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Cheap Credit, Unaffordable Houses?

Claire Labonne, Cécile Welter-Nicol*

* Autorité de Contrôle Prudentiel et de Résolution. Corresponding author: claire.labonne@acpr.banque-france.fr. We thank Frederic Malgras for his help with the data. We thank Jean Imbs, Roberta de Filippis, Henri Fraisse, Fergal McCann, Simon Ray, Sébastien Roux, Benedikt Ruprecht , Frédérique Savignac and the ACPR Scientific Committee for useful comments and suggestions.

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Abstract

We use variations in the Interest Free Loan policy ("IFL" hereafter) in France to assess the causal relationship between credit availability, housing prices and homeownership. The IFL subsidy varies at the municipality level and has been reformed three times between 2009 and 2011. We handle endogeneity between housing prices and policy by sampling municipalities bordering administratively defined policy areas. Using a loan-level dataset, we find IFLs allow a positive housing credit shock, channeled into housing prices. We find a high elasticity of housing prices to housing credit when we instrument the latter variable by the IFL, between 0.4 and 0.7 depending on the estimation strategy. We also test for the effect of credit conditions on homeownership. We approximate credit market selection by the difference between borrowers' and average income. We find an exogenous – IFL induced – increase in LTV reduces credit selection.

JEL: G21, R28

Keywords: Housing Credit, Interest-Free Loan, Real estate prices, Homeownership

Résumé

L'étude utilise les montants de Prêt à Taux Zéro (PTZ) disponibles pour examiner la causalité entre les prix immobiliers, l'accès à la propriété d'une part et la distribution de crédit immobilier d'autre part. La subvention PTZ varie au niveau des communes et a été réformée trois fois entre 2009 et 2011. L'endogénéité entre les prix et la politique du logement est traitée en échantillonnant les communes à la frontière des zones des politiques du logement. En utilisant une base de données de prêts, il est montré que le PTZ permet un choc positif de crédit qui se transmet fortement aux prix immobiliers. Ainsi, l'élasticité des prix immobiliers au crédit s'établirait entre 0.4 et 0.7 selon les stratégies d'estimation. L'effet des conditions de crédit sur l'accès à la propriété est aussi analysé. La sélection sur le marché du crédit est mesurée par la différence entre le revenu des emprunteurs et le revenu moyen des ménages. Un relâchement exogène du ratio de LTV, permis par le PTZ, aboutit à une diminution de la sélection sur le marché du crédit.

JEL : G21, R28

Mots-clés : Crédit immobilier, Prêt à Taux Zéro, Prix immobiliers, Accession à la propriété

1. Introduction

Housing prices have increased 2.5-fold from 1998 to 2008 in France. Prices are overvalued by 10 to 25% (ECB (2014) and EU COM (2013)). Housing under its different dimensions represent 48% of households' wealth, more than 20% of their consumption and 30% of total investment (Arrondel et al. (2013), SOeS (2015)). Real estate exposures are a sizeable share of banks' balance sheet (20%).[2] Housing prices movements thus bear important consequences for both homeownership and financial stability.

Easy access to credit markets is a catalyst for homeownership. However, restricting housing credit to the safest households ensures financial stability. The *Prêt à Taux Zéro* (PTZ) policy lies at the heart of this trade-off. It builds on the credit channel that macroprudential policy aims at controlling. This is an interest-free loan (IFL) making more households creditworthy. It amounted to 2 billion euros of subsidies per year between 2009 and 2011.[3] Until 40% of operations financing main residence included an IFL during this period.

We use the IFL policy as an instrument for credit to trace its impact into house prices and homeownership. Maximum IFL amounts vary across time and municipalities. The policy has been reformed three times between 2009 and 2011. The subsidy size varies along administratively defined housing policy areas. These areas make the subsidy a function of housing market conditions. However, each of the about 36 000 French municipalities is classified into only 4 housing policy areas. They cannot perfectly fit local conditions. To be able to use the IFL as instrumental variable for credit, we sample only municipalities on each side of these areas borders. Their classification is the most likely to be imprecise. We argue that the housing policy is exogenous to housing prices in this sample.

We use a loan-level dataset of housing loans granted by all major French banking groups. We observe loans' and borrowers' characteristics at origination as well as the housing location at the ZIP-code level. We find the IFL allows a positive housing credit shock, then channeled into housing prices. We find a high elasticity of housing prices to housing credit when we instrument the latter variable by the IFL, between 0.4 and 0.7 depending on the estimation strategy. We show our estimate is not driven by demand dynamics.

We also test for the effect of credit conditions on homeownership. We assess whether the IFL subsidy can alleviate the loan-to-value (LTV) ratio constraint. This would allow new households on the credit market. We approximate credit market selection by the difference between borrowers' and average income in each ZIP-code. We find an exogenous increase in the LTV reduces credit selection (makes borrowers' income closer to the average income).

Both results contribute to the literature studying the interplay between the credit and housing markets. Mian and Sufi (2009) underline the growth in mortgage credit and defaults in subprime ZIP-codes as explanations for the financial crisis. Glaeser, Gottlieb and Gyourko (2010) revisit the Poterba (1984) user cost model of housing prices to assess the role of low interest rates in the housing prices boom in the US between 1996 and 2006. They argue that lower real rates can explain only one-fifth of the rise in prices. They stress the need for corrections of the endogeneity of borrowers' decisions to apply for mortgages.
We contribute to the micro-econometric literature using regulation shocks to identify the causal role of credit on housing prices. Landier, Sraer and Thesmar (2013) document a correlation between housing prices across US states and the geographic integration of the US banking market. Instrumenting integration by market deregulation, they show that banking integration explains up to one third of the rise in house price correlation between 1976 and 2000. Adelino et al. (2014) use exogenous changes in

[2] Retail exposures secured by real estate property. Authors' computations for six French banks using 2014 EBA/ECB data available at http://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014/results
[3] Total housing policy amounts to 40 billion euros, about 2% of GDP (SOeS (2015)).

the conforming loan limit to measure the causal effects of lower cost of financing on house prices. They show lower mortgage rates have modest effects on average house prices, but have a strong impact on particularly constrained households. Favara and Imbs (2015) relax the assumptions of instrument exogeneity by building two control groups for banks based on location or legal status. They show that since 1994, branching deregulations in the US have significantly affected the supply of mortgage credit and ultimately house prices. They find evidence that house prices rise with branching deregulation, particularly in areas with inelastic construction.

We propose a parallel exercise in the French context, for which Friggit (2011) and IMF (2013) emphasize the importance of the credit channel. Our identification strategy accounts for endogeneity of housing policy to housing market conditions. Successive reforms and housing policy areas allow our instrument to vary at the municipality level at the half-yearly frequency. Above all, we document the influence of credit conditions on housing markets at the extensive margin, whose importance is stressed by Adelino et al. (2015). These results echo the effect of housing policy on homeownerships decisions studied in Hilber and Turner (2014) in the US. They show mortgage interest deductions are ineffective policies to promote homeownership because of their capitalization into house prices.
Interest-free loans in France have already been studied by Gobillon and Blanc (2005). They measure the impact of IFL on housing demand using survey data and show the IFL does spur homeownership, especially for the poorest first-time buyers. However, 85% of IFL are badly targeted, generating deadweight losses. We document the subsidy capture and proxy homeownership accession using loan-level data. Our work is close to Bono and Trannoy (2013), who estimate the effect of tax benefits when buying housing for rent on the price of building land using the geographic definition of the policy. It is also close to papers on the effect of subsidies on the rental sector in France (Fack (2006), Grislain-Letrémy and Trevien (2014), Laferrère and Le Blanc (2002)).

The rest of the paper is organized as follows. Section 2 presents data. Section 3 details the methodology. Section 4 analyses the results. Section 5 concludes.

2. Data

We present the IFL framework, our loan-level database and the other data sources.

2.1. Interest-Free Loans, *Prêt à Taux Zéro*

The *Prêt à Taux Zéro* (PTZ) is a homeownership policy tool. IFLs wascreated in 1977 and significantly reformed in 1995 and 2005. Their aim is to provide zero interest loans to first-time buyers of their main residence. IFL eligibility, amount and reimbursements schemes are conditional on the location of the house, the household income and size and the house being new or existing. The IFL cannot cover the whole cost of the operation. It is associated with a standard loan. Commercial banks grant the IFLs and the government makes up for the absence of interests by fiscal reductions. Banks are responsible for evaluating borrowers' creditworthiness.[4]

We focus on the 2009-2011 period and describe conditions between 2009 and 2011 to be consistent with our dataset time coverage (see Figure 1). The policy was reformed in 2009, 2010 and 2011. The 2009 reform doubled the maximum IFLs for new housing. The measure lasted until June 2010. Maximum IFL amounts increased by 50% between July and December 2010. The main characteristics of the 2011 reform are the suppression of income eligibility conditions and the increase of the maximum loan amount for both existing and new housing. We can thus observe both expansionary (between 2010h2 and 2011 for example) and contractionary (between 2010h1 and h2 for new housing) movements of the IFL.

[4] See appendix A.1 for a detailed presentation of the tool and its reforms.

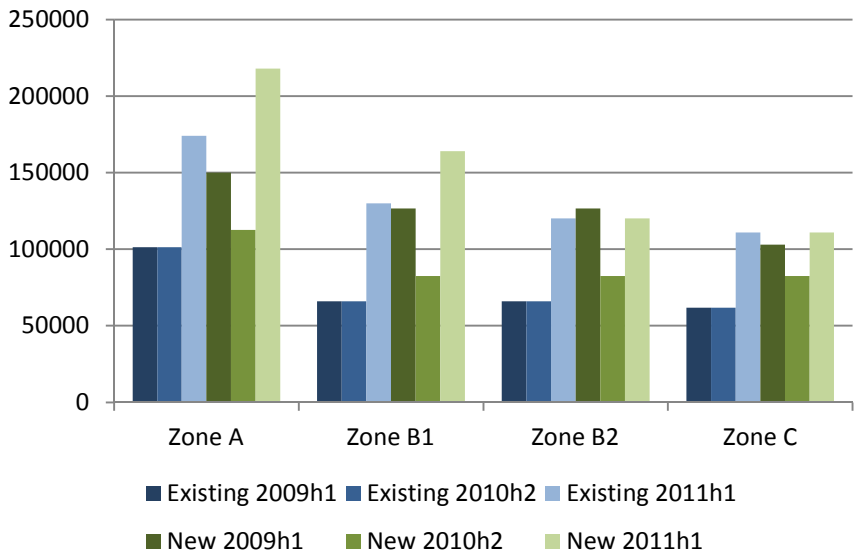


Figure 1 - Maximum IFL amount granted to two-people households.

