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**Høgskolen i Østfold
Arbeidsrapport 2012:4**

Online-versjon (pdf)

Utgivelsessted: Halden

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Høgskolen i Østfold. Arbeidsrapport 2012:4

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ISBN: 978-82-7825-369-4

ISSN: 1503-6677

A comment on LTV, risk and incentives in mortgage markets

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Abstract:¹ This paper comments on the increase in LTV ratios experienced in a number of countries in the years preceding the financial crisis. Highlighting the capital structure of housing investments and the excess return to housing a framework incorporating the incentives for as well as the risks associated with higher LTV ratios among both mortgagees and mortgagors is set out. First, we relate LTV ratios to the return to home equity (RHE) for homeowners to illustrate the incentives for increasing LTV ratios among mortgagors that accompany excess return to housing. RHE is split between a price gain and a leverage gain, where the latter is related to the LTV ratio. Second, we introduce credit risk policy to highlight the increased mortgagor risk that accompanies a higher LTV-ratio. Finally, taking mortgagees nominal return targets into account we show the short-term gains for mortgagees by accepting higher LTV ratios in their mortgage portfolio as well as the risk pricing necessary to eliminate these incentives.

¹ Thanks to Joachim Thøgersen for comments.

1. Introduction

House price growth stimulates the wealth of homeowners. Appreciations are related to a number of factors, but in the years preceding the financial crisis low mortgage rates played a crucial role (IMF, 2011). At the same time are financial innovations argued for house prices in the pre-2007 period (Chambers et al, 2009). Increased loan-to-value (LTV) ratios and lowering of down-payment requirements are, together with higher flexibility in repayment schedules and reductions in the cost associated with extracting home equity, all argued to be important for the high rates of appreciation; see for instance Geradi et al (2006).

Since the turn of the century do especially higher LTV ratios seem to be a common development in most Western mortgage markets, despite the accompanying increase in risk for both mortgagees and mortgagors (IMF, 2011).² For non-prime mortgages Duca, Muellbauer and Murphy (2010) relate higher LTV ratios to two financial innovations: the development of credit-scoring technology that enables the sorting and pricing of such loans as well as the funding of these loans using collateral debt obligations (CDOs) and credit default swaps (CDS) protection. For prime mortgages Borgersen and Robertsen (2012) derive a market-based LTV ratio that equals the inverted user cost of housing, stimulated by expectations of future housing appreciation. When the competition for mortgage market shares is tough and regulatory guidelines are weak, higher LTV ratios can help mortgagees fulfill nominal return targets (Goodhart and Hoffman, 2008).

Koetter and Poghosyan (2009) argue the potential long-term implications of too high LTV ratios to be housing market bubbles and financial instability, and research from a number of countries suggests that caps on LTV ratios could help to moderate house price growth and thereby reduce financial instability (IMF, 2011).

Yet, the basic question remains: why are mortgagees and mortgagors willing to accept higher LTV ratios, in particular when they know the potentially devastating long-term consequences?

This comment relates the increase in LTV ratios to the excess return to housing by considering a conventional capital structure approach to investments. Our simplistic short term framework highlights the incentives for as well as the risks associated with higher LTV ratios among both mortgages and mortgagors. Allowing for short sightedness on both sides of the mortgage market we relate higher LTV ratios to the excess return to housing. Applying a conventional capital structure approach to investments and dividing RHE between a price gain and a leverage gain we see how excess return to housing provides incentives for increasing LTV ratios.

While conventional to commercial investments (see for instance Harris and Raviv (1991) for different aspects of the capital structure approach), a formalized capital structure approach is to the best of our knowledge novel when assessing structural aspects of housing finance and mortgage market developments in general. While simplistic, our framework brings housing finance issues onto the same playing field as commercial real estate and provides a framework for future research.

² See also Engelhardt (1996) for LTV ratios and down-payment constrains.

Combining high rates of appreciation with low mortgage rates creates excess return to housing, which stimulates the leverage gain of housing investments. The leverage gain provides incentives for increasing LTV ratios among short sighted mortgagors. If mortgagees face short term nominal return targets, short sightedness might dominate on both sides of the mortgage market allowing for higher LTV ratios and increased risk taking in the mortgage market.

