On the (in)effectiveness of LTV regulation in a multiconstraint framework

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Abstract

Models in the macro-housing literature often assume that borrowers are constrained exclusively by the loan-to-value (LTV) ratio. I explore an alternative arrangement where borrowers are constrained by the feasibility of repayment, but choose a house of maximum permissible size conditional on the LTV restriction. This assumption, which is arguably more consistent with mortgage lending practices in countries with multiple borrowing constraints, yields results that disagree with much of the existing literature. In particular, I find that policy designed to lower the maximum permissible LTV ratio may actually increase house prices in equilibrium and leave the debt-to-GDP ratio unchanged.

Keywords: Borrowing constraints; Household indebtedness; Macroprudential measures; House prices

JEL-Classification: E2, E3

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1 Introduction

Is stricter loan-to-value (LTV) regulation effective in reducing household indebtedness? Policymakers in Sweden or Canada, where household indebtedness, along with housing prices, have been skyrocketing in the past decades, consider tightening the admissible LTV ratio as a macroprudential measure aimed at lowering the stock of debt in the economy. For Sweden, Chen and Columba (2016) and Finocchiaro, Jonsson, Nilsson, and Strid (2016) find that tighter LTV ratios reduce household indebtedness and are accompanied by lower housing prices. Similar conclusions are reached by Alpanda, Cateau, and Meh (2014) for Canada.

In this paper, using a simple real business cycle model with long-term debt, I argue that in a multiconstraint framework, tighter LTV regulation may have no effect on household indebtedness and may actually lead to an increase in housing prices. Specifically, borrowers in Canada (see Crawford, Meh, and Zhou, 2013), Sweden (see Sveriges Riksbank, 2014), but also e.g. Estonia (see Eesti Pank, 2014) or Brasil (see de Carvalho, Castro, and Costa, 2014) are subject to a debt-service-to-income (DSTI) constraint and to an LTV constraint at the same time. In Sweden, this DSTI constraint takes the form of a 'discrectionary income' limit, and is applied to borrowers by banks, not by the regulator. In such an environment, the maximum debt limit is determined by the DSTI constraint, and the LTV constraint merely determines the housing choice of borrowers.[1] Households first get to know their borrowing limit, and then, conditional on the LTV requirement, buy a house.[2]

Thus, lowering LTV is a very ineffective policy in such an economy, if the aim is to reduce debt to income or debt to GDP. Stricter LTV policy in a multiconstraint framework not only does not influence debt ratios at all (since debt is not a function of LTV), but it also drives house prices up in the equlibrium. Ceteris paribus, if the debt level is determined by a DSTI limit and one unit of housing can pledge less collateral, its value has to increase if it has to collateralize the same amount of debt.[3]

The observation that the LTV limit can determine the housing choice of an individual and not their debt is crucial for the analysis of macroprudential policies in countries with multiple constraints. It may be relevant even for countries without an established DSTI limit, if borrowers impose such a limit on themselves. In the following, I present the benchmark model with DSTI and LTV constraints and contrast its implications with results from a 'LTV only' model.

[1] Of course, in reality not all households choose to borrow up to the maximum. For the purpose of the paper, we assume that they do.

[2] In a setup with an LTV constraint only, the loan process is different. Household first makes the housing choice, and then pledges it as collateral.

[3] A similar mechanism is described in an example in a recent paper by Greenwald (2016). It presents a model for the U.S. in which new borrowing is determined by an LTV and a payment to income constraint. Borrowers switch between being bound by each of constraints. This is different from the setup presented in this paper, in which agents are limited by both constraints at the same time.

2 Model

Consider an economy populated by firms and households that differ in their degree of impatience. Firms operate in a competitive market and are profit maximizers. They use labor to produce the final good. Households derive utility from leisure, consumption and housing. Patient households ('savers') provide long-term adjustable-rate loans to impatient households. In the following, I present the borrrower's problem (savers' and firms' first-order-conditions (FOCs) are standard).

