Impact of Fiscal Policy on Residential Investment in France

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Abstract

This paper assesses the impact of fiscal policy on residential investment in France. In order to account for endogeneity between the variables, the analysis is conducted in the framework of a VECM approach. The so obtained long term relationships show that residential investment is a function of permanent income and fiscal variables, especially fiscal subsidies. A disaggregated approach taking into account several different types of fiscal measures highlights that tax and interest rate subsidies are the most efficient fiscal tool for influencing residential investment. When accounting for financial factors by means of households' borrowing capacity, we find that the latter also impacts residential investment positively. However, the consideration of financial factors underlines the robustness of the above mentioned results, as it confirms subsidies as the most efficient measure to influence residential investment. Our results imply thus that subsidies to residential investment are the most adequate tool when the aim is to stabilise the business cycle.

Key words: Fiscal policy, residential investment, VECM

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1 Introduction

Recent evolutions on European housing markets have been marked by an important degree of volatility and several studies have tented to explain these movements by the emergence of bubbles (Ball, 2005; Norris and Shiels, 2007; Bessonne and al, 2005). Whatever the reasons (fundamentals vs. bubbles) behind these developments, the role of housing markets in the economic cycles of advanced economies have been well established (IMF 2008; Muellbauer and Murphy, 2008): developments in real housing prices have been correlated with the business cycle, and based principally on the nexus between aggregate economic activity and residential investment. Indeed, residential investment has driven the business cycle in several countries and seems to be a good predictor of economic recessions: in the US, Leamer (2008) has shown for instance that residential investment accounted for 10 percent of the weakness in GDP growth a year before a recession. Moreover, some authors point out that residential investment not only leads the cycle but that it actually has become a destabilising factor in most advanced economies due to the volatility it induces (Davis and Heathcote, 2005; Ball and Wood, 1999)[1]. Consequently, residential investment is a key variable to control when it is desirable to stabilise the business cycle.

The aforementioned issues explain easily the attention that has been paid to evolutions on the residential investment. Several studies have identified macroeconomic variables influencing residential investment in housing such as household income and housing prices (Henderson and Ioannides, 1983; Lin & Lin, 1999; Arrondel & Lefebfre, 2001). Other studies have analysed the role of the mortgage market's structure on investment and consumption spending (Campbell and Hercowitz, 2005).

Although it seems very plausible that structural fiscal factors may contribute to determining residential investment (ECB, 2003), studies in that domain are scarce. Among the few existing, most studies have investigated the impact of fiscal policy on asset prices. Alfonso and Sousa (2009) have for example shown that fiscal policy shocks play a minor role in the asset markets of the U.S. and Germany. Fiscal policy measures however substantially increase the variability of housing and stock prices in the U.K and Italy. In the same way, van den Noord (2003) has suggested that the tax systems in smaller euro area countries are conducive to volatile houses prices and have been interacting with the generally higher inflation rates.

In the present study we propose to close the gap by modelling French residential investment by explicitly taking into account fiscal policy measures (taxes and subsidies alike). The nexus we would like to highlight is the possibility of fiscal policy to influence

[1] In the same way, Bisping and Patron (2008) found that shocks to residential investment have a large impact on US GDP.

residential investment and therefore the business cycle. In the following, we will hence use a VECM methodology and have residential investment be explained by a number of macroeconomic (permanent income, house prices, interest rates) and fiscal variables.

The remainder of the paper is organised as follows: Section 2 presents a short overview of housing taxes and subsidies for France. Section 3 outlines the VECM methodology utilised. Section 4 then presents the empirical results obtained. The final section 5 offers some brief concluding remarks.

2 Overview of the fiscal intervention on residential investment in France

This section examines the evolution of residential investment and the various types of housing subsidies and taxes. Data on the different types of subsidies and taxes were provided by the Ministry of Housing, whereas the data on residential investment are taken from national accounts. Our data set covers the period from 1984 to 2006 (the availability of fiscal data constrains the sample period). Residential investment exhibits a constant tendency since 1993: after a decline from 1984 to 1992, its share in GDP is relatively stable around 4.3%. Its growth rate in real terms, however, displays strong cyclical movements inducing the aforementioned instability on the business cycle (Figure 1a).

2.1 Subsidies on residential investment

Residential investment in France is characterised by an important degree of policy intervention. In 2006, the various subsidies amounted to € 11.2 bn in real terms which corresponds to 1.5% of residential investment. Subsidies' growth rate in real terms display strong fluctuations in line with residential investment developments (Figure 1b). Subsidies on residential investment have decreased over the period under consideration: their share in GDP declined from 0.14% to 0.06% in 2006. This evolution covers sometimes opposite trajectories for the different sub categories of subsidies which mainly reflect legislative changes (Figure 2a). Total subsidies can be further subdivided into three categories (financial, interest rate and tax subsidies) for which the Ministry of Housing has provided us with data (Table 1).

Table 1. Amount of subsidies on residential investement in 2006 (bn €)

	Amount
Financial subsidies	1.3
Interest rate subsidies	2.2
of which general loans for households	1.45
of which loans for social housing	0.35
of which "1% housing" framework	0.4
Tax subsidies	7.7

Financial subsidies amounted to € 1.3 bn in 2006 and accounted for approximately 12% of total housing subsidies[2]. This type of subsidies has been relatively stable over the time: financial subsidies decreased somewhat in line with the decline of subsidies related to the construction of social housing rentals around 1995 and increased when the National Housing Agency extended its activities from 2002 onwards.

Interest rate subsidies consist in loans whose rates are lower than market rates. These subsidies are estimated by difference between the amount of a loan (capital and interest) contracted at a market rate and a credit contracted at a preferential rate. This type of subsidy amounted € 2.2 bn in 2006 and represented 20% of total investment subsidies. Interest rate subsidies decreased by around 25% over the period mainly due to the decline of market interest rates. Interest rate subsidies can be divided into three categories:

- General loans for households take the form of either housing saving plans or the so-called "zero rate loan" and were introduced in 1995. A housing saving plan is like a bank account on which the household in question has accumulated monetary holdings for at least 4 and up 10 years. It is the existence of the latter that allows a household to access preferential interest rates. The zero rate loan is a supplementary loan for households planning their first home purchase, its amount being limited to 20% of the total investment. The part of these loans in the total category of interest rate subsidies has increased from 28% in 1986 to 66% in 2006.

- Loans for social housing. The aim of these loans is to promote the purchase and improvements of social housing for low revenue households. The part of loans for social housing has decreased from 55% in 1986 to 16% in 2006.

- Loans which correspond to the "1% housing" framework. These loans consist in supplementary loans for a main home purchase which are financed by a contribution

[2] Financial subsidies correspond to effective subsidies which result in cash flows between economic agents.

of firms. The "1% housing" scheme represents a stable part of 18% of interest rate subsidies.

Tax subsidies amounted to € 7.7 bn or 68% of total subsidies in 2006. This last category of subsidies has doubled over the period, increasing particularly since 1999. These subsidies mainly concern housing improvements that benefit from a reduced VAT rate (5.5%) and, since 1999, tax credits. The remainder of tax subsidies takes the form of income tax reductions ("Perissol", "Robien" and "Borlo" plans).

2.2 Taxes on residential investment

In 2006, taxes on residential investment amounted to € 22.7 bn in real terms, which corresponds to 3.1% of the residential investment flows. As for subsidies, taxes' growth rate in real terms display strong fluctuations in line with residential investment. Over the period under consideration, taxes have increased as a share GDP (0.09% in 1984 to 0.13% in 2006 (Figure 1c).

Taxes on residential investment can be broken down into indirect taxes and property taxes (Figure 2b). The main ones are property taxes and their evolution exhibits a linear trend since their computation is based on a stable tax base (cadastral value) and local tax rates. On the contrary, the evolution of indirect taxes exhibits strong fluctuations and their trajectory was particular affected by the 1995 tax cuts reduction and a number of budgetary measures over the 1999-2001 period.

3 The VECM methodology

The amounts of subsidies and taxes (our explanatory variables) are of course linked to the amounts finally spent on residential investment (the endogenous variable). Therefore, co-movements and endogeneity may occur within the given set of variables. The VECM methodology outlined in the following allows dealing with these issues.

3.1 The data

Residential investment (INV) is commonly thought to depend on households' permanent income (Y). For our study, we chose to proxy permanent income by household's consumption in non-durables goods and services. According to the theory of permanent income, households consume a constant fraction of their permanent income at every period, implying that a household's consumption is proportional to its permanent income. As consumption in durable goods is rather an investment than a consumption decision,

consumption in non-durables and services seems therefore to be a good proxy for permanent income. Since the aim of this study is to analyze the impact of public interventions on residential investment, we include subsidies (G) and taxes (T) in the set of explanatory variables. Policies on housing subsidies and taxes are not coordinated. Indeed, beneficiary of subsidies usually are low income households while taxes mainly affect higher income households. In addition, the subsidies management is ensured by the State while taxes are collected by local authorities. This argues for a separated inclusion of subsidies and taxes in the specification.

