HOUSING MARKETS: MEXICO

by

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Submitted to the Center for Real Estate in Partial Fulfillment of the Requirements for the Degree of

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ABSTRACT

What, When and Where to Develop? The purpose of this study is to help find the major areas of opportunity for housing development and production in Mexico. The thesis intends to help developers in their eternal quest for the right product, location and timing. The answer to these questions will not only help developers with decision making regarding housing projects, but will be helpful to the industry as a whole. It will help lending institutions determine which projects to finance and will be a valuable tool for local and federal governments in determining which cities and income levels or housing products need higher government subsidy or support.

The number of housing units sold in Mexico in the last decade has almost quadrupled, yet market forecasts generated by institutions and developers seem negligible. A greater effort to assess the housing demand and deficit has been made by private institutions and government entities which finance most housing sales in the country, while developers seem only to go as far as is necessary to secure financing for their respective projects.

This study provides an outlook of the housing markets in Mexico and includes an analysis of what is currently being done to measure and forecast housing demand. The thesis concludes with rigorous economics analysis intended to forecast markets through a Vector Autoregression (VAR) Model. The model uses 15 years of historical data on housing prices, inventories and sales with economic and demographic variables to create forecasts for seven cities representing each of the seven regions the country was segmented into for the study.

Thesis Supervisor: William C. Wheaton
Title: Professor of Economics

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TABLE OF CONTENTS

TABLE OF FIGURES

INTRODUCTION

The thesis topic was born of an interest in answering housing developers' three critical questions: what, when and where is it best to develop? In other words, I am hopeful that the conclusions drawn from research detailed herein will help developers in their efforts to target the right locations, products, and timing for housing development in Mexico.

In the last decade the number of housing mortgage loans has more than tripled. Driven by a growing supply of mortgage financing from 1998 to 2008 the number of new housing sales has, correspondingly, almost quadrupled and the sales value is up approximately 8.3 fold in real terms over the same period. According to Softec's research, the robust housing market offers developers attractive opportunities, with returns averaging nearly 20%, but where it is still possible to find projects yielding returns on capital in excess of 50% and margins, before taxes, above 15%.

Though the housing industry in Mexico has performed well, signs of oversupply are apparent. Changing supply and demand fundamentals suggest that investors must thoroughly underwrite and evaluate each market they wish to enter: "the myth of the Mexican Housing Shortage has made many unwary developers enter markets that do not have depth or duration"[1].

Little formal study has been conducted to determine methods for measuring housing demand. Completed studies are often limited to an analysis of the mortgage supply as predictive of housing demand. This thesis is intended to illustrate a new, alternative analytical process by which to measure and forecast Mexican housing markets.

The study first provides readers with an outlook on the Mexican housing system, followed by an assessment of current market conditions. Chapter three details current practices undertaken to

[1] "Mexican Housing Overview 2008," Softec, S.C., January 2008.

measure and forecast housing demand and the final chapter highlights an original econometric approach to forecasting using a multivariate vector autoregression (VAR) Model.

The VAR model is used to analyze 15 years of historical housing price, inventory and sales data, together with economic and demographic variables. The model establishes a framework within which to develop forecasts for seven Mexican cities representing each of 7 distinct regions of the country.

CHAPTER 1:
HOUSING SYSTEM

NATIONAL/MACRO OUTLOOK

Over the past decade Mexico's economic environment has improved significantly, mainly due to improving macroeconomic fundamentals, including diminishing inflation rates, increased Gross Domestic Product (GDP) and low unemployment rates. Each contributed to improved investor confidence and morale, and to reduced economic volatility in the country.

After the 1994/1995 crisis, GDP recovered and has continued growing, in real terms, with GDP per Capita also growing at a slightly slower pace.

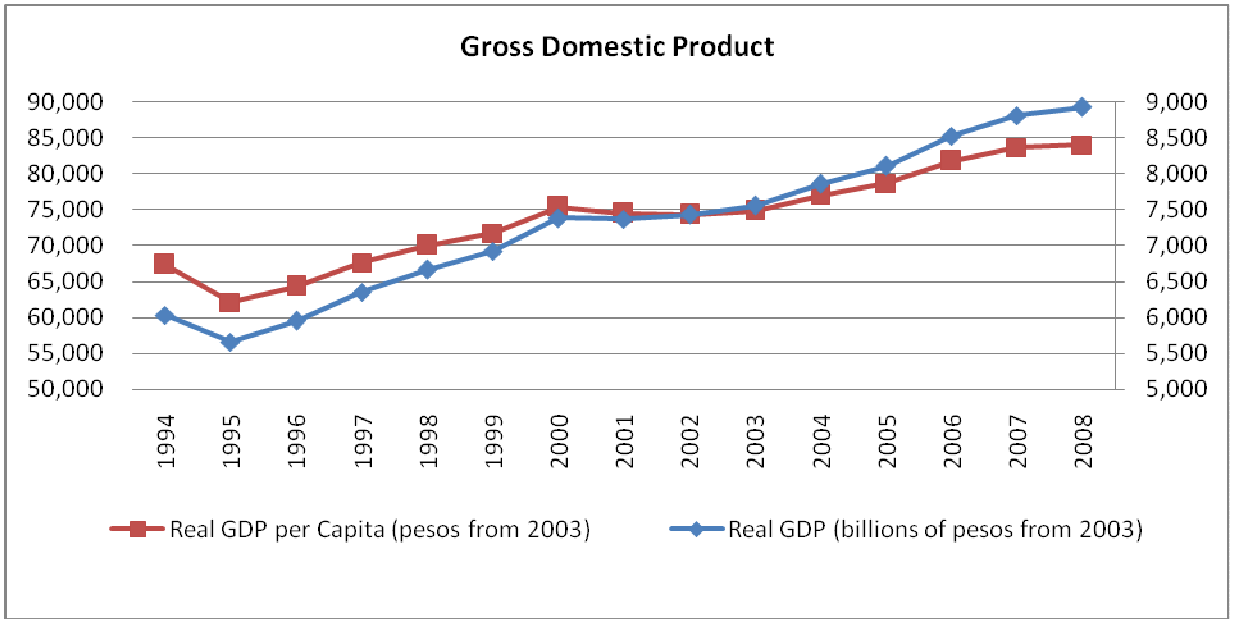


Figure 1: Gross Domestic Product

With the exception of 2001, when the country experienced limited growth, Real GDP and GDP per Capita have demonstrated positive growth each year since 1995.

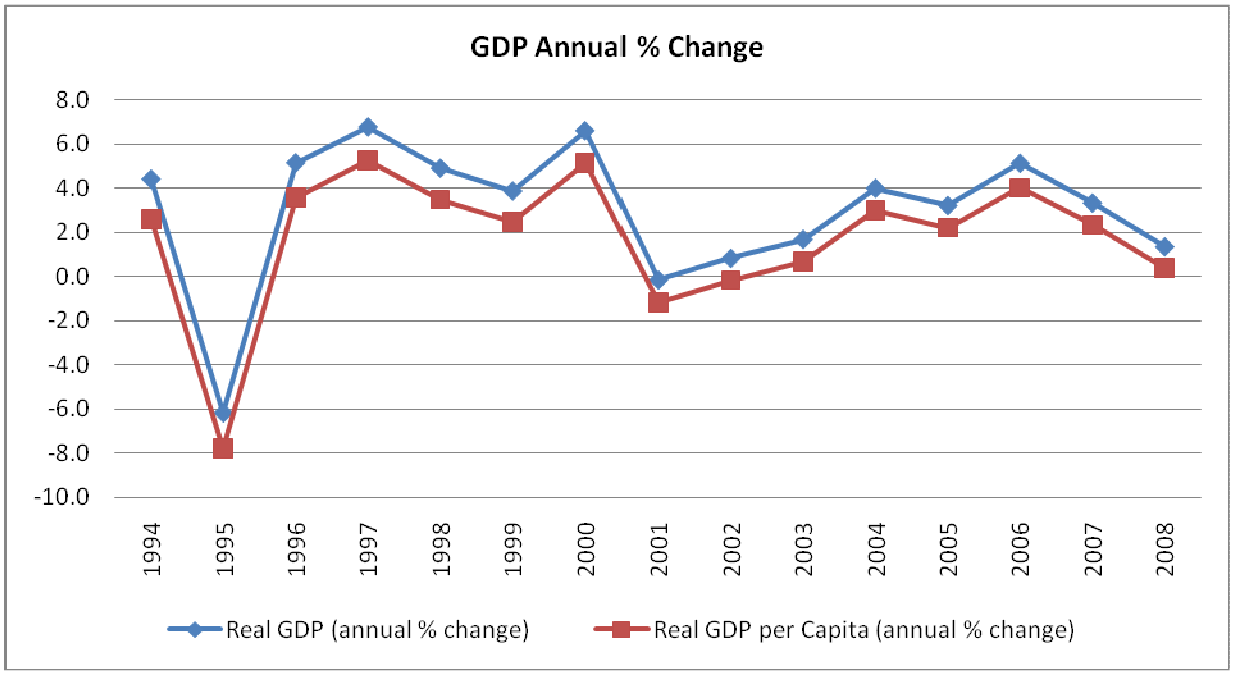


Figure 2: GDP Annual Percentage Change

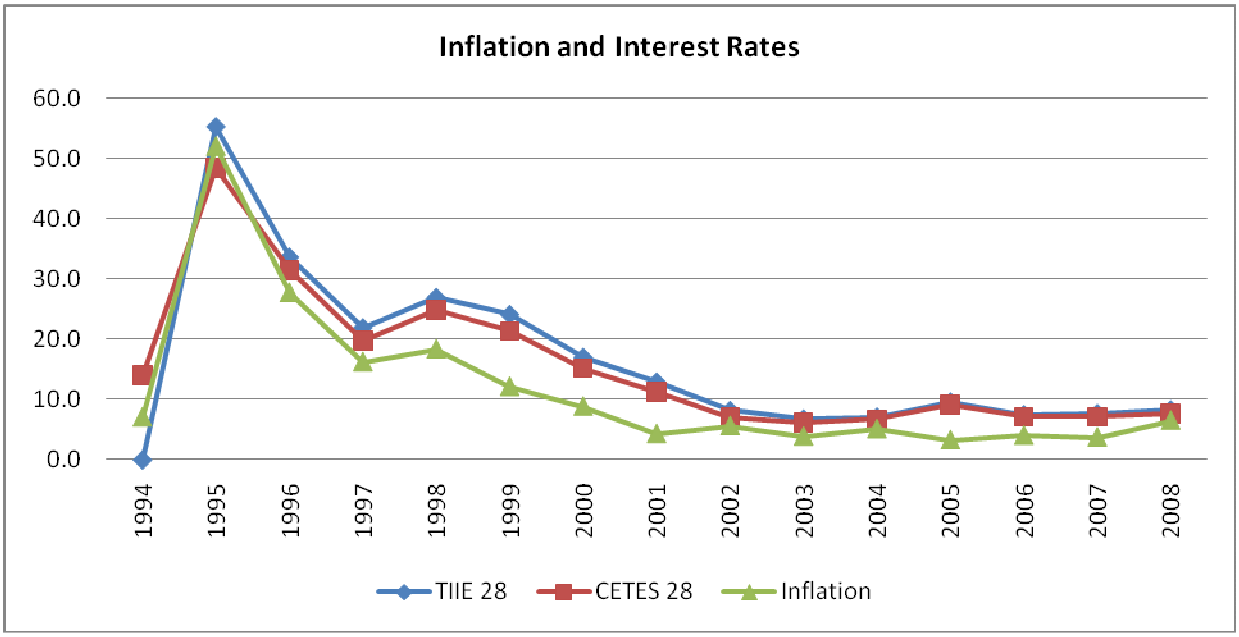
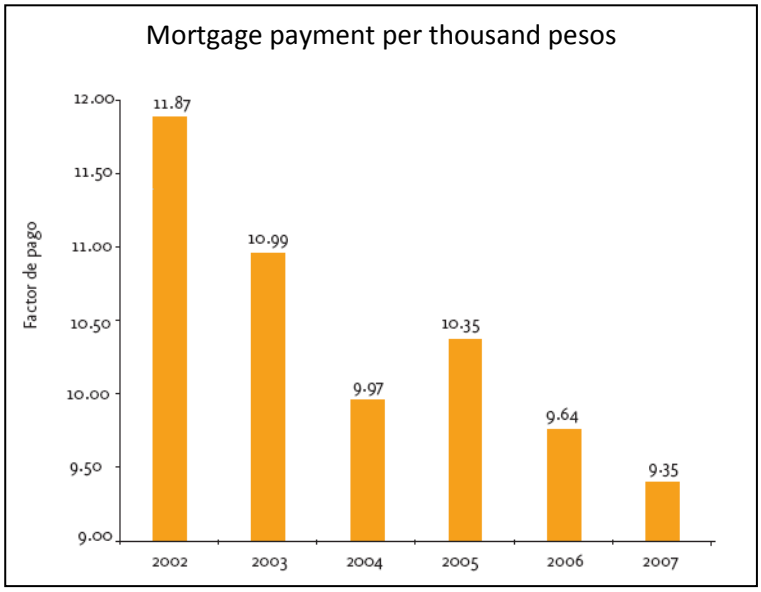


Figure 3: Inflation and Interest Rate

After reaching a high of 52% in 1995, inflation dropped back to the single digits in 2000, where it remained for most of the last decade. It is important to note, however, that inflation peaked above

expectations at the end of 2008 at 6.2%. In response, the Central Bank seeks to decrease inflation in 2009 to approximately 3.5%.

In addition to inflation, interest rates dropped into single digits in late 2001 after peaking at 75% in April of 1995 (CETES 28). Interest rates are expected to close 2009 at 5.4% (see Exhibit A). Diminishing interest rates and lower intermediation margins reflected in lower mortgage payments and increased purchasing power for homebuyers.



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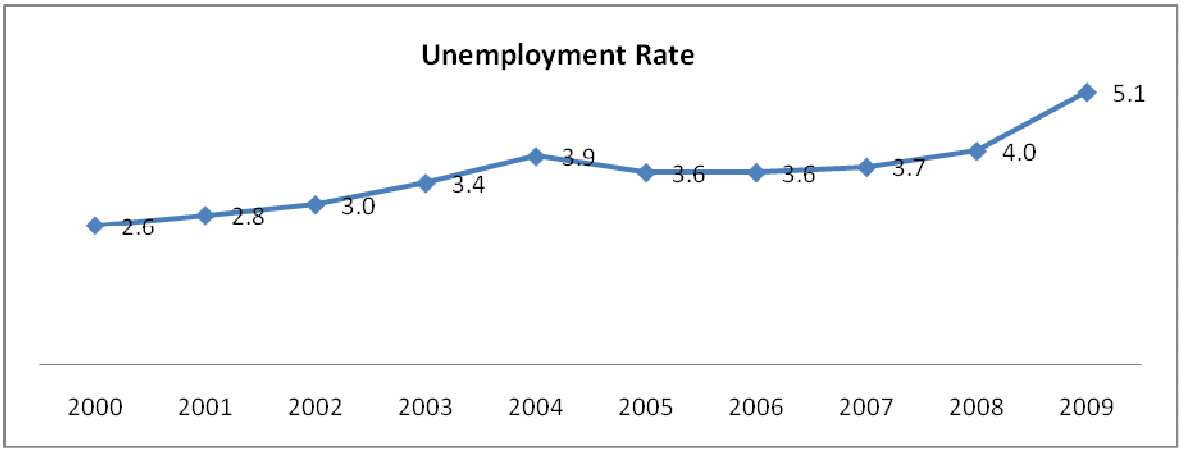


Figure 4: Unemployment Rate

Improving macroeconomic conditions with less expensive mortgage financing, single digit unemployment rates and a drop in mortgage delinquency rates (from 33% in 1998 to a low 3.4% in 2008), generated the needed environment for housing financing.

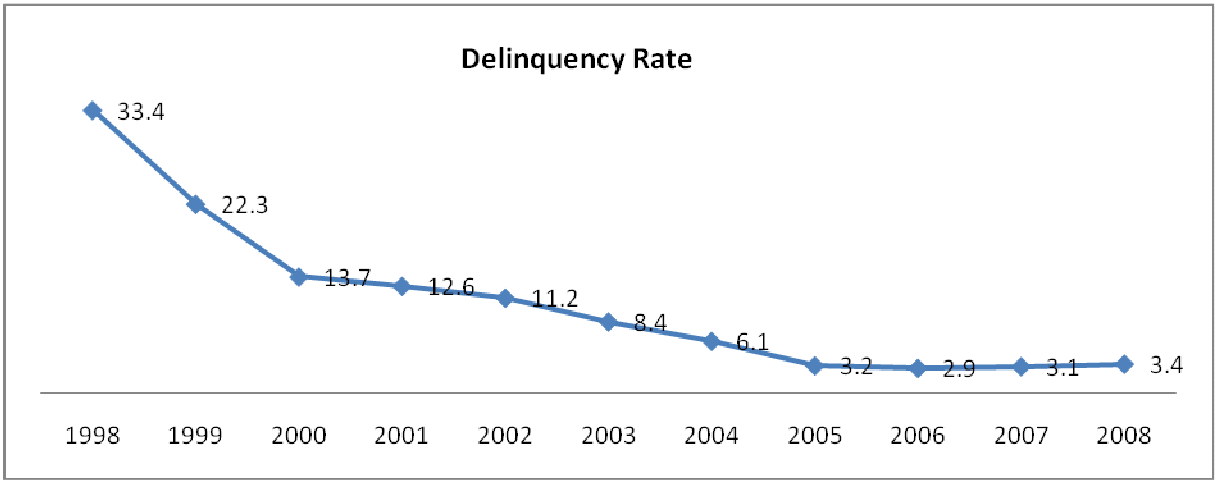


Figure 5: Delinquency Rate

HOUSING FINANCING

After the collapse of Mexico's economy in the 1994/1995 crisis banks halted mortgage lending. As a result, over the balance of the 1990s housing financing was primarily supplied by public entities and SOFOLES. In the early 2000s private banks re-initiated mortgage lending but found themselves at a marked disadvantage to SOFOLES. In an effort to regain market share many mergers and acquisitions took place, including the acquisition of Hipotecaria Nacional by BBVA Bancomer. Hipotecaria Nacional, the largest private mortgage lender at the time, now operates as Bancomer's mortgage arm and continues to maintain a position as Mexico's leading private mortgage lender.

