Basel I, II, and III: A Welfare Analysis using a DSGE Model

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Abstract

In this paper, we take as a baseline a dynamic stochastic general equilibrium (DSGE) model, which features a housing market and a financial intermediary, in order to evaluate the welfare achieved by the banking regulations Basel I, II, and III. We find that the capital requirements imposed do not deliver higher welfare for society than a situation without regulation. However, Basel III states that there should be an extra discretionary capital buffer to avoid excessive credit growth. Here, to incorporate this buffer, we propose a countercyclical macroprudential rule in which capital requirements respond to credit growth, output and housing prices. We find that the optimal implementation of the macroprudential component of Basel III is welfare improving.

Keywords: Basel I, Basel II, Basel III, banking regulation, welfare, banking supervision, macroprudential, capital requirement ratio, credit

JEL Classification: E32, E44, E58

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"*The financial crisis brought home the lesson that financial stability could not be assured only through the use of microprudential tools. And so Basel III represents another important step in the Committee's development. Basel III has substantially enhanced the microprudential framework. And, in the countercyclical buffer, it has also introduced the first international agreement on a macroprudential tool*". Stefan Ingves, Chairman of the Basel Committee on Banking Supervision and Governor of Sveriges Riksbank, at a symposium to mark 25 years of the Basel Capital Accord: 25 years of international financial regulation: Challenges and opportunities, Basel, 26 September 2013.

1 Introduction

The current crisis has taught us that a necessary condition for growth, technological and scientific advances, and innovation is to have a stable economic and financial environment. The crisis has reduced the confidence of citizens on the banking sector, key for investment and development. In order to restore this confidence and stabilize the financial sector, policy makers are proposing some reforms and new regulations. A very important package of regulations is the so-called Basel III. Basel III is a comprehensive set of reform measures in banking regulation, supervision and risk management, developed by the Basel Committee on Banking Supervision (BCBS) at the Bank for International Settlements (BIS), to strengthen the banking sector and achieve financial stability. Furthermore, this set of measures is aimed at preventing future crises, creating a sound financial system in which financial problems are not spread to the real economy. Preventive measures acting in this direction are known between researchers and policy-makers as "macroprudential policies".

The Basel Committee aims at providing some guidance for banking regulators on what the best practice for banks is. Its standards are accepted worldwide and are generally incorporated in national banking regulations. Basel I, signed in 1988, was the first round of deliberations on the issue. Basel I primarily focused on credit risk. Banks with international presence were required to hold capital equal to 8 % of the risk-weighted assets. However, Basel I was soon widely viewed as outmoded because the world has changed as financial corporations, financial innovation and risk management have developed. Therefore, a more comprehensive set of guidelines, known as Basel II were introduced. Basel II, initially published in June 2004, was intended to create an international standard for banking regulators to control how much capital banks need to put aside to guard against the types of financial and operational risks banks and the whole economy face. Nevertheless, since the beginning of the international financial crisis in 2008, central banks all over the world worked on figuring out its reasons and the points of weakness in Basel II accord that was supposed to prevent the occurrence of such a crisis. Hence, the BCBS issued a new agreement in 2010 known as the Basel III Accord concerning the minimum requirements for capital adequacy to face the last financial crisis that had exploded. Basel III introduces an additional capital buffer (the capital conservation buffer) designed to enforce corrective action when a bank's capital ratio deteriorates. It also adds a macroprudential element in the form of the countercyclical buffer, which requires banks to hold more capital in good times to prepare for inevitable downturns in the economy. Then, Basel III introduces a mandatory capital conservation buffer of 2.5% and a discretionary countercyclical buffer, which allows national regulators to require up to another 2.5% of capital during periods of high credit growth. In this way, Basel III tries to achieve the broader macroprudential goal of protecting the banking sector from periods of excess credit growth. As of September 2010, proposed Basel III norms asked for ratios as: 7–9.5% (4.5% + 2.5% (conservation buffer) + 0–2.5% (seasonal buffer)) for common equity and 8.5–11% for Tier 1 capital and 10.5–13% for total capital. Then, although the minimum total capital requirement will remain at the current 8% level, yet the required total capital will increase up to 10.5% when combined with the conservation buffer.

