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[‡] Banque de France, Business Conditions and Macroeconomic Forecasting Unit (46-1383), 75001 Paris, France email : pamfili.antipa@banque-france.fr

[*] Banque de France, Public Finance Unit (46-1371), 75001 Paris, France, email : christophe.schalck@banque-france.fr

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Résumé

Ce papier évalue l'influence de la politique budgétaire sur l'investissement résidentiel en France. En effet, l'investissement résidentiel est une variable clé lorsque l'on veut stabiliser le cycle économique. L'analyse a été conduite en utilisant la méthodologie d'un VECM afin de prendre en compte l'existence d'endogénéité et les co-mouvements entre les séries économiques. Les relations de long-terme obtenues montrent que l'investissement résidentiel dépend du revenu permanent et des variables budgétaires, en particulier les subventions. A travers une approche désagrégée de la politique budgétaire, c'est-à-dire en différentiant les instruments budgétaires, l'étude montre que les avantages fiscaux et les avantages de taux d'intérêt sont les éléments budgétaires les plus efficaces lorsque l'on veut influencer l'investissement résidentiel. Il est à noter que l'introduction de facteurs financiers dans l'analyse, tels que la capacité d'endettement, indique que ces derniers ont un impact positif sur l'investissement résidentiel et confirme que les subventions ont un effet significatif sur l'investissement. Par conséquent, nos résultats suggèrent que la politique budgétaire peut utiliser les subventions à l'investissement résidentiel pour une meilleure stabilisation du cycle économique.

Mots clés: Politique budgétaire, investissement résidentiel, VECM

Code JEL: E62, R21, C22

Abstract

The present paper assesses the impact of fiscal policy on residential investment in France. The analysis is conducted in the framework of a VECM, since this allows accounting for endogeneity between the variables. Our results imply that a long term relationship between investment and subsidies exists, making subsidies an adequate measure to influence residential investment and hence the business cycle. In addition, 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. Moreover, this alternative specification underlines the robustness of the above mentioned results, as it confirms subsidies as the most efficient measure to influence residential investment.

Key words: Fiscal policy, residential investment, VECM

JEL Code: E62, R21, C22

1. Introduction

Recent evolutions on European housing markets have been marked by an important degree of volatility and several studies have attempted 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 has been well established (IMF 2008; Muellbauer and Murphy, 2008). Developments in real housing prices have been correlated with the business cycle; 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 the aim is to stabilise the business cycle.

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

Although it seems very plausible that structural fiscal factors may contribute to determine residential investment (ECB, 2003), studies in that domain are scarce. Among the few existing ones, 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. However, fiscal policy measures substantially increase the volatility 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 house prices and have been interacting with generally higher inflation rates.

In the present study we propose to close the gap by modelling French residential investment, taking explicitly into account fiscal policy measures (taxes and subsidies alike). We assess the possibility that fiscal policy influences residential investment and therefore the business cycle. To that purpose, we build a model where residential investment is explained by a number of macroeconomic (permanent income, house prices, interest rates) and fiscal variables. This will be done in the framework of a Vector Error Correction Model (VECM).

The remainder of the paper is organised as follows: Section 2 presents a short overview of housing taxes and subsidies in 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 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 French Ministry of Housing. 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). The share of residential investment in GDP exhibits a decline from 1984 to 1992, but is relatively stable around 4.3% since 1993. Residential investment's growth rate in real terms, however, displays strong cyclical movements inducing the aforementioned instability on the business cycle (Figure 1a).

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

2.1. Subsidies on residential investment

Residential investment in France is characterised by an important although slightly decreasing degree of policy intervention. In 2006, the various subsidies amounted to € 11.2 bn in real terms which is to be compared to € 14 bn in 1984. For 2006, this corresponds to 1.5% of residential investment. The growth rate of subsidies in real terms displays strong fluctuations in line with residential investment developments (Figure 1b). Subsidies on residential investment have decreased over the period under review: their share in GDP declined from 0.14% in 1984 to 0.06% in 2006. This evolution covers sometimes opposite trajectories for the different sub-categories of subsidies, reflecting mainly legislative changes (Figure 2a). Total subsidies can be further subdivided into three categories (financial, interest rate and tax subsidies) for which the French Ministry of Housing has provided data for (Table 1).

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

	Amount
Financial subsidies	1.3
Interest rate subsidies	2.2
Of which general loans for households	1.5
Of which loans for social housing	0.4
Of which "1% housing" framework	0.4
Tax subsidies	7.7

Source: French Ministry of Housing

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 time: financial subsidies decreased somewhat in line with the decline in subsidies related to the construction of social housing around 1995, but increased again when the National Housing Agency extended its activities from 2002 onwards.

Interest rate subsidies consist in loans at preferential rates. The amount of subsidy is estimated by difference between the amount of a loan (capital and interest) contracted at market rate and a credit contracted at a preferential rate. This type of subsidy amounted to € 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 in market interest rates. Interest rate subsidies can further be divided into three categories:

- General loans for households take the form of either i) housing saving plans or ii) the so-called "zero rate loan" that were introduced in 1995. i) A housing saving plan is very much 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. ii) The zero rate loan is a supplementary loan for households planning their first home purchase, its amount being limited to 20% of total investment. The share of these loans in the total 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 by low income households. The part of loans for social housing has decreased from 55% in 1986 to 16% in 2006.
- Loans that are part of the "1% housing" framework. These loans consist in supplementary loans for main home purchases, financed by companies' contributions to a common fund. The "1% housing" scheme represents a stable part of 18% in interest rate subsidies.

Tax subsidies amounted to € 7.7 bn or 68% of total subsidies in 2006. This last category of subsidies has doubled in real terms over the period, increasing particularly since 1999. These subsidies mainly

[2] Financial subsidies have to be understood as actual cash flows between economic agents and the state.

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, correspondong to 3.1% of total residential investment. As for subsidies, the growth rate of taxes in real terms displays strong fluctuations in line with residential investment. Over the period under consideration, taxes have increased as a share of GDP (0.09% in 1984 to 0.13% in 2006, Figure 1c).

