UNIVERZITA KARLOVA V PRAZE

FAKULTA SOCIÁLNÍCH VĚD

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Bakalářská práce

2011 **Hana Hejlová**

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Efficiency of Regulation on Spanish Housing Market

Bakalářská práce

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ABSTRAKT

Práce se zabývá multilaterálními a vzájemně se umocňujícími vztahy působení mezi hospodářským a úvěrovým cyklem a cyklem cen bydlení, a proto hodnotí španělský trh s bydlením v širších souvislostech. S využitím několika koncepčních poznámek ke struktuře poptávky lze pak dynamiku, kterou ceny bydlení ve Španělsku prošly, vysvětlit na základě rozdílu v reakcích těchto komponentů poptávky na měnící se finanční a makroekonomické prostředí v zemi. Na základě výsledků empirického zkoumání rovnováhy mezi poptávkou a nabídkou v čase i napříč územím jsou pro vysvětlení značného objemu bydlení, které bylo obchodováno v letech prudkého nárůstu cen, uvažována očekávání. Pomocí jednoduchého mikroekonomického modelu rozhodování se zahrnutím daňových kritérií může být dále hodnocen vliv, který měla na prohloubení cyklu bydlení právě příznivá fiskální opatření. Přítomnost vzájemných vztahů mezi proměnnými navrhovaná diskutovanou teorií byla dále empiricky potvrzena pouze v období nárůstu cen, v případě poklesu byla pak indikována asymetrie v rychlosti přizpůsobení se cen směrem dolů, poukazující na redistribuční dopad takto strmých změn v cenách bydlení. Dosažené výsledky umožnily hodnocení možností v lepším využívání anti cyklických regulatorních opatření směrem k eliminování vzájemně se prohlubujících cyklů a nebezpečí vzniku finančních a makroekonomických disbalancí.

ABSTRACT

Covering reciprocal and mutually reinforcing relations between business, housing and credit cycles, the thesis assesses the Spanish housing market in its wider circumstances. With use of several conceptual notes on demand for housing, dynamic path of the house prices in Spain may be explained based on the difference in how these structural

components react on changes in financial and macroeconomic environment. As a result of controlling for match of demand and supply in both timely and spatial manner empirically, expectations were included to explain the subsequent volume of housing traded on the market and simple microeconomic decision making model taking into account taxes was derived to assess the role favourable incentives might have played on fuelling the house price cycle in Spain. Next, existence of the reciprocal relations suggested by the theory discussed was confirmed empirically only during the house price upturn and asymmetry in speed of downward adjustment was found in the opposite case, pointing out at the redistribution effect abrupt changes in house prices have in time. The results derived finally allowed to assess possibilities of better employment of anti cyclical regulatory tools towards eliminating mutually enforcing powers between the cycles and avoiding both financial and macroeconomic imbalances in future.

KLÍČOVÁ SLOVA

Hospodářský a úvěrový cyklus, cyklus cen bydlení, očekávání, procykličnost, dynamické oprávkování, anti cyklická opatření

KEYWORDS

Business and credit cycle, house price cycle, expectations, procyclicality, dynamic provisioning, anti cyclical prudential tools

ROZSAH PRÁCE

Počet znaků: 111 860

PROHLÁŠENÍ

Prohlašuji, že jsem předkládanou práci zpracovala samostatně a použila jen uvedené prameny a literaturu a že práce nebyla využita k získání jiného titulu. Souhlasím s tím, aby práce byla zpřístupněna pro studijní a výzkumné účely.

V Praze dne 19.5.2011 Hana Hejlová

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TEZE BAKALÁŘSKÉ PRÁCE

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Garant studijního programu Vám dle zákona č. 111/1998 Sb. o vysokých školách a Studijního a zkušebního řádu UK v Praze určuje následující bakalářskou práci

Předpokládaný název BP:

Efficiency of Regulation on Spanish Housing Market

Charakteristika tématu, současný stav poznání, případné zvláštní metody zpracování tématu:

Dynamika cen nemovitostí ve Španělsku v posledním desetiletí byla způsobena nárůstem poptávky tažené pozitivními demografickými i ekonomickými trendy. Vysoký stupeň imigrace i odklon od dvougeneračního bydlení zvyšovaly poptávku po primary homes, nárůst zaměstnanosti a zvyšující se disponibilní důchod domácností s pomocí zahraničního financování pak vytvářely poptávku po vacation homes, přičemž především poptávka po nemovitostech jako investici se ukázala být pro tvorbu cen ve Španělsku zcela zásadní. Ve Španělsku tak postupně docházelo k vytváření specifické struktury poptávky po bydlení a pozitivních impulsů pro rozvoj stavebního sektoru. Všechny tyto trendy byly pak podpořeny nebo motivovány nízkou úrokovou mírou před rokem 2007.

Realitní trh ve Španělsku se ukázal být významně procyklický, čemuž se Španělská centrální banka pokoušela čelit zavedením adekvátní kapitalizace a dynamického oprávkování. Jeho zavedení nemělo před vypuknutím realitní krize žádoucí vliv na růst objemu úvěrů, který rostl i tak, umožnilo ovšem vytvoření kapitálových nárazníků. Významnou roli ve vztahu mezi rychlým nárůstem úvěrů a loan looses hraje závislost rizika na výpůjčním cyklu banky, tedy korelace mezi objemem půjček poskytnutých a nesplacených, rozdílná pravděpodobnost nesplacení u různých forem půjček i

přizpůsobující se požadavky na zástavy za hypotéky rovněž ve vztahu k fázi výpůjčního cyklu, ve kterém se banka nachází.
Vzhledem k mezinárodnímu charakteru tématu bude práce vedena v anglickém jazyce. Ke zvýšení její kvality by měla přispět velmi dobrá znalost španělského jazyka, tedy schopnost analyzovat i zdroje dostupné pouze lokálně, stejně jako zkušenost se sociálním i pracovním prostředím v analyzované zemi, které se na výše zmíněných trendech utvářejících poptávku významně podílí.

Struktura BP:

Abstrakt
V první části práce budu zkoumat vývoj cen nemovitostí ve Španělsku v závislosti na reálné úrokové sazbě, a to pomocí komparace s jinou, vhodně zvolenou zemí, která nízkým úrokovým mírám čelila též. Vyhodnocením srovnání vzniknou závěry o struktuře poptávky po nemovitostech ve Španělsku.
Ve druhé části se budu věnovat hodnocení účinnosti nástroje dynamického oprávkování s důrazem na cyklické chování tohoto nástroje v období krize, a to pomocí srovnání nárůstu objemů poskytnutých úvěrů po jeho zavedení a odhadu jejich růstu v případě, že by dynamické oprávkování zavedeno nebylo.

Osnova
1. Úvod
2. Struktura poptávky po realitách ve Španělsku
2.1. Shrnutí dosavadních poznatků
2.2. Vývoj cen nemovitostí v závislosti na výši úrokové míry
3. Hodnocení cyklického efektu dynamického oprávkování v období krize
3.1. Struktura úvěrů před krizí a odhad jejich vývoje bez zavedení dynamického oprávkování
3.2. Srovnání odhadovaného vývoje a skutečného vývoje po zavedení dynamického oprávkování
4. Závěr

Seznam základních pramenů a odborné literatury:

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OBSAH

INTRODUCTION

The 2008/2009 global financial crisis, triggered by burst of the real estate bubble, has attained a lot of attention to the credit granting and rose question about cyclical nature of the regulatory frameworks and the role they play in fuelling the inherent pro-cyclicality of the financial sector. However, two of the most affected countries in the European Monetary Union and Europe as a whole, Ireland and Spain, have followed different regulatory approach in terms of cyclicality on their path towards financial imbalances being built up.

Enhanced by prosperous macroeconomic environment of the last upturn in Spain, the vicious circle of mutually reinforcing powers between residential real estate bubble and related credit boom were inevitably found at the centre of attention. Banco de España in its Financial Stability Report in October 2010[1] assumes the collateral price fall of housing would account for fifty percent in the stress test adverse scenario. Apart from the fact that value of the underlying asset may fall bellow value of the credit if it comes out that the prudential ceilings on loan-to-value ratios, considered conservative that time, were not sufficient facing the scope of the current downturn, most of the credit on housing bears variable interest rates. Increase in nominal interest rates connected with European Central Bank's monetary tightening and level of inflation that reached negative values in some quarters of 2009, may thus bring inability to repay. Although the substantial loan loss provisions, that the banks entered the 2008/2009 crisis with (after introduction of the dynamic provisioning), helped them to cope with the downturn, the question was whether these reserves would be sufficient, given the increase in level of specific loan loss provisions after 2008[2]. According to the 2010 European credit institutions stress testing, "*the stock of specific provisions, combined with the stock of general provisions still available in December 2009, absorb 34% of*

[1] BDE (2010). Available at http://www.bde.es/webbde/en/secciones/informes/boletines/Informe_de_Estab/2010/.

[2] For the graphic illustration, see the appendix where several results from Banco de España latest Financial Stability Report (May 2011) are presented. Selected results depict the absolute level of provisioning and doubtful loans as well as their exposure among sectors, housing and construction included.

the gross impairment for the banking system as a whole (29% for savings banks)."[3] At the same time, extensive process of the savings banks restructuring has been initiated.

Thus, there are unending questions whether steps towards avoiding price bubbles on commodity markets should by adopted by central banks and the recent experience calls for assessing such an issue in much wider circumstances than has been done up till now. Such a turbulent and almost uncharted waters the Spanish housing market entered into, is the reason why structure of this thesis and areas covered have evolved dynamically as well.

[3] Additionally, *"the capacity to absorb hypothetical losses through net operating income and capital gains verified by the supervisory authority is 48% of hypothetical impairment losses for all institutions (23% for savings banks)."* BDE (2010) Available at: http://www.bde.es/webbde/en/secciones/prensa/info_interes/resultados_cebs.html).

PART 1. REAL ECONOMY AND CREDIT MARKET INTERACTION: RECIPROCAL RELATIONS

It is two basic features of real estate sector what makes financial regulators and monetary policy authorities especially concerned about it: the proportion of economy which real estate sector and construction industry represent and the role which debt financing in those transactions plays. In this way, the importance of real estate price dynamics for monetary policy lies in its spillovers to the overall business cycle performance, whereas the implications of possible financial imbalances between real estate and credit institutions are of particular importance for financial stability issues. Independent statements by researchers of Financial Stability Department of Banco de España stating that *"credit is not only pro-cyclical in Spain, but actually amplifies the cycle"* and that *"the credit boom ... can be largely explained by the housing market"* (Herrero, de Lis (2009)) point out at the crucial role these relationships have on the overall economic performance of Spain. In this thesis, let us take into account existing assumptions about the main role housing market in particular played in the dynamics and for simplicity and quality of research restrict ourselves on the part of real estate sector market that deals with housing.

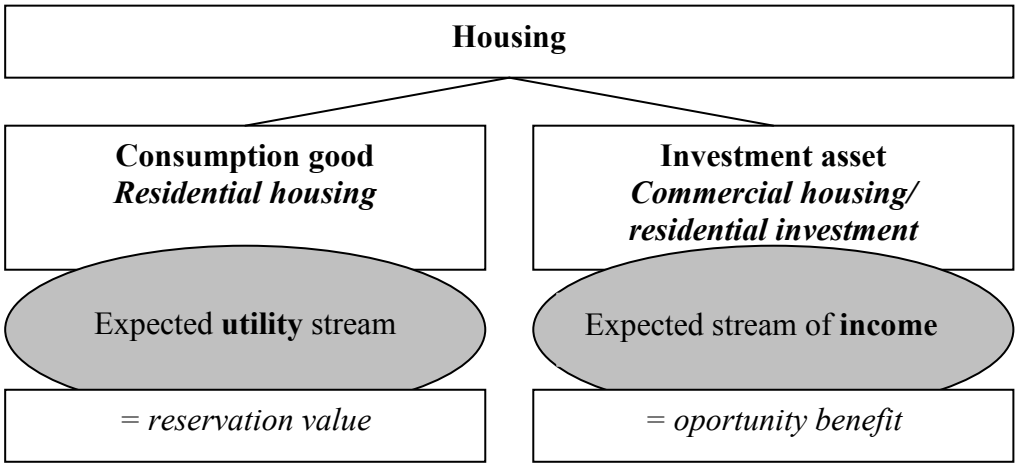
Relations between real economy indicators (for aim of this thesis GDP and house prices are assumed) and the related financial variable (volume of credit on housing granted) are naturally reciprocal, while the dual character of house purchase either as a consumption good or investment asset causes that the final effect of one variable change to another can be a sort of ambivalent. To get an overview of the transmission channels, let us first discuss relations between the three variables in general with impact given on patterns prevalent for the residential and investment housing separately, division so crucial for an analysis of housing market in Spain. Based on the short framework, let us then consider extend of the impacts in the context of Spanish economic and financial background to drain preliminary results about what the drivers of dynamics have been in Spain.

1.1 CONCEPT OF HOUSING DEMAND A: CONSUMPTION GOOD AND INVESTMENT ASSET[4]

The cost of housing with implications for real economy may be defined dually. First, the intrinsic value of housing may be given by the stream of utility generated to the dweller. Discounting value of the expected service stream, we speak about reservation value of the good (Zhu (2003)). We suggest that as well as the utility is subjective, so is personal the discount factor, however the expectations about house price inflation are probable to explain most part it. Defined as such, the discount factor represents detrimental factor for decision making about one's own housing unit purchase. The demand for housing as a consumption good will be referred to as residential housing.

Secondly, the intrinsic value may be viewed as the expected stream of income, the flow of rent most typically, discounted by the rate of return on other assets. Measured by so defined opportunity benefits, we talk about an investment asset. Such demand for housing will be called the residential investment or commercial housing (but keeping such asset is not a domain of corporate sector as wording would suggest, though).

GRAPH 1: CONCEPT OF HOUSING DEMAND A. CONSUMPTION GOOD AND INVESTMENT ASSET



Note: Basic difference between dual measurement of value generated by housing with mutual implications to business cycle of economy.

Source: Author, Zhu (2003)

[4] For all sections dealing with concept of housing demand, it applies that similar but just partial views are presented in works by García and Angel (2004), Esteban and Altuzarra (2008), Pagés and Maza (2003).

1.2 TRANSMISSION CHANNELS: FOR HOUSING AS A CONSUMPTION GOOD AND INVESTMENT ASSET

The mutual relations between business cycle, house price cycle and credit cycle may be channelled in both directions[5]. Graph 2 at the end of the sections summarises and graphically illustrates relations discussed, distinguishing between the two directions of the transmission mechanism primarily and secondly describing patterns prevailing for the two natures of real estate property specifically in each of the streams.

1.2.1 BUSINESS CYCLE → HOUSE PRICE CYCLE: HOUSEHOLD DISPOSABLE INCOME AND BUDGET CONSTRAIN

Cyclical position of economy typically has implications for macroeconomic variables with potential to explain part of house price dynamics, namely the wages, employment and inflation. Based on the fact that housing and equity represent prevailing concurrence part of household sector portfolio, the dual character of housing makes it possible to undo for the overall impact of cyclical position on demand for housing into income and substitution effect.

Given that housing typically represents the biggest portion of households' wealth, scope of which is predominantly determined by income, house price dynamics may be assessed using GDP as an information carrier about level of employment and wages. However, the existence of fiscal subsidies and tax incentives can make the personal disposable income a better proxy. Then, it is the income effect of business fluctuations by which "*twin peaks in equity and housing prices*" (Borio, McGuire (2004)) may be explained.

Simultaneously, in a high inflationary expansion period the transfer of resources towards home ownership may serve as a hedge against inflationary loss of wealth in the case of residential housing, whereas "*high uncertainty levels about future expected returns on investment in bonds and equities*" (Tsatsaronis, Zhu (2004)) shifts the capital towards commercial housing. Moreover, contrary to some of the researchers who discuss the cost of servicing a debt strictly in connection with nominal interest rates as a central bank's tool for monetary policy, author is convinced that since the country's entrance to the Euro zone and implied central bank's loss of control over the monetary

[5] For partial discussions see Tsatsaronis, Zhu (2004), Zhu (2003) and Borio, McGuire (2004).

policy in terms of interest rates setting, the inflation rate has become to a large extend the determinant for the cost of servicing a debt[6], the nominal interest rate being exogenous of central bank's decisions. In this sense, additional wealth effect of lower real interest rates when financing liquidity constrain by nominal debt further spurs the shifts in portfolio that account for the substitution effect here.

1.2.2 HOUSE PRICE CYCLE ↔ CREDIT CYCLE: FINANCIAL ACCELERATOR

Enforced by the increasing competition between financial institutions and their mortgage credit portfolio enlargement, the liberalisation of financial market allowed for the mutually reinforcing powers between the house price market and credit market known as *"financial accelerator amplification effect"* (Zhu (2003)).

Considering that "*property prices are closely connected with the borrower's financial position*" (Zhu (2003)), banks may not only increase the willingness to lend money when the real estate prices rise, but it also adds to their overall profitability as the value of their fixed assets increases, cutting down on both the loan loss provisions made and loan losses themselves incurred. The role of dual character of real estate here consists in higher sensitivity of residential investment to the market volatility implying the provisions and loses to be functions of the asset's stake in banks' portfolios (depending on stake of the corporate and household sector loans). On the other side of the vicious cycle, the inherent pro cyclicality of loan granting further amplifies the house price cycle. Extend of the influence here is given by the level of national prudential policies, the question rather challenging in times of today's tendency to abundance.

Further amplifying, on one side the house price upswing adds to the value of collateral that can be possibly used as a mortgage equity withdrawal, while on the other hand the same increased value is often used by bank itself as a collateral for further borrowing. Crucial for the strength of these effects is the mix between the loan-to-value ceilings and the scope of market sensitiveness of accounting valuation methods that enforces the pro cyclicality as opposed to historically based ones.

[6] Fischer equation.

1.2.3 HOUSE PRICE CYCLE, CREDIT CYCLE → BUSINESS CYCLE: AGGREGATE DEMAND

The extensive empirical research so far has also left no doubts about the subsequent influence real estate cycle has on business cycle, be it directly or financed through the credit market in case of credit constrained agents. Zhu (2003) distinguishes between two channels explained by macroeconomic models behind which the dual character of housing may be recognised again. The permanent income hypothesis model counts with the wealth effect generated by the increased wealth of the already-owners conditioned by the possibility of refinancing, e.g. the mortgage equity withdrawal. The investment channel based on Tobin's q approach starts with construction appraisal driving aggregate expenditures up by increased employment and consequent demand plus the upcoming liquidity effect of wealth increase of the investment property owners, what makes commercial property to be of larger impact of the two types of housing.

