México Survey.

b) Annual Headline Inflation Expectations



Source: Banco de México Survey, monthly periodicity.

c) Compensation for Inflation and Inflationary Risk on Long-term Bonds [1/]

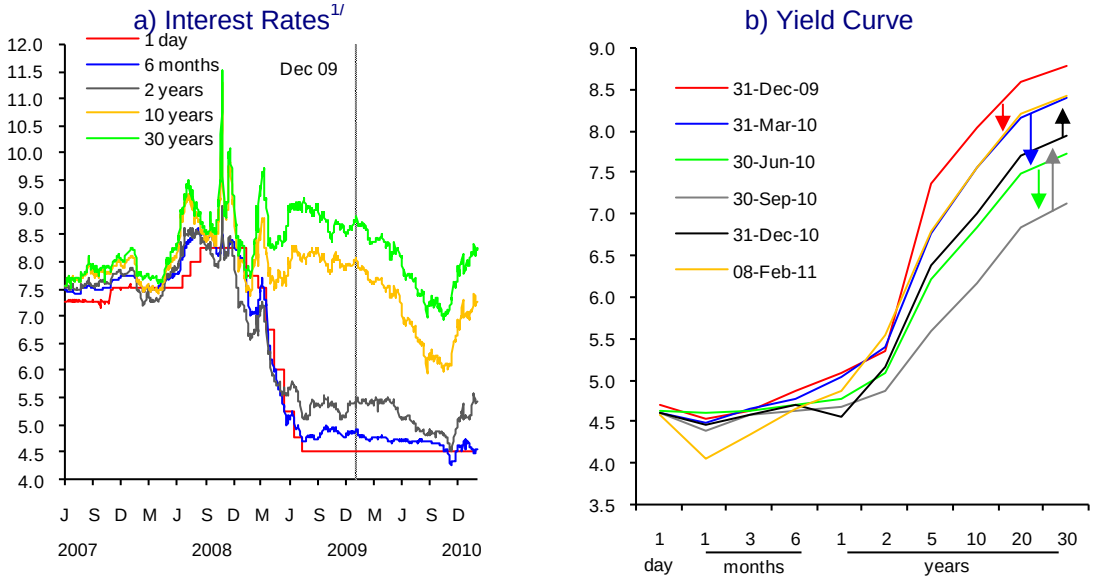


1/ The compensation for inflation and inflationary risk implicit in 10-year bonds is calculated on the basis of nominal and real interest rates from the secondary market.
Source: Banco de México estimate with data from Bloomberg.

Banco de México's monetary stance has allowed a generalized reduction in domestic long-term interest rates. By means of this mechanism, aggregate spending was reactivated, although the level reached by these rates continued being congruent with an absence of demand-related inflationary pressures.

In particular, from the end of 2009 to mid-October 2010, the interest rates of 30-year bonds changed from 8.8 to 6.9 percent, reaching minimum historical levels (Graph 28). In fact, during 2010 the yield curve flattened. This represents a stimulating factor for economic activity, owing to the fact that some demand components of the private sector, such as durable goods consumption and investment, positively respond to a reduction in longer-term interest rates. This is so because saving and investment decisions of households and firms change, to a large extent, depending on the referred rates. The former have higher incentives for smoothing the consumption pattern of durable goods over time, while the financing cost for firms diminishes. It should be noted, however, that part of the curve flattening, registered during the first 3 quarters of 2010, has reverted recently. This was a result of an increase in longer-term rates, which presently locate at 8.4 percent, in the case of 30-year bonds.

Graph 28
Interest Rates in Mexico
Percent annual



1/ Since January 21, 2008, the one-day (overnight) interest rate corresponds to the target for the Overnight Interbank Interest Rate.

The recent increase in longer-term interest rates is not attributable to an increase in the risk premium of the country or to an increase in inflation expectations (Graph 29 and Graph 27). In fact, as it has been previously pointed out, inflation expectations corresponding to medium and long terms have maintained relatively stable. Likewise, the risk premia have remained unchanged, as shown by the EMBI for Mexico.[25]

Among the most relevant factors behind longer-term interest rate increments in Mexico stand out the following:

a. Increments in the longer-term interest rates in the United States, despite the fact that these are located at low levels. This is perceived as a consequence of improvement in the US economic prospects.

b. The phase of the economic cycle that the Mexican economy is going through also reflects a higher pace of the economic activity in the foreseeable future, which leads to higher interest rates as a result of an increase in their real component. This is not only a result of expected higher profitability of investment projects, derived, in turn, from an improvement in the growth prospects.

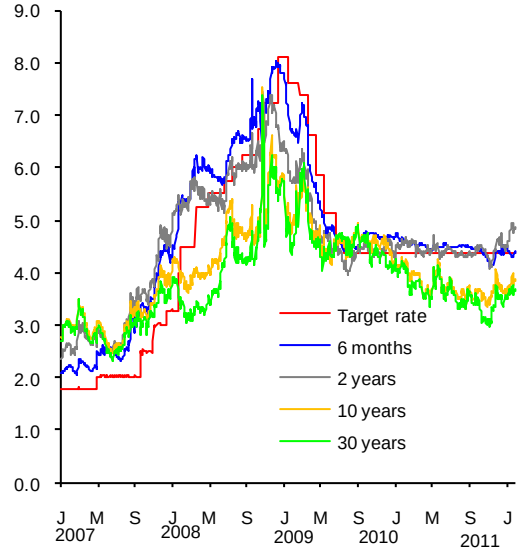
c. Higher risk aversion presented in the international financial markets, as a result of the fiscal problems in some countries of the Euro zone, generated upward pressure in emerging economies' interest rates, including Mexico. This happened especially during some weeks of

[25] EMBI stands for Emerging Markets Bond Index. This indicator, produced by JP Morgan, expresses the average spread registered between the interest rate of risk-free instruments (such as US Treasury securities) and the interest rate granted by debt instruments denominated in dollars coming from emerging countries, such as Mexico.

November. This factor is not considered to be presently functioning, although it should be noted that the fiscal situation in Europe is still characterized by a high level of uncertainty.

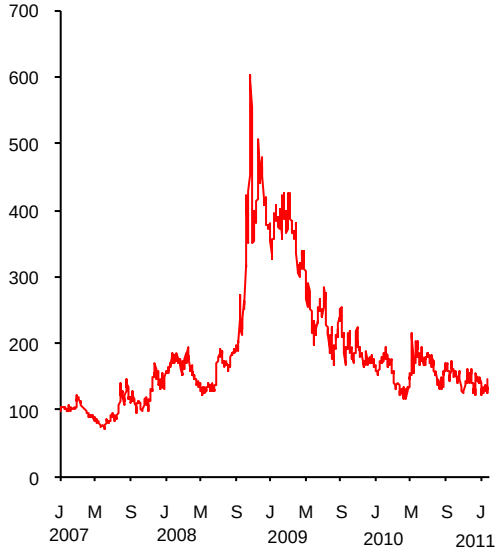
Graph 29
Interest Rate Spreads between Mexico, the United States and EMBI

a) Interest Rate Spread between Mexico and the United States
Percent



Source: Banco de México.

b) Sovereign Risk Spread (EMBI) for Mexico
Basis Points



Source: JP Morgan.

Summing up, the monetary stance maintained by Banco de México was congruent with the economy's movement towards the high phase of the economic cycle without generating spending-related pressures, with anchored inflation expectations (although still above the 3 percent target), and with an operation of exchange rate transmission channel.

To conclude this section, it is necessary to reflect on the possible reasons because of which inflation expectations remain anchored at a level above the inflation target, despite the monetary policy efforts. Regarding this point, there are various characteristics of the price formation process in the economy that could explain this situation.

First of all, the uncertainty related to the possible changes in the public sector's price and fare policies in general affects inflation expectations adversely. Indeed, it has been repeatedly observed that, at the end of each year, headline inflation expectations for the following year can increase fundamentally as a result of the effect that the non-core component can have on inflation. The relevance of this effect on headline inflation expectations cannot be underestimated, considering that to a large extent public sector's prices and fares are associated with goods and services of widespread use as production inputs and that, in general, they are a reference in the price formation process in the economy.[26]

[26] See Box 7 "Recent Impact of Administered and Regulated Prices of Goods and Services on Inflation in Mexico", in the Inflation Report, October-December 2008 of Banco de México, pp. 39-41.

On the other hand, the market structure in diverse sectors producing goods with a high CPI weight, such as some foods included in the basic basket, among others, can also have important repercussions on the inflation dynamics. In particular, the lack of competition in some of these sectors, combined with other particular characteristics of each market, can lead to asymmetries in the response of the price growth to various shocks. This growth can accelerate if production costs or international prices of these goods increase, but it cannot slow down in the case of their reductions. This element could partly explain the fact that in the low phase of the last economic cycle, inflation in Mexico did not reduce with the speed registered in other countries.[27]

Although the relevance of these elements as factors affecting inflation's inertia and the level of inflation expectations cannot be rejected, it is also relevant to mention that recently progress has been made in the degree of competition in some markets, which has contributed to mitigating inflationary pressures in particular sectors. Two examples of this are the air transport and retail chains sectors, where higher competition levels have led to considerable reductions in price growth. Another sector where lower rigidity in price setting has been observed is the labor market. As it has been previously mentioned, wage negotiations implied moderate increases during the year, which is congruent with the present business cycle phase of the economy, and, in particular, with lax conditions still prevailing in the market.

Surely, if these favorable results on inflation strengthen, as it is forecasted by Banco de México, this could fuel the price formation process by means of a downward revision of inflation expectations in the medium and long term. The abovementioned would favorably influence the comprehensive functioning of the nominal system (the entire set of prices) of the economy, which would permanently function with an expected growth of 3 percent. This would accelerate inflation's convergence towards its permanent target of 3 percent. Banco de México will continue monitoring this process, with the purpose of adequately adjusting its monetary policy stance and achieving the referred convergence.

[27] See Box 1 "Market Structure and Other Rigidities and Distortions: Effects on Observed Inflation", in the Inflation Report, October-December 2008 of Banco de México, pp. 9-10, as well as Box 1 "Price Setting under the Current Economic Environment", in the Inflation Report, July-September 2009 of Banco de México, pp. 7-11.