The supply of mortgage financing has driven the housing markets. "Historically, there was an endemic scarcity of funds for mortgage lending, often more than market and demand variables, this variable has defined the size and purchasing power of the market"[2].

[2] "Mexican Housing Overview 2008," Softec, S.C., January 2008.

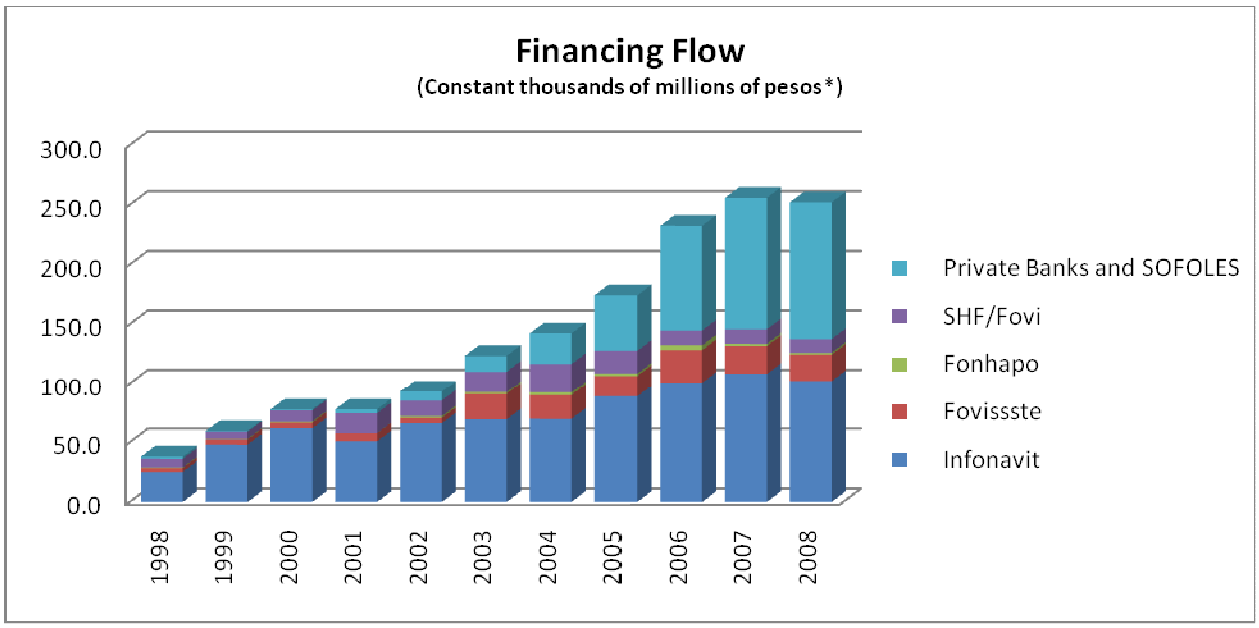
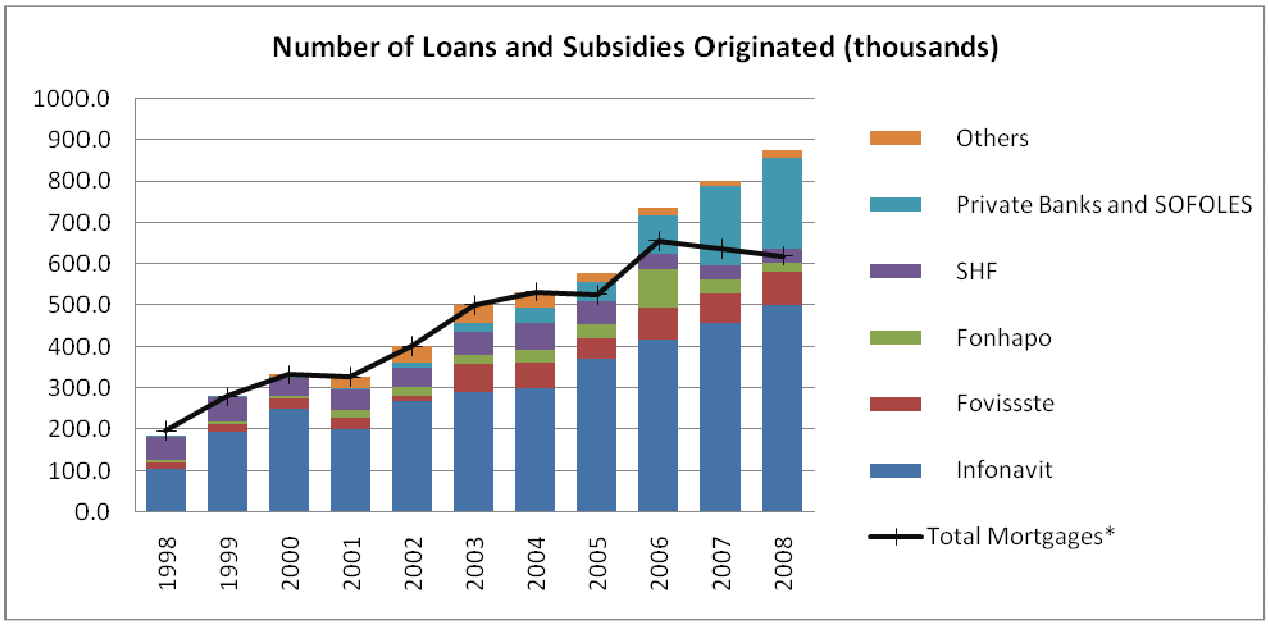


Figure 6: Financing Flow

The main players of the mortgage market are:

- INFONAVIT - Mandatory mutual savings and mortgage lending system for private sector employees. Has an aggressive mortgage origination program that is aimed mainly at lower income employees.
- FOVISSSTE - Mandatory mutual savings and mortgage lending system for government employees and teachers.
- SHF - National development bank that facilitates the availability of mortgage financing.
- FONHAPO - Federal program to provide housing to low income families.
- CONAVI - Coordinates housing policy efforts at all government levels with the housing industry, and facilitates the largest subsidy program for affordable housing instituted by the federal government.
- SOFOLES - Private specialized mortgage lenders that receive funding, originate and package mortgages, and sell packages as mortgaged backed securities (MBS) to either third parties or Sociedad Hipotecaria Federal (SHF).



* Total mortgages originated deducting the loans or subsidies counted by more than one institution

Figure 7: Number of Loans and Subsidies Originated

In the last decade the number of housing mortgage loans has more than tripled, with an aggressive government housing plan increasing the number of loans originated from 196,300 in 1998 to 655,500 in 2006. More specifically, each Infonavit and Fovissste quintupled the number of loans provided over the same 10 year period. Infonavit currently accounts for almost 57% of all new loans originated and up to 40% of the debt originated. Fovissste is responsible for 9% of new loans and debt originated.

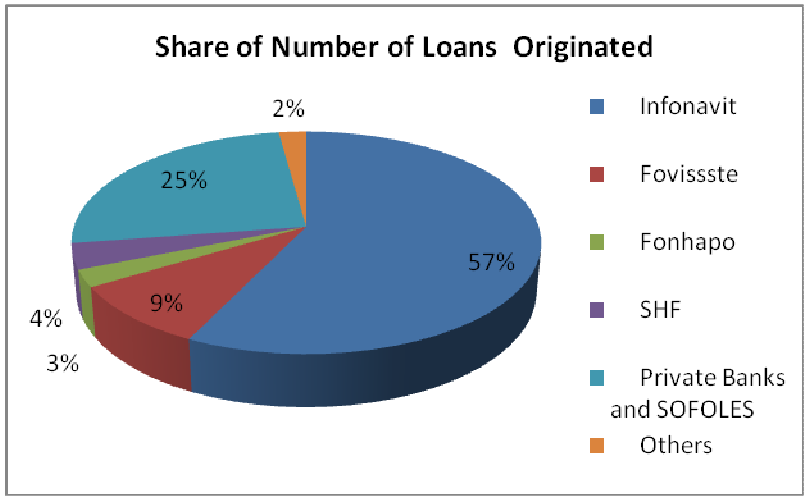


Figure 8: Share of Number of Loans Originated

Private lending has gained market share throughout the decade and although it only accounts for 25% of the number of loans originated, it accounts for up to 45% of the total debt originated. This is largely because banks focus lending efforts on medium and high income families to which they can offer additional banking services and larger loan amounts. Contrastingly public entities and government programs typically focus on low income families (affordable housing). Recently, however, Infonavit's aggressive program initiatives and successful fundraising through the use of Residential Mortgaged Backed Securities (RMBS) have led the institute to implement alternative programs intended to help originate loans for medium income families.

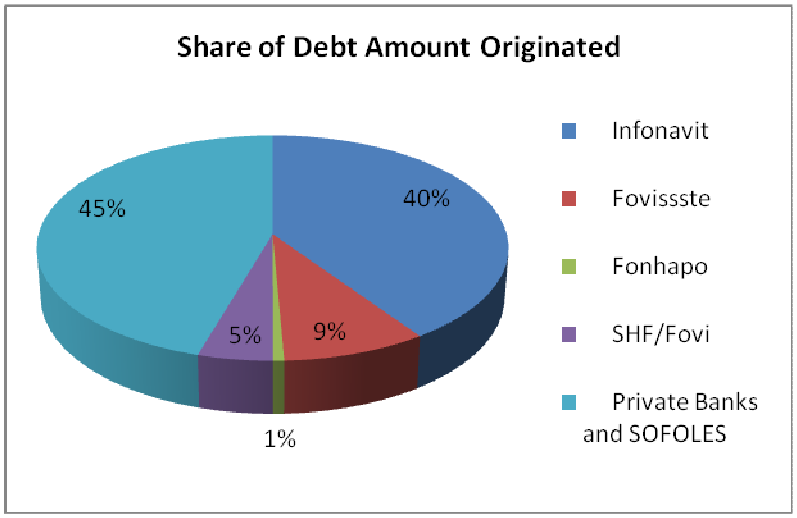


Figure 9: Share of Debt Amount Originated

HOUSING MARKETS

Driven by the supply of mortgage financing in the last decade (1998-2008) the number of housing sales has nearly quadrupled, with an increase in sales volume of approximately 730%, in real terms. After the crisis during the mid 1990s, and up until 1999, the overall average home price dropped by 48%. However, with the return of private banks to the mortgage markets, prices bounced back and reached 1994 levels by 2007. Prices continued to increase and in 2009 are currently 30% above those from 1994. The shift in average home prices responds to the mix of residential products that make up the hosing sales volume. After the economic crisis average prices dropped because of a higher share of affordable housing in the sales volume. With the return of the private banks, high end residential products

represent a more substantial share of the overall sales volume, increasing the average home sale prices. The next section illustrates an analysis of the housing market by product type.

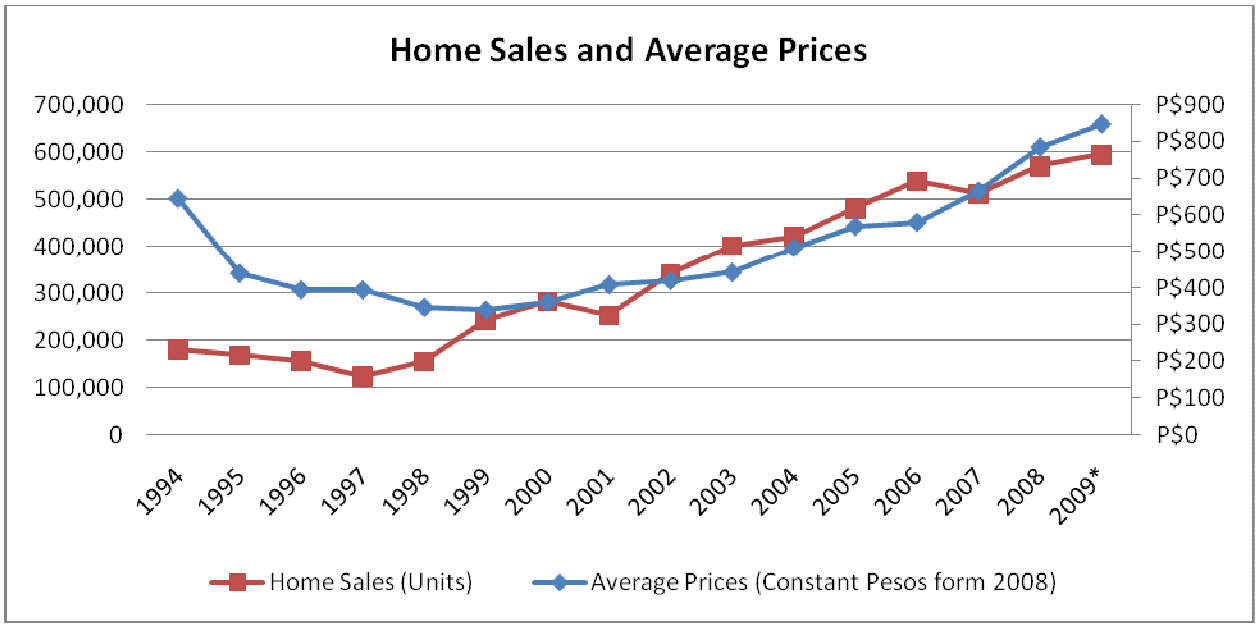


Figure 10: Home Sales and Average Prices

Source: Data from Softec

The trends in average home sizes and prices per square meter also reflect the change in the sales mix. The average house size and price per square meter drop when there's a higher share of smaller affordable homes trading in the for–sale market. Correspondingly, both house size and average price per square meter rise when bigger expensive residential products increase their share of the sales mix.

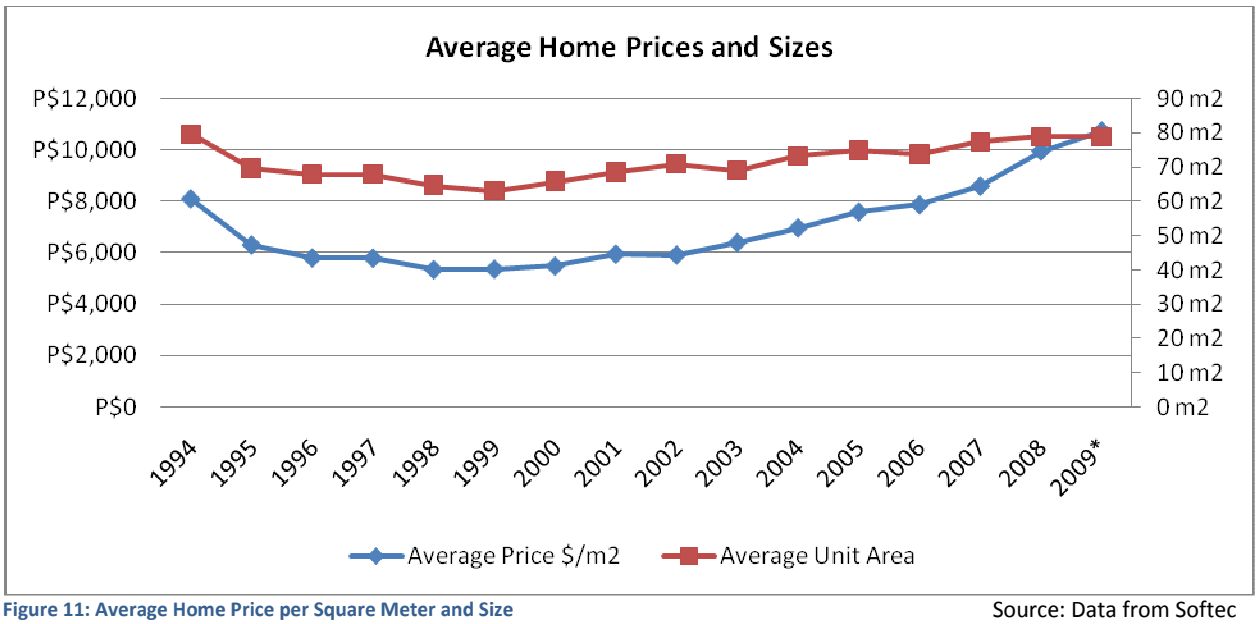


Figure 11: Average Home Price per Square Meter and Size

Source: Data from Softec

New job creation has decelerated with formal employment growth rate measured at 0.1%[3] as of the end of 2008. The risk of a rising unemployment rate and a significant contraction in consumption could impact the demand for housing, making it difficult for mortgage lenders to achieve allocation goals despite their financing capabilities. With strong fundamentals, a housing deficit estimated at 4.5 million houses and annual demand estimated at 1 million new houses[4], the continuous flow of mortgage and construction lending remain critical to the avoidance of a contraction of the housing sector.

Besides the housing deficit, for which estimates are varied, a steady annual population growth of 1.0% and the declining number of occupants per home, from 4.3 in 2000 to 4.0 in 2005, implying an additional 1.5% growth in housing demand, suggest an annual housing growth potential of 2.5% of the stock. The actual housing stock grew an average 2.1% over the same period[5]. Current housing development rate remains below 2.5% of total housing stock, however market participants must be careful not to overbuild. As development rate rises above new household formation the additional housing would be eating up on the difficult to measure housing deficit, which is highly concentrated in the lowest end of the income stratus.

MARKET SEGMENTATION

The housing market can be segmented by price ranges into the following product types:

Segment	Price Range*	Income Level
Social	Up to 250	Affordable Entry Level
Economica	250 - 480	Affordable Entry Level
Media	480 - 1,200	Middle Income
Residencial	1,200 - 2,700	Residential
Residencial Plus	2,700 and up	Residential Plus

* Thousands of pesos

Figure 12: Market Segmentation

[3] See Exhibit A
[4] Cano, Ariel. (February 2009). Director, CONAVI (Housing National Commission). NYC: "Mexico's Housing Day".
[5] Data from INEGI (National Institute of Statistics and Geography). *Population and Housing Census.*

After the 1994/1995 crisis, home sales dropped and private banks abandoned the mortgage market. With their return to the mortgage market coupled with solid macroeconomic conditions, sales have experience a booming growth. We can clearly notice the effects of the exit and re-entry of the private banks on the volume of sales of expensive residential products (Media and up). In 2008 such product sales accounted for 71% of the volume of sales.