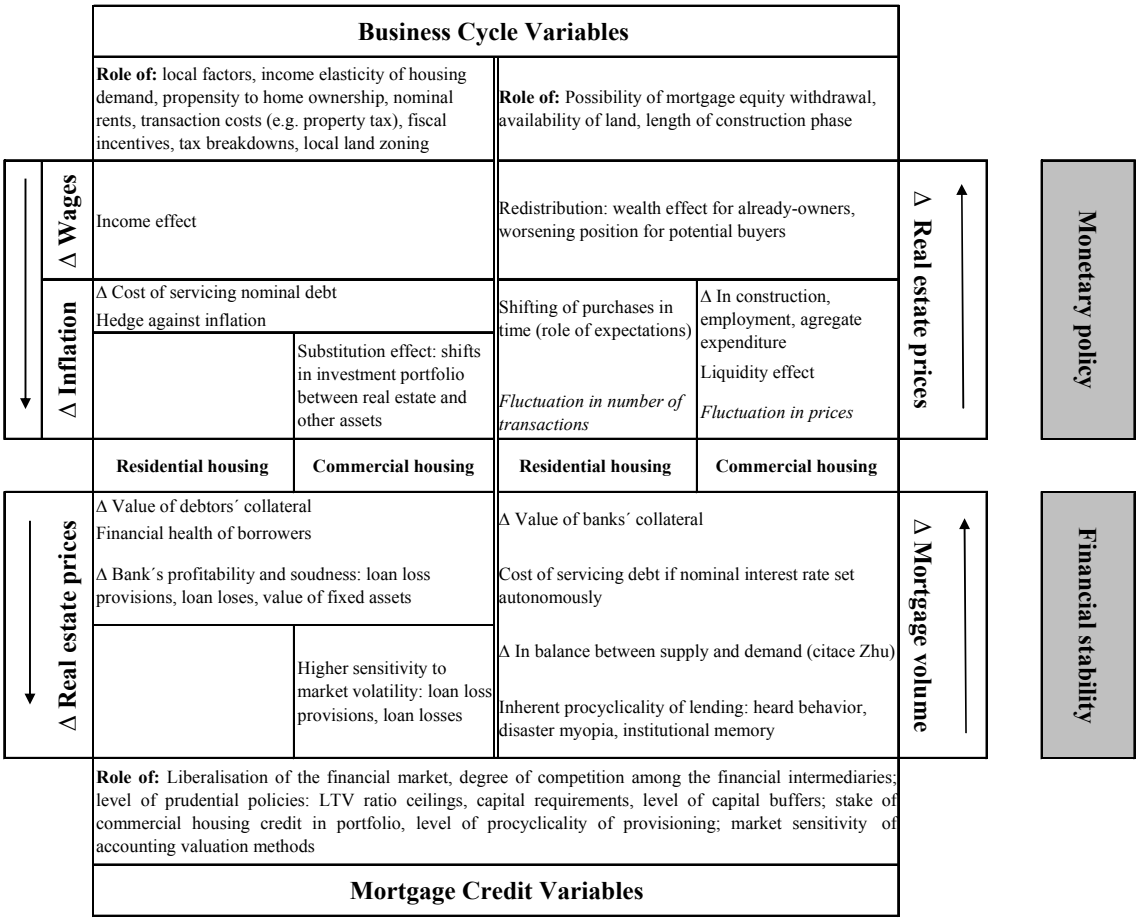
Including expectations, we have approached to explaining the issue our own way a bit. For both of the two natures of housing, the co-movement of real estate prices and expectations of level of capital gains is crucial, apparent first from the shift from rental housing towards home ownership if the price increase is considered long lasting. In case the length of price upswing is expected to encompass even the furthest horizon considered for buying a dwelling, households may be pushed to purchase a property if they are no longer willing to pay a rent (decision for paying for service, not for the property) or are stressed by the number of years left until the end of economic activity required for their credit repayment. The expectations of house prices rise may therefore push them towards the purchase since the next rental costs would exceed the purchase price saved if they waited for house prices to drop again. In the same sense, investing in housing even for higher price may bring greater capital gain than investing in other assets because of the speed of rise in price if considered longer lasting again. The redistribution effect thereafter consists in wealth increase for the already-owners, opposite to worse asset accessibility for those who haven't purchased yet. Such charted theory of house price inflationary pressures will be discussed empirically in the next part. Moreover, according to the theory[7], the investment housing tends to fluctuate in prices, whereas the accommodation of residential housing towards equilibrium is more often done by change in frequency of transaction, which means that its cycle is more

[7] See Banco de España (2010).

autonomous. This point, however, will also be a subject of critical discussion in the empirical part of the thesis, thus having implications for the aggregate demand again.

Finally, the important time lag between market incentives and its impact on amplification of business cycle fluctuations is primarily determined by the availability of land dependent *on the local planning system* (Zhu (2003), availability of funds given by competition between credit institutions and within construction sector as well.

GRAPH 2: RECIPROCAL RELATIONS AND TWO-WAY TRANSMISSION MECHANISMS



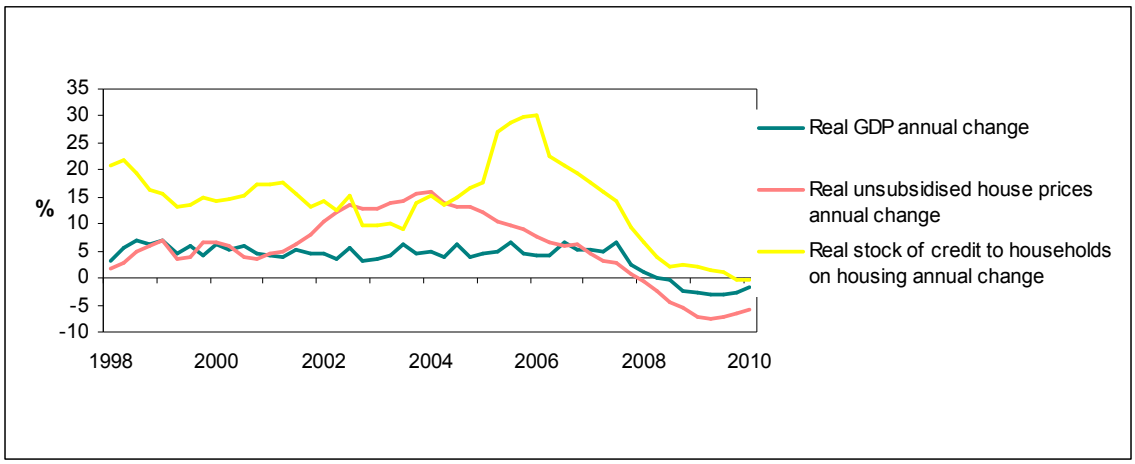
Note: Transmission channels between underlying variables may be channelled in both directions (mutual relations). The chart depicts processes through which change in one variable may have affect on another one, thus having influence on its cycle in a continuous period of time. These mechanisms, however, differ under the dual character of housing, reason why such distinction is also considered.

Source: Author

1.3 DETERMINANTS FOR DYNAMICS IN SPAIN: GRAPHICAL ANALYSIS

Since the real estate prices are to a great extend determined by the local factors, it is natural that also the magnitude of "*impact on the real GDP is different across countries and sectors*", including that "*in many cases the monetary authorities find themselves in a dilemma, as price stability in the goods market and in the asset market may call for different policy responses*" (both Zhu (2003)). In the same way, it is unconditional for the financial regulator to search for the locally specific sources and implications of house price fluctuations to precede the possible financial imbalances.[8] The analysis of the case of Spain is based on relating several time series of financial and real economy variables each time, graphic expression of which are presented at the end of each section.

GRAPH 2: BUSINESS, HOUSE PRICE AND CREDIT CYCLES IN SPAIN. REAL VALUES OF 2010:Q1



Source: Autor based on Banco de España

1.3.1 BUSINESS CYCLE → HOUSE PRICE CYCLE: FAVOURABLE MACROECONOMIC CONDITIONS AND GOVERNMENT POLICIES

The business cycle fluctuations between the second half of 1990s and year 2008 were characterised by annual GDP growth rate of average 3,6% permanently well over the EU15 average of 2,2%[9]. Accompanied by rapid job creation targeted at women (stable increase in woman employment after stagnating at level of only 31% four years before 1996 compared to 50% in EU15 at the same time) and young employees, this meant an

[8] Such locally specific conditions of Spain were significantly covered by IMF country report published a year after the peak in annual house prices growth level in 2004 (see IMF (2005)).
[9] Own computations based on Eurostat.

increase in wage income not only for individuals, but even of a larger scale for a households as a whole, unit determinant for any analysis of housing. As can seen from the graph 5 in the next section, wages have to a good extend kept the pace with house price increase, however the cost of purchasing a house by household expressed by number of years needed to repay the purchasing price by their wage reached about double the stable level of 1996-2000 between 2006 and 2008.

More determinant for the housing demand dynamics in Spain is however the disposable income after deductions in the income tax base from mortgage repayments for the main household residence purchase (IMF (2006)), since Spanish government has been very generous with this form of fiscal incentives, favouring home ownership – that was already enjoying a substantial preference - over renting. As may be undone from the graph 5 in the next section, where cost of servicing a debt is discussed, the amount of instalments payable by households expressed as a percentage of their annual disposable income[10] was complemented in the graph by its gross amount free of the tax deductions. It is obvious that tax incentives lower the annual instalment by not less than 25% approximately. Of the opposite nature to these favourable tax reliefs are the tax rules set by local administrations with collection related to real estate price. According to IMF (2005), *"they derive substantial share of their revenues from taxing real estate ... what creates perverse incentives to limit the supply of residential and commercial land"* (IMF (2006)). However, the resulting effect may be summed up as straightforward: efforts to support residential housing by the means of unilaterally aimed fiscal incentives and reducing investment housing through increasing transaction costs of holding a property or its transfers (annual house ownership tax and levy on patrimonial transmission, respectively).

At the same time, the well over-EU15-average inflation has underlined boosting both residential and commercial demand for housing, adding to already low nominal interest rates that further declined after Spain had joined the Euro Area. Finally, the permanently high inflation combined with the stock market crash in 2001 meant shift in private sector portfolio from less attractive bonds and stocks to more favourable investment in commercial housing, while the rising levels of house price-to-rent ratio

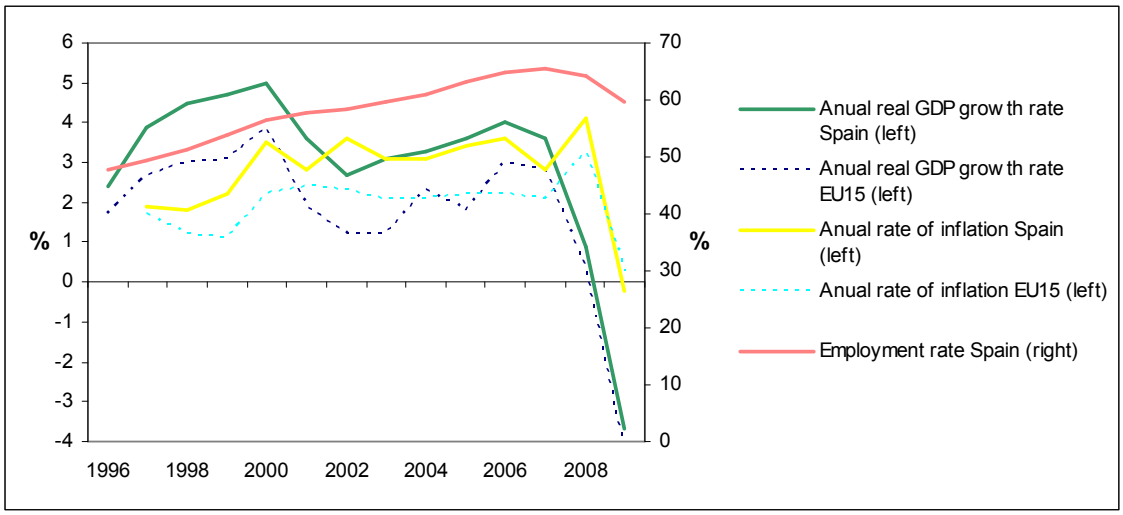
[10] Assumed an average household net of tax deductions during the first year following the purchase of a standard dwelling financed with a standard loan for 80% of the value of the dwelling. (Notes to Housing market indicators, data of Banco de España. Available at: http://www.bde.es/webbde/es/estadis/infoest/htmls/capit04.html).

served as both motivation for households to approach to their own home purchase and incentive for investors to valorise their capital by transferring it into real estate. Looking at the time series, stock market returns proved typically much higher volatility than the returns on housing, while variance of the former stands for 687, compared with 58 of the latter[11]. Turning to the comparison with return on relatively safer investment in the investment market funds, the total gross return on housing, calculated as the estimated gross return based on rent plus increase in value (involving of which is of much importance), not only began to catch up with the former, it remained even higher between 1999 and 2008 (substantially until the housing prices rise peak in 2004, then converging), while returns on even these investments in the investment market funds dropped bellow zero in 2001.

However, large discussions over impact of the individual business cycle variables have taken place in the recent years. Férnandez-Kranz and Hon (2006) estimate income elasticity of housing demand in Spain over income growth between 1998 and 2003 across Spanish provinces, concluding with "*much weaker role of income growth as a vehicle for house price growth in the long run*". According to The Economist in 2003, important for the real estate price boost was the record low ratio of the house price over average income in comparison with nominal rents. However, in 2007 the same The Economist states the boom to be fastened by nominal interest rates set by European Central Bank according to the low level of inflation in Germany, what causes real interest rate in Spain after subtracting its higher inflation are close to zero (between 1997 and 2008 inflation in Spain reached 3,0% in average, compared to half this level in Germany and 1,8% in France). Another cross-sectional analysis made in 17 industrialised countries including Spain by Tsatsaronis and Zhu (2004) then supports the above charted magnitudes for the rest of the economies with even the leading role of housing for inflation, followed by financing factors with surprisingly lowest importance of income out of price dynamics determinants.

[11] Own computation based on Banco de España.

GRAPH 3: MARCROECONOMIC COMPARISON. EU15 BENCHMARK



Source: Author based on Eurostat

GRAPH 4: COMPARISON OF RETURN ON ALTERNATIVE INVESTMENT (SUBSTITUTION EFFECT)

Source: Autor based on Banco de España

1.3.2 HOUSE PRICE CYCLE ↔ CREDIT CYCLE: COST OF SERVICING DEBT AND DYNAMIC PROVISIONING

Since 1997, the Spanish mortgage credit market has witnessed an unprecedented boost in household credit for housing accompanied by historically low level of doubtful loans out of these. According to the graphical analysis of the mortgages granted to Spanish households, this mixture was allowed by extremely low interest rates that kept the cost of servicing a debt affordable, and the master set of prudential policies that were so well able to manage the risk.

Looking at the Spanish households mortgage data, it is obvious that besides the high inflation, it was also importantly the nominal interest rates itself, what kept the cost of mortgage affordable when the house prices were peaking and wages managed to keep the pace with their increase only partially. Gradual drop in nominal interest rates arranged that amount of instalments over annual disposable income[12] remained well bellow 30% even in the very peak of the prices rise, if the instalments net of tax deductions are considered, and kept decreasing between 1996 and 2000 when the property prices were already going up, possibly in consequence with market expectations about country's entrance to the Monetary Union and interest rates convergence to those of Germany. According to IMF (2005), this was next spurred, "*by rapid development of financial markets and fierce competition among credit institutions since the late 1990s*", that brought along an increase in mortgage maturity by three times since early 1990s (up to over 30 years), with possibility to pre-pay.

For an analysis of credit in times price of the underlying the underlying commodity is evolving, both volume of flow of credit must be considered as well as the number of such credits granted. Since the volume of such flow is directly correlated with the prices, frequency of granting may better indicate change in the consumer patterns of behaviour. The best way, finally, is to consider the two characteristics hand in hand. Based on our previous theoretical assumptions about residential housing fluctuating in frequency of purchases, one would suppose number of new mortgage loans to decrease when the prices are rising sharply. The opposite movements during 1997 – 2007 house price boom were observed, actually.

Control for indebtedness in times of raising property prices and interest rates decrease was done by method of credit scoring with automatic sensitivity analysis that at the same time helped to cope with the risk in the following way: since price of the underlying property were possibly overvalued[13], building up of risk on Spanish credit institutions balance sheets might have lied in high loan-to-values ratio and collateralised loans as well as variable interest rates most mortgages granted in Spain bear[14]

[12] Average household and instalment during the first year following the purchase of standard dwelling financed by a standard loan for 80% of the value of the dwelling is again considered here. (Housing market indicators, Banco de España)

[13] Since the issue of defining a house price bubble is very difficult to cope with, we will try to avoid using such expression intentionally.

[14] See also the Annual Report 2010 of Banco Santander. Available at: http://www.santander.com/csgs/Satellite?canal=CAccionistas&cid=1237866946419&empr=SANCorporativo&leng=en_GB&pagename=SANCorporativo/Page/SC_ContenedorGeneral.

(IMF(2006)). In this sense, value of the asset (equity) may drop bellow level of the loan (liability) if it comes to decrease in price and higher interest rate carried with expected tightening of the monetary policy may be something debtor is not able to comply with. Actually, more than 80% LTV ratio mortgage loans did not account for more than 20 percent even in their very peak. IMF survey on selected Spanish credit institutions points out that the large ones use experience-based scoring models for both residential and commercial mortgage loans with in-built automatic analysis of sensitivity of borrower's debt-to-income ratio on the interest rates shocks. Actual absence of prudential regulation ceilings on LTV ratio was substituted by incentives for credit institutions not to exceed the 80% limit, as this would *double the regulatory-capital risk-weighting and require tougher provisioning* (IMF (2006)).