Taxes on residential investment can be divided into indirect taxes and property taxes (Figure 2b). Out of the two, the main component is property taxes. Their evolution exhibits a linear increasing trend since their computation is based on a stable tax base (the cadastral value) and local tax rates. On the contrary, the evolution of indirect taxes exhibits strong fluctuations and their trajectory was in particular affected by the 1995 tax cuts and a number of fiscal measures over the 1999-2001 period (see appendix 4).

3. The VECM methodology

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 households' 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.

Note that in our specification interest rates an exogenous. 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 inflationary expectations. Using the interest rate as an exogenous variable, allows us therefore to focus on fiscal factors, disregarding financing conditions in the standard specification of the present analysis. In addition, the series of 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 small in levels as mortgages are often cross subsidized and used by banks to attract customers while banks' profits are made in other segments of their activity.

Housing prices (*HP*) correspond to the housing index for existing dwellings 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, 1994 and Kenny 1999). The impact on prices will

hence depend on the financing conditions of the economy. However, this subject is beyond the scope of our analysis that concentrates on 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 data were deflated by the CPI. This was also done for the price series used. All variables are expressed in logarithms and real terms. According to statistical tests, data present neither seasonal patterns nor level shifts, the latter being important for the subsequent unit-root and cointegration testing procedure.

3.2. Testing procedure

3.2.1. Unit root analysis

We follow the testing and estimation procedure 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 appendix 1). In that respect, it was particularly important to deflate the fiscal series, since 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: a *K*-dimensional vector of time series x_t is a first order integrated process generated by a VECM of the following form:

$$\Delta x_t = \alpha\beta' x_{t-1} + \Gamma_1 \Delta x_{t-1} + ... \Gamma_{p-1} \Delta x_{t-p+1} + \varepsilon_t \qquad (1)$$

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 *(Kxr)* matrices of rank *r*. They specify the long-run part of the model where β contains the cointegration matrix, *r* is the cointegration 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)* are *(KxK)* 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 determined based on AIC criterion (Lütkepohl and Saikonnen, 1999). Cointegration tests for the model were conducted taking into account the so-determined lag order. As the dimension of a system can have an important impact on the test results (Gonzalo and Pitarakis, 1999), cointegration tests are also undertaken for all possible sub-systems, i.e. pairs of variables[3]. Johansen's trace test detects one cointegration relationship for residential investment (see appendix 2). The results of the pair wise tests (not reported here) are consistent with those for the higher dimensional systems.

[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 cointegration relationships in the whole system.

3.2.3. Imposing restrictions on the cointegration matrix and loading coefficients

For a given cointegration rank and lag order the VECM can be estimated by a reduced rank regression, as shown in Johansen (1991, 1995). To that purpose, restrictions have to be imposed to identify matrices α and β in (2). For one cointegration 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:

$$x_{e,t} = \sum_{i=1}^{p} A_{e,p} x_{e,t-p} + \varepsilon_{e,t} \qquad (2)$$

where $A_1 = \alpha\beta' + I_K + \Gamma_1$, $A_i = \Gamma_i - \Gamma_{i-1}$ for *i = 2,…, p-1* and $A_p = -\Gamma_p$. The impulse responses are then recursively computed by:

$$\Phi_i = \sum_{j=1}^{i} \Phi_{i-j} A_j \qquad (3)$$

where $\Phi_0 = I_K$.

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:

$$\omega_{kj}(h) = (\theta_{kj,o}^2 + \ldots + \theta_{kj,h-1}^2) \Big/ \sum_{j=1}^{K} (\theta_{kj,o}^2 + \ldots + \theta_{kj,h-1}^2) \qquad (4)$$

Where $\theta_{kj,l}$ is the *kj*-th element of Φ.

4. Empirical results

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 cointegration vector for the long-term relationship.

Table 2. Cointegrating vector

INV	Y	G	T	Constant
1.00	-1.095	-0.306	0.093	-2.168
	[-3.618]	[-3.085]	[0.522]	[-0.623]

t-stat in brackets

As can be seen, income (Y) is the main driving factor behind residential investment. The coefficient on households' disposable income is slightly greater than unity, indicating that the share of households' investment in GDP is constant. More precisely, this result implies a high long-run elasticity that is in line with the idea that a housing 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 equal to 0.31. Thus, a rise in subsidies increases residential investment in the long run but the multiplier is below the unity. This result confirms the influence of fiscal policy on residential investment. No long-run relationship is found between taxes (T) and residential investment as the coefficient is not statistically significant. It may seem surprising that only subsidies can influence residential investment in the long run. This may be related to the fact that subsidies are a crucial variable affecting households' investment decisions while taxes determine both consumption and investment choice.

Interestingly enough, the pair wise cointegration tests conducted on the subsystems of the variables, did not indicate that a cointegration relationship exists between housing taxes and subsidies. This is in line with the budgetary principle of non-appropriation which inhibits that specific fiscal revenues are earmarked to specific expenditures. More precisely, this entails 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 and the way they are fixed 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 the actual purchasing price of a housing unity. In addition, the overall tax rate is the aggregation of taxes levied at different layers of local governments (city, department, region) which fixe their own tax rate each year depending on their financing needs. Therefore, the level and the evolution of property taxes are hardly foreseeable for 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, and this in turn may explain that they are not significant in our estimation.

Table 3 summarises the results for the short-term dynamics. The short-term relationship is satisfactory in the sense that the error correction term related to the cointegration vector *(ECT)* is significant and exhibits the expected negative sign. 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].

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]
ΔIRL(-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]
R^2	0.57	0.61	0.54	0.35

t-stat in brackets

4.2. Impulse response analysis and variance decomposition results

In order to analyse the relationship between variables, impulse responses functions were computed for the model. The impulse responses have to be interpreted as the 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 decomposition allows determining which of the explanatory variables is the most prominent for the dynamics of residential investment (Figure 4). The main explanatory variable is residential investment itself, implying some inertia in the series. This result can hint at the existence of autocorrelation which can be expected for a I(1) series. Revenue explains only 6% of investment's variance. On the contrary, the impact of fiscal measures is highly significant: taxes explain up to 13% of the variance after 15 quarters. The explicative power of subsidies even increases over the time and attains 25%.