However, the way to implement this macroprudential component of Basel III has not been specified by the Committee. Given that this reform is extremely important in terms of its scope and time horizon, it is crucial to do research on the topic to anticipate and quantify its effects and design the best possible implementation of the policy. In particular, researchers should focus on studying the effects of this new regulation on economic growth and welfare in order to appropriately find the way to implement it. The amount by which the capital requirement should be increased or decreased, the timing of action and the interaction of this reform with other existing policies is definitive in the success of failure of this new regulation. All the efforts should be make in order to guarantee that these reforms succeed, since that would bring a bright future economic outlook for the whole world. A context of stability, growth, innovation and investment, in which deep crises are avoided, is something that is definitely desirable.

Our results show that the capital requirements imposed by Basel I, II and III do not deliver higher welfare for society than a situation without regulation. However, an optimal implementation of the macroprudential component of Basel III is welfare improving. We propose a countercyclical macroprudential rule in which capital requirements respond to credit growth, output and housing prices and compute the optimal parameters that maximize welfare.

The rest of the paper continues as follows. Section 1.1 makes a review of the literature. Section 2 presents the modeling framework. Section 3 displays simulations. Section 4 studies welfare. Section 5 analyzes the optimal implementation of Basel III. Section 6 concludes.

1.1 Related Literature

Although there is consensus about the need of these policies, the effects of them are still unclear. Thus, given the novelty of this perspective and the uncertainty about its effects, the literature on the topic, albeit flourishing, is also quite recent and full of gaps that need to be filled. Borio (2003) was one of the pioneers on the topic. He distinguished between microprudential regulation, which seeks to enhance the safety and soundness of individual financial institutions, as opposed to the macroprudential view which focuses on welfare of the financial system as a whole. Following this work, Acharya (2009) points out the necessity of regulatory mechanisms that mitigate aggregate risk, in order to avoid future crises. Brunnermeier has done extensive work on the topic. For instance, Brunnermeier et al. (2009) suggests that all systemic institutions should be subject both to micro-prudential regulation, examining their individual risk characteristics, and to macroprudential regulation, related to their contribution to systemic risk.

The literature has proposed several instruments to be implemented as a macroprudential tool. A complete description of them appears in Bank of England (2009) and (2011), or Longworth (2011). However, only some of them have been analyzed in depth. Among the most popular proposed instruments we can find limits on the loan-to-value ratio (LTV). The LTV reflects the value of a loan relative to its underlying collateral (e.g. residential property). Kannan, Rabanal and Scott (2012) examines the interaction between monetary and a macroprudential instrument based on the LTV. Rubio and Carrasco-Gallego (2013a) evaluates the performance of a rule on the LTV interacting with the traditional monetary policy conducted by central banks and they find that introducing the macroprudential rule mitigates the effects of booms on the economy by restricting credit. Also, they show that the combination of monetary policy and the macroprudential rule is unambiguously welfare enhancing. Rubio and Carrasco-Gallego (2013b) studies a macroprudential policy based on the LTV and finds that using this policy together with the monetary policy a more stable financial system can be achieved.

Borio (2011) states that several aspects of Basel III reflect a macroprudential approach to financial regulation. Nevertheless, Basel III regulation focuses on another macroprudential tool, on limits on capital requirements. However, there is some controversy around this regulation that has been pointed out by the literature. In particular, some concerns have been raised about the impact of Basel III reforms on the dynamism of financial markets and, in turn, on investment and economic growth. The reasoning is that Basel III regulation could produce a decline in the amount of credit and impact negatively in the whole economy. Critics of Basel III consider that there is a real danger that reform will limit the availability of credit and reduce economic activity. Repullo and Saurina (2012) shows that a mechanical application of Basel III regulation would tend to reduce capital requirements when GDP growth is high and increase them when GDP growth is low. Then, if banks increase capital requirements during the crises, the credit will be reduced and the economic growth will be even lower; with a lower growth, the welfare would decrease. This is the so-called risk of pro-cyclicality, that is, Basel III could cause a deeper recession in bad times and a higher boom in good ones. Furthermore, it could have an adverse impact on growth plans of the industry, as pointed out by Kant and Jain (2013). If capital requirements ratios increase, households and industries could not borrow as much, and their plans for recovery would be affected, affecting the whole economy. Some authors have attempted to evaluate the effects of capital ratios such as Angeloni and Faia (2013) and Repullo and Suárez (2013). They compare the pro-cyclicality of Basel II and Basel I, the previous frameworks. They find that Basel II is more pro-cyclical than Basel I. That means that probably the newer regulation of Basel III, with even higher capital requirements ratios would boost the recession in the case that the economy is in a crisis. However, a complete welfare analysis including economic and financial stability of the new regulatory framework as a macroprudential policy is still pending for Basel III.