5. Inflation Forecasts and Balance of Risks

The macroeconomic scenario forecasted by Banco de México is based on the following assumptions about the external conditions:

a) US GDP registered a quarterly increase of 3.2 percent in annualized terms in the last quarter of 2010, and thus, presented an increase of 2.9 percent for the year. US industrial production showed an annualized quarterly change of 2.4 percent during the fourth quarter of 2010. So, for the entire year, this sector exhibited an expansion of 5.8 percent.

b) Derived from the approval of a new fiscal package by the US Congress, an increase in the monetary stimulus and an improvement in a wide range of indicators that suggest a greater recovery in that economy, growth expectations for 2011 have been revised upwards.[28] Currently, US output is expected to register an annual expansion of 3.2 percent, while industrial production is anticipated to increase by 4.4 percent. These figures are compared to the annual increases of 2.5 percent and 3.9 percent forecasted in the Inflation Report, July-September 2010, respectively.

c) Finally, US GDP and US industrial production are expected to register expansions of 3.3 percent and 4.1 percent in 2012, respectively.

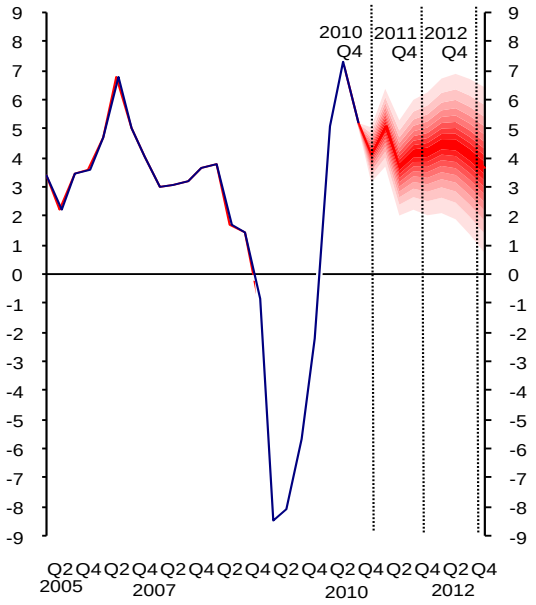
GDP Growth: Based on the information analyzed in this Report, Mexican GDP is estimated to have shown an increase of 4.3 percent in the last quarter of 2010. Thus, for the entire year it is calculated that the economy has registered an expansion of 5.4 percent. In turn, the improvement in US industrial production growth expectations, in a context where a continuing gradual reactivation of the domestic demand is anticipated, suggests that in 2011 the Mexican output will increase more than projected in the previous Inflation Report. Indeed, GDP growth in 2011 is estimated to lie between 3.8 percent and 4.8 percent, as compared to the interval of 3.2 percent to 4.2 percent published in the Inflation Report, July-September 2010. Also, based on the expected evolution of the US economy and the dynamics which the domestic demand is expected to present, Mexican GDP growth between 3.8 percent and 4.8 percent is estimated for 2012 (Graph 30a). As will be shown below, the Fan Charts for the annual output growth show the probability of realization of these forecasts for the considered time horizon (Graph 30a). The darker shaded areas represent the projection more likely to occur. The bands of each side with the same color but with lighter tones accumulate in total 10 percent of probability, and so successively until adding up 90 percent of probability. The same technique is used in the case of output gap and inflation forecasting.

The faster growth of the aggregate demand estimated for 2011 suggests that the output gap will close more rapidly than previously estimated (Graph 30b).

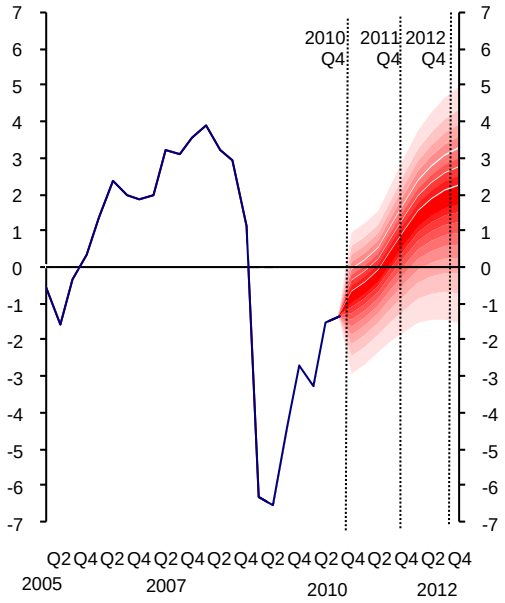
[28] The expectations for 2011 and 2012 are based on the consensus of analysts interviewed by Blue Chip in February 2011.

Graph 30
Fan Charts

a) Output Growth
Percent annual



b) Output Gap
Percent



Employment: The economic activity growth anticipated for 2011 suggests that, in this year, the number of IMSS-insured workers will increase between 600 and 700 thousand. In turn, the higher level of economic activity forecasted for 2012 suggests a generation of between 600 and 700 thousand new formal employments that year.

Current Account: The trade balance deficit in 2010 was USD 3.1 billion (0.3 percent of GDP). Thus, the current account is estimated to have shown a deficit of USD 5.4 billion (0.5 percent of GDP) this year. In turn, it is estimated that the relatively less dynamic export sector in 2011, as compared to 2010, and the gradual expansion of domestic demand will lead to a higher deficit in the trade balance and the current account with respect to the ones observed in the previous year. In particular, it is forecasted that the former registers a deficit of USD 10.0 billion (0.9 percent of GDP), while the latter a deficit of USD 14.2 billion (1.2 percent of GDP). These figures are based on the assumption that the price of Mexican crude oil export will reach an average of around USD 87 per barrel, implying a higher level than the one observed during 2010, which was USD 72.31.

It is noteworthy that although the projected deficits for 2011 are higher than those anticipated for 2010 and those observed in 2009, they are still below the levels registered for the trade balance and the current account in 2008 (USD 17.3 and 16.5 billion, respectively). Additionally, the liquidity conditions that are expected to prevail in the international financial markets, as well as the fact that the Mexican Government already pre-financed its external debt amortization program for 2011, suggest that the projected deficit of the current account will be easily financeable.

Despite the improvement registered in the growth expectations of the US economy for 2011, there are different risks that still persist and that might

affect the performance of the Mexican economy. In this context, the uncertainty with respect to the GDP growth forecast is presented using the corresponding Fan Chart (Graph 30a). In this graph it can also be observed how the probability bands expand when the forecast horizon extends, indicating an increasing uncertainty about longer-term forecasts.[29] Among the most important risks are:

i. The fiscal situation in various European countries could lead to episodes of increased volatility in international financial markets. The European authorities and international institutions, like the IMF, surely continue with their efforts to stabilize the situation, but a crisis in another European economy, besides Greece and Ireland, could severely complicate the situation.

ii. Although the fiscal and monetary stimuli in the United States have led to more optimistic prospects for 2011, in subsequent years this economy will have to continue correcting its structural problems. This could complicate the growth scenario for Mexico.

iii. Finally, in line with private sector economic specialists, public insecurity is a factor that might limit the pace of investment in Mexico.

Inflation: The annual headline inflation forecast remains unchanged, except for the first quarter of 2011, which is revised downwards. Thus, in the first two quarters of 2011 the quarterly average of this indicator is estimated to lie between 3 and 4 percent (the previous forecast for the first quarter established an interval of 3.75 to 4.25 percent). Starting from the third quarter, the inflation is expected to converge to levels congruent with the permanent inflation target of 3 percent, considering a variability interval of plus/minus one percent (Graph 31 and Graph 32).

The main determinant of the inflation forecast is a monetary stance congruent with the attainment of the inflation target. In addition to this, four principal factors that will contribute to reducing inflation during 2011 are taken into account:

a) Fading away of the impact associated to fiscal changes and to the increases in fares authorized by local governments observed in the previous year. Among these, stand out the subway fare and water supply fees in Mexico City.

b) A slower growth pace expected in the services prices, especially those related to housing and tourism.

c) Absence of pressures on labor costs faced by firms.

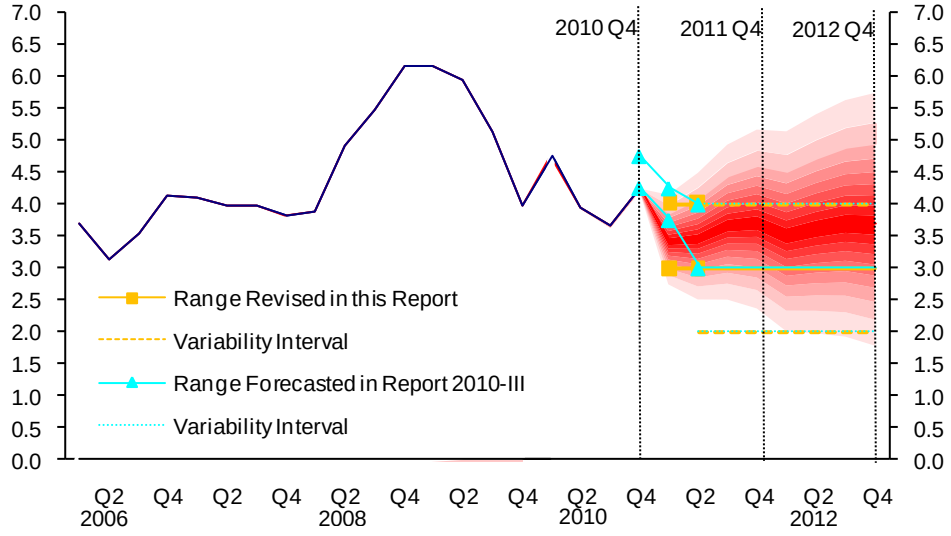
d) Exchange rate behavior.

In turn, the downward revision of the inflation forecast corresponding to the first quarter of 2011 is mainly a consequence of the expectation of a greater

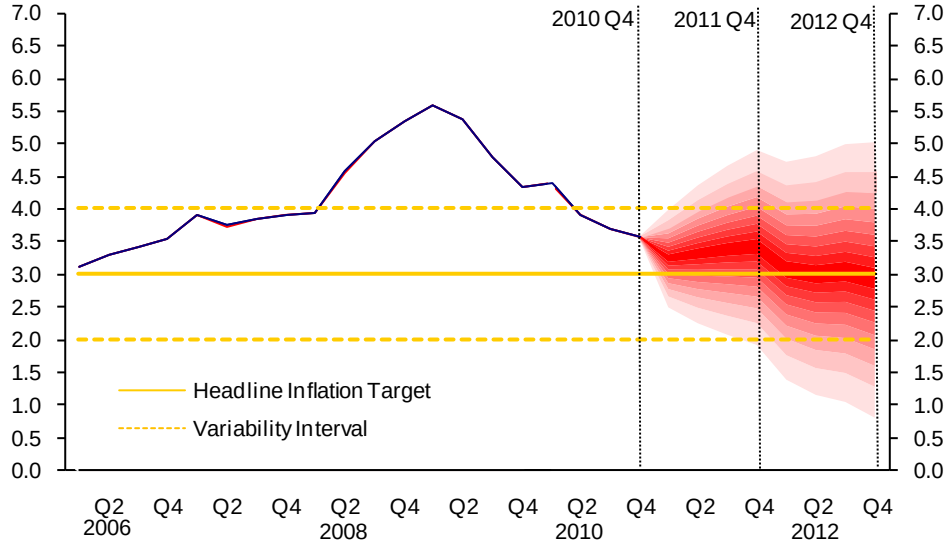
[29] For more details about the construction and interpretation of this type of graphs, see Box 3 “Fan Charts for Illustrating the Probability of Economic Variable Forecasts Realization” in the Inflation Report, July-September 2010.

reduction, in comparison to the one previously forecasted, in the price quotes of agricultural products with a high CPI weight.