2.1 Borrowers

Borrowers get utility from goods (c^B) and housing (h^B) consumption, as well as leisure. They provide labor (l^B) to firms and borrow from savers subject to two constraints.

$$\max_{c_t^B, h_t^B, L_t^B} E_0 \sum_{t=0}^{\infty} \beta^{B,t} \left(\log c_t^B + j_t \log h_t^B - \frac{{l_t^B}^{\eta^B}}{\eta^B} \right). \tag{1}$$

The budget constraint of borrowers is:

$$c_t^B + q_t(h_t^B - (1-\delta_h)h_{t-1}^B) + (R_{s,t-1} - 1 + \kappa)sb_{t-1} = b_t + w_t^B l_t^B, \tag{2}$$

where δ_h is the depreciation of the housing stock, q_t denotes the housing price, $R_{s,t} = 1 + i_t$ is the interest rate, κ is the amorization rate, sb_t is the stock of debt, b_t is new borrowing, and $w_t^B l_t^B$ is labor income.

Debt evolves according to:

$$sb_t = (1-\kappa)sb_{t-1} + b_t \tag{3}$$

Substituting for the evolution of the stock of debt, we get

$$c_t^B + q_t(h_t^B - (1-\delta_h)h_{t-1}^B) + R_{s,t-1}sb_{t-1} = sb_t + w_t^B l_t^B. \tag{4}$$

The stock of debt is limited by a DSTI constraint:

$$sb_t(R_{s,t} + \kappa - 1) \leq DSTI w_t^B l_t^B \tag{5}$$

Given that new borrowing b_t is determined by equation 3, the LTV limit determines the housing choice of the household:

$$b_t = sb_t - (1-\kappa)sb_{t-1} \leq LTV q_t(h_t^B - (1-\delta_h)h_{t-1}^B), \tag{6}$$

where LTV determines the LTV ratio for borrowers.

The FOCs are (λ_t^B is the Lagrangian multiplier on the LTV constraint and λ_{at}^B is the Lagrangian multiplier on the DSTI constraint):

w.r.t. sb_t

$$\frac{1}{c_t^B} = \beta^B E_t\left(\frac{R_{s,t}}{c_{t+1}^B}\right) + \lambda_t^B - E_t\beta^B\lambda_{t+1}^B(1-\kappa) + E_t\beta^B\lambda_{a,t+1}^B(R_{s,t+1}+\kappa-1) \tag{7}$$

w.r.t. h_t^B

$$\frac{q_t}{c_t^B} = \beta^B E_t\left(\frac{(1-\delta_h)q_{t+1}}{c_{t+1}^B} + (1-\delta_h)\lambda_{t+1}^B LTV q_{t+1}\right) + \frac{j_t}{h_t^B} - \lambda_t^B LTV q_t, \tag{8}$$

w.r.t. L_t^B

$$w_t^B = L_t^{B\eta^B-1} c_t^B - DSTI w_t^B \lambda_{a,t}^B, \tag{9}$$

In equilibrium, sb is determined by (5), b by (3), h^B by (6), while (8) and (7) determine the values of Lagrangian constraints. In the LTV-economy, (5) does not exist, b is determined by (6), sb by (3), and h^B by (8).

2.2 Market clearing conditions

The housing stock is fixed to 1:

$$1 = h_t^S + h_t^B, \tag{10}$$

where h^S denotes savers' housing stock.

$$c_t^S + c_t^B + i_h = y_t, \tag{11}$$

where c_t^S is savers' consumption, and $i_h = \delta_h q_t$ is investment in the housing stock .

