Financial Stability

Report

March 2006

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A Note to Our Readers

As of this edition, the *Financial Stability Report* will be published twice a year, in March and September, rather than July and December, as was traditional. This will enable us to analyze the behavior of financial agents at the close of the previous year (in the case of the March edition) and at the end of the first half of the current year (in the September edition). Another advantage of the new schedule is the possibility of analyzing the trend in variables throughout the entire year.

EXECUTIVE SUMMARY

Macroeconomic conditions favored solid growth in the financial system throughout 2005. Moreover, the economic outlook, both domestic and external, indicates this expansion could continue.

At December 2005, the country's credit institutions reported real positive growth in their two main assets. On the one hand, loan portfolio growth was up by an annual rate of 11.3%, mainly due to an increase in the share of consumer credit. On the other, investments rose by 13%. This increase in financial activities has been consistent with appropriate of solvency levels.

As to sources of financing for credit institutions, the rise in deposits has slowed, but increased funding through the inter-bank market and repo operations offset this situation. In addition, the country's financial entities continued to restructure their liabilities in the direction of less costly sources of funding. This was evident in the declining share of certificates of deposit (CD) and the increased growth in current accounts.

Households, where credit institutions have concentrated 26.7% of their total exposure, showed highly favorable results. The continued growth in household consumption was the main reason why, backed by significant improvements on in the job market, such as less unemployment and stability in real wages.

The positive situation in the private sector, accompanied by more portfolio coverage and good asset soundness on the part of financial institutions, suggests that credit risk, at least for the time being, does not pose a threat to the financial system. However, the continued momentum in consumer credit, which saw 32% real annual growth in 2005, will have to be carefully monitored. A prolonged increase in this portfolio could extend to lower quality debtors. Moreover, increased borrowing makes households more sensitive to changes in the economy. This underscores the importance of continuing to design ways and means to measure, monitor and assess the credit risk posed by the consumer loan portfolio. This should be done through the credit-risk management system (CRM) operated by the Colombian Superintendency of Financial Institutions.

Because investments account for a growing share of assets in the financial system, their valorization also represents a larger share of the system's earnings. This makes financial institutions more sensitive to interest-rate changes. Hence, progress towards market-risk measurement, regulation and monitoring is of vital importance to the stability of the financial system.

Board of Governors
Banco de la República

Financial Stability
Report

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I. Macroeconomic Environment

A. External Context

The assessment of the external context is positive for short-term financial stability. To begin with, world economic growth remains strong and is expected to continue this trend during 2006, propelled by the prosperity of China's economy and, to a lesser extent, by economic recovery in Japan and the European Union (Table 1). Forecasts indicate that the United States economy, which purchased 40% of all Colombian exports in the last quarter of 2005, will continue to grow, primarily because of larger capital investments. This suggests output in the United States will remain above its potential level during 2006.

Secondly, real interest rates in the United States and the European Union remain low, but are expected to move gradually towards their normal levels. The impact on liquidity would be moderate, as this increase has been already taken into account. Inflationary pressures and the trend in housing prices will determine the gradual pace at which interest rates are adjusted by the European Central Bank (ECB) and the United States Federal Reserve Bank (the Fed). However, the forecasts indicate that both, the Fed and the ECB, will continue their rate-hike policy throughout the year.

The outlook on the debt market for emerging economies remains healthy. So far this year, these countries have seen their risk premiums decline[1] . This is mainly explained as noted (Graph 1) in the previous edition of the *Financial Stability Report*, low by international interest rates and high liquidity.

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[1] Standard & Poor's even changed their rating of Colombia's sovereign debt, which is now positive.

TABLE 1

Changes in the Growth Forecasts for Colombia's Main Trading Partners
(Percentage)

	2004	Forecast for 2005, at:		Forecast for 2006, at:	
	Actual	Jan-06	Feb-06	Jan-06	Feb-06
Main Partners					
United States	4.4	3.6	3.6	3.4	3.4
Ecuador	6.9	3.0	2.8	3.3	3.1
Venezuela	17.3	9.1	9.4	6.4	6.2
Others					
Euro Zone	1.8	1.4	1.4	2.1	2.1
Japan	2.6	2.4	2.4	2.0	2.2
China	9.5	9.3	9.3	8.5	8.7
Peru	4.8	5.8	6.1	4.8	4.9
Mexico	4.4	3.0	3.1	3.5	3.5
Chile	6.1	5.9	5.9	5.5	5.5
Argentina	9.0	8.7	8.9	5.9	6.2
Brazil	4.9	2.5	2.5	3.4	3.4
Bolivia	3.6	3.4	3.7	3.4	2.9
Developed Countries	3.9	3.2	3.2	3.1	3.1
Developing Countries	10.7	6.1	6.3	5.0	4.8
Total Trading Partners (*)	**5.8**	**4.3**	**4.3**	**3.5**	**3.5**

(*) Balance of payments calculated according to non-traditional exports.
Source: Datastream-Consensus.

GRAPH 1

EMBI+ Spread and for Certain Latin American Countries

(Basis Points)

Source: Bloomberg.
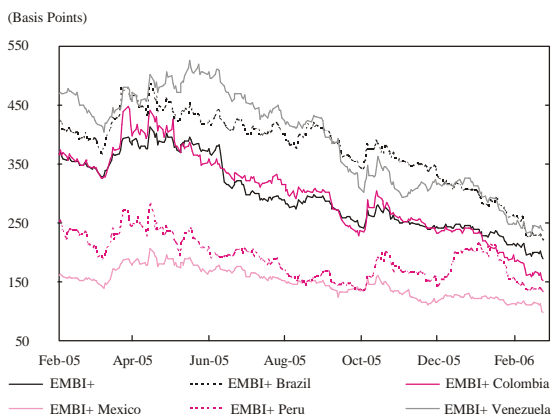
1. Medium-term Risks

The international outlook for short-term financial stability is favorable. However, if the growing worldwide trend in housing prices, the serious current account deficit in the United States and the high oil prices continue, we could see a mid-term rise in vulnerability.

Real housing prices in a number of countries over the world have increased considerably since the mid-nineties (Graph 2), and this has begun to alert monetary authorities.

The trend in housing prices in the United States (USA) has eased in recent months, but remains on a upward course in other countries. This poses a latent

risk. If this trend continues, it will create inflationary pressures that will lead to higher external interest rates. For Colombia, the risk lies within the possibility that higher interest rates will reverse capital flows, thereby reducing domestic liquidity.

On the other hand, the sharp increase in the U.S. current account deficit in recent years has become a cause for concern (Graph 3). However, the forecasts[2] indicate it should remain stable during 2006 and 2007 (-6.5% and -6.1% of GDP, respectively).

A quick correction in this tendency represents a risk to the Colombian financial sector. If the deficit continues to rise, it could begin to exert pressure towards depreciation of the dollar and a reduction in U.S. external demand. In the end, this could affect Colombian exports and investments denominated in dollars.

Finally, the sharp rise in oil prices since 1999 (Graph 4) could bring upward pressure to bear on inflation, causing interest rates to rise.

Nonetheless, the forecasts are positive in that oil price is expected to be US$60.1/barrel by the end of 2006 and US$57/barrel by the end of 2007. An additional indicator of these forecasts is the trend in the price of futures at December 2006, which showed relative stable behavior (Graph 5).

B.   The Domestic Context

Given the trend in the domestic economy during the third quarter of 2005 and the outlook for the last six months of the year, the current domestic context is

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[2]   The forecasts are from the Datastream Consensus.
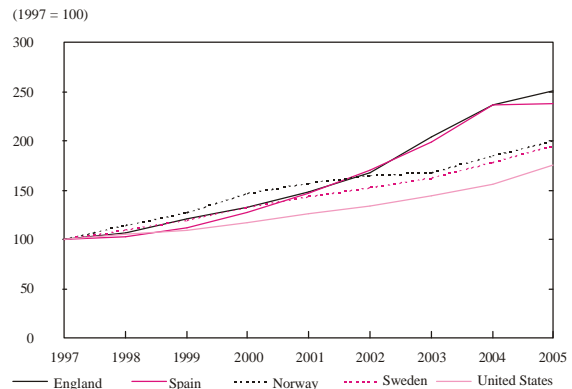
— England — Spain ······· Norway ······ Sweden — United States

Graph 3

US Current Account Deficit

(GDP Percentage)
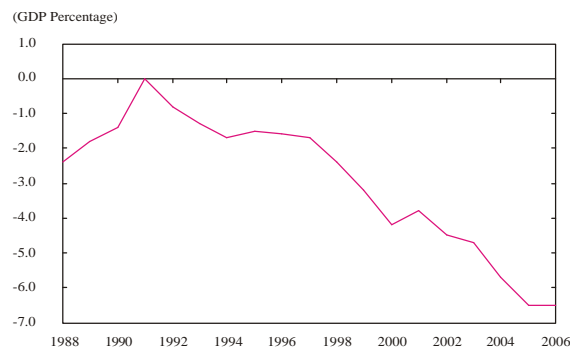
Source: Datastream.

Graph 4

WTI (*)

(Dollars/Barrel)
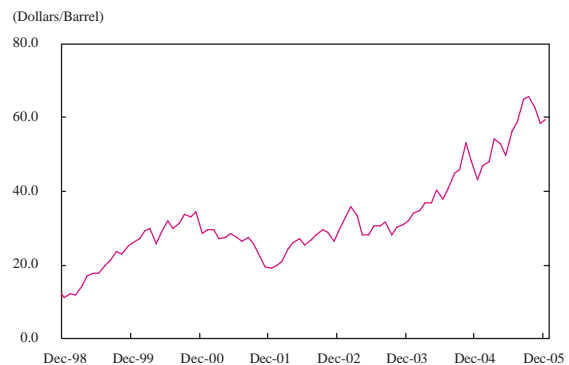
(*) West Texas Intermediate Crude.
Source: Datastream.

**Oil Futures
at December 2006**

(Dollars/Barrel)
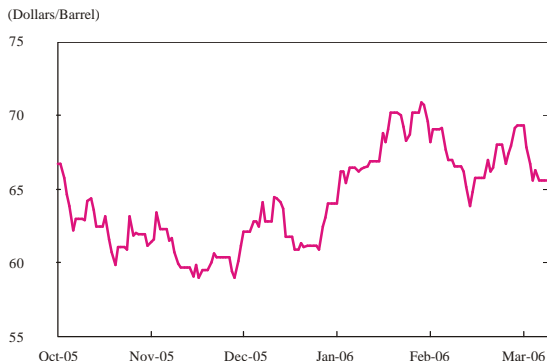
Source: Bloomberg.

generally positive for financial market development. Economic growth was especially dynamic in the third quarter of 2005, prompting a 5.1% increase in the nation's economy during the first nine months of the year. Not since the mid-nineties had the economy grown as much. This was possible, thanks to favorable domestic and external conditions in 2005.

The domestic outlook was marked by improvements on the job market and by high monetary liquidity consistent with the inflation target. Also, the increase in domestic demand during the third quarter of 2005 exceeded GDP and its historic average (10.33%). This was primarily due to household consumption (5.21%) and to gross capital formation (32.47%). In particular, households returned to the durable-goods-consumption levels maintained prior to the crisis in the late nineties, and the good performance in gross capital formation was marked by more investment in machinery and equipment.

In the external sector, although high economic growth rates for Colombia's major trading partners moderately boosted national exports during the first three quarters of 2005 (8.44%), the rise in imports was far greater (25.34%). However, this deficit was more than offset by the sharp increase in foreign direct investment (from US$2,395 million (m) in the first nine months of 2004 to US$3,330 m during the same period in 2005). The increase in current transfers (US$2,588 m to US$2,850 m) and in non-financial service exports (US$1,585 m to US$1,810 m) was a contributing factor as well.

As mentioned in the last edition of the *Financial Stability Report*, the forecast for economic growth in the fourth quarter of 2005 is 4.4%. This would imply 4.9% annual growth, backed again by the non-tradable sector (4.9%), although less so than in the third quarter of that year (7.0%). The fourth quarter ended with excellent results for inflation, with the target proposed by the Central Bank having been met (4.85%).

The forecasts indicate the economy will continue to grow at a good pace during 2006 (4.4%), propelled by increased household spending (5.5%) and investment (15.4%). Nevertheless, a bit of a slowdown is expected in 2007 (3.9%).

The positive trend in recent economic performance will have to be monitored closely. The current scenario could result in inflationary pressures due to the growth in aggregate demand. A rise in interest rates is one likely consequence of this situation and represents the potential materialization of the risks that now face the financial system. These risks are examined in detail throughout the present report [3].

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[3]   As is illustrated later in this report, the market risk (associated with potential losses to the system in the event of unfavorable movement in the market value of its investments) is now the major threat to the financial system.

II. Financial System

A. Credit Institutions

The indicators for credit institutions are analyzed in this section to determine how these entities have performed as of late. A special segment is included at the end to analyze the recent trend in these institutions, compared to the situation in other Latin American countries.

The present section is divided into five parts. The first contains a performance analysis of the main items credit institutions have on their balance sheets. The second discusses exposure to the main debtors (i.e. households, the government and the corporate sector). The third and fourth parts focus respectively on an analysis of loan portfolio quality and coverage, and the profitability of financial intermediation activities. Lastly, there is a brief account of the trend in the interest spreads charged by financial intermediaries.

1. Main Balance-sheet Accounts of Credit Institutions

a. Asset Positions

At the end of 2005, the credit institutions operating in Colombia reported COP$134.9 trillion (t) in total assets. This represents 12% real growth in total assets during the year, which is nearly the same as in 2004. As illustrated in Graph 6, the asset growth rate stabilized at around 11% during 2005.

The growth in total assets reflects the tendency in their two most representative components: loan and investment portfolios. The gross loan

portfolio increased by 11.3% in real terms during 2005 and was slightly above COP$77 t at the end of the year, which is two percentage points (pp) more than the increase noted in the last edition of the *Financial Stability Report*. A quick look at the trend in the different types of portfolios can shed light on this slight acceleration.

As Graph 7 illustrates, the consumer loan portfolio continued to grow, pursuing what is about to become a two-year trend. The real increase in consumer loans during 2005 was 31.9%, which is seven pp more than in 2004. Also, by the end of 2005, the consumer loan portfolio (COP$17.8 t) accounted for 23.1% of the total loan portfolio. As in the last edition of this report, we want to stress that the risk associated with this type of credit must be monitored closely. The vigorous growth in consumer loans could extend to low quality borrowers. Moreover, the consumer loan portfolio lacks sufficient collateral. Eventually, this could place the financial stability of credit institutions at risk, particularly in the event of a negative shock to the solvency of households that might undermine their creditworthiness[4].

On the other hand, the pace of the decline in the mortgage portfolio slowed dramatically in recent months, indicating that obstacles to mortgage growth appear to be disappearing gradually. During 2005, the mortgage portfolio experienced a real decline of 8.3%, which is a relative improvement compared to 2004 (when the reduction was 30.2%). This recovery came primarily in the last months of 2005. The real annual decline at September was 23.5%, which is fifteen basis points more than in August of that year[5].

The outlook for the commercial portfolio is not as positive. During the course of 2005, loans of this type increased at a real rate of 6.3%, which is almost two points less than in 2004. Unlike the consumer and mortgage loan portfolios,
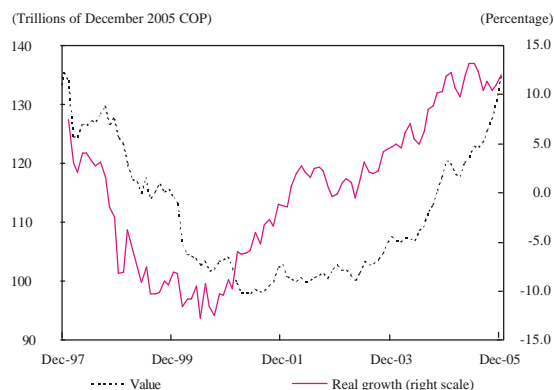
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[4]   Credit card debt has the least collateral. At December, it accounted for 21.2% of all consumer loans extended by credit establishments.

[5]   According to data published by the Institute of Savings and Loan Associations (ICAV), disbursements on mortgage loans were up by 19.7% in real terms during 2005.

Graph 8

Gross Loan Portfolio of Credit Establishments

(GDP Percentage)
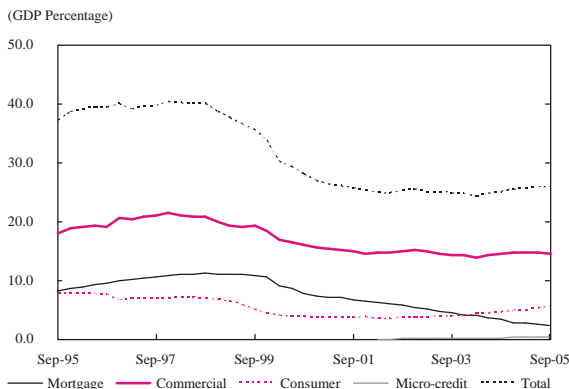
Source: Superintendent of Financial Institutions in Colombia and DANE. Calculations by Banco de la República.

Graph 9

Total Investment Portfolio Held by Credit Establishments

(Trillions of December 2005 pesos)   (Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

the rate of growth in the commercial loan portfolio has declined gradually since March 2005. As suggested in the last edition of the Financial Stability Report, this might be an indication that companies are continuing to use their own resources to finance productive activities[6] . At the same time, the increase in micro-credit, although high (42% in 2005), has slowed since July 2005 (when it was 63.1%)[7] .

In illustrating the scope of the loan portfolios held by credit institutions, Graph 8 shows how each has developed as a percentage of GDP. For example, in the past three years, the consumer loan portfolio has almost doubled in value as a share of GDP, going from 3.6% in mid-2002 to almost 6% at the end of 2005. The commercial loan portfolio has remained stable at around 15%, while the mortgage portfolio, as a share of GDP, has been losing ground since mid-1998 and now accounts for one fiftieth of output. Therefore, the slight increase in the total loan portfolio as a share of GDP is explained by the trend in consumer loans. However, the growth in total loans is far from the levels observed prior to the crisis in 1998-1999.

The investments portfolio held by credit institutions came to COP$43.9 t at the end of 2005, which is 13% more —in real terms— than at the end of 2004 (Graph 9). As the graph suggests, the growth in investments during the past two years has stabilized at around 15%, in real terms. The share of credit institutions' total assets that pertain to the gross portfolio and investments remained stable throughout 2005, at around 51% and 32%, respectively.

b.   Liabilities

Unlike total assets, the growth rate in deposit-taking on the part of credit institutions declined during the final months of 2005. This item accounts for

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6   No closing information on companies at December 2005 is available. The information that suggests this trend can be found in the December 2005 edition of this report, based on closing figures at September 2005.

7   By the end of 2005, the micro-credit loan portfolio accounted for 1.6% of the total loan portfolio held by credit establishments. Consequently, its high growth rate is not as much a cause for concern as the consumer loan portfolio.
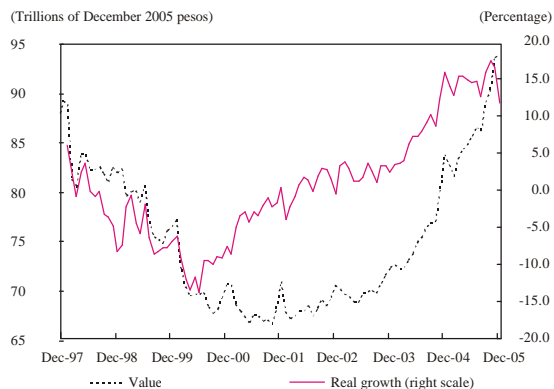
79% of total liabilities and came to COP$93.6 t by the end of the year. Moreover, 2005 witnessed a real increase of 11.9%, as illustrated in Graph 10.

According to the graph, this figure is four points below the one reported in 2004 and six points less than the figure at October 2005. This denotes a slowdown in deposit-taking during the final months of the year. However, the increased use of repos and inter-bank funds made up for the slack[8].

The slowdown in deposits is explained primarily by less growth in savings deposits. Towards the end of 2005, these accounted for 43% of total deposits (three points less than in April 2005, which was the recent high). In real terms, the increase in savings deposits went from 31% in October to 19% in December (Graph 11).

In 2005, the rate of CD growth was slightly above 2%, a fifth of what it was in 2004. However, the increase in these certificates stabilized at around 3% during the final months of 2005 and, in November and December, their share of deposits (29%) ceased to decline. In short, efforts to substitute sources of funding continue, backed this time by the good performance in checking accounts, which increased by 12.1% during 2005. This is almost three points more than the year before. More expensive sources of funding, such as time certificates of deposit, are being exchanged for the least expensive sources, such as savings and checking accounts.

Deposit-taking by Credit Establishments

(Trillions of December 2005 pesos)   (Percentage)

····· Value   —— Real growth (right scale)
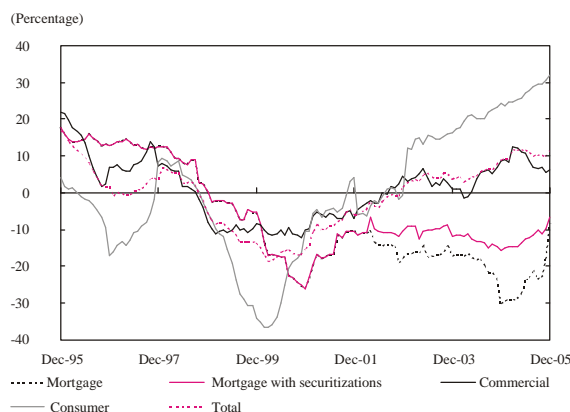
Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

Real Annual Growth in Deposit-taking by Credit Establishments, per Type of Deposit
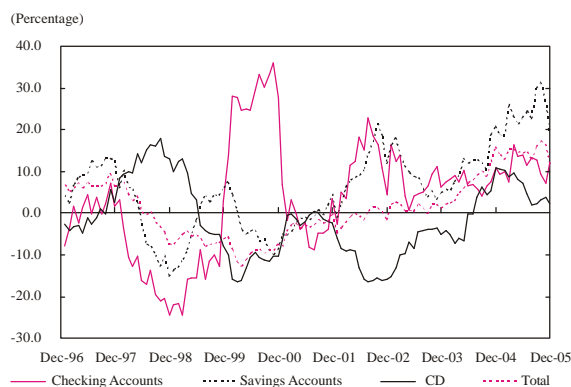
(Percentage)

—— Checking Accounts   ····· Savings Accounts   —— CD   ····· Total

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

2. Credit Institutions' Exposure to their Main Debtors

Table 2 summarizes the tendency in credit institutions' exposure to their main debtors during 2005. At December of that year, this exposure was

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[8]   During the period from December 2004 to December 2005, liability positions on the inter-bank market were up by 7%. This performance was concentrated during the last month of the year, when these positions grew by more than 200%, suggesting somewhat of a seasonal phenomenon.

TABLE 2

Credit Establishments' Exposure to their Major Debtors

Type	Dec-04		Dec-05		Real Annual Growth (Percentage)
	Trillions of Dec. 2005 COP	Share (%)	Trillions of Dec. 2005 COP	Share (%)	
Public Sector					
Loan Portfolio	4.72	5.2	4.31	4.2	(8.8)
Securities	25.58	28.2	30.27	29.7	18.4
Total	**30.30**	33.4	**34.58**	**34.0**	**14.1**
Private Corporate Sector					
Loan Portfolio	36.08	39.7	39.38	38.7	9.1
Securities	0.42	0.5	0.67	0.7	58.0
Total	**36.51**	40.2	**40.05**	**39.3**	9.7
Household Sector					
Loan Portfolio	20.99	23.1	24.69	24.2	17.6
Consumer Loans	13.57	14.9	17.89	17.6	31.9
Mortgage Loans	7.43	8.2	6.80	6.7	(8.4)
Securitizations	**2.99**	3.3	2.50	2.5	(16.3)
Total	**23.98**	26.4	**27.19**	**26.7**	13.4
Total Exposed Amount	**90.79**	**100.0**	**101.83**	**100.0**	**12.2**
Exposed Amount/Assets (Percentage)	75.4		75.5		

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

equal to COP$101,83 t, accounting for 75.5% of their assets and 12.2% real growth during the year. Both the exposure/asset ratio and the growth rate remained near the levels seen at the end of 2004.