Alarmed by the extremely low ratio on non-performing loans in times of extensive granting and cautious of the above described market risk, Banco de España has developed prudential loan loss provisioning policy to eliminate danger of financial imbalances that could result from the high stake banks had of real estate loans in their portfolios, in case of both commercial and saving banks (stake of 55% of mortgage credit of cajas, the saving banks). Convinced that the risk is generated just in these times of plenty, the Spanish regulatory authorities designed the loan loss provisioning to reduce

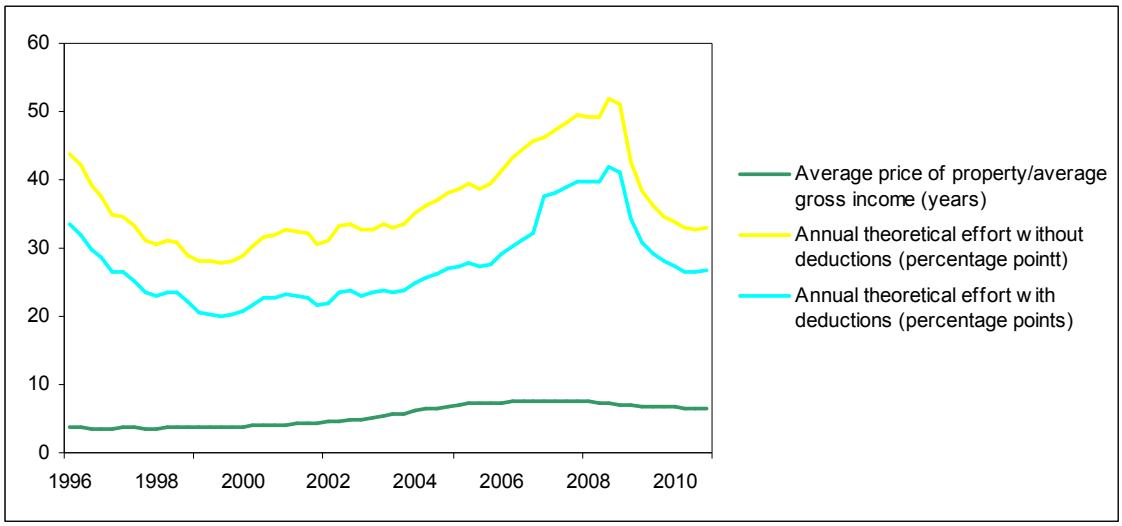
i) the natural lending pro cyclicality of the financial system that existing regulation was not able to avoid (actually it might have enhanced it)
ii) the inducing cyclicality of property prices and business cycles hand in hand.

Contrary to Basel II based on the presumption that risk is more probable to materialise in the downturn, the Spanish regulators approached to the loan loss provisioning on the premise that lending mistakes are prevalent in the upturn, reasons for what may come from country specific factors. The concept of dynamic provisioning introduced statistical provisioning to smooth the currently existing general and specific provisions under that time regulatory framework.

However the issue of dynamic provisioning will not be coped with empirically in details in this thesis since it requires data that are not at dispose and sophisticated methods, those that are beyond the scope of a bachelor's thesis, to be used, the unique use of such concept in world calls for our attention. To maintain line of this part of thesis, few empirical findings about cyclicality of credit risk in Spain that have lead to dynamic

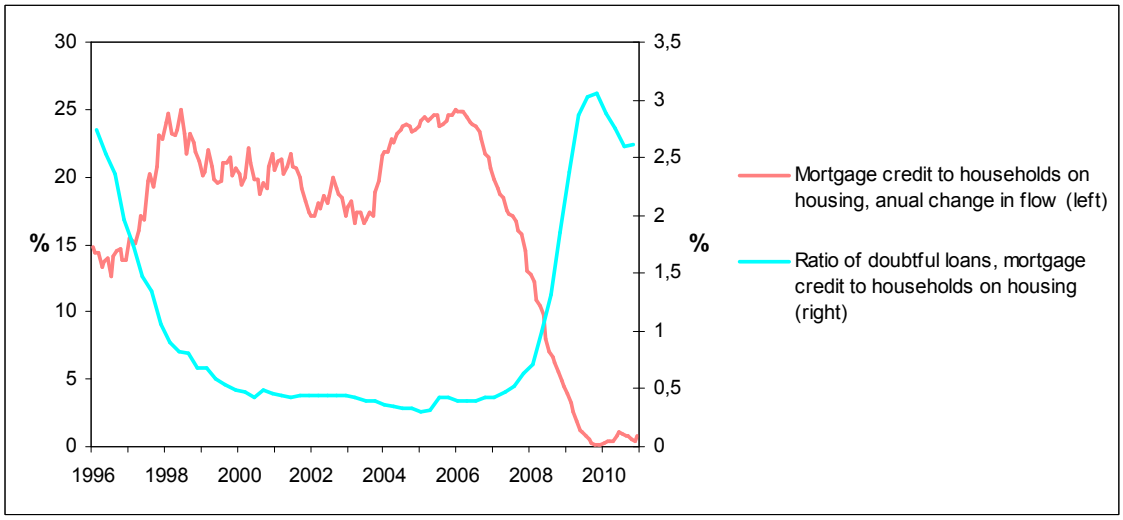
provisioning introduction will be mentioned on this place, while some more conceptual remarks on principles which the dynamic provisioning are based on will be made in the last part. Jiménez and Saurina (2005) "*find strong empirical support of a positive relationship between rapid credit growth and loan looses*" and on their problem loan ratio model, it may be exemplarily concluded on what both micro and macroeconomic Spain specific reasons for ex post credit risk have been. Controlling for GDP, nominal interest rates and risk diversification strategies of banks in terms of both geographic and industry diversification and distinguishing between specialisation in collateralised loans for corporate sector and households, their model has indicated following relationships: relationship between problem loan ratio and regional concentration (positive), stake of collateralised loans to households (negative), economic activity and interest rates (positive and more rapid than the previous one). Finally, "*positive, lagged and significant relationship between loan growth and credit risk*" (Jiménez, Saurina (2005)) was confirmed by robustness test in Spain, while it was proved that at the same speed that rapid credit growth increases the risk, problem loans are reduced in times of its decline. At the same time, they alert to what stands for the spillover of the inherent credit pro cyclicality to the property and overall business cycles. The pro cyclical lending as a result of over optimism leads to "*some negative NPV projects financed to be later found impairment of the loan or default of the borrower, while in recessions, banks suddenly turn conservative and tighten credit standards well beyond positive net present values*" (Jiménez, Saurina (2005)), what further adds to the downturn. Thus, tightening standards in times of plenty reduces both boosting of demand for housing and the would-be drop in output if it were tightened when the losses materialize.

GRAPH 5: COST OF SERVICING NOMINAL DEBT (INCOME EFFECT)



Source: Author based on Banco de España

GRAPH 6: EVOLUTION IN RATIO DOUBTFUL LOAN IN TIMES OF THEIR ABUNDANT GRANTING



Source: Autor based on Banco de España

GRAPH 7: MORTGAGES TOTAL AND FOR HOUSEHOLDS SEPARATELY: VOLUME AND NUMBER

Source: Autor based on Banco de España

1.3.3 HOUSE PRICE CYCLE, CREDIT CYCLE → BUSINESS CYCLE: AGGREGATE DEMAND

In the first year after the introduction, there was an excessive accumulation of general provisions fund, whereas the specific provisions were kept historically low. However, the indirect effect of dynamic provisioning the on business cycle could not have been significant either. On the other hand, our idea is that the resulting effect dynamic provisioning had on the business cycle should be undone for corporate and households sector loans separately, since the first one is more prone to market volatility, thus the effect of anti cyclical regulatory approach might be stronger in relative terms, while secondly the corporate real estate loans are detrimental to future real estate supply. Here again, no more space will be devoted empirically to the issue, thus let us conclude with proposing it for further research.

Directly, "*the analysis of housing volume cycles in Spain is particularly relevant, given the strong investment in residential construction in the decade prior to 2006.*" (Álvarez, Cabrero (2010)) From the point of view important for the regulator, they point out at the leading role residential investment had over GDP, being of an "*anticipatory nature*," (Álvarez, Cabrero (2010)) thus.

However in this thesis, more stress on the opposite causality from business cycle to house price cycle will be put. Secondly, we will rely on the assumptions about demand driven house price increase in Spain (Esteban, Altuzara (2008)), thus impact on business cycle will be explained through impact on the construction sector and rise in residential demand.

PART 2. HOUSING DEMAND AND SUPPLY: ITS DYNAMIC EQUILIBRIUM

Set in the circumstances described, the equilibrium in the housing market has followed rather dynamic path. Interactions with financial and real economy variables as described above were influenced by structural aspects of the demand for housing, each of which reacted differently to the changing circumstances in financial and real economy. For understanding the dynamics of the housing market equilibrium in such dynamic environment, structural components of the demand, supply and the way they react must be studied therefore.

2.1 DEMAND

According to Esteban and Altuzarra (2008)[15], besides the employment generation, increase in per capital income and favourable financial conditions, the housing demand has been triggered by population growth, encompassing both demographic trend and immigration wave, as well as the sociological changes in household creation patterns, while "*the scale of foreign involvement far exceeds any other experience in Europe."*(Esteban, Altuzarra (2008))

At the beginning of our analysis, we approached to breaking statistical aggregate of the *self-generating components* of demand (demographic trend and immigration) down into parts to see which of them had real potential to push the house price equilibrium into dynamics that were so abrupt. In connection with the demographic trend, change in age structure was considered, while in case of foreign immigrants, it was additionally searched for the year first family pioneer arrived. In this sense, the propensity to purchase own housing differs both among age structure (inner variability of the set) and between the groups mentioned (outer variability of the same set). First, arrival of such pioneer is inevitably connected with household unit setting; additionally, such household composition may be examined in connection with its accessibility to financial funds (difference in purely immigrant households vs. those of mixed composition, assumed their different past employment track and other institutional factors when credit is to be granted). We assume such factors to be important almost the same as the pure demographic trend records, since frequency of house trading may be affected substantially. However, in the next part of the thesis, we have dropped off such

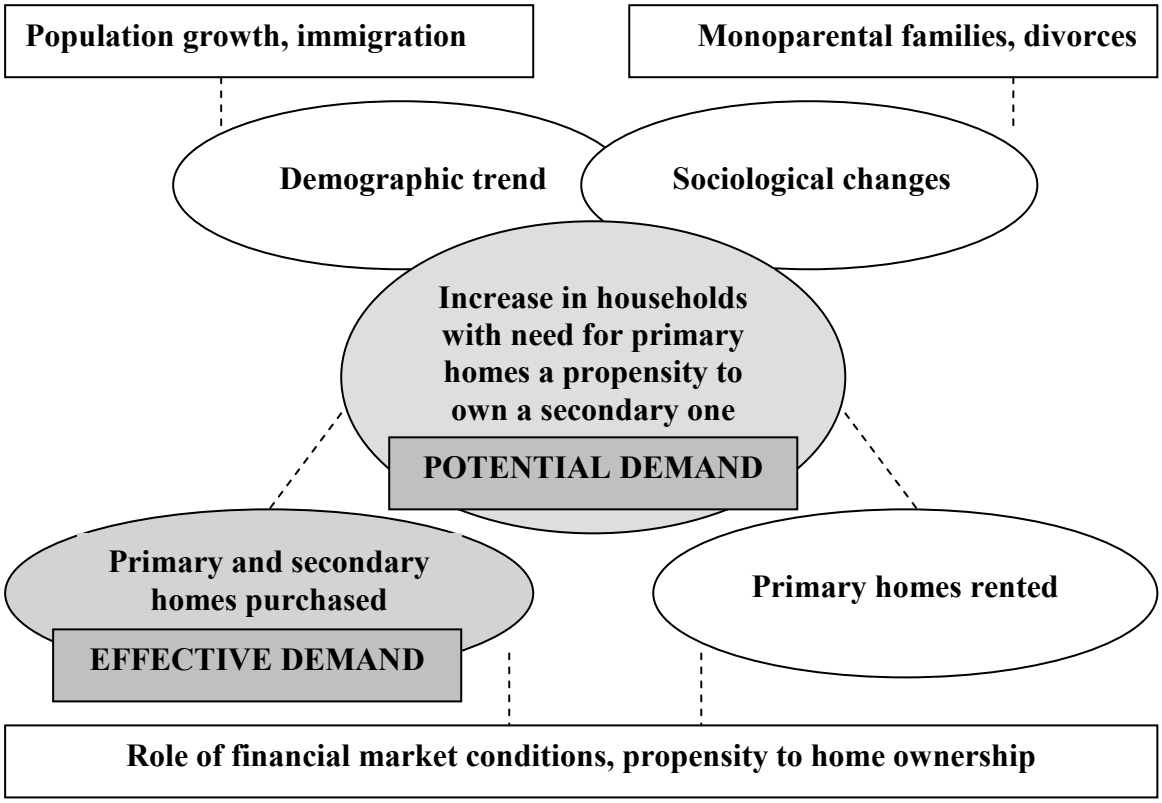
[15] Authors model the Spanish housing market and present, to our limited knowledge, the most complex segmentation of the demand side.

assumptions and used approximations by the effective demand, such that really materialised, causing that the previous results became a sort of redundant. The initial analysis is, although, available upon any request, since it may represent another interesting topic of research to be explored.

2.1.1 CONCEPT OF HOUSING DEMAND B. POTENTIAL AND EFFECTIVE DEMAND

Since the primary purpose of housing is to serve as a shelter, determinants for therefore so called *primary* housing demand are the demographic and social factors combined, with potential to explain number of resident households at one point in time. Assuming that each household needs a dwelling to live in, change in number of households in certain period accounts for change in demand for primary housing of the same scope. However, given the various financial and real economy conditions, such need for a shelter may be fulfilled through either renting a housing unit or its purchase. Besides that, given the certain propensity of household sector to own a secondary home as distinguished bellow, increase in cluster with such propensity generates potential for secondary homes demand as well. Demand for housing that materialises is what is then referred to as an effective demand, while the statistical aggregate that serves as a basis will be called the potential demand. In case of such *primary* homes potential demand, its maturity is assumed to be a question of timing, e.g. we suppose that each household once proceed to their primary home purchase.

GRAPH 8: CONCEPT OF HOUSING DEMAND B. POTENTIAL AND EFFECTIVE DEMAND



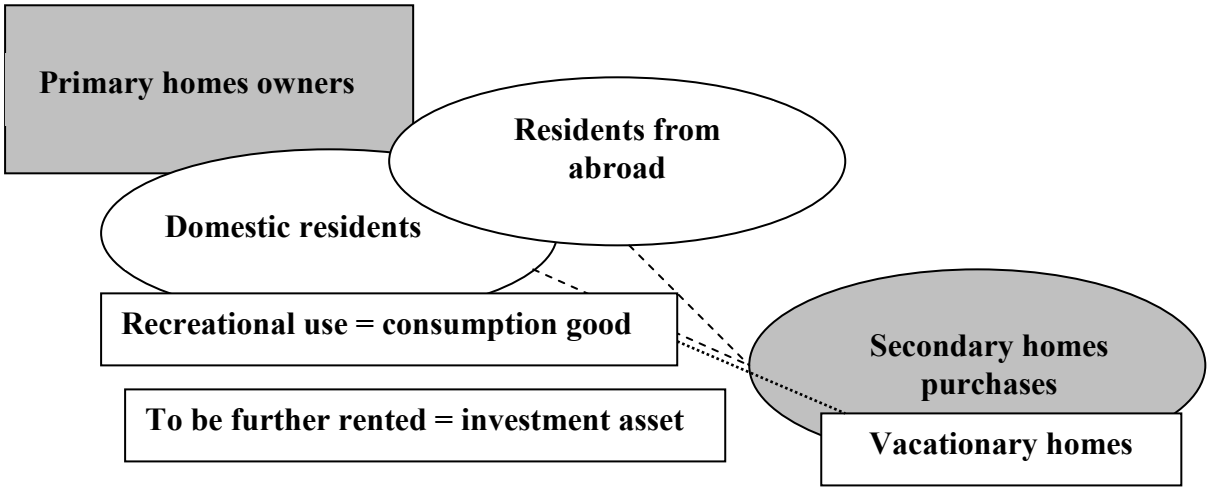
Source: Author

2.1.2 CONCEPT OF HOUSING DEMAND C: PRIMARY AND SECONDARY HOUSING

Besides the service of a shelter, housing may also generate utility connected with stream of income (see concept of investment housing demand) or recreational and other services for its dweller, being in this sense consumption good. Meanwhile having the primary home is a must and must be therefore unconditionally owned or rented, the recreational homes may be considered luxury goods up to the point they are more price and income elastic. For simplicity, only recreational homes ownership will be considered, since renting in this sense is rather taking holidays.

The origins of the secondary housing demand in Spain are twofold, coming from the strong historical propensity of Spaniards to own a secondary home and determined by the geographical location in case of foreign (non) residents as for the recreational purposes. For both recreational and investment nature of the secondary housing, it is assumed that only those who already own their primary home decide to purchase a secondary one.

GRAPH 9: CONCEPT OF HOUSING DEMAND C. PRIMARY AND SECONDARY HOUSING



Source: Author

2.1.3 CONCEPT OF HOUSING DEMAND D. DEMAND FOR SERVICE VS. PROPERTY

Difference between *potential* and *effective* demand *for primary homes* is what stands for demand for housing as a service. Demand for housing as a property encompasses then the *effective* demand for both *primary and secondary homes*. Reasons for why households might postpone their primary homes purchase will be discussed in details.

2.2. SUPPLY

The housing supply in Spain is the most conveniently to be classified first as subsidised and unsubsidised housing according to the legal status of these. Meanwhile the unsubsidised housing is placed in the market, the subsidised housing is predominantly subjected to subsidies from behalf of the public administration entities ensuring affordability of primary homes to the low income classes. The additional heterogeneity of housing stock that has moreover evolved in time is although beyond the scope of this thesis to be considered.

The fact in our focus is that the stock of new dwellings should, naturally, reflect the demographic and social evolution covering the potential demand of households for both primary and secondary homes (made effective through either residential consumption or investment in housing indeed). In this sense, we propose that every house price

upswing, when accompanied by demographic and social changes, should be examined in two ways. First, the positive evolvement of demographics itself must be followed by certain increase of house price level coming from the fact that new dwellings finished to meet the increased demand are priced higher from matter of the fact. As the demand increases, the proportion of stock of new dwellings in the stock of existing ones rises as well, thus pushing the aggregate house price level up. Therefore, there is no reason to talk about any kind of house price overestimation this time, either while the house price level may be to a huge extend explained by demographics. If the categories of newly constructed and existing stock of dwelling separate prove a trend of house price increase, however, we should search for any kind of supply and demand misalignment, be it quantitative in time or spatial, a case of which is to be discussed next.