2 Model Setup

The economy features patient and impatient households, bankers and a final goods firm. Households work and consume both consumption goods and housing. Patient and impatient households are savers and borrowers, respectively. Financial intermediaries intermediate funds between consumers. Bankers are credit constrained in how much they can borrow from savers, and borrowers are credit constrained with respect to how much they can borrow from bankers. The representative firm converts household labor into the final good.

2.1 Savers

Savers maximize their utility function by choosing consumption, housing and labor hours:

$$\max E_0 \sum_{t=0}^{\infty} \beta_s^t \left[\log C_{s,t} + j \log H_{s,t} - \frac{(N_{s,t})^{\eta}}{\eta} \right],$$

where $\beta_s \in (0,1)$ is the patient discount factor, E_0 is the expectation operator and $C_{s,t}$, $H_{s,t}$ and $N_{s,t}$ represent consumption at time t, the housing stock and working hours, respectively. $1/(\eta - 1)$ is the labor supply elasticity, $\eta > 0$. $j > 0$ constitutes the relative weight of housing in the utility function. Subject to the budget constraint:

$$C_{s,t} + D_t + q_t (H_{s,t} - H_{s,t-1}) = R_{s,t-1} D_{t-1} + W_{s,t} N_{s,t}, \tag{1}$$

where D_t denotes bank deposits, $R_{s,t}$ is the gross return from deposits, q_t is the price of housing in units of consumption, and $W_{s,t}$ is the wage rate. The first order conditions for this optimization problem are as follows:

$$\frac{1}{C_{s,t}} = \beta_s E_t \left(\frac{1}{C_{s,t+1}} R_{s,t} \right) \tag{2}$$

$$\frac{q_t}{C_{s,t}} = \frac{j}{H_{s,t}} + \beta_s E_t \left(\frac{q_{t+1}}{C_{s,t+1}} \right) \tag{3}$$

$$W_{s,t} = (N_{s,t})^{\eta - 1} C_{s,t} \tag{4}$$

Equation (2) is the Euler equation, the intertemporal condition for consumption. Equation (3) represents the intertemporal condition for housing, in which, at the margin, benefits for consuming housing equate costs in terms of consumption. Equation (4) is the labor-supply condition.

2.2 Borrowers

Borrowers solve:

$$\max E_0 \sum_{t=0}^{\infty} \beta_b^t \left[\log C_{b,t} + j \log H_{b,t} - \frac{(N_{b,t})^{\eta}}{\eta} \right],$$

where $\beta_b \in (0,1)$ is impatient discount factor, subject to the budget constraint and the collateral constraint:

$$C_{b,t} + R_{b,t} B_{t-1} + q_t (H_{b,t} - H_{b,t-1}) = B_t + W_{b,t} N_{b,t}, \tag{5}$$

$$B_t \leq E_t \left(\frac{1}{R_{b,t+1}} k q_{t+1} H_{b,t} \right), \tag{6}$$

where B_t denotes bank loans and $R_{b,t}$ is the gross interest rate. k_t can be interpreted as a loan-to-value ratio. The borrowing constraint limits borrowing to the present discounted value of their housing holdings. The first order conditions are as follows:

$$\frac{1}{C_{b,t}} = \beta_b E_t \left(\frac{1}{C_{b,t+1}} R_{b,t+1} \right) + \lambda_{b,t}, \tag{7}$$

$$\frac{j}{H_{b,t}} = E_t \left(\frac{1}{C_{b,t}} q_t - \beta_b E_t \left(\frac{q_{t+1}}{C_{b,t+1}} \right) \right) - \lambda_{b,t} \frac{1}{R_{b,t+1}} k q_{t+1}, \tag{8}$$

$$W_{b,t} = \left(N_{b,t}\right)^{\eta - 1} C_{b,t}, \tag{9}$$

where $\lambda_{b,t}$ denotes the multiplier on the borrowing constraint.[1] These first order conditions can be interpreted analogously to the ones of savers.

