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The Role of Macroprudential Policies on Household Wealth Inequality

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Abstract

Macroprudential policies, such as caps on loan-to-value (LTV) ratios, have become part of the policy paradigm in emerging markets and advanced countries alike. Given that housing is the most important asset in household portfolios, relaxing or tightening the access to mortgages may affect the distribution of household wealth in the country. In a stylised theoretical model we show that the final level of wealth inequality depends on the size of the LTV ratio, housing prices, credit cost and the strength of a bequest motive, and therefore it is not possible to predict an unequivocal effect of LTV ratios on wealth inequality. These trade-offs are illustrated with estimations of 'Gini Recentered Influence Functions' (Gini-RIF) which use household survey data from 12 Euro-zone countries that participated in the first wave of the Household Finance and Consumption Survey (HFCS). The results show that high (i.e. less stringent) LTV ratios are related with more wealth inequality, while housing prices are negatively related, i.e. less inequality when prices have risen. The strength of bequest motives tends to be negatively related with wealth inequality, but credit cost does not show a significant role on the distribution of wealth.

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1. Introduction

Macroprudential policies, such as caps on loan-to-value (LTV) ratios, limits on credit growth and other balance sheets restrictions, have become part of the policy paradigm in emerging markets and advanced countries alike. National authorities with explicit macro-prudential mandate have been established in all EU countries in the last 3 years and the Capital Requirements Directive 2013/36/EU now gives to the macro-prudential authorities a new set of policy instruments to address financial stability risks more effectively. The European Systemic Risk Board has developed its Handbook on Macroprudential Policies (ESRB (2014)), which aims to assist macro-prudential authorities to address systemic risk and to operationalize instruments set out in the new prudential rules for the EU banking sector. As Claudio Borio presciently suggested in 2009, paraphrasing Milton Friedman, "we are all macroprudentialists now".

Knowledge is still limited on these tools. Some countries, especially emerging markets, have used these tools and recent analyses suggest that some can reduce procyclicality and crisis risks. Yet, much remains to be studied, including tools costs, by adversely affecting resource allocations; how to best adapt tools to country circumstances; and preferred institutional designs, including how to address political economy risks (Claessens (2014)). As such, policy makers should move carefully in adopting these tools.

The point of this contribution is to explore a specific side-effect of these macro-prudential policies by studying their impact on the distribution of household wealth.

We assess the impact of the macro-prudential regulations not on credit growth, or price dynamics, but rather on households wealth and housing. We use data from more than 20,000 households from 12 Euro zone countries that participate in the first wave of the Eurosystem Household Finance and Consumption Survey (HFCS) (2010).

Our paper is not the first to rely on the HFCS to assess the impact of macro-prudential measures. Ampudia et al. (2014) for example study how caps on the LTV ratio affect the loss given default of the households, and more generally the household distress in case of crisis. Notwithstanding their innovative approach, they do not assess the impact of the cap on LTV ratios on the household's wealth, housing and welfare distribution. We implement 'Gini Recentered Influence Functions' (Gini-RIF) to assess the effects of LTV ratios, housing price evolution, credit costs and bequest motives on wealth inequality.

2. Macroprudential Policies and their effects

Recent evaluations of macroprudential policies' effectiveness at affecting developments in credit and housing markets suggest that some tools can help reduce financial procyclicality and lower crisis risks. Evaluation methodologies either follow panel as country studies approach.

In panel regressions over 57 countries and three decades, Kuttner and Shim (2013) find that housing credit growth is significantly affected by changes in the maximum debt-service-to-income ratio, the maximum LTV ratio and limits on exposure to the housing sector. Vandenbussche et al. (2012) study Central, Eastern and Southeastern Europe, known to have used a rich set of prudential instruments in response to over the last decades of credit and housing boom and bust cycles. Their evidence suggests that some measures did have an impact. These measures were changes in the minimum capital adequacy ratio and non-standard liquidity measures (marginal reserve requirements on foreign funding, marginal reserve requirements linked to credit growth). Using data from 49 countries, Lim et al. (2011) evaluate the effectiveness of macro-prudential instruments in reducing systemic risk over time and across institutions and markets. Their analysis suggests that tightened LTV and debt-to-income ratios, reserve requirements, dynamic provisioning and ceilings on credit growth (also in foreign currency) all seem to reduce the pro-cyclicality of credit growth. Claessens et al. (2013) take an alternative approach and analyze how changes in balance sheets of some 2,800 banks in 48 countries over 2000 to 2010 respond to specific macroprudential policies. They find that measures aimed at borrowers (caps on debt-to-income and LTV ratios) and at financial institutions (limits on credit growth and foreign currency lending) are effective in reducing asset growth.