Subsequently, fiscal policy has a significant impact on residential investment both in the long and short run. Therefore, fiscal variables should be part of the set of explanatory variables, when analysing the factors affecting investment. It seems, however, that housing subsidies have more of an impact than taxes, making the former a more accurate tool to stabilise investment and hence the business cycle.

4.3. Specification tests

Specification tests were performed for the baseline and two other specifications (see appendix 3). LM tests conclude that residuals were not correlated, Jarque-Bera tests (using Urzua's method of orthogonalization) imply their normality, and the models seem 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] 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.

4.4 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 underlines 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 significant. In addition, short-term dynamics exhibit the expected trajectories. 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 again statistically not significant. Finally, impulse responses functions display the same expected paths, as was already the case for the benchmark model (Figure 5).

Table 4. VECM results with net subsidies

Cointegrating vector

INV	Y	NG	Constant
1.00	-1.587	-0.316	-1.361
	[-5.902]	[-3.444]	[-0.121]

Short term dynamics

Variable	ΔINV	ΔY	ΔNG
ECT(-1)	-0.062	0.031	0.041
	[-2.345]	[3.095]	[0.645]
ΔIRL(-2)	-0.052	0.014	-0.021
	[-2.694]	[1.823]	[-0.180]
ΔHP	0.005	0.046	0.251
	[0.079]	[1.756]	[1.529]
constant	-0.005	0.007	0.002
	[-1.190]	[4.490]	[0.180]
R^2	0.50	0.34	0.61

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 had an impact on banks' pricing strategies for mortgages. In the first place, the process of European Monetary integration contributed to a decline in interest rates, a development of which banks and consumers have benefited from in all 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. 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 summarizes the impact of the change in financial factors as 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:

$$K = \frac{1}{3} GDI * \sum_{j=1}^{J} \frac{1}{(1+r)^j} \quad (5)$$

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

The results for that specification 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's magnitude is particularly important, underlining 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 reaction functions are also consistent with the ones for the benchmark model (Figure 6).

Table 5. VECM results with financial factors

Cointegrating vector

INV	K	G	T	Constant
1.00	-0.517	-0.240	0.151	-7.736
	[-5.931]	[-2.476]	[1.516]	[-3.866]

Elements of short term dynamics

Variable	ΔINV	ΔY	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]
R^2	0.55	0.45	0.59	0.54

t-stat in brackets

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

4.5. A disaggregated approach

While the previous sections assessed the impact of subsidies and taxes on residential investment as a whole, this section attempts to exploit the disaggregated data 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) while we replace the aggregate fiscal variable (subsidies or taxes) by a specific fiscal variable. The fiscal items available of are the following: financial subsidies, interest rate subsidies, tax subsidies, indirect taxes, and property taxes[5]. The long term specification exhibits 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 from the financial ones (the latter being the smallest item might explain why there impact is statistically not significant). 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 house 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 decreases rapidly. The impact of a property tax shock on investment is somewhat counterintuitive, as it exhibits a positive sign which might be related to changes in the tax base that are not correlated to the evolutions of residential investment itself. The mixed effect of the disaggregated tax sub-categories explains the non-significance of taxes as an aggregate item.

4.6. Changes in fiscal activism over time

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

The impact of financial subsidies is relatively low over the period. Moreover, although the first impulse on investment is positive, the effect decreases rapidly. When the 1996-1997 period is included, the estimated impact is strongly negative and may reflect the impact of subsidy cuts. Conversely, the extension of the National Housing Agency's working domain in 2002 appears to have a more persistent positive effect. Interest rate subsidies have a positive impact that is relatively stable over the period in consideration. Note that there is a correlation between the increase of the impact and the introduction of "zero rate loans" in 1995 (the number beneficiaries was extended in 2005, without any effect on the data). Finally, tax subsidies' impact is always strongly positive, but seems to have declined somewhat over the time. The results for the dynamic assessment underline that the positive impact subsidies can have on residential investment is also stable over time.

[5] The number of lags chosen for specifications related to financial subsidies and indirect taxes is smaller (3 lags) than the one in the baseline (4 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.

Our results would thus imply that by far the most effective policy to influence residential investment is one that relies on tax and interest subsidies. Interestingly, the actual measures taken since 2006 seem consistent with the results of this study. The deductibility of loan interest rates for instance is a tax subsidy that should have a significant effect on housing market dynamics. Similarly, the green 'zero rate loans' instituted in the 2009 budget should enhance the fiscal stimulus for residential investment and should therefore help cushion turbulences in the French housing market.

5. Conclusion

The present study models 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. Analytically, 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. More precisely, tax and interest rate subsidies have the most significant positive impact 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 our baseline specification, as it confirms subsidies as the most efficient measure to influence investment.
It is also noteworthy that for none of our specifications residential property prices have a statistically significant impact on investment. This result probably hinges on the dual character of housing (investment versus consumption good). While this entails that taxes can distort price signals, it underlines as well the important role fiscal policy can play for the stabilisation of the business cycle.

Measures taken since 2006 seem consistent with the results of this study. The deductibility 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 stimulus should help cushion the ongoing decline in house prices.