Each debtor's share of the total exposure remained virtually unchanged throughout 2005. However, among households, consumer loans continue to gain importance over mortgage loans, as described in the last edition of the *Financial Stability Report.* Once again, there was considerable real growth in the consumer loan portfolio (31.9%), which was 2.3 pp above the rate at October. The share of exposure originating with the consumer loan portfolio increased by 3 pp during 2005 (from 14.9% to 17.6%).

Exposure to the other two debtors; that is, the private corporate sector and the public sector, saw a real increase similar to the rate at October 2005, although with a slight rise in the case of the former and a small reduction with respect to the latter[9]. The added increase in exposure to the private corporate

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[9]   The reference to October 2005 is the result of a comparison to what was summarized in the December 2005 edition of the *Financial Stability Report.*

sector was due to more growth in securities (58%). In the case of the public sector, a sharp drop in the loan portfolio (-8.8%) influenced the slowdown in exposure growth. The exposure of credit establishment to public debt paper was up by 18.4% in 2005, but the share remained virtually unchanged.

Graph 12

Portfolio Quality Index by Type of Credit

(Percentage)

| | | | |
| Mortgage | Commercial | Consumer | Micro-credit | Total |

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

3.   Portfolio Quality and Coverage

Graph 12 shows the recent trend in the portfolio quality index (PQI), which is the overdue/gross loan portfolio ratio. Towards the end of 2005, as illustrated, the PQI recovered its downward trend for all types of portfolios analyzed and even witnessed historic lows for each of them.

The index for the total portfolio was 2.6%, which is slightly below the figure registered at the end of 2004 (3.2%). Moreover, the PQI for the different types of portfolios continued to converge towards a common level. For the commercial portfolio, which is usually the lowest of all those analyzed, it declined slightly from 1.7% to 1.5% during the period between December 2004 and the same month in 2005.

At December 2005, the mortgage PQI, which is normally higher than that of other portfolios, experienced an abrupt two pp decline to 6% (a level not seen since June 1997). This reduction was due largely to the third purchase of overdue mortgage portfolio securities (TECH) on December 15, 2005 for an amount close to COP$110 billion (b).

Following the deterioration witnessed in September-October 2005, the consumer loan PQI dropped by one pp during the period from October to December of that year. Despite the good performance of this indicator, plus a positive financial situation at the household level (summarized later in this report), it is important to reiterate the need to take precautions in view of the high growth seen in loan portfolios of this type, for the reasons mentioned earlier. Continuous monitoring of elements that can have a negative impact on household solvency is crucial. Therefore, from the standpoint of regulations, this trend should prompt the design and initiation of mechanisms within the credit-risk management system (SARC) to adequately assess and monitor the credit risk posed by the consumer loan portfolio and its relationship to the economic cycle.

Coverage: Provisions/Risky Loan Portfolio
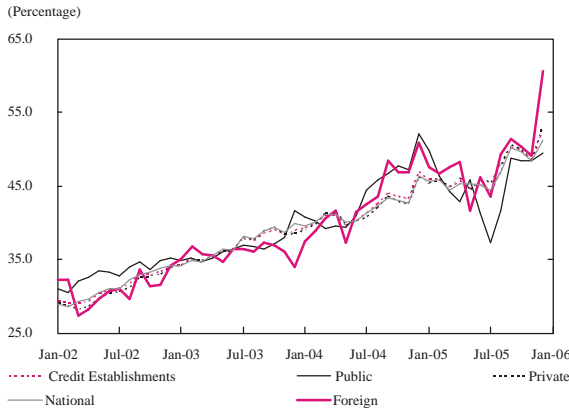
(Percentage)

Credit Establishments ......   Public ——   Private ......
National ——   Foreign ——

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

Return of Asset

(Percentage)

Credit Establishments ——   Foreign ......   National ——

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

The positive PQI is accompanied by more coverage for the riskiest portfolio, as illustrated in Graph 13. Both these factors add to the financial stability of credit institutions. By December 2005, the financial system's reserves amounted to 52.66% of the risky loan portfolio, which is 6 pp more than the percentage reported a year earlier[10] . All credit establishment (foreign, national, public and private) share this increase in provisions. At December, their coverage levels amounted to 60.6%, 51.2%, 49.4% and 53.1%, in that order. As illustrated in the graph, the increase in provisions during December has become a normal event in recent years. However, the rise in 2005 was particularly large.
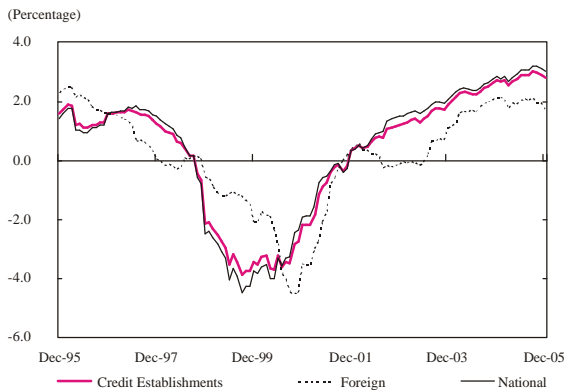
4. Earnings, Profitability and Solvency

The credit institutions reported COP$3.42 t in accumulated profits for 2005, which is 20.8% more than the amount registered the year before.

Despite good performance in terms of profits, credit institutions have seen their return on asset (ROA) decline slightly, following a recent high of 3.02% in September 2005. As illustrated in Graph 14, the indicator was 2.8% at the end of the year, which is marginally above the rate at December 2004 and quite close to recent historic highs. Foreign and national credit institutions share the recent decline in ROA. At December, their respective indicators were 1.74% and 3.01%.

Conclusions on the stability of the financial system can be obtained from a detailed analysis of the sources of income for credit institutions. Graph 15 shows the trend in the share of total income pertaining to earnings on interest (i.e. income on loan portfolios), earnings from commissions and earnings

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[10]   The risk portfolio pertains to the sum of type B, C, D and E portfolios. See Circular 11 published in 2002 by the Colombian Banking Authority.

from investment portfolio valuation changes[11].
According to the graph, commissions have
increased gradually as a share of total income since
1999 and account for almost 10% at present. Even
more relevant is the steady rise in the share of
income from valuation changes of investment
portfolio as of 1997, which accounted for a fourth
of total income at the close of 2005[12]. The share of
income from interest had declined to 55.5% of to-
tal income at December 2005. This was due to the
drop in interest rates and to the fact that the loan
portfolio now accounts for a smaller share of total
assets.

These changes in the make-up of income earned
by credit institutions offer a different view of the
market risk facing the system. Income from
investment portfolio valuation changes is due to fa-
vorable interest rates in recent years. However, if
this context were to reverse itself, some of the
income perceived by credit institutions could be
jeopardized.

The recent trend in credit institutions' solvency ratio
is shown in Graph 16. For these institutions as a
whole, the past year witnessed a slight decline in
the solvency ratio from 13.6% in December 2004
to 13.5% a year later. The downturn this indicator
experienced up until October came to a halt at the
close of 2005. In the case of private institutions,
the trend was similar. Public intermediaries
saw their solvency ratio go from 12.4% to 13.2%
during the year. In every case, the ratio exceeded
the average for the period registered in the graph
(13%.)

In short, an analysis of the solvency ratio points to the same conclusion
noted in the last edition of the *Financial Stability Report:* credit institutions

Graph 15

Composition of Credit Establishments' Income
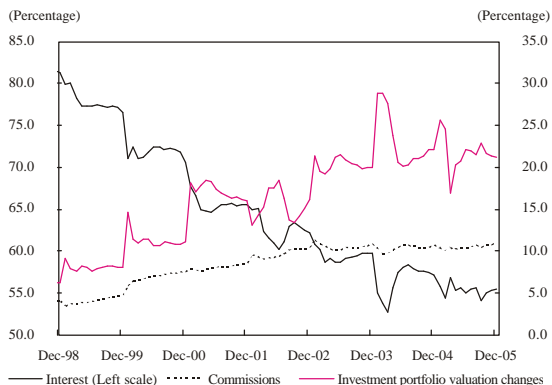
Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

Graph 16

Credit Establishments' Solvency Ratio
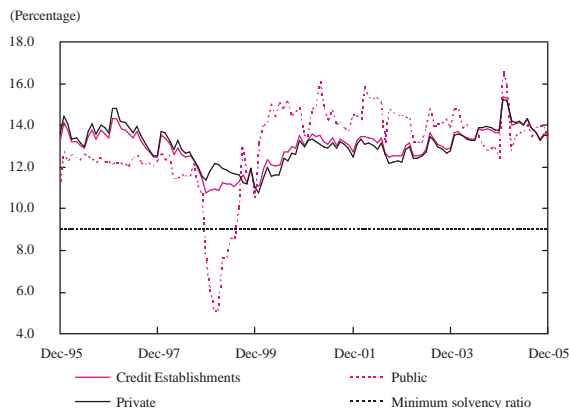
Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

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[11]   Income from interest includes income from adjustment for currency devaluation (indexation).
These earnings, as well as income from investment valuation changes, must be divided by total
income, not by annualized returns. This last alternative leads to inaccuracies when interpreting
the information, as it is impossible to separate disbursements for interest from disbursements
for the valuation changes of investments.

[12]   Specifically, COP$22 out of every COP$100 perceived by credit establishments come from
investment portfolio valuation changes.

easily surpass the requirements set by the Colombian Superintendent of Financial Institutions. This is why capital poses no constraint to growth in the activities of financial intermediaries.

5. Intermediation Margins

As indicated in the last edition of this report, the strong growth in consumer credit has been accompanied by a reduction in interest rates on new loans, which could denote the existence of increased competition among the financial intermediaries in this market. This tendency was reflected in the ex ante margin on credit of this type, which went from 16.0% at December 2004 to 15.4% at December 2005 (Graph 17)[13]. In terms of the intermediation margin, although the deposit rate on CDs dropped by almost 80 basis points (bp) during that period, the reduction of nearly 145 bp in the consumer credit rate more than compensates for the lower deposit rate.

The ex ante margin on other types of loans has remained relatively stable, although there are signs of a moderate and sustained reduction in the interest rate margin on the commercial portfolio as of August 2005: nearly 60 bp compared to December of the same year (Graph 17). However, the consolidated ex ante margin for the entire system exhibited a moderate upward trend as of mid-2004, suggesting the relative share of consumer credit in total disbursements has been increasing. This, in turn, has elevated the total margin, due to higher interest rates on loans of this type.

In the last two years, the ex post margin remained relatively unchanged at around 9% (Graph 18)[14]. The reason is the recent stability in implicit deposit and lending rates at around 6% and 15%, respectively.

Ex Ante Intermediation Margin Using the CD Rate
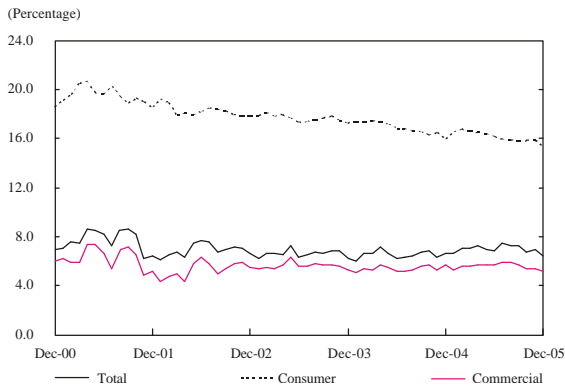
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

Ex Post Intermediation Margin
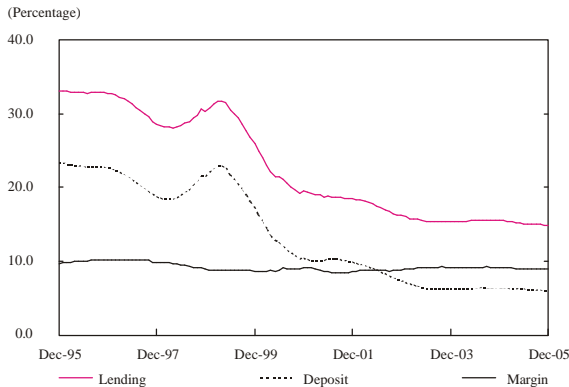
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

[13] The *ex ante* margin is the difference between the marginal lending rates intermediaries charge for each of these types of credit and the deposit rate paid on time certificates.

[14] The *ex post* margin is calculated as the difference between the implicit lending rate and the implicit deposit rate. The former includes income from interest, commissions and adjustment for monetary devaluation, as a respective share of the performing loan portfolio. The latter includes outlays for interest as a percentage of costly liabilities.

Box 1

International Indicators

Several of the principal indicators for the banking system in Colombia and other Latin American countries[1] are examined in this section to determine how the efficiency, profitability and portfolio quality of our system compares in light of international standards.

The general profile of the banking systems in Latin America is not much different from last year. However, there have been changes in certain trends, which are important to point out.

The credit portfolio continues to expand in every country, but its real growth has slowed in Mexico, where it is the lowest, and in Venezuela, where this indicator reflects a change in tendency despite added growth (50.7% real growth at December 2005) (Graph B1.1).

Graph B1.1
Real Annual Gross Portfolio Growth
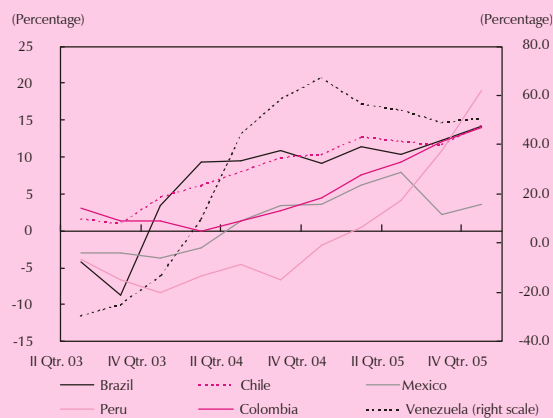
Source: Banking authorities in each country, Banco Central Do Brasil and calculations by Banco de la República.

The strong portfolio growth in Peru is also important. After negative rates since 1999, it is now at real levels around 20%, second only to Venezuela, while Brazil, Chile and Colombia have converged at similar growth rates since 2005.

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[1]   The countries included are Brazil, Chile, Mexico, Peru and Venezuela.

This increase has been accompanied by a steady improvement in portfolio quality, with the exception of Brazil (Graph B1.2). Venezuela has the lowest indicator, even more so than Chile, which always had the lowest total loans ratio. The improvement in Venezuela's indicator is due primarily to good loan portfolio growth. The non performing loans portfolio in Venezuela did decline, but by a much lesser proportion. In spite of continuing to register an increasingly lower indicator, Colombia has the second highest value of the countries in the sample, second only to Brazil.

(Percentage)

Source: Banking authorities in each country, Banco Central Do Brasil and calculations by Banco de la República.

The asset profitability of Latin America's banking systems averaged about 2.14% at December 2005 (Graph B1.3). This indicator was up slightly during the past year in Colombia, Brazil, Peru and Mexico, but declined during the last quarter in Colombia and Venezuela. Nevertheless, these are the only two countries with above-average profitability.

Like asset profitability, the efficiency indicator remained relatively stable. The Venezuelan banking system has the highest level of inefficiency, with an administrative and labor expense ratio above 6%. This might be associated with the higher portfolio levels observed in that country, which require more labor costs to manage. It at December 2005, the average efficiency indicator for all the countries in the sample was 4.65%.

Graph B1.3
Asset Profitability: Net Profit/Asset

(Percentage)

Brazil		Chile		Mexico	
Peru		Colombia		Venezuela	

Source: Banking authorities in each country, Banco Central Do Brasil and calculations by Banco de la República.

Finally, the change in the intermediation margin[2] shows a decline for Venezuela, which was 2 pp above Colombia at December 2004 and, a year later, 28 pb below (Graph B1.4). This was due to less of a margin in Venezuela and to the fact that this variable in Colombia has been on the rise since 2001. At December 2005, it was above the average for these countries, which has been declining since mid-2003.

Graph B1.4
Intermediation Margin with Ex Post Rates
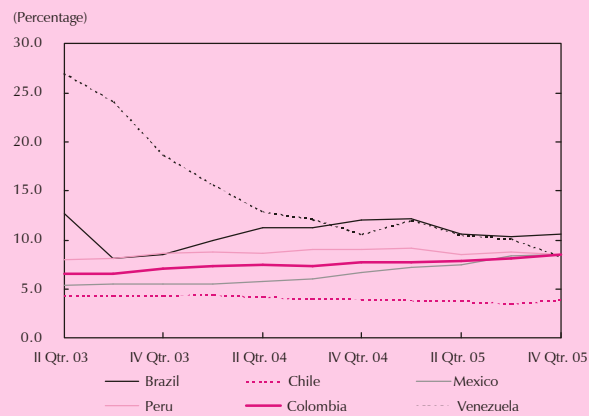
(Percentage)

Brazil		Chile		Mexico	
Peru		Colombia		Venezuela	

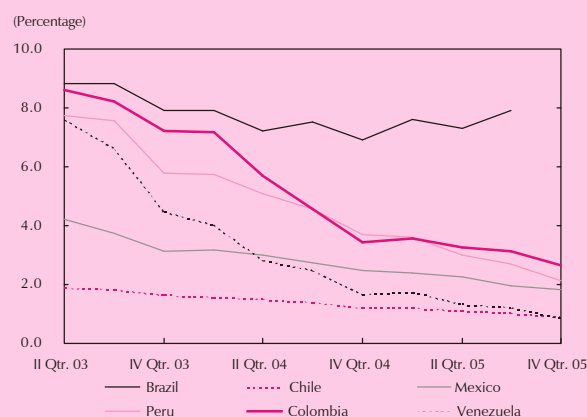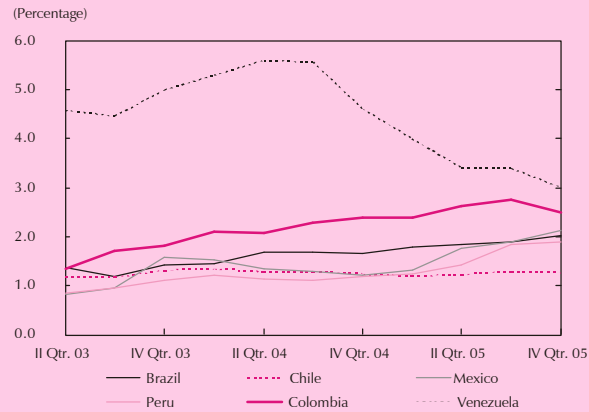Source: Banking authorities in each country, Banco Central Do Brasil and calculations by Banco de la República.

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[2] The intermediation margin is calculated as the difference between the ex post lending and deposit rates in banking systems. The lending rate is the ratio of income from interest to the portfolio; the deposit rate is the ratio of outlays for interest to deposits.

In conclusion, the past year saw no major changes for the banking systems in the countries analyzed. Growth in credit remains favorable, associated with lower non performing loans portfolio rates. Efficiency levels also have remained stable, as have profitability levels, while intermediation margins have declined, on average. However, the change in the upward trend in credit in Venezuela and the relatively high levels of inefficiency in that country are factors of interest.

B.   Non-bank Financial Institutions

The financial investments and the financial risks to which non-bank financial institutions (NBFI) in Colombia are exposed are analyzed in this section. This group includes pension-fund managers (AFP's), life insurance companies (LIC), general insurance companies (GIC) and special and ordinary mutual fund portfolios (SMF and OMF) managed by trust companies.

The investment portfolio of these institutions accounts for nearly 25% of GDP and is growing at real annual rates above 30%. Investment decisions by non-bank financial institutions can affect lending terms for credit customers and for financial entities. This is because of the size of their portfolios and the pace at which they have grown. These institutions also manage a large portion of household savings, particularly the AFP's and the trust companies. Consequently, the analyze of their performance is very important to financial stability.

1.   Pension Fund Managers (AFP's)

a.   Portfolio Growth

The AFP's portfolio amounted to COP$45.99 t at November 2005, which is equivalent to 33.55% real annual growth. This significant momentum was a common feature of the five years prior to that date. These funds practically doubled in size during that period, which means they are becoming increasingly important to the financial system and to the markets where

Table 3

Size of the Portfolio Managed by AFP's
(Trillions of November 2005 COP)

	Pensions		Severance	Total	Real Annual Growth (percentage)
	Mandatory	Voluntary			
Dec-01	14.32	2.38	2.68	19.38	26.13
Dec-02	18.45	3.49	2.84	24.78	27.88
Dec-03	22.49	4.17	3.03	29.69	19.80
Dec-04	27.71	4.71	3.28	35.70	20.26
Nov-05	35.47	6.83	3.69	45.99	33.55

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

their investments are concentrated. Table 3 shows the size of the funds managed by AFP's in the last five years and their real rate of growth.

This momentum is explained largely by the increase in the number of active affiliates and by high profits on the investments made by these funds. First of all, the number of active affiliates[15] increased by 12.1% yr./yr. (year by year), amounting to nearly 338,000 new active members. Secondly, high profitability has been common feature of the pension funds. Their accumulated profitability during the three previous years came to 19.43%, which is 5.42 pp above minimum required profitability. At the individual level, profitability ranges from 18.18% (4.17 pp above the minimum) to 22.03%. During the last five years, none of the funds obtained an accumulated annual profitability of less than 14%.

The accelerated growth in the AFP's portfolio could have major implications for the markets where these investments are concentrated. For example, Graph 19 shows the growing AFP's share of the public-debt securities market. At the end of 2005, 16.5% of all outstanding TES were held by AFP's. At December 2001, this ratio was only 7.1%, this implies a major exposure to market risk. The amount of AFP's risk exposure is outlined in Section 4.

Graph 19

TES Held by AFP's

(Percentage of all outstanding TES)

Source: Banco de la República.

[15]   Figures at September 2005.

AFP's Portfolio Composition by Type of Issuer
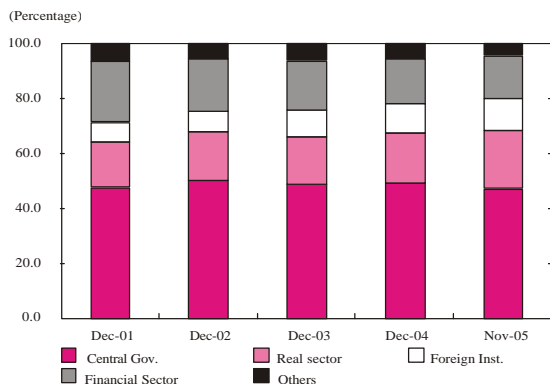
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

AFP's Portfolio Exposure to Domestic Public Debt Versus External Debt
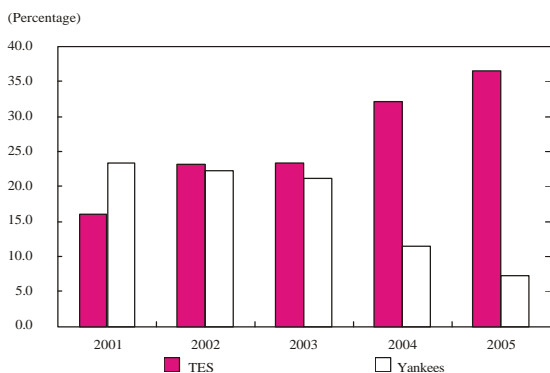
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

AFP's Portfolio Composition by Type of Currency
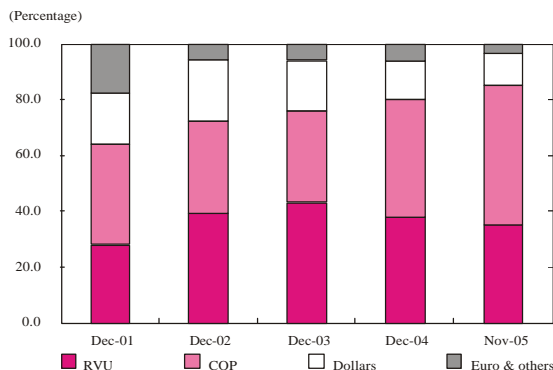
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

b.   Portfolio Composition

1)   Breakdown by Type of Asset and Counterpart

In recent years, the AFP's have restructured their investment portfolios in the direction of the real sector (Graph 20), mainly in the form of stocks. Between December 2004 and November 2005, stocks as a portion of the total portfolio held by mandatory pension funds increased from 7.76% to 13.21%.