Country specific analyses for the U.S. (Berger and Bouwman (2013) and Carlson et al. (2013)), Hong Kong (Craig and Hua (2011)) Spain (Jimenez et al. (2013)), U.K. (Aiyar et al. (2012)), Korea (Igan and Kang (2011)) provide close results and all follow a similar approach by strictly focusing on the response of either the credit growth or the price impact.

Two preliminary conclusions emerge from these empirical studies. First, some macro-prudential policies (which ones depends on the studies) are found to have an impact on credit growth. Second, all these empirical studies focus on credit growth or price dynamics and neglect the cost of macroprudential policies in terms of their impact on household wealth, housing and welfare distribution.

3. The model

We consider a stylised economy where individuals live for two periods. The first period of life comprises the full length of the active life (early and mid adulthood) in which the individual chooses consumption and the quantity of housing to be acquired. Consumption and housing are financed out of a bank loan and an anticipated bequest given at the beginning of the first period. There are not unintentional bequests. For brevity, we abstract from any other form of saving different of housing and source of income. The loan is taken at the beginning of the first period and paid back in full at the beginning of the second period. The bank lends a share θ of the house market value and charges an interest rate equal to r.

The second period of life corresponds to old age where the individual chooses consumption and the bequest amount given to the children. Consumption in the second period is financed out of the updated value of the house -which is the only alternative to finance inter-temporal consumption- and after repaying the loan and leaving a bequest to the child.

There is no specific amenity associated with a house. The house appears in the utility function due to the resources it provides in the future. The house is described by housing units and by a price per unit. Without loss of generality, the housing units can also be interpreted as quality measures. Fertility decisions are not considered because they would unnecessarily complicate the model. It is assumed that each old agent will have only one child.

The loan-to-value ratio (LTV, θ in the model) is a constant parameter that indicates the ratio of the loan over the value of the house. As this ratio is generally lower than one, then $1 - \theta$ is the down-payment required by the bank. The loan amount is mechanically computed based on the LTV and the savings. In this setting, all adults borrow as much as they can to buy the biggest possible house, and therefore the saving can be seen as the down-payment, and the loan as the maximum amount that a bank accepts to lend. Such situation occurs in countries where house price expectations are high, or where the demand is highly elastic compared to the supply. These are precisely the cases that we want to capture since these are the cases where housing prices are affected by credit supply and where specific wealth inequality issues arise. Similarly, Bover et al. (2016) argue that an increase in the regulatory LTV ratio can be modelled as an increase in the demand of credit.

Although housing prices are typically endogenous and affected by the credit supply, our model treats prices as exogenous. This might be criticized as a situation where the LTV is fixed (in other words where agents all borrow

as much as the banks allow), but at least this choice allows to simplify the identification of the channels of credit affecting wealth inequality and hence test the impact of changes of LTV on wealth inequality.

The consumption restrictions of young and old individuals are the following:

$$b_t + H_t p_t \theta = c_{1,t} + H_t p_t \tag{1}$$

$$H_t p_{t+1} = c_{2,t+1} + H_t p_t \theta (1 + r) + b_{t+1} \tag{2}$$

where $c_{1,t}$ and $c_{2,t+1}$ are first period consumption in adulthood and second period consumption when old, y_t is labour income, b_t is the bequest received in t, H_t is the housing units, p_t is the price per housing unit in t, θ is the LTV, r is the interest rate on the bank loan. Furthermore, in this setting there is not Ponzi game, so $b_t \geq 0$ for all t.

Individuals derive utility from consumption in both periods and from the 'joy of giving' motive (Abel and Warshawsky (1988)) of leaving a bequest b_{t+1} to their children. There is no uncertainty. The utility function of an individual born at time t is:

$$U_t = \ln(c_{1,t}) + \beta \ln(c_{2,t+1}) + \gamma \ln(b_{t+1}) \tag{3}$$

The optimal values for H_t and b_{t+1} are obtained from the maximization of the utility function subject to both consumption restrictions, and the growth of prices is assumed constant ($\frac{p_{t+1}}{p_t} = 1 + \pi$). The optimal values are:

$$H_t = \frac{\beta + \gamma}{(1 + \beta + \gamma) p_t (1 - \theta)} (b_t) \tag{4}$$

$$b_{t+1} = \frac{\gamma (1 + \pi - \theta (1 + r))}{(1 + \beta + \gamma)(1 - \theta)} (b_t) \tag{5}$$

It is easy to observe that $dH_t p_t / d\theta > 0$ and $dH_t p_{t+1} / d\pi > 0$, but for the bequest: $db_{t+1}/d\theta > 0$ if $\pi - r > 0$.