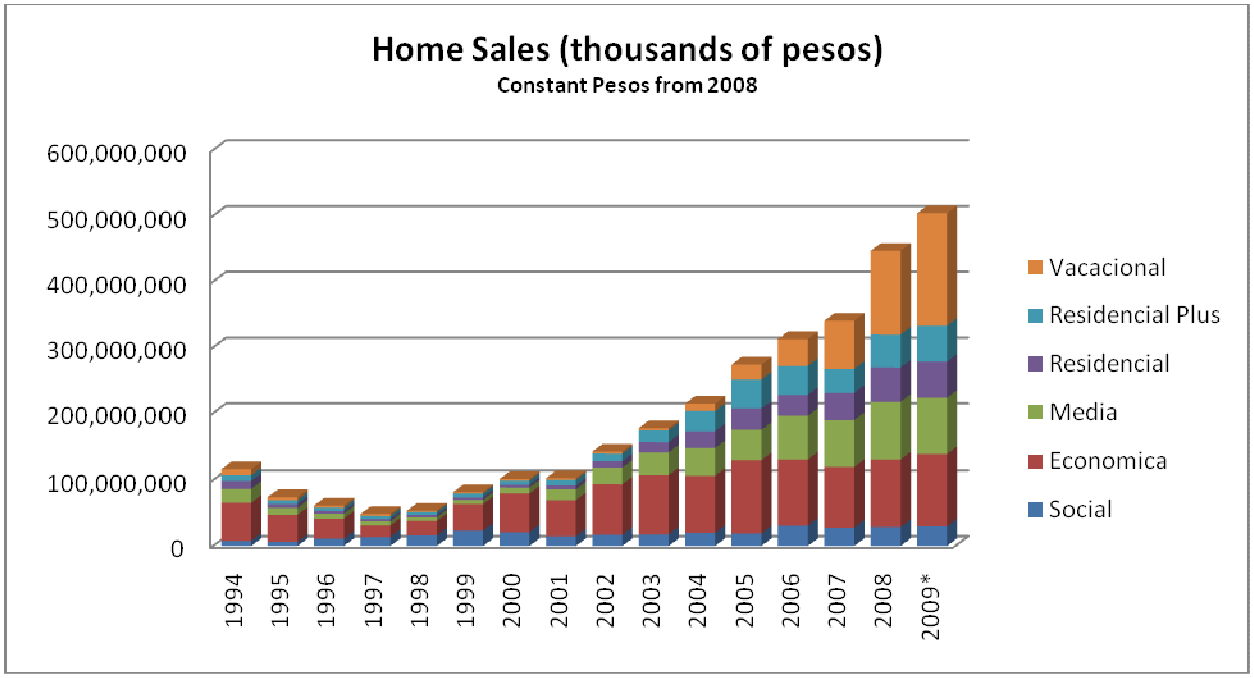


Figure 13: Home Sales

Source: Data from Softec

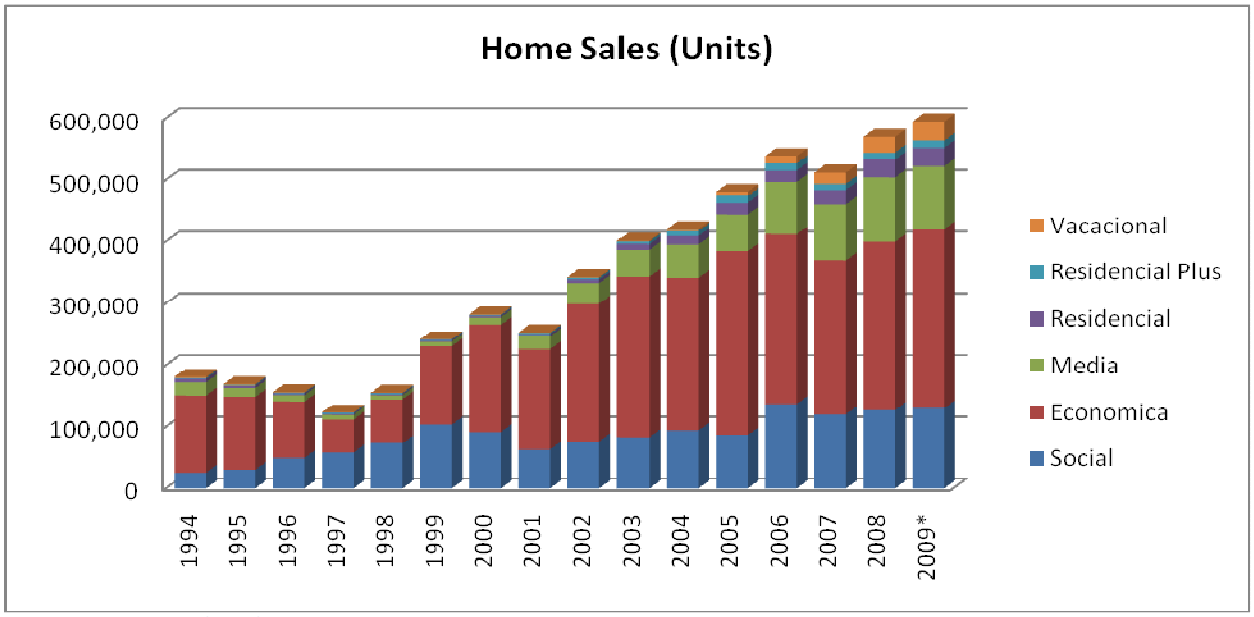


Figure 14: Home Sales (Units)

Source: Data from Softec

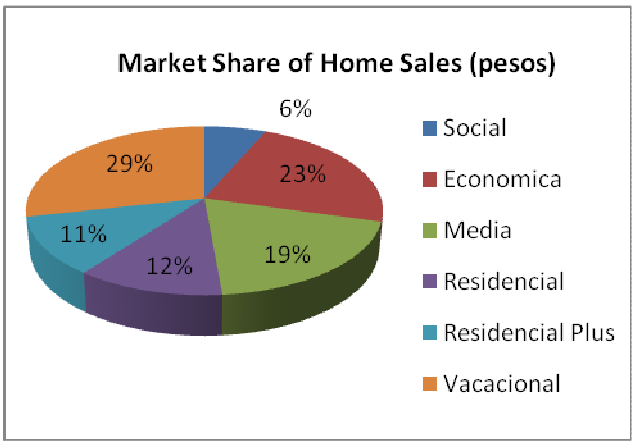


Figure 15: Market Share of Home Sales

Although most of the sales volume is made up by the higher income segments, the housing market has responded well to the government's aggressive housing program and support, focused mainly on affordable housing (Social and Economica). Affordable housing, which made up 29% of the sales volume and accounted for 70% of the total number of units sold in 2008.

As mentioned in the previous section, the average home sales price has shifted over time, reflecting the change in the product mix in the sales volume. But with a small field for speculation because most of the loans are aimed at first time homebuyers, when we look at real home prices by segment, prices are still below 1994 ranges for all segments.

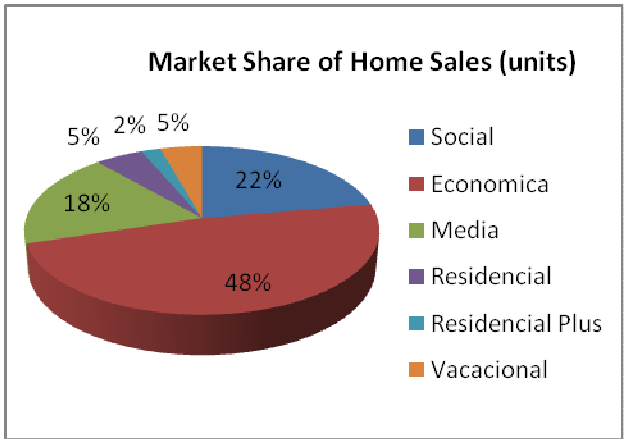


Figure 17: Market Share of Home Sales (Units)

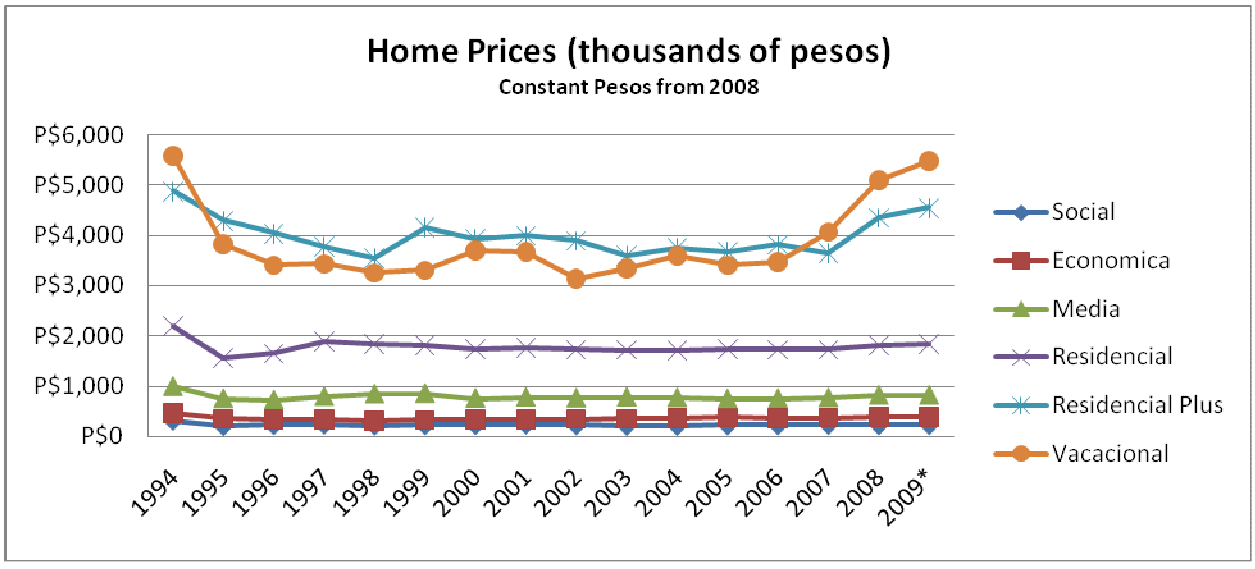


Figure 16: Home Prices by Segment

Source: Data from Softec

Following the 1995 crisis, prices in most segments of the market remained flat with high-end residential products (Residential Plus and Vacional) climbing closer to 1994 levels. That said, despite a 2008 price increase of 22%, product prices for this residential product is still 10% below 1994 levels. The most affordable housing (Social), due to price restrictions and ceilings instituted by public entities and regulation, is still 27% below 1994 levels, and has seen no price change since 1996. All other segments show a steady annual growth of less than 1%, and remain 18% below 1994 prices.

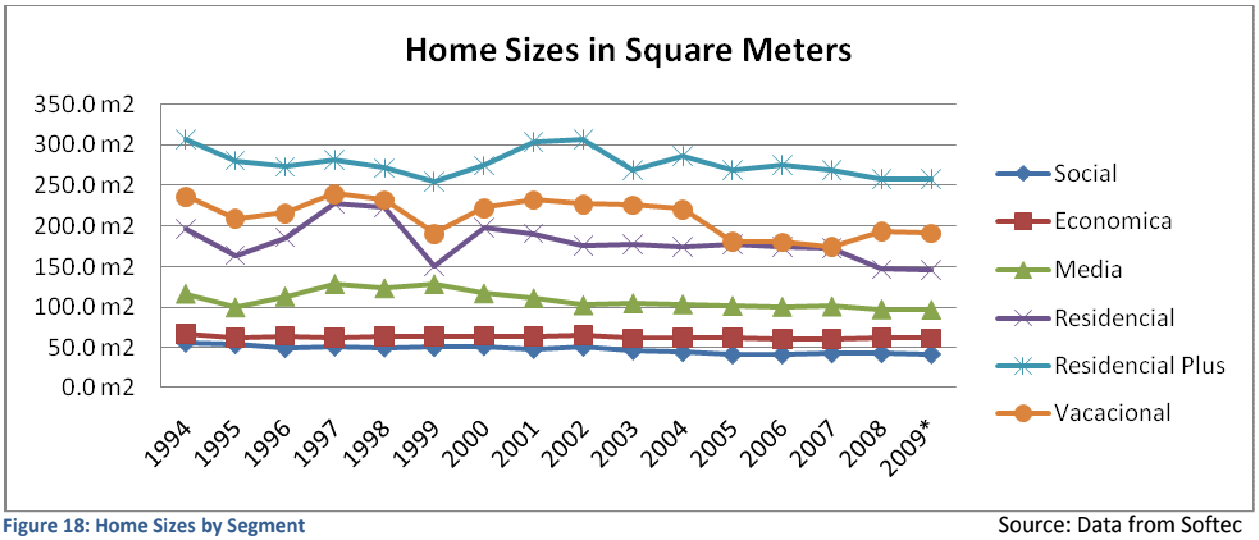


Figure 18: Home Sizes by Segment Source: Data from Softec

As seen in Figure 11 the average home size and price per square meter have also shifted according to the change in the sales mix. But the average home size by segment has been decreasing over time.

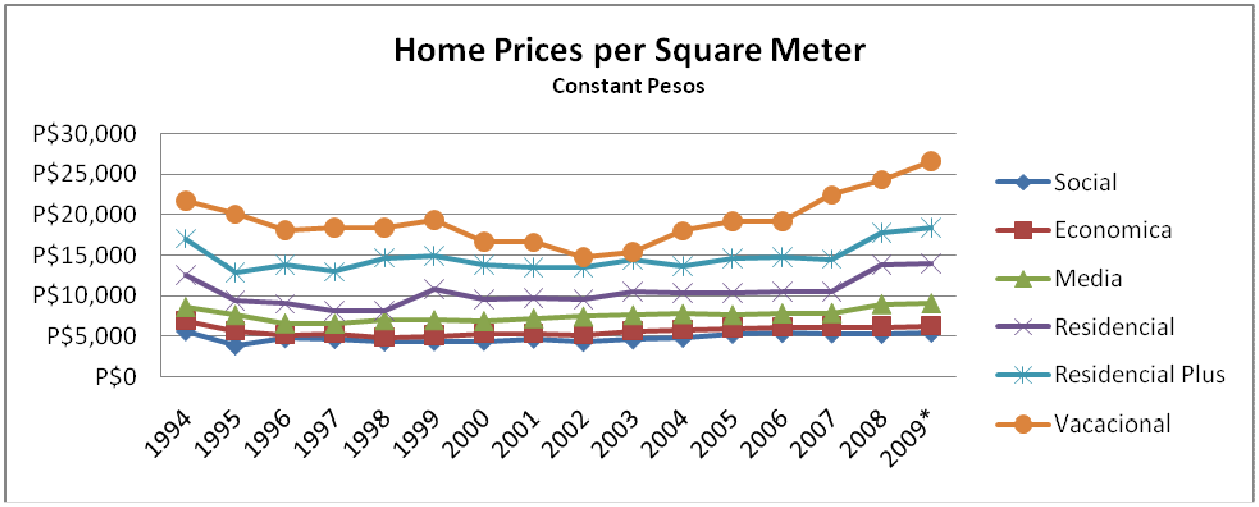


Figure 19: Home Prices per Square Meter by Segment Source: Data from Softec

The slight decrease in home size, together with flat home prices for most segments, has resulted in an increase in actual home prices on a per square meter basis. The high-end residential products that have experienced an increase in average home prices in the recent past, have also experienced an even higher increase in average prices per square meter. With the 2008 price increments, most segments, with the exception of the affordable entry level (Social and Economica), reached prices per square meter that exceed 1994 levels.

CHAPTER 2:
CURRENT HOUSING SITUATION

ONGOING CRISIS

Mexico's economy has slowed because of the country's close links with the U.S. economy (Figure 20), but finds itself in a much better position now than just 10 years ago. With strong policy frameworks and balance sheets, the economy is better positioned to absorb external shocks with the opportunity to implement policies to offset the impact of the current economic downturn[6].

Figure 20: Mexico Vs United States Production

As demonstrated by the behavior of the stock markets in previous economic crisis (1995, 1998 and 2002) Mexico like other Latin American countries, recovered rapidly after hitting bottom. Markets rallied aggressively rather than first stabilizing and then staging a rally (See Figure 21).

[6] Negrete, Sergio. (March 2009). *Global Crisis Weighs on Outlook for Mexico*. IMF Survey Magazine.

Crisis: Peak to Trough performance

	MSCI LatAm			MSCI Brazil			MSCI Mexico		
	Peak	Trough	%	Peak	Trough	%	Peak	Trough	%
Sep 94 - Mar 95	1,154	518	-55.1	876	382	-56.4	1,964	551	-71.9
Mar 98 - Sep 98	1,169	522	-55.3	1,076	414	-61.5	1,546	723	-53.2
Apr 02 - Oct 02	961	551	-42.7	655	279	-57.4	2,029	1,354	-33.3
Apr 08 - Oct 08	5,195	2,503	-51.8	4,728	2,021	-57.2	6,559	3,949	-39.8

Source: Bloomberg and UBS Pactual

Crisis: Trough to 3-month peak performance

	MSCI LatAm			MSCI Brazil			MSCI Mexico		
	Trough	3M Peak	%	Trough	3M Peak	%	Trough	3M Peak	%
From Mar 95	518	815	57.2	382	649	69.7	551	885	60.5
From Sep 98	522	822	57.4	414	709	71.4	723	1,125	55.6
From Oct 02	551	681	23.7	279	437	56.9	1,354	1,536	13.5
From Oct 08?	2,503	na	na	2,021	na	na	3,949	na	na

Source: Bloomberg and UBS Pactual

Figure 21: Latin American Stock Markets in Economic Crisis

CURRENT SITUATION OF THE HOUSING MARKET

The housing market is currently slowing down, mainly due to financing restrictions consequence of banks headquartered in countries with a strong real estate crisis and an overall negative assessment of the real estate environment[7]. Housing developers and homebuyers are rapidly feeling the impact of increasing regulations and policies when attempting to access capital and qualify for loans. Still, 2008 was a strong year for the Mexican housing market, with an 11% increase in the number of units sold in 2007 and a 31% increase in the volume of sales, which was driven by increasing sales of high end residential products.