Note: In 2009h1, a two-person household living in zone A and buying new housing could be granted a maximum IFL of 150 000€

2.2. Loan-level database

We use a loan-level dataset gathering insured loans granted by all major French banking groups. Characteristics of the loans and borrowers are available at origination. We observe the house location, at the ZIP-code level, our statistical unit in the paper unless stated otherwise. There are about 6000 ZIP codes in France.[5] We restrict the analysis to main residence financing[6] and focus on metropolitan France (excluding overseas departments and Corsica).
Figure 2 presents the number of operations through 2009-2011 We observe more than 470 thousands operations[7] over the period. The share of operations including IFL varies with eligibility conditions: 30% in 2009, 28% in 2010 and 42% in 2011.

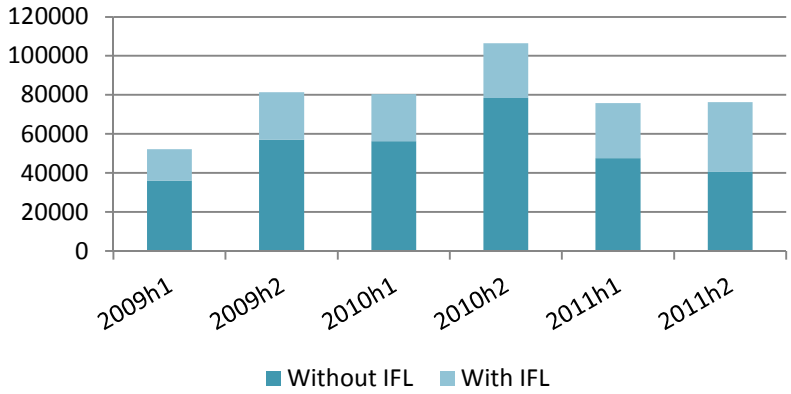


Figure 2 - New operations financing main residence observed, 2009-2011, metropolitan France

Source: banks data, authors' computation

[5] There are 36 000 municipalities. The biggest cities include several ZIP codes and one ZIP code can also include several small cities.
[6] We do not consider credit repurchase, except when associated with a new acquisition or construction. This case represents no more than 0.1% of the database.
[7] An operation is a set of loans destined to finance one real estate purchase.

Figure 3 presents loans and house prices for main residence financing as well as house prices for all kind of acquisition (including secondary residences and rental investment). House prices are not hedonic prices. Evolution of loans amount and real estate prices are parallel through the period. Except for a small decrease until the first semester of 2009, prices have increased continuously between 2009 and 2012. Main residences are on average more expensive than general real estate.

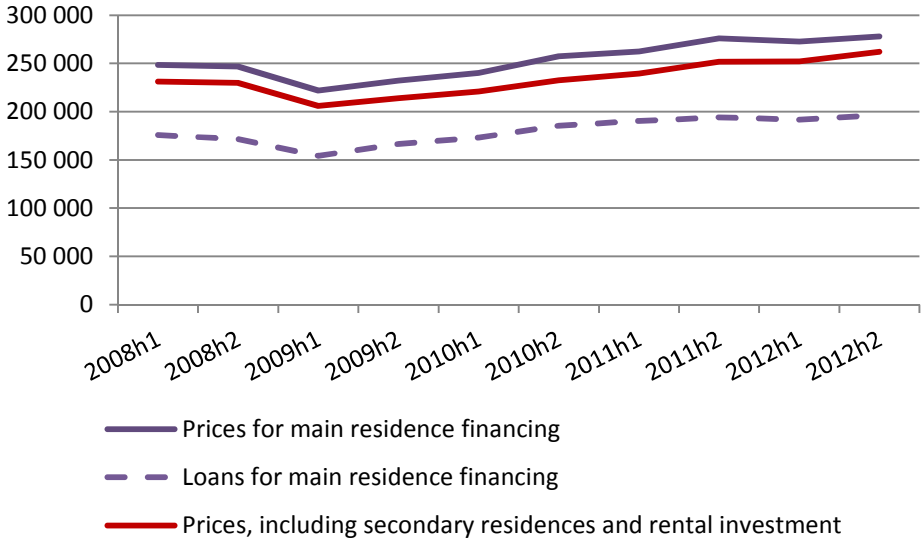


Figure 3 - Loans and Real Estate prices for main residence financing

Source: banks data, authors' computation

2.3. Additional data

We combine banks data with IFL regulation characteristics, fiscal income, housing characteristics and demographic data. IFL regulation characteristics data are extracted from regulatory texts (*Code de la construction et de l'habitation*). Fiscal income data are publicly available at municipality level and yearly frequency from the tax administration (DGFIP) dataset. Housing characteristics and demographic data are extracted from INSEE publicly available results of the 2011 census. Employment areas are extracted from INSEE databases.

3. Methodology

We present the specification and focus on two estimation issues: endogeneity of housing credit and prices and of the housing policy.

3.1. Specification

We first test the impact of the IFL reform on credit supply. We estimate $\beta^{(1)}$ in the following equation:

$$M_{z,t} = \beta^{(1)} IFL_{amount,z,t} + \gamma^{(1)} X_{z,t} + \mu_z + \lambda_{EA,t} + \varepsilon_{z,t} \qquad (1)$$

$M_{z,t}$ is the growth rate of the average amount of housing loans in ZIP-code z at semester t. $IFL_{amount,z,t}$ is the growth rate of the maximum IFL amount available in ZIP-code z at semester t (see next subsection for details). $X_{z,t}$ is a set of controls at the ZIP-code level, including the average age of the borrowers, the average down-payment rate (first difference) and the average debt-service-to-income ratio (first difference). We also include two lagged measures of income: average income in the

ZIP code (growth rate) and average income of observed borrowers in the ZIP code (growth rate). Income is directly reported in our loan-level database. This data source suffers from a selection bias as it captures income only of households who *did* buy a house. To be more representative of the whole ZIP-code hence of potential buyers as well, we also use tax administration data on reference taxable income at the municipality level. We compute the average income by tax household for each ZIP-code. We use both sources of data in our regressions to account for both the general wealth effect in the ZIP-code and of the income of selected borrowers. μ_z is a ZIP-code fixed effect. Considering growth rates and including ZIP-code fixed effects de-trends the variables, with ZIP-code specific trends. $\lambda_{EA,t}$ is an employment area specific time fixed effect. Employment zones are geographical areas, defined by the French National Statistical Institute ("Insee"), within which most inhabitants both reside and work and in which firms can find most of the labor required to fill available jobs. They are thus economically relevant zones. We cluster standard errors at the ZIP code level.

We then test for a direct link from maximum IFL amounts and house prices $P_{z,t}$ through the estimation of the reduced form equation:

$$P_{z,t} = \beta^{(2)} IFL_{amount,\ z,\ t} + \gamma^{(2)} X_{z,t} + \eta_z + \kappa_{EA,t} + \epsilon_{z,t} \qquad (2)$$

with μ_z is a ZIP-code fixed effect and $\kappa_{EA,t}$ an employment area specific time fixed effect.

We finally use IFL_{amount} as an instrument for *M* and estimate the elasticity of real estate prices to credit in the following instrumented equation, with (1) the first stage, ν_z is a ZIP-code fixed effect and $\iota_{EA,t}$ an employment area specific time fixed effect :

$$P_{z,t} = \beta^{(3)} M_{z,t} + \gamma^{(3)} X_{z,t} + \nu_z + \iota_{EA,t} + \varepsilon'_{z,t} \qquad (3)$$

Corresponding log-level estimations are presented in appendix A.4.

3.2. Endogeneity of credit and housing prices – Instrumental variable

Credit and prices are simultaneously determined. As prices were increasing the household may have negotiated a bigger loan. Or rather, as the bank has offered softer credit conditions the household may have bid higher. IFL variation at the municipality level and its 2009, 2010 and 2011 reforms provide an instrument to deal with this endogeneity. The very policy objective of the IFL makes it a relevant instrument for credit. By opening a credit line with zero interest, IFLs mechanically decrease credit costs, everything else equal.

We use the maximum IFL amount available in a ZIP-code as an instrument for credit, computed as:

$$IFL_{amount,z,t} = E_{z,t} * IFL_{existing,z,t} + \left(1 - E_{z,t}\right) * IFL_{new,z,t} \quad (4)$$

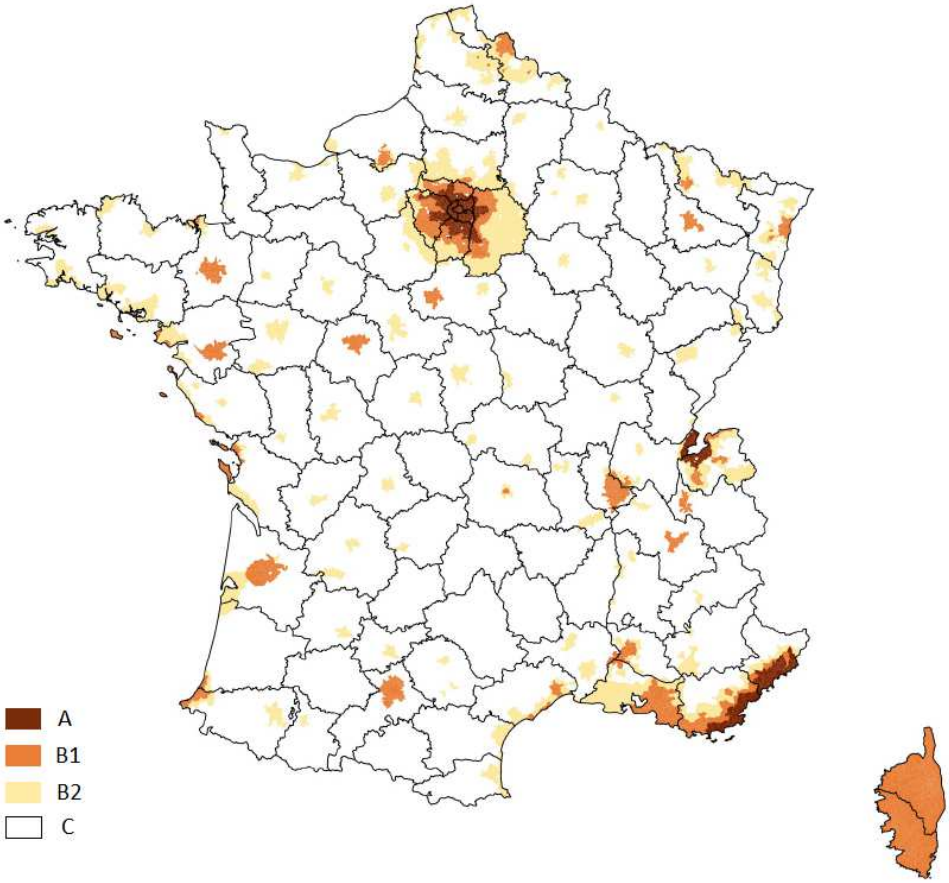
$IFL_{existing}$ and IFL_{new} are the maximum IFL amount for a two-person household[8] for existing housing and new housing, respectively. E_z is the share of existing housing in ZIP-code *z*. We can calibrate this parameter with two data sources. First, we compute the share of existing and new housing observed in each ZIP-code in our database. Between 2009 and 2011, existing housing accounts on average for 80% of transactions. The calibration fits perfectly the transactions we are observing but assumes that the choice between existing and new housing purchase is exogenous to the IFL policy. To test this assumption we also use 2011 census data to compute the share of main residences built more than two years ago (before 2009). Its average is equal to 97%. These data are

[8] We choose the amount for a two-person household to be consistent with the average size of households in France. Moreover, IFL amounts grow linearly going from the two-person household to 6+ household. There is no differentiated treatment of larger than two-person household across housing policy zones.

representative for the whole ZIP-code and not only effectively traded housing. As they are available for only one date, we use the variation in IFL maximum amounts and not of the weighting across time. We here implicitly assume there has been no significant change in the repartition between new and existing housing in each ZIP-code (construction was low between 2009 and 2011 and not significantly affected by the IFL policy). Both versions of the instrument - stock and transaction – are highly correlated (0.97). The weighting calibration is not a key determinant in our instrument variations.