Note that in our specification interest rate is an exogenous variable. The long term interest rate (IRL) that we use for our specification is the 10 year government bond. This variable is clearly not determined by any of the series used in our data sample, but rather by monetary and fiscal policy actions and inflation anticipations. Using the interest rate as an exogenous variable, allows us therefore to focus the analysis on fiscal factors, disregarding financing conditions. In addition, tusing government bonds has the advantage of exhibiting the same trajectory as mortgage rates. Indeed, the margin on mortgage rates over government bonds is stable over time and modest in levels as mortgages are often used by banks to attract clients and banks profits are for the most part made in other segments of their activity.

Housing prices (HP) correspond to the housing index for existing dwelling and are also held exogenous as their impact on residential investment is far from clear-cut. As illustrated in Salo (1994), housing is an 'ordinary good' (its demand is negatively related to prices) in markets where credit is not restricted. In an economy with binding quantitative restrictions imposed on borrowers, housing is no longer necessarily a decreasing function of prices and income and interest rates can have perverse effects on the stock of housing (see also Miles, 1993 and Kenny 1999). The impact on prices will hence depend on the financing conditions of the economy. This subject is beyond the scope of our analysis that concentrates on the fiscal measures' impact on the business cycle.

The data set encompasses data from 1984 to 2006. National account data on residential investment are denominated in chained volumes. The fiscal series are given in current prices; in order to obtain volume indices the data were deflated by the CPI. This was also done for the price series used. All variables are expressed in logarithms and real terms. The data present neither seasonal patterns nor level shifts, the latter being important for the subsequent unit-root and cointegration testing procedure.

3.2 The testing procedure

3.2.1 Unit root analysis

We follow the testing and estimation procedure as outlined in Lütkepohl (2004). As mentioned above, none of the series used exhibit structural breaks or shifts. It is therefore possible to conduct standard unit root tests. We conduct the type of unit root test proposed by Ng and Perron (2001). The Ng-Perron tests have two advantages in comparison to other unit root tests: their power is enhanced by local GLS detrending of the data and the use of modified information criteria leads to substantial size improvements. Unit root tests indicate that all series are first order integrated (see annexe 1a). In that respect, it was particularly important to deflate the fiscal series, as otherwise they were found to have two unit roots, as often the case for data defined in current prices.

3.2.2 Determining the cointegration rank

The model set up takes the following form: the data generating process (DGP) of a given $K-$dimensional vector of time series y_t can be decomposed into a deterministic part θ_t and a stochastic part x_t

$$y_t = \theta_t + x_t \tag{1}$$

The deterministic part is here only of secondary interest, containing for example a constant, a polynomial trend or seasonal and other dummy variables. The stochastic part is a first order integrated process generated by a VECM of the following form:

$$\Delta x_{e,t} = \alpha\beta' x_{e,t-1} + \Gamma_1 \Delta x_{e,t-1} + ... + \Gamma_p \Delta x_{e,t-p+1} + \varepsilon_t \tag{2}$$

ε_t is a K-dimensional unobservable zero mean white noise process with positive definite covariance matrix $E(u_t u_t') = \Sigma_u$. x_t is a K-dimensional vector of observable variables and α and β are $(K\text{x}r)$ matrices of rank r. They specify the long-run part of the model where β contains the cointegration matrix, r is the cointegrating rank of the process, and α represents the loading coefficients. Thus, $\alpha\beta' x$ can be referred to as the error correction term. The Γ_i' $(i = 1, ..., p-1)$ are $(K\text{x}K)$ short-run parameter matrices.

Given the model set-up, it is in practice necessary to determine the number of lags to take into account for the cointegration tests. This can either be done by sequential testing procedures or be based on model selection criteria. For this study the lag order was based on information criteria which recommend 4 lags (Lütkepohl and Saikonnen, 1999).

Then we conducted cointegration tests for the model. As the dimension of a system can have an important impact on the test results (Gonzalo and Pitarakis, 1999), cointegration

test are also undertaken for all possible sub-systems, i.e. pairs of variables[3]. Johansen's tests detect one cointegrating relation for residential investment (see appendix 1b). The results of the pair wise tests (not reported here) are consistent with those for the higher dimensional systems

3.2.3 Imposing restrictions on the cointegration matrix and loading coefficients

For a given cointegrating rank and lag order, the VECM can be estimated by reduced rank regression, as shown in Johansen (1995). To that end, restrictions have to be imposed to identify matrices α and β in (2). For one cointegrating relation ($r = 1$) this amounts to normalising the coefficient of the first variable to one. Note that the normalisation of one or more variables requires adequate ordering of the variables in the VECM. In that sense it is particularly useful to know the cointegration ranks of all subsystems. Economically, applying restrictions on matrices α and β allows us to identify cointegration relations and by that means to replicate economic relations. We chose to normalize the coefficient of investment, since it is the dynamics of this variable that we seek to explain.

3.3 Impulse response functions and variance decomposition

The relationship between variables might be highlighted by impulse response functions, these functions presenting the reactions of one variable to various shocks. However, due to the presence of unit roots (all series are first order integrated), it is not possible to invert the VAR in levels into a MA representation (i.e. the Wold representation does not exist). In order to address this issue, Lütkepohl and Reimers (1992) suggest an algorithm that allows obtaining impulse responses recursively in a cointegrated system.

To that end, the reduced form VECM is rewritten as a VAR representation in levels using the following relations:

$$x_t = \sum_{i=1}^{p} A_p x_{t-p} + \varepsilon_t \tag{3}$$

where $A_1 = \alpha\beta' + I_K + \Gamma_1$, $A_i = \Gamma_i - \Gamma_{i-1}$ for $i = 2, \ldots, p-1$ and $A_p = -\Gamma_p$. Then, impulse responses recursively computed by the following way:

$$\Phi_i = \sum_{j=1}^{i} \Phi_{i-j} A_j \tag{4}$$

where $\Phi_o = I_k$.

[3]The consistency check in a system of variables can best be explained by an example: in a system of three first-order integrated variables, all pairs of variables are found to be cointegrated. Consequently, there has to be two cointegrating relationships in the whole system.

Confidence intervals for impulse responses were constructed by bootstrap, since the latter have certain advantages over asymptotic confidence intervals. In particular, they were found to be more reliable for small samples (Lütkepohl, 2004). The confidence intervals surrounding the following impulse response functions were obtained by the standard percentile interval as in Efron and Tibshirani (1993) with 2000 replications.

Forecast error variance decompositions are alternative tools for analysing the dynamic interactions between the variables. Denoting by $\omega_{kj}(h)$ the percentage contribution of variable j to the h-step forecast error variance of variable k; it can be shown that:

$$\omega_{kj}(h) = \frac{(\theta^2_{kj,0} + ... + \theta^2_{kj,h-1)}}{\sum_{j=1}^{k} (\theta^2_{kj,0} + ... + \theta^2_{kj,h-1)}} \tag{5}$$

Where $\theta_{kj,1}$is the kj-th element of Φ. This method allows to decompose the total variance into different sources of variation.

4 Impact of fiscal policy on residential investment

4.1 Regression results

The tables below report the estimation results for residential investment in France over the 1984-2006 period. Table 2 presents the results for the cointegrating vector for the long-term relationship.

Table 2. Cointegrating vector

INV	Y	G	T	constant
1.000	-1.095	-0.306	0.093	-2.169
	[-3.618]	[-3.085]	[0.522]	[-0.623]

t-stat in brackets

Income is the main driven factor of residential investment. The coefficient on household's disposable income (Y) is greater than unity indicating a high long-run income elasticity that is consistent with common conceptions about the demand for housing investment. This is consistent with the idea that a dwelling service is a superior good whose demand grows faster than income. The coefficient on subsidies (G) has the expected positive sign and is statistically significant. Results suggest a long-run elasticity of investment with respect to subsidies equalling 30.6%. Thus, a rise in subsidies increases residential investment in the long run which confirms the role fiscal policy can have on residential investment. No long-run relationship is found between taxes and residential investment as the former's coefficient is not statistically significant. It may seem curious that only

subsidies can influence residential investment in the long, as the Ricardian Equivalence stipulates that debt financed subsidies are simply a way of postponing taxes (see also Barro, 1974). This may hold at the macroeconomic level, i. e. any debt financed subsidy will end up being pay as a tax, but it is not necessarily the case on the 'sectoral' level.

Interestingly enough, the pair wise cointegration tests conducted on the subsystems of the variables used, did not indicate that a cointegrating relationship exists between housing taxes and subsidies. This is in line with the principle of non budget appropriation which inhibits that a specific budgetary revenue is to be used for specific expenditure. More precisely here that would mean that subsidies for residential investment are not financed by the revenues that taxes on residential investment generate. In addition, property taxes are levied on local levels of government taxes and the way they are fixed entails is surrounded by a high degree of uncertainty. The tax base on which property taxes are levied on is the cadastral value of the property as calculated by the State. This value, although public, is little known by home buyers, since it can differ from actual purchasing prices. In addition, tax rates applied to that tax base are multiple: each local layer of government (city, department, region) fixes its own tax rate each year depending on its financing needs. Therefore, the level and the evolution of property taxes are hardly foreseeable by home buyers or builders. The little information agents have on taxes ex-ante may explain that property taxes are not considered when the decision to buy or construct a house is made, which in turn may explain that they are not significant in our estimation.