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

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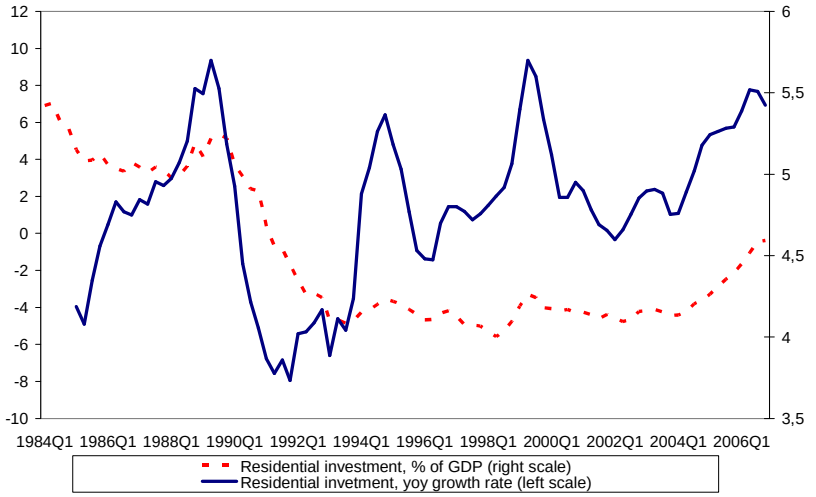


Fig 1a. Residential investment

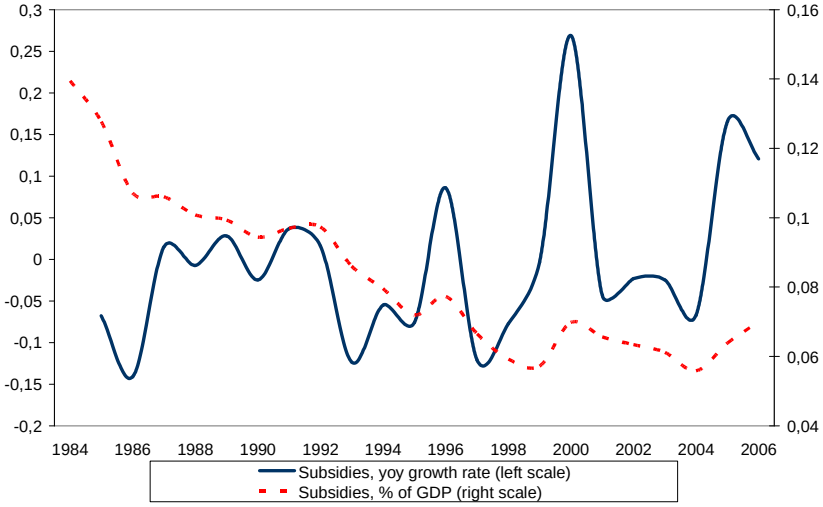


Fig 1b. Subsidies on residential investment

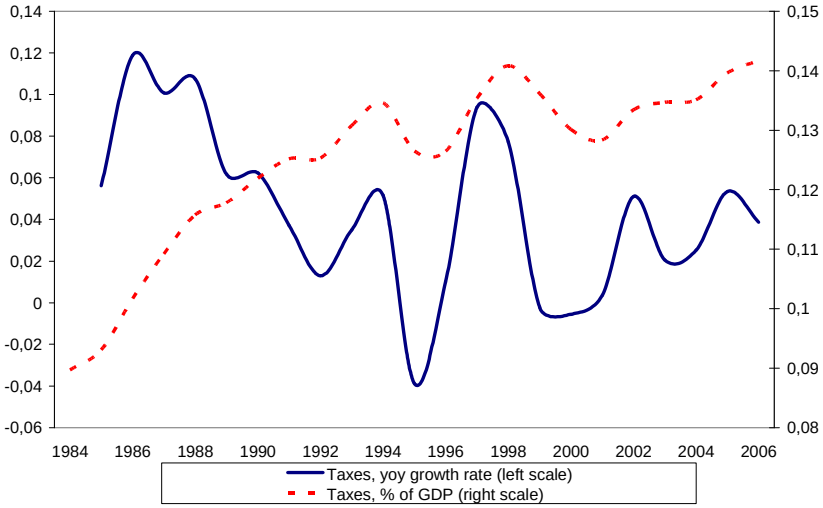


Fig 1c. Taxes on residential investment

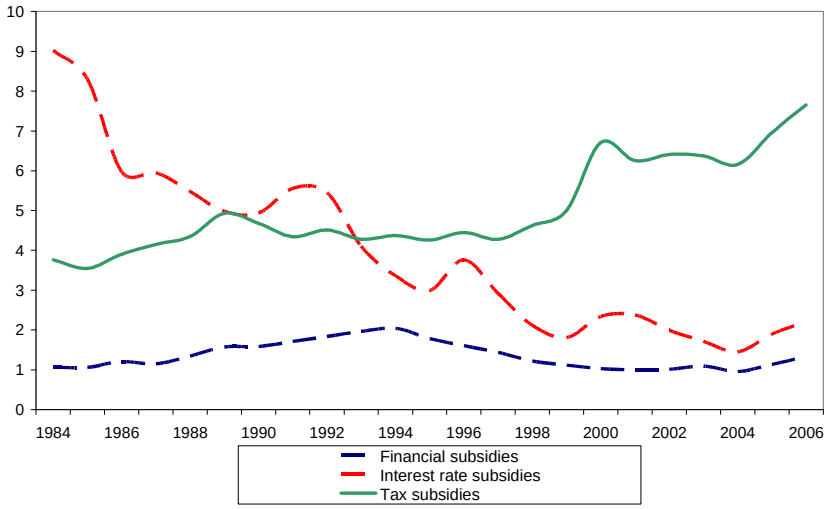


Fig 2a. Evolution of subsidies in real terms (bn €)

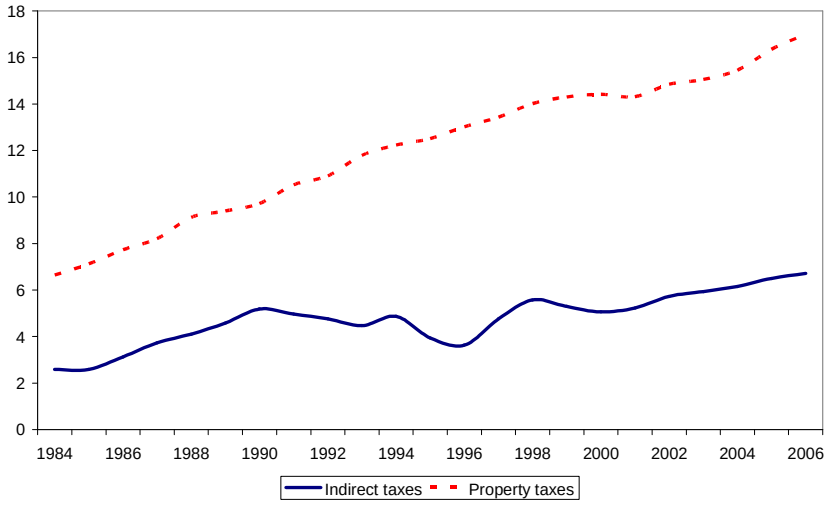


Fig 2b. Evolution of taxes in real terms (bn €)