3.3. Instrument exogeneity: sample selection

To foster homeownership, the policymaker accounts for local housing markets specificities. In France, the competent ministry[9] classifies each municipality into different areas. Each of the (about) 36 000 French municipalities belongs to one of four housing policy areas (A, B1, B2 or C; see Figure 4). This classification[10] depends on the balance between housing supply and demand in the area. The bigger the imbalance, the more generous is the housing policy instrument. [11] The largest cities, notably the Paris area, are included in the areas with the highest degree of public subsidy, consistently with the higher level of prices. The amount of the zero interest loan cannot exceed both 50% of the financing sources of the household and a threshold depending of the policy area. The income condition –e.g. the subsidy is granted only if income is below a certain amount- was relaxed in 2011 but reintroduced in 2012 in order to avoid anti redistributive effects.



[9] Ministère de l'Écologie, du Développement Durable et de l'Énergie

[10] The classification is revised at least every three years. Revisions took place in 1999, 2003, 2006, 2009 and 2011 (and 2014). The 2011 reform consisted in going from 3 (A, B and C) to 4 areas by splitting area B in areas B1 and B2. We here present the 2011 classification to be consistent with our dataset time coverage. Until the 2011 reform, there were only three zones, A, B and C but for the sake of simplicity, we present four zones throughout the period.

[11] This classification is notably used for rental investment policy purposes (*dispositif Scellier*). This policy has not been reformed during our period of interest (*dispositif Scellier* remained 'constant' between 2009 and 2012).

Figure 4 - Housing Policy Areas in France, 2011

This means the housing policy is endogenous to housing prices. As IFL conditions are conditional on house location, we cannot directly argue instrument exogeneity. We verify the higher the tensions in the area, the higher the prices (Figure 5).

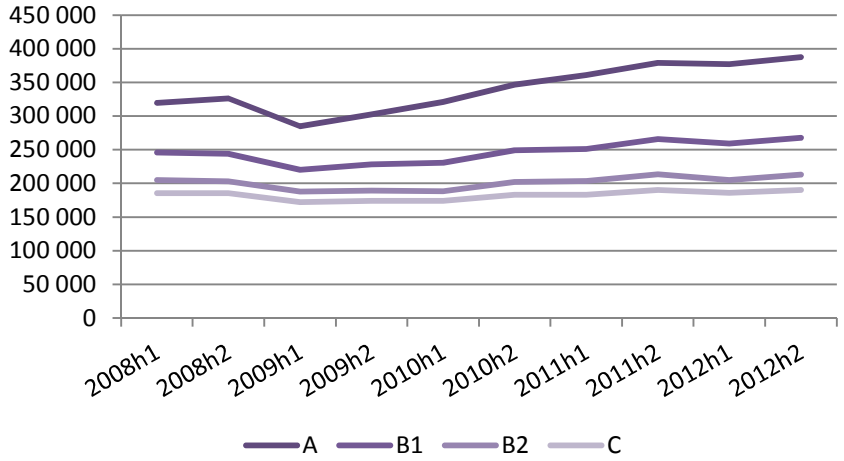


Figure 5 - Real estate prices evolution through time, according to the IFL area

We propose to deal with the endogeneity of housing policy using the limitations of the classification around borders. To classify the whole territory in only four categories, the ABC system creates borders generating threshold effects. The classification has to respect administrative limits even though housing markets delimitations do not necessarily fit municipalities' ones. The limitations of this classification are underlined in a 2012 audit (*Cour des comptes* (2012)[12]). For example, the 2009 revision allowed for reclassification but not declassification of municipalities. This asymmetric update jeopardizes the accuracy of the classification.

We restrict our study to municipalities around IFL zones borders. We represent this sampling in Figure 6. We consider two housing policy areas, green and white. The border between the two is the red line. Classification accuracy is limited around this red line. Dotted municipalities, around this border, are comparable housing markets receiving different IFL subsidies. We include only these dotted municipalities in our estimation sample. IFL amounts are exogenous instruments for these municipalities.

Regulation is defined at the municipality level, so we define borders between two IFL areas and adjacent units at the municipality level. Our data are available at the ZIP code level, but 6 000 ZIP-codes correspond to 36 000 municipalities. We exclude from our sample ZIP-codes including municipalities from different IFL areas. This excludes 573 ZIP codes from our sample (see appendix A.2).[13]

The sample of bordering ZIP codes is not representative for whole France. Table 1 presents average value of some variables for both whole France and ZIP codes in our estimation sample. On average, borrowers' in bordering ZIP codes are richer and buy houses more expensive. They are slightly younger than whole France borrowers. This is consistent with the sampling, which leads to focus on ZIP codes in or close to the most dynamic housing markets.

[12] The *Cour des comptes* is a body of the French Administration in charge of financial and legislative auditing of public institutions.

[13] Our sample includes 5 252 municipalities for growth rates estimations, 10 980 municipalities for level estimation, 6 249 municipalities for level estimation with house size control and 6 396 municipalities in our loan-level estimation.

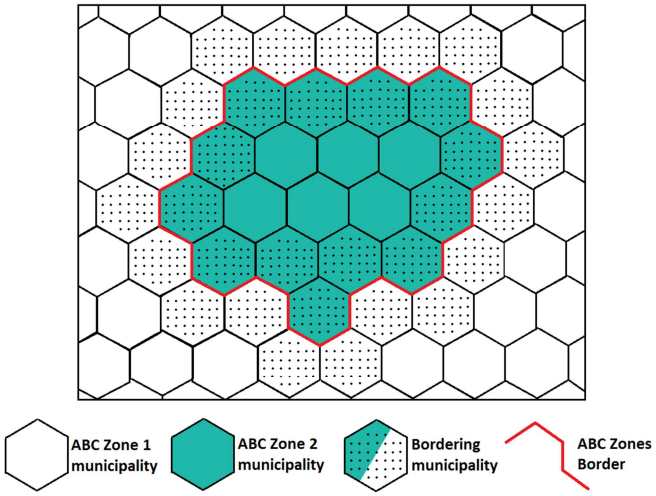


Figure 6 - Selection of ZIP codes adjacent to an IFL border

Note: Each hexagon represents a municipality. Green municipalities are in a given ABC zone while white ones are in a different zone. The so-formed ABC border is delimited in red. We restrict the analysis to bordering municipalities when considering only shaded municipalities.

We verify municipalities around IFL borders are comparable. To do so, we use ABC zones to define housing market areas across France. We isolate each of the housing market zones we can see in Figure 4, keeping only ZIP-codes along each border, both *inside* and *outside* the zone. We form 78 conglomerations that allow us identifying similar local economic conditions. We compare *inside* and *outside* ZIP-codes for each conglomeration.

	Price (k€)	**Income (k€)**	**Age**
Whole France	199 (95.6)	38 (18.7)	37.9 (6.7)
Bordering ZIP codes	222 (83.3)	40 (19.0)	37.4 (5.4)

Standard deviation in parentheses. Income is borrowers' income.

Table 1 – Descriptive statistics: whole France and bordering ZIP codes

Results are presented in Table 2. We compute:

- the percentage difference between outside and inside average price (log, percentage of inside average price),
- a dummy for the maximum price being observed in an outside ZIP-code,
- a dummy for the average price in outside ZIP codes being bigger than in inside ones.

On average, the price difference between inside and outside bordering ZIP codes is less than or equal to 0.4% of prices of inside ZIP codes between 2009 and 2011. Across the period, in 62% to 76% of housing market areas, the maximum price was observed in an outside ZIP-code. In about 45% of housing market areas, average mean price was higher in outside ZIP-codes than in inside ones. For both inside and outside ZIP codes, the share of existing housing is 97%.

To verify the bordering selection ZIP codes dampens the dependence between housing policy and prices, we compare ABC zones fit for whole France and our sample limited to bordering ZIP-codes. We model housing prices as a function of the ABC zones (classes) and perform an analysis of variance (for 2009). R square (ratio of explained to total variances) drops by 40% when going from whole France to bordering ZIP-codes. The ratio of inter-class to intra-class variance (corrected by degrees of freedom, IV F statistic), that is a measure of class homogeneity drops by more than 80% when going

from whole France to bordering ZIP-codes. ABC zones are much more heterogeneous when focusing on bordering ZIP-codes than when considering whole France.

		2009	2010	2011
Price	**Mean (%)**	-0,38	-0,40	-0,35
	s.d.	1,18	1,66	1,47
Maximum		71%	62%	76%
Mean		44%	47%	44%

Table 2 – Comparability of *inside* and *outside* ZIP codes

Note: In 2009, on average, prices in outside ZIP-codes were 0.38% lower than in inside ones. In 71% of housing market areas, the maximum price was observed in an outside ZIP code and for 44% the maximum average price was observed in an outside ZIP code.

4. Empirical results

We test the IFL effects on credit supply and use these as instrument for credit in subsection 1. We underline the IFL shock is a supply side one in subsection 2. Subsection 3 focuses on credit conditions and homeownership.

4.1. Housing credit and prices

Table 3 presents our results for the reduced forms. In column 1, we test the impact of credit on prices on the sample of bordering municipalities but without instrumentation. Spontaneously, a 1 bp increase in credit growth leads to a 0.8 bp house price growth increase. In column 2, we test for a direct effect of growth in IFL amount on house prices. We find a statistically weak positive relationship. The down payment rate and the borrowers' age are key control variables, both positively associated with house prices.

Table 4 presents results for the instrumented specification. We find a significant positive relationship between IFL amount and credit. An increase in IFL growth of 1 bp yields a growth of credit increase by 0.3 bps. The first stage of the estimation has a good fit, R square is equal to 25%. Stock, Wright and Yogo (2002) recommend the F stat should be above 10 for the estimates to be reliable. Our IV F statistic does not point to weak effects, following their criteria. We find an increase of the growth rate of credit by 1 bp increases the growth rate of housing prices by about 0.4 bp. This credit channel accounts for about 44% of house price growth movements.

We now verify we do not identify our effect using transaction weighted variance. We directly include the share of existing housing, used in our IV computation in our equations (column 2). The IV F stat suggest weak IV issue (the IV F stat being lower than 10). We thus also run the estimation with the LIML estimator (column 3). Results are consistent across estimation methods. This reduces concerns that our results are biased by a weak IV. Results indicate a slightly higher elasticity: an increase of the growth rate of credit by 1 bps increases the growth rate of housing prices by about 0.5 bps.