Graph 31
Fan Chart: Annual Headline Inflation



Graph 32
Fan Chart: Annual Core Inflation



The inflation forecast is subject to diverse risks that generate uncertainty about it. This uncertainty increases when the forecast horizon is more distant in time, as presented by the fan chart for the annual inflation (Graph 31). Among the most important upward risks stand out the following:

a. Increases higher than those forecasted in international commodity prices. In the case of grains, they could affect domestic price quotes of products derived from wheat and corn. In particular, stand out the cases of industries where the producers have proven to be able to coordinate significant increases in their products prices.

b. The growth rate of goods and services prices, whose fares are determined by local governments.

c. Higher vulnerability to cost shocks, in an environment where the output gap has been closing.

d. Exchange rate volatility due to a capital flow reversal.

Taking these risks into account, the trajectory most likely to occur, represented by the band of the most intense red color, is located during the entire forecast horizon between 3 and 4 percent. Additionally, it can be seen that a less probable part of the fan chart is above the upper limit of the variability interval of 4 percent during most of the forecast horizon. This reflects, as explained earlier, the existence of diverse upward inflation risks that for the most part do not respond to the monetary policy actions.

Graph 32 shows that the most probable trajectory of core inflation, which is the CPI component that is the most responsive to the monetary policy stance, is located at a level lower than that of the headline inflation. In particular, this variable is estimated to be located under 3.5 percent during 2011, and practically at the permanent inflation target of 3 percent during the major part of 2012. It is noteworthy that this period represents the time horizon where the transmission channels of the monetary policy fully function.

The difference projected in the trajectories of headline and core inflation for the next two years is due to the higher growth rate forecasted in CPI's non-core component. Mainly, this is associated to three elements: first, the policy of increments of energy prices aimed at reducing the existing gap between these and their international references, given the increase of the latter ones; second, the forecast of revisions of different fares authorized by local governments at a pace higher than the expected headline inflation; and, third, during 2012 the group of fruit and vegetables, whose price pattern during the last decade has been characterized by biannual cycles, is expected to make a major contribution to the inflation. It is worth mentioning that Banco de México has already mentioned on previous occasions that the misalignment between domestic and international energy prices entails significant fiscal and economic costs, so that the policy of increments oriented at decreasing the abovementioned misalignment, will allow the government to have sound public finances. This is an important element to maintain an environment of low inflation and to ensure that headline inflation converges to core inflation.[30]

In this context and taking into consideration the elements pointed out in the Inflation Report, Banco de México will carefully monitor the evolution of inflation and its expectations. In case of an adverse change in the behavior of the inflation determinants (such as the output gap, public prices, prices of grains and other commodities), or if a sustained difference between inflation expectations and the permanent target of 3 percent is detected, the Central Institute will adequately adjust its monetary policy to reach this target.

As it has been repeatedly indicated, even when the monetary policy is conducted pursuing the attainment of the permanent inflation target of 3 percent,

[30] See Addendum to the Inflation Report, July-September 2009, p. 18.

there is a certain margin of uncertainty as to its precise and accurate achievement. This is due to a wide variety of factors influencing the evolution of the inflationary phenomenon and that are beyond the monetary authority control, in addition to the fact that it is well known that the monetary policy affects inflation with long and variable lags. In the light of these considerations, Banco de México has defined a variability interval of plus/minus one percentage point around the inflation target of 3 percent, whose interpretation should not be perceived as indifference on the part of the monetary authority towards different realizations of the inflation rate within it. The interval determination is simply one way of taking into account the existence of various disturbances, such as relative price adjustments that can affect inflation in the short term and place it above or below the target of 3 percent.

The risks Mexico is facing, given an international environment that is prone to rapid changes, make it imperative to continue strengthening the macroeconomic soundness of the country and to deepen its structural change. As it has been mentioned in other Inflation Reports, in order to reach an economic growth rate that would lead to a greater level of development, in the first place, a combination of solid public finances and a monetary policy aimed at attaining the inflation target is needed. In particular, the monetary policy will continue with its orientation towards reaching the convergence with the permanent target of headline inflation of 3 percent. Likewise, the fiscal policy, even though it still faces considerable challenges, has been solid and congruent with low and stable inflation.

Besides, it is important to highlight the policy of accumulating international reserves that with an increase of USD 22.8 billion in 2010 has taken total reserves to historical levels of USD 113.6 billion at the end of the period. This, together with the Flexible Credit Line negotiated with the International Monetary Fund for approximately USD 73 billion for two years, implies that the resources, available for Mexico in order to deal with possible external shocks, would amount to around USD 200 billion, which constitutes an essential element of protecting the Mexican economy.

Macroeconomic policy needs to be complemented by an incentive structure that favors higher productivity levels in the economy, which, in turn, is associated with a stronger promotion of competition in the markets and flexibility in allocation of the country's productive resources. Indeed, greater competition in the markets induces every producer to use more productive technology and more efficient labor practices, with the purpose of avoiding to be displaced by more productive competitors. This causes an increase in the productivity levels, at which on average all the producers in the market operate. For this reason, a higher level of competition is especially relevant in the markets of goods which stronger affect consumer spending, as well as in the sectors offering various inputs of widespread use in production, such as energy and telecommunications. On the other hand, the flexibility in the allocation of the productive resources of the country is an indispensable condition for Mexico to fully exploit its comparative advantages at each moment of time, above all in an international environment characterized by relatively frequent changes in the relative prices of different goods. In particular, to the extent to which higher mobility of productive factors, such as labor, exists, the economy will manage to faster increase production of those goods and services, at which it is competitive. In turn, this would lead to a higher national income. It is for this reason that Banco de México reasserts its

stance regarding the great benefits that the Mexican economy is perceived to possibly capitalize, to the extent to which reform efforts take effect, corresponding to the competition policy in the country and in the labor, telecommunication and energy sectors.

Technical Chapter Change in the Nominal System of the Mexican Economy in the early 2000's

This Inflation Report includes for the first time a technical chapter in order to present results of interest related to monetary policy. These results are based on some of the most recent technical developments, and are aimed at formalizing even more the arguments presented elsewhere. The topics covered will be supported by the research realized at Banco de México.

In this occasion, based on diverse studies carried out in the General Economic Research Directorate (*Dirección General de Investigación Económica*), evidence is presented regarding the fact that inflation in Mexico has reached a low and stable level since the adoption of an inflation-targeting regime. This phenomenon is very important since it has permitted price stability, which, in turn, has promoted macroeconomic stability and has generated a favorable environment for economic growth.

1. Introduction

At present, many countries have adopted an inflation-targeting scheme as their monetary policy strategy to reach price stability. The first country to do so was New Zealand in 1990, and since that date various advanced and emerging countries have adopted this regime, such as Canada, Chile, and the United Kingdom, among others. This monetary scheme consists of several elements, among which are the announcement of a numerical medium-term inflation target, as well as the institutional commitment, by an autonomous monetary authority, to price stability and to attaining the inflation target. This regime involves an analysis of all the sources of inflationary pressures in order to evaluate the future growth trajectory of prices, which is the main reference for the monetary policy decisions. All of this within a transparency framework, which is based on a communication strategy with the public regarding the monetary authority's targets, plans and decisions.[31]

In December 1993, the Congress approved a constitutional amendment to article 23 granting autonomy to Banco de México in the execution of its functions and its administration. This autonomy laid the foundations so that Banco de México could adopt some of the characteristic elements of an inflation-targeting regime in 1999 and to formally implement it in 2001. The Central Institute has considered this monetary policy scheme as the most adequate for accomplishing its constitutional mandate of procuring purchasing power stability of the national currency. The medium-term inflation target was defined as an annual inflation of the Consumer Price Index (CPI) of 3 percent, effective from late 2003 onwards.[32] Furthermore, considering the degree of uncertainty with respect to the accurate and precise attainment of this target, given the variety of factors that affect the inflationary phenomenon, a variability interval of plus/minus one percentage point around the 3 percent target was also established.

[31] See note on inflation-targeting scheme available at: http://www.banxico.org.mx/politica-monetaria-e-inflacion/material-de-referencia/intermedio/politica-monetaria/%7B5C9B2F38-D20E-8988-479A-922AFEEBB783%7D.pdf .

[32] See Monetary Program for 2011.

In this technical chapter it is shown that since the adoption of the inflation-targeting regime by Banco de México, inflation has reached a low and stable level. In particular, evidence is presented to show that both the level of headline and core inflation have registered diverse structural changes and that since the beginning of the century both are fluctuating around a level which is the lowest since the CPI is used for inflation measurement. Furthermore, the results also indicate that both headline and core inflation are no longer highly persistent processes and turned into more stable processes around the year 2001.[33]

Inflation stability is a major achievement since, as it will be shown later on, it allows the disturbances that affect it, such as increases in international commodity prices or in taxes, not to have permanent effects on it. Furthermore, inflation stability is fueled by the credibility of the inflation target, so that it can be used to coordinate inflation expectations and thus, to sustain an environment of low and stable inflation.

The results presented in this chapter are consistent with the favorable implementation of an inflation-targeting regime, in an environment where money issuance by the Central Bank has been in line with price stability; in particular, in a context of the autonomy of the Central Institute, and in which the coordination among the monetary and fiscal policies has prevented the financing of the public deficit through primary money issuance.

The technical chapter is organized as follows. Section two presents the arguments that state why price stability is important and its relation to inflation stability and to the inflation-targeting regime. Then, statistical exercises realized to demonstrate the breaks in the mean and the persistence of both headline and core inflation are presented. Section four illustrates some of the benefits for the economy that price stability has brought about. The technical chapter concludes with some considerations about the importance of the results and their implications for the conduction of monetary policy. The appendix contains a more detailed description of the statistical tests used throughout the chapter.

