

Mortgage Design in Mexico: Balancing Cash Flow and Borrower Affordability

by Steven A. Bernstein

INTRODUCTION

Throughout the 1980s and 1990s mortgage lending in Mexico has been a particularly risky endeavor. Repeated financial crises have resulted in borrower affordability problems and massive defaults. Through the years, Mexican bankers and regulatory authorities have attempted, with varying degrees of success, to stem borrower defaults resulting from payment shock and to make mortgages more affordable. They have addressed these issues through use of innovative mortgage design and various subsidy programs. While these efforts have sometimes been successful in addressing affordability issues, they have also created new problems. In particular, the introduction of the dual-index mortgage (DIM) resulted in cash flow problems for lending institutions and has prevented these institutions from being able to securitize their mortgage portfolios.

The purpose of this paper is to examine the Mexican DIM with respect to both borrower

affordability and institutional cash flow management, and the prospects for securitization. While recent work has focused on the general conditions required for creating a secondary mortgage market in Mexico (Campos 1997, Lea 1996 and Lipscomb et al. 1995), none has looked at the mortgage instrument in detail. Drawing on research recently completed for a World Bank project, this paper will attempt to address the mortgage design issue.

HISTORICAL OVERVIEW¹

This section presents a brief historical overview of mortgage lending in Mexico, focusing in particular on the mortgage instruments used. The recent history of mortgage lending in Mexico provides both the context for today's lending environment as well as a good set of lessons on mortgage design in a volatile macroeconomic environment. These lessons should be kept in mind when designing new mortgage products.

In 1984, the Mexican Central Bank (Banco de México) together with the nation's largest commercial bank, Banamex, introduced the DIM. It was targeted at low- to middle-income borrowers and was designed to increase the affordability of homeownership in the face of increasing inflation and declining real wages.

The original DIM worked by separating the mortgage accrual rate from the implicit rate used to calculate the borrower's monthly

mortgage payment. At the start of a loan, the borrower's payment would be set to an amount that was less than the required amount to amortize the mortgage. Increases in the borrower payment were made on a periodic basis by indexing it to the minimum wage index (*salario mínimo*). At the same time, the balance of the mortgage accrued interest at a different rate. For commercial bank loans the rate was equal to an index such as the 28-day treasury (*Cete*) or the inter-bank lending rate (*CPP*) plus an often large 10%-12% spread. Low-income lending programs such as FOVI (*Fondo de Operación y Financiamiento Bancario a la Vivienda*), a trust fund of the Banco de México) offered a DIM with an accrual rate of CPP with no spread.

The DIM indexed to the minimum wage was the predominant instrument used throughout the 1980s and early 1990s. However, by the early 1990s commercial banks found that the DIM did not produce an adequate cash flow in the early years of the loan. This situation was caused in part by a low initial payment rate and was made worse by the increasing disparity between inflation and the minimum wage (see Figure 1). Inflation and interest rates increased at a greater rate than the minimum wage index. This led to borrower payments that declined in real terms and increasing cash flow difficulties for the banks.

An example of the evolution of borrower payments using a generic commercial bank DIM

Steven A. Bernstein is Vice President of Cardiff Consulting Services, Inc., Cardiff, California. He would like to thank Michael Lea for insightful comments and assistance during the preparation of this paper. He would also like to express appreciation to Richard Clifford, The World Bank, for support in sponsoring much of the research used in this paper.