Esteban and Altuzarra (2008) then determine both property developers and existing property owners as groups interested in rising supply when prices are going up. Their behaviour is determined by the expectations over future development of prices, what makes "the *beforehand purchase of land a source of super normal profits,"* (Esteban, Altuzarra (2008)). From this point of view, land price may be considered as an indicator of suppliers´ expectations over the demand. On one hand thereafter, the construction cycle itself is rather long, made even more complicated by the fact in Spain supply is subordinated to a *landing plan*, on the other hand, in times of housing demand rise really abrupt, the households make for acquiring units even before having been finished. As a note to this point, it may be stated that in one way, if might seem that such pre purchases accelerate the moment when the demand and supply meet. Actually, the number of transactions is even higher since such household must have another to live before their "property is ready to be consumed" (such price spiralling process is discussed the next), further, households may proceed to the house purchase even in times they would not do so yet, what makes it impossible for the house price level to adjust automatically downwards. This all is, thus, enhancing the pressure on house price level of an already existing housing shortage.

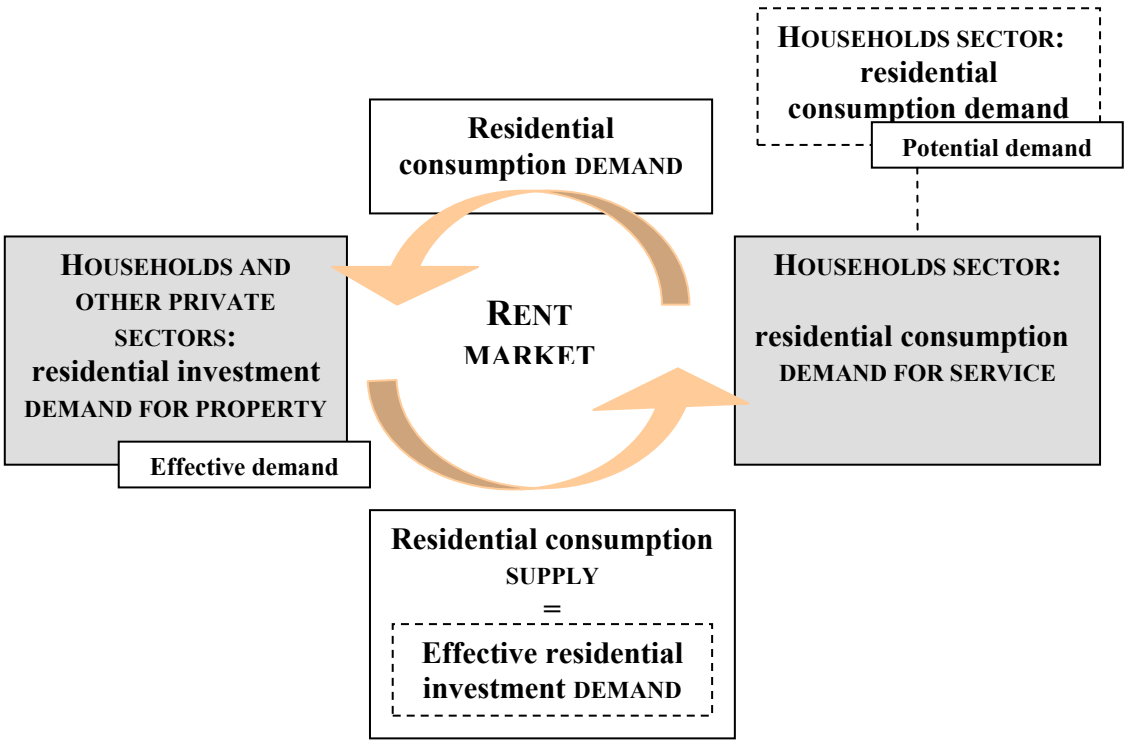
2.3. PARTIAL BALANCE: RENT MARKET. PRECONDITION FOR HOUSE PRICE SPIRAL?

Referring to the previously described concepts of demand, let us note that the residual number of dwellings needed to accommodate households who cannot afford purchasing a unit or wait with their purchase for reasons of expectations may be supplied by those

demanding residential investment, be it households or the rest of the private sector. Thus, the existence of housing rental market allows for the residential housing investors to supply the goods demanded by residential housing consumers. This is, from our opinion, the crucial factor that makes it possible to create a price spiral, when made possible by the financial conditions like it has happened in case of Spain. Meanwhile, in connection with the inversion demand, Pagés and Maza (2003) additionally point out at the importance secondary hand housing market have in allowing for the inversion demand to be created, since residential investment is not connected with such transaction costs that residential consumption must face.

The pitfall, thereafter, lies in the fact that the secondary dwellings are used for purposes with distinct frequencies of use, including seasonal, recreational and occasional use (Esteban and Altuzarra (2008); however, in this thesis, we call it all recreational for simplicity), so that a good part of these dwelling is being offered for renting throughout rest of the year, which means it was counted with investment factors when they were being purchased. This spill over concerning notable part of the housing stock, thus makes any attempt to analyse sources of house prices increase even more complicated.

GRAPH 10: INTERACTION BETWEEN RESIDENTIAL CONSUMPTION AND INVESTMENT DEMAND. RENT MARKET



Source: Author

2.4. OVERALL BALANCE IN TIME: CONCEPT OF UPPER ESTIMATE OF EFFECTIVE DEMAND

Due to the lag between the signal and reaction and possible costs of adjustment thereafter, the crucial parameter for the residential housing price equilibrium dynamics is the match between demand and supply, if the two are evolving in time. Due to the impossibility to assess what the scope of the demand would have been if the supply had evolved differently, we have developed a simple estimation technique using the transactions realised. Banco de España in its report on the residential investment adjustment lately in 2011[16], examines the issue with similar results to ours. Both of them may be graphically consulted at the end of the section.

Under the assumption that in equilibrium, each dwelling is owned by a family, however, one family can have more than one dwelling (Pagés, Maza (2003)), taking yearly differences of primary and secondary homes owned would be a sufficiently approximate estimate of the effective demand for housing. Our estimate of effective demand, however, may be referred to as an upper estimate since it counts with the possibility of non-households sector supplying with dwellings to be rented by households, what the housing statistics probably do not stand with accurately. In this way, we have taken both primary homes owners and tenants and added the sum to the number of secondary homes owners, all in yearly differences. This assumption would be precise in case all secondary homes served exclusively as recreational dwellings. Since the proportion of non-households sector supplying with dwelling for rent is typically very low, most of the demand for primary homes for rent are supplied with household sector secondary homes of investment nature, meaning that some components of effective demand are counted with twice. Thus, such estimate of demand performed with data of housing transactions use is comfortably conservative compared to what has been stated about interaction between demand for primary homes tenancy in the rent market. An estimate more precise is impossible to be made as the data about secondary homes are missing the crucial distinction between recreational and investment use since the statistics of rental market are in general difficult to capture.

[16] "The residential investment adjustment in Spain", BDE (2011). Available at http://app.bde.es/atn_www/jsp/webSearch.jsp?acceso=bde&origen=busqueda_avanzada&idioma=es&tipo=avanzado&T1=inversion+residencial&D1=&D2=&T3=Todos&N1=10&T5=RELEVANCE&busnormal=Buscar+%C2%BB.

Next, the upper estimate of the effective demand was compared with the data of new stock of dwellings finished. For a benchmark, data of new stock of solely unsubsidised housing were added, as well as the construction starts of the whole aggregate. It may be arrived to three conclusions. First, the approximate length of construction cycle, apparent from the parallel shift of the construction starts and completions curves, is from two to three years, a period short enough for developers to react to a well beforehand signals of natality given by baby booms for two decades in consequence (1960s and 1970s). Esteban and Altuzarra (2008) argue that the expectations of agents concerned might bring unwillingness *"to face future excesses of supply"*, however we think that such strong increase in potential demand must be inevitably of long term perspective under the assumption that the increased number of families will have children themselves (alternatively, the space for excess of supply lies in bad estimates about the investment nature of the demand). In line with this, the upper estimate of effective demand is only a slightly above the total constructions finished, the difference being corrected towards 2006. If this access of demand may be attributed to the overvaluation of our estimate might be concluded if data about rent developers and appropriate contracts signed were at dispose. For this while, let us conclude with no mismatch between housing supply and demand relying on the research Banco de España derived right prior to this thesis. Finally, it may be assumed that real estate developers did not count with sink in the effective demand and did not adjust the constructions initiated until 2007, resulting in excessive offer in 2008.

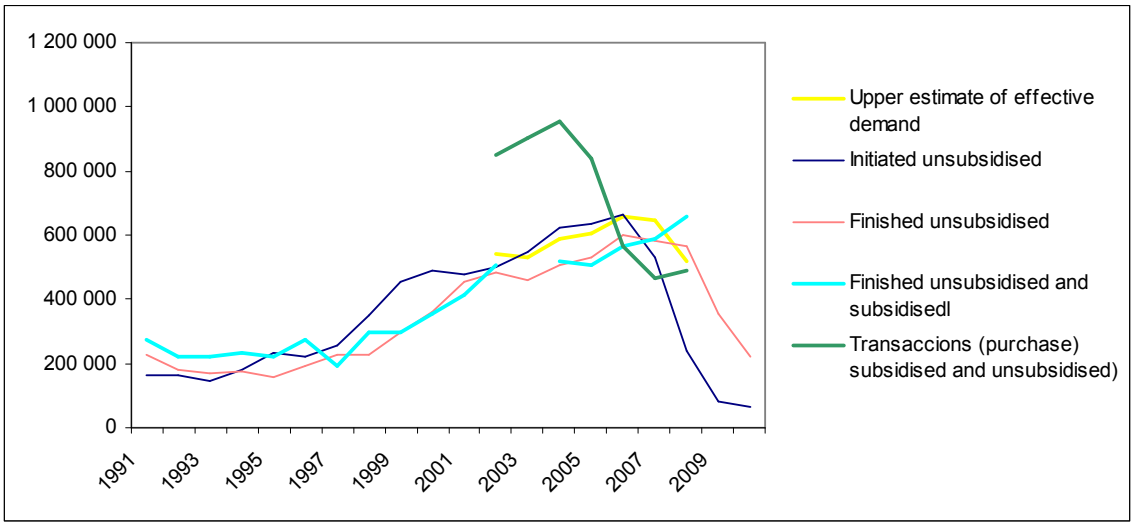
All points assumed, this would suggest that lack of supply was not the reason why the house prices went up abruptly, as the demand did grow, but in an enough predictable way for the dynamics of supply to adjust. However, Esteban and Altuzarra (2008) note without further exploring the issue that the problem with the supply was not the construction, but the spatial concentration of newly constructed units vs. its primary/secondary housing market placement, in another words, that the supply did not correspond with the demand locally. In this way, a cross sectional analysis should indicate the possible mismatch or give us suggestion about an alternative hypothesis.

TABLE 1: 2002-2008 DATA ON UPPER ESTIMATE EFFECTIVE DEMAND

	2002	2003	2004	2005
Primary housing demand	370 275	810 633	1 271 972	1 719 871
Secondary housing demand	170 110	258 565	383 144	543 411
Sum = upper estimate of effective demand	540 385	1 069 198	1 655 116	2 263 282
Dwellings finished	519 328	1 027 596	1 592 874	2 183 505
		2006	**2007**	**2008**
Primary housing demand		2 182 765	2 506 880	2 553 475
Secondary housing demand		740 241	1 059 962	1 532 180
Sum = upper estimate of effective demand		2 923 006	3 566 842	4 085 655
Dwellings finished		2 841 495	3 488 287	4 121 515

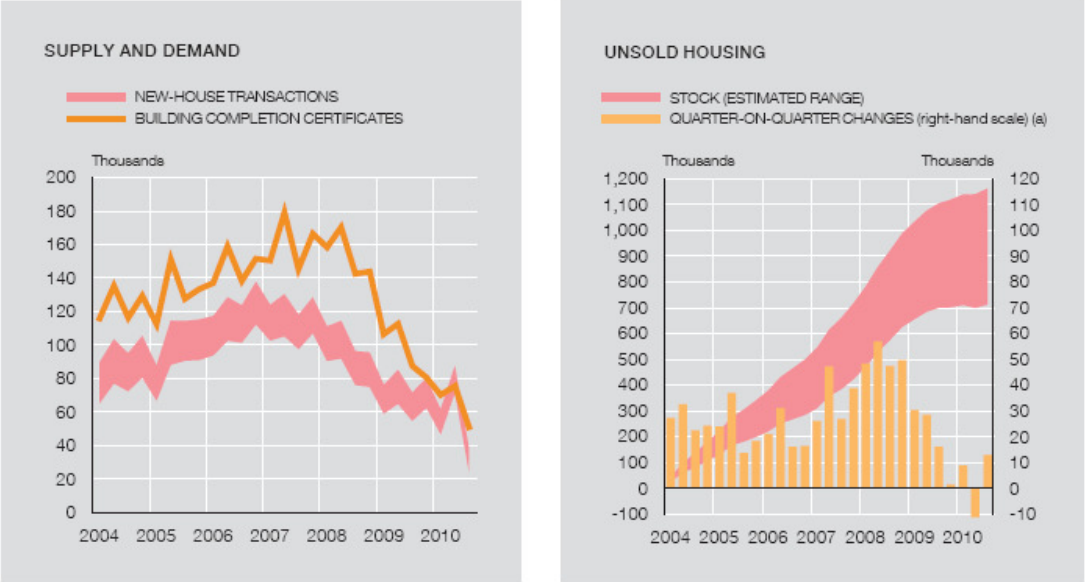
Source: Own computations based on Ministry of Housing

GRAPH 11: UPPER ESTIMATE OF EFFECTIVE DEMAND, CONSTRUCTION CYCLE



Source: Author based on Ministry of Housing

GRAPH 12: CONFIRMATION OF RESULT ABOUT TIMELY MATCH OF DEMAND AND SUPPLY



SOURCES: Ministerio de Fomento and Banco de España.

Source: The residential investment adjustment in Spain", BDE (2011) [17]

2.5 SPATIAL DISEQUILIBRIUM? EMPIRICAL CROSS SECTIONAL ANALYSIS

Spain is an extremely heterogeneous country, including access to both sea and mountains, range of climate from dry continental to humid Mediterranean or oceanic, availability of land for cultivation and industry concentration up to the attitude to working rules and saving patterns of the inhabitants. The same heterogeneity stands for the determinants of demand for housing when moving across the territory, the more when the determinants of housing demand are in general set locally. If we add the structural differences on both demand and supply side, we realise that in determining the local differences, all these aspects must be considered.

Aim of the cross sectional analysis here to be performed is to decide or at least suggest whether the increase in housing supply was sufficient to cover the increased demand *locally*. In another words, we are not interested here in the speed of supply adjustment as it was concluded sufficient, but its spatial concentration within the territory of Spain.

Specifically, Esteban and Altuzarra (2008) point out that housing starts in the last upturn were set mostly on the coast, not in the cities where the demand for primary homes was

[17] "The residential investment adjustment in Spain", BDE (2011). Available at : http://app.bde.es/atn_www/jsp/webSearch.jsp?acceso=bde&origen=busqueda_avanzada&idioma=es&tipo=avanzado&T1=inversion+residencial&D1=&D2=&T3=Todos&N1=10&T5=RELEVANCE&busnormal=Buscar+%C2%BB.

pressing on the local housing markets in particular. To derive results that are possible to make conclusions about hypothesis of spatial mismatch of demand and supply with alternative of structural explanation of the changes in dynamics, we have performed two cross sectional regression analysis for two years separately - 2006 and 2008, differing in that in those years the prices went up, respectively down. On the other hand, the closest years possible were chosen to eliminate that possible differences in results were caused by change in exogenous variables, allowed for by long delay in time. In the analysis, we have assumed three groups of factors primarily in exploring their explanatory power, many of them in alternatives.

The cross sectional analysis was performed among fifty out of fifty-two provinces of Spain. Such distinction, contrary to the superior level of autonomous communities that are 17 in total, offers not only many more observations, but also a higher relevance. The set of provinces is more homogeneous in terms of factors that are not the purpose of our analysis to explore (size), on the other hand it allows to observe more heterogeneity in what we are especially concerned about (location in space). Particularly, location at the seaside may be attached to areas that really lie in a reasonable distance away from the coast. Even prior to viewing the data, two autonomous cities of Spain with status of provinces located in the north-African coast, Ceuta and Melilla, were excluded from our investigation. Reason for this was its location in Africa, concentration of the municipalities close to each other and inhabitants of different religion and sociological patterns, what might have all had serious impact on the location of construction starts (no mismatch is thus expected due to the concentration of real estate), housing consumption and of great extend on the level of investment. Thus, indicators of zero hypothesis and alternative might be affected from different reasons than those explored in this thesis.

2.5.1 EXPLANATORY VARIABLES AND HYPOTHESIS

Based on the discussion of interactions between financial and real economy variables in Part 1, including these into any regression dealing with house prices is indispensable in an environment where such variables play a role in fuelling the house price cycle. Including such variables, moreover, allows for backward identification of the role individual structural parts of the demand played in given period of time, based on our preliminary discussion of different impact financial and real variables have on demand

for housing, with distinction between residential consumption and investment again. Next, ratios measuring demand and supply related to each other were included to measure the mismatch in a backward looking manner, through the construction completions and transactions realised. Opposite to these, price of land was included as an indicator of mismatch which is forward looking and of timely manner, measuring expectations the housing developers have about the future mismatch (viewed as possible capital gains) of demand and supply projected into land purchase. As a matter of the fact, expectations of these agents are a kind of self fulfilling, since aggregated, these expectation of housing developers are determinant for the scope of housing supply increase. Given the limited sources of land, they should therefore be reflected in the house prices immediately. Explanatory power of the unlagged price of land is thus the second hypothesis of this cross sectional analysis.

First, data with request to distinguish between provinces had to be collected. Spanish Regional Accounts (for GDP per capita), Social Indicators 2009 (for unemployment) and other economic statistics (mortgages) worked out by Spanish Statistical office were used[18], while for the data of primary and secondary homes proprietorship, constructions completed, transactions realised and price of land, statistics by Ministry of Housing were used. Variables were included with the following underlying meaning:

Control for economic fundamentals

- ***GDP per capita***

  Pointing out both at the economic condition of households as an indication of wages and impact of phase of the economy on investment in construction, we decided on including GDP per capita rather than wage average only.

- ***Unemployment***

  Variable is a sensitive indicator of phase of business cycle and better indicator of financial distress than participation level since the latter may be affected by number of those who do not seek for a job, thus for their favourable financial position it may be assumed (possible role of economic sustainer).

[18] Overview of the source of data is available in the appendix.

- ***Average mortgage level***

  Average mortgage credit granted in particular year (not accumulated for the previous years) for the purpose of housing was included to complete information about financial constraint and conditions of the debt financing realisations, as well as the past development in house prices through collateral valuation.