During 2008 Infonavit achieved its goal to originate 500,000 loans, a historical high for the institute, and hoping for an upward economy by the end of 2009 Infonavit holds its 500,000 origination goal. With enough resources for 450,000 it would only need to issue bonds for the remaining 50,000 loans.

[7] Requejo, Victor. (March 2009). *The Housing Train*. El Economista 19.

Under the current administration Fovissste has been undergoing significant restructuring and modernization. With an aggressive loan origination program it reached historical highs for the first half of the year and on the 25th of June of 2009 entered the market by issuing there first Residential Mortgage Backed Securities (RMBS) for 3,500 million pesos. The funds generated from the issue will be used to achieve a mortgage origination goal for 2009 of 100,000 loans, nearly 25% higher than their 2008 origination[8].

The rest of the public entities, government programs and private banks have set 2009 annual lending goals above those achieved in 2008, with private banks expecting a 7.5% to 9.5% aggregate growth in the number of loans originated[9].

According to Softec, in July of 2008 housing project starts dropped to 600 down from 1,600 in 2007. The lack of construction financing is restricting housing supply, causing a decline in inventories. Together with a more conservative approach to mortgage lending, it will be difficult for lenders to reach their respective goals, even if they possess the resources to originate. Some lenders, like Infonavit, are looking to the existing housing market to help them achieve origination goals[10].

CONSTRUCTION SECTOR

Average home prices experienced an 18% increase in 2008 and a 16% increase in prices per square meter, reflecting a slight increase in average home sizes. All housing segments realized an increase in average prices except for the affordable entry level homes (Social and Economica), which experienced an insignificant price change. Meanwhile construction prices rose 9.6%, with an 11.4% increase in material costs and a 3.5% increase in labor costs. This suggests that developers were generally able to offset higher average construction costs with increased sales prices. Developers, however, were forced

[8] *Realiza Fovissste primera emision de Cedevis*, (June 2009), Real Estate Market and Lifestyle.
[9] Fernandez, Gonzalo. (February 2009). *Latin America Equity Research*. Santander Bank.
[10] *Mixed National Council of Housing Developers at Infonavit*, (June 2009), Session at CANADEVI.

to reduce margins for affordable housing products, an outcome easily explained by price restrictions established by governing public entities.

Although international material prices are currently falling, they are still to materialize in the domestic market due to losses on the currency exchange rate which makes imported materials more expensive. The currency (Mexican peso) is currently perceived to be undervalued and is expected to appreciate in the near future, which would make materials cheaper and could contribute to a lower aggregate cost for housing production.

REGIONAL LEVEL ANALYSIS

Although 2008 was a strong year for housing, throughout the year differences across regions and segments was increasingly evident. Regions showing a noticeable slowdown were those more highly exposed to the U.S. economy. These regions can be grouped by[11]:

- **Tourist Destinations** (Cancun, Los Cabos, Puerto Vallarta, Ixtapa and Acapulco)

  Where a big part of the housing supply is intended and constructed for International buyers, predominantly for U.S. residents as a retirement, investment or second home. With the economic recession, U.S. consumers have become more cautious and lost purchasing power and investment capability. The local economies and local home buyers in these cities are also highly dependent on the tourism sector.

- **U.S. Border Regions** (Baja California, Coahuila, Chihuahua, Nuevo Leon, Sonora and Tamaulipas)

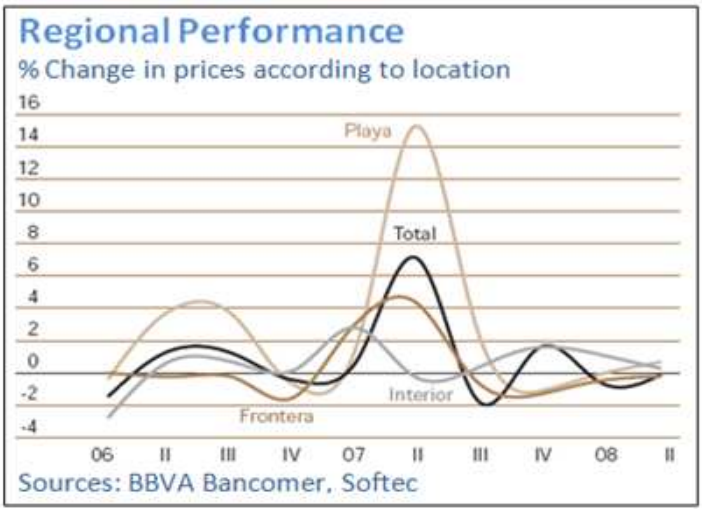


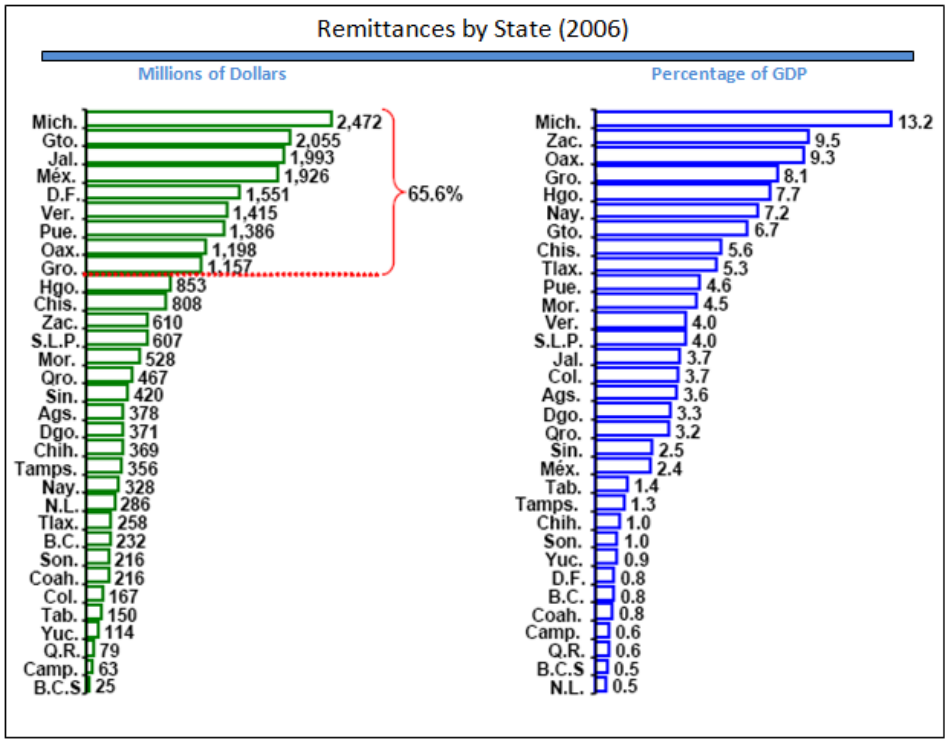
Figure 22: Regional Price Performance

[11] *"Situacion Inmobiliaria,"* Estudios Economicos BBVA Bancomer, January 2009 and September 2008.

Here the industrial and commercial relationships with the US have slowed domestic GDP growth; regions that usually experienced above average employment rates are now facing above national average unemployment rates, effectively lowering the demand for housing and increasing the delinquency rate on mortgage loans.

- **Remittances Regions** (Michoacan, Veracruz, Edo de Mexico and Zacatecas)

  Remittances account for a substantial portion of Mexico's economy (2.7% of GDP), above Tourism and Foreign Domestic Investment and in some states like Michoacan they account for up to 13% of the State's GDP (See Figure 23). After years of growth remittances reached a historical high in 2007, with the US economic recession remittances dropped 3.6% in 2008 and continue to drop through 2009 recording an 11% fall during the first five months of the year[12].



Source: Banco de Mexico

Figure 23: Remittances by State

As shown by Figure 23 regional performance is highly dependent on the location's connection to the U.S. economy. Beach destinations resulting as the most affected followed by border regions. The inner

[12] "Remittances to Mexico fall," The Wall Street Journal, July 2009.

regions of the country are less exposed to the U.S. recession, demonstrating a steady performance with no signs of contraction. The only exceptions are those interior areas with high dependency on US remittances.

INCOME LEVEL ANALYSIS

Throughout the country and within the described regions, the behavior is also significantly differentiated by housing segments. Affordable entry level segments (Economica and Social) demonstrate a positive behavior, middle income housing shows a steady performance, and a negative trending is evident for the high-end residential products (Residencial and Residencial Plus)[13].

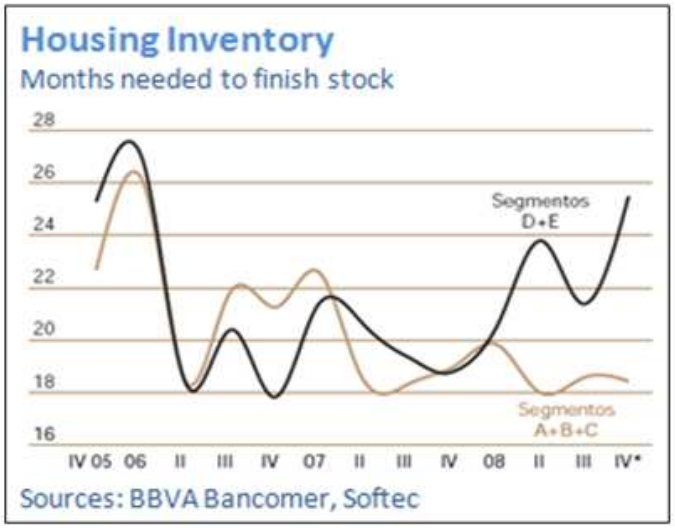


Figure 24: Housing Inventories

Average inventory levels have remained relatively stable but, as shown on the above graph, inventories for lower income levels have decreased while inventories for higher income levels have significantly increased. The strong performance by the affordable entry level submarket is backed by high unmet demand and by the government's aggressive affordable housing programs.

The commencement of government programs for middle income housing has contributed significantly to its recent performance, with Cofinavit (Infonavit's middle income lending program) representing 24% of the institute's loans in 2008, up from only 1% in 2003.

[13] BBVA Bancomer refers to housing segments by A, B, C, D and E, which correspond to Social, Economica, Media, Residencial and Residencial Plus respectively.

High-end residential products, especially in tourist destinations, have been the most affected by the current market, with increasing inventories and falling prices; it will continue to contract throughout 2009 while inventories are reduced. When will the foreign homebuyers return? It is difficult to forecast do to the complexity and lack of knowledge of 2nd homebuyer demand patterns.

POLICY INTERVENTIONS

Mexico's close connection with to the receding U.S. economy and lower international oil prices call for policy-makers to intervene in order to offset the impact of the current downturn.

The authorities have been proactive in taking the appropriate measures to mitigate liquidity constraints in the financial markets and to implement counter-cyclical measures to offset the impact of global turmoil.

Within the housing sector public entities are committing to greater lending volume by increasing lending goals. This is a key element to avoid contraction of the sector. Other issues that policy-makers should address are:

- Regional support by fast tracking resources and infrastructure investments to regions needing to control falling house prices and increasing inventories.
- The promotion of vertical production through incentives for developers and regulations that contribute to increased densities and a superior usage of existing public infrastructure. This effort should also create more regulation for taxation of undeveloped land within city limits;
- The regional designation of housing income levels and prices instead of a national definition, to target and address the income levels it's intended to, rather than simply imposing uniform housing prices and income levels across the country.

- There is a strong financial commitment by mortgage originators for the supply of home and construction loans, but policy intervention could be used to ensure that increased regulation and rigid requirements don't preclude developers and homebuyers from securing financing.
- The determination of an accurate and real housing deficit by region and income level in order to appropriately plan for future development and infrastructure placement.

DEVELOPMENT OPPORTUNITIES

From a developer's perspective the areas of opportunity are found in the inner regions that show strong fundamentals, with steady growth, decreasing inventories, and strong housing demand. These interior areas are less exposed to the U.S. economic recession, and exclude tourist and border destinations.

Low income housing hedges against market and financing restrictions but require a thorough cost analysis by region. Despite the fact that government programs help lower inventories and improve cash flows, prescribed price ceilings make it difficult to achieve the appropriate returns in some regions where higher costs prevail.

Middle income housing continues to offer potential, with minimum price restrictions and accessibility to both public and private resources. The results of Infonavit's middle income lending programs are yet to be capitalized upon. During 2008 due to an inaccurate measure of the program's demand, resources allocated run out around midway through the calendar year. The programs will now be expanded and private banks will contribute with a higher share of the loans originated to avoid a future shortage of funds.

EXISTING HOME SALES

The focus of mortgage originators on first time homebuyers and on new housing resulted in few loan originations for existing homes. Infonavit, with its aggressive program, is quickly responding to this market; approximately 30% of its revised program is aimed at existing homeowners.

Developers and some government officials prefer loans to be assigned to new housing, arguing that only new housing creates employment. They further argue that new housing is preferred because it is built according to the institute's new energy efficient standards.

With only 12% of the housing stock mortgaged, and about 75% of all homes 100% equity owned, home equity loans and existing home financing represent the highest growth opportunities for the mortgage market in Mexico. Resultantly, banks have concentrated on the existing home market as they have reentered the market[14].

Due to scarce mortgage origination for existing homes and the high transaction costs associated with such sales, most of the transactions in this market are informal, unrecorded transactions. It is estimated that over 90% of all transactions are of an informal nature[15]. In many cases the transactions include a mortgage transfer, where the home buyer simply continues to pay the existing loan on behalf of the seller while the legal obligation assigned to the original borrower remains intact throughout the loan.

It is difficult to obtain accurate figures denoting existing home sales due to the informal nature of the accounting, but it is estimated that in 2004 about 25% of all home sales involved existing homes, and that in 2009, the total will likely reach 50%[16].

RENTAL HOUSING

The rental housing market represents only 14.6% of the total dwellings in the country and it is practically nonexistent at the affordable entry level[17]. Compared with other countries this is a very small proportion of rental units, a phenomenon that exists as a result of poor market conditions.

According to a rental housing study performed by SHF intended to precipitate an increase in rental housing investment in Mexico, the current market conditions are unfavorable. The study indicates that

[14] "Mexican Housing Overview 2008," Softec, S.C., January 2008.
[15] Interview with Victor Manuel Requejo, Apoyo Integral Economico.
[16] Interview with Antonio Puig Escudero, SHF.
[17] ENIGH 2006.

investing in for-rent units has an annual yield below the CETES 28 (Treasury bond) rate. Some of the main constrains of the market are[18]:

- Markets with ceilings on starting rental fees;
- Controlled rents that regulate the annual increases on rental fees;
- Controversy between landowner and tenants that, on average, lasts nine months;
- Higher tax burden for corporations than for individuals holding rental units.

According to Softec there is no institutional market for multifamily rental property, although tax legislation introduced in 2004 governing REITs structure, overregulation, scarce financing, complicated evictions and collections, and marginal returns (below those offered by Mexican Treasury bonds) have kept institutions out of operation[19].

[18] "Estudio sobre el mercado de vivienda en renta en México y los mecanismos más adecuados para impulsar la inversión", Sociedad Hipotecaria Federal, 2007.
[19] "Mexican Housing Overview 2008," Softec, S.C., January 2008.

CHAPTER 3:
DEVELOPERS AND CURRENT PRACTICES

"The big housing deficit had developers believe that everything they built was a sure sale. Their numbers already contradict this statement. Last year average inventories grew by 15%. Specifically, those of Homex and Geo grew by 34.6% and 27.4% respectively"[20]. The slowdown of the housing markets, especially in high-end residential projects, together with the lack of availability of construction loan financing has developers across the country reconfiguring their strategies.

Situations are varied across markets, regions and product types, hence it is only reasonable that different developers are experiencing different outcomes and implementing different strategies. Nonetheless certain common trends and patterns can be easily identified among most developers.

In order to determine how housing developers are responding to the current market conditions and to make an assessment of current practices used to measure and forecast the housing markets, prominent industry players were interviewed. Interviewees included both private and public developers, lenders and key housing institutions.

HOUSING DEVELOPERS

Real estate has always been especially local, and Mexico's housing markets are no exception. Highly fragmented, no single developer has a consistent national market share greater than 10%[21]. With over 2,600 homebuilding companies[22] in the country only six are publicly traded on the Mexican Stock Exchange and only Homex is also traded on the New York Stock Exchange (ticker symbol HXM).

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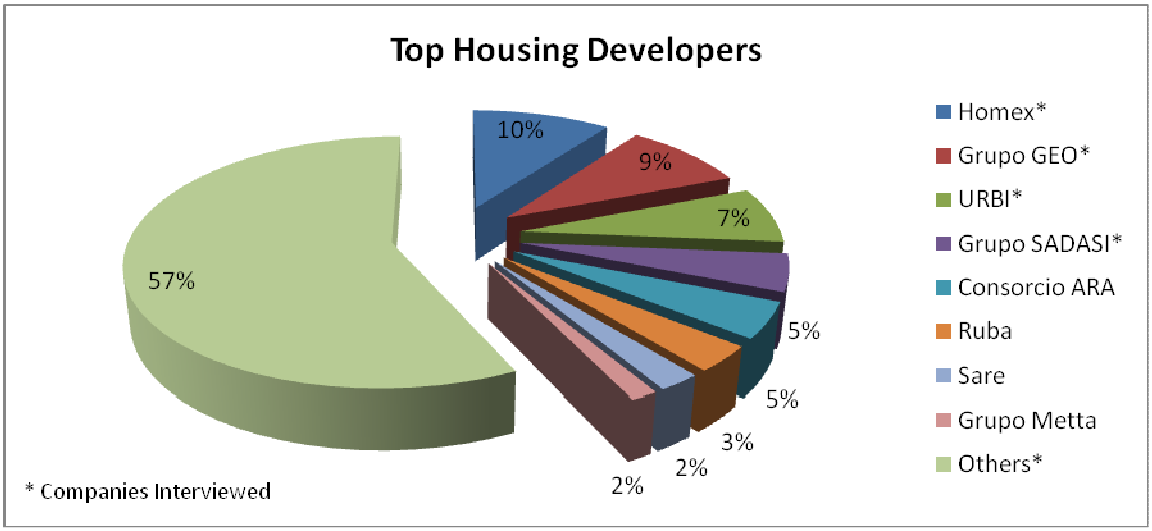
[20] Garcia, Veronica, and Adolfo Ortega, May 2009, "La Gran Estafa", Expansion, No. 1015.
[21] "Mexican Housing Overview 2008," Softec, S.C., January 2008.
[22] INEGI, Economic Census 2004

In 2007 the eight largest developers were responsible for almost 43% of the units sold but only 23% of the total value of sales. The top four developers, which were among those interviewed for this study, account for 31% of sales and 16% of the total volume.