Figure 1. Mexican Prices and Minimum Wage

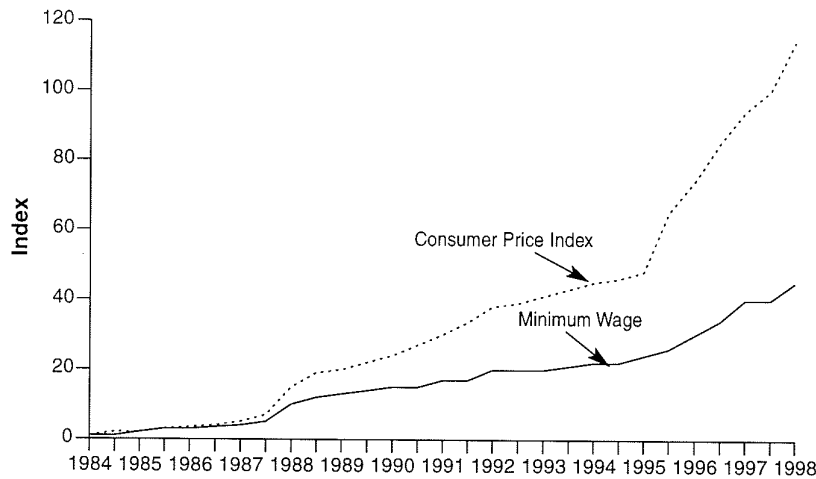
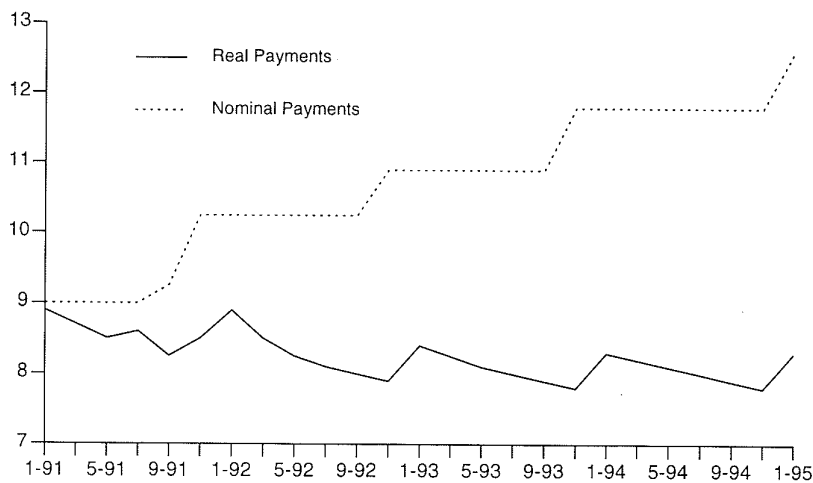


Figure 2. Hypothetical Commercial Bank Minimum Wage Indexed DIM Payments²



and actual historical interest rates is presented in Figure 2. In this example, the typical mortgage payment increases in nominal

terms (top line) but gradually declines in real terms. This was, to varying degrees depending on the vintage of the mortgage, the

profile of many commercial bank mortgages.

In response to this situation, the banks began an uncoordinated program of renegotiating mortgage terms.³ Typically, principal balances were reduced in exchange for a change in the payment index from the minimum wage to the consumer price index.⁴ This initially resulted in an increase in cash flows. However, by late 1993 increases in payments began to cause borrower payment shock.

Figure 3 illustrates this. It presents the hypothetical commercial bank DIM payments, in real terms, indexed to the minimum wage (saw-toothed line) and the new instrument indexed to inflation (flat line). In the 1993–94 period, borrowers who were accustomed to decreasing real payments before re-negotiation often ended up with payments that were more than 10% higher in real terms.

Payment shock from the renegotiated loans was in large part responsible for the high default rate during this period (see Figure 4).⁵ The timing of the renegotiations for the banks was bad. The financial crisis of December 1994 sent the economy into a tailspin, and prices soared, resulting in defaults that spiraled out of control. By early 1995 the commercial banks had stopped virtually all mortgage lending.⁶

Since 1995, the principal activity of the commercial banks in the mortgage sector has been the restructuring of portfolios. The details of the various restructuring programs are too numerous and complex to detail in this paper; if interested the reader is referred to a more detailed study of the post-crisis portfolios restructuring such as Lea 1996 or Bernstein, Lea and Renaud 1997. For the purpose of this paper, the key feature of the restructuring process was the conversion of commercial bank DIM portfolios (both performing and non-performing) into price-level adjusted mortgages (PLAM), often called

Figure 3. Hypothetical Commercial Bank DIM Payments (Originated 1/1/91)