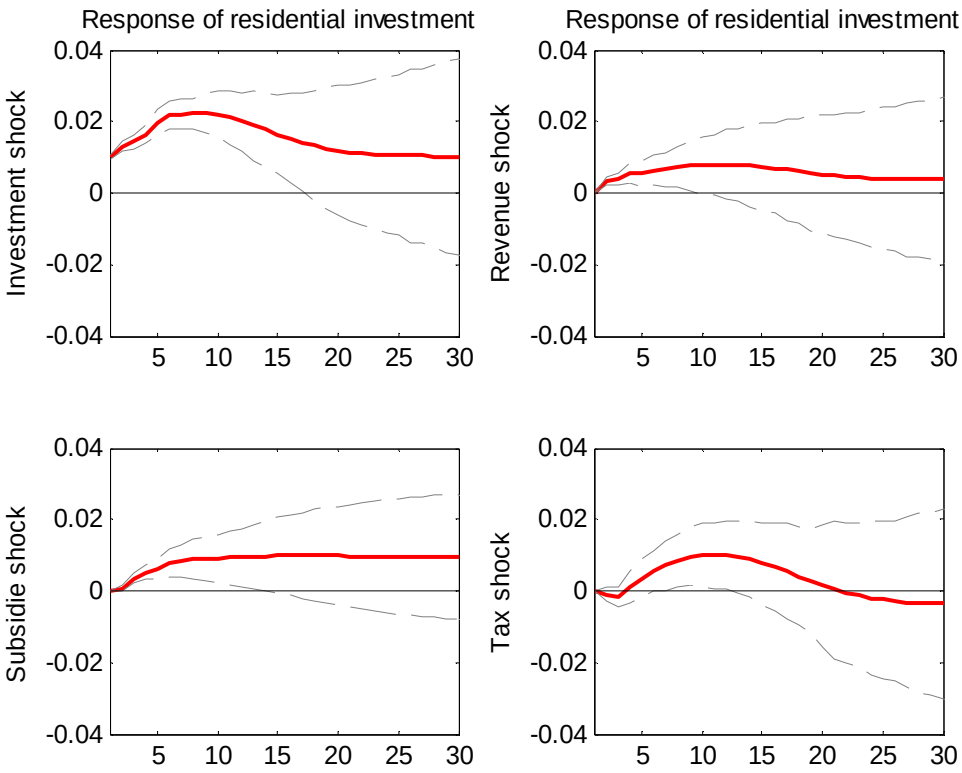


Fig 3. Impulse response functions

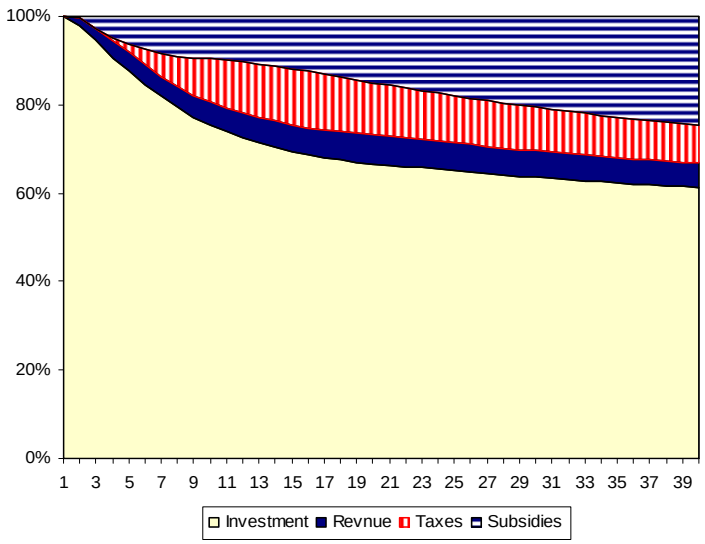


Fig 4. Variance decomposition

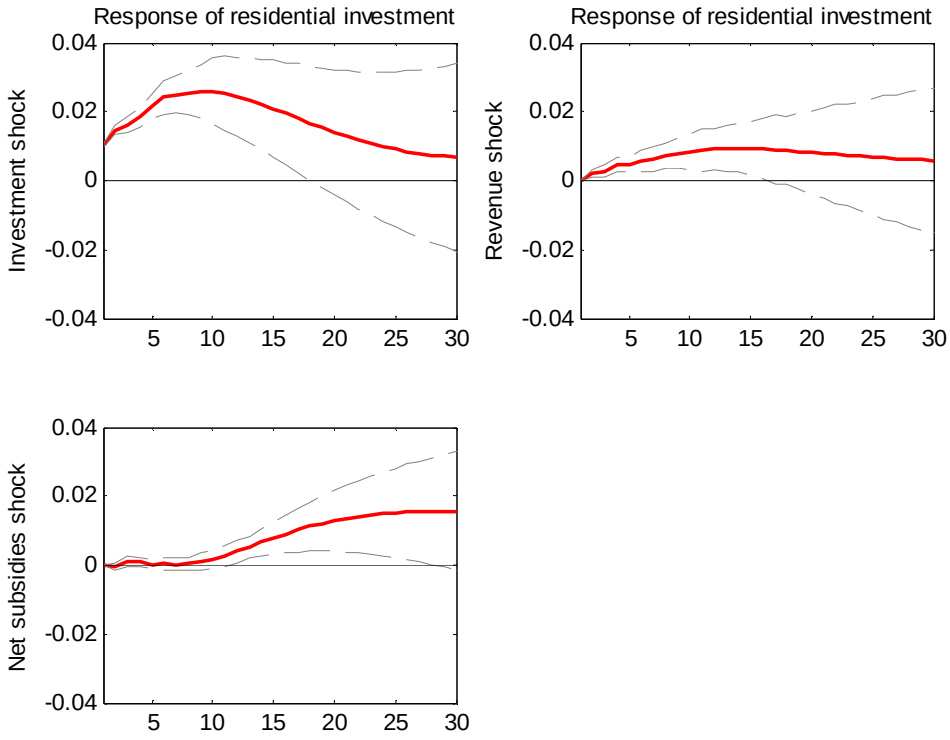


Fig 5. Impulse reaction functions of the model with net subsidies

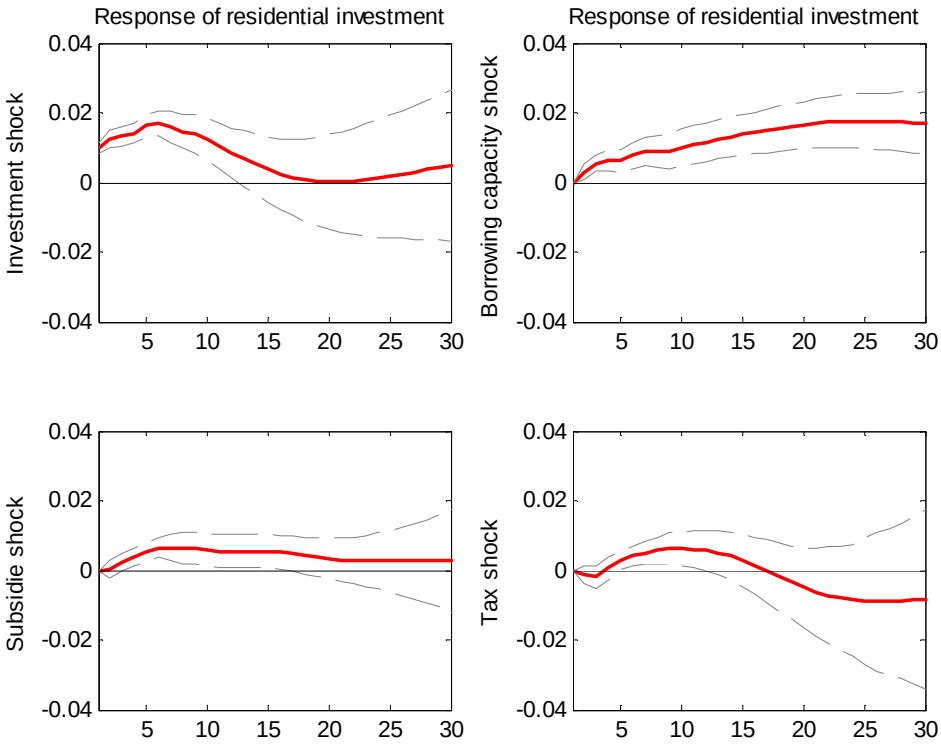


Fig 6. Impulse reaction functions of the model with maximum average amount of Indebtedness per households