Backward looking expectations about spatial mismatch

- ***(Change in number of households)/(number of new dwellings)***

  Ratio of net change in households with inherent need for primary homes per dwellings which the existing stock was newly increased by in the same period was included to cover the possible tensions between demographic and sociological trends and lack or lags in the construction process. On the supply side, both subsidised and unsubsidised dwellings entering the stock were involved in order to better express the pressure on need for construction, under the assumption that substantial part of the demand drivers claim for the subsidised ones (based on the part of demand drivers analysis that was mentioned to be excluded, finally). On the side of demand, a proxy of change in number of households had to be made once again as the number of families annually is only available at the level of autonomous communities. In this place, the yearly difference of primary homes both owned and rented were counted with in expressing the demand pressure consisting in number of households created.

In accumulated terms

Underlying idea of trying for an inclusion of change in number of households and dwellings constructed accumulated since 2001, from when the data is available, is the following: the regional differences in prices are, besides the last year dynamics, determined by level of the prices at the beginning of the last year assumed. Under the null hypothesis we have, such level would be determined by the scope of mismatch year after year backwards, under the principle of induction. Inclusion of average of ratios counted from yearly differences over the period considered would be an alternative, however, a loss of information might be manifold.

Sense of the variable see

Inclusion of the qualitative variable indicating location at the seaside controls for the spatial mismatch due to the construction for reasons of recreational housing demand. Not significance of this variable might, in case the quantitative variable results significant, suggest humble under-construction not responsive to the demographic and social changes. On the other hand, significance of qualitative variable unlike the quantitative one might suggest demand from foreign non residents that is not included in change in the families proxy.

- **(Number of transactions realised with new dwellings)/(number of new dwellings)**

  Such ratio is aimed to capture either the newly finished dwellings turnover as an indicator of urgency or the predominant use of newly constructed units. In line with this, ratio close to one points out at high demand pressure, evidenced by that the newly constructed units are traded immediately, whereas its value significantly above one suggests speculative nature of the demand.

Alternatively

(Number of transactions with new unsubsidised dwellings)/(number of new unsubsidised dwellings)

An alternative dealing with unsubsidised dwellings completed is included for the case the previous results were biased in terms of liquidity caused by nature of the subsidised housing previously involved. The unsubsidised housing first is connected with longer lags in contracting, secondly cannot serve for speculative demand at all (its purchase being restricted on primary home needs).

- **(Number of transactions)/(existing stock of housing)**

  Ratio was taken into account primarily for its potential to detect nature of the underlying demand, reason why the entire stock of housing existing is considered. The higher frequency of transactions per unit may also be consequently fuelled by the higher liquidity brought up with increased prices, in such sense in which the causality will be discussed in the next part.

Alternatively

In line with controlling for some kind of speculative demand, involvement of subsidised housing into the statistical aggregate might represent a source of bias, the same like in the previous case.

Sense of the variable see

Here, the significance of including the qualitative variable of see lies in its indicative power of whether the transaction motive concerns primary homes or the secondary ones in their sense of recreational use, assuming that such are usually concentrated on the sunny coasts of Spain.

Forward looking expectations about the mismatch in time

- ***Price of land***

  Such an inclusion is exactly in line with the previous reasoning.

Fully aware of the limited extend these ratios are able to describe the house price differences, being more responsible for the local inflation in house prices in the year assumed than the house price levels, we wanted to consider past evolution of these ratios as well. First, we attempted to involving lagged variables of these ratios, however, the data proved to be so stable throughout the whole period of peak that there were serious problems with colinearity. On the other hand, the stability of these ratios over time and its differences across the territory supports the hypothesis of the role of the mutual reinforcing power between the house prices and transactions realised. Involving average of these ratios over the years considered proved to be loosing kind of information, though.

2.5.2 REGRESSION

In analysing the regional differences and deciding on stability of role of these difference drivers in two years in which the aggregate price level went in opposite directions, it was preceded in the following manner: it was started with explaining provincial differences in 2006, what let us better understand the mechanism different for generating both price levels and its dynamics between the provinces. Based on these understandings we were better able to derive consistent results while regressing 2008 provincial data thereafter, with implications for further investigation. In performing regressions for each of the years separately, we considered underlying economic

conditions as unconditionally relevant based on the assumptions we made in Part 1 of the thesis. Next, we pursued with using logical combinations of the spatial mismatch explanatory variables and last, checked for alternatives as described above. Results of the main attempts are summarised in the appendix, reporting on the main tests for OLS assumptions as well.

2.5.3 RESULTS

RESULTS FOR 2006

According to our assumptions, all three macroeconomic indicators proved significant on the level of significance 0,001 throughout all the regression equations considered. Checking for the demand and supply spatial mismatch (itself and in relation with coastal location using the dummy variable sea), all the alternative variables proved insignificant, neither with nor without the subsidised housing involvement. When it was checked for excluding price of land conversely, the assumption of homoskedasticity was broken additionally, so that the t-statistics reported might give biased results, though. Checking for involving the ratio of change in families and units newly constructed in accumulated terms brought no significant results either. Last, involving dummy variable see does not help to explain the differences in any of the cases. Therefore, the number of new dwellings per household established, influenced by spatial concentration of the two, cannot be confirmed explanatory for the provincial differences in prices.

In the next step, we proceeded with checking for the frequency-of-transactions explanation of the regional differences in prices. First of all, in accordance with the previous result, the newly constructed unsubsidised housing units turnover was not confirmed explanatory, being insignificant both for the current year ratio and average of the ratios since 2004. The variable that does prove significant is the unsubsidised housing turnover. At the same time, the significance of unemployment dropped to the significance on the level 0,05, reason for what might be a certain role of speculative demand, independent from marginal variables on the labour market and determined more by the level of wealth and sophisticated financial market conditions. Qualitative variable see, however, does not help us explain more of the cross sectional variability in prices. Last, it was checked for adding family-construction mismatch variables again, however, the variable resulted insignificant again.

Finally, we included price of land two years before when the construction currently finished was initiated approximately (our aim was to include price of land three or more years before but the data availability is rather limited in length, unfortunately). According to our expectations, the lagged variable proved significant, however the thorough model was able to explain less variations in price of housing. This means price of land and future expectations about the future demand are reflected in price instantaneously.

The regression equation takes the following form with standard error of the estimates reported bellow:

$$price_{2006} = \underset{344,47}{-1194,340} + \underset{0,01}{0,049}\,GDPC + \underset{15,52}{39,415}\,U + \underset{0,001}{0,008}\,M + \underset{0,34}{1,94}\,PL - \underset{2354,45}{4,156,98}\,TU + e\ *)$$

*) where GDPC stands for gross domestic product per capita, U for unemployment rate, M for mortgages, PL for price of land and TU for unsubsidised housing turnover.

Significant differences between estimates of the coefficients in terms of scale are caused by differences in observed values of the variables themselves. Negative value of estimate of constant does not mean the price might take negative value as well, since none of rest of variables takes the value of less or equal zero in real world (plugging minimum values of each explanatory variables results in fitted value of price being positive). The negative value of estimate of unsubsidised housing turnover would, on the other hand, indicate negative effect on house prices, opposite to the mechanism of higher turnover pressing on the prices to go up that would be assumed for. Constructing confidential interval of (-8770,72;457,74) on 95 percent level of confidence (studentised distribution was approximated by normalised normal distribution as conditions on number of observations and parameters were fulfilled), we may conclude with that the actual value is on 95 percent covered by an interval that goes into positive numbers as well. Unexplained stays the negative estimate of coefficient for unemployment. However, checking for deriving such simple regression with inclusion of GDP, unemployment and mortgage average for year 2005 derived the same sign.

RESULTS FOR 2008

In assessing determinants of cross sectional difference in prices in times of overall house price decrease, some modifications had to be made in order to reflect the structural changes in the price differences generating mechanism.

First of all, following procedure of the previous case, the results showed insignificance of the unsubsidised housing turnover, but surprisingly the unemployment as well. Actually, the model gave limit results for rejection of zero hypothesis of non heteroscedasticity, thus the overall results of t-statistics must have been interpreted with caution. The other of the two variables remain insignificant even under excluding one from the model, supporting the first result of their insignificance, but the heteroskedasticity biasing the t-statistics was not corrected anyway. Next, it was preceded with testing the new unsubsidised units turnover including unemployment again. This time, the unemployment resulted significant on the level of significance 0,1 and the ratio even on 0,001, however the assumption of homoskedasticity was broken again, causing that the p-value corresponding to the t-statistic is undervalued and variables may not be significant in reality. By including seaside as a qualitative variable, the test for homoskedasticity statistic was corrected significantly, giving comfortable results, the coefficient estimate of unemployment dropped on significance, however. Excluding unemployment from the regression, results for all variables prove significant on the 0,001 level of significance, and comfortably complied with OLS assumption. Such results, moreover, give good explanatory power of over 87 percent in variation in price, higher compared to results when previously involving unemployment on detriment of the seaside.

Continuing with the starting point of 2006 regression procedure, e.i. including ratio of spatial mismatch between households increase and number of dwellings constructed, the variable unemployment results the least significant out of all, significant on the level of significance not higher than 0,1. After including the qualitative variable, the unemployment significance deteriorates bellow significance on the level 0,1. Such combination of variables altogether has better explanatory power of the regional variability than the previous model and remains so after excluding the unemployment, result must be interpreted with caution, however. For reason of inclusion of mismatch variable while at the same time excluding unemployment and including seaside, we consider this regression more likely to be spurious. Theoretical assumptions suggest that should the prices be explained by mismatch caused by demographic and social trends, the role of unemployment in time it reaches 20% in some provinces, while in others it does not exceed level of 0,04, should be significant in a cross sectional manner as well.

Thus, the regression equation proposed takes the form of

$$price_{2008} = \underset{153,66}{-609,80} + \underset{0,008}{0,023}\,GDPC + \underset{0,001}{0,008}\,M + \underset{0,333}{1,254}\,PL + \underset{130,793}{385,235}\,TUN + \underset{63,423}{192,4401}\,S + e^{*}),$$

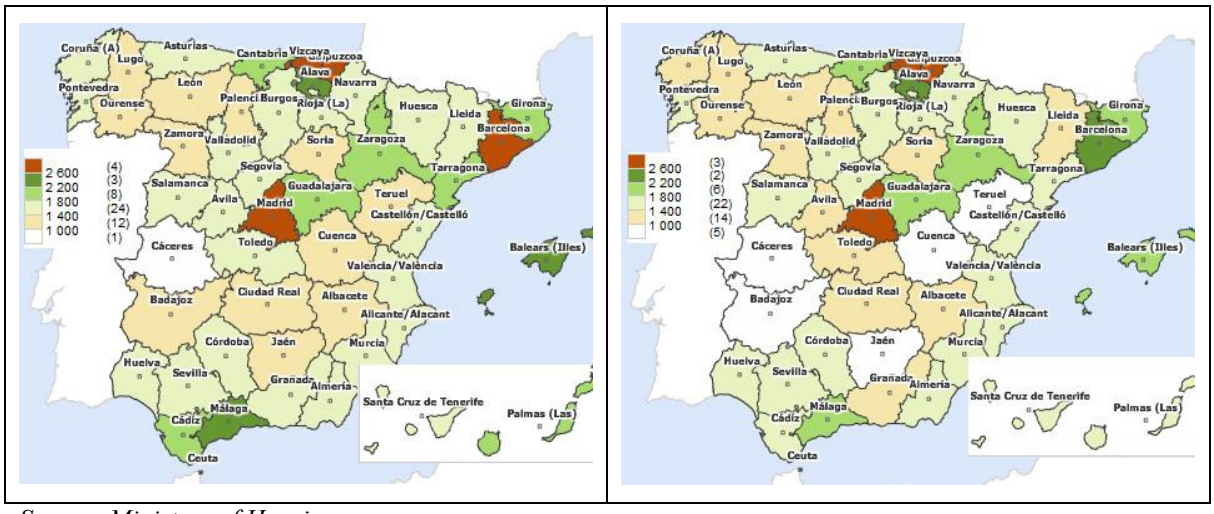
*) where GDPC stands for gross domestic product per capita, M for mortgages, PL for price of land, TUN for unsubsidised housing newly constructed turnover and S for the seaside.

where signs of the estimates are in line with our previous reasoning.

ASSESSING RESULTS WITH IMPLICATIONS FOR THE NEXT PART

In this way, unlike the times of house price increase, when provincial results proved indifferent to location in the interior or at the seaside and thus did not confirm any link to vacation homes over construction and demographic needs inappropriateness, the results proposed for year of house price decrease show patterns of linkage to the seaside. More precisely, significance of unsubsidised stock turnover during the house price increase proposes hypothesis of primary homes turnover, while for 2008 years it suggest turnover of recreational homes, including that these recreational homes were being heavily constructed right before the bubble burst.

GRAPH 13: CROSS SECTIONAL DIFFERENCES IN HOUSE PRICES IN 2006 AND 2008. NOT TO BE COMPARED



Source: Ministery of Housing

2.6 CYCLICALITY IN HOUSING TRANSACTION: ROLE OF EXPECTATIONS. SHORT RUN

After coming to a hypothesis about the role frequency of transactions played on a cross sectional basis in two points of time, analysis of frequency of trading must be pursued on the timely manner to confirm robustness of the results in a continuous sequence of time. Such analysis of path transactions follow in time when price of the commodity

traded is changing, then, covers the existing antagonism economic theory[19] and reality may sometimes represent.

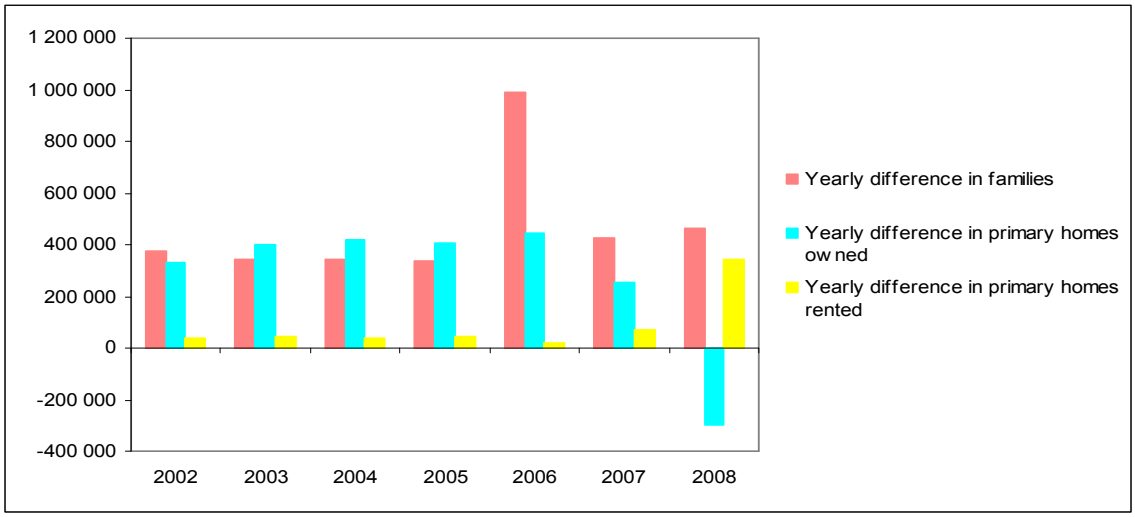
2.6.1 HOUSE PRICES AND VOLUME TRADED

Banco de España (BDE (2010)) itself looks backwards in 2010 to assess the cyclical nature of housing market in Spain, pointing out at its higher volatility as opposed to the GDP lagged and households consumption as its part. Banco de España at the same time exploits implications of certain equilibrium models for an *inverse* relationship between house prices and volume of housing traded, feature stated *not* to be so observable in the data.

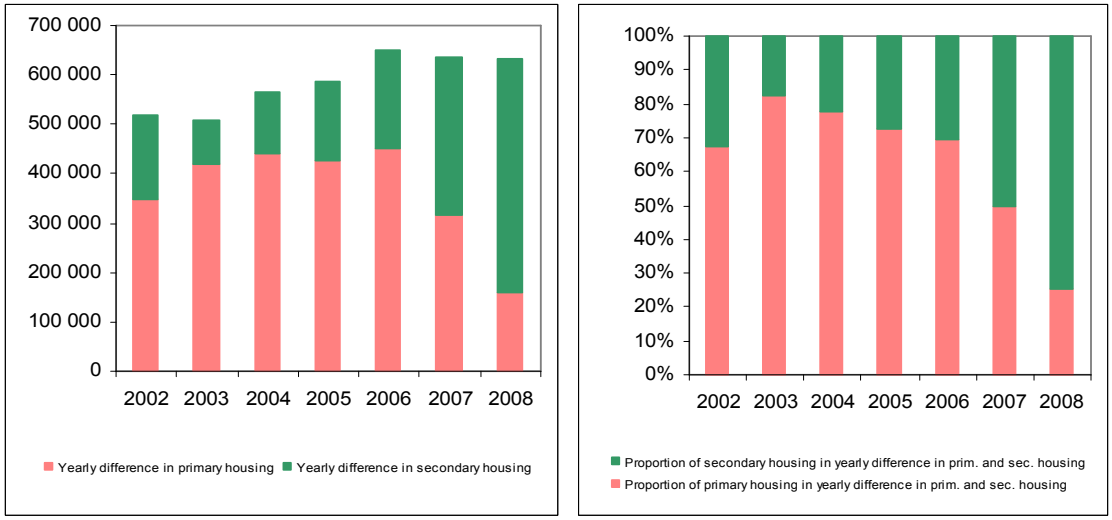
In line with the previous results, we searched for patters in primary and secondary homes purchases in time. Looking at the absolute terms of primary homes purchased versus rented and secondary homes purchased does not give any clue, as the year to year change compared to the long term basis is too small to prove any path. For this reason, it is better to look at the yearly differences instead of cumulative numbers in assessing the change in agents´ behaviour. Computations from the timely limited database of Ministery of Housing suggests primary homes accounted for both absolutely and relatively higher increase in homes demanded in the years when the speed of house price growth was increasing (please, notice that the subsequent increase in 2006 out of the apparently cuadratic trend may be attributed to an outstanding increase in households depicted in the graph above). Out of the demand for primary homes then, the proportion of primary house purchases was increasing in relative terms to the detriment of renting until 2007 when the prices busted and the relationship reversed.