2.3 Financial Intermediaries

Financial intermediaries solve the following problem:

$$\max E_0 \sum_{t=0}^{\infty} \beta_f^t \left[\log C_{f,t} \right],$$

where $\beta_f \in (0, 1)$ is the financial intermediary discount factor, subject to the budget constraint and the collateral constraint:

$$C_{f,t} + R_{s,t-1} D_{t-1} + B_t = D_t + R_{b,t} B_{t-1}, \tag{10}$$

where the right-hand side measures the sources of funds for the financial intermediary; household deposits and repayments from borrowers on previous loans. The funds can be used to pay back depositors and to extend new loans, or can be used for their own consumption. As in Iacoviello (2013), we assume that the bank, by regulation, is constrained by the amount of assets less liabilities. That is, there is a capital requirement ratio. We define capital as assets less liabilities, so that, the fraction of capital with

[1] Through simple algebra it can be shown that the Lagrange multiplier is positive in the steady state and thus the collateral constraint holds with equality.

respect to assets has to be larger to a certain ratio:

$$\frac{B_t - D_t}{B_t} \geq CRR. \tag{11}$$

Simple algebra shows that this relationship can be rewritten as:

$$D_t \leq (1 - CRR)\, B_t, \tag{12}$$

If we define $\gamma = (1 - CRR)$, we can reinterpret the capital requirement ratio condition as a standard collateral constraint, so that banks liabilities cannot exceed a fraction of its assets, which can be used as collateral:

$$D_t \leq \gamma B_t, \tag{13}$$

where $\gamma < 1$. The first order conditions for deposits and loans are as follows:

$$\frac{1}{C_{f,t}} = \beta_f E_t \left(\frac{1}{C_{f,t+1}} R_{s,t} \right) + \lambda_{f,t}, \tag{14}$$

$$\frac{1}{C_{f,t}} = \beta_f E_t \left(\frac{1}{C_{f,t+1}} R_{e,t+1} \right) + \gamma \lambda_{f,t}, \tag{15}$$

where $\lambda_{f,t}$ denotes the multiplier on the financial intermediary's borrowing constraint.[2]

2.4 Firms

The problem for the final good firms is standard and static:

$$\max \Pi_t = Y_t - W_{s,t} N_{s,t} - W_{b,t} N_{b,t},$$

$$Y_t = A_t N_{s,t}^{\alpha} N_{b,t}^{1-\alpha}, \tag{16}$$

where A_t represents a technology parameter. The problem delivers the standard first-order conditions, which represent the labor-demand equations:

[2] Financial intermediaries have a discount factor $\beta_f < \beta_s$. This condition ensures that the collateral constraint of the intermediary holds with equality in the steady state, since $\lambda_f = \frac{\beta_s - \beta_f}{\beta_s}$>0

$$W_{s,t} = \frac{\alpha Y_t}{N_{s,t}}, \tag{17}$$

$$W_{b,t} = \frac{(1-\alpha)\, Y_t}{N_{b,t}}. \tag{18}$$

2.5 Equilibrium

The total supply of housing is fixed and it is normalized to unity. The market clearing conditions are as follows:

$$Y_t = C_{s,t} + C_{b,t} + C_{f,t}, \tag{19}$$

$$H_{s,t} + H_{b,t} = 1. \tag{20}$$

3 Simulation

3.1 Parameter Values

The discount factor for savers, β_s, is set to 0.99 so that the annual interest rate is 4% in steady state. The discount factor for the borrowers is set to 0.98.[3] As in Iacoviello (2011), we set the discount factors for the bankers at 0.965 which, together with the bank leverage parameters implies a spread of about 1 percent (on an annualized basis) between lending and deposit rates. The steady-state weight of housing in the utility function, j, is set to 0.1 in order for the ratio of housing wealth to GDP to be approximately 1.40 in the steady state, consistent with the US data. We set $\eta = 2$, implying a value of the labor supply elasticity of 1.[4] For the parameters controlling leverage, we set k and γ to 0.90, which implies a capital requirement ratio of 10%, in line with the US data.[5] The labor income share for savers is set to 0.64, following the estimate in Iacoviello (2005). We assume that technology, A_t, follows an autoregressive process with 0.9 persistence and a normally distributed shock. Table 1 presents a summary of the parameter values used:

[3] Lawrance (1991) estimated discount factors for poor consumers at between 0.95 and 0.98 at quarterly frequency. We take the most conservative value.

[4] Microeconomic estimates usually suggest values in the range of 0 and 0.5 (for males). Domeij and Flodén (2006) show that in the presence of borrowing constraints this estimates could have a downward bias of 50%.

[5] See Iacoviello (2011).

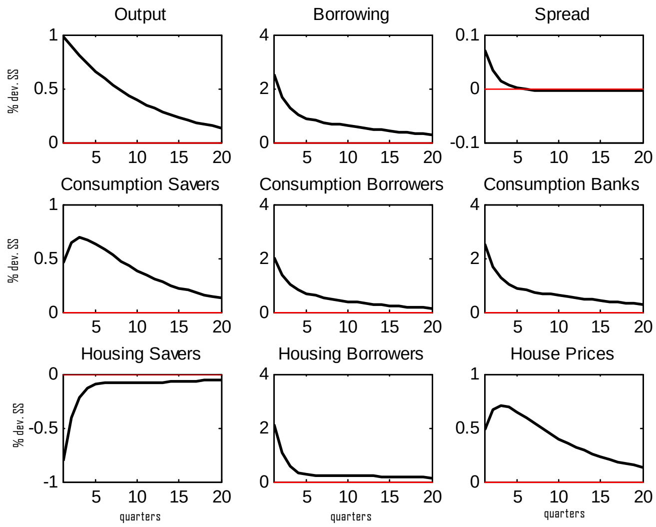

Figure 1: Impulse responses to a technology shock.

Table 1: Parameter Values		
β_s	.99	Discount Factor for Savers
β_b	.98	Discount Factor for Borrowers
β_f	.965	Discount Factor for Banks
j	.1	Weight of Housing in Utility Function
η	2	Parameter associated with labor elasticity
k	.90	Loan-to-value ratio
CRR	.10	Capital Requirement ratio
α	.64	Labor income share for Savers
ρ_A	.9	Technology persistence

3.2 Dynamics

3.2.1 Baseline Model

In this section, we simulate the impulse responses of the baseline model given a positive technology shock and a house-price shock to illustrate the dynamics of the model. Both shocks represent a boom for the economy, in the sense that they increase output, house prices and therefore borrowing and consumption.

Figure 1 presents the impulse responses to a 1 percent shock to technology. Given the increase in technology, output increases and thus, consumption for the three agents increases. Borrowing increases