Table 3 summarises the results for the short-term dynamics, and especially for the exogenous variables. The short-term relationship is satisfactory in the sense that the error correction term related to the cointegrating vector is significant and exhibits the expected negative sign.

Table 3. Elements of short term dynamics

Variable	ΔINV	ΔY	ΔG	ΔT
$ECT(-1)$	-0.103	0.040	0.138	0.008
	[-3.307]	[3.117]	[1.912]	[0.276]
$\Delta IRL(-2)$	-0.054	0.014	-0.008	-0.011
	[-2.882]	[1.775]	[-0.174]	[-0.635]
ΔHP	0.036	0.033	0.248	0.024
	[1.544]	[1.220]	[1.629]	[0.397]
constant	-0.010	0.008	0.012	0.001
	[-2.107]	[4.485]	[1.100]	[0.187]

t-stat in brackets

The change in long-term interest rate has a negative impact on the growth rate of residential investment with a lag of 2 quarters. This is consistent with common economic theory, since an increase in interest rates involves a bigger debt burden for households, weighing on their borrowing capacity and lowering hence the investment's volume. The coefficient of housing prices is not statistically significant. This result might be explained by the fact that house prices can have mixed effects on residential investment. If housing is considered as an 'ordinary good' an increase in prices will dampen investment. If housing is viewed as an investment in the strict sense, an increase in prices can augment residential investment. This distinction hinges also on whether one considers that residential investment is undertaken by households or construction firms the former having to comply with costs while the latter can pass them on to consumers (see also Kenny, 1999)[4].

4.2 Impulse response analysis and variance decomposition

In order to analyse the relationship between variables, impulse responses functions were computed for the model. The impulse responses have to be interpreted as response of residential investment to one Cholesky standard deviation in each variable. As expected, the impact of revenue on residential investment is positive, even if its effect appears to be relatively weak: 0.8% after 3 years (Figure 3). The impact of subsidies is positive as expected and about 1% after 10 years. As already for the cointegration analysis, the impact of taxes on residential investment is not significant.

The variance decompositions allow determining which of the explanatory variables is the most prominent for the dynamics of residential investment (Figure 4). The main explicative variable is the residential investment itself, but explicative power strongly decreases over the time (from 100% to around 60%). This result may reflect the existence of autocorrelation. Revenue explains only 6% of the investments variance. The impact of the fiscal policy is very significant: taxes explain up to 13% of the variance after 15 quarters. The explicative power of subsidies increases over the time up to and attains 25%.

Consequently, fiscal policy has a significant impact on residential investment both in the long and short run. When analysing the factors impacting investment, fiscal variables should be part of the set of explanatory variables. It seems, however, that housing subsidies have more of an impact that taxes, they therefore seem to be a more accurate tool to stabilise the cycle.

[4]This result is also broadly consistent with Girouard and Blöndal (2001), as the authors find that the nexus between residential investment and the price-cost ratio appears to be weak in France.

4.3 Robustness tests

Robustness tests were performed for the model (see appendix 3). Portmanteau and LM conclude that residual were not correlated, Jarque-Bera test imply their normality, and the model seems to be robust to various departures from the standard linear model assumptions. The ordering of the variables may have an impact on the results. This possibility was checked by reversing the ordering of the variables and results show that this has only a negligible effect.

4.4 Alternative specifications

4.4.1 Net subsidies

We consider an alternative specification for residential investment using net subsidies (subsidies minus taxes) as the only fiscal variable. This second set of results seems to underline the relative robustness of our results (Table 4): long-run elasticities of investment with respect to permanent income and to net subsidies (NG) are positive and statistically positive. Moreover, the short-term dynamic has the same properties: the change in long-term interest rate has a negative impact on the growth rate of residential investment with a lag of 2 quarters the change in housing prices is not statistically significant. Finally, Impulse responses exhibit the same expected paths as the ones of the benchmark models (Figure 5).

Table 4. VECM results with net subsidies

Cointegrating vector			
INV	Y	NG	*constant*
1.000	-1.587	-0.316	-1.361
	[-5.902]	[-3.444]	[-0.121]
Elements of short term dynamics			
Variable	ΔINV	ΔY	ΔNG
$ECT(-1)$	-0.062	0.031	0.041
	[-2.345]	[3.095]	[0.645]
$\Delta IRL(-2)$	-0.052	0.014	0.021
	[-2.694]	[1.823]	[0.180]
ΔHP	0.005	0.046	0.251
	[0.079]	[1.756]	[1.525]
constant	-0.005	0.007	0.002
	[-1.190]	[4.490]	[0.180]

t-stat in brackets

4.4.2 Inclusion of financial factors

Financial factors have been highlighted as one of the major determinants in differences in national housing market dynamics. For example, Tsatsaronis and Zhu (2004) have emphasised how different characteristics of mortgage markets regarding loan to value ratios, mortgage rate references, valuation methods or securitisation practises may affect the interactions between housing prices and other macroeconomic variables (GDP, interest rates, bank credit).

Over the period in consideration, major regulatory changes intervened in the French mortgage market. In 1987, the end of administrative control of credit (*"encadrement du crédit"*) triggered a period of fast increases in loans and housing prices as banks competed for market shares. Apart from these important regulatory changes, a series of other factors has had an impact on banks' pricing tactics for mortgages. In the first place, the process of European monetary integration has contributed to a decline in interest rates, a development of which banks and consumers have benefited from in both countries. In addition, banks' pricing and margin behaviour has very much evolved over the period in consideration: mortgages credits have become a product that banks use to attract and secure loyalty of their clients. Consequently, rates on mortgage credits have been very much reduced: for an average over the 1990-2008 period of 7.6% (11.5% in 1990), fixed rates on mortgage credits (the dominant type of credit) have decreased to 4.5% in 2005 and 5.5% on average in the 2000s. Simultaneously, the average duration of new mortgage credits has substantially increased in France: from 11.8 years in average in 1989, it increased to 14.3 years in 1999 and accelerated to 19.2 years in 2008 (Modèle Fanie, Observatoire du crédit immobilier).

Given the above, we propose to construct an indicator of maximum indebtedness that synthesises some of the indications on financial factors mentioned in the preceding paragraphs. This indicator should be understood as the maximum amount of money a household can borrow for the purchase of a house given his income, the average duration of mortgages and interest rates for newly contracted mortgages.

A household may borrow up to a monthly payment equal to a third of its income. It is thus possible to compute a maximum average amount of indebtedness per households (K) as:

$$K = \frac{1}{3} GDI * \sum_{j=1}^{J} \frac{1}{(1+r)^j} \tag{6}$$

Where GDI equals gross disposable income in value per household, J is average mortgage duration and r the average interest rate on mortgages.

Table 5. VECM results with financial

Cointegrating vector				
INV	K	G	T	*constant*
1.000	-0.517	-0.240	0.151	-7.736
	[-5.931]	[-2.476]	[1.516]	[-3.866]
Elements of short term dynamics				
Variable	ΔINV	ΔK	ΔG	ΔT
$ECT(-1)$	-0.126	0.128	-0.042	-0.105
	[-3.456]	[1.518]	[-1.291]	[-1.502]
ΔHP	0.030	0.278	0.046	-0.061
	[0.446]	[1.777]	[0.770]	[-0.474]
constant	-0.002	0.000	0.005	0.010
	[-0.868]	[0.021]	[2.849]	[2.921]

t-stat in brackets

The results for that computation are presented in Table 5. Permanent income and interest rates have been removed from the regressions as borrowing capacity already includes a gross disposable income term and takes into account changes in interest rates. The borrowing capacity has the expected positive impact on residential investment. The coefficient magnitude is particularly important, underlying the important influence of the above mentioned financial factors on investment. In addition, this alternative specification does not change the results obtained in former parts of the analysis: subsidies continue to be highly significant, while taxes and property prices are not. Impulse reactions functions are also consistent with the benchmark ones (Figure 6).

The so far obtained results imply that fiscal tools and financial factors have a large impact on residential investment. When these factors are taken into account, property prices cease to influence residential investment. On the one hand this entails that taxes can distort price signals. On the other hand that underlines also the important role fiscal policy can play for the stabilisation of the business cycle.

4.4.3 A disaggregated approach

While the previous section assessed the impact of subsidies and taxes on residential investment as a whole, this section tempts to exploit the disaggregated data we have on the different types of taxes and subsidies described in section 2.

The methodological framework remains the same (VECM, income as part of the endogenous variables, prices and interest rates as exogenous variables) and we replace the

aggregate fiscal variable (subsidy or tax) by a specific fiscal variable: financial subsidies, interest rate subsidies, tax subsidies, indirect taxes, property taxes[5]. The entire so-estimated long term specifications exhibit the same properties as the originally estimated VECM: income is statistically significant and bears a positive sign, the same is true for all subsidies apart the financial ones. None of the taxes considered is statistically significant. These disaggregated results confirm therefore our first set of estimations.