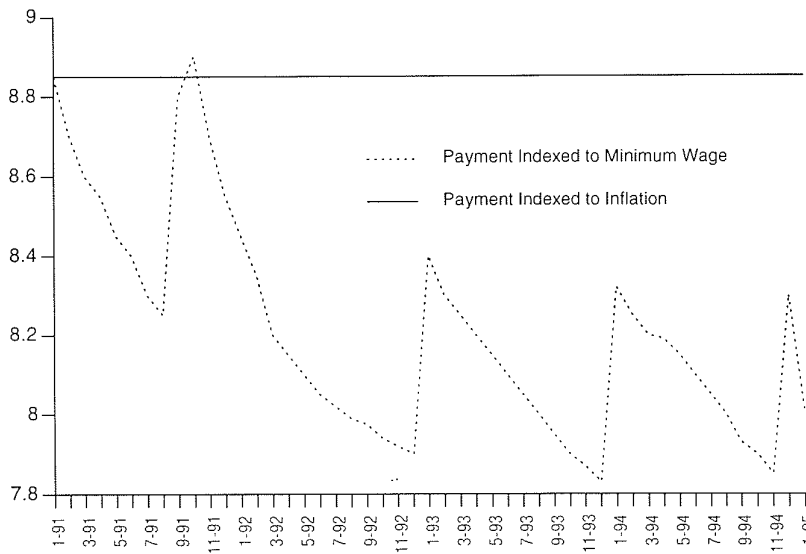
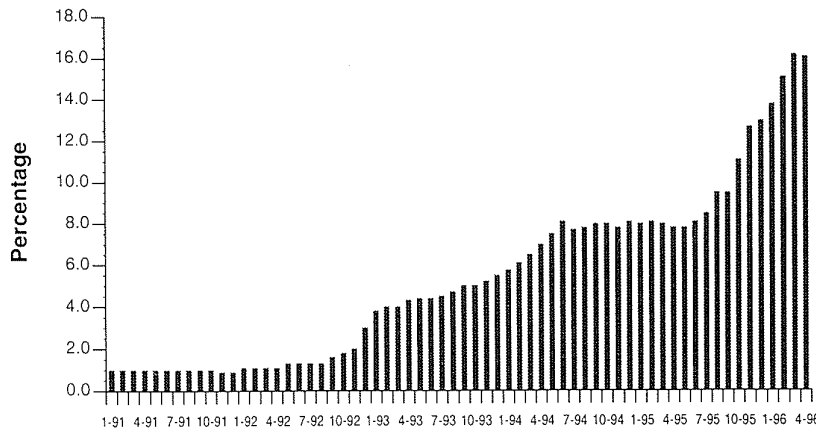


Figure 4. Commercial Bank Non-Performing Loans⁷ (Non-Performing % of Total Outstanding)



Source: Mexican Banking Commission (CNBV)

UDI (Unidades de Inversión) mortgages. The UDI is a daily reporting of the consumer price index that is used to index financial instruments so as to maintain a constant real value. A UDI mortgage is essentially a PLAM that is indexed daily to inflation and denominated in units of inflation with the borrower payment adjusting monthly.

In order to entice peso mortgage holders to convert their outstanding balances into UDI loans, and to minimize payment shock, the Mexican government offered to subsidize a percent of the borrower payment for a 10-year period. The subsidy was substantial, starting at 30% of the total monthly payment and gradually being reduced to 5% in years nine and ten. The program was quite large, and by October 1997 approximately 75% of all old peso (non-FOVI) loans had been restructured into UDI denominated loans, according to an unofficial CNBV estimate.

Despite the large payment subsidy, the restructuring of commercial bank loans was not successful in stemming defaults. Non-performing loans have and continue to make up a significant portion of the commercial bank portfolios. In April 1996 non-performing loans accounted for approximately 16% of the total outstanding loan balances. By October 1997 almost 40% of all commercial bank mortgages were greater than 180 days past due. Of this figure, newly restructured UDI loans accounted for over 20% of the total mortgage portfolios.

This situation was due in part to an inadequate level of the payment subsidy.⁸ The payment subsidy was set up in a way that assumed wages would begin to increase in real terms and thus the need for a payment subsidy would decrease. The opposite happened. Through the 1995-1997 period, the economy continued to deteriorate with real wages continuing to decline in most periods.

Lessons From History

The historical experience of the commercial banks provides two very good lessons for the current architects of the Mexican housing finance sector. First, commercial bank experience with the DIM has been disappointing. Given the volatility of the Mexican economy, it has proved extremely difficult to balance the cash flow needs of the institution and the affordability needs of the borrower. Because it is extremely difficult to forecast the economy, choosing an initial starting payment rate and a payment index is often an educated guessing game.

Second, as the case of the DIM to UDI restructuring highlights, mortgages originated in volatile macroeconomic environments must offer some kind of protection against borrower payment shock. While the UDI did attempt to address this issue through payment subsidies, the plan was not flexible enough and did not take into account that the economy would continue to worsen. Lacking the flexibility to handle worst case contingencies, holders of UDI mortgages continued to experience payment shock and default rates climbed back up.

Mortgage Lending After the Crisis: FOVI

In contrast to the commercial bank experience, a number of government- and quasi-government-sponsored housing programs continue to operate, providing subsidized mortgage loans to lower income households. INFONAVIT, the largest of these programs, currently originates over 50% of all mortgages in the country. It utilizes an instrument that is roughly similar to a PLAM indexed to the minimum wage and embeds a very high level of subsidies.

The second largest originator is the Fondo de Operación y Financiamiento Bancario a la Vivienda (FOVI), a second-tier housing finance institution. Currently, through its

authorized lending agents, FOVI originates approximately 18% of all mortgages (SEDESOL 1998).⁹

FOVI is a particularly important institution because of its market share and because it is one of the least subsidized and best run government housing finance institutions in the country. Given the need to restart mortgage lending, FOVI has been targeted by the World Bank as an institution that can possibly make the transition from being a subsidized lender to a major provider of liquidity for all income segments.