Source: Data from Mexican Housing Overview 2008

Figure 25: Market Share of Top Housing Developers

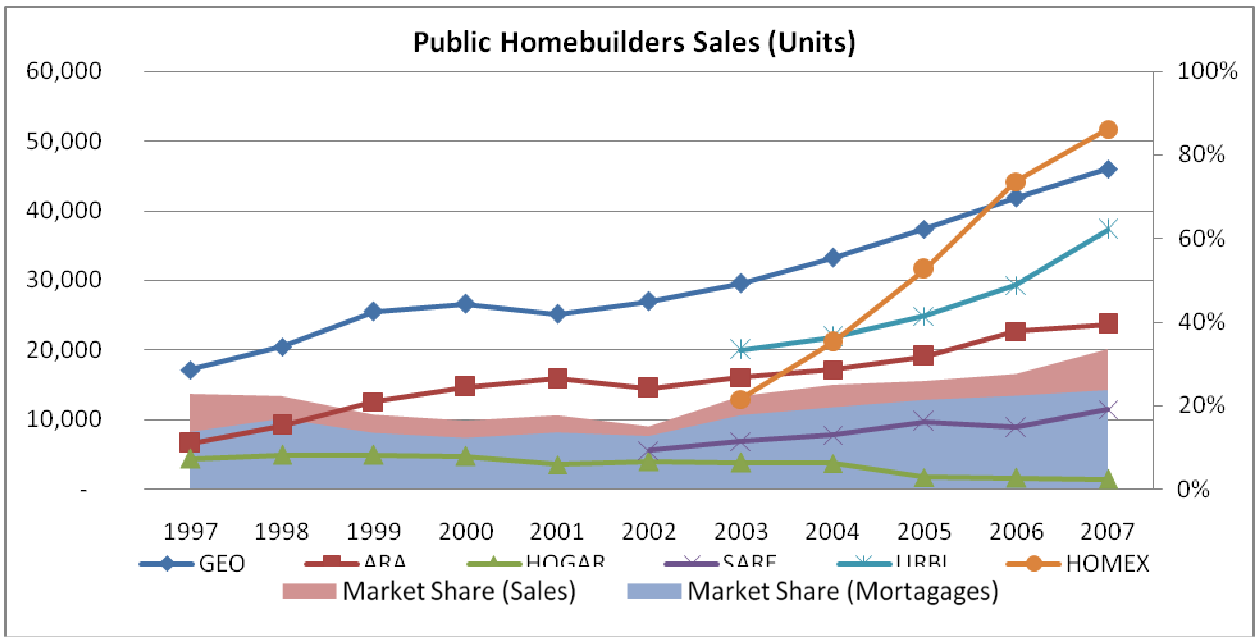
The housing boom allowed housing developers to grow rapidly, making it possible for public homebuilders to achieve an 18% average annual growth rate from 2003 to 2007. The pace of sales combined with the "country's housing demand over the next 20 years of the construction of what has been built in its history"[23] made it easy for companies to establish strategic growth and business plans to at least double company size every five years. These aggressive goals and strategies are now being revised.

PUBLIC VS PRIVATE DEVELOPERS

The lack of construction loan financing is forcing developers to halt housing production. Particularly affected are the country's private developers. The current competitive environment of the housing markets and the difficulty of securing financing for new projects is forcing poorly capitalized, less

[23] Interview with Iñigo Orvañanos, Director of Sales, Geo.

sophisticated developers to exit the market or cease operation. The number of homebuilders registered in Infonavit has already dropped from 1800 to 700 developers[24]. This creates improved opportunity for public homebuilders that are still able to access capital markets in efforts to advance new and current projects[25].



Source: Data from Homex

Figure 26: Public Homebuilders Sales and Market Share

CURRENT SITUATION

As mentioned in the previous chapter developers confirm increasing inventories of more expensive residential products and a slowing market due to mortgage lending restrictions created by private banks. They are also experiencing a significant slowdown in border regions were they had historically experienced strong absorption and returns. With the industrial sector downsizing, developers are losing customers before they are able to close on the property sale. Often a client that has agreed to purchase a house and is still in the mortgage origination process or is waiting for construction of the home to be finished will no longer be eligible for a mortgage. As a result the sale is delayed or lost altogether if the

[24] Interview with Alfonso De Alba, Market Intelligence, URBI.
[25] Interview with David Arelle Sergent, Managing General Partner, Condak.

buyer loses its job. In these regions reliant on industrial job growth even customers that still have jobs are being cautious and are reconsidering home purchasing decisions.

Tourist projects in beach cities like Mazatlan and Vallarta are also experiencing lower absorption rates as wary American buyers retreat. Developers seem unwilling to enter markets in the southern regions of the country, like Chiapas or Oaxaca, even though they present elevated housing shortages. The prevalence of informal employment in these southern regions makes it hard to secure mortgage financing for the potential customers.

According to Infonavit's Home Registration system (RUV), registered new housing projects are down 40% from 2008. The decrease in project totals can be attributed, among other things, to problems with the assignment in 2008 of affordable subsidies and to newly implemented energy efficiency regulations and restrictions[26].

DEFENSIVE HOUSING

In response to the market most developers are implementing defensive strategies based in affordable housing. Although many large developers already had a strong focus on affordable housing, greater returns and high demand for more expensive residential products in the recent past lured them beyond affordable housing development. As a result, developers faced increased exposure to market volatility, characteristic of high-end home development.

The return on investment for a housing project in Mexico typically ranges from 15% to 35%, but margins vary by segment and with the capacity and efficiency of developers. Margins, before taxes, for projects in the affordable entry level segment often yield 8% to 15%, middle and residential returns 12% to 20%, and Residential Plus yield 15% to 30%[27]. Developers are trying to standardize margins across projects

[26] Interview with David Arelle Sergent, Managing General Partner, Condak.
[27] "Mexican Housing Overview 2008," Softec, S.C., January 2008.

and regions, searching for similar returns on capital, and are asking local branch managers to achieve unvarying targeted returns[28].

Now, even though middle income projects were yielding a 25% gross return and affordable entry level projects offer 15% returns, higher sales volume, improved absorption rates and the availability of mortgage loan financing are driving all developers to concentrate on affordable housing. Anecdotally, the top three homebuilders in Mexico are currently attributing between 92% and 94% of total sales volumes to the affordable entry level. "Affordable housing lower margins require higher volumes, efficiency and cost control. Any delay or cost overrun can mean the difference between winning and losing money on a project. Very affordable housing (Social) can be sold anywhere, but not everywhere can it be built"[29].

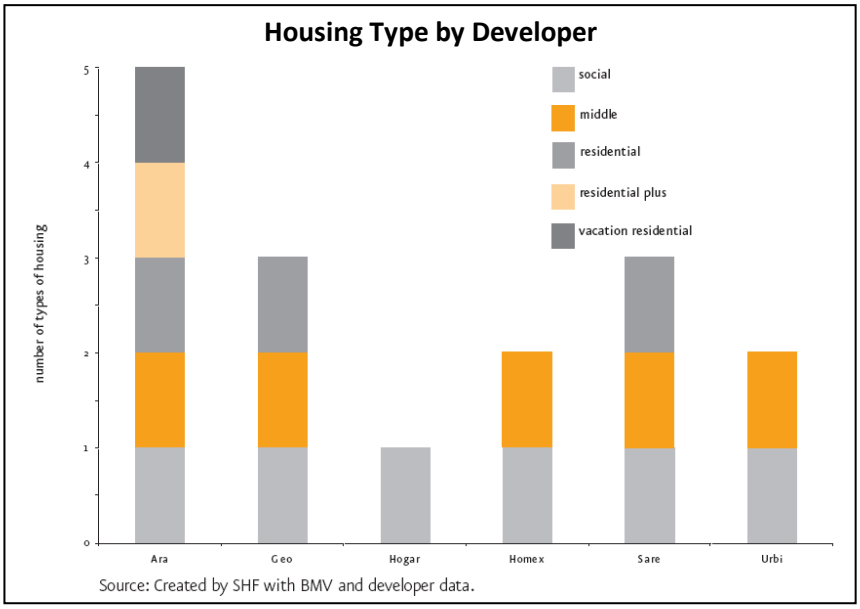


Figure 27: Housing Type by Developer

With a defensive strategy, developers hope to minimize exposure to the volatility of more expensive residential products. They have begun to concentrate on affordable housing, a subsector that continues to have a strong government support. Such support creates an aggressive origination program for this

[28] Interview with Vania Fueyo, Head of Investor Relations, Homex.
[29] Interview with Enrique Vainer Girs, Chairman of the Board of Directors, SADASI

type of product, making it much less vulnerable to the macroeconomic environment and to overall markets conditions.

Through strategic growth plans developers are taking different approaches. Some are undertaking more aggressive plans by entering new markets. Others have begun to focus on expanding market share and penetration within their respective operating regions and cities[30].

SIZING UP THE MARKET

Housing demand is heavily determined by the availability of mortgage financing. According to developers "They don't sell houses, they sell loans stapled to houses", "It's not the product and the client, it's mortgage loan availability" and "The size of the market is the number of loans available for each segment". Hence, the barometer for the strength of housing markets is mortgage loan availability.

Over 66% of mortgage loans are originated by Infonavit and Fovissste, which account for almost 50% of the total debt originated. Through each institution's aggressive lending programs developers are able to measure demand for affordable housing. The mortgage programs allow developers to ascertain how many loans for each product type (housing segment) each institution expects to originate in each city.

Developers execute an analysis of the institutes' affiliates by city and segment, calculating how many affiliates are eligible for a mortgage loan and how many are yet to exercise a loan. They can then estimate how many will elect to exercise their opportunity to obtain a mortgage loan in the near term. Developers research databases to find eligible loan candidates and subsequently approach the potential customers with the appropriate product type in an effort to encourage them to action.

Developers are then able to compare the potential demand against market supply and pipeline through Infonavit's Home Registration system (RUV). This system requires that all housing projects that intend to

[30] Geo has a regional growth strategy, Homex is trying to grow within its operating cities and URBI is implementing a land and local partnership program to penetrate new markets.

use the institution for mortgage financing must be registered prior to construction. Developers can identify oversupply and may attempt to modify the product type to change the targeted segment[31].

Middle income residential projects still rely, to a certain extent, on Fovissste and Infonavit's middle income programs, Infonavit Total and Cofinavit. Fovissste has undergone major restructuring and renovation during the current administration, however its loan assignation methodology is still considered by developers to be obscure.

HIGHER INCOME RESIDENTIAL PRODUCTS

Unfortunately, when it comes to high end residential projects there is much less information available and less market analysis is performed by the real estate industry. Analysis is usually restrained to field studies designed to calculate average absorption rates of comparable projects and to estimate surrounding supply. Developers then simply make bets on markets with the highest absorption rates.

In the past six years, the number of developers grew from 800 to 3,000, resulting in a highly competitive environment[32]. The competitive environment with increasing inventories gave developers a high exposure to demand volatility of high-end residential products. As a result, development firms are starting to generate more sophisticated studies to correlate projects and housing markets with macroeconomic and demographic variables and fundamentals. Some developers have even created alliances with demographic institutes to study effective housing demand"[33].

Even though inventories for non-affordable projects are growing, developers have a strong conviction that the market still demonstrates a large housing deficit that needs to be satisfied, and that "by creating the appropriate product with the right market drivers they will be able to successfully deploy projects"[34]. Sophisticated, larger homebuilders are accustomed to developing mega projects (above

[31] Interview with Vania Fueyo, Head of Investor Relations, Homex.
[32] Interview with Alfonso De Alba, Market Intelligence, URBI.
[33] URBI is working with COLEF (North Border College) to try and determine effective housing demand.
[34] Interview with Juan Manuel Yi, Corporate Communications Manager, URBI.

5,000 to 25,000 units) and to making elaborate master plans for regional development that create new markets and inherent housing demand. When interviewed, two developers stated: “if you build it they will come”.

When creating mega projects homebuilders identify areas proper for major regional growth and development by taking into account urban development master plans, regional government and private investment, employment drivers, local government relationships, and willingness of the governing agencies to cooperate and publicly disclose information.

Sophisticated developers have fully staffed marketing departments that constantly seek to identify the ideal product type for development. They do SWAT analysis, benchmark, develop field market studies, poll focus groups, and track institutional sales.

Small, less sophisticated private developers do little or no market forecasting. Assessments seem to most closely resemble field studies, which consider nearby projects when determining site selection and control. Once the small developers obtain site control they are only prevented from moving forward on a project by any inability to secure financing, if they’re able to secure a construction loan they will build the project, often regardless of market conditions or trends.

Private Banks’ ability to decide which kinds of projects to finance typically forces the developers to build their projects in a way that enables financing. But even private banks and lenders don’t seem to do a thorough analysis of the markets. Each player has a market target; private banks target the high-end residential markets as they seek to offer homebuyers additional services like credit cards, car loans, etc. Sofoles target affordable and middle income residential products according to their funding guidelines and restrictions. SHF imposes a price ceiling on the mortgage loans it will guaranty or buy. Private Banks continue to finance middle and residential projects, though they are aware of rising inventories, they rely on the experience and the relationship with the developer to underwrite a project. The banks usually trust developers market studies, which are often self-servingly optimistic. It stands to reason

that no developer would ask a bank for a construction loan with a market study that doesn't support the proposed project[35].

SALES ESTIMATES

To determine short term sales, developers look at current projects and sales velocities. For long term sales they attempt to reach the certain level of sales that allows them to comply with growth goals and business plans. Sales estimates seem to be more closely aligned with corporate growth strategies than with market trends or expectations. Contrastingly, markets conditions seem to constantly affect the expected corporate growth.

The first thing developers take into account when generating sales estimates is historical performance. They then assign a growth rate to current sales velocities. In order to achieve the necessary sales they create strategic growth plans by segment and region to reach an assigned growth rate. An assigned growth rate is forecast in current markets and a higher growth rate is estimated in new markets, where sophisticated developers try to measure potential market share through effective demand and correlations with housing demand fundamentals.

[35] Interview with Victor Manuel Requejo, Apoyo Integral Economico.

CHAPTER 4:
MARKET FORECASTS – VAR MODEL

With the significant increase in the volume of mortgage lending during the last decade the Mexican housing market has experienced high rates of new housing being added to the existing stock. With some regions and segments showing increasing inventories and oversupply, the financing entities are finally recognizing that their ability to originate mortgage loans for new housing is unmatched by market effective housing demand for some product types and in some regions.

In 2005 officially marks the time when financing availability exceed the market's ability to consume the capital[36]. The industry has a "general perception that we have finally reached production equal to housing demand, and that the urban structure of Mexican cities is exceeded"[37].

The situation requires a more sophisticated analysis of the housing markets based on fundamental demand drivers. Relying solely on the supply of mortgage financing to measure demand in the housing markets is no longer sufficient to truly determine the market potential and trending.

Very few studies have been done in the past to estimate housing demand in Mexico. Gonzalez and Fontela (2009) try to determine housing demand elasticity to its major components by using data from mortgages originated within a two year period. Gonzalez (1997) explains housing demand through tenure choice and expenditure on housing services. Other studies have attempted to use hedonic pricing models to value housing attributes or to create price indexes. Fierro (2008) used hedonic pricing to explain the housing attributes for Ciudad Juarez using a sample of 175 observations. Also, SHF is currently working on a national price index (INAPEV) based on hedonic pricing and repeated sales from 2005 to the present[38].

[36] Interview with Eugene Towle, CEO and Partner, Softec.
[37] "Mexican Housing Overview 2008," Softec, S.C., January 2008.
[38] Interview with Antonio Puig Escudero, SHF.

To date it is my understanding, after a thorough research and review of existing literature, that multivariate time series analysis has never been used to measure or forecast Mexico's housing markets. Multivariate time series analysis is used when one wants to model and explain the interactions and co-movements among a group of time series variables[39].

Econometric models are used frequently to measure and forecast markets; in particular macro-econometricians use multivariate time series to do four things[40]:

1. Describe and summarize macroeconomic data;

2. Make macroeconomic forecasts;

3. Quantify what we do or do not know about the true structure of the macroeconomy;

4. Advise macroeconomic policymakers.

VECTOR AUTOREGRESSION (VAR) MODEL

The time series of the data (15 years) permits the use of a vector autoregression (VAR) model to forecast Mexico's housing markets. A longer time series that includes more than one housing cycle would allow us to create an independent model for each city. But "the combination of time series with cross-sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions"[41].

"The VAR model is one of the most successful, flexible, and easy to use models for the analysis of multivariate time series. It is a natural extension of the univariate autoregressive model to dynamic multivariate time series. The VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting. It often provides superior forecasts to those from univariate time series models and elaborate theory-based simultaneous equations

[39] Zivot, Eric, May 2006, "Class slides on multivariate time series and VAR models," Time Series Econometrics, University of Washington.
[40] Stock, James and Mark Watson, 2001, "Vector Autoregressions," Journal of Economic Perspectives 15.
[41] Yaffee, Robert, September 2003, "A Primer for Panel Data Analysis," NYU

models. Forecasts from VAR models are quite flexible because they can be made conditional on the potential future paths of specified variables in the model"[42].

METHODOLOGY

With the help of RATS (Regression Analysis of Time Series) software the VAR model allows us to correlate time series of our dependant housing variables with independent economic and demographic variables to derive equations that reflect market behavior.

The regression analysis uses the Fixed Effects Model, also known as the Least Squares Dummy Variable Model, which uses dummy variables to differentiate across cities with lagged dependent variables to account for dynamic effects. This creates a series of models with constant slopes for each market segment but with different intercepts for each city. After creating one dummy variable for each city and performing the regression analysis, the constant then becomes the intercept for the default city and the constant plus the dummy variable together become the intercept for other cities.

With the intercepts and coefficients of the regressions we are then able to set an equation for each segment and city to forecast the behavior of our dependent housing variables using conditional forecasts of the independent variables.