2. The Importance of Price Stability and its Relation to Inflation Persistence

Price stability is desirable since it allows prices to perform their primary function, i.e., to transfer information about the conditions prevailing in the goods and services markets in an efficient and easy way. Indeed, in an economy with low and stable inflation, prices reflect, on the one hand, the demand for a good or service and, on the other hand, its availability. Nevertheless, if the general price level increases at high and variable rates, then prices lose a lot of their power as signals for consumers, producers and other agents in the economy. Therefore, the available information is more uncertain, complicating the decision-making with respect to consumption, production, investment and savings, among others. For instance, in a scenario where the demand for one good is growing, an increase in its price is observed; which signals to producers that consumers wish to acquire higher amounts of that good. However, in inflationary periods it is difficult for the firms to distinguish if this really is the message or if the price just increased because all prices in the economy did so. So, if inflation is high and unstable, then consumers and producers can no longer trust prices' indications regarding relative

[33] The term "persistence" applied to inflation will be defined later in the document.

scarcity or availability of different goods and services, impeding the economy to function efficiently.

Therefore, one of the fundamental purposes of Banco de México is to preserve the role of the prices as signals in the economy, so that through them the economy can efficiently perform the production, distribution and consumption of goods and services. Surely, high and unstable inflation generates other significant problems. First, inflation has effects similar to those of a tax, although it is not approved by the Congress and it is highly regressive, which tends to increase income inequality. Furthermore, greater uncertainty about the evolution of inflation in the future, that is associated with periods of high inflation, complicates economic agents' long-term planning. Given this, it results inevitable to shorten households', firms' and government's planning horizons. This discourages savings, productive investments and employment. In this environment, one of the sectors particularly affected is the financial sector, since an environment of high inflation and inertia discourages the development of medium- and long-term financial instruments. Under these conditions, lower economic growth as well as higher volatility of macroeconomic variables tends to be observed.[34]

To reach price stability, a central element of the monetary policy is to have a "nominal anchor". This is a nominal variable, such as wages, the exchange rate, a monetary aggregate (e.g., M1) or even the general price level itself (e.g., measured by the Consumer Price Index, CPI), which helps the central bank to coordinate inflation expectations of consumers, producers and other agents in the economy. When the nominal anchor itself is a price index, a particular level or trajectory for this index (in the case of "price-targeting" regimes) or the index's growth rate (in the case of "inflation-targeting regimes", such as the one followed by Banco de México) can be used as target by the central bank. Adhering to a nominal anchor that holds the reference variable within a reduced range and that results credible for economic agents, helps to coordinate these agents' inflation expectations and therefore, promotes price stability. This, by preserving low and stable levels of both inflation and inflation expectations, allows the prices to maintain their power as economy-guiding signals.

In this context, an important implication of the use of an inflation target as nominal anchor is that inflation should remain stable. In particular, inflation should not present any long-term trend, nor pronounced fluctuations, so that the inflation target is credible and can establish itself as an anchor guiding economic agents' expectations with respect to the development of the economy's nominal system. Therefore, in order to reach price stability, monetary policy should assure that inflation shocks only have temporal effects and, consequently, that inflation tends to fluctuate around a low level.[35] That is, monetary policy should ensure that shocks, such as an increase in the prices of commodities at international levels, tax increases or other disturbances, do not have permanent effects on inflation. This condition should be maintained if the monetary authority follows an inflation-targeting regime, although it is not exclusively a condition of this regime.

An important measure of inflation stability is its degree of persistence. Inflation is said to be very persistent if shocks affecting it have an effect that lasts over time. A very persistent inflation can go as far as maintaining the effect of

[34] See Monetary Program for 2011, where inflation effects and monetary policy transmission mechanism are analyzed.

[35] This level should be sufficiently low in order to reflect relative price changes that usually occur in an economy, as well as a possible measurement bias, such as that of quality or substitution.

some shocks indefinitely.[36] A process of this type can occur if a considerable number of prices, such as wages, are indexed to inflation, i.e., if they change automatically at a rate equal to past inflation rates. If this happens, not just indexed prices, but also other non-indexed goods and services prices increase, given that the producers of these goods experience an increase in their costs (wages in this example), which, at least partially, are passed on to the consumers. In this way, the inflationary process continues and price stability is lost. On the contrary, if persistence is low, inflation tends to be more stable because it has a shorter memory of the disturbances that affect it and thus, it tends to return to its medium-term level. This situation might arise if, for instance, employees anticipate that the central bank will operate to avoid permanent effects of disturbances on inflation. In this case, they will not opt for an increase in their wages at the same rate as the observed inflation, but at a rate consistent with the medium-term inflation level. This allows price stability, as it avoids "second round" effects of disturbances on inflation, i.e., effects on prices of goods and services different than those affected in the first place.

In general, the degree of inflation persistence reflects the effect that the following factors might have on prices: a) cost shocks, for example, the increase in international commodity prices; b) demand pressures, for example, those generated by public sector's deficit; and c) monetary policy response to both supply shocks and demand pressures, as well as public expectations regarding this response. Indeed, in addition to the degree to which cost shocks and demand pressures themselves might be persistent, the monetary policy response and the agents' expectations are fundamental. In the case of supply shocks, a high and very persistent inflation can occur if the monetary authorities follow an accommodative policy of higher money growth rates that try to accommodate the cost shock through aggregate demand stimulation, which, in turn, encourages agents to adjust their inflation expectations upwards. On the other hand, in the case of public sector deficits, a high and unstable inflation can occur if these deficits are financed by primary money issuance, or if the public has the perception that this will happen in the future. If the deficits are financed through money creation, a so-called problem of "fiscal dominance" is generated, given that the fiscal policy "dominates" the monetary policy in the sense that it uses inflation as an additional tax to finance itself. Due to the fact that a high and unstable inflation has as its ultimate cause high growth rates of circulating money, the central banks are the authorities that should safeguard price stability. Nevertheless, they cannot do this in an empty space, and in general it requires an institutional framework that permits central bank's autonomy, as well as the coordination of fiscal and monetary policies in order to avoid fiscal dominance and to achieve low and stable inflation.

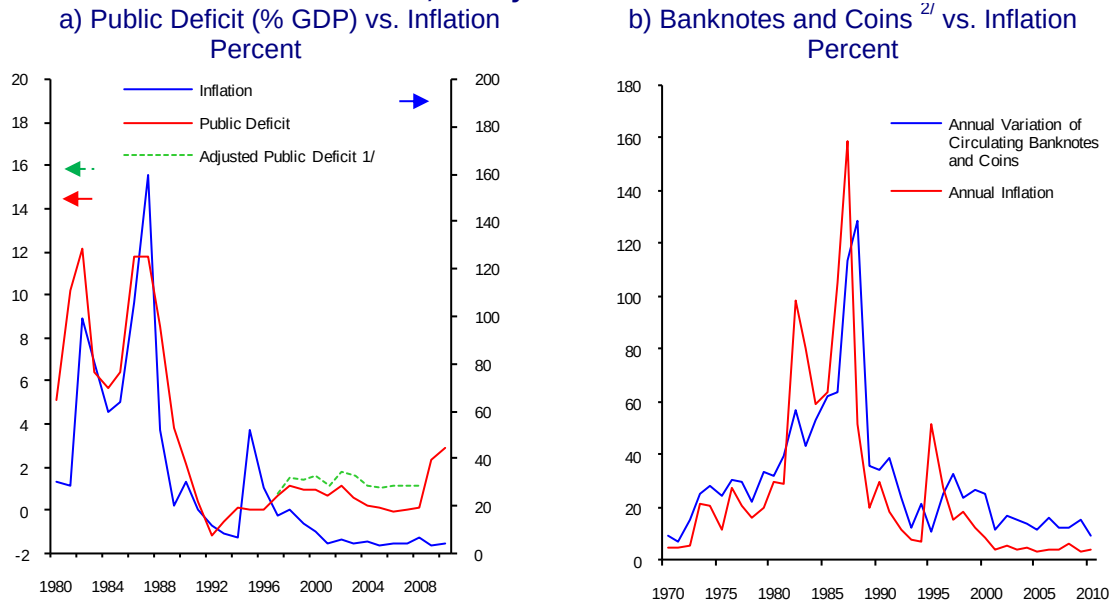
In Mexico, high and unstable inflation rates were observed during the decade of the eighties, as a consequence of the price indexation mechanisms and the situation of fiscal dominance prevailing in the economy during this period (Gil Díaz and Ramos Tercero, 1988). This phenomenon can be observed in Graph 33. First, the evolution of fiscal deficits and of inflation is presented (Graph 33a). It can be seen that in the eighties the public sector maintained high fiscal deficits, while at the same time inflation was high and unstable. The growth of circulating banknotes and coins is also presented (Graph 33b), illustrating that in the end the

[36] In this extreme case, inflation would become a non-stationary process, in the sense that is defined below.

financing of these deficits through money issuance, or the expectation of their monetization in the future, is what produces high and volatile inflation.

By the end of the eighties, Mexico seemed to have left behind this instability, given that both the level and the volatility of inflation showed a downward shift. This change originated from the application of a sequence of stabilization programs based on policies aiming to coordinate the interaction among economic agents in the nominal system of the economy. In particular, anchoring the evolution of this system by restricting exchange rate movements, and also based on the successful renegotiation of the external debt, as well as on the granting of the autonomy to Banco de México. However, the peso devaluation in December 1994 not only increased inflation, but also generated a situation of renewed risk of fiscal dominance. Fortunately, these events were of temporary nature as a result of the fiscal adjustment undertaken, the immediate monetary response, the adoption of a flexible exchange rate policy, the support package obtained from the international financial community in 1995, all this together with Banco de México's autonomy (Carstens and Werner, 1999). By the turn of the century, the monetary policy converged to a framework based on inflation-targeting, both in terms of the rules that govern the monetary policy responses to inflationary shocks, and the transparency in its implementation. This, along with a prudent fiscal policy and relatively favorable global inflationary conditions, contributed to the decline from a 52 percent rate of inflation in 1995 to an inflation rate, that since the year 2000, has remained below 10 percent and, even more, in the last years has tended to converge to a variability interval of plus/minus one percentage point around the 3 percent inflation target (Ramos-Francia and Torres, 2005). This was reflected by the significant decline observed in the level and volatility of inflation at the end of the sample.