3 Equilibrium and dynamic implications of multiple borrowing constraints

3.1 Calibration

The model is calibrated to the Swedish data (see Table 1). Housing depreciation rate is chosen to match the average LTV in the Swedish data: 65% (UC credit data). The values for DSTI and κ result in a debt to GDP ratio of 56%, similar to the value used in Finocchiaro et al. (2016). Borrowers preference for housing J'' is chosen to match the debt to GDP ratio in the

	Parameter	Range
β^S	savers' discount factor	0.99
β^B	borrowers' discount factor	0.98
δ_h	housing depreciation rate	0.0076
LTV	LTV ratio for new loans	0.85
$DSTI$	DSTI ratio for households	0.3
κ	quarterly amortization rate	0.01
α	savers' wage share	0.85
η'	savers' labor supply aversion	2
η''	borrowers' labor supply aversion	2
J'	savers' weight on housing	0.2
J"	borrowers' weight on housing	0.55

Table 1: Benchmark calibration of the model

LTV scenario. The remaining parameter values are fairly standard.

3.2 Equilibirum comparison

Table 2 presents equilibrium implications of two experiments: lowering LTV from 85% to 80% and the annual interest rate from 4.04% to 2% (through a change in savers' discount factor) in the benchmark model and a model with LTV constraint only. In the benchmark model, lowering LTV has no effect on the debt to GDP or debt to income ratio, and it increases house prices in the equilibrium. In the LTV model, under lower LTV, debt to GDP and debt to income go down, and so do house prices. In the benchmark model, debt to income in the steady state is:

$$\frac{SB}{W^B L^B} = \frac{DSTI W^B L^B}{(RS + \kappa - 1) W^B L^B} = \frac{DSTI}{RS + \kappa - 1} \tag{12}$$

In the LTV model, the same ratio is represented by:

$$\frac{SB}{W^B L^B} = \frac{LTV Q H^B \delta_h}{\kappa W^B L^B} \tag{13}$$

It is clear from equation 12 that in an environment, in which the debt limit is determined by a DSTI-constraint and LTV merely affects the housing choice of the household, lowering LTV is a very ineffective policy, if the aim is to reduce debt to income or debt to GDP. Similarly, lowering interest rates will push indebtedness up much more in such an environment than in a purely LTV-driven economy, in which the effect of interest rates on debt comes only indirectly through the effect on house prices. Stricter LTV policy in a multiconstraint framework not only

Variable	LTV 0.85 ↓ 0.8		Annual int.rate 4.04% ↓ 2%	
	Benchmark model	LTV model	Benchmark model	LTV model
Debt to GDP/income	0%	-7.66%	+33.78%	+19.97%
House prices	+1.85%	-0.56%	+37.69%	+33.09%
Output	+0.13%	-0.03%	+2.76%	+1.65%
Borrowers' housing	+4.45%	-1.36%	-0.15%	-8.37%

Table 2: Long-term effects of lower LTV and interest rates

does not influence debt ratios at all, but it also drives house prices up in the equlibrium. Ceteris paribus, if one unit of housing can pledge less collateral, its value has to increase if it has to collateralize the same amount of debt.