[19] Again, see Zhu (2003) or BDE (2010) mentioned consequently

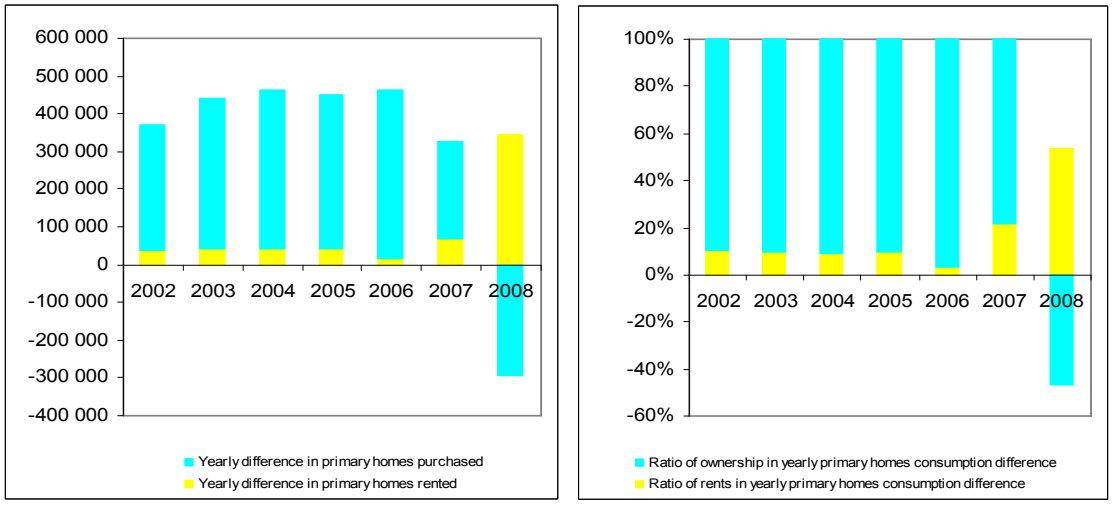
GRAPH 14: YEARLY DIFFERENCE IN FAMILIES AND PRIMARY AND SECONDARY HOUSING CONSUMPTION



GRAPH 15: YEARLY DIFFERENCE IN PRIMARY HOMES PROPERTY AND SERVICE CONSUMED



GRAPH 16: YEARLY DIFERENCE IN PRIMARY AND SECONDARY HOUSING



Source: Author based on Ministery of Housing and National Statistical Office

2.6.2 ROLE OF EXPECTATIONS

Based on the simple observation of change in households´ housing consumption customs when the speed of price change or its direction changes, it may be suggested for a certain role that expectations may play in this on at least adaptive basis. While the issue of defining a house price bubble is a sort of arguable, both the premium economic sources like IMF and The Economist and domestic mass media kept informing about the house price increase on a daily basis disponible to households.

Basically, from such expectations formed in the primary homes market, implication for the investment assets on secondary homes market may be derived consequently. - Reformulating what has been previously said about demand meeting supply in the rent market, effective demand for residential *investment* is a mirror projection of households´ expectations expressed through effective residential consumption demand, since these expectations enter the decision making about demand for housing as a *property*. In another words, if for a constantly increasing number of households the number of primary homes purchases increases, the reverse applies for those who supply with housing services, otherwise they are faced with an excess of their own supply. Thus, first the expectations in decision making between primary homes purchase and keeping on renting must be explored.

Decision making in the period examined is specific due to the redistributive character of the upward phase of house price cycle, the more in the prolonged one that just have been experienced. In such time, buying a primary home eventually financed by mortgage debt in certain moment in time, the purchaser faces strategic decision making problem dependent first on the future evolvement of the purchasing prices. The pitfall lies in that the purchaser, like anybody else, never knows what part of cycle he or she is currently in. If bought, the value of the underlying asset is being immediately amortised, as opposed to the primary homes renting in the sense of "paying for service". It is also assumed that households are time limited in obtaining mortgage credit during period of the strongest labour activity since the repayment periods tend to prolong.

Hypothesis of the next experimental approach to explaining the housing volume paradox on Spanish housing market is the following: in the context of sharp and prolonged house price upswing, households were approaching to the primary homes purchases expecting continual abrupt increase beyond the ultimate horizon they

scheduled for their home ownership (influenced by preference of this in the national circumstances). On the other hand, perception of the breakeven point in direction the prices moved in 2007 reduced the annual increments of primary homes ownership until it dropped bellow zero in 2008, giving space for demanding housing services as households expected housing prices to decline further. According to the assumption of mirror projection and rent market, the opposite is valid for the investment demand. Next, effect of directions in which the house prices change on demand for secondary homes is straightforward, since for its second component, residential homes demand, the same negative relation to house prices applies. First, its price elasticity is high, secondly, bigger portion of wealth might have been previously spent on primary homes under the previous theory derived.

At the same time, there is still assumed to be an important role of patterns in Spanish households consumption customs concerning strong propensity to both primary and secondary ownership proved stable throughout the years.

Finally, it should be noted that "*the relation between house prices and rents may be of both directions. Substitution between primary homes owned and rented may, in its consequence, mean that increase in house prices leads to an increase in rents (since own primary housing becomes worse accessible, thus increasing demand for its renting).*" (Hlaváček, Komárek (2009))[20]

2.6.3 MODEL FOR DERIVING EXPECTATIONS: TIME SEQUENCE OF HOUSEHOLDS DECISION MAKING BETWEEN SERVICE AND PROPERTY

With regards to the last note of the previous section mentioned, purpose of this part will be to derive a simple decision making micro model about primary homes purchase in times of house price growth with control for the financial conditions and fiscal incentives that, based on discussion in Part 1, might have allowed for such a purchase, perfectly in line with idea of the note. Secondly, aggregating the equation for increase in households and plugging data into the model was thought to allow for subtracting estimate of expectations households had about future evolution in price during the last upturn.

[20] For purpose of this thesis, transelated by author of the thesis.

The idea of comparing cost of consuming a service with possible opportunity of benefit by postponing consumption of a good draws on discounted cash flow valuation method on one side of the equation. On the second side, the scope of capital gain is estimated in terms of expectations, where borrowing and fiscal incentives are considered, what allows us to determine the role generous fiscal incentives and favourable debt burden determinants played in housing affordability of the last housing cycle upturn. The stream of payments included on both sides were discounted to the present value using average annual yield of twelve months Spanish government T-bills as an inclusion of alternative investment opportunity assumption. The period of three years considered was forced by rather limited data availability about the rent market, on the other hand it may closely represent first the furthest horizon one may make expectations about, secondly the furthest horizon considered in deciding weather to postpone a primary home purchase.

The model, then, takes the form of

$$\sum_{j=1}^{3} \frac{S \cdot P_{rent_{t-1}} \cdot \Pi^{e}_{t+j-1}}{\left(1+r_{bonds}\right)^{j}} = \sum_{j=1}^{3} \frac{S \cdot \left(P_{house_{t-1}} - P^{e}_{house_{t+3}}\right)}{\left(1+r_{bonds}\right)^{j}} + \sum_{j=1}^{3} \frac{I_j - I^{e}_{j}}{\left(1+r_{bonds}\right)^{j}} \left(1-tr\right),$$

where *S* stands for average size of the dwelling considered, $P_{rent_{t-1}}$ is the observed price of rent in t-1, Π^{e} is the expected level of rents expressed in prices of year *t* and defined as $\Pi^{e} = \frac{1}{3}\sum_{j=1}^{3} \Pi_{t-j}$ or some other adaptive expectations technique, $P_{house_{t-1}}$ for the observed price of meter squared of housing in *t-1*, $P^{e}_{house_{t+3}}$ for expected price per metre squared of housing in *t+3, tr* the tax rate and r_{bonds} for the yield on twelve months government T-bills. Last, the interests paid (I_j) and expected to be paid (I^{e}_{j}) in the three consequent years may be simply counted out with use of amortisation schemes that banks offer on line[21], if average data about loan-to-value ratios are plugged into as a proxy (of course, the expected interest paid must be expressed by the use of expected house price level).

As may be noticed, we use formation of expectations on an adaptive basis, however for simplicity, only simple average adaptation process was used. For a household at the beginning of year *t*, rate of rent inflation for year *t* is expected to be the average this rate

[21] Such one offered by Banco de España may be found on http://www.bde.es/clientebanca/simuladores/simulador_hipotecario.htm#topForm1.

for past three years (*t-1, t-2, t-3*) counted out with use of the real data. Thus, the expected price of rent for year *t* may be approximated by multiplying the level of rent observed in *t-1* by rent inflation expected for year *t*. Expectations about price inflation in *t+1* may be then computed on the same principle as an average of past three values. Here, it is assumed that households believe their expectations are right, so that the value estimated for year t is plugged into the estimate for year *t+1*. For year *t+2*, we may proceed recurrently. Each of these estimates should be, however, expressed in base prices of year *t*. Such procedure may be used since the trend in rent did not prove such abrupt changes like in case of home purchase prices. When plugging into the equation, data of average characteristics on primary housing market like LTV and size of the dwelling may be used. Last, for reasons of expectations in the long run, variables in their nominal values should be included.

One might claim on the limited reliability of the rent market data, however, aim of the model is to serve for estimation of expectations about future level of house prices through estimating expectations about possible gains. The idea behind, then, is that just because the rent market is dispersed and non-transparent, general public is prone to use common internet sources in searching for information about levels of rent, that are certainly not more precise than those Ministry of Housing has at dispose.

Problem with plugging into the equation to subtract the expectations, however, lies in the fact that most of the credit on housing bears variable interest rates. Thus, it is hard to guess without further exploring historical patterns of households´ behaviour how expectations about such debt burden might be derived.

To conclude, our model is a proposal of simplest model of expectations estimate with involvement of tax rules that most of the existing models omit entirely. In the model, extend to which these tax shelters were used in Spain, is the crucial reason for need of their inclusion. Next, it is important to take into account that most credit bear variable interest rates and, above all, the fact that path these interest rates followed was rather dynamic. Since this cannot be done without further research, we propose examining households´ consumption behaviour under variable interest rates as an interesting topic to be dealt with.

2.7 ASSESSMENT OF MULTIPLE RELATIONS AMONG VARIABLES: SHORT AND LONG RUN

After previous results gave us more sophisticated results about the role underlying financial and real economy variables played in balance between the three cycles, we may once again return to our discussion initiated in Part 1 and assess the long run and short run interaction between those variables that really proved important. Secondly, by including this last empirical part on this place, few theoretical remarks concerning prudential policies may be concluded at the end.

2.7.1. CHOICE OF THE RIGHT METHOD

In line with the previous discussion of mutual relations in the system housing market is a part of and suggested by the results derived in two of the previous sections, particular analysis of the forces both in long and short run is straightforward. Tests for cointegration in the long run and error correction in the short run should be done in a consequence. However, as the multiple relations between housing, mortgage and business cycles are suggested by theory and have been empirically confirmed by various authors[22], this makes testing for cointegration and error correction model of multiple variables mode difficult to cope with. In fact, it is the variance of relations and scope of these in its full extend, what should be considered if it comes to any kind of regulation.

As stated by Thomas (1996), if the theory suggests there are more than one cointegrating vectors in case of more than two variables (maximum number of possible cointegrating vectors among n variables always is n-1), the "*Eagle-Granger two stage procedure is no longer applicable, as the OLS estimation of the cointegrating regression no longer provides consistent estimates of any of the cointegrating vectors"* (Thomas (1996)). While the Eagle-Granger first step is accompanied with the problem of which variable to use as an explanatory variable in the OLS regression, causing that in small samples (one of which our data set definitely is) "*one regression indicates the variables are cointegrated, whereas reversing the order indicates no cointegration"* (Enders (2004)), the methodology introduced by Johansen proposes the maximum likelihood estimate approach to avoid problems like this. Moreover, unlike the Eagle-Granger approach that "*can only test for the presence of cointegration but not for the number of cointegrating relationships among the variables",* the Johansen methodology "*investigates the issue of cointegration in its full complexity*" (Kočenda, Černý (2007)).

For all of these reasons, we consider Johansen procedure to be the only proper tool to be used, based on the nature itself of the issue analysed in this work. On the other hand, as noted by Thomas (1996), problems resulting from elements in the alpha matrix being different from zero meaning "*variables are error correcting for departures from more than one equilibrium relationship, or even for departures from some linear combination of such relationships,*" brings serious problems with economic interpretation, issue dealt with by today's econometric theoreticians.

2.7.2. VARIABLES AND ITS TIME SERIES

In order the cointegration and error correction model were not over parameterised, we were very careful about the choice of variables. Few comments are added if inclusion of the variables is felt necessary to be explained.

Index of house prices ***endogenous***

Gross domestic product ***endogenous***

Credit granted to households on housing ***endogenous***

The first idea was to include flow of credit on housing granted quaterly. Cointegration was expected this way, as with house price decrease, volume of credit on housing most probably drops as well. In line with the previous results, we assumed that the increase in credit transactions connected with secondary housing demand does not exceed the drop in volume caused by lower price of the underlying asset. (Causality of these relations is, however, beyond the scope of this thesis.) As has been answered to our correspondence with Banco de España, such statistics have been only collected since 2004, period too short for us to be relied on. The Spanish statistical office does offer such statistics on housing, but only concerning the mortgage credit granted (the same statistics is disclosed by Banco de España as well). This, unfortunately, differs from the total credit on housing by up to 30 percent approximately and moreover, this difference is changing in time. Fortunately, data of stock of credit, collected by regulatory authorities as opposed to the data of flow (that are in charge of European Monetary Authorities) are at dispose from 1996:4. Since the two series

[22] See the discussion in Part 1

have proved correlated, we follow with including the stock variable into the model.

Loan loss provisions on credit to households on housing ***endogenous***

Assumed to detect if the dynamic provisioning had some kind of "error correcting" impact. However, we are fully aware that more sophisticated methods are used to derive really reliable results in this issue.

Foreign investment in housing ***exogenous***

Foreign investment in housing has been included to control for cointegrating relation in time prices were decreasing, as literature suggests on notable role that non-residents played in the recreational housing demand.

On its erogeneity, it was assumed based on the fact that non-residents are barely affected by economic situation in the country, whereas their demand has subsequent influence not only on the house prices, but aggregate demand as a whole. As such, house prices in Spain may be well effected by outer economic conditions.

Since the quaterly series of period between 1996 and 2010 were considered, times of the most abrupt rise in prices are encompassed, including years in which the prices not only went up, but the speed of increase was even rising in time. Such dynamics in time caused that none of the variable's time series is stationary neither in its first differences (what would refer to a linear trend in levels). Even with inclusion of variables in their logarithmic forms to control for non-linearities, using console order in Gretl software, that allows for automatic testing of unit root (stationarity, respectively) on the lowest number of lags without serial auto correlation of residuals, it was found out that all time series were integrated of the order two (I(2)). For testing, both augmented Dickey Fuller test and KPSS test were employed, statistics of which with corresponding p-values are reported in the appendix. Since all of the time series are integrated of the same order, there was no need to exploring multicointegration. Finally, such an analysis is very challenging from an econometric point of view, since "few economic variables are integrated of an order higher than unity." (Enders (2004)).

2.7.3. COINTEGRATION: ASSYMETRY IN ADJUSTMENT FOUND

Technical requirement for including I(2) logarithmic time series into cointegration in their first differences brings differences in interpretation. By including logarithmic forms of the first differenced time series however, the model outcome may be thus reported on as a link between variables´ speed of adjustment (speed of change of one variable may be explained by speed of changes of the rest of these). This may, actually, bring additional information to our results, considering the fact that the trend in house price did not stay linear throughout the period considered, thus each variable might have reacted in a different speed of adjustment. Since we have quaterly series in hand, four lags were chosen to be included, since more would bring additional problem with degrees of freedom.

With regards to aim of future employment of the cointegration results into some kind of error correction model, we started our modelling with deciding on which form of times series to work with. Through the procedure of comparing empirical results with wide theoretical assumptions made in part 1, we arrived to much more results, actually.

Turning to our first assumption considered, since the period examined encompasses more than then years, most of them of notable inflation, the natural way of proceeding would be to include variables in real terms. On the other hand, we have just suggested at the end of the previous section that households´ expectations about future evolution of prices might be self-fulfilling, while expectations are very often made on the nominal basis. In this way, it was first approached to including time series deflated into real terms of 2010 Q1 by the consumer price index. So was finally decided to be deflated the GDP as well, to avoid possible misconduct of using the deflator of GDP, resulting from differences in construction of the indices in time when some price of commodities rose significantly more than those of other ones. Continuing with testing for number of cointegrating vectors, the zero hypothesis of no such vectors is rejected by both λ_{trace} and $\lambda_{\max}$ tests against the alternative there is more than 0, respectively 1 such vector with p-value of 0,0000 and 0,0001. Next, zero hypothesis of less or equal to 1 cointegrating vector was rejected by λ_{trace} test against the alternative of more than one cointegrating vectors, supported by rejecting the zero hypothesis of one cointegrating vector by $\lambda_{\max}$ test, both with p-value lower than 0,05. Finally, the hypothesis of less or equal to 2 vectors with alternative of more than 2 vectors was tested with p-value of

0,1223 by λ_{trace} test, however $\lambda_{\max}$ test would reject the hypothesis of 2 cointegration vectors against the alternative of three with p-value of less than 0,1. Since Johansen (2004) suggests that rejecting the zero hypothesis on level of significance higher than 0,05 may lead to incorrect results, we conclude on the presence of one cointegrating vector among the time series in real terms. In the same way, we have tested for presence of up to 3 cointegrating vectors among the same time series in nominal terms, arriving to existence of the maximum number of such vectors.

Next, it proceeded with further examination of the number of cointegrating vectors among both real and nominal time series. The question, this time, was not why the number of cointegrating vectors differ between the series, but why no more then two cointegrating vectors were found for real term time series, while the economic theory is so sure about their existence. Moreover, the levels of confidence on which we conclude on three cointegrating vectors in case of nominal time series, were also deteriorated for the null hypothesis as we were continuing with testing for more eigenvalues. After plotting the time series, it became clear that until the house prices started to decrease, the variables were moving together. Thereafter, the linkage appeared to have disrupted. For this reason, it was approached to checking for additional cointegration vectors with restriction on the period of house prices increase. Examining period from 1996:4 until 2006:4 when the house prices started to drop, three cointegrating vectors among real time series were found with good confidential levels, while in case of nominal time series the same results with mostly lower p-values in each of the consequent λ_{trace} and $\lambda_{\max}$ tests than in the previous case were indicated.

However it is very difficult to interpret results of the error correction model we have, such results may be a signal of smooth functioning of relations among variables assumed only in times when house prices increase. From the point in time when they start to decline, the relationships were indicated to be disrupted. Reason for this may be an *aversion to lost* concerning proprietors possessing a dwelling, willing to change it for another. If the nominal value has dropped compared to its purchasing price, the proprietors tend to fix the offer price above the price set in the market, what causes the adjustment of prices downwards slowlier! (Genesove and Mayer (2001) in Pagés and Maza (2003)) As such, this may be referred to as asymmetry in adjustment downwards.