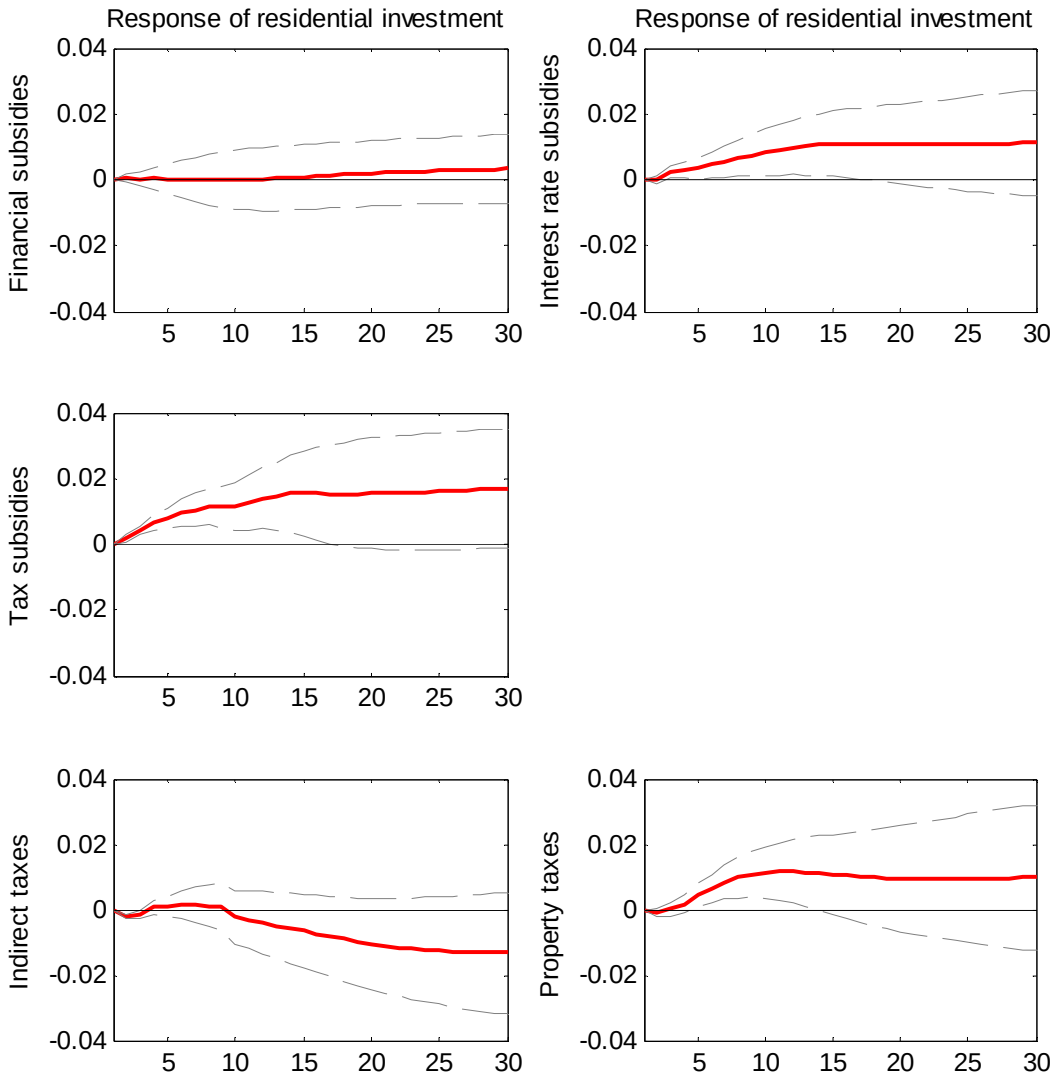


Fig 7. Impulse reaction functions according to fiscal item

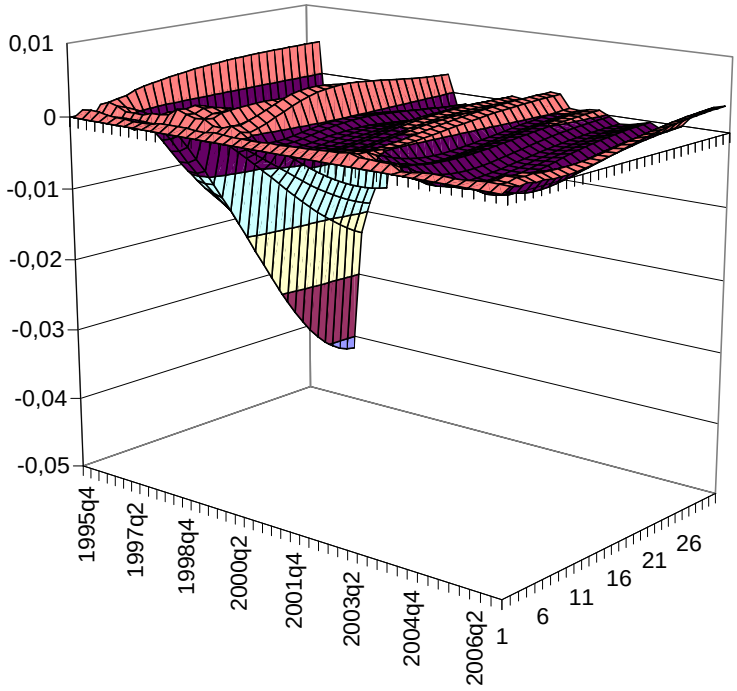


Fig 8a. Recursive impulse reaction function of residential investment
To a financial subsidy shock