Concerning the short-term dynamics, the error correction term is always negative and significant, and the change of interest rates has a remaining negative impact on investment growth. The change in housing prices is still not significant.

Figure 7 displays impulse response functions of residential investment for a positive shock of the fiscal items mentioned above. The reaction of an increase in subsidies is always positive but the magnitude is volatile depending on the fiscal item. The impact of financial subsidies is not significant, which might be due to the relatively low amounts these subsidies account for (see section 2). On the contrary, tax subsidies appear to be the type of subsidy that has the greatest impact on investment. Interest rate subsidies have a significant positive impact and this although they only represent 20% of total subsidies.

Concerning taxes, indirect taxes are the only ones that exhibit the expected negative impact on investment but their significance level is rapidly reduced. The impact of a property tax shock on investment is somewhat counterintuitive, as it exhibits a positive sign and might be related to changes in the tax base that are not correlated to those of the investment. The mixed effects of disaggregated tax do explain the non-significance of taxes at the aggregate level.

4.5 A dynamic assessment

The structure of the public intervention on residential investment in France has strongly changed since the 1980s, and this is especially the case for the structure of subsidies. These changes could have modified the impact each fiscal item has on investment of. To detect possible changes over time, we propose a recursive analysis of subsidies on data windows of 11 years (Figures 8). For each fiscal item, we estimate the impulse function over $[t_1,t_{44}]$. Then, we moved ahead by one period and we reestimate over the sample $[t_1,t_{45}]$. The procedure is repeated up to the last available sample $[t_1,t_T]$:

[5]Note that the number of lags chosen for specifications related to financial subsidies and indirect taxes is smaller than the one in the baseline (3 lags), reflecting the fact that these measures are paid out /levied directly. In contrast, the number of lags chosen for the specification related to tax subsidies is higher (6 lags) as households benefit from the latter only upon reception of their income tax return.

- Financial subsidies: The impact of this subsidy is relatively low over the period. Moreover, if the first impulse on investment is positive, the effect decreases rapidly. When the 1996-1997 is included, the estimated impact is strongly negative and may reflect the impact of subsidy cuts. Conversely, the extension of the intervention field of the Housing National Agency in 2002 appears to have a more persistent positive effect.

- Interest rate subsidies: The positive impact of this subsidy is relatively stable and positive. Note that there is a correlation between the increase of the impact and the evolution of "zero rate loan": the impact seems more important when this loan was instroduced (1995) and during extension of its beneficiaries (2005).

- Tax subsidies: The impact is always strongly positive, but seems to have declined over the time.

- Indirect taxes: The impact of tax is only turns negative from 2001 onwards. Periods during which indirect taxes on investment were reduced (1995 and 1999-2001) seem to be reflected by having a positive impact on investment.

- Property taxes: The impact is always strongly positive, but seems to decline over the time. This result is line with what was found in the preceding section, but remains rather counterintuitive.

Given the above, our results would imply that by far the most effective policy to influence residential investment is one that relies on tax and interest subsidies. Note that the measures taken since 2006 seem consistent with the results of this study. The deduction of loan interest rates is a tax subsidy that should have a significant effect on housing market dynamics. Similarly, the ecological 'zero rate loans' instituted in 2009's budget improved fiscal stimulus for residential investment and should help cushion the landing of the housing market.

5 Concluding remarks

The present study proposed to model French residential investment by means of a VECM that explicitly takes into account fiscal variables. Our analysis has shown that fiscal variables (subsidies and taxes) should be included in the analysis of residential investment. More precisely, a long term relationship between investment and subsidies exists, making subsidies an adequate measure to influence residential investment and hence the business cycle. A disaggregated approach for several different fiscal measures confirms that subsides rather than taxes should be used in order to effectively impact residential investment. Moreover, looking at different types of subsidies, it is noteworthy that tax and interest

rate subsidies have the most significant positive effect on investment. When accounting for financial factors by means of households' borrowing capacity, we find that the latter also influences residential investment positively. In addition, this alternative specification underlines the robustness of the above mentioned results, as it confirms subsidies as the most efficient measure to influence investment.

Measures taken since 2006 seem consistent with the results of this study. The deduction of loan interest is a tax subsidy that should have significant effects on the housing market dynamic. Similarly, the ecological zero rate loan instituted in the 2009 Finance law[6] and improved in the fiscal stimilus should help cushion the house prices fall. At the opposite, change in indirect taxes is more complicated to achieve since it is a local government resources. Such a measure would require compensation from the state, which would be in contradiction with the decentralization carried out in France in recent years. It would be interesting to conduct a similar study when the data will be available to study the impact of fiscal measures in the context of a falling asset prices.

[6] The ecological zero rate loan is a credit to finance environmental works in a old home or buying a new property labelised low energy consumption.

References

[1] Alfonso A., Sousa T. (2009), "Fiscal Policy, Housing and Stock Prices", *ECB Working Paper*, No 990.

[2] Arrondel L., Lefebfre B. (2001), "Consumption and Investment Motives in Housing Wealth Accumulation: A French Study", *Journal of Urban Economics*, 50, pp.112-137

[3] Ball M. (2005), RICS European Housing Review, RICS, London.

[4] Ball M., Wood A. (1999), "Housing investment: long run international trends and volatility", *Housing Studies*, 14.

[5] Bisping T., Patron H. (2008), "Residential Investment and Business Cycles in an Open Economy: A Generalized Impulse Response Appraoch", *Journal of Real Estate Finance and Economics,* vol 37(1), 33-49.

[6] Beffy P-O., Montfort B. (2003), "Patrimoine des ménages, dynamique d'allocation et comportement de consummation", I*NSEE Working Paper*, No G2003/08.

[7] Bessonne A-J., Boissinot J., Heitz B. (2005), « Are we seeing a bubble on the French housing market ? », *INSEE Conjoncture*, march, pp.9-16.

[8] Campbell, J., Hercowitz, Z. (2005), "The Role of Collateralized Household Debt in Macroeconomic Stabilization", *NBER Working Paper*, No.11330.

[9] Davis M., Heathcote J. (2005), " Housing and the Business Cycle", *International Economic Review,* vol 46(3), 751-784.

[10] ECB (2003), "Structural factors in the EU housing markets", Monthlu Bulletin, march.

[11] Efron, B., Tibshirani, R.J. (1993), *An Introduction to the Bootstrap*, Chapman & Hall, London.

[12] Girouard N., Blöndal S. (2001), "House Prices and Economic Activity", *OECD Working Paper*, No 279.

[13] Gonzalo J., and Pitarakis, J-Y (1999), "Dimensionality effect in cointegration analysis", in R. Engle and H. White (eds), *Cointegration, Causality, and Forecasting. A Festschrift in Honour of Clive W.J. Granger*, Oxford University Press, Oxford.

[14] Henderson J., Ioannides Y. (1983), "A model of housing tenure choice", *American Economic Review*, 73, pp.98-111.

[15] IMF (2008), "The changing housing cycle and the implications for monetary policy", *World Economic Outlook*, April, 103-132.

[16] Johansen S. (1995), "A Statistical Analysis of Cointegration for I(2) Variables", Econometric Theory, vol 11(01), pp.25-59.

[17] Leamer (2008), "What's a recession, anyway?", *NBER Working Paper*, No 14221.

[18] Lin C-C, Lin S-J. (1999), "An Estimation of Elasticities of Consumption Demand and Investment Demand for Owner-Occupied Housing in Taiwan: A Two-Period Model", *International Real Estate Review*, 2(1), pp.110-125.

[19] Lütkepohl, H. (2004), "Recent Advances in Cointegration Analysis", *European University Institute Working Paper*

[20] Lütkepohl, H., Reimers H-E. (1992), "Impulse response analysis of cointegrated systems", *Journal of Economic Dynamics and Control*, 16, pp.53-78

[21] Lütkepohl, H. and Saikkonnen, P. (1999),"Order selection in testing for the cointegration rank of a VAR process in R. Engle and H. White (eds), *Cointegration, Causality, and Forecasting. A Festschrift in Honour of Clive W.J. Granger*, Oxford University Press, Oxford.

[22] Miles D. (1993), "House Price, Personal Sector Wealth and Consumption: Some Conceptual and Empirical Issues", The Manchester School of Economics and Social Studies, vol 61(0), pp.35-59.

[23] Muellbauer J., Murphy A. (2008), "Housing markets and the economy: the assessment", *Oxford Review of Economic Policy*, 24(1), pp.1-33.

[24] Ng S., Perron (2001), "Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power", *Econometrica*, vol 69(6), 1519-1554.

[25] Norris M., Shiels P. (2007), « Housing inequalities in an enlarged European Union: patterns, drivers, implications », *Journal of European Social Policy*, 17(1), pp.65-76.

[26] Van den Noord P. (2003), « Tax Incentives and House Price Volatility in the Euro Area: Theory and Evidence », *OECD Working Paper*, No 356.