[42] Zivot, Eric, and Jiahui (Jeffery) Wang, 2002, "Vector Autoregressive Models for Multivariate," Chapter 11, Modeling Financial Time Series with S-PLUS, Wang, Springer-Verlag

REGIONAL SEGMENTATION

The country was segmented by Softec into eight different regions according to proximity, economic development, communications and location. Although housing trends tend to be local, this segmentation creates regions with cities that show similar behavioral patterns and housing trends.

Figure 28: Regional Map

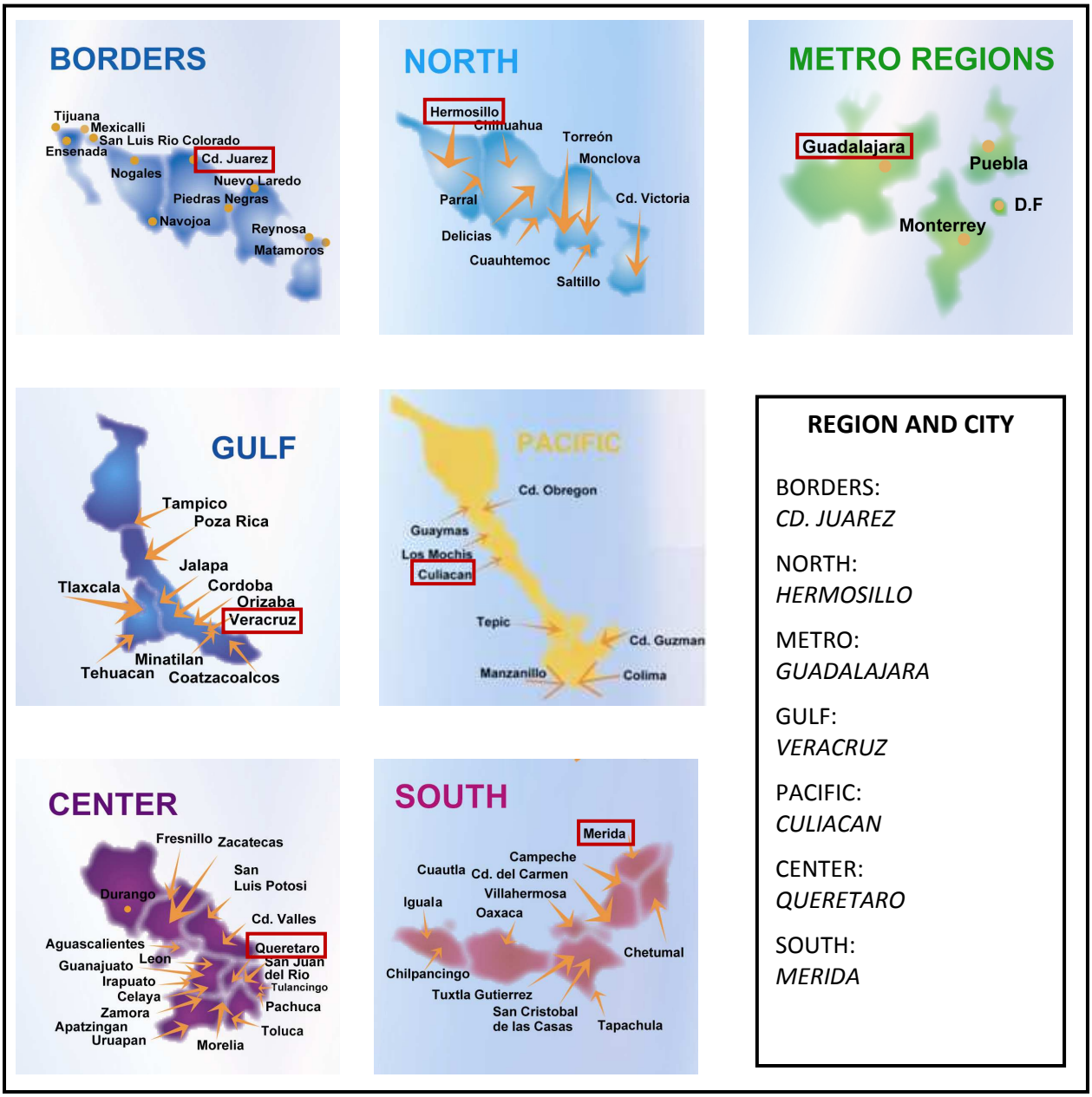
Source: Softec

For the purpose of this analysis the Tourist region, which includes six important centers, was excluded primarily due to the complexity of forecasting second homes. Second home market demand responds to different variables, drivers and patterns that are unique to this region.

CITIES OF THE STUDY

One of the most representative cities out of each region was chosen to carry out this study.

Figure 29: Cities of the Study



Source: Softec

DATA DESCRIPTION

The data consists of annual home prices, sales, inventories and sizes, as provided by Softec, from 1994 through the first quarter of 2009 for each housing segment of the selected cities. The annual 2009 housing data is adjusted and estimated from first quarter performance.

After testing different models and variables for significance and forecasting ability to predict other variables (Granger-cause) the final variables used in the model are:

MODEL'S DATA	
Dependent Variables **Homes annual data by city and segment**	
SALES	Number of units sold
RPSQM	Real price per square meter
INVENT	Year's average monthly inventories
Independent Variables	
POPGR	City's population growth
INTRATE	Interest Rate (Average CETES 28)
GDPCAPGR	State's real GDP per capita growth
Dummy Variables	
D1	For GUADALAJARA
D2	For HERMOSILLO
D3	For CD. JUAREZ
D4	For CULIACAN
D5	For QUERETARO
D6	For MERIDA
	Default city (no dummy) VERACRUZ

Figure 30: Model's Data

The final equations for each of the dependent variables follow:

$SALES = \alpha + DUMMY + \beta_1 SALES(-1) + \beta_2 RPSQM + \beta_3 INVENT + \beta_4 INTRATE$

$RPSQM = \alpha + DUMMY + \beta_1 RPSQM(-1) + \beta_2 POPGR + \beta_3 GDPCAPGR + \beta_4 INTRATE$

$INVENT = \alpha + DUMMY + \beta_1 INVENT(-1) + \beta_2 RPSQM(-1) + \beta_3 POPGR + \beta_4 GDPCAPGR + \beta_5 INTRATE$

The lack of observations for a given period creates an unbalance panel; it doesn't mean that prices were equal to zero, it only means that there were no transactions recorded in the period. In order to balance the data set when observations are missing the regressions ignore all missing or zero values.

The independent variables were chosen according to their ability to explain the dependent variables. However, changes in calculation methodologies (i.e. employment) or the lack of city-level data for some variables that could be highly correlated with the housing markets forced the use, testing and adjustment of state and national level data in the model. The independent variables used by the model are city population growth rates estimated from INEGI's census data, average interest rates (CETES 28 days) from Banco de Mexico and real Gross Domestic Product per capita growth calculated from INEGI's data.

STATISTICAL RESULTS

In the VAR model each variable is explained by its own lagged values, plus current and past values of the remaining variables. In data description and forecasting, VARs have proven to be powerful and reliable tools that are now, rightly, in everyday use[43].

In the case of inventories, the model uses a lagged value of prices as an independent variable. The one period lag (one year) is to reflect the time for permitting and construction. High prices encourage new construction that gets added to the inventory once it is finished, causing the next period's inventory to grow.

The model only takes into account new housing, hence it is a supply driven model in which higher inventories "Granger causes" sales of new homes to grow. Without inventory sales of new homes could not increase.

Inventories show a significant positive relation to sales. Sales also seem to be highly explained by interest rates and previous period sales. Lower interest rates mean lower mortgage payments or

[43] Stock, James and Mark Watson, 2001, "Vector Autoregressions," Journal of Economic Perspectives 15.

increased purchasing capacity, which in turn increase home prices. Higher sellout prices coupled with less expensive construction financing yields an increase in housing production and supply. The larger inventories allow more home sales. GDP and population growth seem to have a positive effect on prices and inventories.

Summary of Statistical Results

	SOCIAL		ECONOMICA		MEDIA		RESIDENCIAL		RESIDENCIAL PLUS	
Dependent Variable SALES										
	Centered R2	0.9171	Centered R2	0.9582	Centered R2	0.9855	Centered R2	0.9804	Centered R2	0.9826
Variable	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat
Constant	342.2448	0.5586	-694.0850	-0.8279	277.6775	0.9476	13.5980	0.2766	-19.1712	-0.6494
SALES{1}	0.4177	9.7133	0.2630	4.7412	0.6176	24.3595	0.3208	9.1367	0.1643	3.3726
RPSQM	-0.0319	-0.2417	0.2193	1.3873	-0.0213	-0.5170	0.0011	0.2260	0.0014	0.7296
INVENT	0.3841	14.9677	0.3381	12.9628	0.2080	17.1695	0.4198	19.1313	0.4663	16.8874
INTRATE	-7.1873	-0.9302	-20.7406	-2.6590	-7.7376	-3.0412	-0.7088	-1.2784	-0.0641	-0.2548
D1	-314.4203	-1.1789	1,662.4678	5.0038	210.7898	1.7762	-5.9005	-0.2358	21.3891	1.8757
D2	78.1054	0.3031	369.6617	1.3020	20.0391	0.1944	-51.1599	-2.2152	7.6226	0.5231
D3	365.1437	1.4254	609.5176	2.1459	136.6094	1.3752	11.2478	0.5176	13.7079	1.1951
D4	-397.5841	-1.5318	597.3333	2.0940	71.2004	0.6621	-66.0802	-2.6915	12.5623	1.0015
D5	-286.8109	-1.0973	991.4430	3.4671	95.6996	0.9311	-2.6362	-0.1149	12.2427	0.9512
D6	274.6412	1.0079	539.2025	1.6227	-20.3479	-0.1674	15.1247	0.5883	9.4426	0.5694
Dependent Variable RPSQM										
	Centered R2	0.6551	Centered R2	0.7903	Centered R2	0.7019	Centered R2	0.7225	Centered R2	0.7799
Variable	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat
Constant	3,023.3354	8.0569	2,352.3802	7.0185	3,891.9025	7.4962	4,460.3112	5.3700	7,148.5516	5.0299
RPSQM{1}	0.4185	5.4385	0.6302	10.4531	0.4503	6.0166	0.6030	7.8518	0.5402	5.8312
POPGR	-197.6986	-2.4475	-115.7539	-1.6607	151.0852	1.3129	15.6318	0.0680	977.3303	2.6498
GDPCAPGR	-11.6929	-0.9924	-0.9567	-0.0936	7.4075	0.4253	-2.5403	-0.0832	-92.9458	-1.7863
INTRATE	-11.5068	-2.1818	-26.1431	-6.3923	-36.9879	-5.6323	-53.0464	-4.3804	-95.2955	-4.5479
D1	214.4218	1.3416	133.5758	1.0013	278.7776	1.2885	476.9903	1.2494	-870.1880	-1.5493
D2	367.6829	2.1212	177.1086	1.2343	-510.1285	-2.0984	-256.8550	-0.5384	-3,670.6612	-3.7482
D3	356.3003	2.0302	145.1574	0.9900	-22.5293	-0.0935	-549.6834	-1.2755	-2,453.6311	-3.4107
D4	183.2687	1.1249	191.1150	1.4066	-45.3461	-0.1882	-192.6035	-0.4410	-2,199.1188	-2.9792
D5	443.6969	2.2887	263.8406	1.6900	-203.8612	-0.7841	-664.1697	-1.3270	-3,804.0969	-4.1080
D6	-413.4273	-2.4442	-264.3208	-1.7607	-949.4273	-3.6702	-1,129.6143	-2.3851	-894.1020	-0.8206
Dependent Variable INVENT										
	Centered R2	0.6738	Centered R2	0.8389	Centered R2	0.8737	Centered R2	0.9121	Centered R2	0.8828
Variable	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat
Constant	-1,690.0035	-0.8130	5,648.6750	2.2202	-1,697.0383	-1.1635	-116.9765	-0.6896	-57.5370	-0.5364
INVENT{1}	0.7073	9.2155	0.7999	12.7977	0.8290	16.3870	0.8138	16.6369	0.8104	11.0055
RPSQM{1}	0.6405	1.4340	-0.8518	-1.7667	0.2813	1.3225	0.0189	1.1427	0.0037	0.4926
POPGR	126.1198	0.2838	648.5733	1.1764	267.7734	0.8314	67.1643	1.4876	37.9788	1.4305
GDPCAPGR	101.4758	1.6290	-93.2756	-1.1728	58.8675	1.2109	7.8210	1.3121	2.1049	0.5571
INTRATE	-19.9099	-0.6954	-57.5999	-1.5505	-40.7166	-2.0576	-8.6408	-3.1725	-3.3230	-2.1178
D1	1,336.3683	1.4754	1,742.2849	1.5884	1,547.7445	2.2586	266.7355	3.0864	91.1782	1.9079
D2	-444.6991	-0.4633	-1,213.0126	-1.0546	66.5726	0.0982	-15.9663	-0.1740	-13.1150	-0.1860
D3	-116.4038	-0.1199	-1,153.9038	-0.9820	-76.0518	-0.1134	-47.9217	-0.5642	-33.0737	-0.6391
D4	-128.3813	-0.1422	214.9755	0.2078	244.2480	0.3629	80.1840	0.8659	7.1451	0.1364
D5	-50.4872	-0.0482	-1,310.8675	-1.0466	346.9189	0.4736	-10.5154	-0.1073	-35.9508	-0.5718
D6	118.7192	0.1287	-2,323.9458	-2.0026	506.4100	0.6991	7.0068	0.0749	-8.9818	-0.1150

Figure 31: Table of Statistical Results

FORECASTING

The model then uses forecasts of the economic independent variables provided by the International Monetary Fund (IMF). In the case of Real GDP per Capita Growth, each state's real GDP was used to calculate the average growth rate of each state within the analyzed time frame (1994-2009). The states' average growth rates were then compared to the national average growth rate over the same period to generate a ratio between the two. The ratio was then applied to IMF estimates of national GDP growth to obtain states GDP growth forecasts. This implies that states GDPs will continue to grow at a pace that maintains the ratio with national GDP growth.

Demographic Forecasts

Midyear Numbers	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	10 Yr Annual % change
Population (millions)	107.6	108.4	109.2	110.0	110.8	111.6	112.3	113.0	113.7	114.4	115.1	0.7
Annual % change	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	
Households (millions)	27.5	28.1	28.7	29.3	29.9	30.5	31.1	31.7	32.3	32.9	33.5	2.0
Annual % change	2.2	2.2	2.1	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	
Housing Stock (millions)	26.7	27.3	27.9	28.5	29.1	29.6	30.2	30.8	31.4	31.9	32.5	2.0
Annual % change	2.2	2.2	2.1	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.8	
Occupants per Home (# persons)	4.0	4.0	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	-1.3
Annual % change	-1.4	-1.4	-1.4	-1.3	-1.3	-1.3	-1.3	-1.2	-1.2	-1.2	-1.2	