3.1. Wealth inequality

How to measure wealth inequality, what wealth definition, and in what period? For a recent survey on wealth inequality measurement see Cowell and Van Kerm (2015). In our setting, we look at any period $t+1$ where the adult and the old individuals overlap:

wealth in adulthood: $W_{1,t+1} = W_1$

wealth in old age: $W_{2,t+1} = W_2$

Measuring inequality at the very beginning of $t+1$ means that we are only considering the initial wealth of the adult (the bequest received) and the house of the old. In contrast, if we consider the very end of period $t+1$, the adult would have a house, but the old will have zero wealth (there are not accidental bequests). So, in order to circumvent this limitation, we define net wealth for each agent as the market value of the house minus credit debt in $t+1$.

$$W_1 = H_{t+1}p_{t+1} - H_{t+1}p_{t+1}\theta(1+r) \tag{6}$$

$$W_1 = \frac{(\beta+\gamma)\gamma(1+\pi-\theta(1+r))(1-\theta(1+r))}{(1-\theta)^2(1+\beta+\gamma)^2}(b_t) \tag{7}$$

$$W_2 = H_{t+1}p_{t+1} - H_t p_t\theta(1+r) \tag{8}$$

$$W_2 = \frac{(\beta+\gamma)(1+\pi-\theta(1+r))}{(1-\theta)(1+\beta+\gamma)}(b_t) \tag{9}$$

The population n in $t+1$ is composed of $i = 1, ...n_1$ adults and $i = 1, ...n_2$ old individuals, with $n = n_1 + n_2$. Wealth of each agent is:

$$W_{1i} = \alpha_1 b_i \text{ , with } \alpha_1 = \frac{(\beta+\gamma)\gamma(1+\pi-\theta(1+r))(1-\theta(1+r))}{(1-\theta)^2(1+\beta+\gamma)^2} \tag{10}$$

$$W_{2i} = \alpha_2 b_i \text{ , with } \alpha_2 = \frac{(\beta+\gamma)(1+\pi-\theta(1+r))}{(1-\theta)(1+\beta+\gamma)} \tag{11}$$

Equations 10 and 11 indicate that wealth observed in $t+1$ for the adult and old generation is a function of the bequests received in period t. This

setting will allow us to find some closed form solutions for inequality measures. Wealth inequality will be measured for the total population n, and given that this can be subdivided in two groups, we prefer to use an inequality index that can be additively decomposed by groups with certain desirable properties. This is the case of the generalized entropy family of indices proposed in Shorrocks (1980):

$$I_c(W) = \frac{1}{n}\frac{1}{c(c-1)}\sum_1^n[(\frac{W_i}{\mu})^c - 1] \text{ with c} \neq 0, 1 \tag{12}$$

The popular Theil index of entropy is obtained with $c = 1$. For simplicity, we will use I_2, that is equivalent to half the squared coefficient of variation:

$$I_2(W) = \frac{1}{2n}\sum_1^n[(\frac{W_i}{\mu})^2 - 1] \tag{13}$$

This index can be decomposed into a component measuring within-group inequality (I_w) and another component measuring between-group inequality (I_b). We will focus on the within inequality index. The reason is that this metric does not take into account the inequality arising from comparing the group of adult individuals with that of old individuals. Intergenerational inequality is significantly affected by life-cycle effects, i.e. by the position of the individual in the life-cycle. In such context, it is more difficult to identify the effects of macroprudential policies on inequality.