Our direct approach to the relation between appreciations and the LTV ratio is related to, and extends, the more indirect approach of Stein (1995) on how changes in LTV ratios stimulate the borrowing capacity of mortgagors and increases the house price response following changes in household income or mortgage cost. This amplifying mechanism allows for financial accelerators in mortgage markets (Almeida et al (2006)). If borrowing capacity is related to home equity it is not only the rate of appreciation, but also the capital structure of housing investments which, together with the cost of borrowing, can stimulate financial accelerators. A combination of high rates of appreciation and low mortgage rates creating excess return to housing stimulates the leverage gain and RHE, thereby collateral values and finally the financial accelerators in housing markets.

This comment sets out a conventional and simplistic framework for the capital structure of housing investments highlighting the incentives for, as well as the risk associated, with higher LTV ratios. Focusing on the excess return to housing both mortgagees and mortgagors are taken into account. The focus is put on the relation between LTV ratios and the leverage gain accompanying mortgage financed housing at exogenous rates of appreciation. First, while separating the equity gains of home owners between a price gain and a leverage gain we show the incentives for increasing LTV ratios that are present when there is excess return to housing. Second, introducing credit risk policy among mortgagees we show the increased mortgagor risk that is associated with higher LTV ratios. Third, taking into account the nominal return targets of mortgagees and the impact on the home equity ratio of their mortgage portfolio, we highlight mortgagees' short term gains when accepting higher LTV ratios. Finally, we derive the risk pricing necessary to eliminate the incentives for accepting higher LTV ratios among mortgagees.

The rest of this comment is structured as follows. In the next section the capital structure approach to housing investments is presented for mortgage-financed housing. Using data on excess return in the Norwegian housing market, an example of how RHE is influenced by both price gains and leverage gains is presented in section 3. In the fourth part we introduce credit risk policy, nominal return targets and risk pricing. The last part concludes.

2. Price and leverage gains for homeowners

Let us start by assuming a dwelling with a market value equal to V . The purchase of the dwelling is financed by equity, E , and a mortgage, D , allowing us to express the market value as

1)
$$V = D + E.$$

The total return to housing investments is given by the house price growth, p . The total return must compensate creditors and provide a return for home equity. The former is determined by the mortgage rate, r_b . The return to housing equity (RHE), expressing the wealth effect for home

owners, is denoted e . Introducing two ratios, loan to value (LTV), $\frac{D}{V}$, and equity-financed housing, $\frac{E}{V}$, allows us a framework in which changes in mortgage markets, operationalized through LTV and the mortgage rate, are shown to impact on RHE. From standard investment theory and the Modigliani–Miller approach (see any textbook on corporate finance, for instance Berck and De Marco (2007)), we know that

$$2) \quad p = e \frac{E}{V} + \frac{D}{V} r_B.$$

By rearranging, we have

$$3) \quad e = p + \frac{D}{E} (p - r_B),$$

where RHE is endogenously determined by the interaction between the mortgage and the housing market. RHE is divided between a *price gain*, p , and a *leverage gain*, $\frac{D}{E} (p - r_B)$. The *leverage gain* increases with the mortgage-to-equity ratio (D/E) and the difference between the rate of appreciation and the mortgage rate.³ In the absence of mortgage-financed housing ($D=0$), RHE is identical to the rate of appreciation. Likewise, RHE is equal to the rate of appreciation when the rate of appreciation equals the mortgage rate ($p = r_B$). Stated differently, the leverage gain is neutralized when the monetary policy is used to control housing market developments.

For a homeowner the leverage gain is influenced both by the degree of mortgage-financed housing and by developments in mortgage and housing markets. If the rate of appreciation exceeds the mortgage rate, the leverage gain makes RHE exceed the price gain. If the mortgage rate exceeds the rate of appreciation, the situation is reversed and the homeowner experiences a leverage loss. When the price gain and the leverage gain offset one another, $pV = r_B D$, a homeowner does not experience any RHE even in the presence of house price growth.

The relation between RHE and the excess return to housing given above abstracts away from the endogenous relation between collateral values and credit, as discussed by for instance Kiyotaki and Moore (1997). Over time it is reasonable to assume that higher leverage stimulates the rate of appreciation and hence also RHE. Expression (3) can be interpreted as the short run relation between leverage and RHE. Still, it illustrates an important characteristic of most western economies in an extremely simplistic but intuitive way: Among inflation targeting economies ignoring housing appreciations financial imbalances might build when excess return to housing develops.