There was a considerable decline in exposure to the financial sector, which dropped from 22.13% of the total AFP'S portfolio at December 2001 to 15.57% by November 2005.

High AFP'S exposure to public debt paper has remained relatively constant in recent years. At November 2005, these instruments accounted for 47.17% of the total AFP'S portfolio. Yet, in terms of government bonds, there has been a clear shift towards the domestic debt (Graph 21), primarily because of revaluation and the recent trend in prices for domestic-debt securities.

2)   Breakdown by Type of Currency

A breakdown of the portfolio by type of currency shows a clear shift towards peso denomination in recent years (Graph 22). In fact, by November 2005, 49.8% of the total AFP'S portfolio was dominated in COP. There also has been a major reduction in the percentage denominated in foreign currency, both in dollars and other currencies. Investments denominated in dollars accounted for 11.42% of the total portfolio at November 2005, which is 2.5 pp less than at December 2004 and 6.6 pp less compared to December 2003.

The value of the uncovered AFP'S portfolio in foreign currency also continued to decline, as illustrated in Graph 23. Being uncovered, this portfolio is a good approximation to the exchange

risk AFP's exposure. Moreover, at November 2005, it was equivalent to 6.6% of portfolios value in the case of mandatory pension funds. In the case of voluntary pension funds, this percentage came to 7.5%. It was 4.4% for the severance-pay funds.

On the other hand, nearly one third (35.21%) of the AFP'S portfolio is denominated in real-value units (UVR) or in denominations tied to inflation (CPI). This percentage had declined in the two years prior to 2005, as the UVR-denominated portfolio accounted for 38.02% and 43.12% of the total in December 2004 and 2003, respectively.

A breakdown of the AFP'S portfolio, according to maturity, shows that the gap between investments and the outlook for future payments continues (Graph 24). For example, 74% of current affiliates to pension funds are younger than 40 years of age, while 95.8% of AFP'S investments mature in less than ten years. This underscores the need to create long-term financial mechanisms to adjust the AFP'S investment portfolio in a way more consistent with future payments.

2. Life Insurance and General Insurance Companies

The life insurance companies (LIC) reported COP$5.81 t in investments at December 2005. This is equivalent to a real annual increase of 26.5%. The general insurance companies (GIC) reported COP$3.51 t in investments, with 18.2% real annual growth. The LIC investment portfolio is 1.32 times the technical reserve[16]; this ratio for the GLC was 1.25.

As to portfolio composition by counterpart (Graph 25), exposure to the public sector remains high: 50% in the case of the LIC portfolio and 42.3% for the

Percentage of Portfolio Value Denominated in Foreign Currency, without Coverage
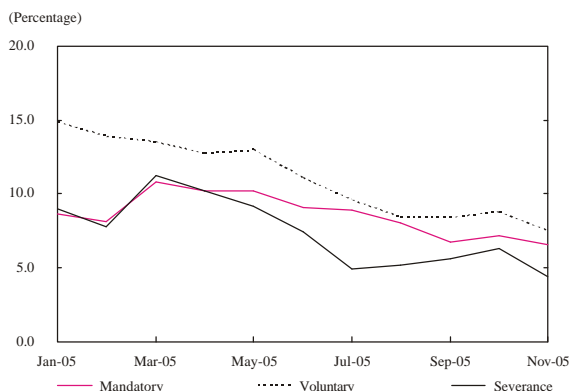
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

AFP's Portfolio by Maturity and Currency (November 2005)
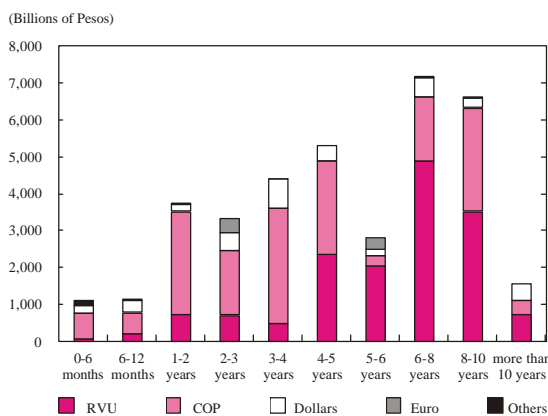
(Billions of Pesos)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

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[16] At December 2005, the minimum requirement was 0.8.

Graph 25

Investment Portfolio of General
and Life Insurance Companies
December 2005 (COP$9.3 t)
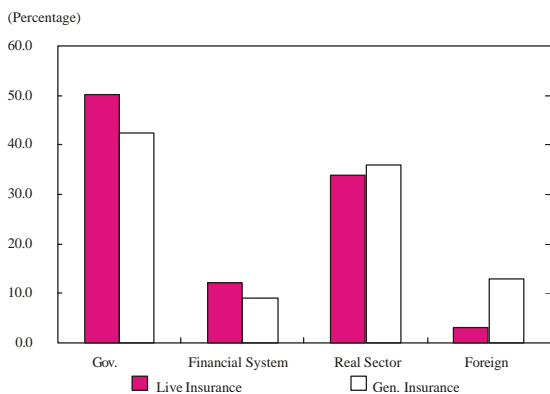
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

GIC portfolio. However, it is less than in December 2004, when LIC and GIC portfolio exposure to the public sector was 54% and 45%, respectively.

During the same period, both life insurance companies and general insurance companies increased their exposure to the productive sector and, by the end of 2005, the share of their portfolios with this particular counterpart came to 33.9% and 36.1%, respectively. This shift in composition was primarily in the form of stocks.

Despite good net results for general and life insurance companies alike, 2005 was not a good year for the insurance business. The technical margin[17] dropped from 3.23% in December to 3.11% for the GIC. In the case of the LIC, the situation was even less favorable, as the technical margin remains negative (-6.32%).

The good results for these companies as a whole were reflected in the net margins at December 2005: 15.82% for the GIC and 36.02% for the LIC. These are well above the levels obtained the year before, mainly due to the highly profitable investments these companies have made. However, if the prices on public debt bonds and stocks change, the soundness of these institutions could be threatened. Unlike the other NBFI, the tendency in insurance activities has not been favorable.

3.   Special and Ordinary Mutual Funds

The value of the SMF-managed investment portfolio at December 2005 was COP$3.12 t, having increased at a real annual rate equivalent to 54.4%. On the same date, the OMF investment portfolio was valued at COP$5.33 t, which implies 12.5% real annual growth.

As to exposure by counterpart (Graph 26), there have been no major changes since the last edition of the *Financial Stability Report*. These funds are different

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[17]   Defined as the ratio between the technical result and the premiums issues.

from the other NBFI in that their portfolio is exposed mostly to the financial sector (primarily through time certificates of deposit). As a counterpart, the financial sector accounts for 75.0% of the OMF portfolio and 54.0% of the SMF portfolio. With respect to the government, 22.0% of the OMF portfolio is exposed to public debt paper, as is 34.3% of the SMF portfolio.

Graph 26

OMF and SMF Investment Portfolios at December 2005 (COP$8.4 t)
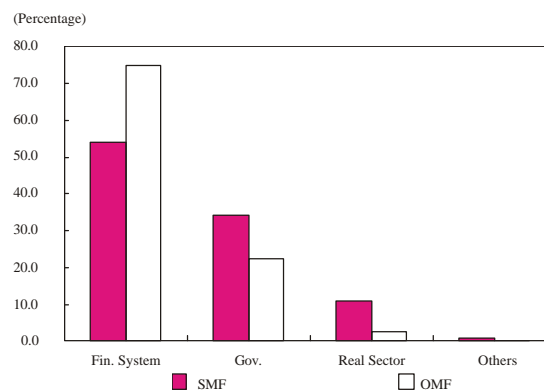
(Percentage)

Source: Colombian Superintendent of Fin. Institutions. Calculations by Banco de la República.

III. Financial System's Debtors

A. Households

1. Household Finances

The momentum in household consumption remained favorable, ending the third quarter of 2005 with almost 5.2% real annual growth (Graph 27). As in the first two quarters of the year, the rise in consumption was based on substantial annual increases in spending on both services and non-durable goods (3.2% and 4.6%, respectively). These items account for more than 80% of all household consumption. Spending on durable goods continued to be the most dynamic of all items, registering a real annual increase of 18% in the third quarter of 2005. As for the remainder of the year, this positive trend is expected to continue and even persist during the early quarters of 2006, as the GDP-growth forecasts for this year (4.4% yr./yr.) are based largely on how household consumption is expected to behave (5.5% yr./yr.).

Although consumption as a share of GDP has been relatively stable in recent months, as illustrated in Graph 28, it is important to note that the real growth in consumption is the primary reason for the vigorous momentum in the consumer loan portfolio.

The outlook for the job market is also favorable, due to the increase in household spending. A

Graph 27

Household Consumption
(Seasonally Adjusted Series)
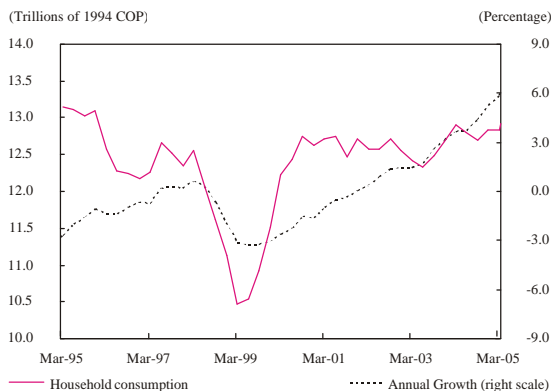
Source: DANE, Calculations by Banco de la República.

comparison between January 2005 and January 2006 for the 13 major cities as shows a marginal decline in unemployment (16%) as of January 2006 (Graph 29). Since the beginning of the Continuous Household Survey (CHS), this is the lowest level recorded for that month. On the other hand, underemployment, which had been above the 2004 rates since August 2005, began the year at the lowest level since the start of the CHS (28.6%). This is 0.7 pp less than in January 2005 (29.3%).

The employment rate declined by 0.3 pp from 52.2% in January 2004 to 51.9% in January 2006. This slight reduction was produced by an increase in the working-age population. The period between the two months in question saw only a marginal rise in the number of people with jobs. However, the January employment rate has remained relatively stable since 2004.

Real wages continue to perform well, registering positive growth during the second half of 2005 (Graph 30). The increase in retail wages had been slowing since early 2005, but seems to have stabilized around 1%. Manufacturing wages grew by more than 2%, confirming the acceleration

Graph 29

Employment Rate

(Percentage)
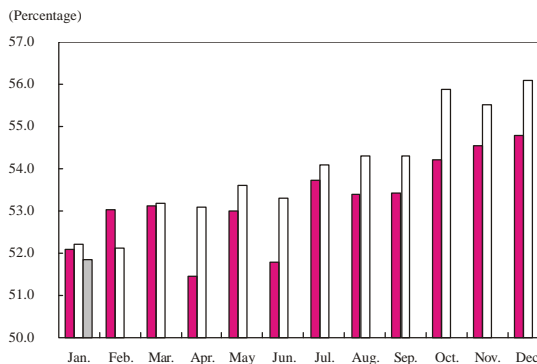
Unemployment Rate

(Percentage)

| ■ 2004 | □ 2005 | ■ 2006 |

Source: DANE. Calculations by Banco de la República.

Graph 30

Annual Growth in the Real Wage Index, by Industry
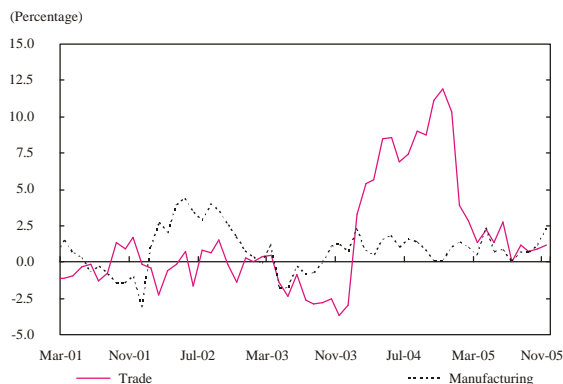
(Percentage)

Trade ········· Manufacturing

Source: DANE. Calculations by Banco de la República.

Graph 28

Household Consumption

(GDP Percentage)
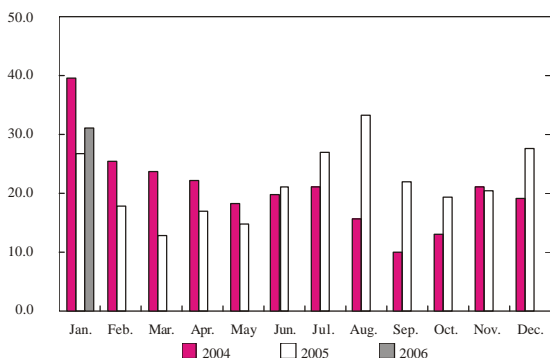
Source: DANE. Calculations by Banco de la República.

witnessed since July 2005 and placing them above the increase in retail wages for the first time since the final quarter of 2003.

In general, conditions on the labor market point to a situation similar to the one described in the last edition of this report. The increase in household spending and in the consumer loan portfolio, coupled with more capacity for household indebtedness, are being backed by the rise in real wages and improvements in the labor market.

2. Prospects

During the second half of 2005, Fedesarrollo's expectation index, which attempts to measure how households view the state of the economy, surpassed the levels registered in 2004. Also, consumers were more optimistic in January 2006 than at the start of 2005, although their expectations remain less favorable than in January 2004 (Graph 31).

The durable goods purchase perception index appears to have stabilized as of late October 2005, fluctuating at around eight points (Graph 32). This is due to stable levels in the vehicle and durable-goods purchase indexes during the final months of 2005. This indicator remained positive during the first month of 2006, something not seen since mid-2005.

The home purchase perception index in January 2006 was 13 points higher than in January 2005 (Graph 33). Despite being less than the historic high registered in August 2005, this indicator appears to have departed from the downward trend witnessed in the last four months of 2005.

The high levels of the durable-goods purchase index appear to be reflected in increased private consumption on the part of households and in real

additional sales of vehicles, furniture and electrical appliances. At December 2005, the annual growth in private consumption was 39% while real sales experienced an expansion of 26%. The rise in these items has been accompanied, in turn, by an increase in consumer loans, which could continue if actual conditions and growth forecasts for 2006 remain unchanged.

The situation concerning the mortgage portfolio is similar to what was described in the last edition of the Financial Stability Report. Real annual growth in disbursements for home purchases continues, having increased by 23% as of December 2005. However, it has yet to be on par with the levels observed prior to the crisis (Graph 34). The level of disbursements is not expected to equal the levels registered in 1997. However, the downward trend in real marginal mortgage rates in the second half of 2005, which is likely to continue during the next few months, could signal a continuation of the increase in the amounts being disbursed (Graph 35).

The increase in disbursements has been accompanied by a rise in the number of square meters approved for construction, which was up by 5.9% during the course of 2005 (accumulated during the 12 months of the year). The area approved for construction contributed 5 pp to the accumulated variation, even though building permits were down by 3.98% at December 2005. This is explained, in part, by 1.16% fewer building permits approved for home construction.

Consequently, the forecast continues to suggest a new equilibrium in the mortgage market. In this sense, the coming months should see a further decline in the stock of mortgage loans on the balance sheet of the financial system. However, if the current favorable mortgage conditions being offered by credit institutions continue, home-loan disbursements should keep rising and could eventually halt the decline in this portfolio.

Finally, as highlighted in the last edition of this report, the accelerated growth in the consumer loan portfolio could eventually pose a threat to the health of

Graph 34

Monthly Disbursements for Home Purchases
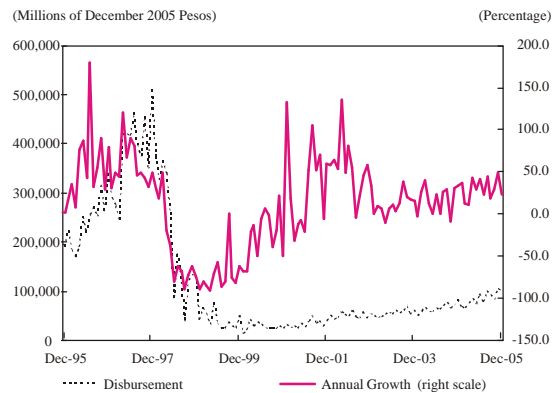
Source: Colombian Savings and Loan Institute (ICAV).

Graph 35

Real Marginal Rate on the Mortgage and Consumer Portfolios (*)
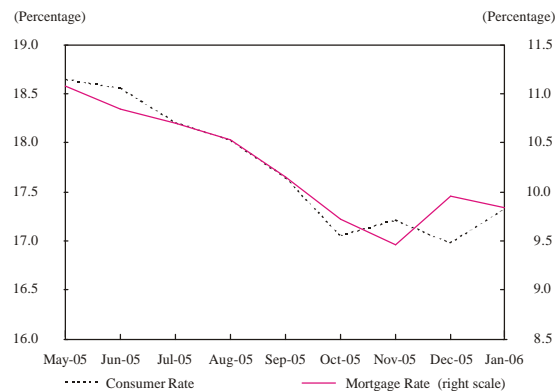
(*) The marginal rate is the rate at which a loan is contracted.
Source: Colombian Superintendent of Financial Institutions. Calculations by Banco de la República.

Graph 36

New Housing Price Index in Real Terms

(January 1994 = 100)
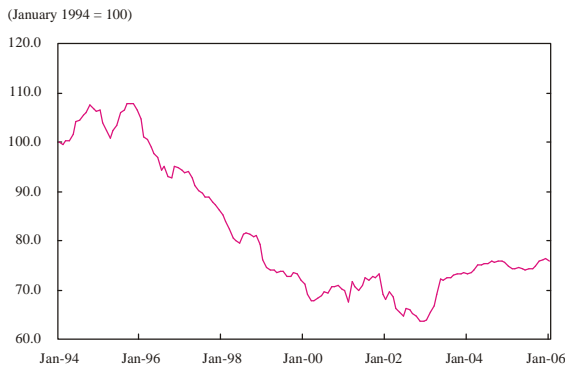
Source: DNP. Calculations by Banco de la República.

household finances. Presently, households seem to be in a favorable financial position, given the fall in real marginal interest rates on consumer loans[18] and stable home values (homes are households' most important asset) (Graph 36). Nevertheless, any reversal of present conditions that might jeopardize their ability to pay would increase the rate of post-due loans, thereby affecting the stability of the financial system.

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[18] In spite of a slight increase between December 2005 and January 2006, these rates tended to decline throughout 2005 (Graph 8).

Box 2

Asset Price Bubble

As in past editions of the *Financial Stability Report*, this section offers an analysis of speculative bubbles, in this case the possibility of a bubble in new and used housing prices in Colombia[1].

A price-to-equity index was constructed to examine these markets by comparing the price index of an asset to an indicator of the return it offers[2]. The resulting ratio is compared to its long-term value, in order to measure any excess appreciation in the particular asset.

The ratio between the New Housing Price Index (NHPI), calculated by the Departamento Nacional de Planeación (DNP), and the rental index[3] was evaluated for the new housing market. The deviations then were plotted with respect to the average indicator for the 1994-2005 period. As illustrated in Graph B2.1, the value of the indicator has been

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[1] Information on stock price bubbles is not included in this edition, as no new corporate figures are available other than the information presented in the last report.

[2] The purpose of the indicator is to compare the asset price to an indicator of what we call " asset value fundamentals" (the indicator of return). Accordingly, if a bubble exists, the price index should be high in relation to profitability and, therefore, the indicator would be higher. Otherwise, if profitability is up but the price is not, the indicator is low, suggesting the asset is undervalued.

[3] The rental index pertains to the CPI housing component.

Graph B2.1
DNP-NHPI/Rental Price Ratio

(1994-2005 Average = 100)

Source: DNP and Banco de la República.

near the long-term level since March 2004. As of October de 2005, it was less than 1% above the long-term value. This overvaluation is insignificant when compared to the levels registered between 1994 and 1995, which were close to 27%.

A similar index was developed for the used housing market. However, the NHPI was replaced with Banco de la República's used housing price index (UHPI)[4]. The results for both markets coincide with respect to the speculative bubble observed between 1994 and 1995, when both indicators reached a peak in terms of overvaluation. In the case of the UHPI, these levels were highest at the end of 1995, when overvaluation was 15% (Graph B2.2). It means the bubble was more pronounced on the new housing market than on the market for used homes. This is due to the menu costs implicit in the construction business[5], due to which price adjustments are not immediate. Therefore, if suppliers overestimate the price of the asset, these inflexibilities would imply a stronger bubble in that market.

The bubble in the market for used homes disappeared at the start of 1997, approximately one year ahead of a similar event in the new housing market. Later, both indicators fell below their long-term value, which was exceeded only during the last quarter of 2004 in the used home market, with a slight overvaluation of 3.4%. Once again, this market seems to have adjusted faster than the new housing market, where a slight overvaluation began to be evident only at the start of 2006.

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[4]   Escobar J.; Huertas C.; Mora D. A.; Romero J. V. (2005). "Índice de precios de la vivienda usada en Colombia (IPVU), método de ventas repetidas", in *Borradores de Economía, Banco de la República,* No. 368, December.

[5]   Builders have marketing expenses that make it impossible for prices to be adjusted immediately.
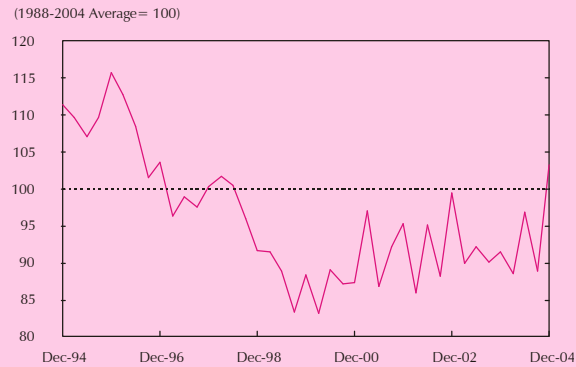
In short, both outcomes suggest the equity-to-price ratio on the new and used housing markets is slightly above the long-term level. This rules out the presence of a housing-market bubble, particularly compared to the period prior to the crisis in 1998-1999. Furthermore, the results appear to show the used housing market increases before the market for new homes, because its prices are quicker to adjust.

Finally, it is important to emphasize the need to monitor these markets constantly for any eventual bubble. However, as mentioned earlier, there does not appear to be one at present.

B.   NON-FINANCIAL PUBLIC SECTOR (NFPS)

1.   Aggregate NFPS Debt

After a high of 63.5% at the end of 2002, total NFPS indebtedness as a percentage of GDP has been declining (Table 4). The slowdown in gross indebtedness was accompanied by a shift towards domestic borrowing, which allowed for a reduction in the exchange risk and rollover risk. However, the increased amount of government bonds held in the financial system has elevated the extent to which these entities are exposed to market risk. Furthermore, the Central Government (CG) still accounts for about 90% of NFPS borrowing, both domestic and external, and its ability to pay continues to improve.

The reduction in the gross debt as a percentage of GDP was lower in 2005 than in previous years. NFPS indebtedness rose at a real annual rate of 3.23%

during 2005, which was more than in 2003 (2.1%) and 2004 (-3.3%). This was the result of higher domestic indebtedness (a 16.6% real increase). The shift towards domestic borrowing has been spurred by central government bonds, particularly the issue of peso-denominated TES B, which increased from COP$43.5 t at December 2004 to COP$61.2 t at December 2005 (a real rise of 36%). In addition, the issuance of global-TES since 2004 has elevated the debt in COP and reduced the central government's exposure to fluctuations in the exchange rate (lower portion of Table 4).