We insert equations 10 and 11 into equation 13. The population of adults (n_1) is always equal to that of old individuals (n_2), i.e. each individual has one child, which is a consequence of no including fertility decisions in the model. We obtain the following expression for the within inequality index:

$$I_w = \frac{\alpha_1^2 + \alpha_2^2}{(\alpha_1 + \alpha_2)^2}A_1 \text{ ,with } A_1 = \frac{1}{n}\sum_1^m[\frac{b_i^2 - \bar{b}^2}{(\sum_1^m b_i)^2}] > 0 \tag{14}$$

Where $n_1 = n_2 = m = n/2$. The expression A_1 must be positive because parents cannot transmit debts to children. In addition, A_1 was determined in period t and hence this is a constant in period $t+1$, which is our period of evaluation for wealth inequality. Therefore, A_1 will be treated as a constant in the comparative statics performed in $t + 1$.

3.2. Comparative statics

We study the effects of changes in LTV and other parameters on wealth inequality.

$$\frac{dI_w}{d\theta} = \frac{(1+\beta)(1-\theta)+r\theta\gamma}{((1+\beta+2\gamma)(1-\theta)-r\theta\gamma)^3} 2r\gamma(1+\beta+\gamma)A_1 \tag{15}$$

And therefore,

$$Sign[\frac{dI_w}{d\theta}] = Sign[(1+\beta+2\gamma)(1-\theta)-r\theta\gamma] \tag{16}$$

$\frac{dI_w}{d\theta}$ will tend to be positive for large values of θ or γ. However, this derivative can become negative if both interest rate r and the joy of giving γ are large enough. The following expression show the relationship between the parameter values that will assure $\frac{dI_w}{d\theta} > 0$, meaning that wealth inequality will increase with 'easy' credit:

$$r < \frac{(1+\beta+2\gamma)(1-\theta)}{\theta\gamma} \tag{17}$$

And wealth inequality will decrease with 'easy' credit $\frac{dI_w}{d\theta} < 0$ if:

$$r > \frac{(1+\beta+2\gamma)(1-\theta)}{\theta\gamma} \tag{18}$$

Figure 1 shows some simulations of wealth inequality for different values of the loan-to-value ratio (θ)and other parameters. A rate $r = 0.33$ is the total financial cost of a mortgage of 30 years with a yearly interest rate of 2%. Figure 1(a) shows the baseline case. We observe, first, that wealth inequality increases with easy credit (higher θ) but then, when LTV is large enough (about 0.92) the effect is reversed. So, easy credit can have positive effects in the reduction of wealth inequality only if the LTV is sufficiently close to 1. Figure 1(b) shows that, when the cost of credit is high ($r = 1.40$ is equivalent to the cost of a 30 years mortgage with a yearly interest rate of 7%), easy credit can reduce wealth inequality. Richer individuals (in our case, the individuals with larger bequests) can benefit more from easy credit to acquire more housing, and in this way, increase wealth inequality. But, a high financial cost will neutralize or reverse this impact.

Figure 1(c) shows that the intensity of the bequest motive is important in determining the relationship between easy credit and wealth inequality. If the bequest motive is low ($\gamma = 0.10$ compared to previous 0.90), then easy credit increases wealth inequality for most of the plausible values of the LTV cap. Therefore, it is important to investigate the intensity of the bequest motive in order to better assess the relationship between credit market and wealth inequality. In a similar vein, some studies in wealth taxation have pointed out that much more must be done to understand what is the incidence of bequest motives because the responses to estate taxation crucially depends on these motives (Kopczuk (2013), Pestieau and Thibault (2012), Cremer and Pestieau (2011) and Cigno et al. (2011)).

4. Data and methods

4.1. The data

We will use the Eurosystem Household finance and Consumption survey (HFCS) which is a harmonized household survey initiated and coordinated by the European Central Bank. The survey is implemented in the Eurozone countries, it is nationally representative and includes a large set of core questions inquiring about assets, debts, income and demographics of the household and some country-specific questions. The HFCS resembles the US Survey of Consumer Finances (SCF), which is considered as standard for household surveys on wealth. See European Central Bank (2013) and HFCS (2014) for details. Two waves of HFCS data have been collected about 2010 and 2014, but only the first wave was available at the time of writing.

Although the first wave of HFCS is available in 15 countries, we can only use 12 countries. Finland and France are excluded from our sample because they do not have information on key variables for the analysis (such as the means of acquisition of the house of main residence), and Slovenia is left out because of its small sample size. Following the theoretical model, the population of households is divided into two distinctive generations: adult households aged 25-59 and old households aged 60-84. The age and other demographic characteristics are drawn from the 'reference' person in the household, which is identified in the HFCS as the person who is at the centre of the households finances.