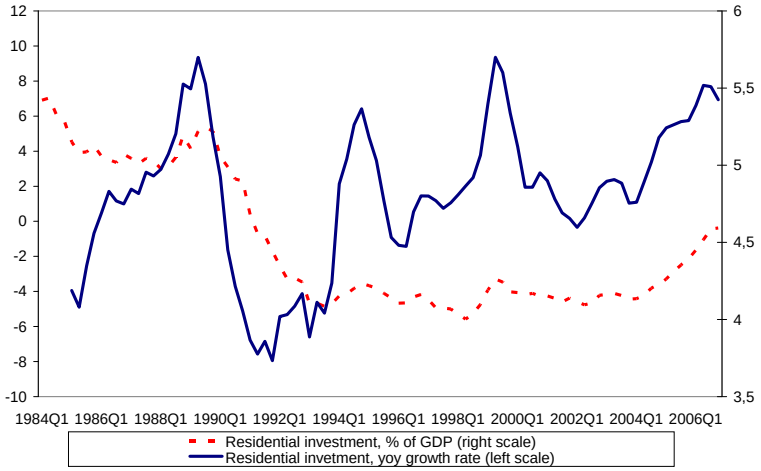


Fig 1a. Residential investment

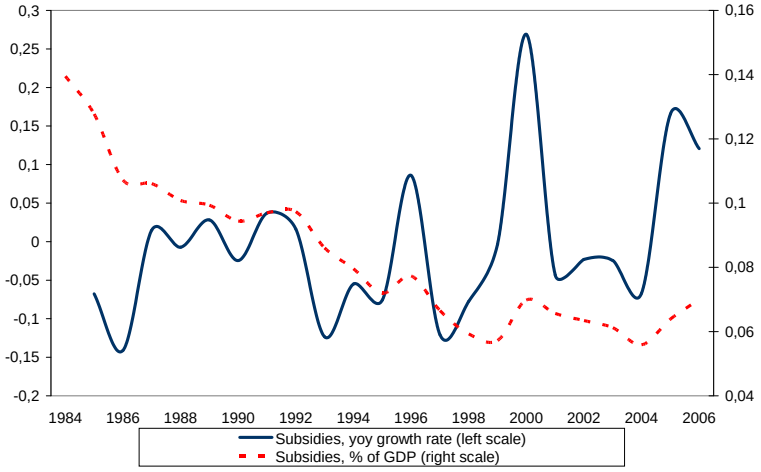


Fig 1b. Subsidies on residential investment

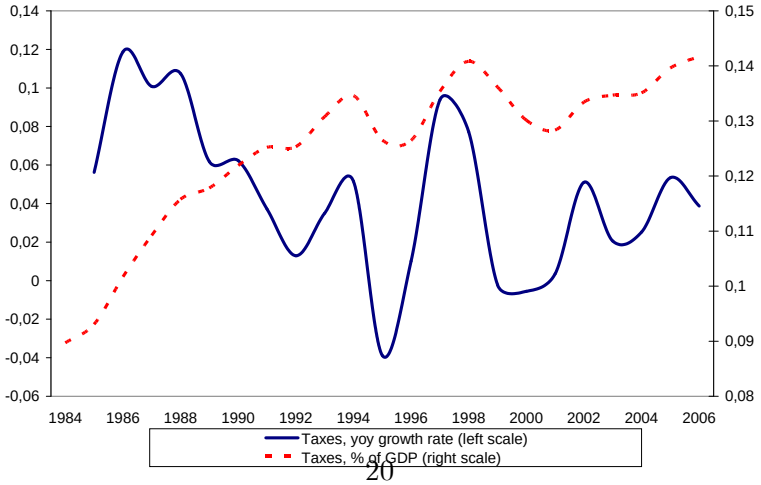


Fig 1c. Taxes on residential investment

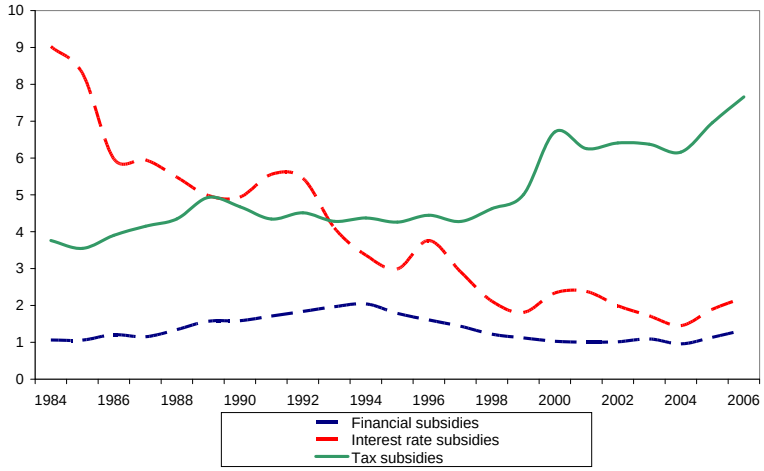


Fig 2a. Evolution of subsidies in real terms (bn €)

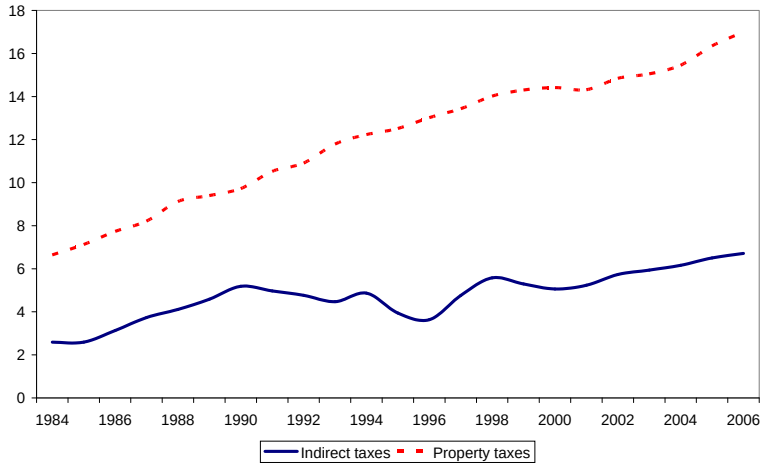


Fig 2b. Evolution of taxes in real terms (bn €)