However, the new issues were done under better financial conditions than in the past. The real average TES-B rate declined since the second half of 2005, especially on medium and long-term maturites (Graph 37). In addition, the duration

Gross NFPS Debt

	(Billions of COP)			(Percentage of GDP) 2/			(Share)		(Nominal Annual Growth)		
	Domestic 1/	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Domestic	Foreign	Total
Dec-96	12,679	12,927	25,606	12.6	12.8	25.4	49.5	50.5	27.71	7.56	16.68
Dec-98	23,946	24,448	48,395	17.0	17.4	34.4	49.5	50.5	27.55	38.84	33.02
Dec-00	46,653	41,965	88,618	26.7	24.0	50.7	52.6	47.4	41.68	27.63	34.66
Dec-02	67,838	61,975	129,813	33.2	30.3	63.5	52.3	47.7	23.56	22.01	22.81
Dec-03	75,078	65,883	140,961	33.0	28.9	61.9	53.3	46.7	10.67	6.31	8.59
Dec-04	84,322	59,779	144,101	32.8	23.7	56.6	58.5	41.5	12.31	(9.27)	2.23
Mar-05	88,815	59,149	147,964	33.8	22.9	56.7	60.0	40.0	15.92	(5.98)	6.05
Jun-05	91,790	53,225	145,015	34.2	19.8	54.1	63.3	36.7	18.46	(16.52)	2.67
Sep-05	95,958	52,093	148,051	35.1	19.1	54.2	64.8	35.2	21.14	(16.25)	4.70
Dec-05	102,408	53,343	155,751	36.4	19.0	55.3	65.8	34.2	21.45	(10.77)	8.08

(Composition by Exchange Exposure) /3

	(Billions of COP)			(Percentage of GDP) 2/			(Share)		(Nominal Annual Growth)		
	Pesos	F/C	Total	COP	F/C	Total	COP	F/C	COP	F/C	Total
Dec-96	12,679	12,927	25,606	12.6	12.8	25.4	49.5	50.5	27.71	7.56	16.68
Dec-98	23,624	24,770	48,395	16.8	17.6	34.4	48.8	51.2	25.83	40.67	33.02
Dec-00	44,740	43,878	88,618	25.6	25.1	50.7	50.5	49.5	42.64	27.40	34.66
Dec-02	64,986	64,827	129,813	31.8	31.7	63.5	50.1	49.9	26.31	19.49	22.81
Dec-03	73,138	67,823	140,961	32.1	29.8	61.9	51.9	48.1	12.54	4.62	8.59
Dec-04	84,471	59,630	144,101	32.9	23.7	56.6	58.6	41.4	15.50	(12.08)	2.23
Mar-05	90,019	57,945	147,964	34.3	22.4	56.7	60.8	39.2	20.24	(10.39)	6.05
Jun-05	93,009	52,006	145,015	34.7	19.4	54.1	64.1	35.9	22.58	(20.44)	2.67
Sep-05	97,192	50,860	148,051	35.5	18.6	54.2	65.6	34.4	25.14	(20.22)	4.70
Dec-05	104,315	51,436	155,751	37.1	18.3	55.3	67.0	33.0	23.49	(13.74)	8.08

1/ The CG domestic debt includes public-bank capitalization bonds.
2/ GDP in the last 12 months
3/ The NFPS debt in pesos is calculated as domestic borrowing plus outstanding global-TES, minus outstanding TES TRM. Indebtedness in foreign currency (F/C) is calculated as domestic borrowing minus outstanding global-TES, plus outstanding TES TRM.
Source: Banco de la República, Ministry of Public Finance and Credit.

Graph 37

Average Real Rate on TES B (*)
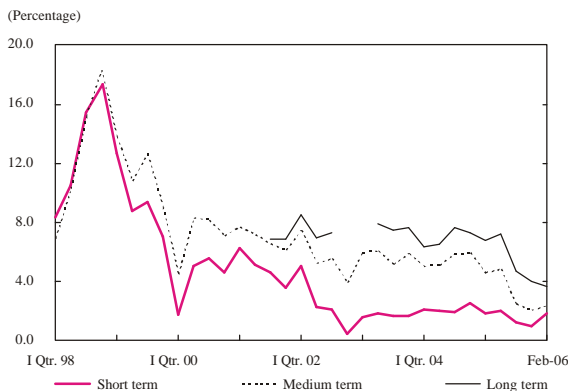
(Percentage)

(*) The rate was calculated as the weighted average of the amount issued. Short, medium and long terms were determined by the number of days to maturity: 1. Short term: up to one year. 2. Medium term: 366 days to five years. 3. Long term: from five years and one day to 15 years. Source: Banco de la República.

Graph 38

Average Duration of Medium and Long-term TES B (*)
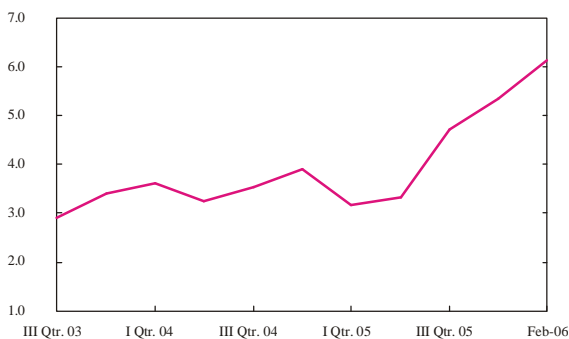
(*) The rate was calculated as the weighted average of the amount issued. Short, medium and long terms were determined by the number of days to maturity: 1. Short term: up to one year. 2. Medium term: 366 days to Five years. 3. Long term: from five years and one day to 15 years. Source: Banco de la República.

of medium and long-term securities issued since late 2004 has increased (Graph 38), and new fifteen-year bonds have been on the market since July 2005 (See Graph 2).

The Finance Ministry used the bulk of these resources to prepay loans, repurchase foreign bonds considered unfavorable or with a high cost to the nation, and to purchase international reserves from Banco de la República. Besides reducing the exchange risk, this substitution of external by internal debt helped to achieve three objectives. First, the duration of the foreign bond portfolio increased. Second, the concentration of amortizations scheduled for 2008 and 2011 was corrected, lowering the roll-over risk during those years. Third, the cost of external borrowing was reduced, as evidenced by a lower average coupon and a parallel shift (reduction) in all maturities on the dollar yield curve. Finally, US$2.2 b of the US$4.25 b in international reserves sold to the Finance Ministry by Banco de la República will be used to meet the country's external financial needs during 2006[19]. In short, due to the accelerated increase in domestic bonds during 2005, it was possible to reduce the extent of foreign borrowing and to improve its profile[20].

2. Creditworthiness

The period between 2002 and 2005 witnessed an improvement in the creditworthiness of the central government, which is the main NFPS debtor. The reduction in the ratio of total debt to revenue was due to the rise in tax payments[21] throughout 2005. The only increase in this indicator came in the last quarter, when most of the internal debt was issued. However, it is expected to continue declining during 2006 (Table 5).

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[19] No foreign bond sale in dollars is scheduled for 2006. *Revisión Plan Financiero 2006*, Confis (2006).

[20] During 2005, the extent of external borrowing declined in COP (11%, see Table 1) and in dollars (7% from US$25 b at December 2004 to US$23.4 b at December 2005).

[21] Customs duties and external VAT were especially important, due to the high level of imports, as well as a high income tax and VAT (calculated based on 2004 financial income).

Table 5

Central Government's Creditworthiness

Year	(Billions of COP)		Debt / Revenue
	C G Debt	Revenue	
1995	11,560	9,600	120
1996	14,452	12,144	119
1997	21,778	15,238	143
1998	31,232	16,810	186
1999	47,916	20,171	238
2000	70,677	23,197	305
2001	88,689	28,942	306
2002	110,579	31,459	352
2003	123,635	35,798	345
2004	128,408	40,629	316
Mar-05	132,848	41,335	321
Jun-05	130,172	43,146	302
Sep-05	133,719	44,833	298
Dec-05	141,439	46,207	306
2006 (*)	155,606	52,814	295

(*) An 11% increase in the domestic debt is assumed for 2006. This is consistent with growth in the domestic debt in TES assumed for in the Revised Financial Plan for 2006. , Confis (2006). The domestic debt accounts for Col$104 t of the total debt (COP$155 t). The different is external debt (US$2.280 b).
Source: Banco de la República and Confis.

3.   Prospects

The central government plans to issue COP$29 t in TES during 2006. This is COP$3 t less than in 2005. In doing so, it hopes to finance a projected deficit of COP$17 t[22]. This reduction in the supply of securities is the result of lower financing needs, partly due to the improvement in tax revenue for 2005, a trend that is expected to continue during 2006. However, the financial sector's exposure to market risk will increase to the extent that it acquires a portion of these securities[23].

[22]   *Revisión Plan Financiero 2006*, Confis (2006). Includes bonds of all maturities and denominations (COP and RVU, as there are no plans for a bond issue in dollars during 2006).

[23]   Most of the COP$19.7 t in TES-B placed on the market during 2005 were purchased by commercial banks and BECH (COP$4.3 t), as well as pension funds (COP$3.9 t).

IV. Potential Risks

The growth experienced by financial institutions, which has been accompanied by low levels of non performing loans, considerable profitability and high capital, is described in Chapter II of this report. The favorable macroeconomic conditions are consistent with an environment of short-term financial stability. As indicated in earlier editions of the *Financial Stability Report*, the most important potential threat to the financial system comes from market risks. Credit and liquidity risks pose no threat to the stability of the system, at least not on a short-term basis.

A. Market Risk

Due to the growing share of investments comprising the financial system's assets, institutions and regulators alike are paying more attention to market risk (MR) associated with the trading book[24]. The need to carefully monitor the appreciable increase in market risk exposure has been emphasized in past editions of the *Financial Stability Report*, given the rising percentage of securities held by the financial system. In fact, credit institutions as a whole reported almost COP$44 t in total investments at December 2005. These account for 36% of their total assets, making the portfolio more sensitive to changes in interest rates on investments. Such changes could translate into major losses, if the prices of these assets adjust adversely and there is not enough capital to deal with the situation.

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[24] The trading book is the portfolio of positions the Bank maintains for the benefits to be derived from their short-term purchase and sale.

The Superintendencia Financiera de Colombia is working on a new method to calculate the amount of capital required for MR, which is determined by identifying the risk to which financial agents are exposed. As in past editions of this report, the following section contains an assessment of the portfolio held by the financial system and its susceptibility to unexpected changes in the rate of interest on securities.

1. The Financial System's Exposure to the TES B Market

These securities were valued using the method described in the last edition of this report. Each security is assessed at the average price at which the respective issue is traded on the market [25]. When this exercise was conducted with the portfolio at December 30, 2005, it showed credit institutions were holding COP$25,6 t in TES B valued at market prices[26]. This is 6.6% more than the amount registered the month before (COP$24 t) (Table 6). Likewise, the non-bank financial sector continues to be more and more exposed to public-debt securities. Its balance at market prices rose by slightly less than 9%, from COP$22 t to COP$24 t between November and December 2005 (Table 7).

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[25] For more details on the method, see the December 2005 edition of the *Financial Stability Report,* Banco de la República.

[26] The appraisal exercise includes all TES B held by agents (negotiable, available for sale and up to maturity).

TES B Balances Valued at Market Prices: Credit Establishments
(Millions of COP)

	In COP	At variable rates	In UVR	Total
Balance at December 30, 2005				
Commercial Banks	18,264,872	1,043,518	4,550,651	23,859,041
Commercial Finance/Leasing Companies	83,153	3,372	9,129	95,655
Superior-grade Finance Coops. Finan.	11,503	0	0	11,503
Finance Corporations	1,486,231	9,780	96,164	1,592,176
Credit Establishment Total	**19,845,760**	**1,056,671**	**4,655,944**	**25,558,375**
Balance at November 4, 2005				
Commercial Banks	16,843,900	953,987	4,570,177	22,368,064
Commercial Finance/Leasing Companies	96,500	3,479	9,533	109,511
Superior-grade Finance Coops.	18,254	0	0	18,254
Finance Corporations	1,351,225	6,431	128,077	1,485,733
Credit Establishment Total	**18,309,878**	**963,897**	**4,707,787**	**23,981,562**

Source: Banco de la República.

Concentration, by type of intermediary, is the same as noted in the last *Financial Stability Report.* More than 90% of the total balance held by credit institutions was concentrated with commercial bank, while nearly 70% of the non-bank financial sector total was concentrated in pension and severance management funds. Once again, there is a convergence towards fixed-rate securities (in COP). Respectively, they account for 78% and 65% of the portfolio held by credit institutions and the non-bank financial sector[27] at December 2005 (76% and 62% at November).

The increase in these balances at market prices is not just because of the increase in the appraisal value of securities (price effect). It also is due, in part, to growth in the capital balance (quantity effect). However, the price effect does continue to explain nearly 30% in the case of credit institutions and 40% in the case of non-bank institutions (Table 8). This reflects the importance of the price component in the value of the portfolio held by financial agents, but also the importance of measuring just how sensitive portfolio value is to interest rate changes that affect security prices.

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[27]   In the non-bank financial sector, as considered in this section, the trust companies include mutual investment funds. The insurance and investment companies include reinsurance firms.

TABLE 7

TES B Balances Valued at Market Prices: Non-bank Financial Sector
(Millions of pesos)

	In COP	At Variable Rates	In UVR	Total
Balances at December 30, 2005				
Stockbrokers	350,476	1,527	116,240	468,243
Insurance and Investment Companies	1,387,522	213,413	886,140	2,487,075
Pension and Severance Management Funds	10,998,742	670,286	4,658,016	16,327,044
Trust Companies	2,868,992	763,614	1,070,480	4,703,086
Non-bank Financial Sector Total	**15,605,732**	**1,648,840**	**6,730,876**	**23,985,448**
Balances at November 4, 2005				
Stockbrokers	220,409	1,523	120,292	342,224
Insurance and Investment Companies	1,413,627	215,309	773,639	2,402,574
Pension and Severance Management Funds	9,600,261	788,028	4,538,265	14,926,554
Trust Companies	2,556,267	743,232	1,086,154	4,385,653
Non-bank Financial Sector Total	**13,790,564**	**1,748,091**	**6,518,350**	**22,057,005**

Table 8

Variations in TES B Holdings (*)
(Millions of COP)

	Quantity Variation	Price Variation	Total Variation
Credit Establishment Total	**1,085,807**	**491,005**	**1,576,812**
Commercial Banks	1,055,078	435,899	1,490,977
Commercial Finance/Leasing Companies	(8,760)	(5,096)	(13,856)
Superior-grade Financial Coops.	(6,193)	(558)	(6,751)
Finance Corporations	45,682	60,761	106,443
Non-bank Financial Sector Total	**1,201,947**	**726,496**	**1,928,443**
Stockbrokers	93,198	32,821	126,019
Insurance and Invesment Companies	46,241	38,260	84,501
Pension and Severance Management Funds	831,080	569,409	1,400,490
Trust Companies	231,427	86,006	317,433

(*) The variations occurred between May 27 and November 4, 2005.
Source: Banco de la República.

2. Sensitivity to TES B Rate Increases

To measure the financial system's exposure to changes in interest rates, we estimated the valuation or appraisal loss that would result from a parallel increase of 200 bp [28] in interest on fixed-rate TES and UVR TES[29]. As with the exercise presented in the last edition of the *Financial Stability Report*, only the positions of these securities in the Trading Book[30] were included. The change in portfolio value was calculated according to the RiskMetrics[31] securities allocation method. It is based on the idea that financial instruments can be broken down - mapped - into a set of simpler instruments with exposure to just one market factor. For example, a TES can be broken down into a set of zero-coupon bonds; namely, one bond for each coupon and one for the principal. Each of these zero-coupon bonds is exposed to only one market factor (the specific the zero-coupon rate).

These "stripped" securities[32] are distributed into 13 time bands, according to their residual maturity. The shock caused by the change in the band's spot rate is assigned to the exposure of each band. Based on the portfolio at December 30, 2005, the estimated loss for credit institutions came to COP$1,169 b, which is equivalent to 31% of the profits accumulated during

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[28] This is the shock suggested by Basel for countries other than the G10.

[29] An increase in the real margin on the RVU reference rate is assumed for the TES UVR. A rise in inflationary expectations would provoke losses only on the fixed-rate TES. There would be no change in the real return on the UVR —denominated security—.

[30] In the Colombian case, the positions in negotiable investments available for sale are included. These account for 89.5% of the total.

[31] J. P. Morgan, Technical Document RiskMetrics, 1996.

[32] Each coupon of a bond and the principal are treated as independent zero-coupon bonds.

the year. This is 10.4% more than the loss registered in the last edition of this report: COP$969 b based on the portfolio at November 4, 2005. The pension and severance management funds increased their expected losses by 15.5%, due to a sizeable increase in exposure to fixed-rate securities and the concentration on longer maturing securities in the UVR-denominated portfolio (Table 9).

B.   Credit Risk

Based on the method outlined in the last report[33], this section offers an analysis of the effect of drastic changes in macroeconomic variables on the loan portfolio of the financial system. For the most part, the exercises assume changes as drastic as those observed in the late nineties. Furthermore is an analysis of how the solvency of credit institutions would be affected by a negative turn in the commercial, consumer and mortgage portfolios.

The exercises are based on a 450 bp rise in interest rates, a 6.8% decline in economic activity, a 9% drop in sales and a reduction in housing prices equivalent to the average decline observed between 1996 and the year 2000. Table 10 shows the number of banks[34] whose solvency ratio would fall below the minimum (9%) and the impact on the aggregate solvency ratio of the credit institutions analyzed. In response to the shock from interest rates

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[33]   See Amaya (2005). "Evaluación del riesgo de crédito en el sistema financiero colombiano", in Special Topics on Financial Stability in *The Financial Stability Report,* December.

[34]   Twenty banks were analyzed. They account for 80% of the assets of credit establishments.

TABLE 9

Valuation Losses in the Trading Book from a 200 bp Shock
(Millions of COP)

	At fixed rate (pesos)	In RVU	Total	Percentage of Profit Last 12 months (Dec.05)
Credit Establishment Total	**812,157**	**261,151**	**1,073,308**	**31.4**
Commercial Banks	762,649	255,066	1,017,715	34.3
Commercial Finance/Leasing Companies	2,587	380	2,967	1.6
Finance Corporations	46,921	5,705	52,626	21.1
Pension & Severance-pay Management Companies	670,037	383,280	1,053,317	

Source: Banco de la República.

or housing prices, four of the 21 banks analyzed would see their solvency ratio fall below 9%. These four banks account for 7% of the assets in the financial system. As to the decline in economic activity, eight of the banks that account for 18% of the assets in the system would exhibit a ratio below 9%. Finally, the combination of these extreme scenarios would place the solvency ratio below the mandatory minimum in the case of 10 banks that account for 38% of the assets. Explained by the increase in technical equity reported between October and December 2005, the results of this exercise show a slight improvement compared to those presented in the last edition of this report.

C. Liquidity Risk

The transformation of short-term liabilities (e.g. deposits) into long-term assets (e.g. loans) is a normal part of financial intermediation, but does imply a predisposition to liquidity risk. This risk is understood as a financial institution's inability to cover its liabilities, due to a shortage of liquidity resources. In extreme cases, illiquidity can lead to bankruptcy. The following section offers a look at the trend in liquidity among credit institutions, which is an extremely important factor. It also offers a sensitivity analysis to capture the strength of the financial intermediaries to face an increase in withdrawals.

1. Method

Any attempt to adequately measure liquidity risk is limited by the impossibility of determining the maturity of a large portion of the liabilities on the balance sheets of financial intermediaries (e. g. savings accounts). In the following analysis, statistical techniques were used to separate the temporary and permanent components of liabilities[35]. Liabilities susceptible to redemption would include all liquid liabilities (LL) and the temporary component would be comprised of all other liabilities (TC)[36]. To discharge these liabilities, entities must have enough liquid assets (LA) on hand to satisfy any actual need for liquidity.

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[35] Applying the Hodrick-Prescott filter to the liability series identifies the temporary component. See Hodrick, Robert and Edward Prescott, "Postwar U.S. Business Cycles: An Empirical Investigation" in Journal of Money, Credit and Banking, *Vol. 29, No. 1, Ohio State University Press, 1997, pp. 1-16.*

[36] The assumption is that all liquid liabilities are susceptible to short-term redemption.

A liquidity risk indicator[37] was constructed as follows, using balance-sheet data on financial entities.

Ratio of uncovered liabilities $(RUL) = (TC + LL - LA) / TA - LA$

Here, *TA* represents to total assets.

The numerator applies to the difference between liabilities susceptible to redemption and liquid assets; the denominator refers to illiquid assets[38]. If the *RUL* is positive, the intermediary does not have enough liquid assets to cover its liabilities susceptible to redemption. In this case, the liquidity risk is high. The opposite is true if the *RUL* is negative.

2.   Trend and Sensitivity Analysis

Credit institutions have seen their RUL decline (e.g. high liquidity) since 1999. It was -36.5% at December 2005 (Graph 39, Panel a). This suggests, in aggregate terms, this suggests financial intermediaries, on the whole, have a large reserve of liquid assets that could be used to withstand any adverse fluctuation in their liabilities. This comfortable situation with respect to liquidity is due largely to the growing share of investments on the balance sheet (i.e. TES). Consequently, a drastic change in interest on securities that cause these investments to devaluate could affect the financial system's current liquidity position[39].

To determine how sensitive commercial banks are to liquidity risk, we examined the effect a 12% drop

RUL of Credit Establishments
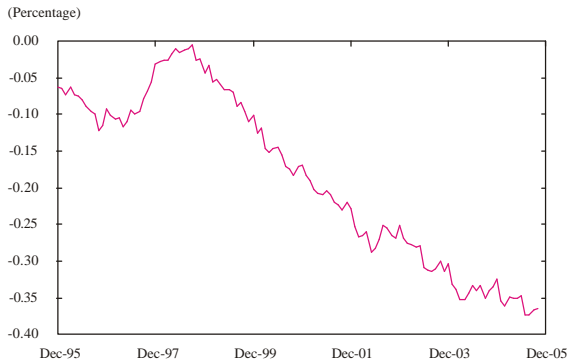
Sensitivity Analysis: RUL of Banks and BECH
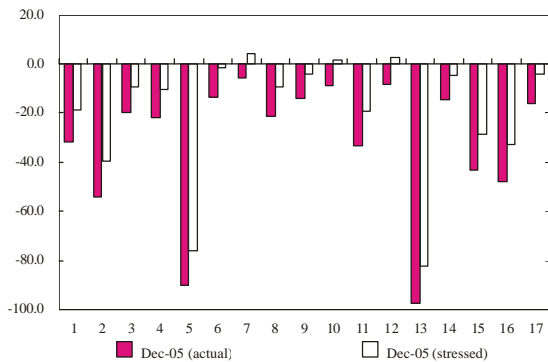
Source: Superintendencia Financiera de Colombia. Calculations by Banco de la República.

[37] The spirit of the expression comes from Dziobek, Claudia, Kim Hobbs and David Marston, *Toward a Framework for Systemic Liquidity Policy*, IMF, Working Paper No. 34.

[38] According to Dziobek, Hobbs and Marston, the difference between liabilities susceptible to redemption and liquid assets should be scaled by illiquid assets. This would prevent the indicator from favoring the large *banks, which have more transactions*.

[39] See Estrada and Osorio (2006). "Un enfoque de riesgo de mercado para el análisis del Riesgo de Liquidez", in the section entitled "Financial Stability Issues" at the end of this report.

in deposits[40] would have on the RUL, at a disaggregated level. As illustrated in Graph 39, Panel b, the drop would turn the RUL positive for three of the 17 intermediaries analyzed. They account for 7.3% of the assets held by credit institutions and their average RUL would be 3%. This means they would have to liquidate a portion of their illiquid assets. As for the other intermediaries, which account for 84% of all assets in the system, their RUL would be -26%.

In short, the financial soundness exhibited by credit establishment has been accompanied by a high degree of liquidity on their part. This means that large withdrawals by depositors are very unlikely. However, as this exercise indicates, if sizeable withdrawals were made, the bulk of the financial system would be in an excellent position to discharge its liabilities.

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[40]   The selected shock for this exercise is equivalent to the simple average of the largest drop in deposits experienced by each of these intermediaries during the 1994-2005 period.

FINANCIAL STABILITY

A MARKET-RISK APPROACH TO LIQUIDITY RISK ANALYSIS

Daniel Osorio Rodríguez
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INTRODUCTION

A financial crisis usually is due to the emergence of one or more risks to the financial system at a particular point in time. The costs to the economy affected by a crisis are high, which is why financial system stability is of constant concern to economic authorities, including the central banks.[1]

According to Sir Andrew Large (2005), Deputy Governor of the Bank of England, this concern should translate into a profound analysis of those risks, the idea being to monitor their course in the interest of preserving financial stability. Nonetheless, any such analysis depends essentially on what is known about the origins of the risks at hand and, more importantly, the underlying forces that might result in a situation were a risk to a particular institution becomes a problem for the financial system as a whole.