For the US, Favara and Imbs (2015) estimate the housing prices growth rate elasticity to the growth rate of credit is 0.12 at impact and peaks two-year after the shock at 0.2.[14] They include lagged house price in their estimation, which we cannot do due to the reduced time dimension of our sample. As lagged and contemporaneous values of house prices growth are positively correlated, this may create a positive bias in our estimation. But these differences are consistent with differences in housing supply elasticity. Sánchez and Johansson (2011) compare this parameter across OECD countries and

[14] Kelly et al. (2015) find reduced-form loan-level elasticities of between 0.15 and 0.2 for Ireland.

conclude it is higher in North America than in Europe. France has amongst the lowest housing supply elasticity (about 0.3 when it is higher than 2 for the US - about 7 times higher).

2010h2-2011	House prices	
	(1)	(2)
Credit	0.782***	
	(0.031)	
IFL amount		0.122*
		(0.064)
Down payment	1.141***	0.408***
	(0.058)	(0.055)
DSTI	0.072	0.001
	(0.058)	(0.095)
Borrowers' Age	0.003**	0.006**
	(0.001)	(0.003)
Borrowers' income	0.008	-0.024
	(0.006)	(0.017)
ZIP code average income	-0.097	-0.266
	(0.125)	(0.315)
Observations	3,461	3,461
Absorbed	EA*time ZIP code	EA*time ZIP code
Cluster	ZIP-code	ZIP-code

Table 3– Reduced form. Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Constant and fixed effects included but not reported.

2010h2-2011	(1)	(2)	(3)
First stage: Credit (growth rate)			
IFL amount - growth rate	0.280***	0.211**	0.211**
	(0.085)	(0.085)	(0.085)
Existing houses (% - first difference)		-0.061	-0.061
		(0.039)	(0.039)
Second stage: Housing Prices (growth rate)			
Credit - growth rate	0.437***	0.503**	0.503**
	(0.162)	(0.223)	(0.223)
Existing houses (% - first difference)		0.017	0.017
		(0.036)	(0.036)
Observations	3,461	3,461	3,461
Absorbed	EA*time ZIP code	EA*time ZIP code	EA*time ZIP code
Cluster	ZIP-code	ZIP-code	ZIP-code
Est	2SLS	2SLS	LIML
R2 first	0.252	0.253	0.253
IV F stat	10.83	6.220	6.220

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code and employment zone*time fixed effects included but not reported. Controls include the down payment rate (first difference), the debt service to income ratio (first difference), the borrowers' age, the borrowers' income (growth rate) and the ZIP code average income (growth rate).

Table 4 – Instrumentation 2010-2011

Another source of bias is the difference between IFL eligible and non-eligible borrowers. The estimate would be biased if the whole distribution of borrower types is included in the credit and price measures but not in the instrument and the elasticity parameter is not homogenous across the

population. First, for the whole year 2011, there is no income related eligibility condition. We perform our estimation at the ZIP-code and not the borrower level. In the previous IFL regime, households were eligible until their income represented 130% of average fiscal income in zones B/C and 150% in zone A (see appendix 1). A sizeable share of income distribution is thus IFL eligible. Above all, we consider prices and credit irrespective of the IFL eligibility criteria, which alleviates this potential bias.[15]

4.2. Robustness tests: a supply side shock

We show in this subsection our IV captures a supply side shock. There are two demand channels which could affect our estimations. First, the IFL subsidy can affect house location choices. Borrowers can choose to buy in municipalities with the highest subsidy. Second, IFL may be bigger because housing demand is higher. Higher demand incentivises local representatives to actively require bigger subsidies. In both cases, the price increase we find where IFL subsidies are higher would be demand driven.

To verify our results are not driven by house location choices, we exclude from our estimation sample *inside* ZIP codes. House location can be marginally affected by the IFL subsidy. Borrowers can easily choose to prefer the bordering ZIP code with higher subsidy. But it is unlikely they choose a different region because of the subsidy. For each border between two IFL areas, we thus use only bordering ZIP codes in the lowest subsidy zone (outside ZIP codes). Estimation now relies on IFL variation across IFL areas, but only for lowest subsidy zones for each border. Results are presented in table 5. The estimated elasticity between housing prices and credit is not significantly different from previous estimates. As the sample is reduced, even if the first stage R square is still high, the F stat points to weak instrument issues. But results are left unchanged if using a LIML estimator.

We propose another robustness test for the second channel, demand-induced subsidy increase. The IFL policy is decided at the national level. The relevant ministry is responsible for the classification of municipalities into ABC areas. Once this classification is established, it is submitted to regional authorities for validation (*Cour des Comptes* (2012)). There is thus no direct involvement of municipalities into the reforms. They can only indirectly influence their classification.
To verify our results are not driven by demand driven classification, we use the 2011 reclassification of municipalities. Until then, there were only three areas, A, B and C. C is the default category. C municipalities cannot be suspected of demand driven reclassification. Category B was split into B1 and B2. We can think of B1 municipalities as reclassified ones, while B2 municipalities remained in the same category. Indeed, B2 municipalities are treated as C municipalities for some IFL characteristics, as B ones used to be. To consider only municipalities least suspect of demand driven IFL subsidies we perform our estimation on ZIP-codes around a B2/C border only. Results are presented in table 5. We still find a significant positive relationship between the IFLs and credit. Our elasticity of house prices to credit is not significantly different from previous estimates. Again, even if the first stage R square is still high, the F stat is below 10. When we use the LIML estimator, results are left unchanged.

[15] We also try to modify the instrument to account for different effects according to the share of eligible households in each ZIP code. We use fiscal administration (DGFIP) data on the repartition of households in different income buckets to proxy for the share of households IFL eligible each year. We compute the new instrument as:

$$IFL_{eligibility,z,t} = Share\ of\ eligible\ households\ x\ IFL_{amount,z,t}$$

Results are left unchanged by this modification.

2010h2-2011	(1)	(2)	(3)	(4)
First stage: Credit				
IFL amount	0.411***	0.411***	0.262*	0.262*
	(0.140)	(0.140)	(0.158)	(0.158)
Second stage: House Prices				
Credit	0.542***	0.542***	0.685***	0.685***
	(0.208)	(0.208)	(0.262)	(0.262)
Observations	1,995	1,995	1,530	1,530
Absorbed	EA*time ZIP code	EA*time ZIP code	EA*time ZIP code	EA*time ZIP code
Cluster	ZIP-code	ZIP-code	ZIP-code	ZIP-code
Est	2SLS	LIML	2SLS	LIML
Sample	B2/C	B2/C	Outside	Outside
R2 first	0.226	0.226	0.205	0.205
F stat	8.608	8.608	2.735	2.735

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code and employment zone*time fixed effects included but not reported. Controls include the down payment rate (first difference), the debt service to income ratio (first difference), the borrowers' age, the borrowers' income (growth rate) and the ZIP code average income (growth rate).

Table 5 – Robustness tests

4.3. IFL and borrowers' selection – analysis of the LTV ratio

We test whether the IFL policy allows new households on the credit market. It eases credit to spur home-ownership. By creating a credit line with zero interest, the IFL affects the debt to income (DSTI) ratio as well as the loan to value (LTV) ratio. Banks monitor these credit standard ratios to make credit allocation decisions. An increase in IFL is analogous to a loosening of credit standards. This loosening can allow new households on the credit market.

We observe households which did manage to enter the housing credit market. We know borrowers' incomes. We also know average fiscal income in each ZIP-code. The percentage difference between borrowers' income and average income in each ZIP-code is our proxy for credit market selection. This is an imperfect measure. Average fiscal income includes homeowners who entered the credit market some periods ago or did not need a loan. These homeowners are certainly older and richer than new borrowers. To this extent, our proxy underestimates housing credit market selection.

Figure 7 graphs the evolution of both incomes – average (disposable or fiscal) income in the population and real estate borrowers' income – through time. Borrowers' income is on average 45% higher than average fiscal income in 2010-2011. This is consistent with the 41% difference documented for 2010 in Arrondel et al. (2015). Real estate borrowers' income has been higher than median and average incomes since 2001. But the difference between real estate borrowers' income and average income has significantly widened through time. In 2001, borrowers' income was about 3% higher than average disposable income. In 2012, it is 25% higher. As a comparison, in the Euro Area, owners with mortgage have an average *disposable* income 39% higher than the whole population of households (HFCN (2013)). In the US, Adelino et al. (2015) find a 80% difference between average household income and average homebuyers income.

We study how credit market selection reacts to changes in LTV. We use IFL reforms as exogenous source of variation. We estimate the following equations:

$$LTV_{i,z,t} = \beta^{(4)} IFL\ amount_{z,t} + \gamma^{(4)} X_i + \rho_z + \xi_i \qquad (4)$$

$$Income\ difference_{i,z,t} = \beta^{(3)} LTV_{i,z,t} + \gamma^{(3)} X_i + \rho'_z + \xi_i \qquad (5)$$

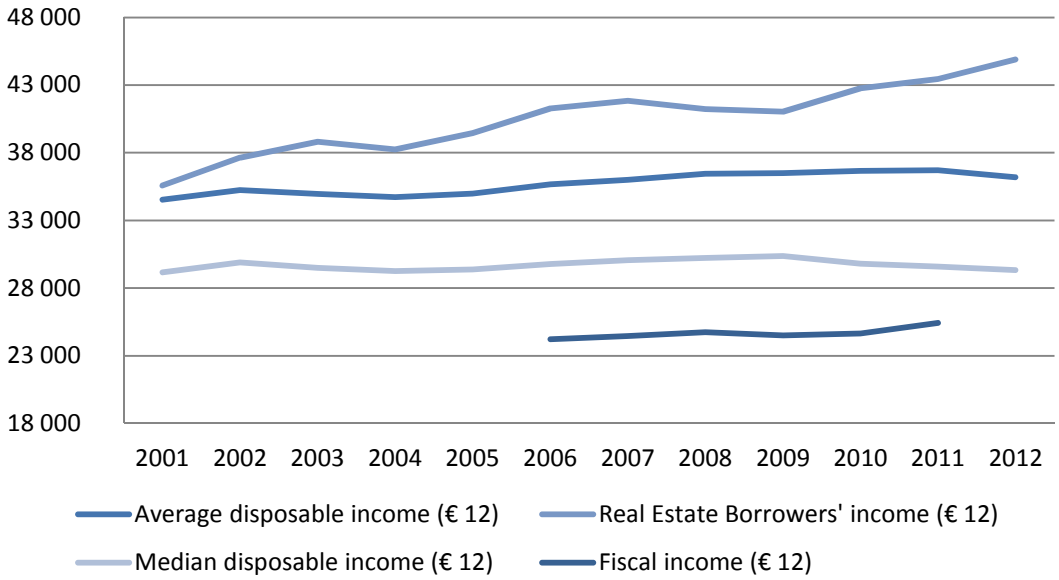


Figure 7 – Average income and Real Estate Borrowers' income – 2001-2012

$Income\ difference$ is the positive percentage difference between borrowers' income and the average income. We exclude negative values from the estimation sample, observed in rich ZIP-codes, due to interpretation issues. We apply a logit transformation to this variable. $LTV_{i,z,t}$ is the LTV of household i, in ZIP-code z, at date t. X_i is a vector of controls including maturity at origination, the age of the borrowers, the *aggregate* interest rate and the PD rating. ρ_z and ρ'_z are ZIP-code fixed effects. We estimate these equations using loan-level observations to avoid masking individual heterogeneity by averaging at the ZIP code level. We cluster the variance-covariance matrix at the ZIP-code level. We use (4) as a first stage to instrument $LTV_{i,z,t}$ in (5).