FOVI is now at a critical juncture. It is questionable whether the institution can continue to provide its current level of subsidies, as its principal funding source, the Mexican government through the Central Bank and the Ministry of Finance, is drying up. To address this, FOVI, with assistance from the World Bank and others, has looked at numerous alternatives. In particular, securitization of FOVI mortgage portfolios is seen as a potentially good way to increase liquidity and flow of funds for housing.

While there are many pre-conditions for setting up a successful program of securitization,¹⁰ the mortgage instrument is ultimately the most critical component; it is the main component of the final product, the mortgage security. Sophisticated investors are concerned with all facets of the security, including understanding the deal structure, the total return and all aspects of risk (including credit, prepayment and liquidity). At a minimum, in order for the security to be of value to investors, it must produce a "forecastable" set of cash flows at a desirable risk-adjusted yield and duration. Currently, the FOVI DIM does not do this.

The next section presents a description of the current FOVI mortgage and analyzes its weaknesses with respect to securitization.¹¹

THE FOVI DIM

Prior to 1995, FOVI, through its authorized lending agents¹² originated a traditional DIM with payments indexed to the minimum wage and the balance accruing interest at CPP.¹³ FOVI introduced a new variant of the DIM in 1995 that continued to index the borrower payment to the minimum wage but indexed the loan balance to inflation plus a 5% spread. This new instrument now makes up the bulk of outstanding loans. The remainder of this section will examine only the new fixed-real-rate DIM.

A significant feature of the FOVI DIM is that it contains a fair level of subsidization. The principal subsidy is found in the low accrual rate on the loan which at any point in time is approximately 100 to 200 basis points lower than the government 28-day treasury rate. A low initial payment and manageable payment increases have made the mortgage affordable to the low-income borrower. Aided by the mortgage's affordable design and aggressive servicing, many of FOVI's active lenders have been successful in keeping defaults low. Less than 2% of SOFOLEs' portfolios are greater than 90 days in arrears.¹⁴ Despite this impressive default rate, it is questionable whether or not FOVI can afford to keep funding this instrument. The remainder of this section examines why this may be the case.

Like generic DIMs, the balance of the FOVI instrument accrues interest at a rate of interest completely separate from the borrower payment (this is the defining characteristic of a DIM). The FOVI DIM balance accrues interest at a fixed real rate of 5%. This is done by accruing interest at a fixed rate of 5% and then indexing monthly the outstanding balance to inflation. Indexing will increase the balance in nominal terms. The balance will also increase if the mortgage experiences negative amortization. This occurs when the borrower payment is insufficient to cover the

principal and interest payment required to fully amortize the loan.

Calculating the Monthly Payment

There are two parts to calculating the monthly borrower payment. First, the initial payment is calculated using what is called in Mexico a *payment factor*. The payment factor is expressed in pesos-per-thousand-pesos of loan balance. Currently the FOVI payment factor is 7 pesos per thousand or .7% of the initial loan balance.¹⁵ An approximate implicit starting borrower payment rate can be calculated for this mortgage. Assuming a 30-year amortizing mortgage that completely amortizes and an initial payment rate of 7 pesos-per-thousand, the starting interest rate on the loan is equivalent to 7.51% (annual). Given that the first period accrual rate on the principal balance has historically been significantly higher (approximately 19% in January 1998), the mortgage begins negatively amortizing immediately. Second, after the initial period, the payment is adjusted by the periodic change in the minimum wage index. Historically, the minimum wage has been adjusted one or two times per year.

By construction, the FOVI DIM is a flexible-term mortgage. It is possible to get to the end of the loan term and still have a positive principal balance. This situation results from the payment index lagging the accrual rate over the life of the loan. If there is a balance outstanding at the end of the original term (typically 20–25 years), the term can be extended an additional five years with payments continuing to be indexed to the minimum wage. Any remaining balance outstanding at the end of the life of the loan is forgiven.¹⁶

In sum, the FOVI DIM is basically a mortgage instrument concerned with borrower affordability. This was, and continues to be a primary goal of FOVI. The problem is that many of the characteristics of the mortgage

create difficulties if FOVI wants to transform itself into a market-driven institution. These characteristics are:

1. Estimating Mortgage Yield. It is very difficult to determine the final yield of the instrument. Given that a mortgage may never completely pay off, the yield on all of the cash flows could be considerably less than the mortgage accrual rate (5% real). This is because the borrower is only obligated to make payments until his or her contract term has expired. As the lag increases, the total sum of borrower payments decreases and consequently the mortgage yield decreases.