³ We abstract away from taxes.

3. Excess return to housing and the LTV ratio: The Norwegian case

We illustrate the importance of price and leverage gains for homeowners, respectively, by considering the Norwegian housing market. As an inflation targeting economy with strong growth and low inflation, the Norwegian case is illustrative for the importance of the leverage gain. Figure 1 shows Norwegian house prices during the period between 1985 and 2010. Despite the substantial accumulated equity gain for homeowners, huge variations are apparent in the annual house price growth over the period. In the wake of both the Norwegian banking crisis and the international financial crisis, the annual house price growth turned negative. The Norwegian housing market has also seen years with exceptionally high rates of appreciation.

Figure 1: Nominal house prices

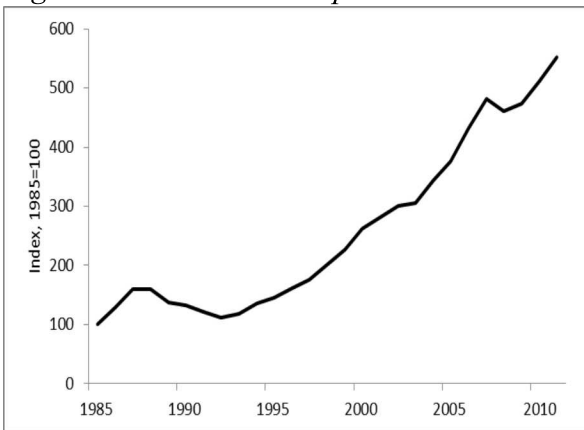
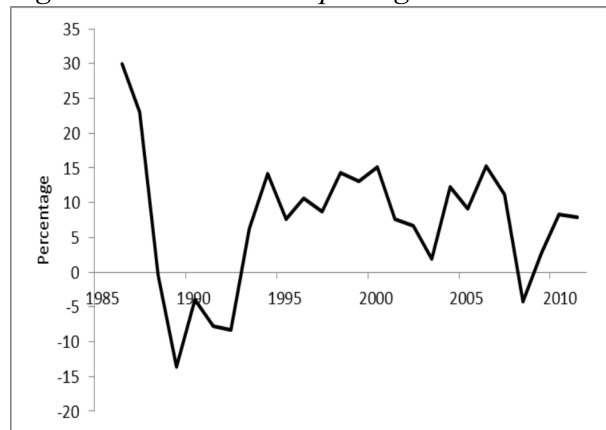


Figure 2: Annual house price growth



Source: NEF/Econ

Source: NEF/Econ

House price growth in Norway is related to a number of factors, including the mortgage rate (Anundsen and Jansen, 2010). Due to low inflation mortgage rates in Norway remained low despite high rates of appreciation. This allowed home owners, in addition to the price gain, a substantial leverage gain. In fact, mapping annual RHE, price and leverage gains between 1986 and 2010 (as defined by expression (3)), Figure 3 shows how the latter often dominated the price gain (assuming that the LTV ratio equals 80 per cent).

Figure 3: RHE, price and leverage gains

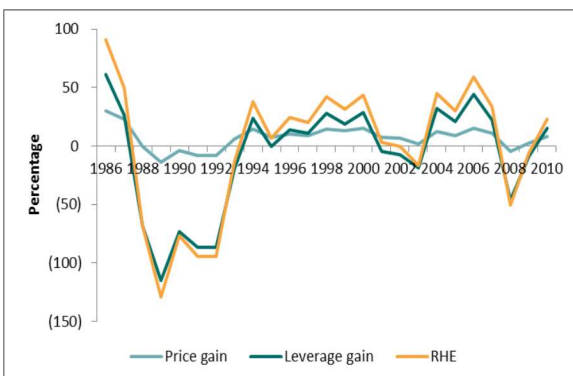


Figure 4: The excess return to housing components



Source: NEF/Econ and Statistics Norway

Source: NEF/Econ and Statistics Norway

Focusing on the period from 2000 until 2010, Figure 4 shows the factors impacting on the leverage gain, the mortgage rate and the rate of appreciation. During this period there were substantial variations in the annual excess return to housing. In particular, the deviation between the rate of housing appreciation and the mortgage rate is large between 2004 and 2007, the years preceding the financial crisis.