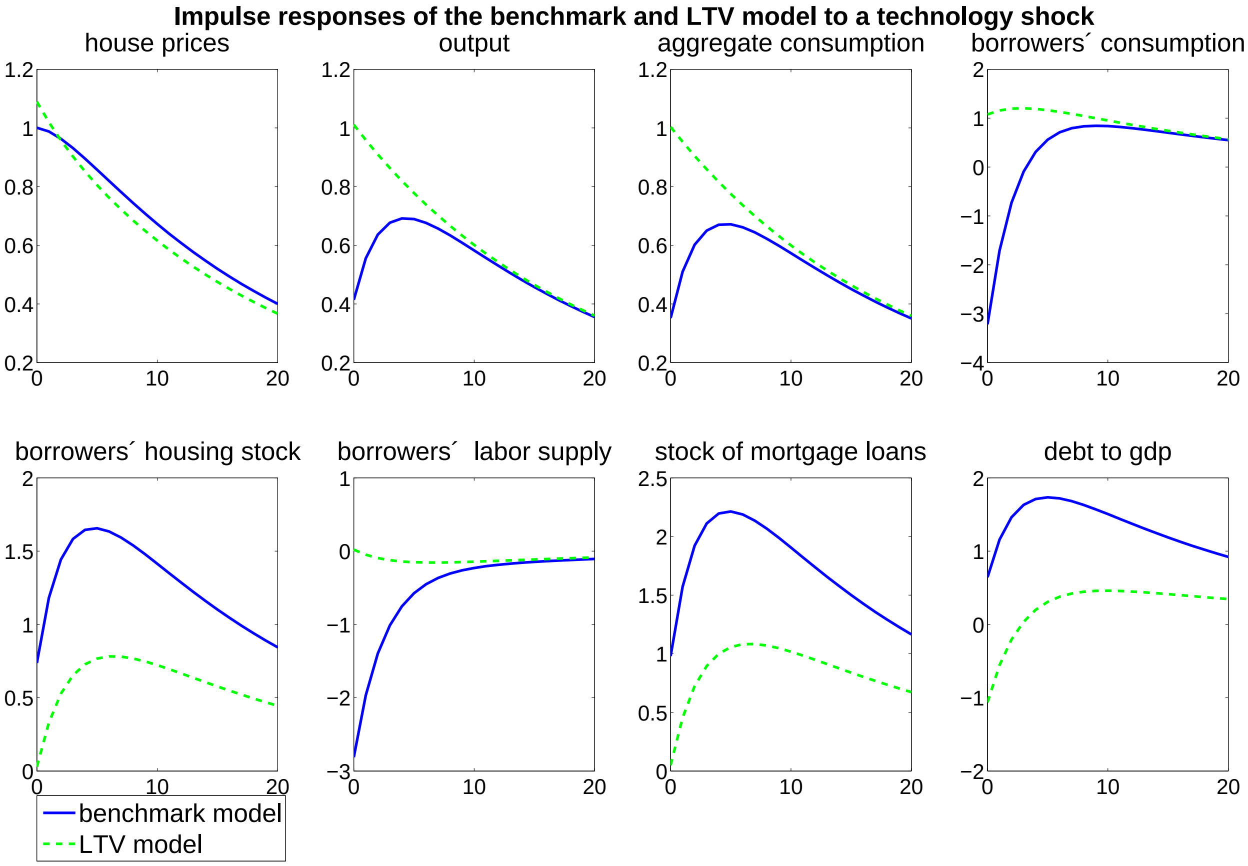
3.3 Model dynamics

To investigate dynamic properties of the benchmark model, I consider a positive technology shock of 1% and an LTV shock that reduces LTV by 1%. Shocks are AR(1) processes with a persistence of 95%.

Figure 1 presents impulse responses to a positive technology shock. Households wage income increases, so they can reduce their labor supply. In the benchmark model, higher income from working enables borrowers to borrow more, so the stock of debt and their housing consumption increase, crowding out their goods consumption, more so than in an LTV model. With a relatively lower increase in aggregate consumption and similar house price dynamics, the output response in the benchmark model is less positive than in an LTV economy, and debt to GDP increases.