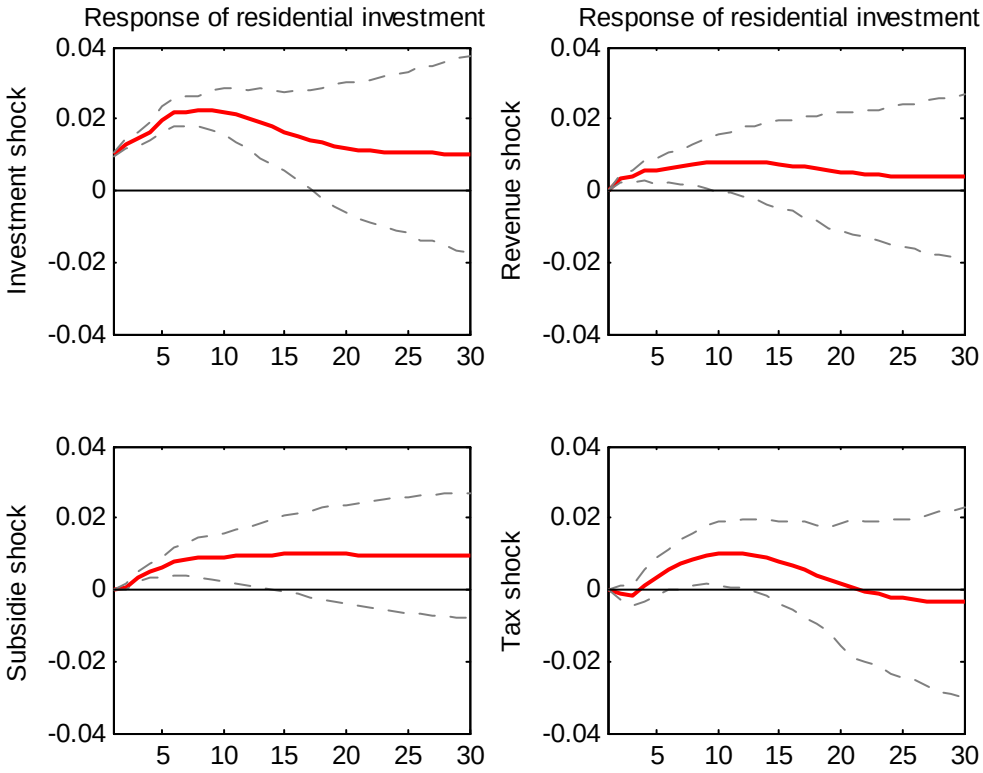


Fig 3. Impulse response functions

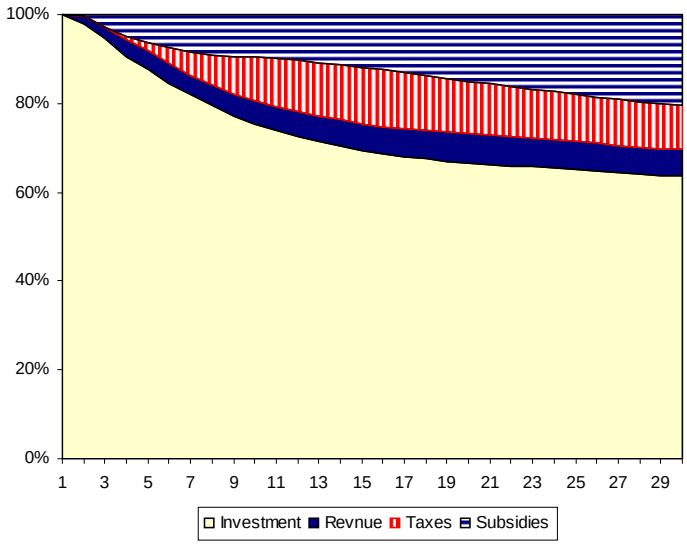


Fig 4. Variance decomposition

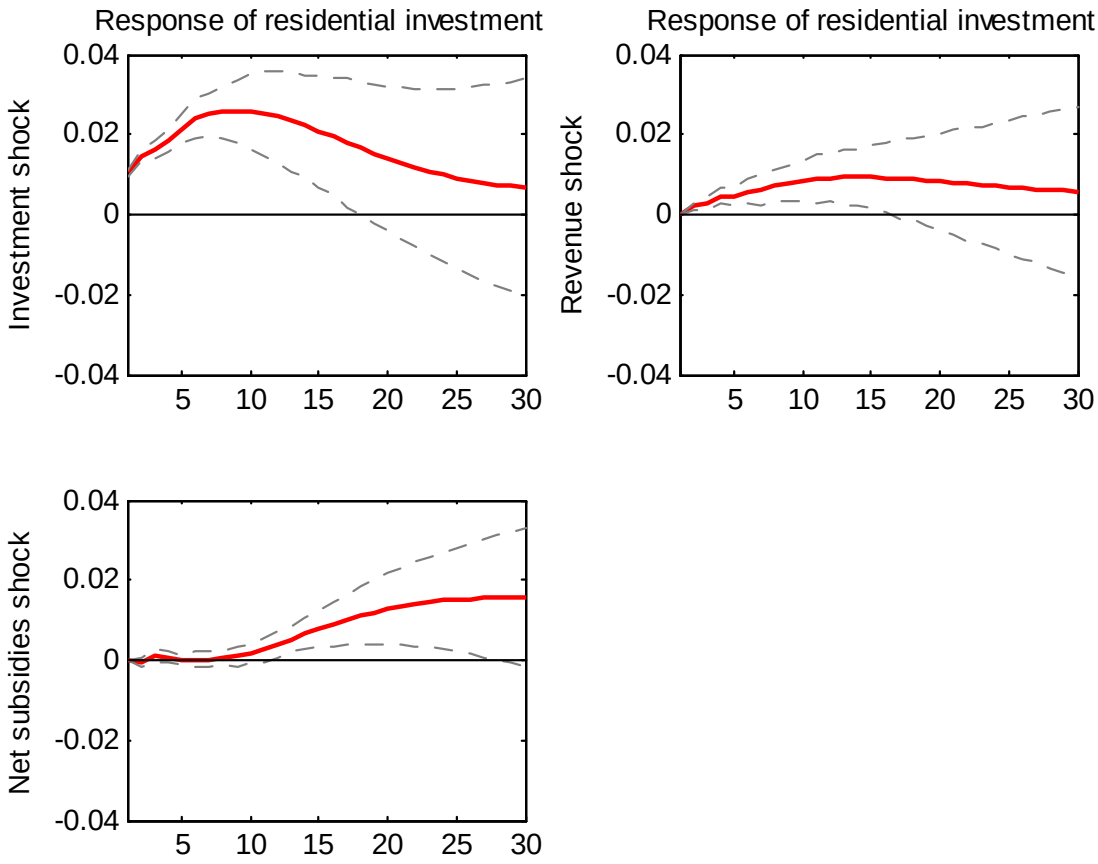


Fig 5. Impulse reaction functions of the model with net subsidies

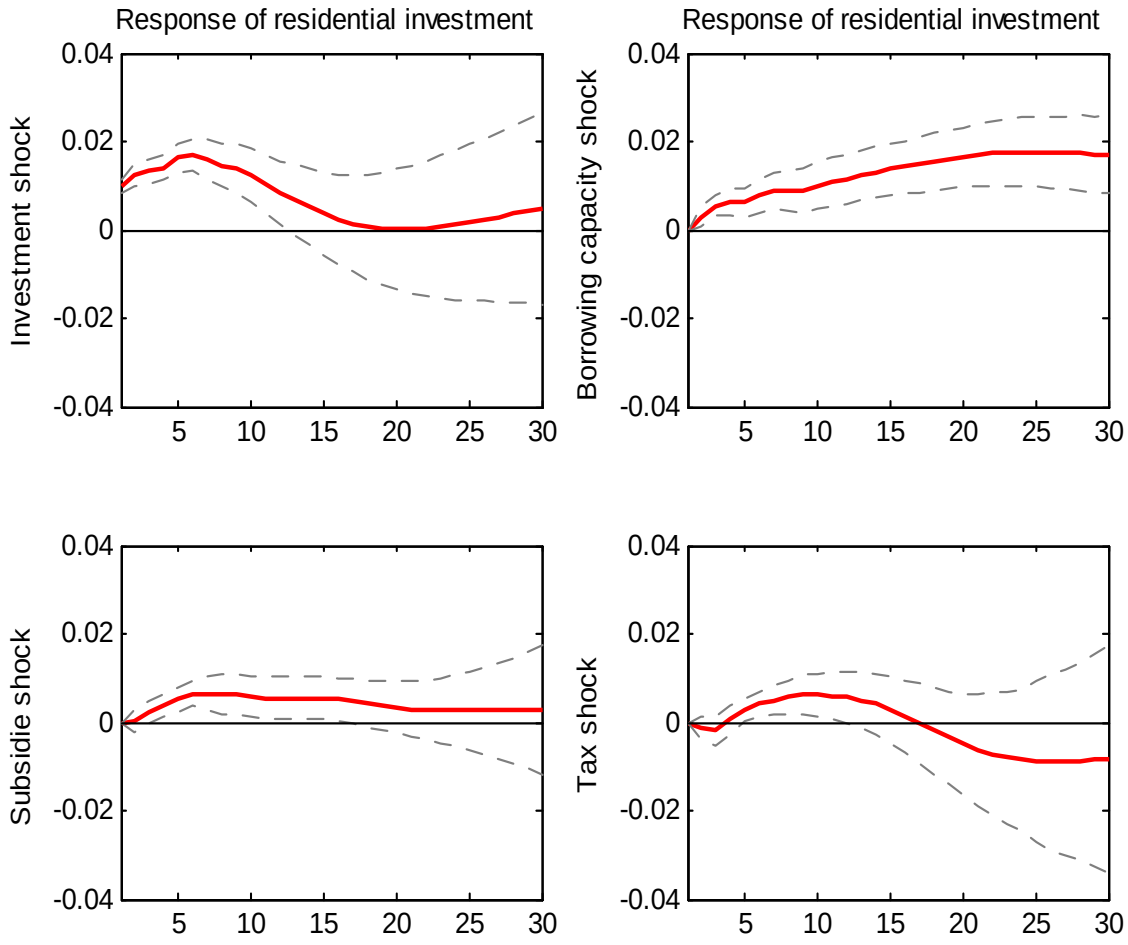


Figure 6. Impulse reaction functions of the model with maximum average amount of indebtedness per households