2. Projecting Wages and Inflation. Calculating the yield requires that long-term forecasts of wages and interest rates be made. Given the historical volatility of the Mexican economy, deriving accurate forecasts of more than a year or two is next to impossible.¹⁷ Furthermore, minor changes in assumptions can lead to very different yield estimations.

The following example illustrates these first two points: If we originate a FOVI DIM and assume that the average increase in wages matches the increase in inflation exactly, then in real terms, the mortgage would fully amortize and the yield would equal 5%. If the same mortgage is originated but we assume that wages lag inflation by an average of 5% during the life of the loan, the mortgage will not pay off and the resulting yield in real terms would be 3.4% (see Table 1).

Thus a modest change in the macroeconomic assumptions results in two very different numbers for expected portfolio yield.

From an institutional perspective the cash flow from borrower payments can be problematic. The low initial payment and subse-

Table 1. Hypothetical FOVI DIM

	<i>Projected Real Mortgage Yield</i>
Scenario 1: Average Wage Increases = Inflation Increase	5.00%
Scenario 2: Wages Lag Inflation on Average 5%	3.40%

quent minimum wage indexing results in cash flows that can be quite low in the early years relative to the later years. Thus, the cash flow profile can be characterized as “back-ended.” Back-ended cash flows not only constrain the institution’s operations by reducing its available cash, they can also cause more insidious funding problems.

Typically loans must be funded with short-term to medium-term debt that requires the institution to make periodic payments. If there are unmatched low cash flows in the early part of the mortgage and not enough equity in the form of cash, then additional debt must be issued to make the interest payments on the old debt. This may result in a debt spiral in which the institution must originate new debt to fund old debt and make up for the cash shortfall stemming from the low mortgage payments. Such a situation could ultimately lead to institutional insolvency.¹⁸

Finally, given all of the above (the low accrual rate, unpredictability of the cash flows combined with their back-ended nature) and the availability of alternative investments, it is questionable whether a FOVI DIM pass-through security would be marketable. Enhancement of the cash flow to create a security with level payments and an acceptable yield would not only require the

institution to increase the accrual rate and the borrower payment rates, but it would also have to guarantee against cash flow deficiencies that are likely to occur, thus negating the benefits of securitization.

In sum, the FOVI DIM has worked well in keeping borrower payments affordable. It is, however, doubtful that it can be used in its current state if FOVI wants to become a market-based organization and promoter of off-balance sheet securitization. Few would argue that fixing the issues described is an easy task. Fortunately, given the existence of simpler mortgage instruments, it may not be necessary.

THE PLAM REVISITED

Research has recently been undertaken to address these critical evaluations of the FOVI DIMS shortcomings. One of the more fruitful projects has been research into the development of a PLAM hybrid to replace the DIM. This section will detail the proposed instrument and examine its strengths and weaknesses vis-à-vis the needs of FOVI. It concludes that a carefully constructed PLAM is well-suited for a macroeconomic environment of moderate volatility and can overcome many of the DIMS weaknesses. That said, this section also concludes that no mortgage is robust enough to protect institutions, borrowers and investors from catastrophic macroeconomic crises.

Price-level adjusted financial instruments have been used successfully in a number of countries. For example, governments including the United States and Mexico have issued indexed debt and financial institutions in Chile and Colombia have originated price-level adjusted mortgages. The basic objective of a price-level adjusted instrument is the protection of yield from the effects of inflation. In the case of the PLAM, the goal is to protect the lender from deterioration in mortgage yield cause by inflation.

A standard PLAM addresses some of the shortcomings of a DIM. First, estimating yield is easy. In real terms, the yield is always the initial accrual rate on the loan. In addition, the PLAM is a fixed-term instrument; it fully amortizes in a fixed term. Second, forecasting complexity is reduced because only one index is used. Third, in real terms, cash flows are guaranteed to be level in real terms, thus eliminating the DIMS back-ended cash flow profile. Fourth, given its predictable cash flows, it is an easily securitizable instrument. Finally, the PLAM is an easier-to-understand instrument and one with which investors would, arguably, feel more comfortable.