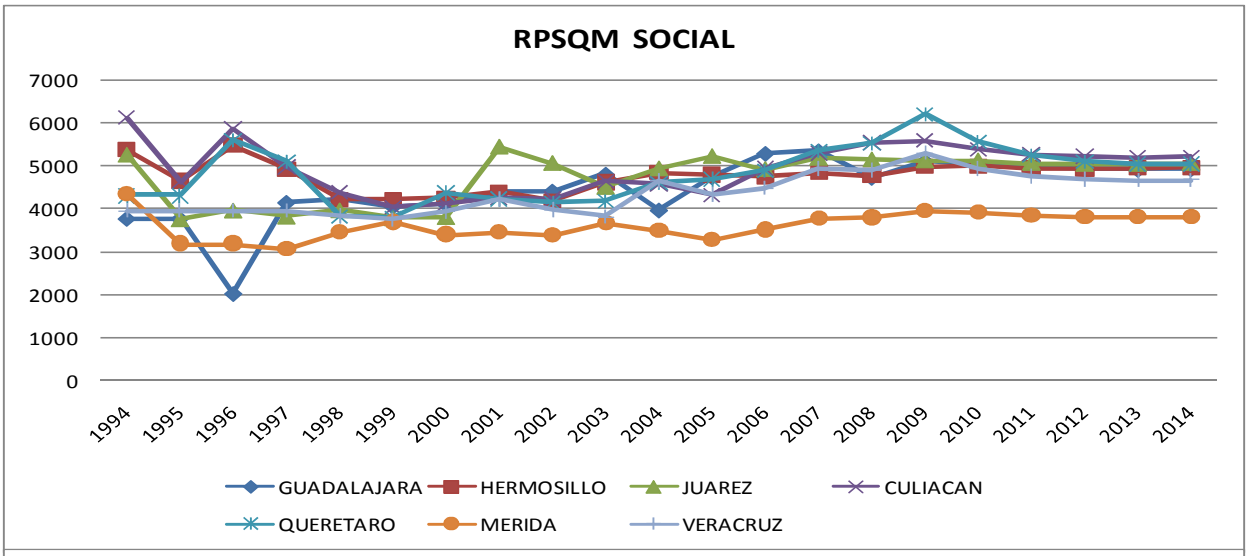
Sources: CONAPO

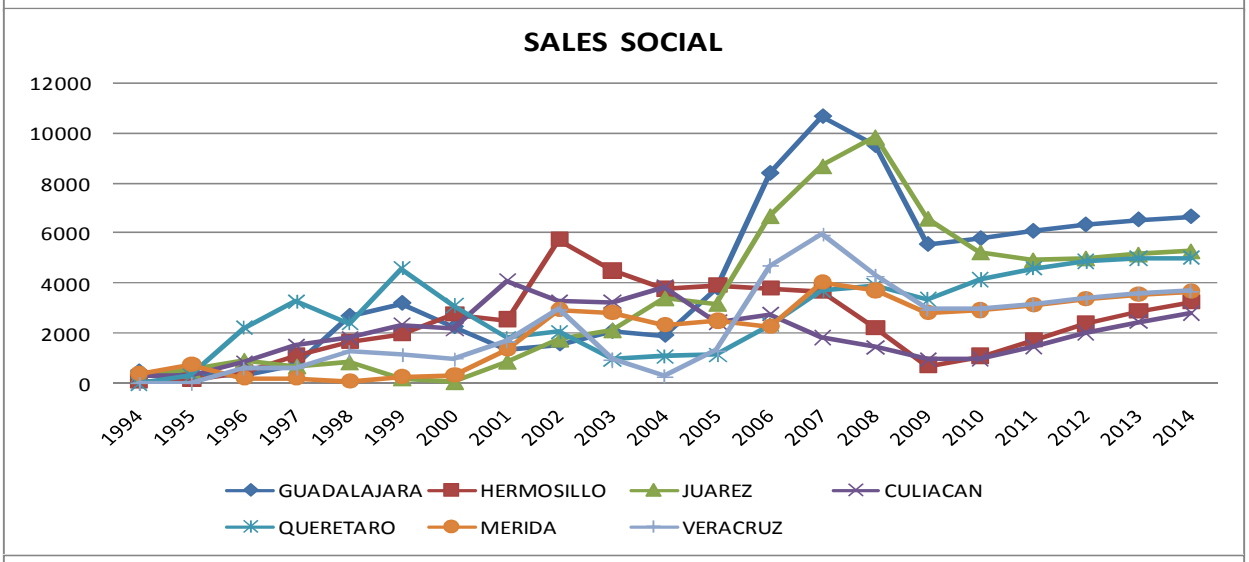
Figure 32: Demographic Forecasts

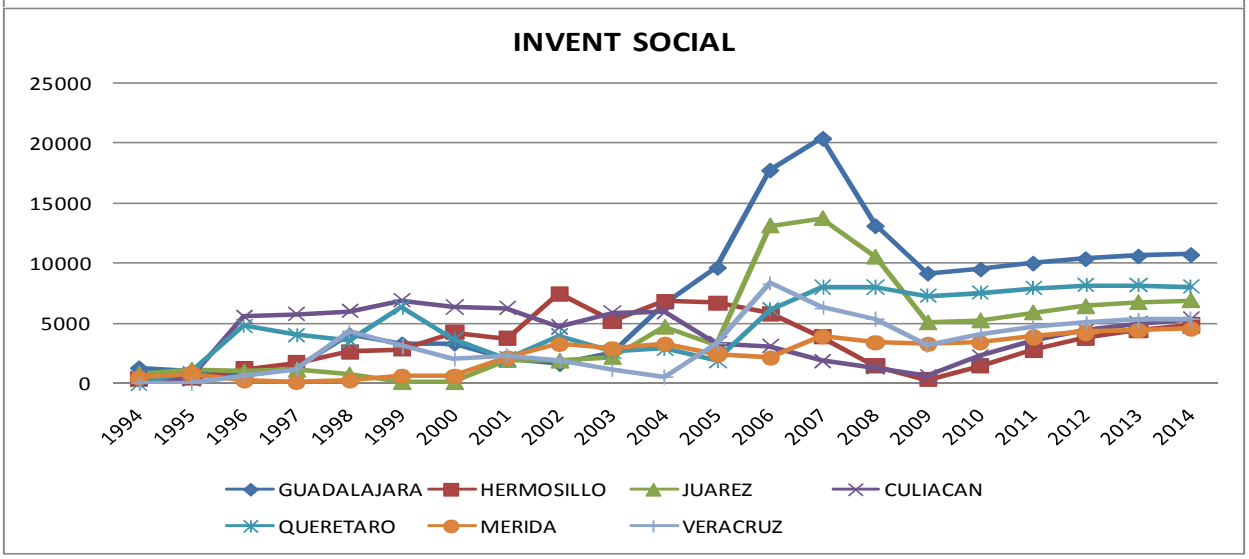
Population growth was calculated from estimates provided by the National Population Council (CONAPO), which provides forecasts of demographic variables up to the year 2030. Housing has a natural, strong correlation with population and household growth, according to Sara Topelson of Sedesol, who states, "housing demand will be three times as high as demographic growth, and nearly 80% is expected to be found in metropolitan areas where over 75% of the population is expected to live by the year 2030"[44]. All city level calculations were done according to CONAPO's official delimitation of metropolitan areas[45].

[44] "Estado Actual de la Vivienda en Mexico 2008" CIDOC foundation and SHF, November 2008.
[45] Delimitación de las zonas metropolitanas de México 2005.