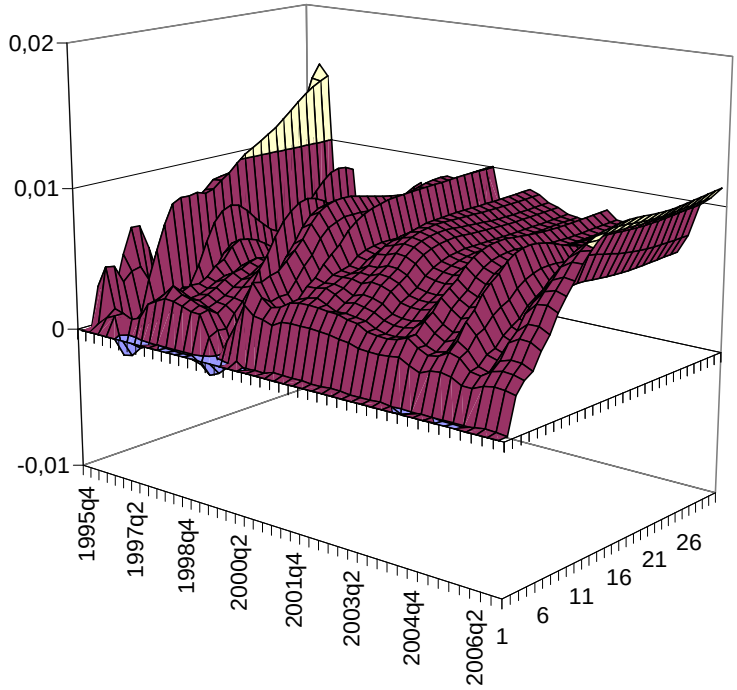


Fig 8b. Recursive impulse reaction function of residential investment
To an interest rate subsidy shock

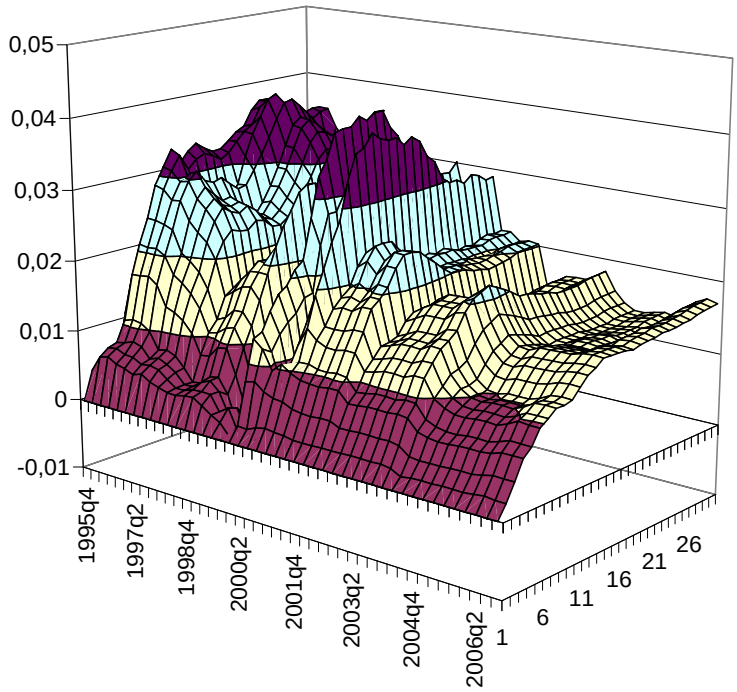


Fig 8c. Recursive impulse reaction function of residential investment
To a tax subsidy shock