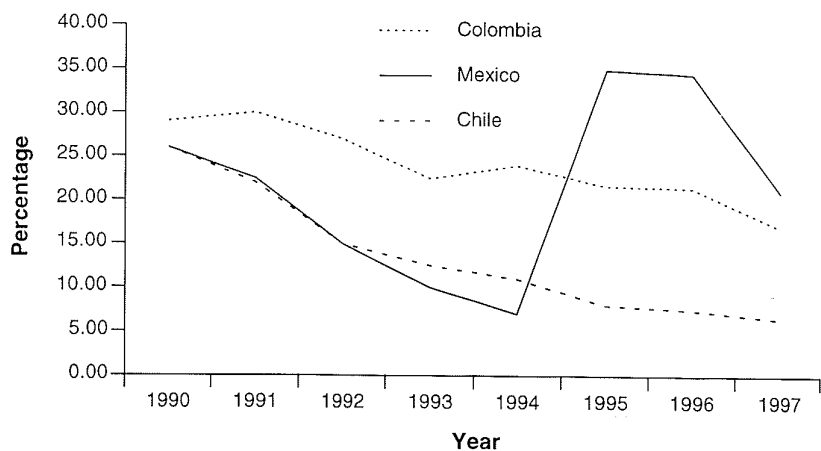
To date, PLAM affordability in Chile (with its UF or development units mortgage) and Colombia (with its UPAC mortgage) has not been an issue. Careful underwriting combined with gradually decreasing inflation (see Figure 5) has resulted in very stable mortgage portfolios.¹⁹ In contrast, a generic PLAM has not been the answer for Mexico. Its experience with inflation-indexed DIMS

(which are roughly similar to PLAMS) and its catastrophic experience with the UDI mortgage imply a need to build in "shock absorbers" to protect borrowers from sudden large increases in inflation.

To address the affordability issue, the World Bank team proposed a PLAM with a cap on the annual increase in a borrower's payment. This new instrument has been named the *capped PLAM* or *C-PLAM*.

The C-PLAM cap is defined as "the maximum inflation indexed percentage increase that a payment can increase in a prescribed amount of time."²⁰ In other words, while the instrument does not specifically protect against declining real wages, it acknowledges that it is important to give a borrower enough time to adjust to higher payments. An important feature of the payment cap is that it is determined by a real increase in the payment rather than a nominal increase. This feature ensures that the payment will not lag too far behind the required amortizing payment.

Figure 5. Annual Changes in Consumer Prices



Research into an appropriate cap amount and payment increase timing has not been completed. Preliminary analyses have used a 15%-20% real increase maximum in any 12 month period. The 12 month time period was chosen because most workers receive raises once a year.²¹ The payment cap is, in essence, a shock absorber for sudden increases in inflation which, with a traditional PLAM, might lead to payment shock and default.

In the current FOVI DIM, borrower payments are protected whether or not they need it. A worker's payment is indexed to the minimum wage index even if his wages increase at a faster rate. A key characteristic of the C-PLAM is that the cap is only used when the borrower actually needs it. The payment cap can be set to kick in for any level of payment increase. It can be set high, to protect only against catastrophic increases or at any other level that has been determined appropriate for the specific borrower cohort to which the institution lends. It is important to point out that the higher the cap rate, the more risk the borrower will share with the lending institution. This is a different lending philosophy than the one currently employed by FOVI which, at least implicitly, lets the borrower bear little to no risk.

If a C-PLAM mortgage hits a payment cap, the resulting payment will be insufficient to fully amortize the loan. In order to ensure complete amortization and a constant real yield, the missing portion of the payment must come from some source other than the borrower (particularly if the lender needs cash to meet funding obligations). To address this, the World Bank team has proposed implementing an insurance fund that would make up any payment shortfall in the event of payment cap.

An insurance fund could be capitalized initially by FOVI or the Mexican government. In addition, borrowers would be required to pay

a premium which would be added into the monthly mortgage payment. In the event that a cap is hit, the fund would automatically cover any payment shortfall. Significant over payments into the fund could either be returned to the borrower, used to subsidize low-income borrowers or remain in the fund.

Preliminary Monte Carlo simulation analyses have shown that the required insurance premium ranges from 0.3%-1.21% per month, for various macroeconomic scenarios of low to moderate inflation with low to moderate volatility. Simulation analyses have also demonstrated that given various macroeconomic scenarios in which history basically repeats itself, the required premium would require a 10 percentage point increase in the monthly rate that the borrower is charged. In other words, mortgage lending simply cannot survive in a country with severe long-term macroeconomic instability.

Finally, the insurance fund can be used as a flexible tool for low-income lending. For example, depending on the income level of the borrower, the insurance premium can be discounted, with the government making up the difference.

Figure 6 demonstrates the responsiveness of the C-PLAM and the DIM to macroeconomic shocks and recovery. The inflation forecast that generated this graph uses the historical inflation and wage time series of Mexico from 1991-1997, after which it assumes a gradually recovering economy with positive real wage growth after the year 2001.