The intention of this article is to help readers understand the mechanics of liquidity risk, particularly the forces that allow it to be "transmitted" to every institution in the financial system, in the event of a crisis.[2] Specifically, we try to show how the liquidity risk to these institutions can become a financial crisis by being "converted" into a market risk. Briefly speaking, the process works as follows. When a financial institution runs into liquidity problems, it tries to liquidate some of its negotiable assets to cover its obligations. If the demand for those

[1]   In the case of Colombia's central bank, a financial crisis could even restrict the application of monetary policy. See Vargas et al. (2006).

[2]   Liquidity risk is associated with the possibility that a financial institution might be unable to meet its obligations, as required, given a lack of liquid resources to do so.

assets is not perfectly elastic, their price will drop. And, if the banks list those assets on their balance sheets at market prices (mark to market), the drop in price results in a loss in portfolio value for every institution in system. This is how liquidity risk ends up becoming a market risk.

This idea is explained herein by simulating a microeconomic model that captures a bank's treasury objectives and behavior in the face of uncertainty surrounding its liquidity needs and opportunities for investment. To accomplish this, the article is divided into four sections. The first classifies the major contributions to literature on how liquidity risk operates. As we attempt to demonstrate, literature on this subject tends to ignore the "mechanics" of liquidity risk. The second section provides an outline of the model and the third contains the results of its simulations. The fourth section offers several thoughts in the form of a conclusion.

I.   STATE OF THE ART

Recent studies on individual liquidity risk as the source of systemic risk can be classified into three groups.[3] This classification is, however, arbitrary and not necessarily exclusive; its only objective is a straightforward identification of how the ideas contained in this article contribute to the state of the art.

The first group of studies emphasizes the idea that liquidity risk can pose a problem for the financial system as a whole, given the possibility of a run on banks. Diamond and Dybvig (1993) outline this situation using a model that exhibits a possible equilibrium where all depositors "run" to the bank to withdraw their deposits.[4] A particularly valuable feature of their study – which is reflected in this article – is its baseline: namely, the structure of bank liquidity. In other words, the reason for a bank's

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[3]   Systemic risk is associated with the possibility that the financial problems of a particular institution subsequently (and by various means) could have an adverse effect on other institutions (see De Bandt and Hartmann, 2000). While our review focuses on the most recent articles (i.e. since circa 1980), it does not imply the phenomena mentioned are new or have not been analyzed before. For example, see Kindleberger (1978) for what is now a classic analysis.

[4]   This equilibrium is, however, just one of many that are possible in the model, and the selection of any one in particular is not justified. Gorton (1988) suggests the appearance of a bank-run equilibrium is determined by how agents perceive the aggregate state of the economy. Groton (1988) and Dwyer and Hasan (1994) have analyzed various historic experiences with bank runs.

existence implies the transformation of liquid liabilities (deposits) into non-liquid assets (portfolio). This transformation implies the emergence of liquidity risks in the event that banks face deposit shocks.

Most of the researchers fall within the second group of studies where, in the words of Craig Furfine (1999), liquidity risk can be a source of systemic risk as long as "the failure of one or a small number of institutions is transmitted to others through *explicit ties between them"* (our translation and italics). These ties are associated, primarily, with the existence of credit exposure on the interbank market. When a bank fails because of a liquidity problem, it inevitably declares its inability to pay its liabilities on the interbank market. This leaves other banks in a difficult financial situation and eventually in bankruptcy (with the subsequent inability to pay their liabilities).

Various studies associated with this group analyze the problem from different angles. They include Allen and Gale (2000), Rochet and Tirole (1996), Freixas, Parigi and Rochet (2000), Castiglionesi (2004), Iori and Jafarey (2000), Iori, Jafarey and Padilla (2003) and Estrada (2001). The last two works share a feature taken up in this article: computer simulation of a macroeconomic model that captures a bank's treasury behavior. According to the authors, because of the controlled environment and the limitations in existing information,[5] this is a good way to address the problem.

The third group of studies is the least developed. Its most representative authors are Schnabel and Shin (2004); Cifuentes, Ferrucci and Shin (2005) and Plantin, Sapra and Shin (2005). According to their conclusions, when an institution encounters liquidity problems, it generally will try solve them by selling off a portion of its liquid assets, thereby disrupting the market for negotiable assets in which other institutions participate. This is how liquidity risk becomes a market risk. Nonetheless, the works of these authors impose a series of restrictions if the mechanism to become a reality. For example, the presence of an interbank market or procyclical capital controls is required. Moreover, they do not explicitly model the existence of liquidity risk.[6]

The fundamental idea behind the present articles originates with this last group, as our objective is to show that a bank with liquidity problems can be a source of market risk for the rest of the financial system. Therefore, we will attempt

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[5]   There are several empirical studies on the appearance of contagion in interbank markets. See Furfine (1999). An interesting application of the network theory to this problem is developed by Boss et al. (2005).

[6]   In these articles, the source of initial disruption is always exogenous.

to explicitly include liquidity risk, using the ideas of the first group – through a simulation model similar to those of the second group – and to overcome the restrictions imposed by the third group. We also attempt to show that the mechanism for conversion (from liquidity risk to market risk) is present, even without the existence of a bank run, interbank market or procyclical control, as argued by each of the three groups, in that order.

II.   THE MODEL

A.   The Assertion

The theoretical exercise presented in this section is based on prior works by Iori, Jafarey and Padilla (2003) and Estrada (2001), which consist of a model that captures the daily problem faced by the treasurer (or liquidity manager) of a financial institution in an environment of uncertainty surrounding the depositors' liquidity needs and the institution's investment possibilities.

The treasurer described by the model can be regarded as a representative agent of the financial system. The fundamental assumption, therefore, is that his behavior is representative of that of all treasurers of all banks in the system, and his sole objective is to meet the bank's obligation to depositors who need liquidity. Moreover, the treasurer has no financial tools at hand to cover all liquidity contingencies.[7] The following structure represents the financial institution's equilibrium, on the basis of which the representative treasurer makes his decisions.

Loan Portfolio *Investments in negotiable assets* *Cash*	*Deposits*

The bank's assets are comprised of the loan portfolio, investments in a sole negotiable asset, to be bought or sold on the market and listed on the balance sheet at market prices,[8] and cash. The bank's liabilities are the deposits of its customers.

Given the random behavior of deposits, the bank might not have enough cash to satisfy the demands of its depositors. As mentioned earlier, in this model, the

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[7]   In this sense, the model is characterized by the presence of incomplete markets.

[8]   In other words, mark-to-market practices are used in the valuation of this asset. The other items on the balance sheet are not traded on the market.

treasurer has no interbank market to turn to. So, he tries to sell the bank's investments in the negotiable asset, and the buyers of such investments will be other treasurers whose liquidity position may not be problematic. The supply and demand for investments on the market are what determine the new market price at which the investments of all banks are valued. If the price falls, so does the value of the investment portfolio of all banks, leaving them in a less comfortable position to deal with future liquidity shocks.

B.   How the Model Operates: What happens during period t?

Figure 1 represents the temporary structure of the model, focused particularly on what happens within a representative period of time; that is, period t.   At the start of period t, the financial system is comprised of N_t banks, labeled with the exponent k, where $k \in \{1, 2, …, N_t\}$. When the period begins, bank treasurer k inherits an amount of cash from the previous period, M_{t-1}^k. Said amount comes from subtracting the transactions in which the bank has been involved from net reserve deposits (expression (1) in Figure 1). Once in possession of this amount, the treasurer must deal with four types of flows simultaneously:

1.   *Portfolio earnings*: income from capital and interest on the portfolio placed two periods earlier; the interest rate (r_l) is exogenous and constant (expression (2)).

2.   *Income from interest on investments*: received in proportion to the stock of investments. The interest rate (r_a) is constant and exogenous (expression (3)).

3.   *Outlays for interest on deposits*: paid every period. Here, the depositors never "run" on the bank to withdraw the capital from their deposits (this model does not include bank runs), except in the case mentioned in the following point. The rate of interest paid to depositors (r_{dt}) is given in expression (4) as a function of the number of banks in the system (Salop, 1979).   A liquidity gap inevitably occurs as a result of the difference between the frequency of portfolio earnings and outlays on deposits.[9]

4.   *Movements of depositors between banks:* although depositors never conduct a "run" on the banking system, they might move their deposits from one bank to another due, for example, to geographic migration. The equation (5) takes into account the behavior of the deposits with each bank. According to that expression, the accrued deposits of the financial system (given exogenously) are distributed at random among all the banks in the financial system.

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[9]   In the International Monetary Fund's Financial System Assessment Program (FSAP), this liquidity gap is a crucial tool when analyzing risk to the financial system.

FIGURE 1

The Representative Treasurer Model

Inherited from the previous period:

$$M_{t-1}^k = D_{t-1}^k(1-\beta) - L_{t-1}^k - p_{t-1}A_{t-1}^k \quad (1)$$

$$(1+\rho_l)^2 L_{t-2}^k \quad (2)$$

At the start of the period, the treasurer confronts four types of flows:
i) Portfolio earnings
ii) Movement of depositors
iii) Outlays for interest
iv) Income from interest on investments

$$(\rho_a)A_{t-1}^k \quad (3)$$

$$r_{dt}D_{t-1}^k \rightarrow \quad r_{dt} = \rho_l - \frac{\alpha}{N_t} \quad (4)$$

$$D_t^k = \pi D_{t-1}^k + (1-\pi)\left[(1-\sigma_d)\frac{D_t}{N_t} + \sigma_d \varepsilon_t^k D_t\right] \quad (5)$$

$$\hat{M}_t^k$$

After calculating the liquidity needs created by these flows, the treasurer estimates his "intraperiod liquidity position" (6).

$$\hat{M}_t^k + \beta D_t^k = D_t^k - (p_{t-1}A_{t-1}^k) - L_{t-1}^k - r_{dt}D_{t-1}^k + (1+\rho_l)^2 L_{t-2}^k + \rho_a A_{t-1}^k \quad (6)$$

$$\hat{M}_t^k + \beta D_t^k > 0 \quad (7)$$

$$\hat{M}_t^k + \beta D_t^k < 0 \quad (8)$$

According to the "intraperiod liquidity position", the treasurer determines his supply (if liquidity is needed) or demand (after having made a portfolio placement in the event of excess liquidity) with respect to the negotiable asset.

$$o_t^k = (1-\sigma_o)\frac{\Omega}{N_t} + \upsilon_t^k \sigma_o \Omega \quad (9)$$

$$w_t^k = \min\left\{\max\left[0, \hat{M}_t^k\right], o_t^k\right\} \quad (10)$$

$$b_t^k = \frac{\hat{M}_t^k - w_t^k}{p_{t-1}} \quad (11)$$

$$s_t^k = -\min\left\{0, \frac{\hat{M}_t^k + \beta D_t^k}{p_{t-1}}\right\} \quad (12)$$

The demand and supply converge in the market for the negotiable asset.

$$x_{ij} = \min\left[s_t^i, b_t^j\right] \forall i, j \in [1,2,...,N_t] \quad (13)$$

$$\sum_{j=1}^{N_t} x_{ij} \leq s_t^i \forall i, j \in [1,2,...,N_t] \quad (14)$$

$$x_{ij} \leq \sum_{j=1}^{N_t} b_t^j \forall i, j \in [1,2,...,N_t] \quad (15)$$

$$p_t = p_{t-1} \exp\left[-\lambda(\sum_{j=1}^{N_t} s_t^j - \sum_{j=1}^{N_t} b_t^j)\right] \leq 1 \quad (16)$$

Banks that have failed are liquidated

$$D_t = D_{t-1} + \sum_{j=1}^{B_t}\left\{\hat{M}_t^j + \gamma\left[L_{t-1}^j + p_{t-1}A_{t-1}^j\right] - D_{t-1}^j\right\} \quad (17)$$

The accounts on the balance sheet are restated or updated.

$$M_t^k = D_t^k(1-\beta) - L_t^k - p_t A_t^k \quad (18)$$

Donde:

t: index for the period

k, i, j: bank ratios

M: cash

D^k: : deposits of bank k

b: reserve

L: loan portfolio

p: market price of the negotiable asset

A: stock of investments in the negotiable asset

r_l: lending rate

r_a: yield on the negotiable assete

r_{dt}: deposit rate

a: cost associated with movement by depositors

D: aggregate deposits

p: self-regressive component of deposits

s_d: random component of aggregate deposits (to be distributed among the N banks)

e_t^k: the portion of random deposits remaining to bank k

$\hat{M}$: the cash position during the period

o_t^k: portfolio of loans bank k is able to extend

W: aggregate demand for credit

s_o: random component of aggregate portfolio demand (to be distributed among the N banks)

u_t^k: the portion of random portfolio demand that remains in bank k

w_t^k: amount of the portfolio effectively extended by bank k

s_t^k: supply of negotiable assets

b_t^k: demand for negotiable assets

x_{ij}: transaction carried out between bank i (supplier) and bank j (demander)

l: parameter that incorporates the elasticity of the demand

B: banks that fail

g percentage of assets recovered for depositors in the liquidation process.

Based on the foregoing (with a bit of algebra[10]), the treasurer calculates his cash position ($\hat{M}_t^k$) and, more often, his "intraperiod liquidity position (IPLP)". This indicates the amount of liquidity he has on hand to pay depositors (expression (6). It is comprised of the sum of cash ($\hat{M}_t^k$) and available reserves(bD_t^k). The combination of the four flows can leave the treasurer in one of two situations:

- Positive IPLP: the treasurer has enough liquidity to pay depositors, and the surplus is equivalent to the IPLP (7).

- Negative IPLP: the treasurer does not have enough liquidity to pay depositors, in an amount equivalent to the IPLP (8).

Once all the bank treasurers have undergone the same experience, the banking system is left divided between banks with a liquidity surplus and those with a shortage. The banks with a liquidity shortage turn to the market for the negotiable asset to liquidate a portion of their investment stock and to secure the liquidity they lack. The amount of the negotiable asset that needs to be sold on the market is given by expression (12). It equals the IPLP divided by the price of the negotiable asset before the market opens (p_{t-1}).[11]

The banks with a positive IPLP do not use all their surplus liquidity to purchase investments in the negotiable asset. First, they invest a portion in loan portfolio placement.[12] However, the portfolio that can be placed also has a stochastic pattern given by expression (9), where the aggregate demand for credit in the economy (**W**) is exogenous and constant. The amount of the portfolio the treasurer is effectively able to place (w_t^k in expression 10) is restricted by the size of the liquidity surplus (net resources in reserve).

If, after portfolio placement, the treasurer still has surplus liquidity, he will use it to purchase negotiable assets on the market. His bank's demand for negotiable assets is determined by expression (11). If **W** is especially large, the demand for the negotiable asset is reduced, thereby reducing the size of the market. This point will be considered in the following section.

The supply of negotiable assets (from banks with liquidity needs) and the demand for them (on the part of banks with surplus liquidity) come together in the market, where purchase and sale transactions x_{ij} are conducted. Their viability is determined by conditions (13-15). Condition (14), in particular, indicates the market does not necessarily empty out, inasmuch as some supplier banks may not be able to liquidate as many negotiable assets as required to meet their liquidity needs. Finally, a new price (expression (16)) is determined on the market. It is the price at which all transactions are conducted and all investments are "revalued".

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[11] Necessary sales of the negotiable asset are assessed at the actual market price, because investments are valued on a mark-to-market basis.

[12] This is guaranteed by making the exogenous portfolio rate (ρ_t) greater than the exogenous rate on the negotiable assets (r_a).

C.   The End of Period t and the Channel of Contagion: Market Risk

When the market closes, the banks that were unable to liquidate the amount of negotiable assets required to satisfy their liquidity needs enter into bankruptcy and are liquidated by the regulator, whose only job is to take over banks in that situation. The regulator liquidates the failed bank's assets at a discount and turns them over to the depositors, who redeposit those resources with other banks in the system. The aggregate deposits in the system evolve according to equation (17), where $1-\gamma$ is the liquidation cost.

During the subsequent period ($t+1$), the treasurer inherits a quantity of cash determined by (18). It is important to note that the stock of investments is valued at the new market price (p_t), even with respect to banks that did not participate in the market for the negotiable asset. This is precisely the channel of contagion emphasized herein (and, hence, the channel through which systemic risk materializes). In other words, the reduction in the price of the negotiable asset that can occur with the appearance of liquidity risk in certain institutions affects other institutions by leaving them less prepared for future liquidity shocks, since the cushion for dealing with those shocks looses value. Therefore, the probability of bankruptcy in future periods becomes greater.

In short, the conversion of liquidity risk to market risk can disseminate among banks, obviously causing bankruptcies and financial crisis. Within the scope of the model, these events are understood as the simultaneous bankruptcy of a large number of institutions. The following section explores this interaction between liquidity risk and market risk through simulations of the model.

III. SIMULATIONS

The principal results of the simulations done with the model described in the previous section are summarized in this section. Three types of simulations were carried out, the difference being the initial structure of the simulated financial system.

All the exercises, however, have the following characteristics in common. To begin with, 150 time periods (iterations) were simulated in each case. Secondly, to exacerbate the liquidity risk, the initial banks (N_0) were divided into two groups: the first group receives interest from income in $t = 0$ (as if it had made portfolio placements in $t = -2$), while the second only receives income from interest up to $t = 1$ (as if it had made a portfolio placement only in $t = -1$). Consequently, in all the simulations, the financial crisis of the first period is deeper than in subsequent periods, due to the artificial creation of this liquidity gap. Finally, each outcome is the product of an average of 1,000 simulations. Hereinafter, the definition of financial stability is understood as the number of "surviving" banks during a particular time period.

A. Homogeneous System

A system comprised of ten banks ($N_0 = 10$) identical in the structure of their initial balance[13] is used in this section. The effect - all else being constant - of W (aggregate demand for credit) and s_d (volatility of deposits) on financial stability is shown in Graph 1. According to Panel A, Graph 1, the aggregate demand for credit has a negative impact on financial stability. At that particular point in time, a larger number of banks clearly survive with less a demand for credit.
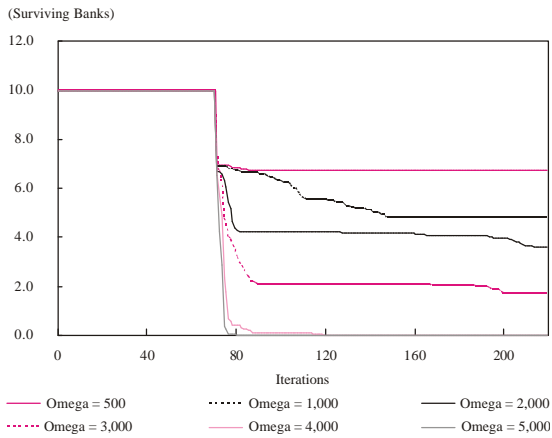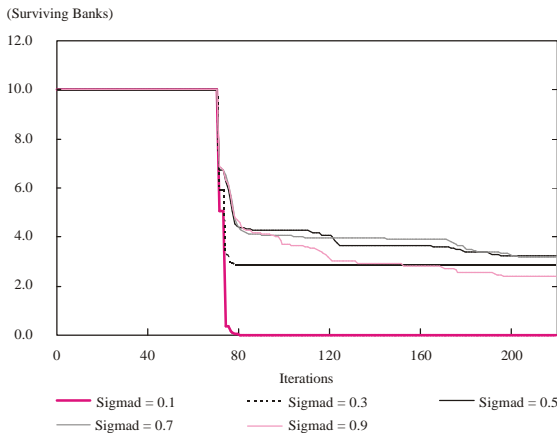
This can be interpreted as the effect the size of the investment market has on financial stability. If the aggregate demand for credit is greater, expression (9) indicates this reduces the demand for investments and, therefore, the size of the investment market. If the size of the investment market is less, the same level of supply has a more pronounced impact on the drop in price. In other words, it exacerbates market risk and, consequently, poses more of a threat to financial stability.

The effect - all else being constant - of more volatility with respect to deposits is not as clear (Panel B, Graph 1). Considering the range of the results of each simulation, it is possible to conclude, statistically, that volatility has no impact on stability.

PANEL A

(Surviving Banks)

Iterations

— Omega = 500   ····· Omega = 1,000   — Omega = 2,000
····· Omega = 3,000   — Omega = 4,000   — Omega = 5,000

PANEL B

(Surviving Banks)

Iterations

— Sigmad = 0.1   ····· Sigmad = 0.3   — Sigmad = 0.5
— Sigmad = 0.7   — Sigmad = 0.9

Source: The authors' calculations.

B. Heterogeneous System: Random Case

To incorporate the heterogeneous nature of the financial system, we simulated a financial system comprised of ten banks. In each case, the structure

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[13]   The following is the set of parameters used in this simulation: $A_0 = D_0 = L_{-1}{}^a = L_{-2}{}^b = 1{,}000$. $a = 0.1$. $b = 0.2$. s_d (when it does not change) = $s_0 = g = p = 0.5$,

$r_1 = 0.1$. $r_a = 0.05$. $W = 2{,}000$ (when it does not change). $l = 0.01$,

of their initial balance was selected at random.[14] Both Panel A and Panel B in Graph 2 confirm the results obtained in the homogeneous case, particularly the negative impact more demand for credit has on the system. In this instance, although the magnitude of the first financial crisis is vastly similar in all cases and there is no surviving bank by the end of the iterations. Banks belonging to systems that face less demand for credit clearly survive longer.
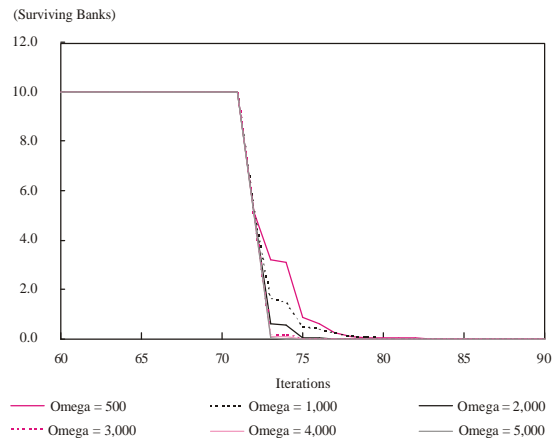
C. Heterogeneous System: A Simulation of the Colombian Banking System

One alternative to the random heterogeneity of banks is to use, as the initial balance structure, the structure of balance of banks that were part of the Colombian financial system in November 2005. That month, the system was comprised of 16 banks. To reflect the structure of the balance in the Colombian financial system, the system's total assets were standardized at 1,000. The initial deposits, portfolio and investments for each of the 16 banks were calculated on the basis of this standardization.
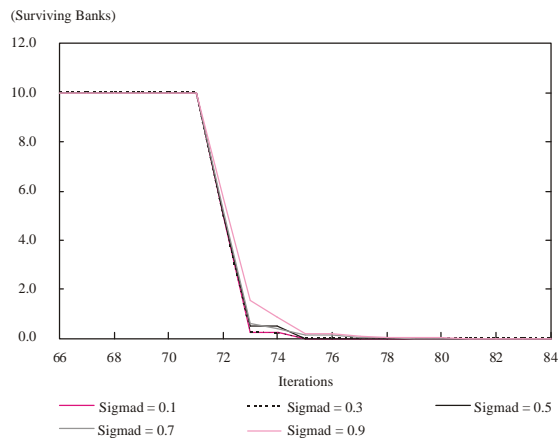
A significant feature of the simulation should be mentioned at this point. As noted earlier, the initial banks were divided into two groups. In this case, it is impossible to determine which banks pertain to each group. The results, therefore, have to be presented according to two extreme distributions, with the largest banks in the system situated in the first group; the second in size in the second group.[15]

GRAPH 2

FINANCIAL STABILITY:
THE RANDOM HETEROGENEOUS CASE

PANEL A

(Surviving Banks)

| | Omega = 500 | Omega = 1,000 | Omega = 2,000 |
| | Omega = 3,000 | Omega = 4,000 | Omega = 5,000 |

PANEL B

(Surviving Banks)

| | Sigmad = 0.1 | Sigmad = 0.3 | Sigmad = 0.5 |
| | Sigmad = 0.7 | Sigmad = 0.9 | |

Source: The authors' calculations.