The substantial excess return to housing experienced during this period stimulated the RHE through a higher leverage gain and created incentives for shifts in the Norwegian mortgage market. The Mortgage Survey of the Norwegian FSA reports marked changes in the mortgage markets from 2004, in favor of higher LTV and DTI (Debt-to-income) rates as well as increased maturity and increased demand for interest-only payment structures (Financial Supervisory Authority of Norway, 2011).

When comparing the leverage gain of 80 per cent LTV with that of 90 per cent LTV from the turn of the century, we see gains increasing with the LTV ratio in the case of excess return to housing (Figure 5). Also, when considering the year 2008, and the combined increase in mortgage rates and drop in appreciation following the international financial crisis, we see the risk increase associated with higher LTV ratios - expressed in terms of a leverage loss and a negative RHE which is increasing with the LTV ratio.

Figure 6 gives an alternative illustration of the gain and risk accompanying higher LTV ratios, where the relation between RHE, housing appreciation and mortgage rates is simulated. While fixing the rate of appreciation, both the LTV and the mortgage rate are allowed to vary. That is, while abstracting away from the argument of Kiyotaki and Moore (1997), we relate the gain and the risk associated with higher LTV ratios to different mortgage rates. Figure 6 maps the RHE for mortgage rates between 2 and 15 per cent for LTV ratios of 80 and 90 per cent, respectively, when the rate of appreciation is fixed at 8 per cent.

Figure 5: Excess return to housing and leverage gains, LTV=80 and LTV=90

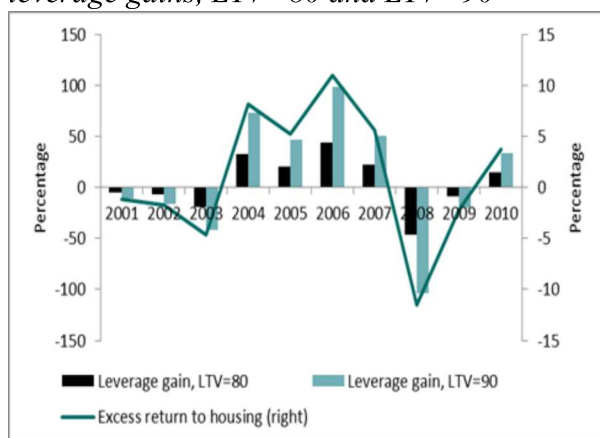
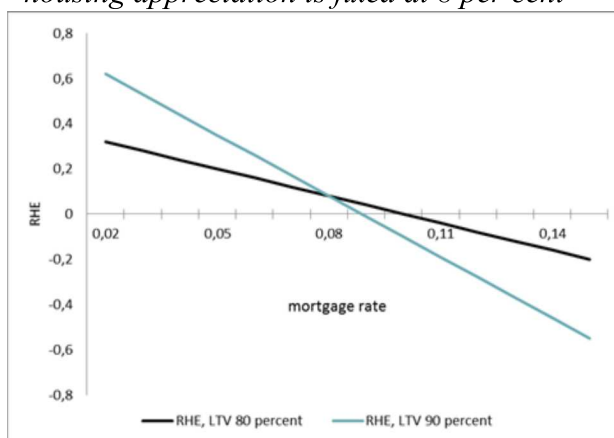


Figure 6: RHE, mortgage rates and LTV, housing appreciation is fixed at 8 per cent



When the mortgage rate is *below* the rate of appreciation RHE for a 90 per cent LTV ratio exceeds the RHE when LTV equals 80 per cent. Likewise, when the mortgage rate *exceeds* the rate of appreciation the RHE is higher when LTV equals 80 per cent. This is due to that in the former case the leverage gain impacts positively on RHE, while it impacts negatively in the latter. Figure 6 shows both mortgagors incentives for increasing LTV ratios and the risk associated with doing so.