Graph 33
Headline Inflation, Money Creation and Fiscal Dominance



Source: Ministry of Finance (*Secretaría de Hacienda y Crédito Público,* SHCP) and Banco de México.
Note: For 2010, the GDP proportions correspond to those published by the Ministry of Finance (SHCP) in the Economic Situation, Public Finances and Public Debt Reports, corresponding to the fourth quarter of 2010.
1/ Includes net investment projects (Pidiregas) of amortization of Pemex between 1997 and 2008.
2/ Refers to the annual average of monthly stocks.

3. Evidence of Structural Breaks in Inflation Dynamics

To analyze the evolution of inflation in Mexico it is necessary to have a model that is able to incorporate both the mean and the persistence of inflation within the same theoretic framework, since these are two of the main features determining whether a break in inflation dynamics has occurred. Furthermore, the model should be sufficiently flexible to allow changes in these features because, as shown before, it is possible that both have changed over time.

In this chapter, the following general process for modeling inflation dynamics is used:[37]

$$\pi_t = \beta_{0t} + \sum_{i=1}^{p} \beta_{it}\, \pi_{t-i} + \varepsilon_t,$$

where π_t is the headline inflation (or core inflation, if applicable), β_{it} are the parameteres determining inflation dynamics and ε_t is a random variable with zero mean.[38] This data generating process (DGP) is an autoregressive process of order $(AR(p))$. However, unlike the more traditional processes of this type, the one presented here allows for breaks in inflation persistence, measured as $\rho_t = \sum_{i=1}^{p} \beta_{it}$, as well as breaks in the mean of inflation, defined as $\mu_t = \frac{\beta_{0t}}{1-\rho_t}$.[39] It is noteworthy that ρ_t is a good measure of persistence because, in a process like this one, a necessary condition for the modeled series to be stationary is that $|\rho_t| < 1$, while a sufficient condition for the series to be highly persistent (not stationary) is that $\rho_t = 1$.[40,41]

To carry out the analysis of structural changes in the inflation dynamics, in this technical chapter monthly series are used, comprising the period from February 1969 to December 2010 for headline inflation, and from February 1982 to December 2010 for core inflation.[42] The starting date of the analysis was determined by data availability. Inflation is measured as the annualized monthly CPI change (or of its core inflation, if applicable), calculated as $1200 * \ln(P_t/P_{t-1})$.[43]

As a first approximation in order to see if the data presents evidence that inflation dynamics have changed over time, the $AR(p)$ process was estimated using a methodology known as "rolling windows" where the equation is estimated

[37] The model used follows the document of Capistrán and Ramos-Francia (2009), where inflation dynamics in 10 Latin-American countries are analyzed.

[38] Formally, the random term is assumed to follow a martingale difference process. A process is said to follow a martingale difference sequence if its expectation conditional on its past is equal to zero. These types of processes are useful because they permit certain degree of autocorrelation and heteroscedasticity, while at the same time they satisfy certain versions of the Central Limit Theorem (White, 2001).

[39] The unconditional mean equation requires that $|\rho_t| < 1$.

[40] For more information regarding the question why the sum of coefficients associated to the lagged terms constitutes a good measure of persistence for time series, see Capistrán and Ramos-Francia (2009) and references cited therein.

[41] Stochastic processes whose first and second order moments are not time-dependent are called second order stationary or stationary in covariance. A stochastic process is strictly stationary if the density function for an arbitrary set of random variables is invariant to time shifts. In this technical chapter the term stationary is used to refer to processes stationary in covariance. In addition, highly persistent process and non-stationary process are used indistinctly.

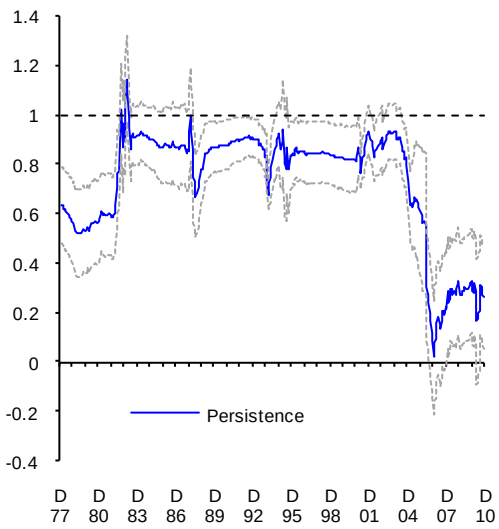
[42] The source is Banco de México. Data can be obtained from the following link: http://www.banxico.org.mx/politica-monetaria-e-inflacion/estadisticas/inflacion/indices-precios.html.

[43] Inflation series is seasonally adjusted. For this, the Tramo/Seats procedure was used (Maravall, 1999).

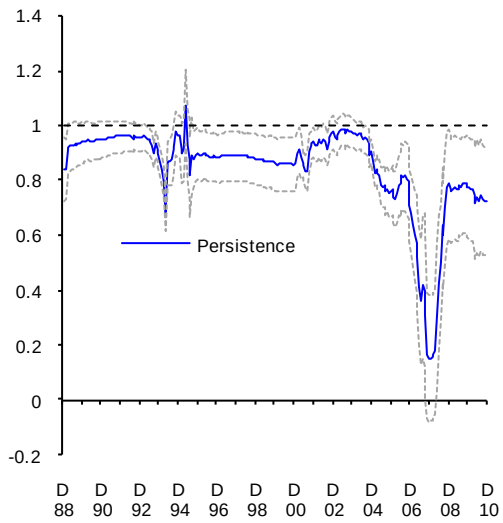
using a subsample of the data. In this case, the first window comprises the first 6 years (72 observations), and the following estimations are carried out by removing one observation (the first one of the window) and adding another one (at the end of the window), in such a way that the window of estimation will be moving throughout the entire sample. The regressions are estimated using OLS. For each window the lagged model is estimated (i.e., $AR(p)$ order) using the Bayesian Information Criterion (BIC), starting with the maximum number of 6 possible lags. Once the regression order is obtained, the estimate for ρ_t (as well as its standard error) is extracted in order to plot it against time afterwards. Graph 34 illustrates the evolution of persistence of both inflation series (headline and core) since 1977 and 1988, respectively, years in which the first windows end.

Graph 34
Evolution of Persistence of Headline and Core Inflation

a) Headline Inflation [1/]



b) Core Inflation [1/]



Source: Banco de México.
1/ 90 percent confidence intervals are presented.

Indeed, it can be observed that inflation persistence seems to be time-varying. For headline inflation three phases can be noticed: i) approximately from late 1977 to mid-1982, where the series presents persistence less than one (even considering the 90 percent confidence intervals); ii) from mid-1982 to late 2004, where persistence is very close to or equal to one; and iii) from late 2004 to late 2010, where a pronounced decline of persistence is observed, even reaching zero.[44] For core inflation, only two phases can be observed: i) from late 1988 to late 2006, where persistence presents a level very close to one; and ii) from late 2006 to late 2010, where persistence is clearly lower than that presented at earlier dates.

These results present evidence that inflation persistence may have been high during the seventies, but it is not until the eighties when inflation seems to be very volatile with abrupt changes in the trend where the shocks affecting it have

[44] The use of rolling windows makes that structural breaks are detected after they occur. In particular, by using rolling windows, it takes longer to notice the breaks since almost all windows that contain the break also include data prior to the date when the break occurred. Later on, more precise estimations of the break dates for both the mean and persistence of inflation are presented.

permanent effects (i.e. like a non-stationary process). Nevertheless, in the last decade the empirical evidence suggests that the degree of inflation persistence has declined in such a way that inflation seems to follow a stationary process, in which case it would tend to be mean-reverting and hence, the shocks would only have temporary effects, allowing price stability.

Although the previous exercises show evidence that inflation dynamics in Mexico have changed over time, there are formal statistical tests demonstrating that, indeed, there have been structural breaks in inflation's mean and persistence. In this sense, Graph 34a and Graph 34b only indicate that the persistence parameter has changed over time, but they do not present a formal test of the occurrence of these breaks, nor of the date when they might have occurred.[45] Thus, in the following section, the results of statistical tests specifically designed to detect structural breaks are described.

3.1 Evidence of Structural Breaks in the Mean of Inflation

In this section, a statistical test to detect structural breaks in the mean of inflation is applied. The test is applied to headline inflation and its core component. The test proposed by Lavielle and Moulines (2000) and Lavielle (2005) is used. This test, as the one by Bai and Perron (1998), allows detecting the presence of multiple structural breaks in the mean of a time series. Nevertheless, in contrast to Bai-Perron, this test allows the time series under study to have a time-varying (conditional) variance.[46] Lavielle's test is based on the search for possible structural breaks; this search is sequential and is performed setting a maximum number of structural breaks to be found $(Kmax)$, a minimum amplitude among each of them $(Lmin)$, as well as a contrast function (J), which depends on the inflation and the candidate break-dates.[47,48]

The results of this test can be observed in Graph 35. The horizontal lines in the graph present the mean of each period for which no structural breaks are detected by the test. Thus, it is possible to distinguish the dates in which the statistical test estimates the existence of structural breaks. In the case of headline inflation, it is interesting to observe the inverted U-pattern that the series presents. The series starts with a low mean in the seventies, followed by a series of higher means reaching their maximum between 1986 and 1988, decreasing again until reaching a mean below 10 percent from late 1999 onwards. Something similar seems to occur with core inflation, although in this case only its behavior from 1982 onwards can be observed. It is important to note that in the two cases, the lowest inflation level on records occurs with the last break, in the present period.

[45] The result of the break in persistence also indicates that it is possible that the mean of inflation has changed over time, because, as shown before, the persistence measure is part of the equation defining the mean process.

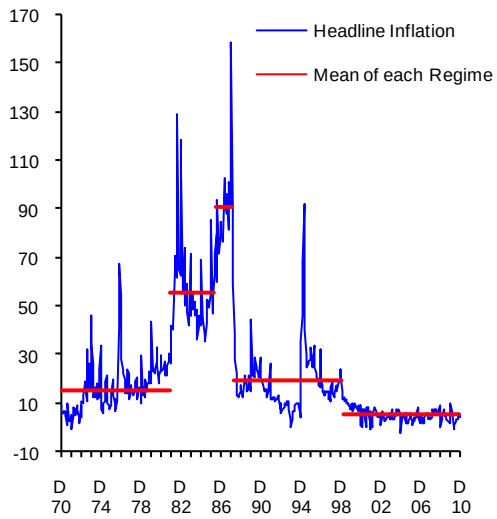
[46] I.e., it allows inflation to present ARCH-type effects (Engle, 1982).