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[14]   In other words, A_0, D_0 and L_{-1} or L_{-2} are the same for a *particular* bank but are different among banks, in which case the selection within the interval [0.1000] is random. This makes it possible to incorporate the existence of "big" and "small" banks within the simulated system. The set of parameters used was:

   $a = 0.1$, $b = 0.2$. s_d (when it does not change) $= s_o = g = p = 0.5$. $r_l = 0.1$. $r_a = 0.05$. $W = 2,000$ (when it does not change). $l = 0.01$,

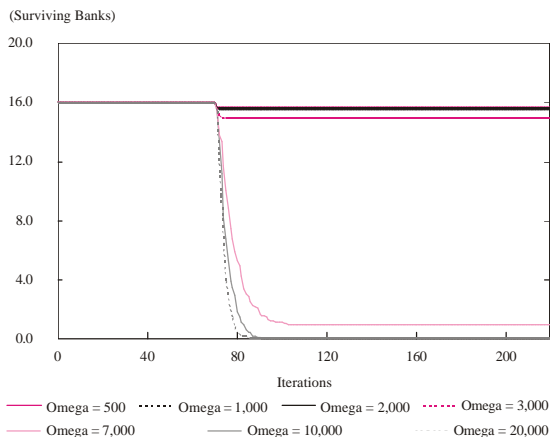[15]   The following set of parameters was used in this simulation:

   $a = 0.1$, $b = 0.06$ (real data), s_d (estimated in this case, so it does not change) $= 0.9$, $s_{d'} = g = 0.5$, $p = 1$ (estimated), $r_l = 0.152$ (calculated), $r_a = 0.00132$ (estimated), $l = 0.01$.

GRAPH 3

FINANCIAL STABILITY: THE COLOMBIAN CASE

PANEL A

(Surviving Banks)

| | Omega = 500 | Omega = 1,000 | Omega = 2,000 | Omega = 3,000 |
| | Omega = 7,000 | Omega = 10,000 | Omega = 20,000 | |

PANEL B

(Surviving Banks)

| | Omega = 500 | Omega = 1,000 | Omega = 2,000 | Omega = 3,000 |
| | Omega = 7,000 | Omega = 10,000 | Omega = 20,000 | |
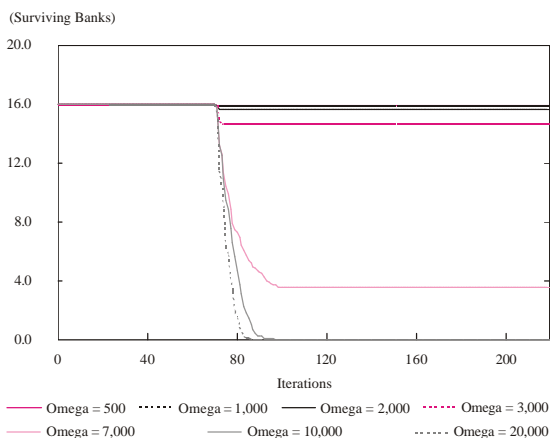
Source: The authors' calculations.

All else being constant, the impact of W on financial stability with each of the two distributions is shown in Graph 3. As to demand for credit, the principal outcome is the same. Only with an extreme demand for credit do none of the 16 banks survive the 150 iterations. If W is small enough, less than one bank, on average, fails by the end of the 150 iterations.

IV. CONCLUSIONS

The purpose of this article is to demonstrate that liquidity risk to financial intermediaries can become a systemic risk and eventually a financial crisis, when banks with liquidity problems disrupt the normal operation of the markets where they do business. In this sense, liquidity risk becomes a market risk for all institutions in the banking system.

Through simulation of a microeconomic model, we not only show this mechanism works, but that it is crucially dependent on the "depth" of such markets. The mechanism also is shown to be present, even in the absence of credit exposures in the interbank market, procyclical controls or bank runs.

The practical usefulness of this exercise can be questioned, inasmuch as the results originate with a very limited theoretical specification.[16] However, it has several realistic lessons to offer, despite the controlled environment. To begin with, in addition to the mere fact of risk "conversion", there is the recent concern expressed by economic authorities in Colombia over the threat market risk poses to stability of the country's financial system.[17]

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[16] For example, the mechanism makes no sense if the Central Bank is willing to inject into the system the amount of liquidity required at a given moment, in the event of problems. Nevertheless, it is possible to argue that, because central banks are concerned about controlling inflation, intervention of this sort has its limits. The mechanism outlined in this article can occur once that limit is reached.

Also emphasized in this article is the importance of monitoring certain variables. In a particular environment, these can contribute to financial instability. The depth of the market in which banks interact is a case in point.

As to the source of liquidity risk, the results described herein support the idea that market liquidity is not an exogenous element. In developing countries, such as Colombia, market liquidity is crucially dependent, for example, on the behavior of foreign markets. Turbulence on those markets can be mirrored quickly in liquidity shortages in the domestic financial system, which can have a negative impact on the value of assets and financial stability through interaction endogenous to the way banks behave.

On the other hand, it is possible to regard the mechanisms mentioned in this article as a logical outcome of the growing complexity of financial markets. Banks now have various investment alternatives at their disposal, which can be transacted easily on the financial markets. Nevertheless, the study by Schnabel and Shin (2004) reminds us that a complex financial system is not essential for "conversion" to occur. That argument favors the simplicity of the model used for this article.

The model also teaches us a very subtle lesson that is important to bear in mind. According to Plantin, Sapra and Shin (2005), investment assessment practices such as the mark-to-market method (despite its transparency) can pose a threat to financial stability due to their tendency to accentuate the financial cycles. In the context of this exercise, that tendency is evident.

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[17] In this respect, see recent editions of the *Financial Stability Report* published by Banco de la República. Investments in negotiable assets account for nearly one third of the holdings in Colombia's banking system, and a good portion are valued at market prices.

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THE CREDIT SITUATION IN COLOMBIA FROM THE STANDPOINT OF THE FINANCIAL SECTOR

Andrés Murcia
José Hernán Piñeros[*]

INTRODUCTION

To complement a number of studies done in Colombia, based largely on figures from institutional balance sheets, *Banco de la Republica* has conducted three surveys to date on the credit situation in Colombia. The aim is to collect qualitative information that can be used to determine how financial institutions feel about different aspects of the credit business. The questionnaire for the credit survey done in November 2005 was filled out by the commercial and/or credit vice presidents of 18 credit institutions. The other two surveys, which are similar, were conducted in 2001 and 2003, making it possible to compare the results found at different stages of the economic and credit cycle.

One of the primary objectives of the present study, which is the result of an assessment and analysis of the survey, is to determine if credit dynamics respond more to supply factors than to demand, and if these - particularly the supply factors - have changed in recent years. With this information, it is possible to assess the presence of credit rationing in the Colombian economy.

The survey of the credit situation contains information on how institutions perceive access to credit in the economy and in its different sectors, their outlook, and how easy it is to identify good clients. This same analysis was done according to company size. Questions were asked about how credit institutions might use their surplus liquidity and how they perceive the risks associated with such uses. There also were questions on loan assessment by financial institutions.

The findings of the survey suggest that financial institutions continue to believe the outlook for most sectors of the economy is good, which suggests the demand

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for credit might continue to grow. However, not all sectors or companies of different size have the same expectations or the same conditions for access to credit. Information-related problems, especially for the farming and livestock sectors and, to a lesser degree, for the export sector, play a major role in identifying good clients and the expected profitability of projects.

The findings suggest there are fewer supply restrictions. However, several exceptions arise in the tradable sectors. This contrasts with the sectors characterized by supply restrictions (non-tradables) in past years, and may be related to trend and expectations concerning the exchange rate.

Shortly after the financial crisis in 1998-1999, the huge losses experienced by Colombian financial institutions seriously reduced their capital, curtailing credit growth. This situation, and the exacerbation of risk, generated a marked preference for low-risk liquid assets (e.g. TES), dampening credit activity.

The evidence now suggests that financial institutions are much less adverse to credit risk, and most restrictions on the credit supply have disappeared. According to the latest survey, the perception of risk with respect to consumer credit and mortgage loans has declined, contrary to earlier surveys, where these types of loans were considered riskier than commercial credit.

Unlike the post-crisis era, current requirements for loan approval are far more lax, and project feasibility and profitability are important elements for a decision on credit. So is knowledge of the client and his credit history.

I. ECONOMIC AND CREDIT ACCESS OUTLOOK

There are high expectations regarding economic performance. More than half the credit institutions (56%) believe the economic outlook for the next two years has improved, 33% expect current conditions to continue, and 11% expect them to deteriorate.

Regarding sectors, most credit institutions believe economic growth will be spurred by services, commerce, communications and imports. The perception
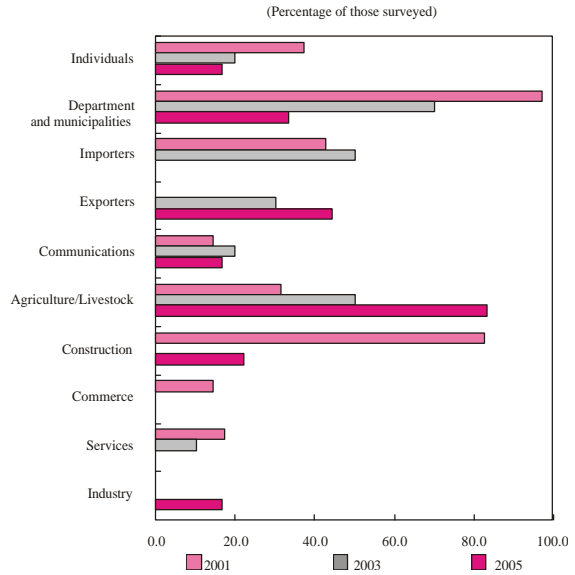
is that these sectors are doing better than the average for the economy as a whole. In contrast, less-than-average growth is anticipated for agriculture/livestock and exports (Graph 1). Other sectors, such as industry, construction, departments/municipalities, and individuals, are expected to grow at a rate similar to the economy.

There appears to be a close correlation between sector prospects and the perception of access to new credit on the part of financial institutions. Graph 2 illustrates the trend, between 2001, 2003 and 2005, among those surveyed (as a percentage of the entire sample) who believe that specific sectors have problems with credit access. Most companies and institutions believe credit access in almost every sector is similar to the average for the economy. The only exception is the agricultural/livestock sector, which is perceived as having less-than-average access to credit and less momentum than the economy as a whole. Most financial intermediaries (83.3%)

Source: Credit Situation Survey, Banco de la República.

also see it as being less profitable. This close correlation is also evident in earlier surveys, but with respect to other sectors. For example, in 2001, most of the problems with prospects for the economy and credit access were concentrated in the construction sector and in the departments and municipalities.

It is interesting to see how financial institutions have changed their preferences in terms of the different sectors and their access to credit. This might be linked to the exchange rate trend. For instance, in the survey done for 2001, when the exchange rate depreciated sharply, expectations and favorable conditions for access to credit were centered primarily in the tradable sectors (exporters and industry). However, in the 2005 survey, good prospects were concentrated largely in the non-tradable sectors.

Unreliable information for identifying good clients (Graph 2B) is a determining factor for financial intermediaries and explains the difficulty the agricultural/livestock sector has in gaining access to credit. The commercial and industrial sectors have the same problem though at a lesser degree. The direct correlation between difficulty in identifying good clients and increased credit-access restrictions is evident as well (Graph 2).
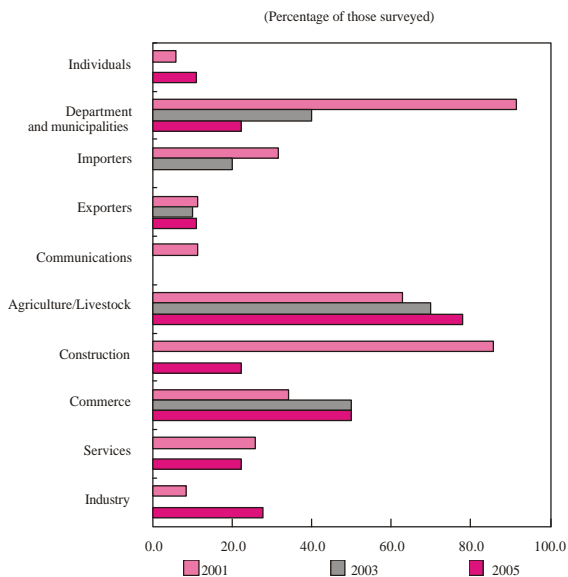
Graph 2

**Problems with Credit Access
and Identifying Good Clients**

A. **Access to Credit Below
Average for the Economy,
by Sectors**

(Percentage of those surveyed)

2001	2003	2005
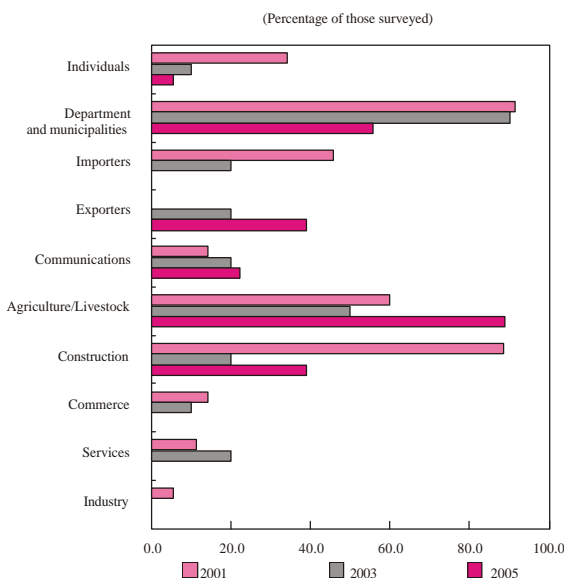
B. **Sectors Posing Problems
for Identifying Good
Clients**

(Percentage of those surveyed)

2001	2003	2005

Source: Credit Situation Survey, Banco de la República.

When the analysis is performed according to company size[1], there was no major difference in the opinion with respect to economic outlook. Most financial institutions expect the growth of small, medium and large companies to be similar to the average rate of economic growth. Each of the institutions was asked the financial sector's credit preferences in terms of company size and if they have any preferences in this respect (Graph 3). The results suggest that, although the perception of credit access in the financial sector favors the big companies (as would be expected), on an individual level (by institution), this sector appears to cover the entire spectrum of companies with no size discrimination.

In short, there are contrasts in terms of access to credit at the sector level. These are explained by differences in the prospects and profitability of economic sectors, and by problems with identifying good clients, particularly in the case of the agricultural/livestock sector. Regarding size discrimination, problems are perceived with access to sources of financing for small companies and privileged credit access for big companies.

II. LIQUIDITY SURPLUS
AND RISK PERCEPTION

In the presence of credit rationing, financial institutions would prefer to invest their surplus liquidity in low-risk securities (e.g. TES), rather than to expand their loan portfolio. The preferences of financial intermediaries concerning the use of liquidity surplus are analyzed in this section (Graph 4), and are different from those perceived during the period after the crisis in the late nineties (1998-1999). Therefore, the acquisition of highly liquid and low-risk assets remains typical of the behavior in the financial sector, although less so.

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[1] Small companies are defined as those with less than 50 employees. Medium-sized companies have 50 to 200 employees, while large companies have more than 200.

Graph 3

Credit Access Problems by Company Size

**A.   Perception of Below Economic
       Average Access to Credit
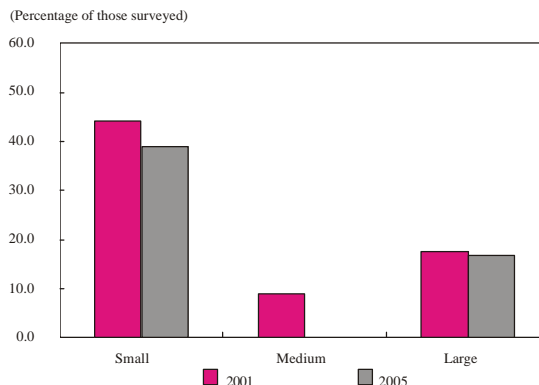   in the Financial System,
       by Company Size**

(Percentage of those surveyed)
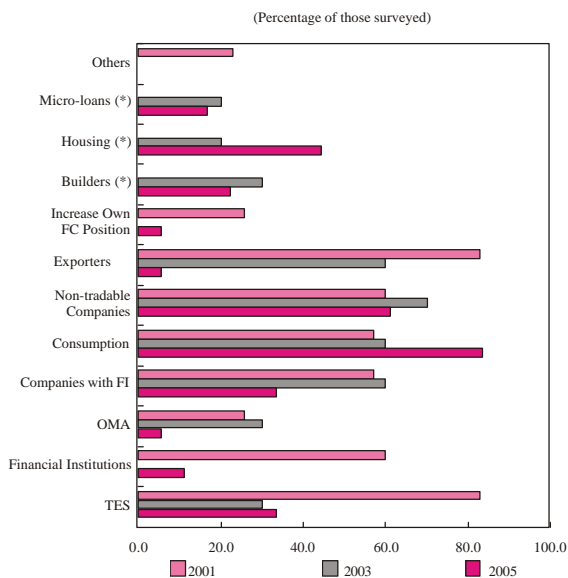

■ 2001   ■ 2005
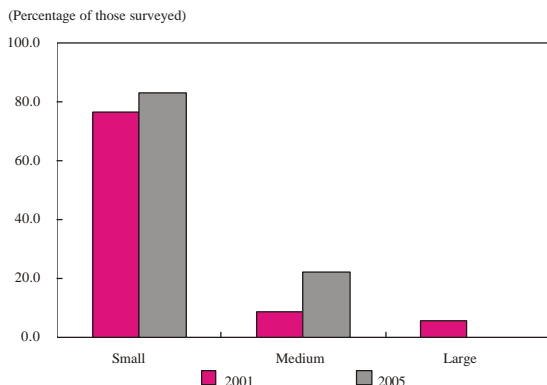
Source: Credit Situation Survey, Banco de la República.

**B.   Particular Institution's Perception
       of Below Economic Average
       Access to Credit,
       by Company Size**

(Percentage of those surveyed)

■ 2001   ■ 2005

Graph 4

Most Probably Use of Liquidity Surplus

The next question concerned the most frequent or probable use of liquidity surplus, considering the risk. Acquisition of government securities, loans to financial institutions and placement of resources with Banco de la República were classified by banks as the least risky. Medium-risk activities include consumer loans, loans to companies producing for domestic and foreign markets, and home loans (the perception of risk on the latter is down considerably from what the earlier surveys showed). The riskiest activities include transactions to increase the bank's foreign currency position and the placement of micro-loans, loans to construction companies, loans to territorial entities and to government-owned companies. In absolute terms and compared to mortgage loans, risk perception on consumer loans was down (Graph 5A), as it was on loans to non-tradable companies compared to those producing tradables (Graph 5B).

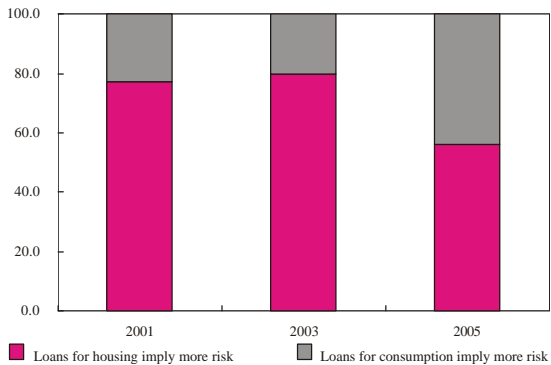(Percentage of those surveyed)

■ 2001   ■ 2003   ■ 2005

(*) This option was not included in the 2001 survey.
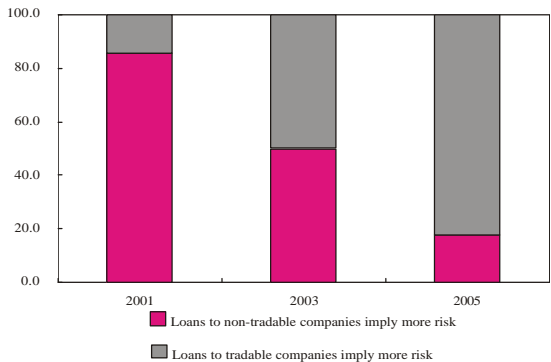Source: Credit Situation Survey, Banco de la República.

Graph 5

Risk Perception

**A.   Loan Risk Perception:
        Consumer vs. Housing nda**

(Percentage of those surveyed)

■ Loans for housing imply more risk   ■ Loans for consumption imply more risk

**B.   Company Risk Perception:
        Tradables vs. Non-Tradables**

(Percentage of those surveyed)

■ Loans to non-tradable companies imply more risk

■ Loans to tradable companies imply more risk

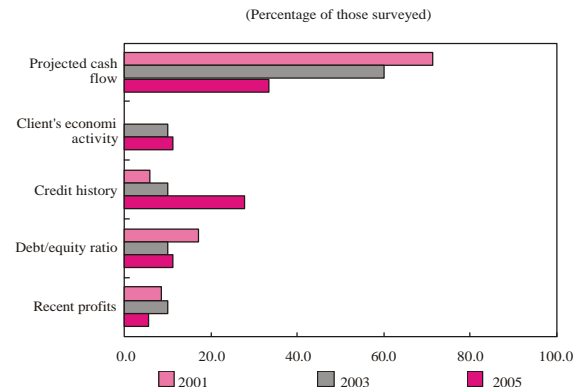Source: Credit Situation Survey, Banco de la República.

Reorientation of the credit business has prompted financial institutions to shift their liquidity surplus, particularly in the case of institutions that specialize in mortgage loans. The shift is from mortgage loans to consumer and commercial loans. However, preservation of the market segment is still the most important factor in the portfolio decisions of credit institutions.

In conclusion, financial institutions will most likely use their liquidity surplus based, to some degree, on the perception of less risk. Accordingly, the perception that micro-loans are high risk explains some of the problems small companies have with credit access. Moreover, activities once considered extremely risky – such as consumer credit – are gaining acceptability among financial institutions, clearly prompting a portfolio shift in assets from investments in highly liquid securities to loan placement (particularly consumer loans). There also has been a noticeable recovery in mortgage loans, as financial institutions now consider them to be less risky. This suggests that the main features of the credit crunch, which were identified in earlier surveys, are disappearing and the current low growth in mortgage loans is perhaps more the result of demand constraints than supply problems.

III.   REJECTED CLIENTS AND RISK-ASSESSMENT CRITERIA FOR CREDIT ALLOCATION

When asked how a new client's risk is assessed, the two most important criteria mentioned by financial institutions were the client's credit history and projected cash flow (Graph 6). For example, 61.6% indicated these are among the three major criteria. However, an attempt to rank them in order of importance proved inconclusive. Other criteria such as business sales, recent profits, the debt/equity ratio, collateral and the client's economic activity appear to be less relevant to financial intermediaries when assessing credit risk.

In a credit crunch, one should expect the client's credit history to be more important than the project's cash flow. The risk assessment done by financial institutions shows that the client's credit history has become more important, in relative terms, than projected cash flow; however, the latter is still considered fundamental (Graph 6). In any case, the results are not conclusive. When financial institutions were asked about the criteria they consider for approving a loan, credit history acquires more importance than the project's cash flow and profitability.[2]

In the case of clients whose application was rejected, the institutions surveyed were asked whether or not they would have approved the loan if the client had agreed to a higher interest rate. The majority (83.3%) said no. A similar percentage said the same in the earlier surveys. When asked what they would have done had the client been willing to accept a shorter loan, most of the institutions surveyed said they would not have agreed to the loan.

When asked if they would have granted the loan, had the client offered more collateral, 66.7% answered affirmatively. This response appears to be somewhat contradictory to the answer to earlier questions, where collateral appears to be less important when assessing a loan request. However, the findings of earlier answers - more insistence on the quality and amount of collateral, and denial of credit despite the client's willingness to pay a higher rate of interest and/or to accept a shorter loan - are consistent with the characteristics of credit rationing. Consequently, there is evidence that vestiges of the credit crunch that occurred after the last financial crisis still exist or, at least, that certain practices indicating the presence of a credit crunch remain in place.