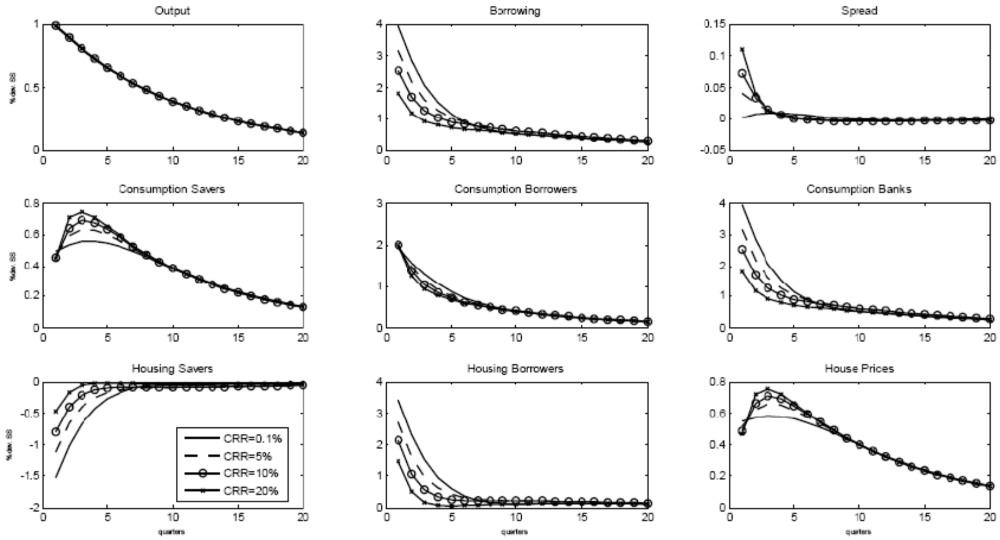

Figure 2: Impulse responses to a technology shock. Different capital requirement ratios.

and borrowers demand more housing, which is compensated by a decrease in the housing by the savers, given that the supply of housing is fixed. The increase in house prices increases consumption for borrowers further, given the collateral constraint they face. In this model, wealth effects are present through the collateral constraint. Situations in which house prices increase make the value of the collateral higher, and thus, wealth effects expand the economy even further.

3.2.2 Different Capital Requirements

In order to understand the effect of the regulation on banks on the dynamics, here we simulate the model for different capital requirement ratios.

Figure 2 presents impulse responses to a technology shock. We observe that, when the capital requirement ratio increases, borrowing decreases and therefore borrowers consume less. Banks, since they are not able to lend as much, also suffer a decrease in their consumption. However, the effect is the opposite for savers. The overall effects are distributional and they do not affect the aggregate.

4 Welfare

4.1 Welfare Measure

To assess the normative implications of the different policies, we numerically evaluate the welfare derived in each case. As discussed in Benigno and Woodford (2008), the two approaches that have recently been used for welfare analysis in DSGE models include either characterizing the optimal Ramsey policy, or solving the model using a second-order approximation to the structural equations for given policy and then evaluating welfare using this solution. As in Mendicino and Pescatori (2007), we take this latter approach to be able to evaluate the welfare of the three types of agents separately.[6] The individual welfare for savers, borrowers, and the financial intermediary, respectively, as follows:

$$W_{s,t} \equiv E_t \sum_{m=0}^{\infty} \beta_s^m \left[\log C_{s,t+m} + j \log H_{s,t+m} - \frac{(N_{s,t+m})^\eta}{\eta} \right], \tag{21}$$

$$W_{b,t} \equiv E_t \sum_{m=0}^{\infty} \beta_b^m \left[\log C_{b,t+m} + j \log H_{b,t+m} - \frac{(N_{b,t+m})^\eta}{\eta} \right], \tag{22}$$

$$W_{f,t} \equiv E_t \sum_{m=0}^{\infty} \beta_f^m \left[\log C_{f,t+m} \right]. \tag{23}$$

Following Mendicino and Pescatori (2007), we define social welfare as a weighted sum of the individual welfare for the different types of households:

$$W_t = (1 - \beta_s) W_{s,t} + (1 - \beta_b) W_{b,t} + (1 - \beta_f) W_{f,t}. \tag{24}$$

Each agent´s welfare is weighted by her discount factor, respectively, so that the all the groups receive the same level of utility from a constant consumption stream.

4.2 Capital Requirement Ratios

Figure 3 presents the welfare change that each group experiments when increasing the capital requirement ratio for banks. We see that there is a welfare trade-off between borrowers and savers. While savers are better off when banks are required to hold more capital, borrowers are worse off with this measure.

[6] We used the software Dynare to obtain a solution for the equilibrium implied by a given policy by solving a second-order approximation to the constraints, then evaluating welfare under the policy using this approximate solution, as in Schmitt-Grohe and Uribe (2004). See Monacelli (2006) for an example of the Ramsey approach in a model with heterogeneous consumers.