[47] For this exercise, parameters were set to $= 15$ $LMin = 20$, as recommended by Lavielle (2005) with the purpose of capturing the most significant breaks in the series. For the penalty function a Gaussian likelihood function was used, also following the recommendation by Lavielle (2005). The appendix presents more technical details regarding this test.

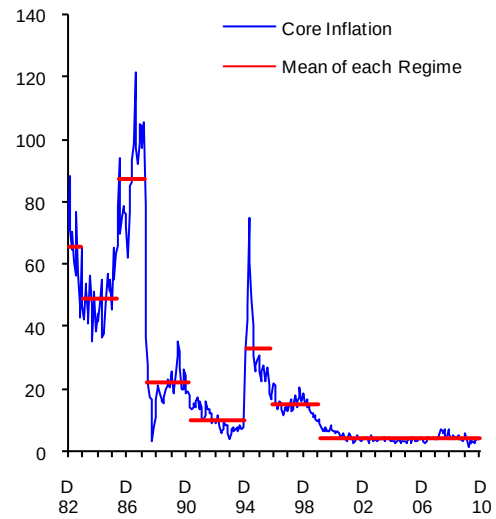
[48] The exercises presented in this section update the ones realized by Capistrán and Ramos-Francia (2009) for the Mexican case. This document reports multiple breaks in the mean of inflation in the 10 most important Latin-American countries, including Mexico, for a sample which starts in 1980 and ends in 2007. The results of this document show that inflation in the region increased during the decade of the eighties and declined during the nineties, documenting that the increase and the decline of inflation in these Latin-American countries occurred one decade later than in industrialized countries.

Graph 35
Headline Inflation and Core Inflation

a) Headline Inflation [1/]
Percent annual



b) Core Inflation [1/]
Percent annual



Source: Banco de México.
1/ Annualized monthly rate.

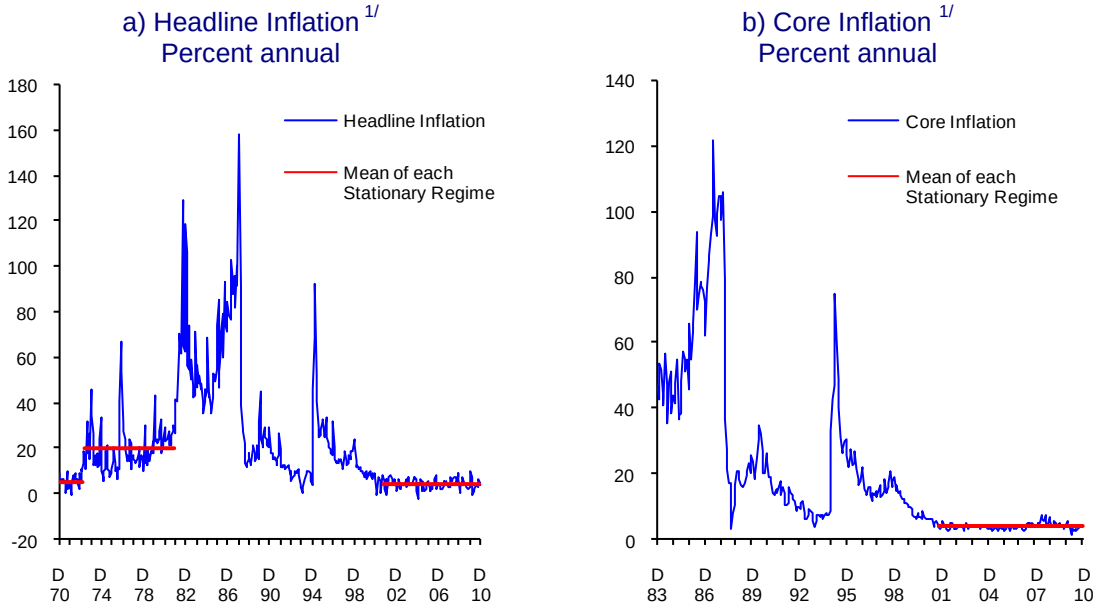
3.2 Evidence of Structural Breaks in Inflation Persistence

In order to delve into some technical aspects related to the argument of reduction in inflation persistence in Mexico, in this section a test for changes in the order of integration of time series is applied, which was developed by Leybourne, et al. (2007). This test allows a consistent estimation of the change dates, which is also robust to the presence of (multiple) level breaks.[49]

There are two hypotheses for the test: the null, $H_0: \pi_t \sim I(1)$, implying that inflation is non-stationary throughout the whole sample, i.e., $\rho_i = 1$; and the alternative, $H_1: \pi_t$ experiments m changes in persistence. Thus, the procedure divides inflation for the entire sample into separate stationary ($I(0)$) and non-stationary ($I(1)$) regimes and consistently estimates the associated change-point fractions. Graph 36 presents the results of the test application for persistence changes. A straight line superimposed on the inflation data indicates a $I(0)$ period, identified by the M test (described in the appendix). For convenience, this line is plotted at the mean of each identified $I(0)$ period. As can be seen, according to the evidence only in the 1982-2001 period inflation observed high levels of persistence. These levels were so high that inflation became a non-stationary process. This corroborates what was shown before regarding the fiscal dominance present in Mexico in the decade of the eighties, as well as the crisis of the mid-nineties, leading to high and unstable inflation.

[49] The existing tests for a one-time change in persistence, such as those from Kim (2000), Harvey, et al. (2006) and Leybourne, et al. (2006), are not consistent for processes that show multiple breaks in persistence. Furthermore, nor the Augmented Dicker-Fuller (ADF) test is consistent when it is applied to series with breaks in persistence, given that the $I(1)$ part will dominate asymptotically. Details of the applied tests, as well as some specific results are presented in the appendix.

Graph 36
Headline Inflation and Core Inflation



Source: Banco de México.
1/ Annualized monthly rate.

For completeness, Table 5 reports, for each of the $I(0)$ and $I(1)$ identified periods, the mean and the standard deviation, as well as the unbiased estimations of the median parameter of persistence ρ_i, together with the corresponding confidence intervals (at 90 percent), calculated using Hansen's (1999) grid-bootstrap methodology and the inflation measured as the annualized monthly change of the corresponding price index.[50] Two important conclusions can be drawn from Table 5. First, the stationary period found by the end of the sample for headline inflation (October 2001 to December 2010) is the one that reports the lowest mean and standard deviation among all analyzed periods. Even more, following Leybourne, et al. (2007), this is, in fact, the most prominent $\mathrm{I}(0)$ period, since it was the first one detected by the test. The same occurs in the case of core inflation. Second, for the $\mathrm{I}(1)$ periods detected by the M test for both headline and core inflation, the mean, the standard deviation and the estimated autoregressive parameter observe their highest levels in this subsample. Furthermore, for these non-stationary subsamples, the 90 percent confidence intervals include 1, thereby confirming the results obtained from the M test.

From the results presented, it can be argued that inflation in Mexico observed a non-stationary behavior during a 20-year period, since the beginning of 1982 to 2001. In contrast, since 2001, inflation became stationary, around a constant mean.[51] In line with this result, the document by Capistrán, et al. (2010) presents indirect empirical evidence (due to the small sample size), indicating that the inflation components at seasonal frequencies also seem to have passed from

[50] Following the recommendation by Hansen (1999), 200 grid points and 1000 bootstrap replications at each grid point were used.

[51] For an empiric study about an analysis of breaks in persistence for a sample that includes various countries, see Noriega and Ramos-Francia (2009a), where the test by Leybourne, et al. (2007) was applied to a set of 45 economies, including Mexico, and where, in line with the findings reported here, high persistence levels have been identified in various Latin-American countries during the eighties and nineties. For the Mexican case, also see Chiquiar et al. (2010).

having non-stationary to stationary behaviors, confirming what occurs with the long-term trend of inflation. This implies that the shocks affecting inflation recurrently within the year do not turn into permanent shocks, rather, their effect fades gradually under the present inflation-targeting regime.

Table 5
Summary Statistics and AR Parameter Estimates for Monthly Inflation

Series/Sample	Mean	Standard Deviation	O.I.[1/]	ρ_i[2]	Confidence Interval[3/]	
					Lower	Upper
Headline						
1969:0 - 1972:12	5.05	2.83	I(0)	-0.032	-0.263	0.252
1973:0 - 1981:11	19.82	9.82	I(0)	0.579	0.464	0.735
1981:1 - 2001:09	32.43	29.06	I(1)	0.936	0.902	1.019
2001:1 - 2010:12	4.32	2.23	I(0)	0.216	-0.024	0.521
Core						
1982:0 - 2001:10	31.81	27.10	I(1)	0.955	0.932	1.011
2001:1 - 2010:12	4.03	0.98	I(0)	0.474	0.352	0.636

Source: Banco de México.
1/ Indicates the order of integration derived from the M test.
2/ Unbiased median estimate of ρ_i using a maximum value of $k_i = 12$, and the BIC for selection of the lag length.
3/ 90 percent confidence interval, calculated using Hansen's (1999) grid-bootstrap method.

4. Benefits of Price Stability

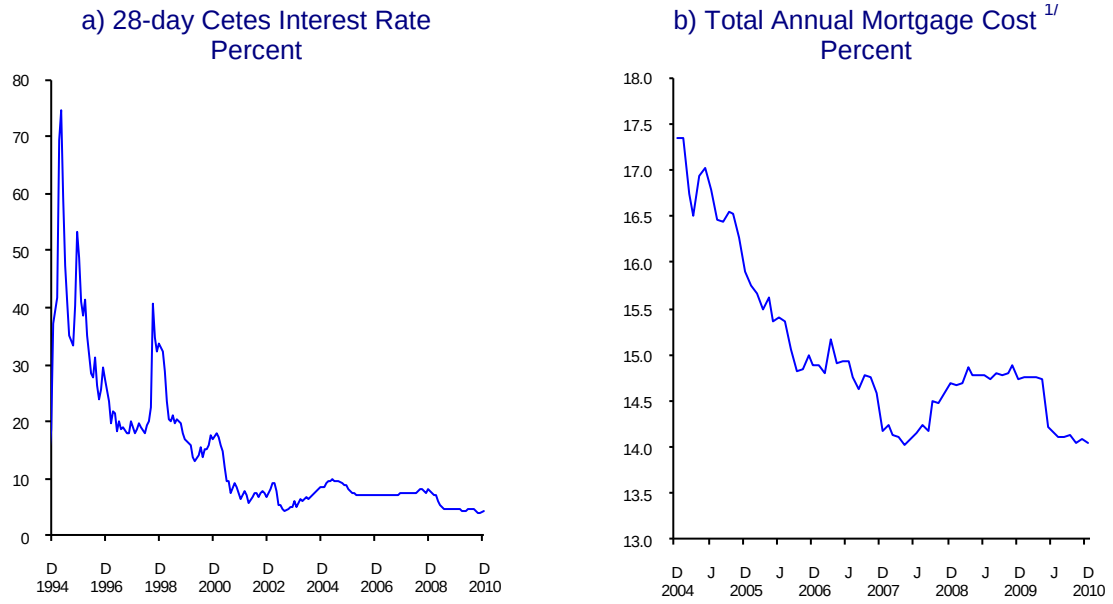
Since Mexico has experienced a less persistent and considerably lower inflation, the economy has suffered to a lesser extent distortions associated with inflationary periods. As mentioned before, one of the most important negative effects generated by inflation is the uncertainty about the future evolution of prices, which increases as inflation gets higher and also when it is more persistent.[52] Nevertheless, inflation that is stationary around a low level facilitates the formation of inflation expectations.[53] With respect to this, there is evidence suggesting that the change in the level and persistence of inflation in Mexico has had positive effects on inflation expectations.[54] In this sense, stability of the nominal system of the economy has been fundamental for reducing uncertainty associated with the inflationary phenomenon and for anchoring inflation expectations. Thus, in an environment where it is easier to forecast inflation, the pricing system can work better since agents can more easily distinguish between relative price changes and changes in the general price level and besides, they can have a longer planning horizon.