As to the particularities of clients whose loan applications were rejected, the financial institutions surveyed indicated that most were new clients. Again, this suggests the client's credit history is key to loan approval decisions.

Graph 6

The Main Consideration in Risk-Assessment for New Clients

(Percentage of those surveyed)

Source: Credit Situation Survey, Banco de la República.

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[2] For 77.8% of those surveyed, good information on the client's credit history was the most relevant, followed by low risk (11%) and profitability of the project (5.6%). None of the institutions surveyed mentioned the existence of satisfactory collateral as a key reason for approving a loan.

Graph 7

The Most Recurrent Complaints or Comments Received by Financial Institutions

(Percentage of those surveyed)
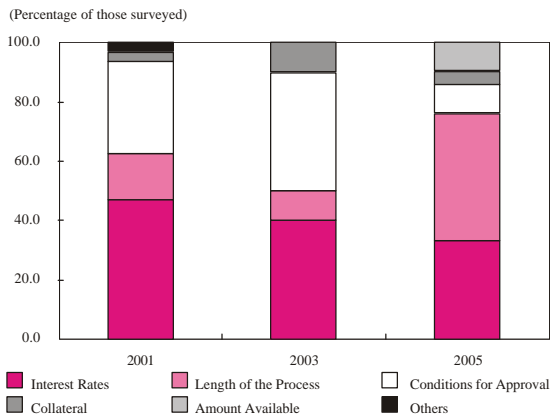
Source: Credit Situation Survey, Banco de la República.

Complaints from clients about the process financial institutions use to study a loan application constitute another topic (Graph 7). The most recurrent complaint is that the procedure is too long. Moreover, a third of the institutions surveyed said the most common complaint is high interest rates. Complaints about the conditions for loan approval and the kind of collateral required (which is considerable) appear to be less frequent.

This contrasts with the earlier surveys, (Graph 7), where the most recurrent complaints from clients involved strict conditions for loan approval. In short, the client's credit history and the project's cash flow are the most important factors credit institutions consider when evaluating a loan application. Constraints involving high interest rates and strict conditions for loan approval seem to have become less important.

IV. EFFECTS OF AN INCREASE IN CREDIT DEMAND AND FACTORS THAT DETERMINE FINANCIAL ACTIVITY GROWTH

As part of the survey, financial institutions were asked how the credit supply would most likely react to an increase in the demand for loans, represented by a rise in economic activity. Among the three most likely events, 77.2% indicated the system could meet the demand for credit without a great deal of strain. However, 55.6% of those interviewed said small and medium-sized companies likely would face credit bottlenecks, while 50% cited the possibility of constraints to access for certain sectors.

The survey also included questions on how institutions perceive the factors that prevent – or could prevent – the Colombian financial system and each institution in particular from extending more credit to the private sector, and the actions or events financial institutions regard as necessary to increase the amount of credit in the economy.

With respect to the factors that limit credit growth (Graph 8), the main problem mentioned by most of those interviewed is the client's creditworthiness or ability to pay. Half the institutions surveyed point to the

shortage of low-risk projects as another major constraint. Legal instability and lack of financial information on new clients are also significant limitations.

Compared to the results of the 2001 survey (Graph 8), there has been an improvement in the perception of clients' ability to pay and their economic activity. Provisioning and legal instability were considered more important by credit institutions in 2001, although they are currently cited by many as factors that limit credit growth.

Another question concerns the actions or events financial institutions regard as necessary to increase the amount of credit in the economy (Graph 9). In this respect, 83.3% of those surveyed agreed an increase in economic activity would be one of the three factors that would raise credit, while 50% insisted on legal stability. An important portion of those interviewed felt more profitable projects and better information on the applicant's creditworthiness also would result in more credit.

No credit establishment perceived central bank liquidity as a constraint to credit. Regarding interest rates, 11.1% of the institutions surveyed indicated that higher lending rates would boost credit activity. This suggests there is no conclusive evidence with respect to high price elasticity in the credit supply.

Capital constraints were an important feature during the post-crisis period, but were not relevant in this survey. No institution said that having more capital would prompt higher lending activity.

According to these findings, the private sector's demand for loans is perceived by financial intermediaries to be the primary constraint to further growth in the credit market. From the standpoint of the financial sector, an increase in economic activity would boost the demand for credit, which would be backed by the favorable situation in the sector and its willingness to loan. Consequently, an increase in

Graph 8

Main Problems for Financial Institutions that Prevent More Growth in Credit

(Percentage of those surveyed)
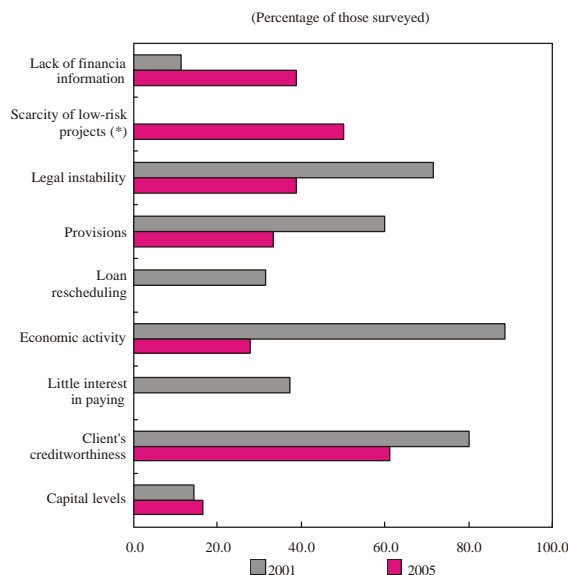
(*) This option was not included in the 2001 survey.
Source: Credit Situation Survey, Banco de la

Graph 9

Actions or Events Required to Increase Credit in the Economy 2005 Survey

(Percentage of those surveyed)
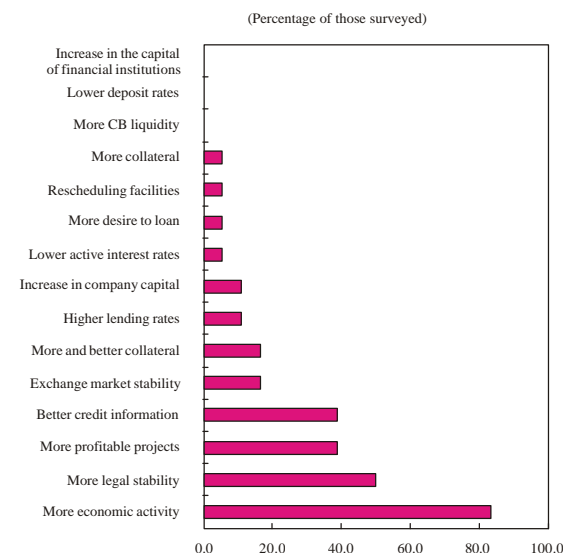
Source: Credit Situation Survey, Banco de la República.

the supply of credit is to be expected. This would imply a new equilibrium in the credit market, where the volume of loans would increase. In contrast, legal instability, lack of financial information on new clients and their creditworthiness are supply constraints that inhibit credit growth.

V.   SUMMARY AND CONCLUSIONS

The credit situation survey provides valuable qualitative information on how financial institutions perceive the credit market. This can be useful to examine the existence of credit rationing in the Colombian economy. At present, they see good prospects for most sectors of the economy, which indicates the demand for credit might continue to rise. The findings also suggest that expectations and conditions for credit access are not homogeneous across sectors and companies size. To begin with, credit access is restricted by information problems related to the client's creditworthiness and project profitability. This is particularly true for the agricultural sector and, to a lesser degree, for the export sector.

It is interesting to see how the factors that reflect the possible existence of credit rationing have changed, and how this phenomenon has been disappearing. In the post-crisis era, the huge losses accumulated by Colombia's financial system meant sharp restrictions on growth in the supply of credit, due to capital constraints. The latter generated extreme risk aversion, preference for low-risk liquid assets, coupled with an unwillingness to expand credit activities. Although financial institutions still turn to government bonds, a certain preference for loans to households and to companies that produce for the domestic market is evident.

The results of the survey show credit institutions have substantially less credit risk aversion. This may be related, among other factors, to more client information, increased economic activity and more risk control. This has allowed for a noticeable reduction in supply constraints on the credit market. Consumer credit and mortgage loans have been favored in this sense, thanks to a lower risk perception, particularly with respect to mortgage loans. However, the demand for mortgage credits does not appear to be related to the pace of supply.

The requirements for gaining access to credit are another aspect that identifies the existence of a credit crunch. When there are supply problems, the requirements would be expected to increase. However, in contrast to past years, the perception is that requirements for loan approval are less strict.

Although the features of a project (such as viability and profitability) appear to be important for loan approval, the highest priority is related to prior knowledge of the client and his credit history. Consequently, new clients

with insufficient information are the ones that face more credit access restrictions. As those clients acquire a history of credit with the financial system, they will become less sensitive to a credit crunch.

Finally, the results point to disappearance of the factors that hamper access to credit, at least those concerned with limited capital and credit risk aversion. The problem with the credit market seems to be more serious on the demand side, especially for mortgage loans. Nevertheless, there also are indications of supply problems concentrated in specific sectors (agriculture and exports) and among small and medium-sized companies.

A GENERAL EQUILIBRIUM APPROACH TO ANALYZING FINANCIAL STABILITY IN COLOMBIA

Agustín Saade Ospina
Daniel Osorio Rodríguez
Dairo Estrada[*]

INTRODUCTION

Central banks have achieved positive results for inflation during the last two decades. At the same time, their concern for financial stability has increased, particularly after the late nineties, when they experienced the high costs that come with financial crisis.[1] Moreover, it now seems clear that, under extreme circumstances, financial stability can pose a constraint to the normal operation of monetary policy (See Vargas et al., (32006)).

For these reasons, central banks now use a set of tools to assess and promote financial stability. According to Bårdsen, Lindquist and Tsomocos (2006), these tools range from calculating indicators to designing structural macroeconomic models. The latter are understood as complex environments that allow for an analysis of interaction between the different agents at hand and the financial system (banks, depositors, regulators, etc.), as well as the effect of changes in the stance of monetary policy.

The Bank of England was a recent pioneer in constructing models of this type, particularly dynamic general equilibrium models with a finite horizon (DGEMFH).[2] The main developments in this respect are summarized in the

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[1] See Borio and Lowe (2002), and García Herrero and Del Río (2003) for an interesting interpretation of why financial stability has emerged as a policy problem at a time when inflation is ceasing to be one.

[2] In models of this type, equilibrium is the result of interaction between rational economic agents who must cope with a restricted optimization problem and a finite horizon for reaching a decision.

work of Tsomocos (2003) and Goodhart, Sunirand and Tsomocos (2004, 2005, 2006a and 2006b). The Financial Stability Department at Banco de la República has applied these developments to a recent analysis of the stability of Colombia's financial system. The initial results of that exercise are summarized herein,[3] particularly the assessment of how the model behaved in replicating the series observed in the Colombian financial system.

There are five sections in this article. The first offers justification for using a model to analyze financial stability. The second presents a simplified version of the model that was employed. It is a DGMFH with several features particular to the Colombian financial system. The third and fourth sections outline how the model was applied. Finally, several thoughts about its application are presented in the form of a conclusion.

1. Advantages of Using a DGMFH

Probably none of the tools central banks now use are sufficiently comprehensive to resolve all the problems inherent in a financial stability analysis. A good analysis clearly depends on the use of various tools, applied in a complementary way. Under those terms, the use of general equilibrium models has found a place, because - in a flexible and simplified environment - they involve the interrelations found among all agents in the system.
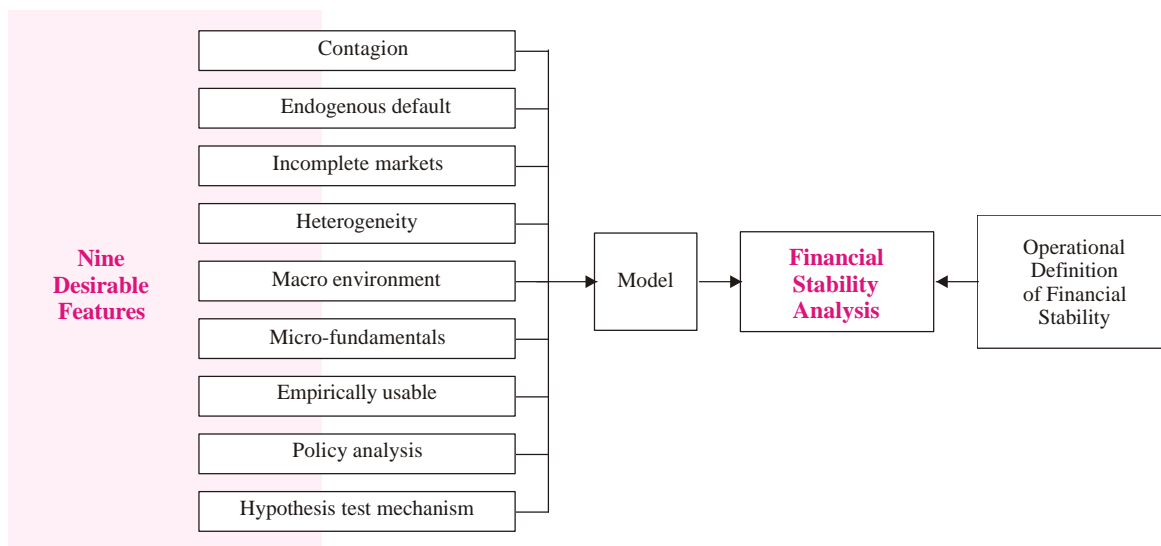
The study by Bårdsen, Lindquist and Tsomocos (2006) is a careful examination of how different macroeconomic models behave in a financial stability analysis. The results of that comparison suggest that, although no single model can answer all the questions in an analysis of this sort, some have certain features that make them desirable for assessing financial system stability. Those features, and how they come together when the model is applied, are summarized in Figure 1.

According to the diagram, a model that contains the nine desirable features is insufficient to analyze financial stability. It is necessary to have reached a consensus on the particular definition of "financial stability" beforehand. In other words, as concluded by the aforementioned authors, an analysis is the combined product of a definition and the exercise involved in operation of the model. Hence, the definition of financial stability must be operational and quantifiable, so the quantitative results of the model's application can be translated directly into conjectures about the stability of the financial system.

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[3]   The articles by Saade and Estrada (2006) and Saade, Osorio and Estrada (2006) detail the development of this agenda.

FIGURE 1

TEMPORAL STRUCTURE OF THE MODEL

Source: Constructed according to Bårdsen, Lindquist and Tsomocos (2006).

Unlike other macroeconomic models, a DGMFH in its simplest versions (like the one used in this article) contains the nine desirable features shown in Figure 1. It also permits operational use of the following specific definition of financial stability: a situation where profitability for financial institutions is high and there is a reduced risk of default in the markets where these institutions come together (See Bårdsen, Lindquist and Tsomocos (2006).[4]

In short, if this definition is considered general enough to cover the Colombian case,[5] the use of a DGMFH as a complementary tool for analysis can enhance the quality of Banco de la República's monitoring of financial stability, which

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[4] The definition of financial stability proposed in this article is intended only for financial stability analysis in connection with the model. Naturally, there are other more general definitions outside the scope of the model. They can be supplemented with the one summarized herein.

[5] For example, it is important to remember that one of the features of the 1998-1999 financial crisis in Colombia was the negative profitability experienced by credit establishments and the reduced rate of portfolio repayment, in both traditional credit markets and the interbank market. According to information published by the Superintendent of Financial Institutions in Colombia, profitability as a percentage of the assets in the financial system at September 1999 was -3.88% (a historic low). The losses accumulated during the crisis were not recovered until mil-2005. In November of that same year, the overdue portfolio as a percentage of the total portfolio reached 16% (a historic high).

explains the Financial Stability Department's recent effort to develop this research agenda.

II.   Simplified Model: Frame of Reference

Pursuant to the method suggested by Goodhart, Sunirand and Tsomocos (2206a and 2006b), the proposed model allows for coherent interaction between various economic agents in financial markets. Participating in the model are heterogeneous banks: $b \in B = \{g, d, t\}$, private-sector agents who act as bank clients:$h \in H = \{a, b, q, f\}$, a regulator and a central bank. A restricted optimization problem was constructed for each of the banks. Reduced forms of behavior were assumed for the agents in the private sector, due to the impossibility of finding data broken down to the required level and also because this facilitates a computational solution to the model. The temporal horizon is infinite. However, the agents make their optimization decisions by considering finite periods in the future. The agents are rational and base their expectations on two possible "states of nature" (normal, extreme crisis). These can occur in the immediate future, according to a known distribution of probability.

The agents interact in various markets (Figure 2). As in Goodhart, Sunirand and Tsomocos (2006b), the assumption is that, at the start of each period, those
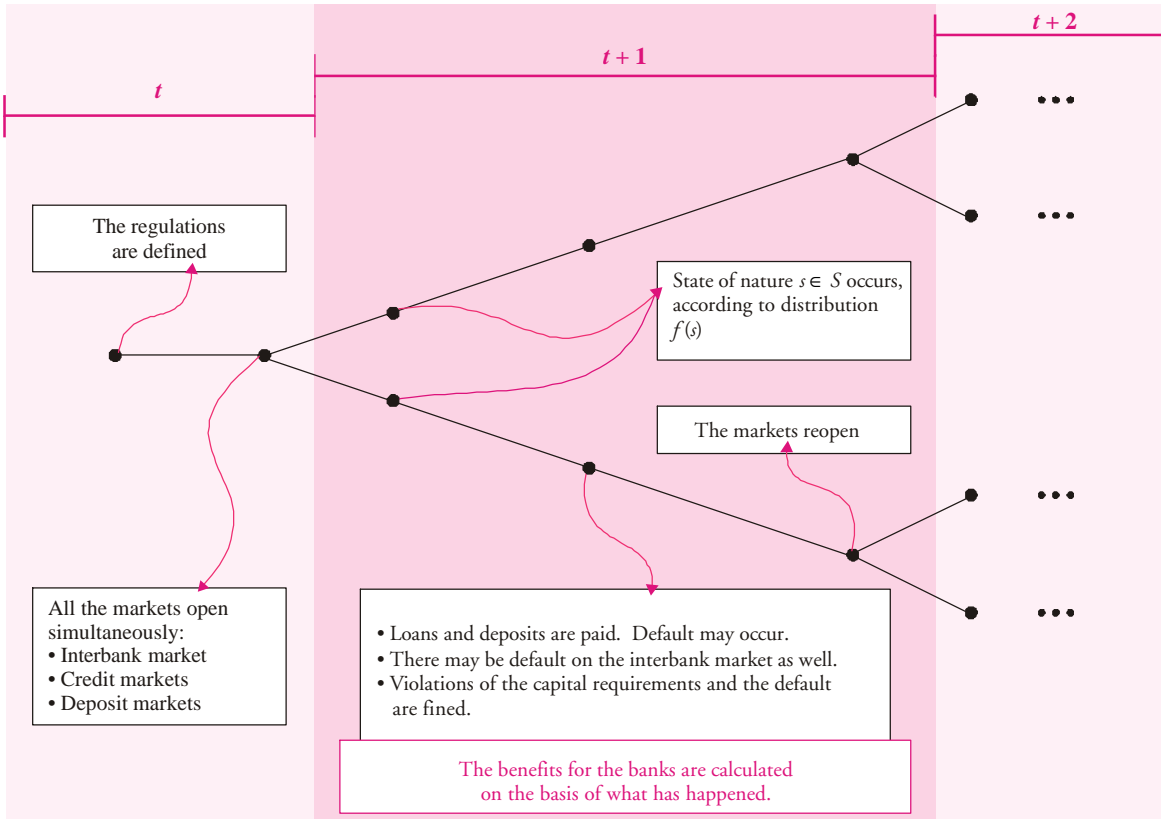
Figure 2

Agents and Interaction
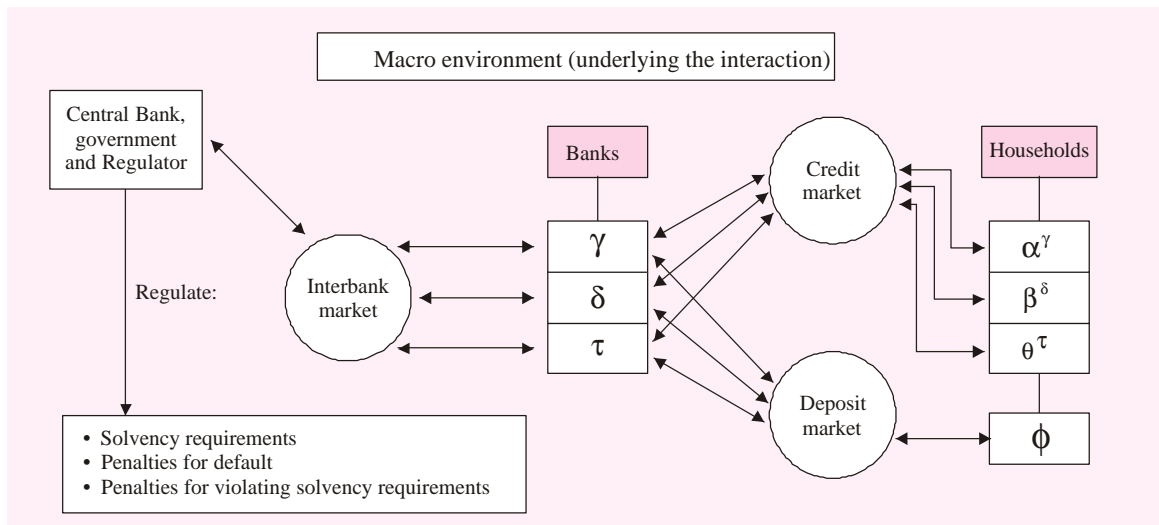
in need of credit have been assessed by the bank, either on the basis of their credit history or according to information constraints (assumption of limited participation). In other words, there is a credit market for each bank to which the client and the respective bank have recourse. In this simplified world, households a, b y q demand credit from banks g, d, y t, respectively. However, on the deposit side, each bank competes in its respective market to attract the aggregate pool of depositors (called f). They diversity its portfolio, depending on the profitability offered.

Finally, there is an interbank market where the banks contract credit among themselves. Participating in this market is a central bank-regulator that supplies or reduces liquidity through open market operations (OMO). The central bank-regulator also establishes certain measures for financial regulation.

The temporal structure of the model is outlined in figure 3. At the end of period t, the credit, deposit and interbank markets open simultaneously. Each bank

TEMPORAL STRUCTURE OF THE MODEL

$t + 2$

$t + 1$

t

The regulations
are defined

State of nature $s \in S$ occurs,
according to distribution
$f(s)$

The markets reopen

All the markets open
simultaneously:
• Interbank market
• Credit markets
• Deposit markets

• Loans and deposits are paid. Default may occur.
• There may be default on the interbank market as well.
• Violations of the capital requirements and the default
  are fined.

The benefits for the banks are calculated
on the basis of what has happened.

Source: Constructed according to Goodhart, Sunirand and Tsomocos (2006b).

decides how much credit to offer and the volume of deposits to demand on the respective markets, while forming a rational expectation of possible future states of "nature". For their part, households decide on their demand for credit and the deposits to offer, and the central bank conducts OMO on the interbank market.

One of the "possible states of nature" ($s \in S$) occurs at the start of period $t + 1$. Deposits and loans are paid according to the state of nature. There also might be a certain degree of endogenous default by households and banks. The latter would be subject to penalties for failing to meet their contract obligations; these would be proportional to the extent of default, plus penalties for failure to comply with the minimum requirements for solvency. Both the penalties for default and the solvency requirements and the penalties for violating them have been regulated before the markets open in period t. At the end of period $t + 1$, the benefits for the banks are calculated and the financial markets reopen.

The following is a brief explanation of how each agent is modeled, their decision variables, and the particular way they were specified for the Colombian case.