The analysis of the effects of LTV ratios and other variables on wealth inequality is performed on the sample of adult households. The initial sample size consists of 20,477 households in 12 countries: Austria, Belgium,

Cyprus, Germany, Spain, Greece, Italy, Luxembourg, Malta, The Netherlands, Portugal and Slovakia.

4.2. Variables

The main variable of interest is the LTV ratio of the mortgage obtained by the household. This is computed as the ratio between the amount of the granted loan over the value of the house at the time of acquisition. We focus on the house of main residence (HMR) that has been collateralised for obtaining a mortgage. In HFCS, this information is only available for households with an outstanding balance on a mortgage, so that the group of households without LTV information can be interpreted as households not owning their homes and households owning their homes through inheritance, gifts, repaid loans or ex-ante savings. The LTV values that are unlikely to be realistic are recoded as missing (in few cases, they were larger than 2). On average, the LTV is 0.77 for all countries, and about 13% of households have a LTV larger than 1, although there are important country differences. For example, in Netherlands, 37% of households have an LTV larger than 1, and the average LTV is 0.88, while in Austria the LTV mean is 0.58 and only 7% of households have an LTV larger than 1.

The financial cost of the loan (similar to r in the theoretical model) is the percentage of the principal that must be paid at the end of the mortgage. This variable requires information on annual interest rate, principal and period of the mortgage. However, some households in Belgium, Cyprus, Italy, Netherlands, Portugal and Slovakia present missing information on interest rates. This is more acute in Italy and Portugal, where 47% and 34% of households with LTV information do not have information on interest rates. Therefore, the econometric results employing interest rates in those countries must be taken with caution.

The strength of the bequest motive is computed as a dummy variable indicating whether the household has received a substantial gift or inheritance (including the HMR) or expects to receive it in the future. Spanish households do not have information on bequest expectations, while Italian households lack information on both received and expected bequests. Therefore, the role of bequest motives is not analysed in Italy, while the econometric results for Spain are not perfectly comparable with the rest of countries.

Price housing variation is computed as the yearly variation between the value of acquisition of the HMR and the current value reported by the household. Other variables entering as controls are sex, age, educational

levels, gross income and its square and dummies of year periods for the acquisition of the HMR ($\geq$2007, 2003-06, 1999-02, 1995-98, $<$1995).

The distributional analysis is focused on the variable net worth (net wealth) which is simply the amount of total assets (excluding public and private occupational pension plans) minus total liabilities in the household. As an alternative, we also compute a variable measuring 'net housing wealth', which is the current self-reported value of the HMR minus the outstanding balance of the HMR mortgage. This variable only measures the wealth that is related to housing.

4.3. Methods

The analysis uses the so called Gini recentered influence function (Gini-RIF) regressions (see Firpo et al. (2009) and Choe and Van Kerm (2014)) to assess the impact of LTV ratios and other covariates on net wealth inequality. Gini-RIF regressions consist of two stages. First, we calculate the influence on the net wealth Gini coefficient of each household in our samples as a function of their net wealth and of the distribution of net wealth in their country - this is the influence function calculation (Hampel (1974)). Intuitively, households in the tails of the distribution of net wealth will tend to have positive influence on inequality - all else equal, more of them will tend to increase the Gini coefficient - whereas households in the middle of the distribution will have negative influence - more of them will tend to reduce the Gini coefficient. In a second stage, we regress households' Gini influence on LTV ratios and other variables of the household. A positive coefficient for LTV will suggest that LTV increases net wealth inequality: that is, households that have experienced less stringent credit conditions will tend to have net wealth levels in the segments of the net wealth distribution that have positive influence on the Gini coefficient.

Let $\nu(F)$ be a statistic of interest (a function) calculated in the distribution F. In our illustration this is the Gini index but it could be the mean, median, the Atkinson index, a top income share, etc.

The influence function of ν is a function of y and F and is defined as:

$$\mathrm{IF}(y;\nu,F) = \lim_{\epsilon\to 0} \frac{\nu((1-\epsilon)F + \epsilon\Delta_y) - \nu(F)}{\epsilon} \tag{19}$$

The IF captures the effect on $\nu(F)$ of an infinitesimal contamination of F at point mass y. Expressions for $\mathrm{IF}(y;\nu,F)$ exist (or can be derived) for a wide range of statistics. See Essama and Lambert (2012) for a catalogue of IFS relevant to income distribution analysis.