Along with the reduction in inflation and thereby, in the risk premia associated with the instruments denominated in national currency, a considerable decline in interest rates has taken place (Graph 37a). Further, the reduction in inflation has substantially contributed to the decline in financial costs of private debt (Graph 37b), which allowed, among others, an increase in the volume of peso-denominated fixed-rate mortgages. The lower inflation has also contributed

[52] In the extreme case of persistence, when a series is non-stationary, the variance depends on the time and can become infinite.
[53] This is largely explained by the fact that in the long term stationary processes can be forecasted more easily than non-stationary ones, since the first mentioned is mean-reverting, thus being, on average, a better forecast for long horizons.
[54] An evaluation of inflation forecasts carried out by Capistrán and López-Moctezuma (2010) reveals that it is easier to forecast inflation from the change date in dynamics of the nominal system of the economy onwards, in the sense that the difference between the mean squared error of the average of the private sector specialists' forecasts and of the simple time series forecasts becomes statistically equal to zero.

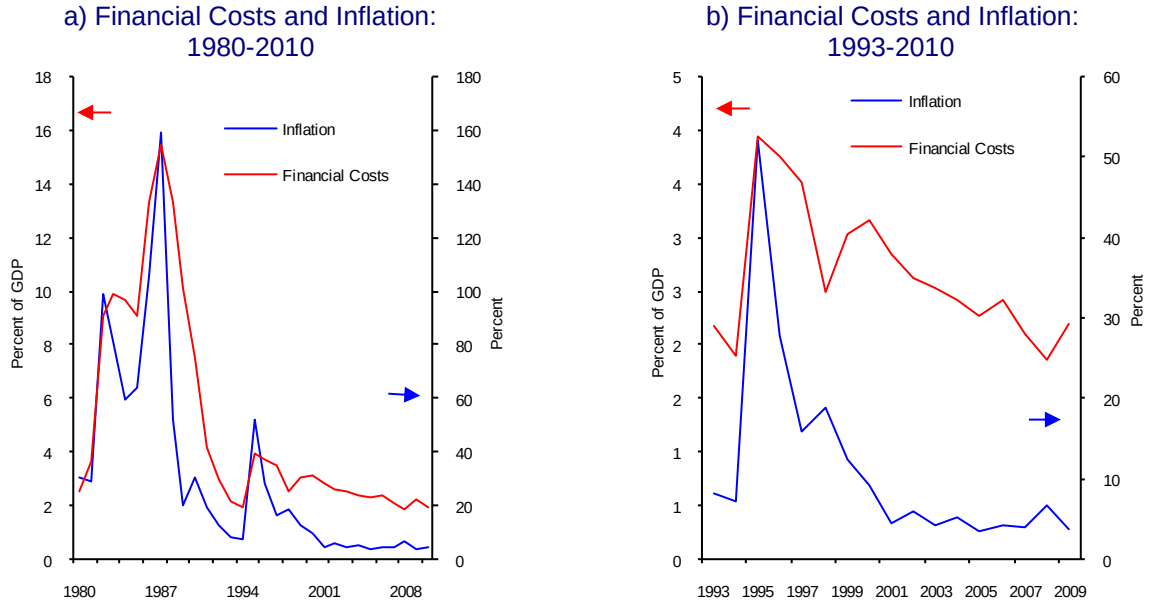
to considerably reducing the costs of public debt (Graph 38), which has permitted to reallocate public spending and to reduce economic deficit.

Graph 37
Interest Rate Reductions



Source: Banco de México.
1/ Indicator that sums up total annual credit costs and includes the costs for: interest rate, commissions, bonus, obligatory insurance and other financial service expenses, including banks and sofoles.

Graph 38
Lower Financial Costs for Public Finances



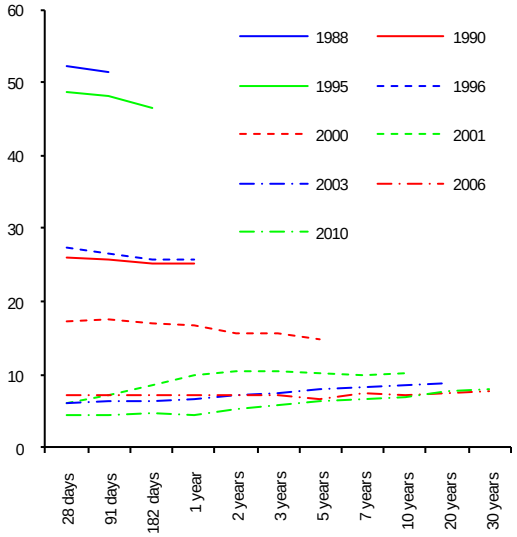
Source: Ministry of Finance (*Secretaría de Hacienda y Crédito Público*) and Banco de México.
Note: For 2010, the GDP proportions are congruent with those published by Ministry of Finance (SHCP) in the Economic Situation, Public Finances and Public Debt Reports, corresponding to the fourth quarter of 2010.

The environment of stable prices prevailing in Mexico in the last decade has generated a situation that facilitates long-term decision making, which seems

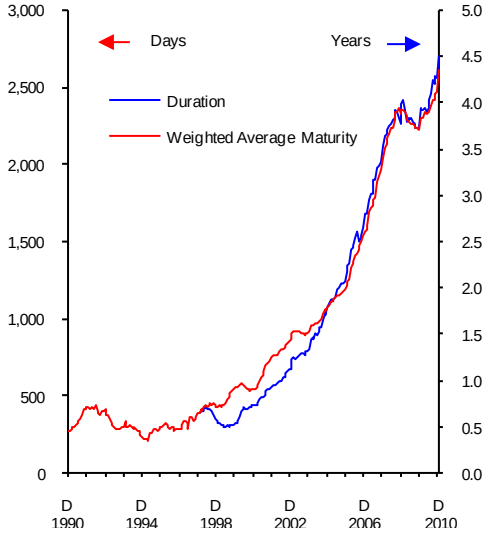
to have contributed to a greater financial development. The changes in the yield curve in Mexico prove the aforementioned. Cortés et al. (2009) document that, despite its short existence, the Mexican yield curve seems to behave like one in more developed financial markets. It is even likely that one of the reasons that has permitted to extend the maturity of bonds issued by Mexican agents has precisely been price stability, since this extension has basically occurred in the last decade (Graph 39).

Graph 39
Modernization and Deepening of the Financial Sector

a) Government Bond Yield Curve [1/]
Percent



b) Government Bonds: Weighted Average Maturity and Duration



Source: Banco de México.
1/ End of period data. From 2002 onwards data corresponds to the secondary market.

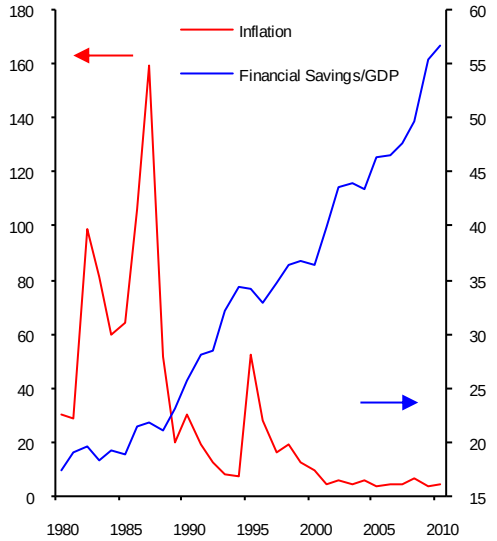
Inflation stability has also favored a more efficient resource allocation in the economy, which, in turn, has helped to improve economy's productive capacity. It has also generated a suitable environment for economic growth and has allowed a greater macroeconomic stability. In fact, Cuadra (2008) documents that since 1999, the economic cycles in Mexico are characterized by a greater macroeconomic stability.[55] This stability has been fundamental to promote financial savings and to boost private sector credit, in particular credit to households (Graph 40).

Maintaining low inflation levels, in a context of stability characterized by a stationary process for inflation, like the one from the last decade, is largely a result of the monetary policy framework and the macroeconomic stance that Mexico has adopted in recent years. In turn, this environment has facilitated the conduction of monetary policy by improving several of its transmission channels, such as expectations.

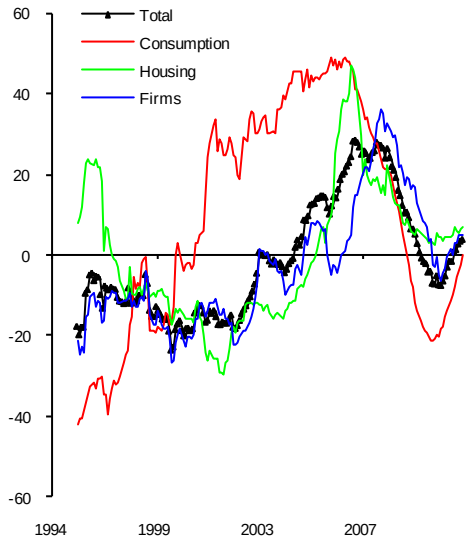
[55] Cuadra (2008) compares the behavior of macroeconomic variables in Mexico for the periods 1980-1998 and 1999-2006. He finds that the first period is characterized by high economic instability and the second one, including the most recent complete economic cycle, is distinguished by greater macroeconomic stability.