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	19.978
	5% critical value		-17.300	-2.910	0.168	5.480
Y	C+T	1	-2.275	-1.034	0.454	38.509
	5% critical value		-17.300	-2.910	0.168	5.480
G	C	5	-2.505	-1.112	0.444	9.738
	5% critical value		-8.100	-1.980	0.233	3.170
T	C+T	1	-4.036	-1.371	0.339	22.013
	5% critical value		-17.300	-2.910	0.168	5.480
HP	C+T	2	-3.275	-0.971	0.297	22.106
	5% critical value		-17.300	-2.910	0.168	5.480
IRL	C+T	1	-12.548	-2.525	0.198	3.839
	5% critical value		-17.300	-2.910	0.168	5.480

Variable in difference

Variable	Exogeneous	Lag	MZa	MZt	MSP	MPT
ΔINV	C	1	-8.536	-2.175	0.228	2.602
	5% critical value		-13.800	-1.980	0.233	3.170
ΔY	C	1	-0.783	-0.498	0.636	22.364
	5% critical value		-13.800	-1.980	0.233	3.170
ΔG	C	5	-13.153	-2.536	0.193	1.975
	5% critical value		-13.800	-1.980	0.233	3.170
ΔT	C	1	-13.153	-2.589	0.188	1.915
	5% critical value		-13.800	-1.980	0.233	3.170
ΔHP	C+T	2	-19.766	-2.689	0.178	1.903
	5% critical value		-17.300	-2.910	0.168	5.480
ΔIRL	C	1	-39.511	-4.444	0.112	0.622
	5% critical value		-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).

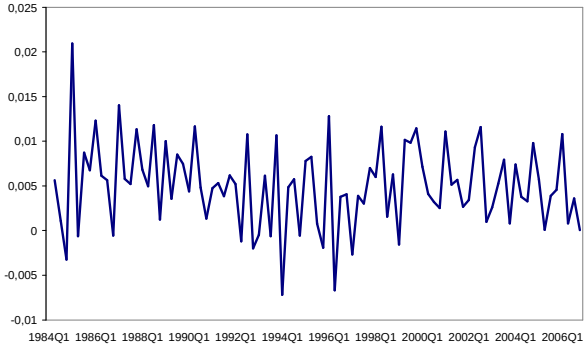


Fig A1. Permanent income in first difference

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 tests

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

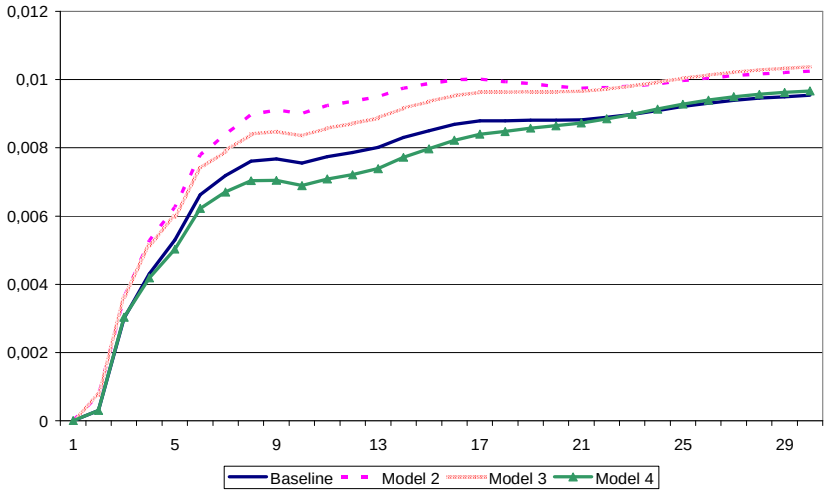
rank	Eigenvalue	Trace stat	5% critical value	Max Eigen value	5% critical value
r = 0	0.301	58.831	47.856	31.138	27.584
r = 1	0.176	27.684	29.797	16.887	21.132
r = 2	0.072	10.807	15.494	6.471	14.265
r = 3	0.049	4.335	3.841	4.335	3.841

Appendix 3. Robustness tests

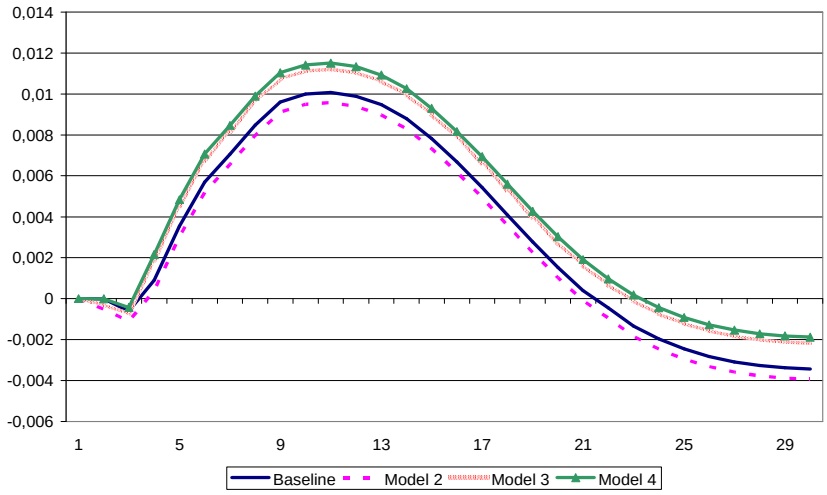
Table A2. Residuals tests

Test	t-stat	p-value
LM-Type	25.601	0.157
Jarque-Bera	62.880	0.217

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 tax	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 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 subsidy	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
	Tax subsidy	Scellier Plan

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