4. Credit risk policy

An alternative illustration of the risk associated with higher LTV ratios for mortgagors is to introduce an explicit rule for credit risk policy among mortgagors. For simplicity we ignore debt-servicing ability and assume that the risk associated with a mortgagor is related to her home equity. More specifically, we assume that a mortgagor is lifted into a higher risk category if 20 per cent of her home equity is lost, that is, $\Delta e = -0.2$.

To compare the risk associated with different LTV ratios, we derive partial expressions for *critical* mortgage rates and *critical* rates of appreciation, respectively. The critical rates are defined as those that trigger a shift into a higher risk category.

The critical mortgage rate can be expressed as:

$$4) \quad r_B^{kri} = p + \frac{E}{D} (p - e)$$

and the critical rate of appreciation equals

$$5) \quad p^{kri} = \frac{1}{1 + D/E} \left(e + r_B \frac{D}{E} \right)$$

While Figure 7 gives the critical mortgage rates for LTV of 80 and 90 per cent, respectively, when the rates of appreciation vary, figure 8 maps the critical rates of appreciation for LTV ratios equaling 80 and 90 percent respectively, when mortgage rates are allowed to vary.

Figure 7: The critical mortgage rates

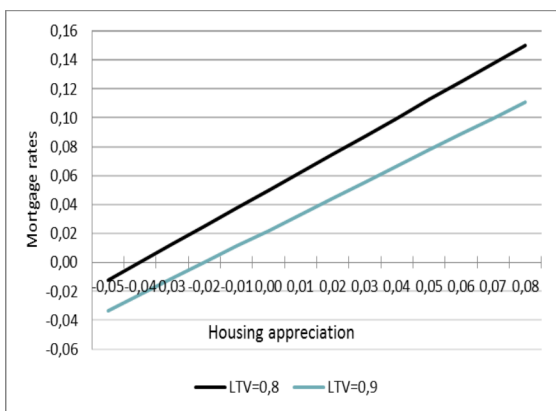
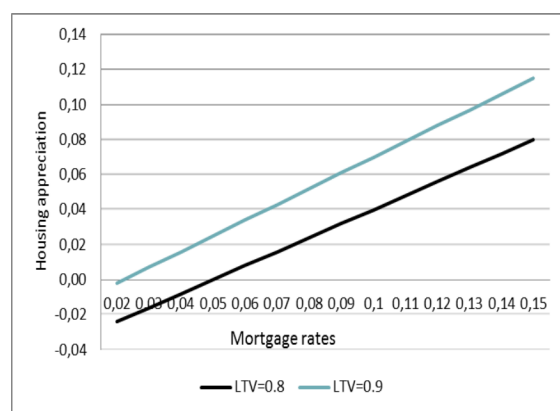


Figure 8: The critical rates of appreciation



Figures 7 and 8 show the risk associated with higher LTV ratios in a simplistic, but yet illustrative way. In Figure 7 we see how mortgagors are moved into higher risk categories at *lower* mortgage

rates when LTV equals 90 per cent. In Figure 8 we see how a LTV of 90 per cent moves a mortgagor into a higher risk category at *higher* rates of appreciation.

Stated differently, the increased risk accompanying higher LTV ratios manifests itself as mortgagors are moved into higher risk categories at *lower* mortgage rates and *higher* rates of appreciation. The risk increase accompanying higher LTV ratios takes the form of mortgagors being moved into a higher risk category earlier in the downturn.

5. Nominal return targets, LTV and the risk premium

Turning to mortgagees, we start by acknowledging their short-term nominal return targets and the potential relation between lending and capital ratios (Goodhart and Hoffman, 2008). Short-termism can imply that booms are associated with excessive lending and downturns by credit crunches. This procyclicality can be related to a number of different arguments (see for instance Borgersen and Robertsen, 2012).

To illustrate a mortgagee's incentives to accept higher LTV ratios in the presence of short-term nominal return targets, we (at first) ignore risk⁴ and assume the value of a mortgagee M , exclusively as a function of the (home) equity ratio in its mortgage portfolio, $M = m\left(\frac{E}{D}\right)$.⁵ This relates changes in the market value of a mortgagee to changes in the home equity ratio in its mortgage portfolio.