Graph 40
Inflation, Broad Financial Savings and Commercial Banks' Credit

a) Inflation and Broad Financial Savings as percentage of GDP [1/ 2/ 3/]
Percent



b) Credit Granted by Commercial Banks to the Non-financial Private Sector
Real Annual Change



Source: Banco de México.
1/ Includes savings of the public sector defined as Federal Government, firms and public agencies, state and municipality governments, Government of the Federal District and trust funds.
2/ Excluding the impact of ISSSTE law reform.
3/ Average GDP in the last 4 quarters.

5. Final Remarks

Price stability is fundamental for the proper functioning of the economy because it allows prices to reflect the relative scarcity of produced, consumed and distributed goods and services. Furthermore, the effect of inflation as a tax, which is not authorized by the Congress and which is considerably regressive, is reduced significantly. In order to preserve price stability, Banco de México uses a CPI growth rate target as nominal anchor. A nominal anchor helps to achieve price stability because it coordinates economic agents' inflation expectations. In turn, an environment of stable prices allows them to distinguish between changes in relative prices of the goods they buy or sell and the changes in the general price index. In this sense, a first test of the degree of success that the monetary policy has had in Mexico in recent years is to verify whether inflation is low and stable, so that it is effective as a nominal anchor in the economy.

The results presented in this technical chapter suggest that, indeed, inflation in Mexico seems to have changed from a non-stationary to a stationary process around 2001, and that the inflation level also seems to have had a structural downward shift around the same year, demonstrating stability of inflation from the turn of the century onwards. Furthermore, these results indicate that the monetary policy was successful at making the inflation target function as nominal anchor in the economy. Therefore, it is important to reach the 3 percent inflation target.

6. Appendix

a. Statistical Test for Breaks in the Mean

In order to search for structural breaks in the mean, the test by Lavielle (2005) assumes that the mean of the random variable, in this case inflation, abruptly changes in some unknown moments of time $\tau_1^* < \tau_2^* < \cdots < \tau_{k-1}^*$. So, the procedure proposed by Lavielle consists in:

1. For the case of breaks in the mean, the data generating process takes the following form (using the notation presented before):

$$\pi_t = \mu_t + \varepsilon_t.$$

It is assumed that there are some change-point fractions $\tau_1^* < \tau_2^* < \cdots < \tau_{k-1}^*$, so that for any $1 < k \leq Kmax$, $\mu_{\tau_{k-1}^*+1} = \mu_{\tau_{k-1}^*+2} = \cdots = \mu_{\tau_{k-1}^*}$.

2. A contrast function is defined $J(\tau, \pi)$. For the model of changing regimes in the mean, a Gaussian log-likelihood function is defined as contrast function. In this case:

$$J(\tau,\pi)=\frac{1}{n}\sum_{k=1}^{K} G(\pi_{\tau_{k-1}+1}, \dots, \pi_{\tau_k}) = \frac{1}{n}\sum_{k=1}^{K}\sum_{i=\tau_{k-1}+1}^{\tau_k} (\pi_i - \bar{\pi}_{\tau_{k-1}+1:\tau_k})^2,$$

where $\bar{\pi}_k$ is the sample mean of $(\pi_{\tau_{k-1+1}+1}, \dots \pi_{\tau_k})$.

3. The penalty function is defined as $pen(\tau)$, which is increasing in the number $K(\tau)$ of the segments of τ. In line with the most popular information criteria, Lavielle suggests using a simple penalty function, like $pen(\tau) = K(\tau) = K$.

4. Simultaneously:

   4.1 Then, given the contrast function J and the penalty function pen, a parameter φ has to be chosen, which adjusts the tradeoff between the minimization of $J(\tau, \pi)$ and the minimization of $pen(\tau)$: $J(\tau, \pi) + \varphi pen(\tau)$, for which the algorithm suggested by Lavielle (2005) is followed.

   4.2 Estimate the observations vector where the structural break is presented $\hat{\tau}_n$ and, simultaneously, estimate the number of structural breaks $\hat{K}$ that minimize the penalized contrast function. So that, $\hat{\tau}_n$ is the sequence of regime changes minimizing:

$$H(\boldsymbol{\tau}, \boldsymbol{\pi}) = \frac{1}{n} J(\boldsymbol{\tau}, \boldsymbol{\pi}) + \varphi pen(\boldsymbol{\tau}).$$

This algorithm was the one used to detect the structural breaks in the mean of headline and core inflation in section 3.1.

b. Statistical Test for Breaks in Persistence

The data generating process for this test is like the one presented in section 3.1, but it is written using k: $k_i = p_i - 1, i = 1, \dots, m+1$, where m is the number of breaks in persistence. So, the model is:[56]

$$\pi_t = \beta_{0t} + u_t,$$

$$u_t = \rho_i u_{t-1} + \sum_{j=1}^{k_i} \phi_{i,j}\, \Delta u_{t-j} + \varepsilon_{t.}$$

This model allows for a dominant AR root, ρ_i, and the lag coefficients, $\phi_{i,j}$, differ across $m+1$ separate regimes.

There are two hypothesis: the null, $H_0: \pi_t \sim I(1)$, implying that inflation is non-stationary throughout the entire sample, i.e., $\rho_i = 1\ \forall\ t$; and the alternative, $H_1: \pi_t$ experiments m persistence changes, generating $m+1$ segments with change-point fractions given by $\tau_1 < \cdots < \tau_{m-1} < \tau_m$. The procedure partitions π_t, for $t = 1, \dots, T$, in its separate $I(0)$ and $I(1)$ regimes and consistently estimates the associated change-point fractions. Leybourne, et al. (2007) define the fraction $\tau \in (\lambda, 1)$, for a given λ in $(0,1)$, and base their hypothesis testing on the local GLS de-trended ADF unit root statistics, which uses the sample observations between λT and τT, denominated $DF_G(\lambda, \tau)$, obtained as standard t-statistics associated with $\hat{\rho}_i$ in the fitted regression:

$$\Delta\pi_t^d = \hat{\rho}_i \pi_{t-1}^d + \textstyle\sum_{j=1}^{k_i} \hat{b}_{i,j}\, \Delta\pi_{t-j}^d + \hat{\varepsilon}_t, \text{ for } t = \lambda T, \lambda T + 1, \dots, \tau T$$

where $\pi_t^d \equiv \pi_t - z_t'\hat{\beta}$, with $\hat{\beta}$ being the OLS estimate of β obtained by regressing $\pi_{\lambda,T}$ on $z_{\lambda,T}$, where $\pi_{\lambda,T} \equiv (\pi_{\lambda T}, \pi_{\lambda T+1} - \bar{\alpha}\pi_{\lambda T}, \dots, \pi_{\tau T} - \bar{\alpha}\pi_{\tau T-1})'$ y $z_{\lambda,T} \equiv (z_{\lambda T}, z_{\lambda T+1} - \bar{\alpha} z_{\lambda T}, \dots, z_{\tau T} - \bar{\alpha}\pi_{\tau T-1})'$, with $\bar{\alpha} = 1 + \bar{c}/T$, $\bar{c} = -10$, and $z_t = 1$. In the empirical application λ is set to $\lambda = \frac{1}{T}$, such that $\lambda T = 1$. As in Leybourne, et al. (2007), $\tau = 0.20$ is used.[57] For determining the value of k_i following Pivetta and Reis (2007), the BIC is used. This criterion chooses the appropriate lag length for values of k_i between 0 and 12 for each regression of the estimated sample and subsample.

The persistence break test is based on doubly-recursive sequence of *DF*-type unit root statistics, which Leybourne, et al. (2007) call the *M* test, and whose application generates the start and end points of the first $I(0)$ regime over the whole sample. The presence of any further $I(0)$ regime can be detected sequentially through the application of the M statistics to each of the resulting subintervals $[0, \hat{\lambda}]$ and $[\hat{\tau}, 1]$.[58] Continuing this way, all $I(0)$ regimes together with their start and end points can be identified. The period between the end point of

[56] Given its simplicity of presentation, this DGP is used, but the methods in Leybourne, et al. (2007) also allow for linear trends and breaks in the level and trend of β_{0t}. Another application of these methods is found in Noriega and Ramos-Francia (2009b).

[57] As robustness check in the empirical application, different values of τ and $\bar{c}$ were used and qualitatively similar results were obtained.

[58] It might be the case that the $I(0)$ period indicated by the test lies at one extreme of the sample. If this is the case, the test can be applied to the resulting segment $[0, \hat{\lambda}]$ or $[\hat{\tau}, 1]$.

one $I(0)$ regime and the start point of the next $I(0)$ regime must represent an $I(1)$ regime.

Table 6 summarizes the empirical results. The M test is initially applied over the whole sample, detecting an interior $I(0)$ regime between October 2001 and December 2010, for which the unit root null is rejected at the 1 percent significance level (M statistic is -6.051 and the critical value from Leybourne, et al. (2007) at 1 percent for $T = 400$ is -4.438). Subsequently, the test is applied over the period from February 1969 to September 2001 and the M statistic results significant at 1 percent for the subsample from April 1973 to November 1981, rejecting again the presence of a unit root in this subsample. Then, the M statistic is calculated over the subsample from December 1981 to September 2001 and the statistic did not result significant at a 10 percent significance level (and therefore, it is not reported in Table 6). The search for a stationary regime ends by applying the test over the subsample from February 1969 to March 1973, finding a third $I(0)$ regime which ends in December 1972. In the case of core inflation, the M test only finds one $I(0)$ subsample, corresponding to the period from November 2001 to December 2010. For the remaining subsample, the test cannot reject the presence of a unit root, even at a 10 percent significance level.

Table 6
Results of M test of Leybourne, et al. (2007) for Headline and Core Inflation [1/]

Inflation Series	Sample	Sample Size	k*	M	I(0) Periods	
					Start	End
Headline	1969:02-2010:12	503	0	-6.051***	2001:10	2010:12
	1969:02-2001:09	392	0	-5.175***	1973:04	1981:11
	1969:02-1973:03	50	0	-6.917***	1969:02	1972:12
Core	1982:02-2010:12	347	0	-6.206***	2001:11	2010:12

Source: Banco de México.
1/ Results Leybourne, et al. (2007) using BIC with $Kmax = 2$, $C = -10$ and $Trimming = 0.2$.
*** Indicates rejection of H_0 at 1%.

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