A.   The Banking Sector

As mentioned earlier, three heterogeneous banks: $b \in B = \{\textbf{g, d, t}\}$, were modeled. For the Colombian case, each of these banks is associated with a group of entities; namely, $\textbf{g}$ = banks specializing in mortgage loans (BECH), $\textbf{d}$ = domestic banks and $\textbf{t}$ = foreign banks. This classification tries to capture the differences in behavior t among these banks, as observed in the Colombian financial system.[6] With respect to simulation of the model, the three banks differ not only in their initial capital endowment, but also in their preferences as to risk.

Bank $b \in B$ decides the following variables in period $t \in T$: the supply of credit to household h^b $(\overline{m}^b_t)$, the deposits demanded of household $\textbf{f}(\textbf{m}^b_{d,t})$, loans on the interbank market (d^b_t), debt on the interbank market $(\textbf{m}^b_t)$,, and the repayment rates (1- default) in $t + 1$, depending on the state that occurs $(v^b_{t+1,s}$ $s \in S)$. The decision responds to the solution of an optimization problem with the following characteristics :

$$\underset{\overline{m}^b_t.\textbf{m}^b_{d,t}.d^b_t.\textbf{m}^b_t.v^b_{t+1,s}, s \in S}{Max \ U^b}, = E^b_t \ [f^b_s(\textbf{p}^b_{t+1,s}) - \{\text{penalidades}^b_{t+1,s}\}],$$

subject to (1) balance sheet restriction and (2) $\textbf{p}^b_{t+1,s} \geq 0$.

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[6]   See Avella and Osorio (2005) and Orozco (2005) for an analysis of the differences in how domestic and foreign banks act.

[7]   The explicit form the utility function takes is found in Saade and Estrada (2006). Essentially, it is the same as in Goodhart, Sunirand and Tsomocos (2006b), with modifications in the constraints of the problem.

Function $f_s^b(\boldsymbol{p}_{t+1,s}^b)$ is quadratic in "benefits" $\boldsymbol{p}_{t+1,s}^b$. these being the sum of income expected from interest in $t + 1$ and the profitability expected from the portfolio of negotiable investments, minus the outlays for interest expected in $t + 1$, considering the repayments rates (1-default) for both the bank and those expected for the households. Penalties function $_{t+1,s}^b$ divides penalties into groups proportional to the amount of default in $t + 1$ by the bank in state $s \in S$, in addition to penalties for failing to meet the requirements on minimum solvency. This optimization problem is not linear in the control variables of the bank.

B.   The Private Sector

As mentioned earlier, the agents in the private sector are modeled via reduced forms.

1.   *Demand for credit on the part of households $h \in \{a, b, q\}$*

In period t, the demand for credit on the part of household h^b depends negatively on the lending rate offered by bank b, and positively on the level of GDP anticipated for period $t + 1$. In other words, agent h^b rationally anticipates the product level in the immediate future. This, in turn, determines his expected income for $t + 1$. And, given the foregoing, agent hb adjusts the demand for credit in t to smooth his consumption:

$$dda\_crédito_t^{h^b} = h\ (E_t\ (GDP_{t+1}),\ r_t^b),\ \text{con}\ h_1 \geq 0\ \text{y}\ h_2 \leq 0.^8$$

2.   *Supply of deposits from household f*

All the banks compete in the deposit market to attract the resources of depositor pool f. This is contrary to what happens in the credit market, where participation is limited. Pool f tries to diversify its portfolio. The supply of deposits from f to bank b in period t is a positive function of the deposit rate offered by b and depends negatively on the deposit rate offered by the other banks ($b' \neq b$). Nonetheless, household f knows the banks can default on their obligations. Consequently, its deposit supply responds to the "expected profitability" ($r_{d,t}^b \times E_t[v_{t+1,s}^b]$) of its savings in b and the profit its savings would earn with the other banks. Finally, the deposit supply is a positive function of the GDP expected for $t + 1$.

$$Of\_depósitos_t^{\ b} = g\ (E_t(GDP_{t+1}),\ r_{d,t}^b \times E_t[v_{t+1,s}^b],\ \sum_{b \neq b} r_{d,t}^{b'}\ E_t[v_{t+1,s}^b]),\ \text{with}\ g_1 \geq 0,\ g_2 \geq 0\ \text{and}\ g_3 \leq 0.$$

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8   The following notation is used: $f_k = \P f / \P x_k$.

3.   Repayment rates of households $h \in \{a, b, q\}$

As in Goodhart, Sunirand and Tsomocos (2006b), it is assumed the rates of repayment in $t + 1$ by household h^b to bank b for each of the states ($v^{h^b}_{t+1,s}$, $s \in S$) is a positive function of future GDP. Moreover, repayment in $t +1$ responds t the banking system's total supply of credit in t. This ratio is negative: an increase in t with respect to the loans offered is associated with a moderate deterioration in the quality of the portfolio, possibly due to fewer filters in the process whereby the banks select debtors[9]

$$v^{h^b}_{t+1,s} = v_s\, (GDP_{t+1,s},\, \sum_{b \neq B} \overline{m}^b_t),\, s \in S,\, \text{where } v_1 \geq 0 \text{ and } v_2 \leq 0$$

4.   GDP

The last of the reduced forms incorporates the GDP path into the model. It is assumed that GDP in $t + 1$ for state s is a positive function of the aggregate supply of credit in t:

$$GDP_{t+1,s} = p_s\, (\sum_{b \neq B} \overline{m}^b_t)\ \text{ with } p_1 \geq 0.$$

C.   Central Bank and Regulator

For the effects of the model, the decisions of the central bank and regulator are exogenous.[10] The regulator determines the minimum solvency requirements ($k^b_{t+1,s}$, $s \in S, b \in B$), in addition to the penalties banks would incur if minimum solvency is not met (l^b_{ks}, $s \in S, b \in B$). It also imposes penalties or fines for default on the banks' repayment obligations (l^b_s, $s \in S, b \in B$). Finally, the regulator determines the weighted risk of the various assets used to calculate the solvency ratio.

For its part, the central bank conducts OMO on the interbank market, effectively setting the interest rate for trading on that market (r).

D.   Equilibrium

There are seven active markets featured in the model: three credit markets, three deposit markets and the interbank market. In each of them, the interest rate is determined by the supply and demand on the market. The model includes

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[9]   For Goodhart, Sunirand and Tsomocos (2006b), this ratio is positive insofar as a credit rationing can exist.

[10]   The working agenda for the future attempts to include, in an endogenous way, the decisions taken by economic authorities.

a condition for each possible future state, specifically one that ensures banks structure their expectations correctly with respect to the rate of repayment they receive in $t + 1$ on their interbank loans.

III. CALIBRATION

Two econometric strategies were required to calculate the value of the relevant parameters.

A. Estimate of Long-term Relationships (Cointegration Vectors)

The parameters for the reduced forms of GDP and household credit demand were obtained by estimating cointegration vectors (relationships) between the variables found therein.[11] For the reduced form of credit demand, limitations in available information make it necessary to estimate a set of parameters that is common to the clients of each of the three groups of banks. In this case, the variables included in the system are: consumption, money supply, the unsecured consumer portfolio, inflation, unemployment, GDP and the spread on the consumer portfolio. The strategy proposed by Chrystal and Mizen (2001) is used in this respect.[12]   The estimated cointegration ratio is:

$$L_t = 4{,}89 \ln (GDP_{t+1}) - 0{,}723 (SC_t) + 2{,}18 \, p_t + 0{,}19 (\Delta u_t)$$

where L is the unsecured portfolio, SC is the spread on the consumer portfolio, p is inflation and u is unemployment. The estimators associated with GDP and SC are the values of the parameters of the reduced forms of credit demand used in the simulation.

As to the reduced form of GDP, the system included information on GDP and the entire loan portfolio. Besides normalization, the cointegration vector estimated in this case includes a deterministic tendency component:

$$\ln(GDP_{t+1}) = 0{,}0053t + 0{,}1589 \ln(L_t)$$

where L is the entire loan portfolio.   Both the tendency estimator and GDP elasticity to the loan portfolio were used in the simulation as the parameters of the reduced form of output.

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[11]   See Hendry and Juselius (2000) for details on estimating restricted cointegration vectors.

[12]   See Estrada, Osorio and Saade (2006) for details on the estimate.

B. Panel Data Models

When the reduced forms include components of the general balance sheet or income statement for the three groups of banks, the strategy was to estimate panel data models in which each bank is regarded as a separate individual within the panel. Specifically, the reduced forms of the deposit supply and household repayment were estimated in this way.

In the case of the deposit supply, the dependent variable pertains to the sum of each individual entity's checking accounts and savings deposits. Moreover, the dependent variables are the real GDP (one period ahead), the entity's implicit deposit rate, and the average implicit rate of deposit for the other two groups of banks. The estimate, pertaining to a random effects model in the intercept, yielded the following result.

$$\ln(\text{deposits}_{it}) = C + 1.832 \ln(GDP_{t+1}) + 0.143 \text{ deposit rate}_i - 1.243 \text{ deposit rate } -i$$

where i refers to a particular bank (-i refers to the group of banks other than the one to which i belongs).[13]

Finally, the estimate of the reduced form of household repayment included, as a dependent variable, the difference ($1 - \frac{overdue\,portfolio}{total\,portfolio}$) for each individual institution; and, as independent variables, the total portfolio for the three groups of banks and GDP (ahead one period). The results were:

$$\ln(1 - \frac{overdue\,portfolio_i}{total\,portfolio_t}) = C + 0.1446 \ln(GDP_{t+1}) - 0.1085 \ln(\text{portfolio}_t)$$

These estimators, and those presented in the foregoing expression, were used as the parameters for each of the reduced forms.[14]

IV. THE RESULTS

Graphs 1 through 4 show some of the series simulated with the tendency model, using the fourth quarter of 1999 as the initial period. The simulations are quarterly. For the purpose of comparison, the simulated series are accompanied by their actual counterparts, with real data.[15]

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[13] As noted earlier, the deposit supply is consistent with "expected profitability", which is comprised of the bank's interest and repayment rates. With respect to the estimate for the panel data model, the deposit rate is calculated as the flow of the bank's outlays on total deposits. For this reason, it implicitly includes the repayment rate.

[14] The C intercepts of each of the two expressions were obtained endogenously to improve the empirical adjustment in the initial period of the simulation.
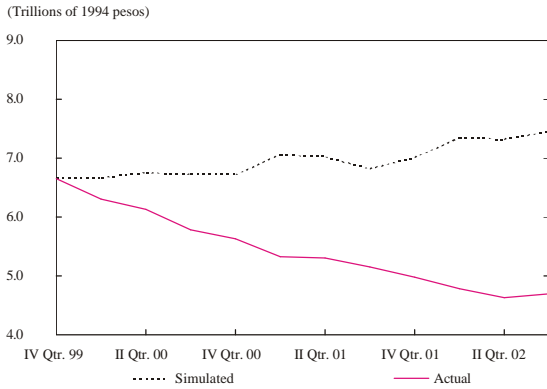
[15] The Superintendent of Financial Institutions in Colombia is the source of each actual series presented in the graphs, with the exception of quarterly GDP, which comes from the National Bureau of Statistics (DANE).

In terms of the credit portfolio (Graph 1), what stands out is the model's capacity to adjust to real data in the short term (approximately one year) for each of the three groups of banks. In the long term, the model's adjustment is far better for the domestic and foreign banks (panels B and C, respectively), than for the BECH (A). This is because common parameters were used for the reduced form of the demand portfolio. The calibration does not detect the differential in BECH behavior. Given the initial conditions, the model also replicates the relative differences in the size of the banks' portfolios (Panel D). It is important to point out that the results are moderately optimistic about the performance of the portfolio, due to a slight overestimation of GDP during the entire simulation horizon (Graph 4).
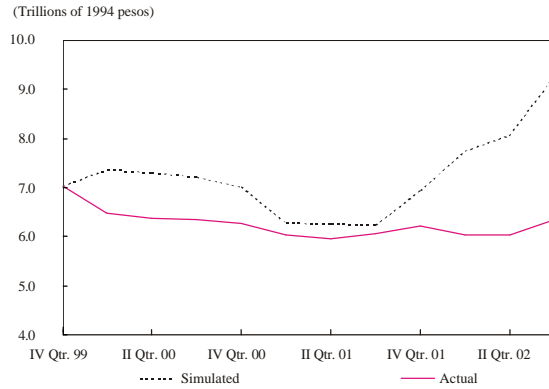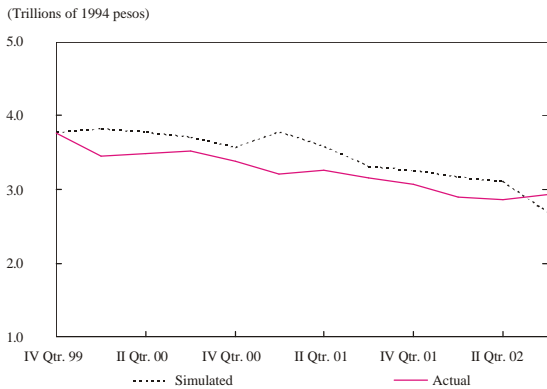
GRAPH 1

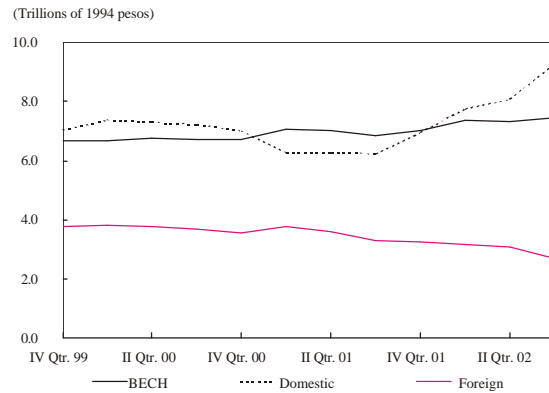**LOAN PORTFOLIO**

A. PORTFOLIO: BECH

(Trillions of 1994 pesos)

Simulated   Actual

B. PORTFOLIO: DOMESTIC BANKS

(Trillions of 1994 pesos)

Simulated   Actual

C. PORTFOLIO: FOREIGN BANKS

(Trillions of 1994 pesos)

Simulated   Actual

D. PORTFOLIO SIMULATION

(Trillions of 1994 pesos)

BECH   Domestic   Foreign

Source: Colombian Superintendent of Financial Institutions (actual series) and the authors' calculations (simulated series).

As to the pattern of deposits (Graph 2), the adjustment is much better - in both the short and long term -although the optimism (originating with the GDP path) continues to some extent. This outcome confirms the merits of the calibration strategy that was used. In this case, the assumed pool of depositors turns out to be quite adequate, since - in the real world - there appears to be no limited participation when its comes to choosing a bank to open a savings account.
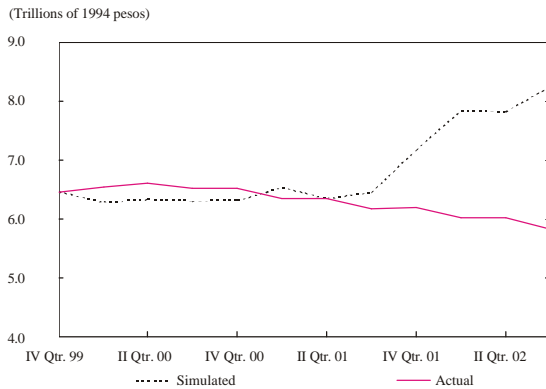
Repayment of the banks' credit portfolio (Graph 3) suggests optimism only in the case of foreign banks and the BECH (panels A and C).[16]

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[16]   In the simulated BECH repayment series, one sees a jump to the end of the simulation horizon. Rather than a normal outcome, this appears to be an abnormal product of the optimization algorithm used in the simulation.
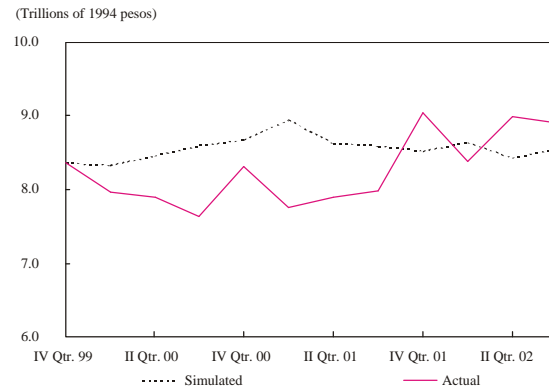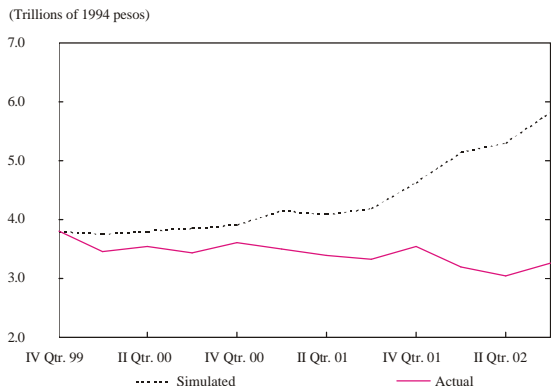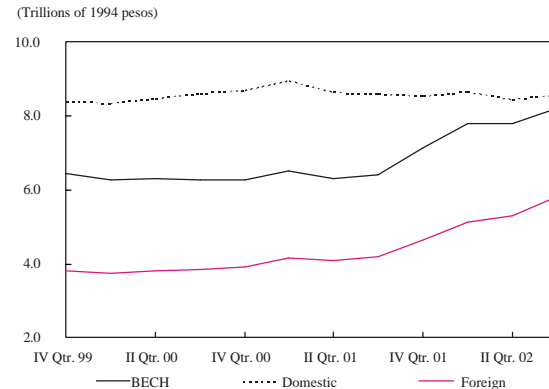
Graph 2

Deposits

A.   Deposits: BECH

(Trillions of 1994 pesos)

.... Simulated   —— Actual

B.   Deposits : Domestic Banks

(Trillions of 1994 pesos)

.... Simulated   —— Actual

C.   Deposits: Foreign Banks

(Trillions of 1994 pesos)

.... Simulated   —— Actual

D.   Deposit Simulations

(Trillions of 1994 pesos)

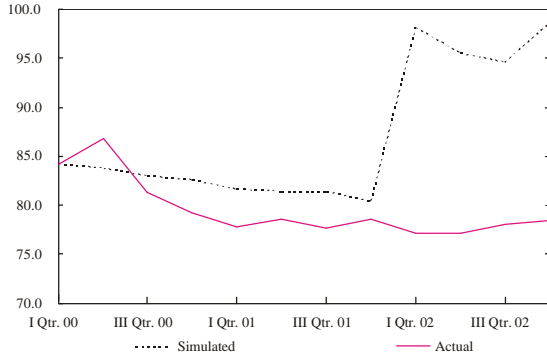——BECH   .... Domestic   —— Foreign

Source: Colombian Superintendent of Financial Institutions (actual series) and the authors' calculations (simulated series).

GRAPH 3

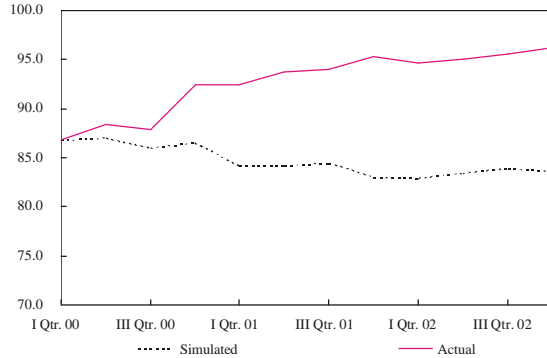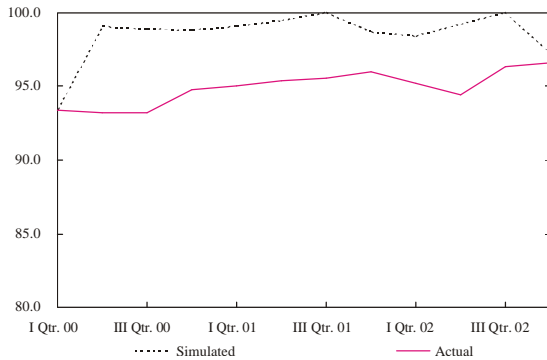**CREDIT DEMANDERS' REPAYMENT TO BANKS (PERCENTAGE)**
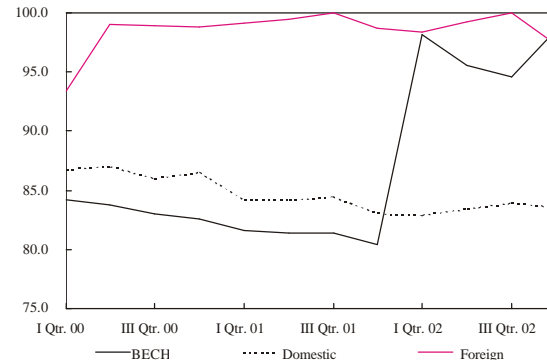
A.   REPAYMENT BY BECH CLIENTS

Simulated   Actual

B.   REPAYMENT BY DOMESTIC BANK CLIENTS

Simulated   Actual

C.   REPAYMENT BY FOREIGN BANK CLIENTS

Simulated   Actual

D.   LOAN REPAYMENT SIMULATIONS

BECH   Domestic   Foreign
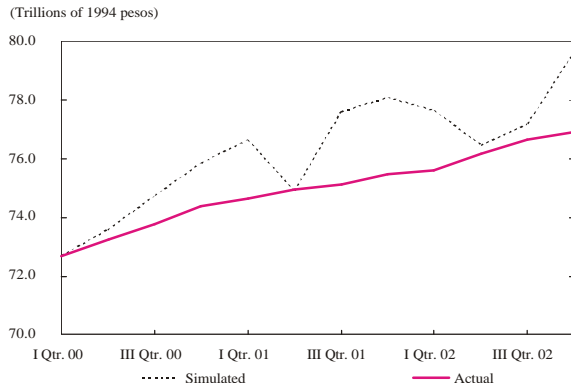
Source: Colombian Superintendent of Financial Institutions (actual series) and the authors' calculations (simulated series).

GRAPH 4

GROSS DOMESTIC PRODUCT

(Trillions of 1994 pesos)

Simulated   Actual

Source: DANE (actual series) and the authors' calculations (simulated series).

Panel D shows an interesting outcome: the simulations replicate the stylized event in Colombia in the sense that foreign banks have a better-quality portfolio.[17]

Finally, overestimation of the GDP path (Graph 4) may be the result of calibration problems, which means new strategies aimed in this direction will have to be explored further.

[17]   The stylized event that foreign banks "attract" better-quality clients is known as cherry picking. See Crystal, Dages and Goldberg (2001).

V.   CONCLUSIONS

The chief objective of this article is to summarize the principal results of a research agenda undertaken by the Financial Stability Department at Banco de la República, which consists essentially of applying a DGMFH to analyze the stability of Colombia's financial system. The main results of the simulation of this model (calibrated in advance for the Colombian case) highlight its merits, particularly in the short term, as a useful analytical tool complementary to the ones now being applied.

It is important to emphasize, as noted in the introduction to this article, that the model cannot, on its own, resolve all the problems inherent in a financial stability analysis. In other words, the model is not designed specifically for a certain set of objectives. For example, it is not designed to forecast the future course of GDP. The special comparative advantage of the model is that it permits a careful analysis of those agents in the financial system with the most resources; that is, the financial institutions, as well as the main characteristics of how they interact with the other agents in the economy.

As to the future, there are two complementary tasks for this agenda. First, the structure of the model can be used to simulate the effect of certain exogenous variables, particularly those associated with the regulatory environment and economic policy (e.g. the monetary authority's intervention rate or the minimum solvency ratio).[18] Secondly, it is important to explore ways to adjust the model better and, hence, its capacity for analysis. This includes adding elements of a small, open economy subject to different types of shocks originating in the rest of the world, which would be a good approximation to the environment wherein the Colombian economy operates. Also, some of the problems noted in this article (e.g. the model's optimism) are related to the calibration strategies, where there is plenty of room to improve the estimates in this respect.

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[18]   Simulating the model based on exogenous paths for GDP is another possibility worth exploring. An advantage associated with this strategy is the possibility of removing an "error source" from the model when adjusting other endogenous variables that are more relevant to a financial stability analysis.

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