2010h1-2011h1	**Income difference >0 (logit)**					
	(1)	(2)	(3)	(4)	(5)	(6)
LTV	1.965***	1.983***				
	(0.138)	(0.146)				
IFL amount (stock)			-0.147***	-0.155***		
			(0.038)	(0.038)		
IFL amount (transaction)					-0.148***	-0.157***
					(0.041)	(0.041)
Borrowers' Age	0.013***	0.012***	0.001	0.006***	0.001	0.006***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Interest rate (%)	-0.197***	-0.199***	-0.149**	-0.137**	-0.133*	-0.119*
	(0.066)	(0.066)	(0.069)	(0.069)	(0.070)	(0.070)
PD rating	-0.014	-0.010	0.189***	0.162***	0.189***	0.162***
	(0.018)	(0.018)	(0.013)	(0.014)	(0.013)	(0.014)
Maturity		-0.004		0.015***		0.015***
		(0.003)		(0.002)		(0.002)
Observations	30,646	30,646	30,655	30,655	30,655	30,655
R-squared	0.126	0.126	0.080	0.082	0.080	0.081
Cluster	ZIP code	ZIP code	ZIP code	ZIP code	ZIP code	ZIP code

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects included but not reported.

Table 6 – Reduced form, homeownership accession – 2010h1-2011h1

Table 6 presents results for the reduced forms. Spontaneously a higher LTV is associated with a stricter credit market selection (columns 1 and 2). There is certainly an endogeneity bias as richer borrowers can be granted a bigger loan. ZIP-codes with bigger amounts of IFL have smaller income differences between borrowers and other inhabitants (columns 3 to 6).

Table 7 presents results for the instrumented estimations. The IFL amount has a significant and positive impact on the LTV, whatever its measure. The F-stat is above 10 when not controlling for maturity at origination and is equal to about 7 when controlling for it. Results are similar if using a LIML estimator. The second stage shows an exogenous increase in the LTV ratio reduces housing credit market selection. The size of the effect increases when we control for maturity at origination. Exogenously increasing LTV by 1 ppt reduces the difference between borrowers' and average income by 1 bps.

2010h1-2011h1	(1)	(2)	(3)	(4)
First stage		**LTV**		
IFL amount (census)	0.017***	0.012***		
	(0.004)	(0.004)		
IFL amount (bank)			0.018***	0.012***
			(0.005)	(0.005)
Borrowers' Age	-0.006***	-0.004***	-0.006***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
Interest rate (%)	-0.013	-0.005	-0.015*	-0.007
	(0.008)	(0.008)	(0.008)	(0.008)
PD rating	0.103***	0.087***	0.103***	0.087***
	(0.002)	(0.002)	(0.002)	(0.002)
Maturity at origination		0.009***		0.009***
		(0.000)		(0.000)
Second stage		**Income difference > 0 (logit)**		
LTV	-8.670**	-12.889**	-8.217**	-12.769**
	(3.384)	(5.929)	(3.316)	(6.141)
Borrowers' Age	-0.054**	-0.041*	-0.051**	-0.040*
	(0.022)	(0.021)	(0.021)	(0.022)
Interest rate (%)	-0.259**	-0.204	-0.257**	-0.204
	(0.108)	(0.131)	(0.105)	(0.130)
PD rating	1.082***	1.279**	1.036***	1.269**
	(0.348)	(0.511)	(0.341)	(0.530)
Maturity at origination		0.137**		0.136**
		(0.057)		(0.059)
Observations	30,646	30,646	30,646	30,646
Cluster	ZIP code	ZIP code	ZIP code	ZIP code
R2 first	0.204	0.241	0.204	0.241
IV F stat	15.13	7.872	14.97	7.253

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects included but not reported.

Table 7 – Instrumented specification, homeownership accession – 2010h1-2011h1

5. Conclusion

We use the IFL policy as an instrument for credit to trace its impact on house prices and homeownership. Our identification strategy is based on the fact that the subsidy varies at the municipality level and has been reformed three times between 2009 and 2011. We handle endogeneity

between housing prices and policy by sampling municipalities bordering administratively defined policy areas.

Using a loan-level dataset, we find that IFLs induce a positive housing credit shock, channeled into housing prices. We find a high elasticity of housing prices to housing credit when we instrument the latter variable by the IFL, between 0.4 and 0.7 depending on the estimation strategy. We show our estimates are not driven by demand dynamics. We also test for the effect of credit conditions on homeownership. We approximate credit market selection by the difference between borrowers' and average income. We find an exogenous – IFL induced – increase in LTV reduces credit selection.

Further research could consider the role of banks in the transmission of the IFL subsidy. With interest rates data, it would be possible to test whether banks can capture part of the subsidy. With default history, we could test if subsidised loans are riskier than average loans. On the housing sector side, further research could assess the effect on homebuilders in zones where land is available. Indeed, the IFL favours new over existing housing. Home building is very interesting to favour economic activity. This sector is labour intensive, cannot be outsourced and uses inputs mostly locally produced. Construction data would allow testing how homebuilders benefit from the subsidy depending on land availability.

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Appendix

A.1. Prêt à Taux Zéro

Prêt à Taux Zéro : general framework

First-time buyers are defined as households that have not owned their residence during the last two years. Eligibility depends on the resources of the persons that will live in the residence, the number of persons to live in the residence and its location (see table A.1.1). Households' resources are measured by the sum of reference fiscal income of people that will live in the house, capped by 10% of the total cost of operation. The reference fiscal income (*revenu fiscal de référence*) is computed by fiscal administration using declared net income and capital gains for income taxes of the precedent year. Income and capital gains are increased by some exempted revenues, rebates or deductible charges. The cost of operation includes the costs of the house, the land, negotiation fees except registration fees (*acte notarié*), refurbishment costs, construction taxes and insurance costs.

The amount of the loan is the minimum of 20% of the cost of the operation and 50% of the amount of other loans used for the financing of this operation. The 20% of the cost of the operation are themselves capped by an amount function of the number of persons to live in the residence, location of the residence and its being new or existing. Maximum amounts are higher for new housing than for existing ones. One IFL only can be granted per operation.

# people	Zone A	Zones B and C
1	31 250 €	23 688 €
2	43 750 €	31 588 €
3	50 000 €	36 538 €
4	56 875 €	40 488 €
5 +	64 875 €	44 425 €

Table A.1.1 – Households' size and resources conditions for IFL eligibility 2005-2010

Source: Article R318-29 livre 3-1-VIII du code de la construction et de l'habitation, modifié par décret 2007-464 du 27/3/2007 - article 1 JORF, mars 2007.
Note: Two-person households buying in Zone A are eligible to IFL if their reference fiscal income is lower than 43 750 €.
The 2011 reform builds on former versions of the IFL while suppressing the fiscal deduction of housing loans interest and the possibility to separate the loan for the house and the land (Pass-Foncier). The two main characteristics of the 2011 reform are the suppression of any resource condition for eligibility and the increase of the maximum loan amount (see Table A.2.1). A penalty for housing with poor energetic performance is also created.

The 2011 version of the IFL has been heavily modified for 2012 by the reintroduction of resources conditions for eligibility[16], detailed in table A.1.2[17].

Prêt à Taux Zéro : successive reforms

Prêt à Taux Zéro reforms can shape its characteristics along three types of criteria, detailed for each reform in table A.1.4:

[16] Code de la construction et de l'habitation, partie législative, livre III, titre 1er, chapitre 10, section 1, article L31-10-3 modifié par loi n°2011-1977 du 28 décembre 2011.
17 After this reform, resource conditions are further reinforced in December 2012. Further modifications are minor and focus mainly on energetic performance. A more important reform is to be implemented in end 2014.

1. **Eligibility conditions**: the share of the income distribution below the maximum income and how it varies with the ABC zones and the size of the household, existing or new housing eligible
2. **Loans financial characteristics for the borrower**: the share of the operation that can be funded by the IFL, the maximum amount of the IFL, how the loan has to be insured, its repayment scheme
3. **Loans financial characteristics for the bank**: the bank is compensated for the absence of interests by fiscal deductions indexed on a rate depending on the French bond rate

# people	Zone A	Zone B1	Zones B2 and C
1	43 500 €	30 500 €	26 500 €
2	60 900 €	42 700 €	37 100 €
3	73 950 €	51 850 €	45 050 €
4	87 000 €	61 000 €	53 000 €
5	100 050 €	70 150 €	60 950 €
6	113 100 €	79 300 €	68 900 €
7	126 150 €	88 450 €	76 850 €
8+	139 200 €	97 600 €	84 800 €

Table A.1.2 - Resources conditions for IFL eligibility in 2012

Source: JO 31/12/2011, décret 2011-2059 relatif aux prêts ne portant pas intérêt consentis pour financer la primo-accession à la propriété
Note: Households living in Zone A constituted by 2 persons are eligible to IFL if their reference fiscal income is lower than 60 900 €

Contrary to other tool based on the ABC areas such as rental investment policy, the IFL policy covers the whole territory, although with different conditions across zones. The highest are the tensions on the housing market, the less restrictive are the eligibility conditions based on income and the more generous is the tool. The choice of being less restrictive in zones with the highest market tensions is not obvious. Indeed, from a housing planning perspective it may be defended to subsidize more places where tensions are less important. This would help shifting demand towards less constrained markets and ease tensions on the most constrained ones. The approach preferred here looks like aiming at offering a same level of subsidy throughout the territory. It goes also against urban sprawl.
Making conditions an increasing function of the size of the household can be justified by two elements. This is a way to proxy the housing needs of each household, that do increase with household's size. This is also consistent with family policy.
Deciding to consider existing housing depends on whether the policy-maker wants to spur only home-ownership or also to favor construction. Opening to existing housing was done in 2005 and stopped in 2012. In France, the accent is generally laid on housing construction deficit (500 000 housing units per year[18]). Hence, even when the tool is opened to both existing and new housing, subsidies are bigger for the latter type. This ensures credit-worthy demand for housing builders. For the period 2008-2011, between 30 and 37% of operations funded by a IFL were for new housing (see table A.1.3)[19]. The 2009 reform and the emphasis it laid on new housing (both increase in maximum amounts and on the share of the operation that can be covered by the IFL) increased this share by 2.5 ppt the first year and 3.2 ppts the second year, even though conditions were less generous then. It was effective in raising

[18] The last policy to spur building is names '*Objectifs 500 000'*, 'Objective 500 000'.
[19] In our database, about 25% of operations are in new housing. But this cannot be used to argue the IFL distorts operations towards new housing because IFL is targeted at first-time buyers and eligibility conditions are less restrictive for new housing.

the subsidy rate in each zone (see table A.1.5). For example, it increased by 11 ppts in zone A and 10 ppts in zone C.
The interest-free loan policy is not targeted at the poorest households. In 2009, the average income by tax home was 25 000 € considering both zones B and C and 30 000 € in zone A[20]. Considering the condition for a two-person household, households were eligible in 2009 until they made 146% of average income by tax home in zone A and 126% in zones B/C. In 2011, the average income by tax home was 33 000 € in zone A, 32 000€ in zone B1 and 26 000 € in zones B2 or C. In 2012, households were eligible until 185% of the average income in zone A, 133% in zone B1 and 143% in zone B2/C. Income eligibility conditions are thus not responsible for the sharp decrease of the number of IFL in 2012 but rather the restriction to new housing.