The DIM instrument assumes the standard FOVI parameters but with a 180-month term. The C-PLAM assumes an implicit starting accrual rate of 10% with the balance indexed to inflation and a maximum real payment increase of 15% within any 12 month period.

Through the inflationary period the C-PLAM offers almost the same borrower payment

protection as the DIM. During the recovery period, beginning in about month 60, the C-PLAM payment rises to a level higher than the DIM and remains higher for the remainder of the loan. The C-PLAM is responsive to shocks, particularly in the critical early years of the mortgages.

Because the C-PLAM cap is indexed as a percent of inflation, the responsiveness of the mortgage in later years reduces slightly. This feature helps to ensure that the borrower payments will increase as the loan matures. Nominal yields on the mortgage cash flows are: C-PLAM 21.63% and DIM 19.77%. An uncapped PLAM with the same parameters as the C-PLAM would generate a yield of 23.03% or 140 basis points higher than the C-PLAM. The additional yield would be provided by the insurance fund.

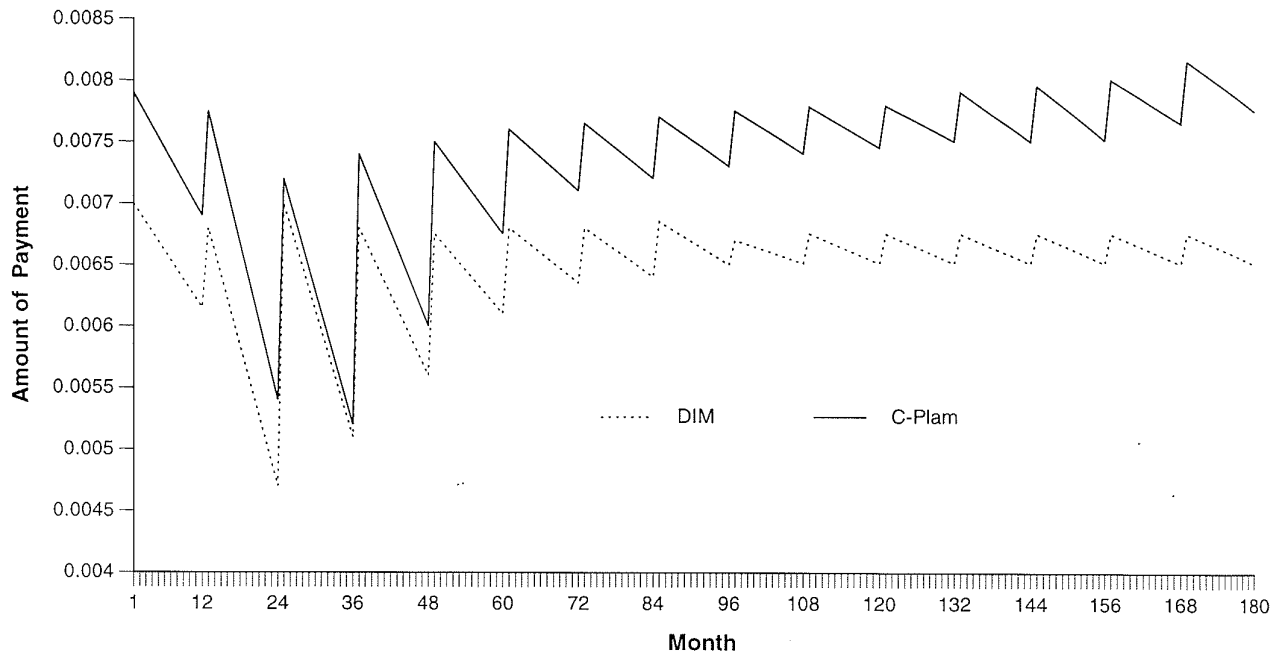
CONCLUSION

The current state of the Mexican housing finance sector is primarily a function of a highly volatile economy. Throughout the 1980s and 1990s Mexico suffered repeated financial crises that made mortgage lending a dangerous business for commercial banks, and an extremely expensive endeavor for many borrowers. While numerous attempts have been made to address the issue of borrower affordability, efforts at balancing it with the financial needs of the lending institutions have been largely unsuccessful.

Mortgage design is, in large part, responsible for this situation. To date, none of the institutions have been successful in coming up with an instrument that is flexible enough to maintain a sufficient yield while minimizing the probability of borrower payment shock and subsequent default. Development of such an instrument is critical if the Mexican housing finance sector is to be restarted.