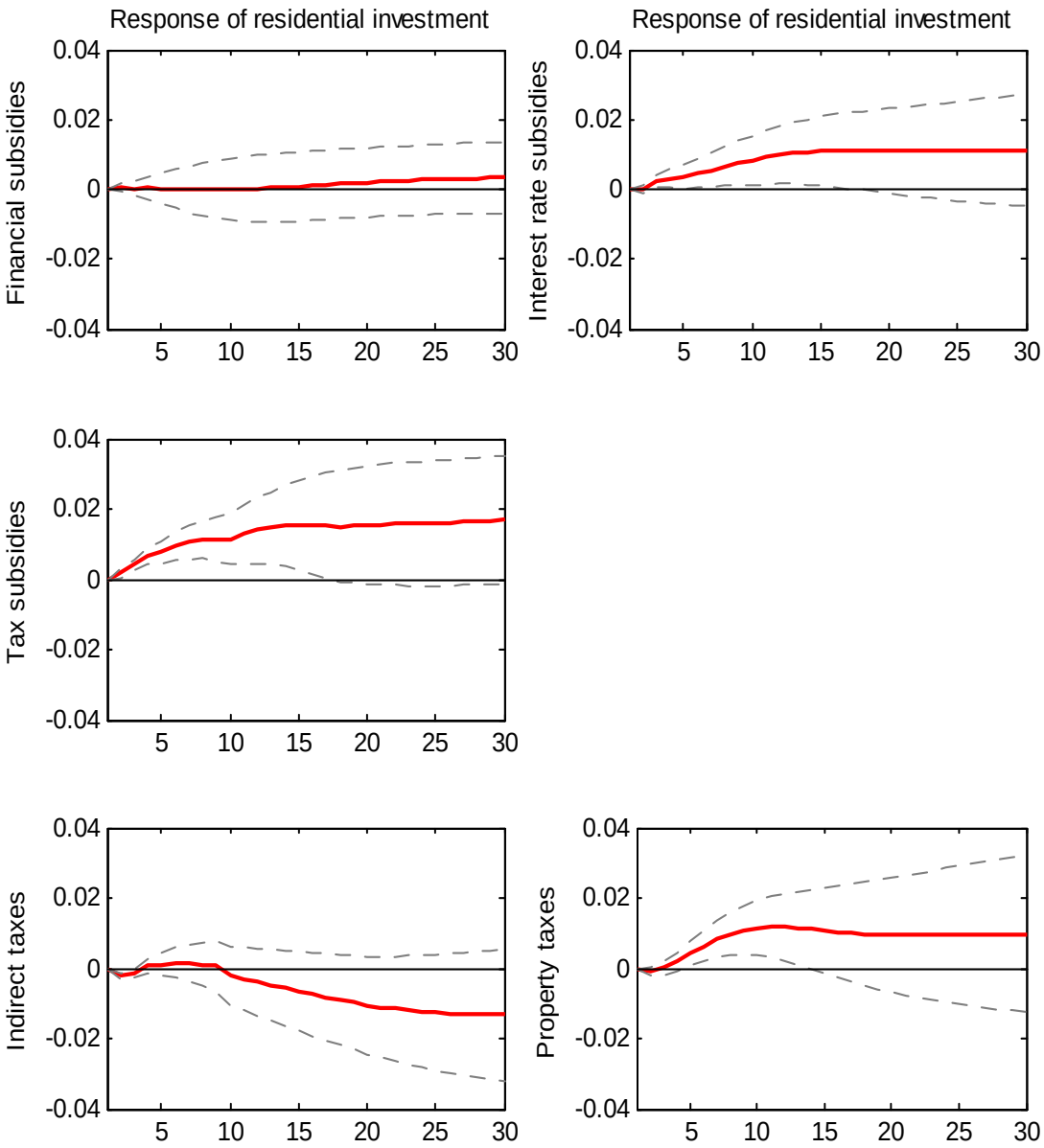


Fig 7. Impulse reaction function according to fiscal item

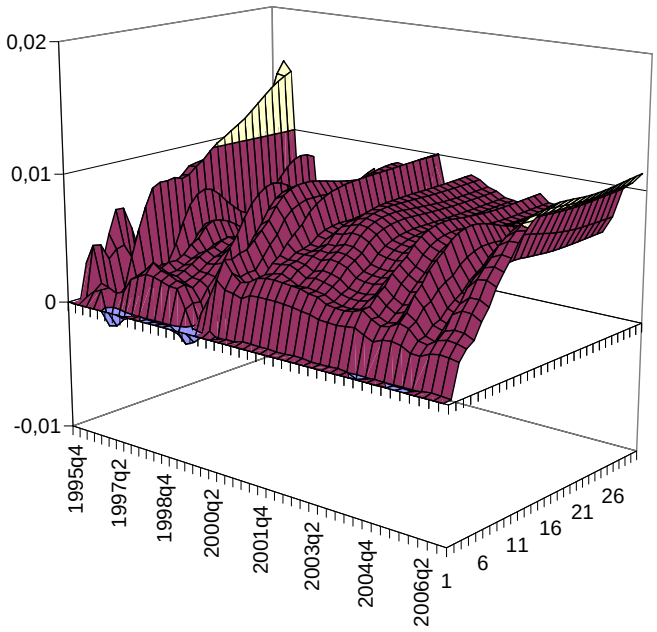


Fig 8a. Recursive impulse reaction function of residential investment to a financial subsidy shock

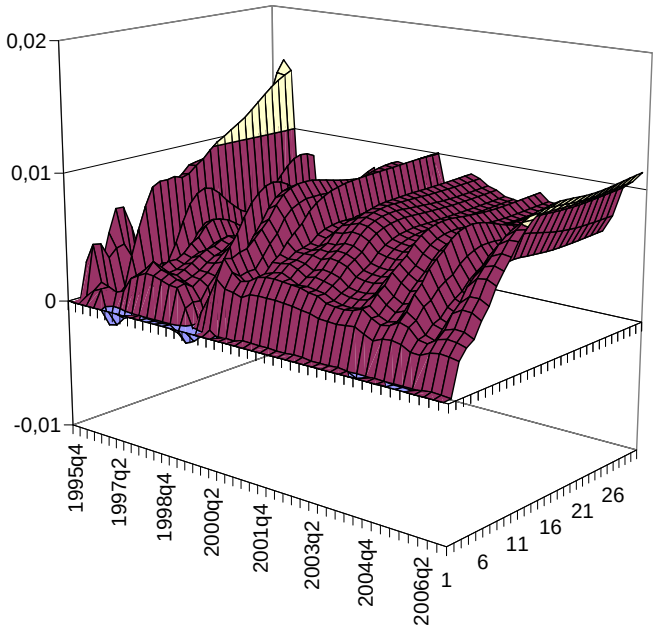


Fig 8b. Recursive impulse reaction function of residential investment to an interest rate subsidy shock

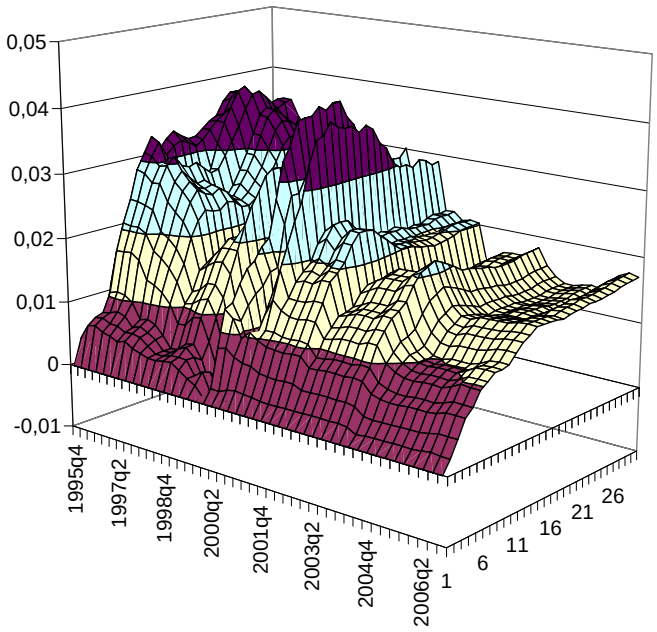


Fig 8c. Recursive impulse reaction function of residential investment to an interest rate subsidy shock

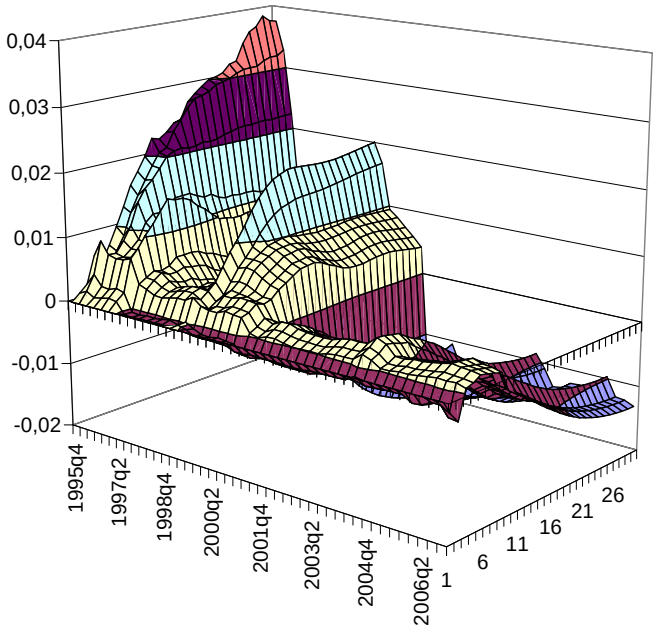


Fig 8d. Recursive impulse reaction function of residential investment to an indirect tax shock