	2008	**2009**	**2010**	**2011**	**2012**
Average IFL	15 400€	21 810€	22 380€	25 000€	32 700€
New housing in IFL	30.7%	33.3%	36.5%	26.4%	99.5%
Average income	28 920€	30 120€	30 000€	35 400€	34 700€
IFL in operation cost	10.5%	14.6%	14.9%	13.6%	17.1%

Table A.1.3 - Summary statistics for the Prêt à Taux Zéro (IFL) between 2008 and 2012, on the whole territory.

Source: SGFGAS and authors' computations
Lecture: In 2008, the average IFL granted was 15 400€, the average borrower had an income of 28 920€ and its IFL accounted for 10.5% of its operation cost. 30.7% of transactions were for new housing.

We notice the 2009 reform on new housing was not homogenous across zones (table A.1.4). Before 2009, B and C zones received the same maximum amount but when doubling this amount for new housing, the policymakers have chosen to favor zone B over zone C. The former maximum amount was increased by 2.3 when in the latter zone the increase was only by 1.9. This can be understood in a cost management perspective, as zone C represented about 50% of transactions before the reform (2008, see table A.1.5).
The 2011 reform did not increase amounts homogenously neither. In zone A, with represented about 17% of IFLs in 2010, the maximum loan for existing housing increased by 70% and was almost doubled for new housing. In zone B1, with represented another 17% of IFLs in 2010, amounts were almost doubled for both existing and new housing. In zone B2 and C, the distinction between new and existing housing has been removed. By construction, the increase of the subvention is then much more important for existing than for new housing (about 80% for existing housing in both zones, 35% for new housing in zone B2 and 35% in zone C).
As the 2011 reform of the maximum amounts is combined with a reform of the constraints on the share of the operation costs that can be covered by the IFL its impact on the effective subsidy rate is not straightforward. Before 2011, the IFL parameters took into account the urban policy objective through the subsidy rate. Indeed, the maximum share of operation cost covered by the IFL was raised in tax-free zones and sensitive urban areas, both types of municipalities being considered as priorities. Since 2011, this parameter accounts rather for the energetic policy and varies across ABC zones. Consequently, the effective subsidy rate (tables A.1.3. A.1.4.) did not necessarily increase for all market segments. In zone C for example, the subsidy rate increased by more than 2 ppts for existing housing but sharply decreased for new housing, as 76% of transactions could not benefit from the maximum subsidy because of energetic conditions (SGFGAS (2012)).

[20] These data are not available for 2008 and not yet for 2012.

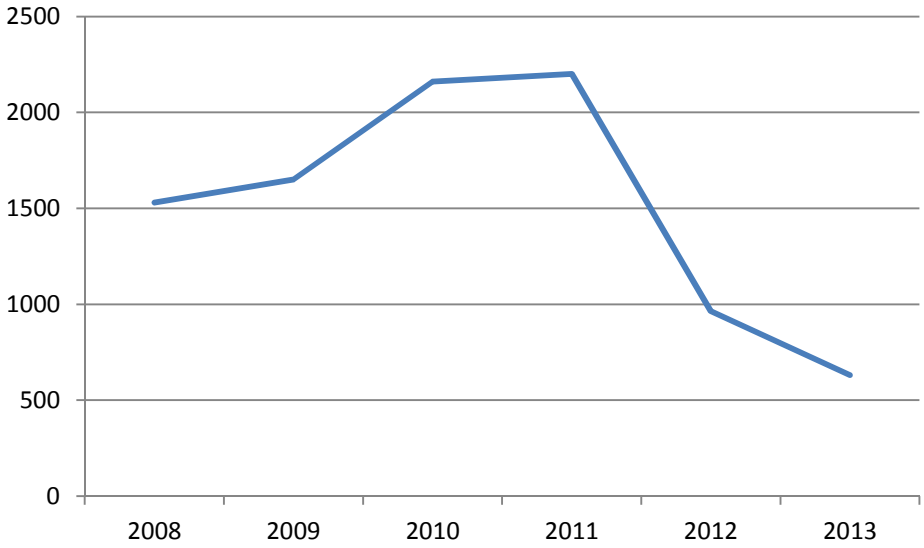

Figure A.1.1 – IFL subsidies (million €) Source: SGFGAS

<table>
<tr><th colspan="5">IFL characteristics</th><th>2008</th><th>2009 - 2010h1</th><th>2010 h2</th><th>2011</th><th>2012-2014</th></tr>
<tr><td rowspan="5">Eligibility conditions</td><td rowspan="4">Income condition:</td><td>A</td><td colspan="3">43 750 €</td><td rowspan="4">No condition</td><td>60 900 €</td></tr>
<tr><td>B1</td><td colspan="3" rowspan="3">31 588 €</td><td>42 700 €</td></tr>
<tr><td>B2</td><td rowspan="2">37 100 €</td></tr>
<tr><td>C</td></tr>
<tr><td colspan="2">Household size</td><td colspan="5">The bigger is the household, the less restrictive the eligibility conditions based on income.</td></tr>
<tr><td colspan="2">Housing type</td><td colspan="4">Both new and existing housing are covered.</td><td>New housing (existing only social</td></tr>
<tr><td rowspan="11">Financial characteristics for the borrower</td><td rowspan="2">Subsidy rate</td><td colspan="2">Maximum share of operation cost</td><td>20%
30 % for tax-free zones and sensitive urban areas</td><td colspan="2">Existing: 20% - New: 30%

In tax-free zones and sensitive urban areas : Existing: 30% - New: 40%</td><td>Existing: 20%
New: between 25 and 40% according to ABC zones
Lowered if energetic conditions not met</td><td>New: between 24 and 38% according to ABC zones

Lowered if energetic conditions not met on new housing</td></tr>
<tr><td colspan="2">Max. share of amount of other loans</td><td>50%</td><td colspan="2">50% for existing housing
100% for new housing</td><td colspan="2">100%</td></tr>
<tr><td rowspan="10">Max. amount

(E = existing, N = new)</td><td rowspan="2">A</td><td>E</td><td>101 250€</td><td>101 250€</td><td>101 250€</td><td colspan="2">174 000€</td></tr>
<tr><td>N</td><td>112 500€</td><td>150 000€</td><td>112 500€</td><td colspan="2">218 000€</td></tr>
<tr><td rowspan="2">B1</td><td>E</td><td colspan="3">66 000€</td><td colspan="2">130 000€</td></tr>
<tr><td>N</td><td>82 500€</td><td>126 500€</td><td>82 500€</td><td colspan="2">164 000€</td></tr>
<tr><td rowspan="2">B2</td><td>E</td><td colspan="3">66 000€</td><td colspan="2" rowspan="2">120 000€</td></tr>
<tr><td>N</td><td>82 500€</td><td>126 500€</td><td>82 500€</td></tr>
<tr><td rowspan="2">C</td><td>E</td><td colspan="3">61 875€</td><td colspan="2" rowspan="2">111 000€</td></tr>
<tr><td>N</td><td>82 500€</td><td>103 000€</td><td>82 500€</td></tr>
<tr><td colspan="2">Repayment schemes</td><td>The repayment scheme allows a deferred payment for a fraction of the loan that is decreasing in the household’s income</td><td colspan="4">The repayment scheme allows a deferred payment for a fraction of the loan that is decreasing in the household’s income but increases with the ABC zone and is higher for new than for existing housing.</td></tr>
<tr><td colspan="5">Financial characteristics for the bank</td><td colspan="5">Fiscal deductions compensate for the loss of earnings and its opportunity cost using a rate indexed on the French government bond rate.</td></tr>
</table>

Table A.1.4 – Key points of each *Prêt à Taux Zéro reform*. Maximum amounts and income condition are for a two-person household.

Source: Code de la construction et de l’habitation
Lecture: In 2008, in zone A, two-person households were IFL eligible until an income of 43 750€ per year. The maximum amount they could be granted was 101 250€ for existing housing and 112 500€ for new housing. The IFL could not cover more than 50% of the amount of their other loans to finance the house or 20% or their operation cost.

			2008	2009	2010	2011	2012
A	New	% of transactions	2,0%	3,2%	3,3%	3,3%	14,5%
		Operation cost	204 275	207 090	214 490	242 107	237 882
		IFL size	22 051	45 210	46 650	72 930	72 922
		IFL share	10,8%	21,8%	21,7%	30,4%	31,2%
	Existing	% of transactions	14,8%	15,0%	13,4%	14,2%	0,1%
		Operation cost	183 182	184 340	192 480	222 771	166 526
		IFL size	19 057	19 290	19 150	27 521	15 573
		IFL share	10,4%	10,5%	9,9%	12,9%	9,6%
B1	New	% of transactions	7,1%	4,7%	5,3%	4,5%	17,5%
		Operation cost	164 350	170 590	177 930	206 417	199 986
		IFL size	17 987	39 380	40 480	45 499	45 586
		IFL share	11,0%	23,1%	22,8%	22,8%	23,4%
	Existing	% of transactions	27,4%	13,7%	12,1%	16,9%	0,1%
		Operation cost	135 352	144 420	148 390	179 890	111 086
		IFL size	12 734	12 770	12 440	22 289	10 670
		IFL share	9,4%	8,8%	13,3%	13,2%	9,8%
B2	New	% of transactions	B1 / B2 = B	5,1%	6,3%	4,2%	15,9%
		Operation cost		159 910	169 990	186 756	180 598
		IFL size		40 290	40 140	26 553	26 792
		IFL share		25,2%	23,6%	14,7%	15,2%
	Existing	% of transactions		13,2%	14,0%	16,1%	0,1%
		Operation cost		12 770	129 460	148 307	97 057
		IFL size		12 890	12 790	18 473	9 382
		IFL share		10,1%	9,9%	13,1%	9,8%
C	New	% of transactions	21,5%	20,2%	21,6%	14,5%	51,7%
		Operation cost	147 992	150 020	156 690	167 713	166 194
		IFL size	18 252	34 300	33 830	19 722	19 060
		IFL share	12,4%	22,9%	21,6%	12,2%	11,7%
	Existing	% of transactions	27,0%	24,8%	24,1%	26,3%	0,1%
		Operation cost	127 521	127 190	127 810	150 894	85 116
		IFL size	12 693	12 720	12 560	17 253	8 329
		IFL share	10,0%	10,0%	9,8%	12,0%	9,8%
Total	# IFL		211 478	216 503	286 256	351 932	79 116
	Operation cost		146 500	149 180	153 480	171 884	184 371
	IFL size		15 400	21 810	22 380	23 256	32 696
	IFL share		10,5%	14,6%	14,6%	14,0%	17,1%

Table A.1.5. - Summary statistics for the Prêt à Taux Zéro (IFL) between 2008 and 2012, by zone and for new or existing housing

Source: SGFGAS and authors' computations
Lecture: In 2008, existing housing in zone A represented 14.8% of transactions. In this market segment, the average operation cost was 183 000€ and the corresponding IFL 19 000. The share of the IFL in the operation cost was 10.8%.