5. Econometric Results

As mentioned in the methodological section, we first estimate the Influence Function (IF) of households' net wealth on the Gini index for each country and store the predicted 'influence' of each household. The OLS regression results of Tables 1 to 4 show the effects of some covariates on the 'influence' of each household on wealth inequality. The model specifications always include the LTV ratio and a set of control variables (sex, age, education, gross income and its square and period of HMR acquisition). Other specifications add one by one other covariates drawn from the theoretical discussion. The control variables are included because the access to a mortgage and its conditions can be importantly determined by the age and socio-economic status of households. We only report the coefficients on LTV ratios and other covariates related to credit and housing conditions. The complete econometric results of the control variables are available upon request.

Table 1 shows that LTV ratio has a positive effect on wealth inequality in 9 over 12 countries. The effect is imprecisely estimated in the Netherlands, Portugal and Austria. We observe that the magnitude of estimated coefficients of LTV tends to be larger in countries with a lower number of households with HMR mortgages (e.g. in Greece, Italy and Slovakia). The correlation between the LTV coefficients and the share of households with mortgages is -0.47. It is interesting to note that the LTV ratio has a larger influence on wealth inequality in countries where mortgages are more scarce. This means that a policy seeking to restrict the housing credit, i.e. through LTV caps, may also reduce wealth inequality more significantly in countries with a more limited mortgages market. But in the contrary, more easy credit (larger LTV) in these countries may increase wealth inequality more rapidly.

The model specification of Table 2 adds the financial cost of the mortgage. In this case, 8 countries keep a positive and significant effect of LTV ratio on wealth inequality. There is not a clear result for the effect of financial cost as this is only statistically significant in 4 countries. The effect is positive in Germany, Portugal and Italy and negative in the Netherlands. We tried the annual interest rate instead of the financial cost, but the results are even less precisely estimated. The bequest motive is added in the specification of Table 3. LTV is still significant and positive in 8 countries over 11 (Italy does not have information on bequest motives). The bequest motive has a negative effect on wealth inequality in Germany, Luxembourg, Malta and Portugal, but a positive effect in Spain. This means that the first four countries are behaving as they will be somewhere in the right zone of Figure

1(a) and 1(c) of the theoretical section, while Spain will be somewhere in the left zone of these figures.

The price variation of the HMR is added in the model specification of Table 4. As before, the coefficient of LTV is always positive and this time it is statistically significant in 10 over 12 countries. So, LTV is never significant in any of the specifications for the Netherlands and Portugal. It is observed that the effect of price variation, when significant, is always negative. This occurs in 7 countries. In alternative specifications, we have also introduced the LTV ratio jointly with the other covariates and have not observed qualitatively different results. In addition, we have used net housing wealth (defined before) instead of net wealth for the models of Tables 1 to 4 and have not observed changes in the directions of the effects. Indeed, the effects of the LTV ratio and housing price variation are more precisely estimated.

6. Concluding remarks

In this paper we present a simple model that is able to highlight the main trade-offs and links between the credit market, housing market and household wealth inequality in the society. In particular, we focus on the effects of LTV caps on wealth inequality as this is one of the relevant tools at disposal for macro-prudential policy. It is generally acknowledged that LTV caps are able to reduce the supply of mortgages and prompt a better selection of household risk profiles by the banks. In the end, this is an important aim to keep prudent levels of household indebtedness and reduce the risk of crisis. However, policy makers should be aware that these credit regulations also have effects on the accumulation of wealth by households and on its distribution. Some policy makers in Ireland, Finland or Cyprus have recently imposed LTV regimes with caps depending on the household status (first-time buyer or not; value of the house). It will be interesting to investigate in the future HFCS survey waves whether such devises will affect or change our conclusions.

There is not an unequivocal theoretical effect of LTV ratios on household wealth inequality, but at least we can illustrate some interesting trade-offs between LTV ratios, loan financial costs, housing prices and bequest motives. We illustrate this first by simulations of our theoretical model, and then with household survey data drawn from HFCS. We employ Gini-RIF regressions to explore the effects of those variables on wealth inequality. The econometric results show that higher (i.e. less stringent) LTV ratios are positively related with wealth inequality, while housing prices are negatively related.

The strength of bequest motives tends to be negatively related with wealth inequality, but credit costs do not show a significant role on the distribution of wealth. In general, the LTV ratio has a statistically significant positive effect on every country with the exception of the Netherlands and Portugal where it is not possible to establish an effect.