Such an explanation in asymmetry of reaction is, moreover, perfectly in line with the need for interpretation of the results as a linkage between speeds of adjustments.

Last, it was tested if the previous results were next confirmed by an attempt to include the flow of mortgages granted with corresponding loan loss provisioning data. Even when assuming nominal time series, no (!) cointegration was found when the whole period was considered. When restricting ourselves on period before 2007:1, two such vectors were indicated, compared to the three there were in case of credit on housing stock, though. Assuming the value of collateral is evolving along with the house price, such result for a downturn is quite a surprising.

2.7.4. VECTOR ERROR CORRETION MODEL REPRESENTATION

According to Eagle-Granger representation theorem, such cointegrated variables have a vector correction model representation and error correction model is the only correctly specified multivariable model to be estimated if variables are cointegrated.

Since interpretation with the asymmetry in speed of adjustment is, to our opinion, the most appropriate result we can arrive to within the Johansen procedure facing I(2) time series, lagged values of variables were added into the model to see which of them have significant influence.

The model was derived for nominal time series and the unrestricted period considered and takes the following form

$$\Delta^2 \ln y_t = \alpha\beta'\Delta \ln y_{t-1} + \sum_{i=1}^{p} \Pi_i \Delta^2 \ln y_{t-1} + \varepsilon_t ,$$

"where $y_t = \left(y_{1t},...,y_{Nt}\right)'$ *is the* $N \times 1$ *vector of the N cointegrated variables,* $\varepsilon_t = \left(\varepsilon_{1t},...,\varepsilon_{Nt}\right)'$ *is the* $N \times 1$ *vector of N possibly correlated cointegrated variables,* $\prod_i$ *are* $N \times N$ *matrixes of autoregressive coeficients,* $\beta = \left(\beta^{(1)},...,\beta^{(r)}\right)$ *is the* $N \times r$ *cointegrating matrix,* α *is the* $N \times r$ *matrix of adjusment coefficients."*[23]

From the lags that the model was augmented with, only those significant on level 0,1 at least were assumed. Since the autoregressive coefficients stand by variables in twice differenced logarithms, we will restrict ourselves on commenting on the number of lags

[23] Whole description of model, with some adjustments, from Kočenda and Černý (2007).

in which these forms of variables proved significant with regards to the explained variable. Since plugging into would not bring no more results, for the regressions detail, we refer to the appendix and present only conclusions on this place. In this sense, several points, some of them that are confirming our previous results, may be concluded from the lagged values´ significance:

$\Delta^2 \ln IHP_t$

Change in speed of index of house prices movement is explained by its own lagged values of twice differenced logarithms. This confirms our results that expectations may cause changes in house prices are of self-fulfilling nature (enhancing itself); however, influence of foreign demand did not prove significant here; only first lagged forms of credit variable significant might be a confirmation of institution memory hypothesis.[24]

$\Delta^2 \ln GDP_t$

According to all past assumptions, change in speed of GDP movement seems to be affected by forms of index of house prices, that were assumed to go hand in hand; significance of form of foreign investment may indicate its influence on the aggregate demand.

$\Delta^2 \ln C_t$

Significance of last considered lag of IHP form with regards to credit concerning explained variable may be a sign of lag between house prices signal and moment credit is granted (institutional factors), while significance of the first lag of loan loss provisions variable form confirms consistency with previous institutional memory hypothesis result.

$\Delta^2 \ln LLP_t$

Finally, significance of lagged forms of IHP and GDP with regards to change in speed of evolution of loan loss provisions indicates their design to react on changing macroeconomic conditions even before these are reflected in volume of credit granted.

[24] For more about theoretical explanations the credit cycle procyclicality, see Jiménez and Saurina (2006).

Finally, Pagés and Maza (2003) derive similar model based on their own theoretical assumption about variables to be included. However, the models are impossible to be compared, since the period they deal with was 1978-2002 and thus, by avoiding period of the abrupt changes, their variables proved stationary in the first differences already.

PART 3. WHY EXISTING REGULATION MIGHT NOT BE EFFICIENT. COMPARATIVE STUDY[25]

According to the extensive research, the so called dynamic provisioning did not help to reduce the increase in credit granted, however it is hard to assess how this would grow if the dynamic system would not have been introduced. On the other hand, the contribution which such anti cyclical regulatory tool had on the state of the banks that they entered the financial crisis in, is highly appreciated[26].

Structure of the part of this thesis is as follows: to describe main differences between two existing approaches in determining regulatory capital in Europe with emphasis on the issue of cyclicality and summarise main differences between regulatory and economic capital of a bank. Next, to make few remarks on assessing influence of the two scenarios of regulatory capital setting on the real economy during the upturn and finally, to assess the current stage of convergence and discuss the possible options in interactions between regulatory and economic capital towards avoiding building up of instability and asset bubbles in future.

Until year 2000, tools for ensuring stability of the financial system in Spain were the capital requirements and loan loss provisions in accordance with Basel II, while it is the loan loss provisions that may be explained by the credit cycle of the system. Dynamic provisioning introduced statistical provisioning to smooth the currently existing general and specific provisions, the latter calculated as a proportion of credit growth and bad loans. Following the logic of ex ante credit portfolio risk materialising ex post in credit loses (Saurina (2009)), statistical provisions were introduced to be booked in time the loan is granted, out of the still homogenous loan portfolios "*where losses have not yet been identified in specific loans*" (Saurina (2009)), using: first, the estimate of latent risk measured by the means of average credit loss or impairment in a cyclically neutral year, secondly, the average specific provisions out of these (based on Saurina (2009)). Level of provisioning thus depends on the absolute values of the two estimates and therefore it determines naturally counter cyclical generation and depletion of a fund. Tax deductibility of the statistical provisions faced disapproval with the IFRS, though.

[25] For part 4 of this thesis, author's essay for Financial Economy course (JEB027) on the topic of Economic versus regulatory capital, that was written in parallel with the thesis and submitted at the IES in academic year 2010/2011, was after some modifications almost entirely used.
[26] See Caruana (2005).

Under the new system since 2005 then, the statistical provisions are part of the general provisions, however, these still include both ex post and ex ante identification of the risk, compared to the solely ex post nature of general provisions under Basel II.

However, according to Saurina (2004), banks often hold significant buffers over the capital required, while the cyclical nature of the banks balance depends just on the way these buffers are made over the entire cycle. Seeming convergence of dynamic provisioning system towards Basel II allowed better for an analysis of the distinct determinants of regulatory and economic capital to be made by Banco de España, in line with attempts of Spain to anti-cyclical nature of the provisioning system on financial and real economy. Elizalde and Repullo (2004) find source of lasting divergence between regulatory and economic capital in dependency on different variables and different reactions on changes in variables on which they depend on commonly. While the regulatory capital depends on level of confidence from the regulator, the economic capital, on the other hand, varies across with cost of bank capital and margin of intermediation, causing the economic capital to be superior to the regulatory one only in case these costs are low, as well as when competition between the financial intermediaries is high, the case of which has been Spain since 1990s. Otherwise, it may fall under the level required by the regulator. Finally, the market discipline causes the two capitals merge together; however, its role in the last crisis stays a question for itself. In this way, the incompatibility of regulatory and economic capital seems to be a sort of principal agency problem to be sorted out under the next regulatory framework. In reality, it might mean that meanwhile regulatory capital has potential to raise the price of credit, "*research suggests that the most relevant variable for understanding banks´ decision about the amount of credit to be extended and its price is economic capital*." (Caruana (2005))

Naturally, testing of correlation between mortgage volume and housing prices is influenced by the mutually reinforcing relationship between the two. Moreover, the relationship itself is affected by the business cycle up trend allowing for real estate purchases, unless the banks relax their lending standards, another side effects that make comparing reactions on ways loan loss provisions are made rather ambivalent. To the assessment of influence of the provisioning policy on mortgage cycle thus, one can also proceed another way around. Under the assumption that regulator requires provisions to be made dynamically, so that price of the credit must increases, banks, in order to cope

with the volume of mortgages demanded in connection with the house price upswing, probably need to rise their capital. Following this way, banks may also drop on paying out dividends in accordance with varying stake of real estate mortgages in their portfolios, thus increasing accumulated retained earnings and capital as desired (we assume that the abnormal increase in mortgages in absolute terms, given the real estate boom, means an increase of their stake in banks´ portfolios in relative terms as well). It should be the result, then, that the value of shares of individual bank partially depends right on the provisions that have had to be made. If this can be concluded from an empirical analysis, counter cyclical provisioning had limited impact on mortgage cycle with implications for economic capital change in concept to be reinforced. However, it may be the reason as well that profit margins banks have on their services are enough high for the additionally incurred costs to be covered by simply cutting down on these margins, while the volume of services bring additional revenues at the same time. This issue is another topic of research we would like to propose.

Based on the basic purpose of the economic capital to ensure solvency of the institutions individually, whereas the regulatory capital is aimed to guarantee stability of the system (Kadlčáková, Sůvová (2002)), dynamic provisioning seems to comply with the requirement stated above more, as "*the anti cyclical nature enhances resilience of both individual banks and the banking system as a whole.*" (Saurina (2009)) On the other hand, dynamic provisioning, in fact, passed a part of coverage for the unexpected loses into the coverage for expected ones, by the transfer of a part of capital requirements into provisioning fund (concerning credit risk for the most part). Thus, it strengthened the importance of the part of regulatory capital that is not involved in the economic capital and, from this point of view, formally differentiated even more definitions of the two. Looking inside the process, at the methodologies of regulatory capital setting with and without the dynamic provisioning tool, differences from the value at risk approach may be found, too. In case of Spain, internal methodologies are necessary to estimate impairments in portfolios, consisting in banks assets being classified according to risk categories. (Saurina, (2009)) Following this logic, parameters are the same for all banks, however, "*the overall impact will differ for each bank depending on the structure of its loan portfolio."* (Saurina (2009)) In case of Basel II, particular importance is given to external rating agencies in the IRB process.

If the loan loss provisioning might have impact on volume of loans granted, regulatory and economic capital must converge, while the example of Spain showed this must be done not only in terms of regulatory capital that well estimates the risk, but also by the means of considering economic capital in wider circumstance. Thus, to ensure reliability of the economic capital setting, steps focusing on the management incentives to behave circumspectly must be preceded, confronted by the motivation to adverse selection of these to adjust economic capital for the purpose of investors´ demands. The credibility of bank managers´ estimates of the risk, then, must be conditioned by taking into account not only risk profile of the bank portfolio, but also the risk profile of the system as a whole, with position in the economic cycle as the main indicator best capable of detecting financial imbalances entering balance sheet of bank for which policy of credit granting they are responsible for. Lately, patterns of anti-cyclical regulatory approach in Basel III being prepared would prove steps forward in the two capitals´ convergence.

CONCLUSION

Although there are no doubts about demand driven house price increase in Spain, incentives of capital gains for construction sector, coming from the enough predictable way the demand was evolving, arranged for that supply and demand met in a timely manner. Reason for such house price dynamics, then, might have been the frequency of trading, while under the expectations that house prices would be long lasting, households were approaching to their primary homes purchase along with the upturn. When the house prices started to drop and the relationship reversed, it was probably the recreational housing what was extensively traded with as the cross sectional analysis indicates. Included, proves of high stake of recreational housing in new construction completions were detected towards 2008 when this resulted in an excess of supply. Evolution of such expectations in time and deciding on the role low interest rates and fiscal incentives on primary housing played in fuelling such cycle, however, could not be completed due to need for additional research about consumers´´ behaviour under variable interest rates most credit bears in Spain. Model derived that incorporates existing tax rules may serve as a basis for that, anyway.

Finally, the multiple mutual relations the theory suggests to exist among the financial and real economy variables were confirmed in the expansionary period only. In the downturn, variables seem to be much less related, reason for which might possibly be a kind of irrational behaviour of the agents as well as the financial and macroeconomic imbalances if found present in the economy. Since such results concerned change in speed in which variables react on each other, an asymmetry of adjustment downwards was detected, possibly explained by the redistributional character of the downturn period with regards to the property owners, while demand for their assets was motivated by the transaction motive right.

Since the speed of change of loan loss provisions was detected in connection with underlying macroeconomic conditions, not the credit granted itself, automatic design of such tool may be confirmed. However, possibilities why volume of credit granted was not corrected downwards in a consequence were detected as a principle agent problem. Thus, incentives for circumspect risk management were called for, so that for the risk profile of the whole system it is assumed while the economic capital is set, if anti cyclical tools might be efficient in avoiding amplified cycles in future.

SUMMARY

To depict possible creation of financial imbalances between the business, housing and credit cycles, the channels of monetary and financial stability transmission mechanisms were discussed in the first part. Based on the framework introduced, country specific data were used to derive preliminary results of what drivers of the dynamics might have been in Spain.

Secondly, demand for housing in Spain was broken down into structural parts based on the above charted assumption that each of such may react differently on changes in the economic environment that the country went through extensively. With use of such division, meeting of demand and supply in time might have been assessed first.

Based on the timely manner results, it was proceeded with checking for the spatial match between the demand and supply with regards to structural nature of the two. Results derived in cross sectional regression through the heterogeneous territory of Spanish provinces in two years when the house prices moved in opposite directions gave base to the expectation based explanation.

Next, a basic microeconomic model was proposed to confirm in a continuous sequence of time weather the lax monetary policy and fiscal incentives on primary housing might have really allowed for the expectations driven demand. However, problems with expectations about varying interest rates were detected, thus leaving space for further research.

With more information based on the above charted results, it might have been then returned to the issue of reciprocal relations between financial and real economy empirically. First of all, the scope of these relations among variables assumed was focused on, based on Johansen method for cointegration approach. Next, a multivariable error correction model was estimated and interesting result derived with regards to the difficult possibilities of interpretation that were faced.

Last, assessment of the variables´ impact on change in speed the others were moving allowed to assess discussion from the very beginning of the thesis, while few conceptual notes were made on why anti cyclical nature of a regulatory approach may not result anti cyclical at the end, pointing out at the future possibilities in regulatory framework we have in hand.

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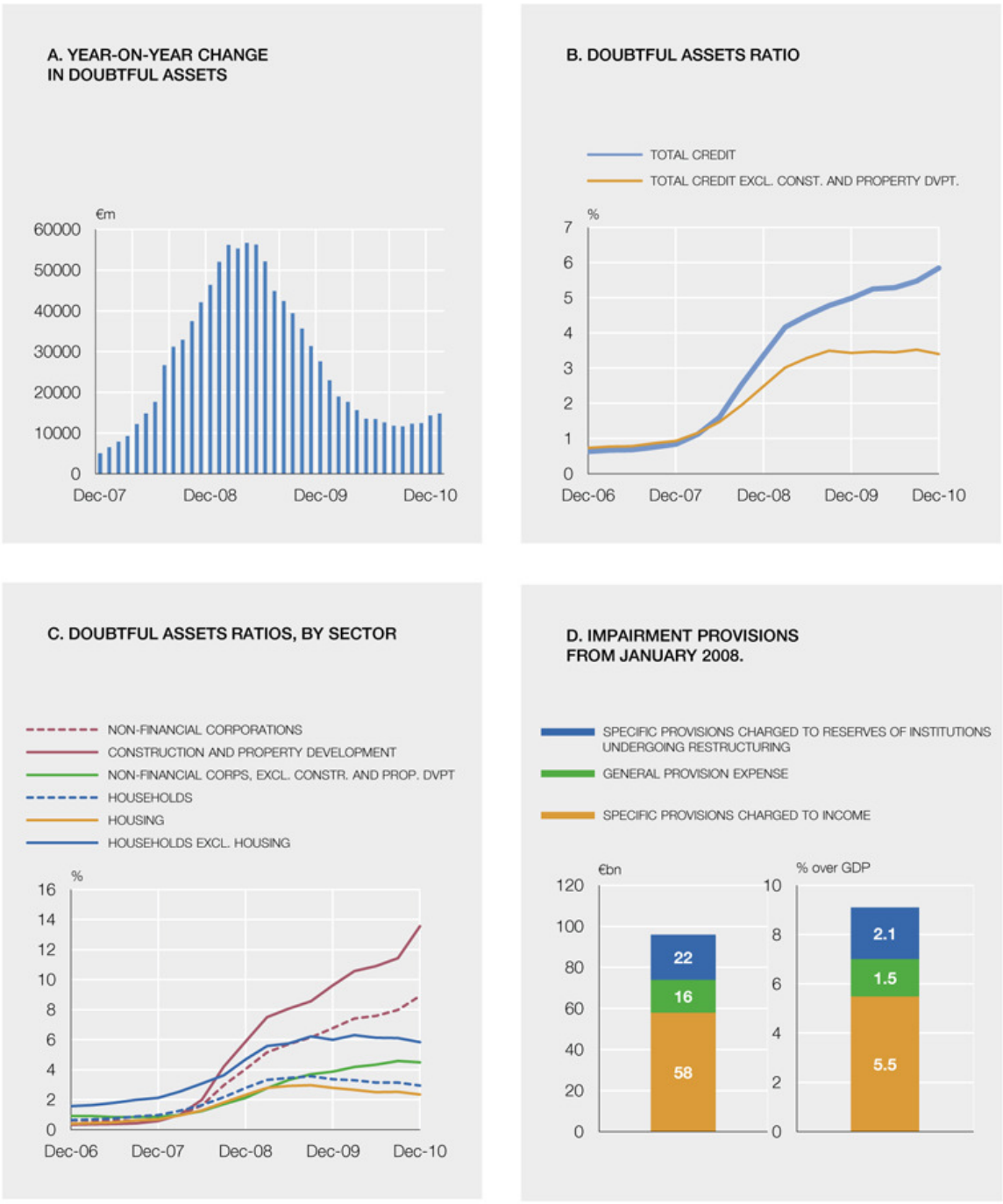
LIST OF APENDICES

1. DETAILS OF THE SPANISH BANKING SYSTEM IN THE CURRENT DOWNTURN

DOUBTFUL ASSETS AND PROVISIONS TO THE RESIDENT SPANISH PRIVATE SECTOR
Deposit institutions. ID

CHART 2.2



SOURCE: Banco de España

Source: Banco de España, Financial Stability Report May 2011[27]

[27] Financial Stability Report May 2011, Banco de España. Available at: http://www.bde.es/webbde/en/secciones/informes/boletines/Informe_de_Estab/anoactual/