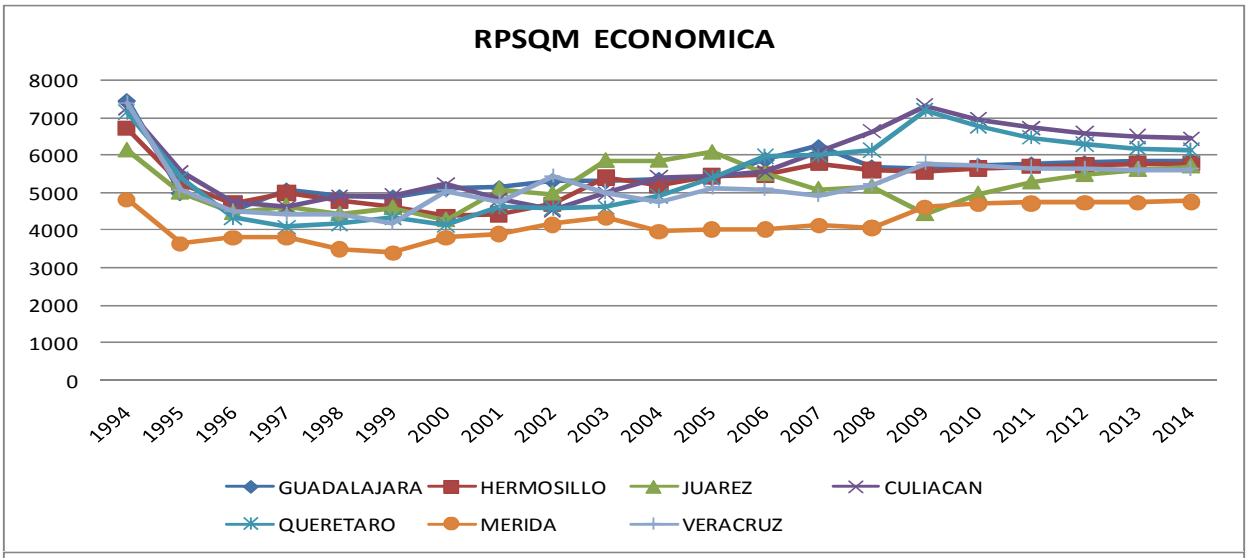
SOCIAL SEGMENT FORECASTS

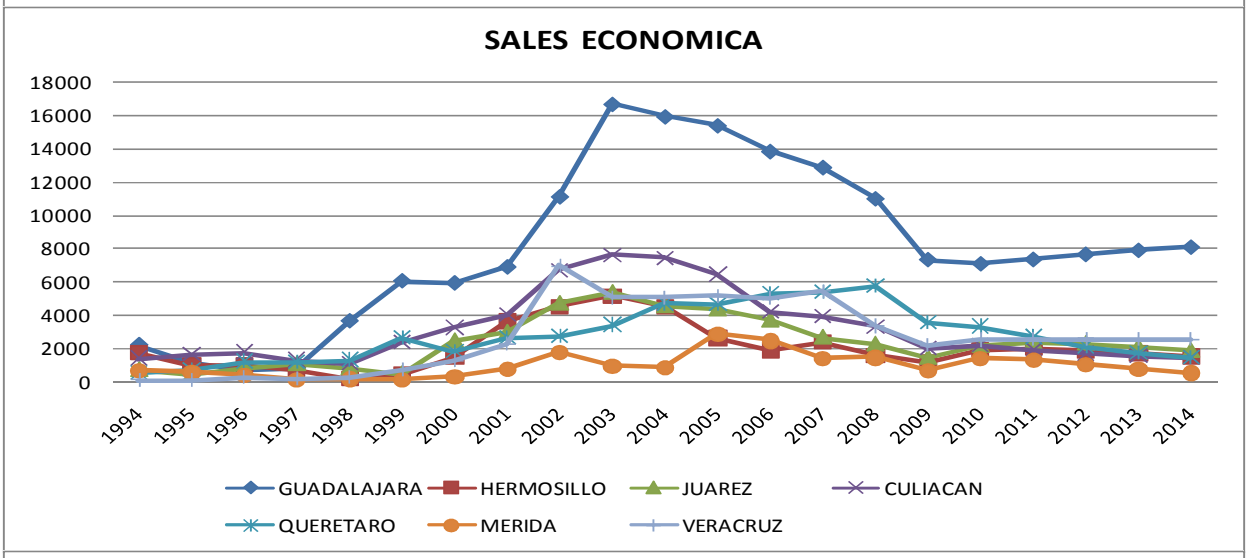


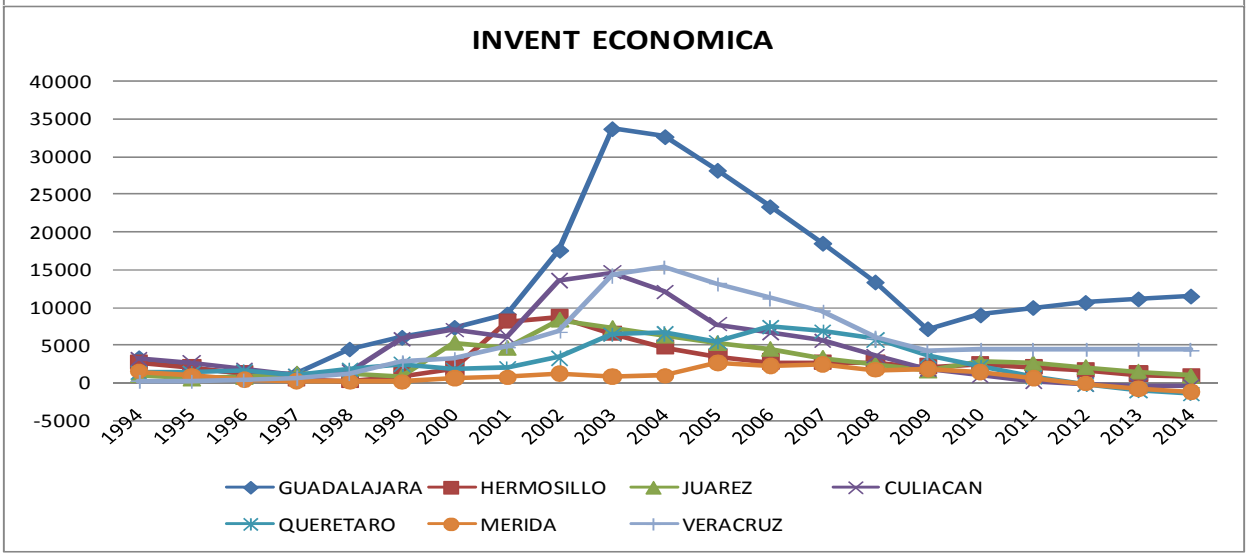




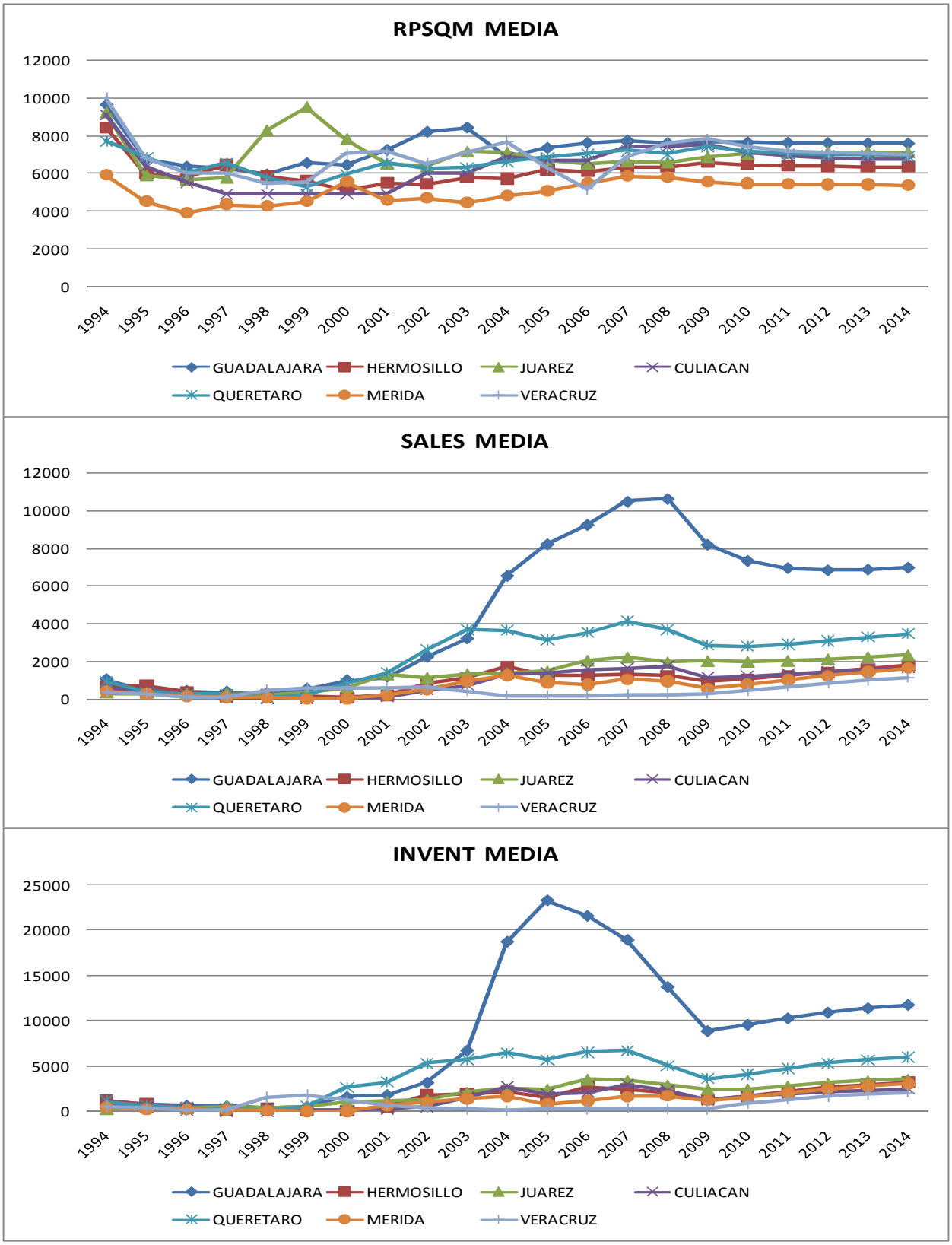
ECONOMICA SEGMENT FORECASTS



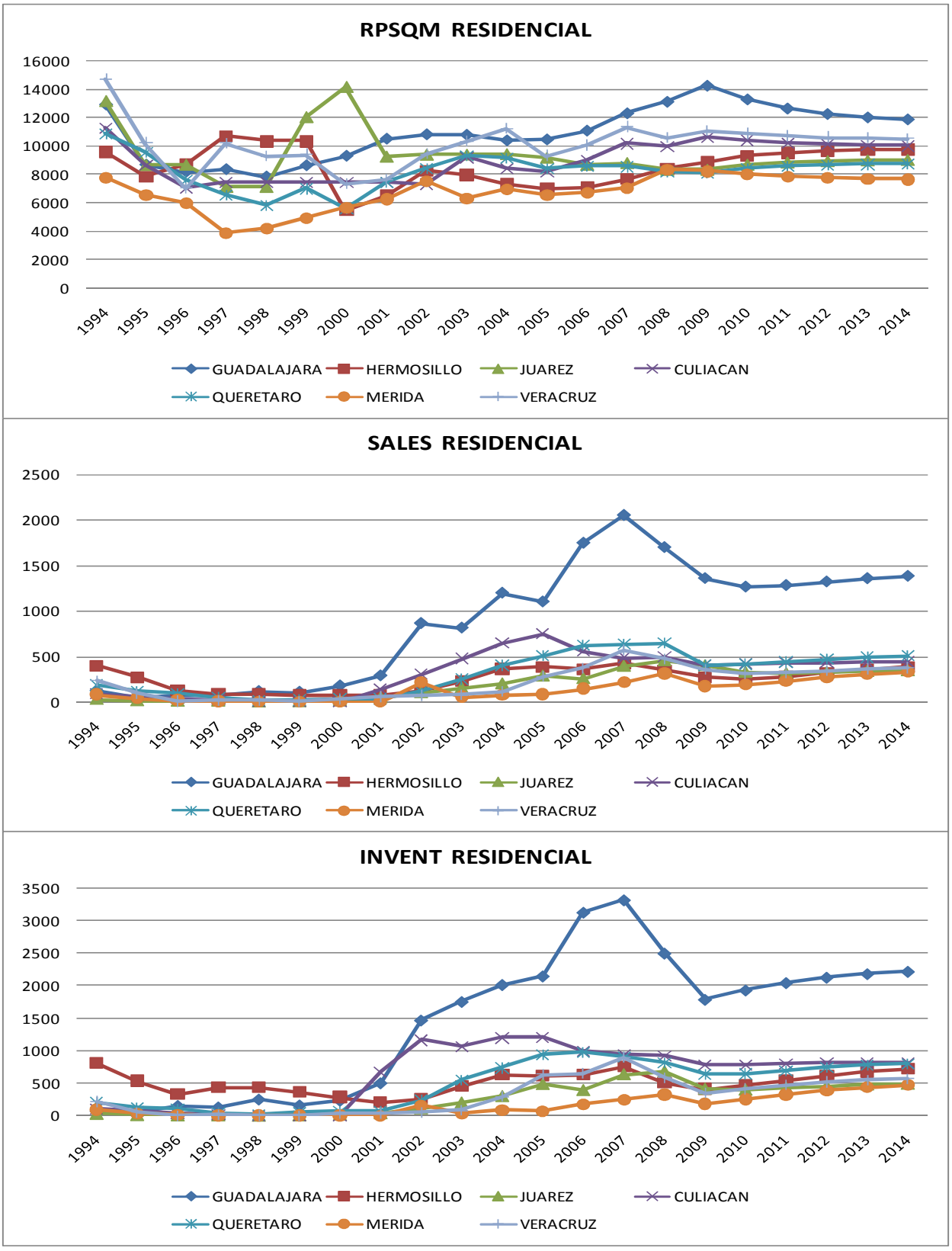




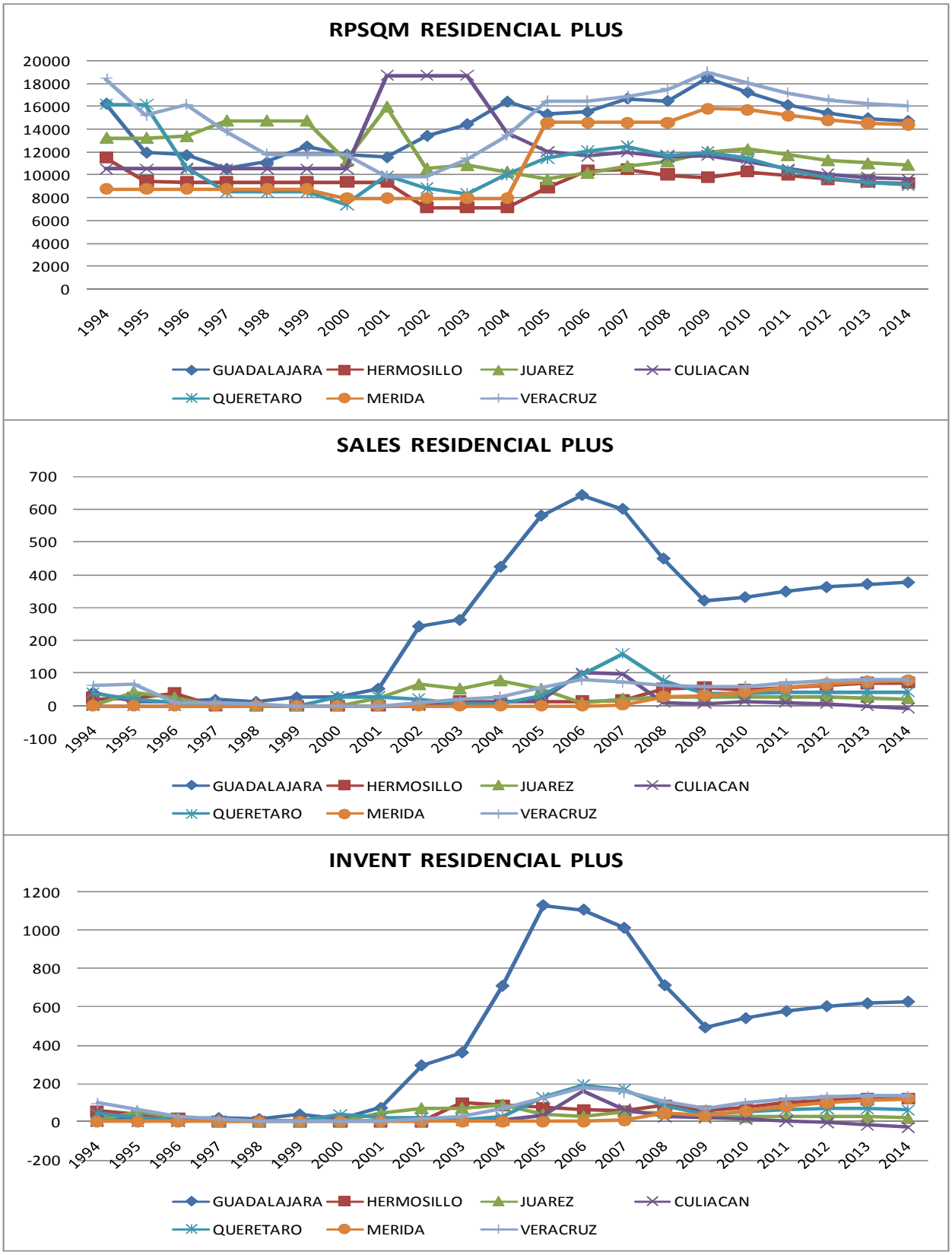
MEDIA SEGMENT FORECASTS



RESIDENCIAL SEGMENT FORECASTS



RESIDENCIAL PLUS SEGMENT FORECASTS



All segments and cities seem to behave in a way that is consistent with national performance. Prices remain relatively stable after falling as a result of the 1994/1995 crisis, and sales increase with the improvement of macroeconomic conditions and the return of private banks to the housing capital markets.

The forecasts seem logical, with prices and sales adjustments expected in 2009 and 2010 in response to the current housing market situation. After a small adjustment in prices the model forecasts prices will remain relatively stable, except for the high-end residential market (Residencial Plus) where the model projects a stronger downward adjustment on prices, responding to the pronounced increase realized in this segment in the recent past.

After the adjustment in sales the model forecasts sales to continue growing but at a much slower pace than that experienced leading up to 2007, when housing markets grew at historic rates. The slower sales growth is consistent with expectations of many housing market participants.

As expected when using a supply driven model, inventories and sales appear highly correlated such that higher inventories drive higher sales, and lower inventories result in fewer sales.

Forecasts seem to agree with the regional analysis and with developers defensive housing strategies. The results show greater opportunity in the most affordable housing (social), with stabilized prices and the highest sales growth. The high-end residential market (Residencial Plus) trend demonstrates the worst performance with a more prominent price adjustment and a slower sales pace.

CONCLUSIONS

The housing industry in Mexico still offers attractive investment and development potential, with appealing average returns and exceptional additional upside. However, there is no doubt that the market is maturing and that industry players must begin to employ more sophisticated strategies in order to remain relevant.

It is anticipated that only sophisticated, opportunistic developers that are able to identify under-served submarkets and to deliver the appropriate product will survive the recessionary economic climate. The VAR model developed in this thesis offers a solid framework within which to measure and forecast Mexican housing markets. It provides a flexible analytical tool that may be used to measure and forecast market performance and trends through the relation between dependant housing variables and fundamental variables of real estate development. This valuable tool permits analysts to make educated guesses about expected market behavior, and to strategize and plan accordingly. The model also enables comprehensive sensitivity analysis for different scenarios and outcomes of the independent variables.

The resultant forecasts allow developers to identify markets with greater opportunity, while providing the requisite information with which to avoid the development of over–supply in a certain market, of a specific product type. The VAR tool will also help housing financing entities to create mortgage origination thresholds, in turn allowing them to decide which regions and which segments or product types to finance. An auxiliary effect is a reduction in delinquency rates, as lenders finance projects with a higher likelihood of success.

This analysis also enables mortgage lenders to improve capital allocation mechanisms. Lenders are forced to consider true market demand for mortgage financing, mitigating the need to redistribute resources that were inappropriately assigned.

In the same way, the analysis may help government agencies and policy makers create a more thoughtful method for assigning subsidies or creating housing support programs for cities, product types, and income levels that need it the most.

For further analysis a larger sample of cities may contribute to a more rigorous and reliable model. The flexibility of the model also allows repeated testing with different variables, which may add significance and may be used to help explain the market. If too many variables were to be added to the model, Bayesian model selection methods could be implemented to the VAR framework. Bayesian VAR models have proven to work well with large datasets that include many variables. A simple VAR model typically doesn't exceed 18 variables. The virtue of the Bayesian model is that one can begin with the "full model" (or with an overparametrized model) and then search for restrictions over the parameter space[46].

A model with a larger sample of cities would also allow the grouping of cities, which would facilitate regional analyses. A regional analysis could, for example, allow us to forecast the markets for border or beach cities. The specific regional model could then be tested with variables that help explain those respective markets' strong correlation with the US economy.

[46] Korobilis, Dimitris, 2007, "Forecasting in VAR models with large datasets," Department of Economics, University of Strathclyde.

REFERENCES

[1] Stock, James and Mark Watson, 2001, "Vector Autoregressions," Journal of Economic Perspectives 15.

[2] DiPasquale, Denise and William C. Wheaton, 1996, "Urban Economics and Real Estate Markets".

[3] Zivot, Eric, and Jiahui (Jeffery) Wang, 2002, "Vector Autoregressive Models for Multivariate," Chapter 11, Modeling Financial Time Series with S-PLUS, Wang, Springer-Verlag.

[4] Zivot, Eric, May 2006, "Class slides on multivariate time series and VAR models," Time Series Econometrics, University of Washington.

[5] Lutkepohl, Helmut, 2000, "Vector Autoregressions," Chapter 32 in Baltagi, A Companion to Theoretical Econometrics.

[6] Korobilis, Dimitris, 2007, "Forecasting in VAR models with large datasets," Department of Economics, University of Strathclyde.

[7] Yaffee, Robert, September 2003, "A Primer for Panel Data Analysis," NYU.

[8] Wheaton, William C. and Nai Jia Lee, 2009, "The co-movement of Housing Sales and Housing Prices: Empirics and Theory," Center for Real Estate, Massachusetts Institute of Technology.

[9] Kunz, Ignacio and Irma G. Romero, 2008, "Naturaleza y dimensión del rezago habitacional en Mexico," Economia, Sociedad y Territorio 26.

[10] Requejo, Victor, March 2009, "The Housing Train," El Economista 19.

[11] "Estado Actual de la Vivienda en Mexico 2008" CIDOC foundation and SHF, November 2008.

[12] Fernandez, Gonzalo, February 2009, "Latin America Equity Research," Santander Bank.

[13] Cano, Ariel, February 2009, Director, CONAVI (Housing National Council). NYC: "Mexico's Housing Day".

[14] Negrete, Sergio, March 2009, "Global Crisis Weighs on Outlook for Mexico," IMF Survey Magazine.

[15] "Mexican Housing Overview 2008," Softec, S.C., January 2008.

[16] "LatAm Crisis Over Time," Latin Strategy Briefing, UBS Pactual, October 2008.

[17] "Remittances to Mexico fall," The Wall Street Journal, July 2009.

[18] Fierro, Karen, 2008, "Hedonic Housing Prices in Ciudad Juarez," Thesis from the Economics Department of the University of Texas at El Paso.

[19] Arimah, Ben C., 1992, “An Empirical Analysis of the Demand for Housing Attributes in a Third World City,” Land Economics.

[20] Bible, Douglas S., and Chengho Hsieh, 2001, “Gated Communities and Residential Property Values,” The Appraisal Journal.

[21] Blomquist, Glenn, and Lawrence Worley, 1981, “Hedonic Prices, Demand for Urban Housing Amenities, and Benefit Estimates,” Journal of Urban Economics.

[22] Can, Ayse, 1992, “Specification and Estimation of Hedonic Housing Price Models,” Regional Science and Urban Economics 22.

[23] Garcia, Veronica, and Adolfo Ortega, May 2009, “La Gran Estafa”, Expansion No. 1015

[24] “Realiza Fovissste primera emission de Cedevis,” Real Estate Market and Lifestyle, June 2009.

[25] “Situacion Inmobiliaria,” Estudios Economicos BBVA Bancomer, January 2009.

[26] “Situacion Inmobiliaria,” Estudios Economicos BBVA Bancomer, September 2008.

[27] González, Leonardo, 1997, “Estimación de la Demanda de Vivienda: Tenencia y Gasto en Servicios. El Mercado Metropolitano de México,” El Trimestre Económico 64.

[28] Eppli, Mark and Monty Childs, 1995, “A Descriptive Analysis of U.S. Housing Demand for the 1990s,” The Journal of Real Estate Research 10.

[29] Sirmans, G. Stacy, David A. Macpherson, and Emily N. Zietz, 2005, “The Composition of Hedonic Pricing Models,” Journal of Real Estate Literature 13.

[30] Fontela, Matias and Fidel Gonzalez, 2009, “Housing demand in Mexico,” Journal of Housing Economics 18.

BIOGRAPHY

Ricardo Solórzano graduated with honors from his Bachelor in Financial Management from the Instituto Tecnológico y de Estudios Superiores de Monterrey (Campus Monterrey) in May 2002. After graduating he assumed the position of Managing Director of Grupo Sol, a real estate group dedicated for over 25 years to the integrated development, administration and sale of commercial and housing projects. The group has grown to be one of the pioneer residential developers in the state of Chihuahua, Mexico. Today, Ricardo has over 8 years working in the Real Estate market, 6 of them overseeing the operations of Grupo Sol and all the companies that comprise this real estate group. Aside from his role as Director, Ricardo is also actively involved as a member on the National Chamber for the Industry of Housing Development and Promotion (CANADEVI), as well as a founding member of the Mexican Association of Real Estate Professionals (AMPI Juarez A.C.).

Through his studies at MIT, Ricardo looks to continue learning about the real estate business in order to acquire the tools necessary to take his company to the next level, so that it may continue with it's mission of improving our quality of life through the spaces in which we work and live, by the integrated development of real estate.

APPENDIX

EXHIBIT A: MACROECONOMIC INDICATORS

Macroeconomic and Construction Indicators

																Projections					
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Population (millions)	89.5	91.1	92.6	93.9	95.3	96.6	98.0	99.0	100.0	101.0	102.1	103.1	104.2	105.3	106.3	107.4	108.5	109.5	110.6	111.7	112.9
Annual % change	1.8	1.8	1.6	1.5	1.4	1.4	1.4	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Inflation - INPC end of period (index 2000=100)	30.7	46.6	59.6	69.2	81.9	91.9	100.0	104.3	110.2	114.5	120.3	124.3	129.3	134.1	142.9	147.9	152.5	157.1	161.8	166.7	171.8
Inflation - INPC end of period (annual % change)	7.1	52.0	27.7	16.2	18.4	12.1	8.9	4.3	5.6	3.9	5.1	3.3	4.0	3.7	6.5	3.5	3.1	3.0	3.0	3.0	3.0
Real GDP (billions of pesos from 2003)	6,032	5,660	5,951	6,354	6,666	6,924	7,381	7,370	7,431	7,556	7,858	8,110	8,526	8,810	8,929	8,601	8,688	9,099	9,598	10,110	10,605
Real GDP (annual % change)	4.4	-6.2	5.2	6.8	4.9	3.9	6.6	-0.2	0.8	1.7	4.0	3.2	5.1	3.3	1.3	-3.7	1.0	4.7	5.5	5.3	4.9
Real GDP per Capita (pesos from 2003)	67,357	62,094	64,288	67,651	69,983	71,690	75,346	74,446	74,305	74,794	76,999	78,671	81,807	83,694	83,982	80,098	80,112	83,071	86,755	90,478	93,970
Real GDP per Capita (annual % change)	2.6	-7.8	3.5	5.2	3.4	2.4	5.1	-1.2	-0.2	0.7	2.9	2.2	4.0	2.3	0.3	-4.6	0.0	3.7	4.4	4.3	3.9
TIIE 28 average (%)	ne	55.2	33.6	21.9	26.9	24.1	17.0	12.9	8.2	6.8	7.1	9.6	7.5	7.7	8.3	5.9	5.5	6.3	6.3	6.3	6.3
CETES 28 average (%)	14.1	48.4	31.4	19.8	24.8	21.4	15.2	11.3	7.1	6.2	6.8	9.2	7.2	7.2	7.7	5.4	5.1	5.9	5.9	5.9	5.9
Unemployment Rate							2.6	2.8	3.0	3.4	3.9	3.6	3.6	3.7	4.0	5.1					
Total Private Formal Employment (annual % change)	0.6	-5.4	2.6	7.7	7.8	5.7	5.9	-0.5	-0.8	-0.5	1.1	3.1	4.6	4.2	0.1	0.0					
Real Construction GDP (annual % change)	8.4	-23.5	9.8	9.3	4.2	5.0	4.2	-5.7	2.1	3.3	5.3	2.5	7.9	3.0	0.0	0.3					
Residential Construction Prices (annual % change)																					
General	4.6	45.6	25.4	15.9	19.1	14.4	7.6	3.5	3.5	6.9	12.2	-0.4	8.5	3.0	9.6						
Materials	4.0	49.0	24.1	19.2	18.6	15.4	6.9	2.2	2.7	7.2	14.8	-1.6	10.0	2.6	11.4						
Labor	7.4	31.4	31.3	1.0	21.9	8.8	11.2	10.1	7.6	5.4	4.4	3.7	4.0	4.4	3.5						

Sources: Banco de México, INEGI, BBVA Bancomer, IMF

Housing Financing

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Loans and Subsidies Originated (thousands)											
Total	196.3	279.5	331.9	326.8	400.3	500.7	532.0	525.6	655.5	636.9	619.2
Annual % change		42.4	18.7	-1.5	22.5	25.1	6.3	-1.2	24.7	-2.8	-2.8
Infonavit	105.6	195.4	250.1	200.5	268.7	291.4	300.8	371.7	418.0	456.0	500.0
Fovissste	15.3	17.9	24.3	26.6	11.1	66.4	59.4	48.7	76.5	70.5	80.0
Fonhapo	5.5	6.4	6.7	21.1	24.1	23.1	31.0	33.0	91.5	35.7	21.8
SHF	55.4	59.1	46.7	47.6	46.1	54.2	65.3	54.4	37.1	32.6	32.9
Private Banks and SOFOLES	2.0	0.8	0.8	3.7	9.7	20.7	37.5	49.0	92.8	191.2	220.0
Others			3.2	27.3	40.5	44.8	37.9	21.5	17.3	14.4	19.0
Reduction**								-52.8	-77.7	-163.5	-254.4
Financing Flow (Constant thousands of millions of pesos*)											
Total	43.5	65.6	84.2	85.6	100.5	142.4	157.7	174.2	232.5	255.9	252.1
Annual % change		50.8	28.4	1.7	17.4	41.7	10.7	10.5	33.5	10.1	-1.5
Infonavit	25.2	48.1	61.8	50.8	66.2	69.4	69.8	88.9	100.6	108.0	102.0
Fovissste	3.3	4.3	5.0	6.8	4.6	21.7	20.2	17.5	27.6	23.6	22.3
Fonhapo	0.5	0.5	0.8	0.1	1.3	1.4	2.2	1.9	4.1	2.0	1.7
SHF/Fovi	7.3	6.0	9.3	17.0	13.2	17.5	24.2	19.3	12.5	12.2	11.5
Private Banks and SOFOLES	1.8	0.7	0.9	3.2	7.7	13.4	25.8	46.6	87.7	110.2	114.6
Private Bank Mortgage Loans											
Balance end of period (tmp)	52.4	51.2	50.2	49.4	50.9	56.4	73.6	135.8	204.4	251.3	
Delinquency Rate	33.4	22.3	13.7	12.6	11.2	8.4	6.1	3.2	2.9	3.1	3.4

Sources: Softec, Banco de México, BBVA Bancomer, SHF, CONAVI

* Pesos from June 2008

** Refers to loans or subsidies considered in two or more institutions