A.2. ZIP code sampling

IFL is defined at the municipality level, so we define borders between two IFL areas and adjacent units at the municipality level. Our data are available at the ZIP code level, but actually 6 000 ZIP-codes correspond to 36 000 municipalities. The problematic case we want to evict from our analysis sample is a ZIP-code containing municipalities from different IFL areas. So after defining bordering municipalities, we select the corresponding ZIP-codes and remove the ZIP-codes crossing IFL area borders from our sample (see figure A.2.1).

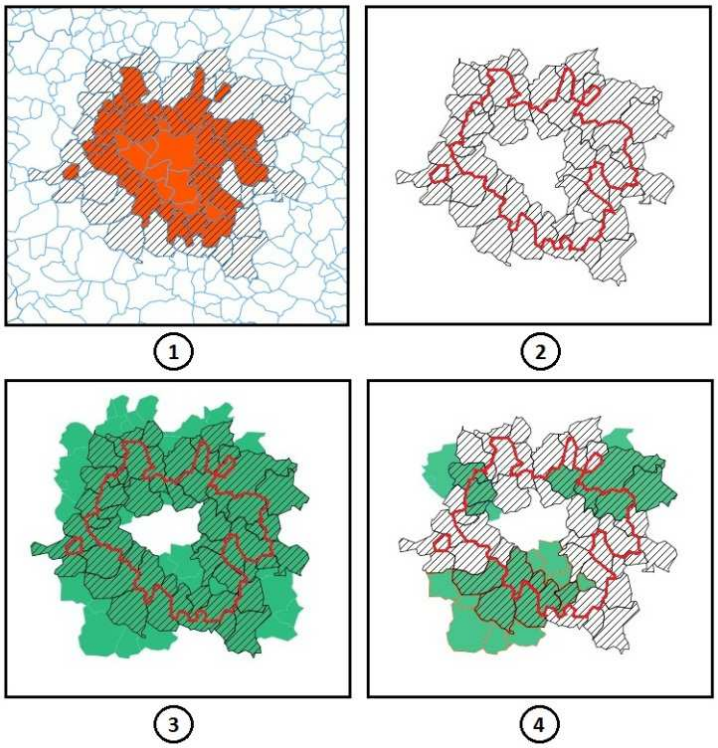

Figure A.2.1 - Definition of our ZIP-codes sample: example of Rennes area

Note: (1) we first delimit an urban area delimited by an IFL area border (in orange) and then select the municipalities on both sides of the border (hatched municipalities). We keep the bordering municipalities only (2) and then determine the ZIP codes associated (3). We finally remove all the ZIP codes crossing the IFL border (4) and only keep the ZIP codes in green in our sample.

Table A.2.1 shows selecting bordering ZIP-codes leads to keep almost half of ZIP-codes in areas B1 and B2, but only one fourth in areas A and C. As regards the number of operations (table 3), we keep about a quarter of them in areas B1 and C. We keep only around 16% of operations in area A but almost half of operations in area B2.

	A	**B1**	**B2**	**C**
Share of bordering municipalities	25%	45%	52%	21%
Share of operations in bordering municipalities	16%	31%	50%	26%

Table A.2.1 – Share of operations in bordering municipalities in the total available in whole territory

Note: On average, 25% of the municipalities from IFL area A are bordering ones, i.e. next to an IFL area border and 16% of operations in zone A take place in bordering municipalities.

A.3. Summary statistics

N=3461	Mean	Std. Dev.
House prices growth	0,06	0,27
Credit growth	0,07	0,32
IFL amount growth	0,24	0,40
Down payment	0,21	0,12
DSTI	0,13	0,05
Borrowers' Age	37,27	4,46
Borrowers' income	0,10	1,19
ZIP code average income	0,03	0,03

Table A.3.1 – Summary statistics for variables used in the estimation. *Sample for estimations reported in table 4.*

	Obs	Mean	Std.Dev.
Income difference	30 646	0.457	0.277
LTV	30 646	0.870	0.221
Maturity at origination	30 646	20.88	5.355

Table A.3.2 –Summary statistics, loan-level database – 2010h1-2011h1

Note: On average, the loan-to-value is 87% between 2010h1 and 2011h1 and the loan has a maturity of 21 years at origination. When not restricting the sample to our estimation one, but considering all loans for the period 2010h1-2011h1, the average LTV is 79%, income difference 33% and maturity 19 years. The estimation sample selection is due to the introduction of ZIP-code fixed effects. Sample for estimation reported in table 7.

A.4. Log-level estimations

We present results for the reduced forms in our preferred time span, 2010h1 to 2011h1 (Table A.4.1). This period covers three different regimes of IFL of same duration for the three semesters: the prolongation of the 2009 doubling of amounts for new housing in 2010h1, the 50% increase in 2010h2 and the general reform of 2011.

Column 1 presents the regression of the log price on log credit. Without any correction for endogeneity, a one percent increase in credit is associated with a 0.5 percent increase in prices. The result is significant at the 1% level.
Columns 2 and 3 test the direct relationship between the output variable and the proposed instruments – IFL amounts, computed with stock or transactions calibration. The two versions of the instrument have a significant positive effect on prices. These results suggest the Interest-Free Loan policy has a non-negligible impact on housing prices. The model adjustment is as expected much lower with these instruments (about 7%) than when using directly credit (about 45%).

As regards controls, through all specifications, the older are the borrowers, the more expensive the house. The borrower's income is also positively associated with housing prices when the interest variable is credit. When we focus on IFL measures (columns 2 and 3), it is on the contrary negatively associated with prices. This is because we do not control for the credit volume, which certainly causes omitted variable bias as richer households certainly have a bigger down-payment. We do not find a

significant effect of average income in the ZIP code (results are similar if dropping the variable). Higher interest rates (measured by the aggregate value and the PD rating[21]) decrease the housing price.

2010h1-2011h1	Housing prices (log)		
	(1)	(2)	(3)
Credit (log)	0.536***		
	(0.020)		
IFL amount (stock)		0.063***	
		(0.010)	
IFL amount (transactions)			0.074***
			(0.011)
Borrowers' Income (log)	0.057***	-0.065***	-0.065***
	(0.011)	(0.013)	(0.013)
ZIP code Avge Income (log)	0.032	0.072	0.073
	(0.097)	(0.156)	(0.153)
Borrowers' Age	0.008***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)
PD rating	-0.114***	-0.053***	-0.052***
	(0.009)	(0.012)	(0.012)
Interest rate (%)	-0.081***	-0.214***	-0.236***
	(0.016)	(0.021)	(0.022)
Observations	4,546	4,546	4,546
R-squared	0.455	0.074	0.076
# ZIP codes	1,596	1,596	1,596

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects and constant included but not reported.

Table A.4.1 - Reduced form of the baseline specification

Results for the instrumented specifications are presented in Table A.4.2. We test for the two versions of the instrument. They are very highly correlated (0.97) so we do not present a Hansen test for over-identifying restrictions as our model is just-identified.

In the first stage, the instruments have a significant impact on credit, with the expected sign: a more generous IFL set-up is associated with more credit. Across all specifications, the older or the richer the borrower, the smaller is the credit granted, certainly because of higher down-payment. Richer ZIP codes are granted more credit. The effect of the interest rate on housing credit is decomposed into the effect of the PD rating (idiosyncratic component) and the average rate (average component). On average for our estimation sample, the PD rating is 1.7 and the interest rate on credit housing is 3.7 so the interest rate component affects credit negatively. IV F stat values rule out weak IV issues.

When turning to the second stage (for column 1), we note credit has a positive and significant impact on housing prices. When the variable is instrumented, the coefficient is higher than spontaneously in the reduced form (Table A.4.1). A one percent increase in credit is associated with about a nearly 0.7% increase in house prices. Controls in the second stage have significant effects with the expected sign. Older households buy more expensive houses and so do richer borrowers. We find a negative sign on

[21] We approximate the interest rate thanks to two variables. We first use the aggregate series for the interest rates of new housing credit. This variable varies only in the time dimension. To try and capture more precisely the interest rate effect, we use the probability of default rating (averaged by ZIP-code). We consider the variation around the mean (captured by the aggregate data) is well proxied as the rating measures the idiosyncratic component at the ZIP-code level.

the coefficient for ZIP code average income in one specification. As borrowers have a bigger income than the ZIP code average (see section 4.3), the overall effect of income remains positive. A higher interest rate tends to decrease housing prices. The model fit is good at about 40%.

2010h1-2011h1	(1)	(2)
First stage: Credit (log)		
IFL amount (stock)	0.093***	
	(0.012)	
IFL amount (transactions)		0.104***
		(0.013)
Borrowers' Income (log)	-0.226**	-0.225**
	(0.093)	(0.093)
ZIP code Avge Income (log)	0.263*	0.303**
	(0.143)	(0.138)
Borrowers' Age	-0.004***	-0.004***
	(0.001)	(0.001)
PD rating	0.115***	0.116***
	(0.019)	(0.019)
Interest rate (%)	-0.241***	-0.271***
	(0.026)	(0.027)
Second stage: Housing Prices (log)		
Credit (log)	0.675***	0.716***
	(0.065)	(0.060)
Borrowers' Income (log)	0.088***	0.097***
	(0.026)	(0.032)
ZIP code Avge Income (log)	-0.104*	-0.144***
	(0.059)	(0.055)
Borrowers' Age	0.009***	0.009***
	(0.001)	(0.001)
PD rating	-0.128***	-0.133***
	(0.012)	(0.014)
Interest rate (%)	-0.052***	-0.044**
	(0.017)	(0.019)
Observations	4,464	4,464
Cluster	ZIP code*Time	ZIP code*Time
R2 first	0.151	0.152
R2 second	0.428	0.410
IV F stat	66.05	60.04

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects and constant included but not reported.