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Tables and Figures

Table 1: **Country specific OLS estimates of LTV ratio on wealth inequality**

Country	LTV		hhs with mortgage	total of hhs
	coeff	s.e.		
Austria	0.125	(0.087)	164	1447
Belgium	0.183***	(0.07)	404	1339
Cyprus	0.128**	(0.065)	245	960
Germany	0.24***	(0.077)	342	1986
Spain	0.197***	(0.073)	756	2962
Greece	0.32***	(0.068)	254	2007
Italy	0.3***	(0.062)	351	4050
Luxembourg	0.232***	(0.069)	235	667
Malta	0.222***	(0.079)	62	472
Netherlands	0.145	(0.264)	210	698
Portugal	0.013	(0.121)	644	2317
Slovakia	0.227**	(0.097)	128	1571

*sig. at 10%, **sig. at 5%, ***sig. at 1%. Robust standard errors are in parenthesis. Each row contains the relevant coefficient of OLS regressions performed on household Influence Function (IF) for each country. The IF of each household was computed, in a first stage, as the influence of the household net wealth on the Gini index of net wealth in the country. Other covariates included in the regressions are sex, age and education level of the reference person in the household, household gross income and its square, dummies of year periods for the acquisition of the household of main residence.

Table 2: **Country specific OLS estimates of LTV ratio and loan financial cost on wealth inequality**

Country	LTV ratio		loan financial cost		hhs with mortgage	total of hhs
	coeff	s.e.	coeff	s.e.		
Austria	0.109	(0.097)	-0.029	(0.081)	155	1447
Belgium	0.211***	(0.063)	0.093	(0.084)	324	1339
Cyprus	0.093	(0.069)	-0.019	(0.069)	186	960
Germany	0.222***	(0.077)	0.167*	(0.088)	321	1986.2
Spain	0.179**	(0.081)	0.069	(0.059)	751	2962
Greece	0.337***	(0.068)	-0.024	(0.039)	250	2007
Italy	0.218***	(0.081)	0.173**	(0.074)	184	4050
Luxembourg	0.214***	(0.064)	0.097	(0.112)	234	667
Malta	0.223***	(0.08)	0.014	(0.066)	62	472
Netherlands	-0.08	(0.253)	-0.462*	(0.249)	175	698
Portugal	0.106	(0.144)	0.1***	(0.03)	425	2317
Slovakia	0.253**	(0.107)	-0.011	(0.062)	107	1571

*sig. at 10%, **sig. at 5%, ***sig. at 1%. Robust standard errors are in parenthesis. Each row contains the relevant coefficient of OLS regressions performed on household Influence Function (IF) for each country. The IF of each household was computed, in a first stage, as the influence of the household net wealth on the Gini index of net wealth in the country. Other covariates included in the regressions are sex, age and education level of the reference person in the household, household gross income and its square, dummies of year periods for the acquisition of the household of main residence.

Table 3: **Country specific OLS estimates of LTV ratio and bequest motive on wealth inequality**

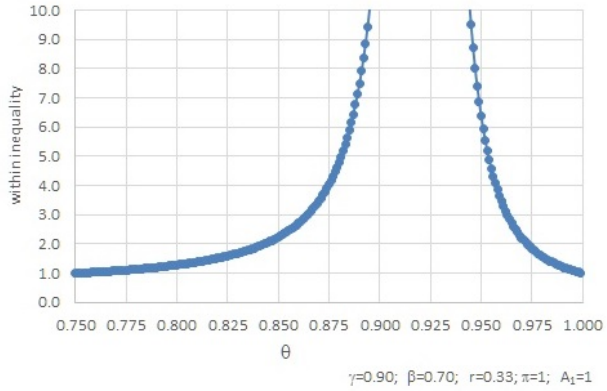
Country	LTV ratio		bequest motive		hhs with mortgage	total of hhs
	coeff	s.e.	coeff	s.e.		
Austria	0.128	(0.085)	0.04	(0.097)	164	1447
Belgium	0.193***	(0.074)	0.036	(0.037)	404	1339
Cyprus	0.112*	(0.065)	-0.054	(0.037)	245	960
Germany	0.187**	(0.079)	-0.13***	(0.039)	342	1986.2
Spain	0.198***	(0.072)	0.134*	(0.071)	756	2962
Greece	0.321***	(0.068)	0.084	(0.071)	254	2007
Italy						4050
Luxembourg	0.216***	(0.072)	-0.063*	(0.038)	235	667
Malta	0.215***	(0.076)	-0.075**	(0.037)	62	472
Netherlands	0.118	(0.269)	-0.189	(0.128)	210	698
Portugal	-0.04	(0.136)	-0.122**	(0.056)	644	2317
Slovakia	0.228**	(0.097)	0.005	(0.066)	128	1571