Given its position in the housing finance system, development of a new mortgage in-

Figure 6. Comparison of Borrower Payments



strument is particularly critical for FOVI, which stands to become a major non-subsidized housing institution in Mexico. It will, however, have a difficult time if it continues to originate dual-indexed mortgages. In the coming years FOVI will find it necessary to rely on the market for its funding. One way to tap these resources is to offer a security that is desirable to institutional investors. The DIM in Mexico cannot be structured in a way that is appealing to investors. It is therefore paramount that FOVI implements an alternative.

This paper has argued that, in the absence of catastrophic financial crises, it is possible to create a mortgage instrument that will work in an unstable economic environment. The mortgage proposed in the paper, the

capped PLAM, if managed properly, can overcome the limitations of the DIM by providing both payment shock protection for the borrower as well as predictable and level cash flows for the institution. In contrast to the DIM, which generates very unpredictable and back-ended cash flows, the C-PLAM's cash flow profile implies that the instrument can be the basis for securitization in Mexico.

NOTES

¹ For more complete historical overviews see: Michael J. Lea, "Restarting Housing Finance in Mexico," *Housing Finance International* Vol. XI, No. 2, December 1996; S. Bernstein, M. Lea and B. Renaud, "Mexico's Housing Finance System 1991-

96, Privatization in an Unstable Environment," paper presented at the AREUEA International Real Estate Conference, Berkeley, June 1997; Manual T. Campos Spoor, "Broadening Access for More Affordable Housing: Challenges and Opportunities in Mexico," *Housing Finance International*, Vol. XII, No. 2, December 1997.

² Assumes a DIM with payments indexed to the salario mínimo, balance indexed to 28-day Cetes + 10%. Historical wage and interest rate series used.

³ Not all mortgages were renegotiated.

⁴ The renegotiated reduction in the borrower balance addressed primarily the negative amortization.

⁵ It is important to note that the commercial bank default rate was also caused in part by poor underwriting and poor servicing.

⁶ As of June 1998 none of the commercial banks had resumed any substantial amount of mortgage lending.

⁷ Until 1997 Mexican banks reported defaults in terms of proportion of missed payments. This graph represents this type of account. After 1996 banks began reporting defaults as is done in the United States in which the entire balance of the loan is written-off after it becomes 90+ days delinquent.

⁸ Default also contained a large moral hazard component. Many borrowers quit paying their mortgages because there was little danger in doing so; banks simply did not pursue foreclosure.

⁹ Relative to other low-income housing programs, FOVI embeds only moderate levels of subsidies in its mortgage products. Subsidies include below-market rates, end-of-term balance forgiveness and underpriced-mortgage-loss protection for lenders. For more on subsidies in Mexican housing finance, see Bernstein, Lea and Renaud 1997.

¹⁰ For a good review, see Leon Kendall and Michael Fishman, *A Primer of Securitization*, 1996, MIT Press.

¹¹ For a description of the basic DIM design, see the article by Chiquier in this issue of the journal.

¹² Both commercial banks and mortgage banks (SOFOLAS) are authorized FOVI lenders. While commercial banks continue to service their existing portfolios, since 1997 only the SOFOLES have actively originated FOVI mortgages.

¹³ The average real accrual rate for the 1991-1995 period was approximately 8%.

¹⁴ Unverified reports put default rates of FOVI mortgages held by commercial banks at approximately 24%. While this is lower than the default rate on the non-FOVI portfolios, it is still very high. This situation is most likely due to poor servicing of these portfolios.

¹⁵ For example, a N\$100,000 loan would have an initial payment of N\$700.

¹⁶ This remaining amount, discounted back at the current opportunity cost of capital, can be viewed as an implicit mortgage subsidy to the borrower.

¹⁷ The minimum wage, rather than being a true reflection of wages, is often viewed more as a politically motivated index.

¹⁸ This effect was partly demonstrated in Michael Lea and Steven Bernstein, "Housing Finance in an Inflationary Economy: The Experience of Mexico," *Journal of Housing Economics*, No. 5, 1996.

¹⁹ For a review of the Chilean mortgage market, see Andrés Sanfuentes, "Development of the Market for Mortgage Loans in Chile," *Housing Finance International* Vol. XI, No. 2, December 1996. For a review of the Colombian mortgage market, see Guillermo Gomez, "The Mortgage Business in Colombia," *Housing Finance International* Vol. XI, No. 2, December 1996.

²⁰ The actual cap index can be adjusted at levels less than inflation. For example, the cap can be adjusted by some percent of inflation or even by a wage index. Obviously, not indexing the cap fully to inflation will, in some cases, result in the need for a higher insurance premium. The analyses in this appendix assume that the cap is indexed fully to inflation.

²¹ Analyses have also been performed using a six-month time frame. From a financial standpoint this results in a better instrument. It is, however, unclear if the average worker can safely adjust to bi-annual increases in his or her mortgage.