To highlight the implications of different LTV ratios we abstract away from mortgage repayments, allowing the value function to equal

$$7) \quad \dot{M}_i = M\left(\frac{E_0 + e}{D_0}\right) = \dot{M}_i(e)$$

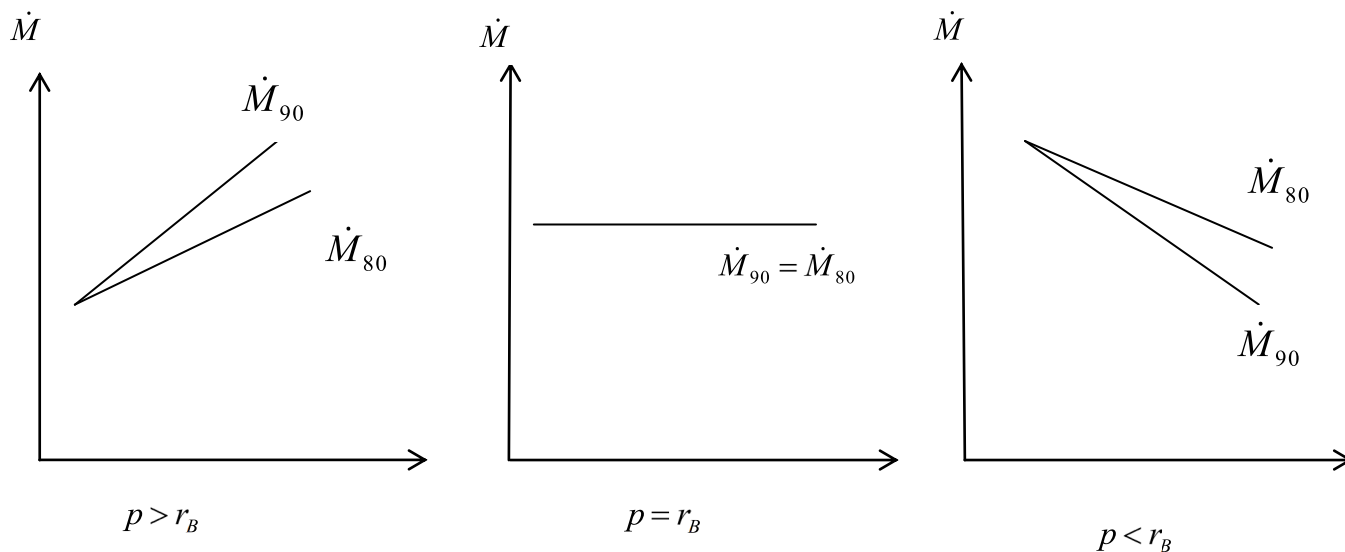
From the reasoning above we know that whether the RHE among mortgagors differ between LTV ratios is related to the excess return to housing. Figure 9 summarizes the relation between the market value of a mortgagee and the LTV ratio in its mortgage portfolio for the three possible regimes for the excess return to housing (positive, zero or negative).⁶

⁴ See for instance Saunders and Wilson (2001) for a more complete assessment regarding risk and regulation in the banking industry, where deregulation is argued to increase competition, reduce charter values and increase risk taking by banks. In our framework increased risk taking is associated with accepting higher LTV ratios.

⁵ For a more comprehensive framework for assessing the market value of mortgagees and the impact of leverage, see for instance Peterkort and Nielsen (2005).

⁶ Without loss of generality the starting point is assumed to be equal for a mortgage portfolio where LTV (on average) equals 80 percent to that of a portfolio where LTV (on average) equals 90 per cent.

Figure 9: Mortgage return and excess returns to housing



We now easily see how it is easier to fulfill a nominal return target in a period in which there is excess return to housing when accepting 90 per cent LTV ratios than when accepting 80 per cent LTV ratios. In the absence of such a return no incentives for higher LTV ratios are in place, and a higher LTV ratio imposes additional financial risk for the mortgagee when the mortgage rate exceeds the rate of appreciation and the excess return to housing is negative.