*sig. at 10%, **sig. at 5%, ***sig. at 1%. Robust standard errors are in parenthesis. Each row contains the relevant coefficient of OLS regressions performed on household Influence Function (IF) for each country. The IF of each household was computed, in a first stage, as the influence of the household net wealth on the Gini index of net wealth in the country. Other covariates included in the regressions are sex, age and education level of the reference person in the household, household gross income and its square, dummies of year periods for the acquisition of the household of main residence.

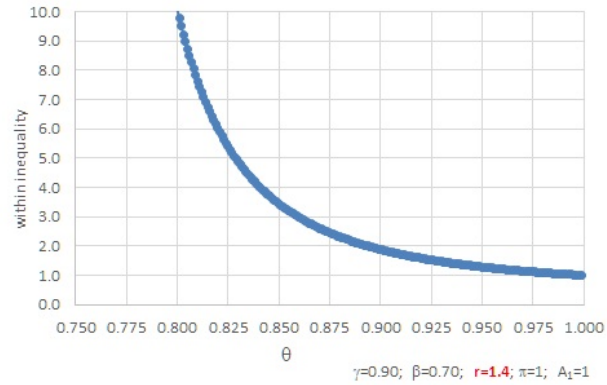
Table 4: **Country specific OLS estimates of LTV ratio and house price variation on wealth inequality**

Country	LTV ratio		house price variation		hhs with mortgage	total of hhs
	coeff	s.e.	coeff	s.e.		
Austria	0.141*	(0.085)	-0.16	(0.19)	164	1447
Belgium	0.19***	(0.07)	-0.228*	(0.132)	404	1339
Cyprus	0.154**	(0.061)	-0.501***	(0.174)	245	960
Germany	0.279***	(0.078)	-0.732***	(0.227)	342	1986.2
Spain	0.218***	(0.075)	-0.855**	(0.34)	756	2962
Greece	0.344***	(0.067)	-0.989***	(0.271)	254	2007
Italy	0.307***	(0.06)	-0.206	(0.205)	351	4050
Luxembourg	0.221**	(0.087)	0.248	(0.689)	235	667
Malta	0.272***	(0.084)	-1.214***	(0.339)	62	472
Netherlands	0.165	(0.271)	-1.061	(1.371)	210	698
Portugal	0.024	(0.121)	-1.338***	(0.435)	644	2317
Slovakia	0.248**	(0.108)	-0.158	(0.297)	128	1571

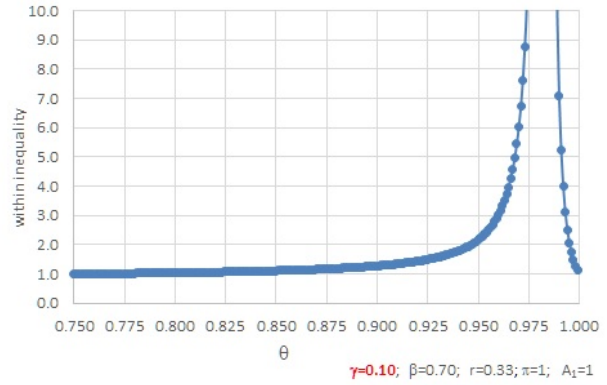
*sig. at 10%, **sig. at 5%, ***sig. at 1%. Robust standard errors are in parenthesis. Each row contains the relevant coefficient of OLS regressions performed on household Influence Function (IF) for each country. The IF of each household was computed, in a first stage, as the influence of the household net wealth on the Gini index of net wealth in the country. Other covariates included in the regressions are sex, age and education level of the reference person in the household, household gross income and its square, dummies of year periods for the acquisition of the household of main residence.



(a) baseline, credit cost r=0.33; bequest motive γ=0.90



(b) with higher credit cost r=1.40



(c) with lower bequest motive γ=0.10

Figure 1: Effects of LTV changes (θ) on within inequality (I_w)