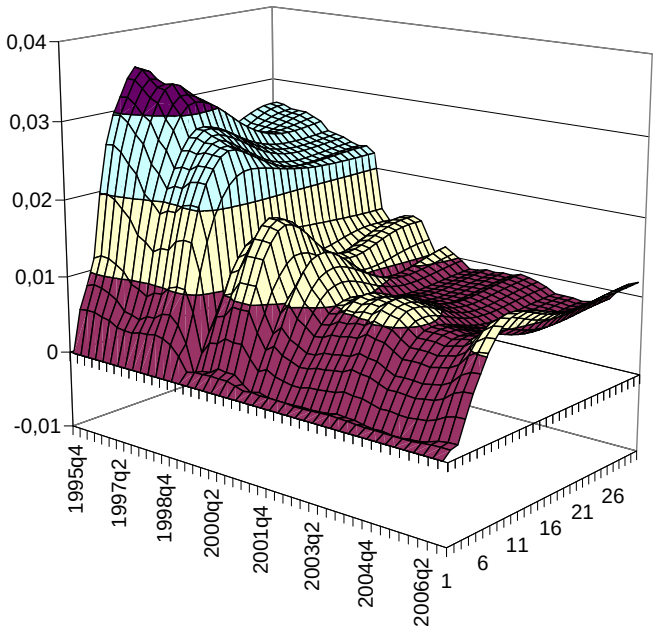


Fig 8e. Recursive impulse reaction function of residential investment to a property tax shock

Appendix 1. Ng-Perron unit root tests

Variable in level

Variable	Exogeneous	Lag	MZa	MZt	MSP	MPT
INV	C+T	1	-4.084	-1.191	0.292	19.878
	5% critical values		-17.300	-2.910	0.168	5.480
Y	C+T	1	-2.275	-1.034	0.454	38.509
	5% critical values		-17.300	-2.910	0.168	5.480
G	C	5	-2.505	-1.112	0.444	9.738
	5% critical values		-8.100	-1.980	0.233	3.170
T	C+T	1	-4.036	-1.371	0.339	22.013
	5% critical values		-17.300	-2.910	0.168	5.480
HP	C+T	2	-3.275	-0.971	0.297	22.106
	5% critical values		-17.300	-2.910	0.168	5.480
IRL	C+T	1	-12.548	-2.525	0.198	3.839
	5% critical values		-17.300	-2.910	0.168	5.480

Variable in first difference

Variable	Exogeneous	Lag	MZa	MZt	MSP	MPT
ΔINV	C	3	-8.536	-2.175	0.228	2.602
	5% critical values		-13.800	-1.980	0.233	3.170
ΔY	C	10	-0.783	-0.498	0.636	22.364
	5% critical values		-13.800	-1.980	0.233	3.170
ΔG	C	5	-13.153	-2.536	0.193	1.975
	5% critical values		-13.800	-1.980	0.233	3.170
ΔT	C	9	-13.153	-2.589	0.188	1.915
	5% critical values		-13.800	-1.980	0.233	3.170
ΔHP	C+T	2	-19.766	-2.589	0.188	1.915
	5% critical values		-17.300	-2.910	0.168	5.480
ΔIRL	C	0	-39.511	-4.444	0.112	0.622
	5% critical values		-13.800	-1.980	0.233	3.170

The Ng-Perron test fails to reject the null hypothesis of a unit root the first difference of the permanent income series. However, as can be seen from figure below, there is no reason to believe that the series for permanent income still contains a unit root, once it is differentiated. In order to confirm that intuition, ADF and Phillips Peron unit root tests are additionally conducted. The results are presented in table A1. Indeed the null hypothesis of a unity root is rejected in both cases. Note that for seasonally adjusted series the null hypothesis of a unit root is less often rejected than it should be (Davidson et al., 1992).

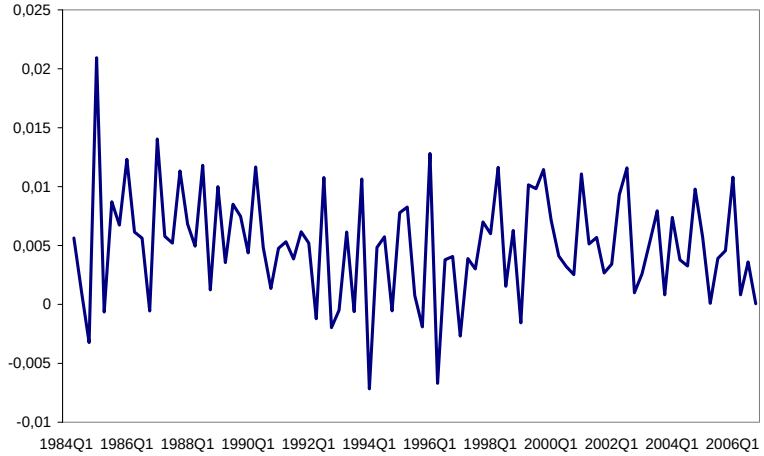


Fig A1. Permanent incorme in first difference

Table A1. Unit root test on permanent income, first difference

Test	C/T	Lag	t-stat	5% critical value
ADF	C	0	-12.509	-2.894
PP	C	3	-12.336	-2.894

Appendix 2. Cointegration test

Series included: INV, Y, G, T
Lags: 1 to 4

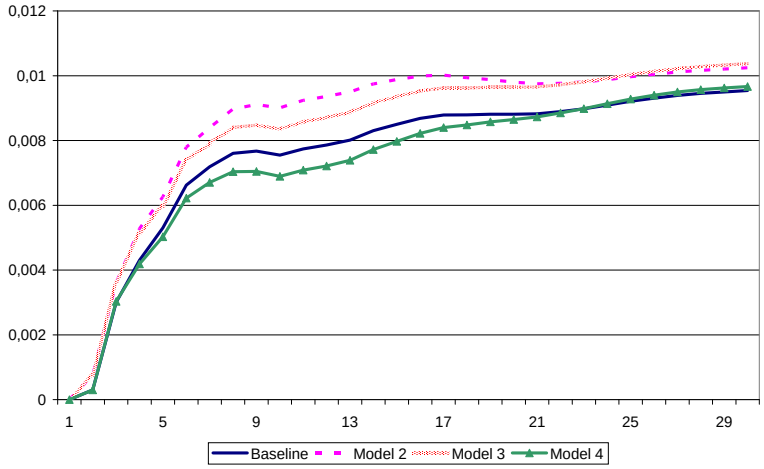
rank	Eigenvalue	Trace Stat	5% critical value	Max Eigen Stat	5% critical value
r=0	0.301	58.831	47.856	31.138	27.584
r=1	0.176	27.684	29.797	16.887	21.132
r=2	0.072	10.807	15.494	6.471	14.265
r=3	0.049	4.335	3.841	4.335	3.841

Appendix 3. Robustness tests

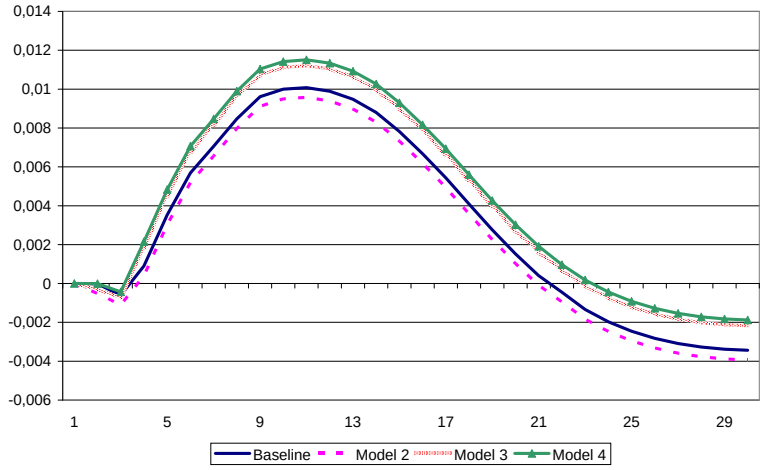
Table A2: Residuals tests

Test	t-stat	p-value
Portemanteau	37.590	0.003
Portemanteau adj.	37.361	0.002
LM-Type	25.601	0.096
Jarque-Bera	17.160	0.029

Fig A2. Checking of the ordering of the variables



Response of investment to a subsidy shock



Response of investment to a tax shock

Appendix 4. Chronology of fiscal measures since 1984

Date	Category	Measure
1984	Tax subsidy	Mehaignerie Plan
1993	Interest rate subsidy	Social renting loan ("PLS")
1995	Interest rate subsidy	Instauration of the zero rate loan
	Indirect tax	Reduction of the regional rate
1996	Financial subsidy	Rate reduction
	Interest rate subsidy	Modification of housing saving plan taxation
	Tax subsidy	Perissol Plan
1998	Indirect tax	Abolition of regional rate
1999	Interest rate subsidy	Abolition of subsidies renting loan ("PLA")
	Interest rate subsidy	Introduction of a social renting loan ("PLUS")
	Tax subsidy	Besson Plan
	Tax subsidy	Income credit tax for small housing works
	Indirect tax	Ceiling of indirect taxes
	Indirect tax	Reduction of VAT for housing sector
2001	Tax subsidy	Extension of income credit tax
2002	Financial subsidy	Extension of the intervention field of ANAH
2003	Tax subsidiy	Robien Plan
2005	Interest rate subsidy	Extension of the zero rate loan
2006	Tax subsidy	Borloo Plan
2009	Interest rate subsidy	Instauration of the ecological zero rate loan
2009	Tax subsidy	Scellier Plan