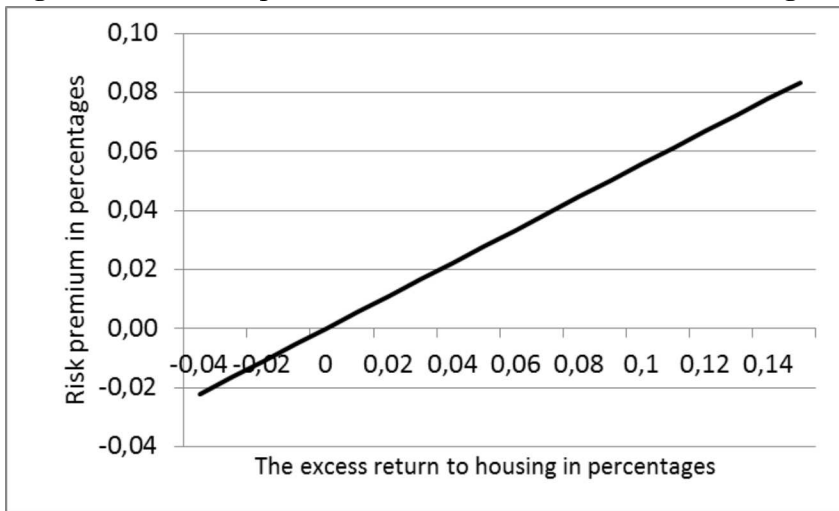
Finally, introducing risk we ask how high risk premium the mortgagee must face when accepting higher LTV ratios in order to eliminate the incentives highlighted above. This increased capital cost can be due to either market or regulatory interventions.

The answer to this question is in our framework reduced to finding the condition for equality between RHE when LTV is 80 and 90 per cent, respectively; $e_{LTV=90} = e_{LTV=80}$. Using expression 3 for both LTV=80 and LTV=90 per cent, and inserting for a risk premium θ defined as the difference between the rate for 80 and 90 percent LTV mortgages, $r^{90} = r^{80} + \theta$. We find the risk premium necessary to offset the short-term gain for mortgagees of accepting 90 per cent LTV ratios to equal

$$9) \quad \theta = \frac{5}{9} (p - r_{80})$$

The risk premium is positively related to the excess return of housing. When considering the partial effects we see the premium to be increasing in the rate of appreciation and decreasing in the rate for 80 per cent LTV mortgages. If the pricing of risk incorporates 5/9 of the excess return to housing credit markets eliminate the short-term incentives for accepting higher LTV ratios described above.

Figure 10: The risk premium and the excess return to housing



6. Summary

This paper comments on a predominant feature in most western mortgage markets in the years preceding the financial crisis; increased LTV ratios. To highlight the incentives for as well as the risk associated with higher LTV ratios for both mortgagees and mortgagors we focus the capital structure of housing investments. While conventional when analyzing commercial real estate, the formal distinction between price gains and leverage gains is to the best of our knowledge novel when analyzing mortgage financed housing.

Our simplistic approach is intended to bring assessments of housing finance onto the same playing field as the capital structure approach to commercial real estate. Being a first step, it still allows us to highlight a number of mortgage market features in a conventional and non-technical way. First, taking into account the capital structure of housing investments, RHE for homeowners is split between a price gain and a leverage gain. When there is excess return to housing, the leverage gain can contribute significantly to the RHE. And more importantly, the leverage gain creates incentives for short sighted mortgagors to increase their LTV ratios.

Second, introducing a rule for credit risk policy among mortgagees we see how a higher LTV ratio goes together with increased risk for mortgagors: A mortgagor is lifted into a higher risk category at higher rates of appreciations or lower mortgage rates, the higher the LTV ratio.

Third, to illustrate why mortgagees are willing to increase their portfolio risk by allowing for higher LTV ratios, we introduce nominal return targets and relate the value of a mortgagee to the (home) equity ratio in its mortgage portfolio. In the presence of excess return to housing we show the incentives for accepting higher LTV ratios now existing at both sides of the mortgage market.

Finally, knowing how mortgagees' different returns are related to the equity gain of its mortgagors and the home equity ratio in its mortgage portfolio, we derive the risk premium necessary to eliminate the gains accompanying a mortgagee's higher LTV ratio. If the risk premium is

insufficient, regulations are necessary to eliminate the short term gains arising from the excess return to housing. The framework shows how financial imbalances might build in inflation targeting economies ignoring asset inflation, and allowing for excess return to housing creating short term incentives for increased risk taking on both sides of the mortgage market.

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