Table A.4.2 – Credit instrumented by IFL instrument, first and second stages

Our estimations so far do not account for any house characteristics. We do not work with hedonic prices so part of the effect we are measuring could be quality effect rather than pure price inflation. To

try and analyze the impact of this limitation on our estimates, we combine our dataset with surface data we have obtained from an alternative source (another bank). We compute the average surface by ZIP code for these transactions and assume the house characteristics are comparable across banks. We thus add these data as an additional control in our database. Data are available only for the period 2010h2-2011 for a sufficient number of ZIP codes.[22] Results are presented in Tables A.4.3 (reduced form) and A.4.4 (instrumentation). On the sample used for estimation, the average house size is 102 m², and this is highly variable (sd = 175).

2010h2-2011h2	**Housing prices (log)**		
	(1)	(2)	(3)
Credit (log)	0.556***		
	(0.036)		
IFL amount (census)		0.046***	
		(0.011)	
IFL amount (bank)			0.055***
			(0.012)
House surface (log)	0.002	0.023**	0.023**
	(0.009)	(0.011)	(0.011)
Observations	2,954	2,954	2,954
R-squared	0.456	0.057	0.058
Number of postal_code	1,456	1,456	1,456
Cluster	ZIP code*Time	ZIP code*Time	ZIP code*Time

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects included but not reported. Controls include borrowers' income, ZIP code average income, borrowers' age, the interest rate on housing markets (aggregate) and the PD rating.

Table A.4.3 – Reduced form – controlling for house surface – 2010-2011

The number of observations is reduced due to both the time period and the ZIP code coverage. As for the reduced form (Table A.4.3), we first note that interest variables – credit and the two versions of the instrument – remain significant at the same level once the house surface control is included. The estimate on credit is slightly higher than without the house surface control. On the contrary, coefficients on the instrument variables are lower with this control. But there is no statistically significant difference with results presented in Table A.4.1. Control variables results are unaffected by this new variable.

Results for the instrumented specification are presented in Table A.4.4. The identification strategy is still valid when controlling for the house size. IV F stats are still high but lower than without this additional control. The estimated elasticity of house prices to credit is between 0.5 and 0.6, lower than what we find with our preferred specification in Table A.4.2. Including housing characteristics does not seem to drastically alter our results. But the data limitations underlined above prevent from completely ruling out quality effects in our estimations. Results for the first stage and control variables are stable.

Table A.4.5 breaks down previous results border by border. Indeed, as the territory is broken into four ABC zones, we are using borders of different nature as they separate areas characterized by different housing market tensions. For the sake of simplicity, we present results only for the instrument calibrated thanks to stock data.

[22] This is the reason why we do not include this control in growth rates regression presented in next subsection. Using growth rates reduces the sample to 2011, for which the IFL policy is constant so our identification strategy becomes irrelevant.

2010h2-2011h2	(1)	(2)
First stage: Credit (log)		
IFL amount (stock)	0.093***	
	(0.016)	
IFL amount (transactions)		0.095***
		(0.016)
House surface (log)	0.038**	0.039**
	(0.019)	(0.019)
Second stage: Housing Prices (log)		
Credit (log)	0.500***	0.575***
	(0.093)	(0.109)
House surface (log)	0.004	0.001
	(0.010)	(0.010)
Observations	2,584	2,584
Cluster	ZIP code*Time	ZIP code*Time
R2 first	0.149	0.147
R2 second	0.452	0.456
IV F stat	34.08	35.63

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects included but not reported. Controls include borrowers' income, ZIP code average income, borrowers' age, the interest rate on housing markets (aggregate) and the PD rating.

Table A.4.4 – Instrumentation - controlling for house surface – 2010-2011

We first note that most observations belong to a B2/C border hence results found in Table A.4.2 are mostly driven by those presented in the B2/C column of Table A.4.5. The instrument is significant for all borders and the model fit is good and does not vary much across borders but the F-stats for B1/B2 and B1/C point to weak instruments. Controls for the first stage have the same sign as in the reference estimation (table A.4.2) but sample restrictions makes difficult finding significant effects, especially for the average income in the ZIP-code. Turning to the second stage, we always capture a significant positive impact of credit on prices. The size of the confidence intervals around the estimates prevent from commenting on the differences between elasticities across borders.

We have presented results for the 2010h1-2011h1 period. These three successive quarters have the advantage to cover three different IFL regimes. To be sure our results are not exclusively driven by the high variance in our instrument this induces we propose results for a larger time span (2009 to 2011 – six semesters)[23].

[23] If we include macroeconomic controls (other than the interest rate) such as the unemployment, the inflation and the growth rates or time dummies, the instrumentation strategy remains valid for the instrument calibrated with bank data. However, the coefficients obtained on instrumented credit are implausibly high, certainly because of the short time period we are studying to get enough variance in macroeconomic controls.

2010h1-2011h1	A/B1	B1/B2	B1/C	B2/C
First stage: Credit (log)				
IFL amount (stock)	0.139***	0.084***	0.070**	0.119***
	(0.036)	(0.031)	(0.030)	(0.023)
Borrowers' Income (log)	-0.198***	-0.184***	-0.232***	-0.236***
	(0.055)	(0.033)	(0.035)	(0.017)
ZIP code Avge Income (log)	0.294	0.237	0.796*	0.148
	(0.448)	(0.559)	(0.436)	(0.272)
Borrowers' Age	-0.005	-0.004**	-0.002	-0.005***
	(0.004)	(0.002)	(0.002)	(0.001)
PD rating	0.116***	0.133***	0.179***	0.104***
	(0.042)	(0.025)	(0.029)	(0.013)
Interest rate (%)	-0.379***	-0.268***	-0.150**	-0.287***
	(0.084)	(0.063)	(0.068)	(0.044)
Second stage: Housing Prices (log)				
Credit (log)	0.632***	0.855***	0.791***	0.733***
	(0.122)	(0.248)	(0.286)	(0.131)
Borrowers' Income (log)	0.054*	0.070	0.130*	0.108***
	(0.031)	(0.050)	(0.071)	(0.032)
ZIP code Avge Income (log)	-0.105	-0.090	-0.186	-0.151
	(0.224)	(0.413)	(0.435)	(0.194)
Borrowers' Age	0.007***	0.011***	0.008***	0.009***
	(0.002)	(0.002)	(0.002)	(0.001)
PD rating	-0.068***	-0.141***	-0.158***	-0.140***
	(0.025)	(0.036)	(0.054)	(0.016)
Interest rate (%)	-0.076	-0.067	-0.064	-0.037
	(0.052)	(0.067)	(0.053)	(0.040)
Observations	375	807	779	2,859
Cluster	ZIP code*Time	ZIP code*Time	ZIP code*Time	ZIP code*Time
R2 first	0.179	0.136	0.164	0.155
R2 second	0.648	0.479	0.285	0.400
IV F stat	14.66	7.329	5.552	26.83

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).
ZIP-code fixed effects and constant included but not reported.
Borders A/B2 and A/C are not studied here because there are too few observations to calculate relevant estimates.

Table A.4.5 –Results broken down by border type

A.5. Results for whole France

2010h1-2011h1	Housing prices (log)		
Credit (log)	0.571***		
	(0.007)		
Borrowers' Income (log)	0.059***	-0.059***	-0.060***
	(0.006)	(0.007)	(0.007)
ZIP code Avge Income (log)	0.285***	0.763***	0.777***
	(0.091)	(0.123)	(0.120)
Borrowers' Age	0.007***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)
IFL amount (bank)		0.032***	
		(0.008)	
IFL amount (census)			0.047***
			(0.008)
Observations	14,613	14,489	14,507
R-squared	0.430	0.022	0.024
Number of postal_code	5,377	5,319	5,328

Table A.5.1 – Reduced form for whole France, 2010h1-2011h1. Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Constant and fixed effects included but not reported.

A.6. Housing prices in France, 1996-2014

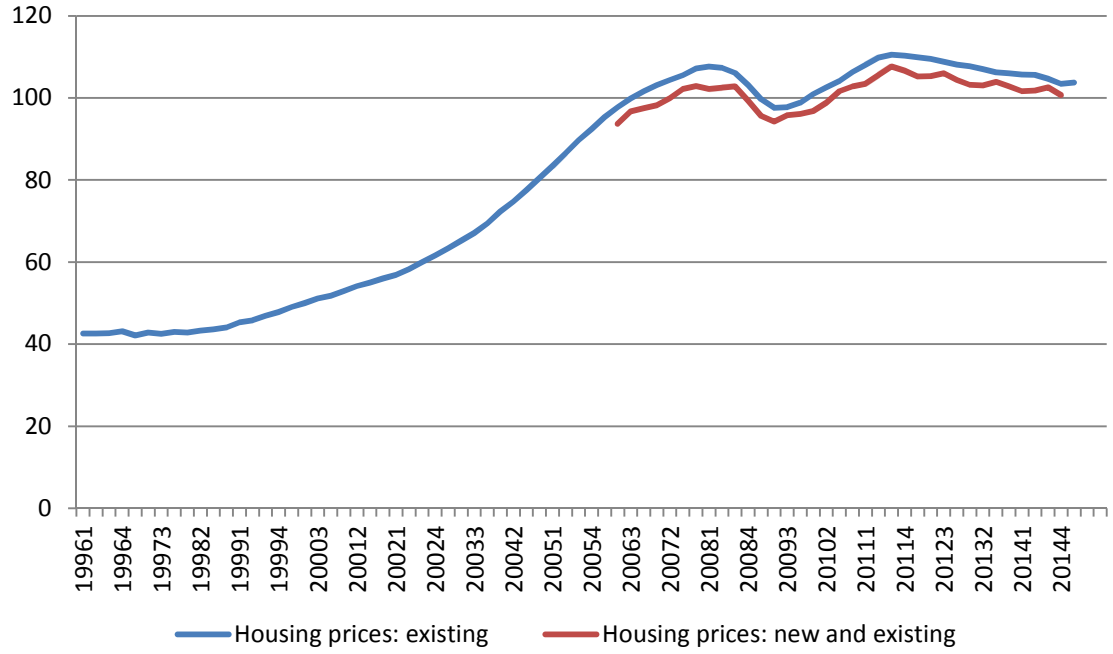

Figure A.6.1 – Housing prices in France, 1996-2014. Both series cover metropolitan France. The existing housing prices series is seasonally adjusted and uses 2010q1 as reference period. The existing and new housing series uses 2010 (annual average) as reference period. Source: INSEE.

Débats Économiques et Financiers

1. M. Dietsch, H. Fraisse, « De combien le capital réglementaire diffère-t-il du capital économique : le cas des prêts aux entreprises par les grands groupes en France », Février 2013.
2. O. de Bandt, N. Dumontaux, V. Martin et D. Médée, « Mise en œuvre de stress tests sur les crédits aux entreprises», Mars 2013.
3. D. Nouy, « Les risques du *Shadow banking* en Europe : le point de vue du superviseur bancaire », Avril 2013.
4. L. Frey, S. Tavolaro, S. Viol, « Analyse du risque de contrepartie de la réassurance pour les assureurs français », Avril 2013.
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75009 Paris
Téléphone : 01 49 95 40 00
Télécopie : 01 49 95 40 48
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