2. DETAILS OF OLS CROSS SECTIONAL REGRESSION

	Main results out of the alternatives from the cross sectional regression process and assessing: coeficient estimates and p-values of the t-statistics												
	Constant	GDP per capita	Unemployment	Mortgage average	Price of land	Family/construction total	Transaction unsubsidised new/construction unsubsidised	Transaction unsubsidised/stock unsubsidised	Seaside	White test of homoskedasticity (squares)	Breuch Pagan test of homoskedasticity	Normality test	Adjusted R2
2006	-1433,960 0,00018 (***)	0,054 0,00008 (***)	43,262 0,0096 (***)	0,008 <0,00001 (***)	1,743 <0,00001 (***)	-36,902 0,320				0,126	0,290	0,812	0,833
	-1441,170 0,0002 (***)	0,055 0,00009 (***)	43,321 0,0102 (**)	0,008 <0,00001 (***)	1,662 0,00006 (***)	-36,578 0,329			31,610 0,647	0,239	0,487	0,683	0,830
	-2177,110 *<0,00001 (***)*	*0,089* *<0,00001 (***)*	*82,840* *0,00003 (***)*	*0,008* *<0,00001 (***)*		*-15,451* *0,740*				*0,051*	*0,089*	*0,224*	*0,732*
	-1317,350 0,00148 (***)	0,051 0,00013 (***)	40,848 0,01506 (**)	0,008 <0,00001 (***)	1,714 <0,00001 (***)		-37,394 0,860			0,119	0,282	0,764	0,829
	-1194,340 **0,00119 (***)**	**0,049** **0,00014 (***)**	**39,415** **0,01469 (**)**	**0,008** **<0,00001 (***)**	**1,936** **<0,00001 (***)**			**-4156,980** **0,0844 (*)**		**0,326**	**0,173**	**0,840**	**0,841**
	-1196,320 0,00124 (***)	0,051 0,00012 (***)	39,412 0,01519 (**)	0,008 <0,00001 (***)	1,817 0,00002 (***)			-4463,890 0,06933 (*)	53,300 0,434	0,231	0,330	0,795	0,839
	-1224,720 0,00158 (***)	0,048 0,00039 (***)	39,555 0,01548 (**)	0,008 <0,00001 (***)	1,928 <0,00001 (***)		51,025 0,770	-4133,120 0,0897 (*)		0,337	0,144	0,885	0,837
2008	*-636,270* *0,03629 (**)*	*0,035* *0,00622 (***)*	*13,633* *0,215*	*0,007* *<0,00001 (***)*	*1,512* *0,0007 (***)*			*0,000* *0,443*		*0,201 (0,083)*)*	*0,009*	*0,179*	*0,825*
	-951,662 *0,00183 (***)*	*0,034* *0,0035 (***)*	*17,607* *0,08538 (*)*	*0,008* *<0,00001 (***)*	*1,513* *0,00006 (***)*		*427,111* *0,00393 (***)*			*0,182 (0,047)*)*	*0,165*	*0,179*	*0,854*
	-922,246 0,00126 (***)	0,033 0,00229 (***)	13,401 0,162	0,008 <0,00001 (***)	1,068 0,00431 (***)		411,688 0,00296 (***)		178,071 0,00755 (***)	0,780	0,790	0,802	0,873
	-609,979 **0,00026 (***)**	**0,023** **0,0038 (***)**		**0,008** **<0,00001 (***)**	**1,254** **0,0005 (***)**		**385,235** **0,00514 (***)**		**192,440** **0,00404 (***)**	**0,764**	**0,537**	**0,692**	**0,870**

*) levels of variables included

Note: the shaded fields indicate model that it was commented on.

Source: Author

3. JOHANSEN COINTEGRATION PROCEDURE FOR COINTEGRATION TESTING

TESTING FOR ORDER OF INTEGRATION IN GRETL CONSOLE

ADF test; H0: a = 1					
Variable	**d_d_l_IHP**	**d_d_l_for**	**d_d_l_credit**	**d_d_l_cor**	**d_d_l_gdp**
Number of lags used	2	0	0	8	2
Autocorrelation coefficient of the first order	0,4	-0,021	-0,064	0,053	-0,048
Estimated value	-2,74618	-1,26077	-1,84953	-2,38074	-3,28393
t-statistics	-7,44928	-9,49172	-2,13778	-4,30482	-9,75388
as. p-value	1,28E-12	1,53E-32	0,0313	1,79E-05	9,01E-19

TIME SERIES IN REAL TERMS, WHOLE PERIOD CONSIDERED

Johansenův test:
Počet rovnic = 4
Řád zpoždění = 4
Perioda odhadu: 1998:1 - 2010:1 (T = 49)
Případ 3: Neomezená konstanta
Exogenní nezávisle proměnná (proměnné): ld_for

Hodnost Vlastní číslo Test stopy matice p-hodnota Lmax test p-hodnota
0 0,58279 77,911 [0,0000] 42,834 [0,0001]
1 0,36518 35,077 [0,0104] 22,266 [0,0323]
2 0,22684 12,810 [0,1223] 12,606 [0,0892]
3 0,0041530 0,20392 [0,6516] 0,20392 [0,6516]

vlastní číslo 0,58279 0,36518 0,22684 0,0041530

TIME SERIES IN NOMINAL TERMS, WHOLE PERIOD CONSIDERED

Johansenův test:
Počet rovnic = 4
Řád zpoždění = 4
Perioda odhadu: 1998:1 - 2010:1 (T = 49)
Případ 3: Neomezená konstanta
Exogenní nezávisle proměnná (proměnné): ld_for

Hodnost Vlastní číslo Test stopy matice p-hodnota
Lmax test p-hodnota
0 0,67650 105,36 [0,0000] 55,299 [0,0000]
1 0,48150 50,061 [0,0000] 32,184 [0,0005]
2 0,29408 17,877 [0,0199] 17,064 [0,0157]
3 0,016455 0,81302 [0,3672] 0,81302 [0,3672]

TIME SERIES IN REAL TERMS, PERIOD 1996:Q4-2006:Q4

Johansenův test:
Počet rovnic = 4
Řád zpoždění = 4
Perioda odhadu: 1998:1 - 2006:4 (T = 36)
Případ 3: Neomezená konstanta
Exogenní nezávisle proměnná (proměnné): ld_for

Hodnost Vlastní číslo Test stopy matice p-hodnota
Lmax test p-hodnota
0 0,73844 97,003 [0,0000] 48,279 [0,0000]
1 0,50700 48,724 [0,0001] 25,461 [0,0096]
2 0,33921 23,263 [0,0022] 14,916 [0,0373]
3 0,20696 8,3477 [0,0039] 8,3477 [0,0039]

4. VECTOR ERROR CORRECTION MODEL FOR NOMINAL TIME SERIES AND WHOLE PERIOD CONSIDERED

VECM systém, řád zpoždění 4

Maximální věrohodnost odhady, pozorování 1998:1-2010:1 (T = 49)

POŘADÍ KOINTEGRACE = 3

Případ 3: Neomezená konstanta
beta (kointegrační vektory, směrodatné chyby v závorkách)

ld_gdp	1,0000	0,00000	0,00000
	(0,00000)	(0,00000)	(0,00000)
ld_ihp	0,00000	1,0000	0,00000
	(0,00000)	(0,00000)	(0,00000)
ld_credit	0,00000	0,00000	1,0000
	(0,00000)	(0,00000)	(0,00000)
ld_cor	0,19630	0,36193	0,50525
	(0,042548)	(0,074628)	(0,11655)

ALPHA (adjustační vektory)

ld_gdp	-2,4031	0,86144	0,32034
ld_ihp	-0,80829	-0,11939	0,38824
ld_credit	0,61851	0,53114	-0,62170
ld_cor	118,31	-62,500	-4,0964

Logaritmus věrohodnosti = 522,54062
Determinant kovarianční matice = 6,4178264e-015
AIC = -18,3894
BIC = -15,6096
HQC = -17,3348

ROVNICE 1: d_ld_gdp

	Koeficient	*Směr. chyba*	*t-podíl*	*p-hodnota*	
const	0,00446388	0,00139304	3,2044	0,00306	***
d_ld_gdp_1	1,29824	0,343233	3,7824	0,00064	***
d_ld_gdp_2	0,841115	0,252358	3,3330	0,00218	***
d_ld_gdp_3	0,236945	0,155414	1,5246	0,13718	
d_ld_ihp_1	-0,593481	0,150599	-3,9408	0,00041	***
d_ld_ihp_2	-0,368053	0,12197	-3,0176	0,00497	***
d_ld_ihp_3	-0,235792	0,0848785	-2,7780	0,00907	***
d_ld_credit_1	-0,24974	0,0875248	-2,8534	0,00752	***
d_ld_credit_2	-0,229028	0,0813714	-2,8146	0,00829	***
d_ld_credit_3	-0,121239	0,0587766	-2,0627	0,04734	**
d_ld_cor_1	0,00585059	0,00339507	1,7233	0,09449	*
d_ld_cor_2	0,00267793	0,0032177	0,8322	0,41144	
d_ld_cor_3	0,0013108	0,00276541	0,4740	0,63872	

ld_for	0,0808409	0,0251733	3,2114	0,00301	***
EC1	-2,40314	0,471431	-5,0976	0,00001	***
EC2	0,861445	0,154249	5,5848	<0,00001	***
EC3	0,320337	0,104596	3,0626	0,00442	***

Střední hodnota závisle proměnné	-0,000317	Sm. odchylka závisle proměnné	0,010367
Součet čtverců reziduí	0,000766	Sm. chyba regrese	0,004893
Koeficient determinace	0,851496	Adjustovaný koeficient determinace	0,777244
rho (koeficient autokorelace)	0,268020	Durbin-Watsonova statistika	1,261358

ROVNICE 2: d_ld_ihp

	Koeficient	*Směr. chyba*	*t-podíl*	*p-hodnota*	
const	-0,002137	0,00367872	-0,5809	0,56537	
d_ld_gdp_1	1,47541	0,906408	1,6278	0,11338	
d_ld_gdp_2	1,27919	0,666426	1,9195	0,06388	*
d_ld_gdp_3	0,0980335	0,410416	0,2389	0,81273	
d_ld_ihp_1	-0,834376	0,397701	-2,0980	0,04389	**
d_ld_ihp_2	-0,647953	0,322099	-2,0117	0,05274	*
d_ld_ihp_3	-0,466107	0,224147	-2,0795	0,04567	**
d_ld_credit_1	-0,280383	0,231135	-1,2131	0,23398	
d_ld_credit_2	-0,275789	0,214885	-1,2834	0,20856	
d_ld_credit_3	-0,151086	0,155217	-0,9734	0,33766	
d_ld_cor_1	0,0178814	0,00896569	1,9944	0,05468	*
d_ld_cor_2	0,00814482	0,00849727	0,9585	0,34499	
d_ld_cor_3	-0,00664245	0,00730288	-0,9096	0,36985	
ld_for	0,107467	0,0664775	1,6166	0,11578	
EC1	-0,808289	1,24495	-0,6493	0,52081	
EC2	-0,119386	0,407339	-0,2931	0,77135	
EC3	0,38824	0,276216	1,4056	0,16949	

Střední hodnota závisle proměnné	-0,000509	Sm. odchylka závisle proměnné	0,016234
Součet čtverců reziduí	0,005342	Sm. chyba regrese	0,012921
Koeficient determinace	0,577695	Adjustovaný koeficient determinace	0,366543
rho (koeficient autokorelace)	0,077238	Durbin-Watsonova statistika	1,716685

ROVNICE 3: d_ld_credit

	Koeficient	*Směr. chyba*	*t-podíl*	*p-hodnota*	
const	0,00426065	0,00401974	1,0599	0,29711	
d_ld_gdp_1	0,508206	0,990431	0,5131	0,61139	
d_ld_gdp_2	0,47385	0,728202	0,6507	0,51988	
d_ld_gdp_3	0,103138	0,448461	0,2300	0,81957	
d_ld_ihp_1	-0,617496	0,434568	-1,4209	0,16501	
d_ld_ihp_2	-0,467012	0,351957	-1,3269	0,19393	
d_ld_ihp_3	-0,663086	0,244925	-2,7073	0,01079	**

d_ld_credit_1	-0,105745	0,252561	-0,4187	0,67824	
d_ld_credit_2	-0,0234154	0,234804	-0,0997	0,92119	
d_ld_credit_3	0,0835325	0,169605	0,4925	0,62572	
d_ld_cor_1	0,0172114	0,0097968	1,7568	0,08851	*
d_ld_cor_2	0,0066901	0,00928495	0,7205	0,47643	
d_ld_cor_3	0,000133415	0,00797985	0,0167	0,98676	
ld_for	-0,0643399	0,0726399	-0,8857	0,38237	
EC1	0,618506	1,36036	0,4547	0,65242	
EC2	0,531139	0,445098	1,1933	0,24152	
EC3	-0,621696	0,30182	-2,0598	0,04763	**

Střední hodnota závisle proměnné	-0,001103	Sm. odchylka závisle proměnné	0,018414
Součet čtverců reziduí	0,006379	Sm. chyba regrese	0,014119
Koeficient determinace	0,608098	Adjustovaný koeficient determinace	0,412147
rho (koeficient autokorelace)	-0,005147	Durbin-Watsonova statistika	1,962858

ROVNICE 4: d_ld_cor

	Koeficient	*Směr. chyba*	*t-podíl*	*p-hodnota*	
const	-0,178583	0,110017	-1,6232	0,11435	
d_ld_gdp_1	-95,9768	27,1072	-3,5406	0,00125	***
d_ld_gdp_2	-52,6855	19,9302	-2,6435	0,01260	**
d_ld_gdp_3	-7,49423	12,274	-0,6106	0,54579	
d_ld_ihp_1	53,8357	11,8937	4,5264	0,00008	***
d_ld_ihp_2	34,7506	9,63273	3,6076	0,00104	***
d_ld_ihp_3	16,8753	6,70337	2,5174	0,01702	**
d_ld_credit_1	4,48629	6,91236	0,6490	0,52095	
d_ld_credit_2	8,90741	6,42639	1,3861	0,17531	
d_ld_credit_3	6,67202	4,64194	1,4373	0,16033	
d_ld_cor_1	0,263428	0,268129	0,9825	0,33324	
d_ld_cor_2	0,288206	0,254121	1,1341	0,26517	
d_ld_cor_3	0,280621	0,218401	1,2849	0,20806	
ld_for	-2,451	1,98809	-1,2328	0,22661	
EC1	118,307	37,2317	3,1776	0,00328	***
EC2	-62,5004	12,1819	-5,1306	0,00001	***
EC3	-4,09643	8,26055	-0,4959	0,62335	

Střední hodnota závisle proměnné	0,001754	Sm. odchylka závisle proměnné	0,670341
Součet čtverců reziduí	4,778149	Sm. chyba regrese	0,386416
Koeficient determinace	0,778473	Adjustovaný koeficient determinace	0,667709
rho (koeficient autokorelace)	0,339108	Durbin-Watsonova statistika	0,797816

KOVARIANČNÍ MATICE KŘÍŽOVÝCH ROVNIC:

	ld_gdp	ld_ihp	ld_credit	ld_cor
ld_gdp	1,5634e-005	2,5993e-006	9,8238e-006	-0,00080048
ld_ihp	2,5993e-006	0,00010903	4,3747e-005	0,0012161
ld_credit	9,8238e-006	4,3747e-005	0,00013018	0,00072852
ld_cor	-0,00080048	0,0012161	0,00072852	0,097513

determinant = 6,41783e-015

TESTING FOR AUTOCORRELATION

Rovnice 1:
Ljung-Box Q' = 5,97263 s p-hodnotou = P(Chí-kvadrát(4) > 5,97263) = 0,201

Rovnice 2:
Ljung-Box Q' = 3,02017 s p-hodnotou = P(Chí-kvadrát(4) > 3,02017) = 0,554

Rovnice 3:
Ljung-Box Q' = 0,512881 s p-hodnotou = P(Chí-kvadrát(4) > 0,512881) = 0,972

Rovnice 4:
Ljung-Box Q' = 9,10515 s p-hodnotou = P(Chí-kvadrát(4) > 9,10515) = 0,0585

5. DETAIL ON SOURCES OF DATA USED

Institution	
Source	**Series (description)**
Banco de España	
http://www.bde.es/webbde/es/estadis/infoest/series/si_1_6.csv	Housing market indicators
http://www.bde.es/webbde/es/estadis/infoest/series/be0413.csv	Credit granted by whole sector
Eurostat	
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsieb020	Real gdp growth rate
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tsiem010&tableSelection=1&footnotes=yes&labeling=labels&plugin=1	Employment total and female
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tsieb060&tableSelection=1&footnotes=yes&labeling=labels&plugin=1	Inflation rate anually
Ministery of housing (Development)	
	Unsubsidised housing
http://www.fomento.gob.es/BE2/sedal/32200500.XLS	initiated
http://www.fomento.gob.es/BE2/sedal/32201000.XLS	finished
http://www.fomento.gob.es/BE2/sedal/33102000.XLS	Primary and secondary housing
http://www.fomento.gob.es/BE2/sedal/33102500.XLS	Primary homes rented and purchased
http://www.fomento.gob.es/BE2/sedal/34010120.XLS	Number of transactions in total
http://www.fomento.gob.es/BE2/sedal/34010120.XLS	Number of transactions unsubsidised
http://www.fomento.gob.es/BE2/sedal/34010130.XLS	Number of transactions unsubsidised new
http://www.fomento.gob.es/BE2/sedal/34010180.XLS	Number of transactions in total new
http://www.fomento.gob.es/BE2/sedal/34010180.XLS	General index of house prices
http://www.fomento.gob.es/BE2/sedal/35101000.XLS	Prices of unsubsidised housing
http://www.fomento.gob.es/BE2/sedal/36400500.XLS	Price of land
National Statistical Office	
http://www.ine.es/daco/daco42/sociales09/sociales.htm	Social Indicators 2009, unemployment, dwellings
http://www.ine.es/jaxi/menu.do?type=pcaxis&path=/t35/p010&file=inebase&L=0	Regional Accounts, GDP per capita - provintial data
http://www.ine.es/jaxi/menu.do?type=pcaxis&path=%2Ft30%2Fp149&file=inebase&L=	Financial and Monetary Statistics, mortgages
http://www.ine.es/jaxi/menu.do?type=pcaxis&path=%2Ft30%2Fp149&file=inebase&L=	Mortgages

Note: some data series might have been actualised since research for this thesis was completed since data of last change are not reported.