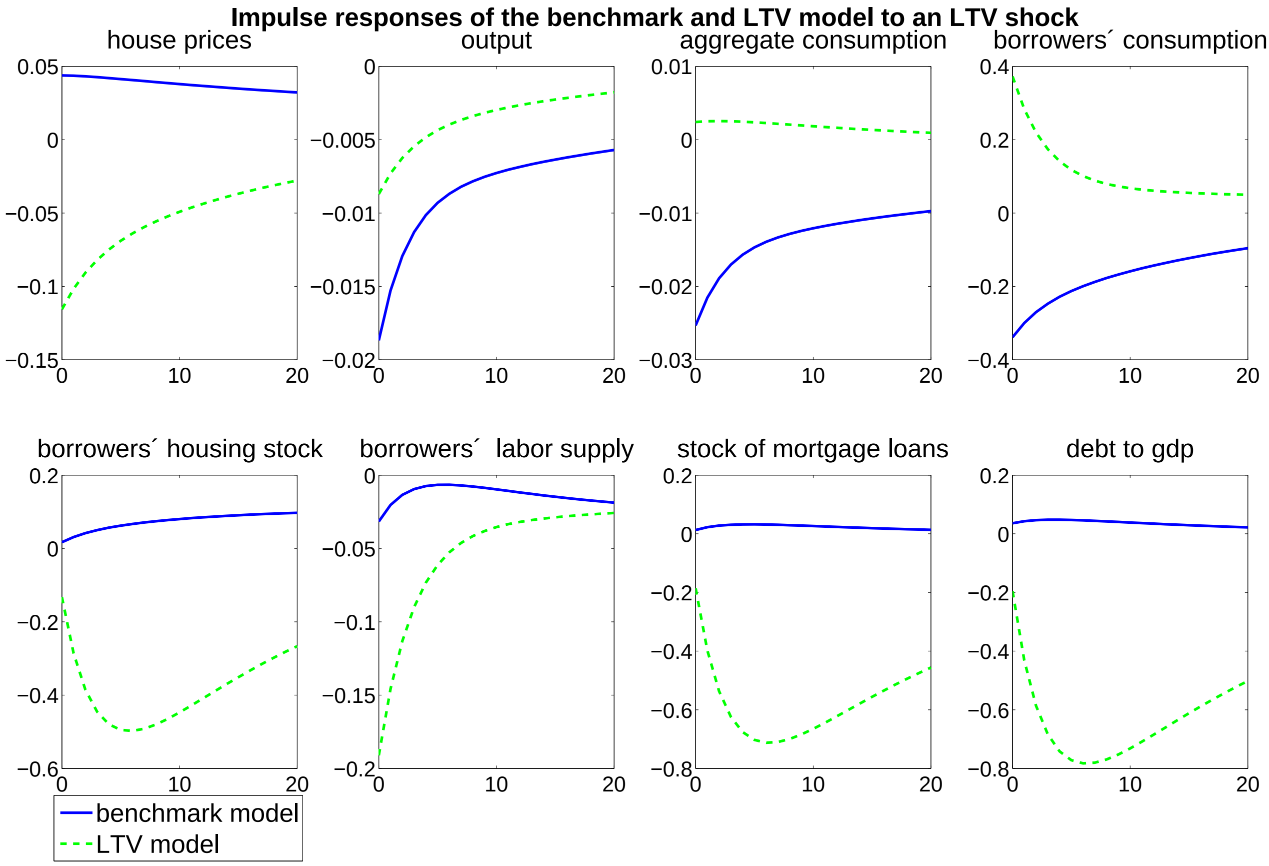
Figure 2 presents impulse responses to a negative LTV shock. In the benchmark economy, the change in LTV has almost no effect on the borrowing and debt to GDP (borrowing increases only slightly due to a decrease in interest rates). Lower LTV increases borrowers demand for housing, so house prices rise (similar to the equilibrium effect described in section 3.2). Given increased housing consumption, borrowers consume less consumption goods and the output falls. In the LTV economy, a lower LTV drives the indebtedness down. Borrowers consume less housing, but more goods. With lower demand for housing, house prices fall.

The analysis of the dynamic behaviour of benchmark and LTV economies shows that while the output response to different shocks may be similar, the behavior of borrowers in both economies is strikingly different. As such, while analyzing the role of the LTV constraint in a multiconstraint framework, it is crucial to account for other possible constraints that the borrowers might face.



Notes: The impulse responses are measured in percentage deviations from steady state.

Figure 1: Impulse responses after the technology shock



Notes: The impulse responses are measured in percentage deviations from steady state.

Figure 2: Impulse responses after the LTV shock

4 Conclusion

I use a DSGE model with borrowers facing multiple constraints to show that the LTV limit can determine housing choices of individuals, and not their borrowing. If the actual debt is determined by a DSTI constraint and a LTV constraint is present, the latter becomes a 'residual' condition, which takes debt limit as given. In such an economy, tighter LTV regulation will be ineffective in reducing households' debt. It will increase house prices in equilibrium and not change the stock of debt at all. Interest rate movements will have a stronger impact on house prices and debt ratios in such environments, which may overturn some of the conclusions about the effectiveness of monetary vs LTV policy in addressing household indebtedness.

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