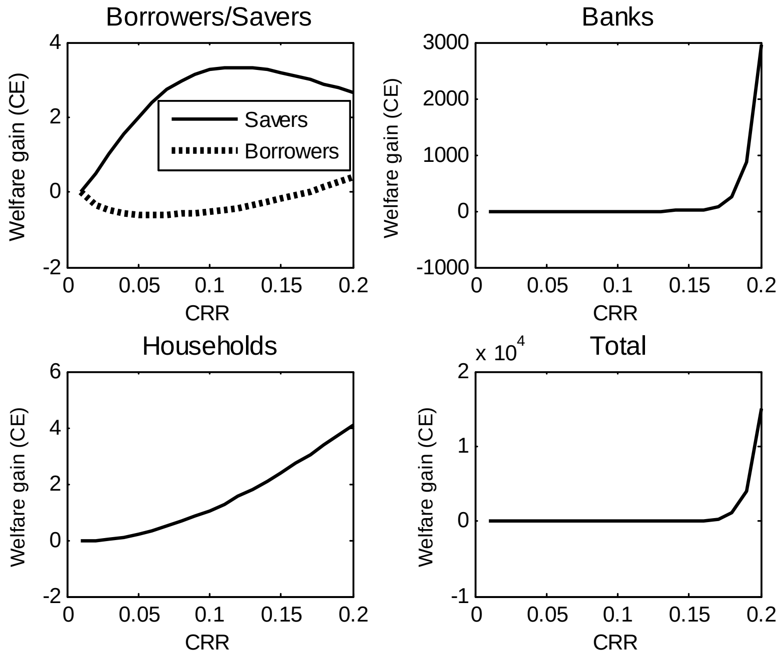

Figure 3: Welfare gains from increasing the capital requirement ratio.

The reason is that increasing capital requirements does not allow borrowers borrow as much as they would like and their consumption decreases. For banks, welfare starts to increase for larger values of the capital requirement ratio. When capital requirements are very large, banks cannot lend and they are able to transform all their assets into consumption. If we look at the welfare of the households, we see that increasing capital requirements is welfare increasing, that is, the welfare gain experimented by the savers compensates the loss of the borrowers. Total welfare mimics the pattern of banks, given that their gains are very large and dominate welfare of the other groups of the economy.[7]

5 Optimal Implementation of Basel III

Basel III states that there should be an extra discretionary capital buffer that should avoid excessive credit growth. However, it does not specify the criteria to change the capital requirement or under which conditions. Here, we propose a rule that includes credit growth, house prices and output to state what the optimal implementation of Basel III would be, that is, the one that would maximize welfare:

$$CRR_t = (CRR_{SS}) \left(\frac{B_t}{B_{t-1}}\right)^{\phi_b} \left(\frac{Y_t}{Y}\right)^{\phi_y} \left(\frac{q_t}{q}\right)^{\phi_q} \tag{25}$$

[7] We eliminate banks from the welfare function in the "Households" panel to observe a cleaner pattern.

This rule states that whenever regulators observe that credit is growing, or output and house prices are above their steady-state value, they automatically increase the capital requirement ratio to avoid an excess in credit.

5.1 Optimal Parameters

Table 2 presents the optimal parameters in equation (25) that maximize social welfare and compare results in terms of welfare gains with respect to the benchmark (no regulation). We see that under Basel I and II (first column), only savers benefit from higher capital requirements, with respect to the no regulation situation. The third column presents the increase in capital requirements stated in Basel III, however, it does not take into account the seasonal buffer. We see that increasing further the capital requirements as in Basel III is also beneficial for savers, but the whole society keeps losing welfare. However, optimally implementing the macroprudential component of Basel III manages to increase total welfare. However, the losers in this case are the savers. Both borrowers and banks benefit from this measure, since it provides a more stable financial scenario.

Table 2: Optimal Implementation of Basel III

	Basel I, II	**Basel III**	**Basel III+Macropru**
CRR_{SS}	8%	$8\% + 2.5\%$	$8\% + 2.5\%$
ϕ_b^*	-	-	0.1
ϕ_y^*	-	-	1.9
ϕ_q^*	-	-	1.6
Welfare gain			
Savers	2.97	3.29	-0.88
Borrowers	-0.58	-0.49	2.61
Banks	-0.99	-0.98	1.58
Total	-0.99	-0.96	4.61

5.2 Simulations

Here, we simulate the model for the Basel I and II requirements compared with Basel III. Basel I and II require a total capital of 8%. In order to simulate Basel III, we consider a capital requirement of 2.5%, that is, 10.5% in the steady state, together with the optimal macroprudential rule found in the previous

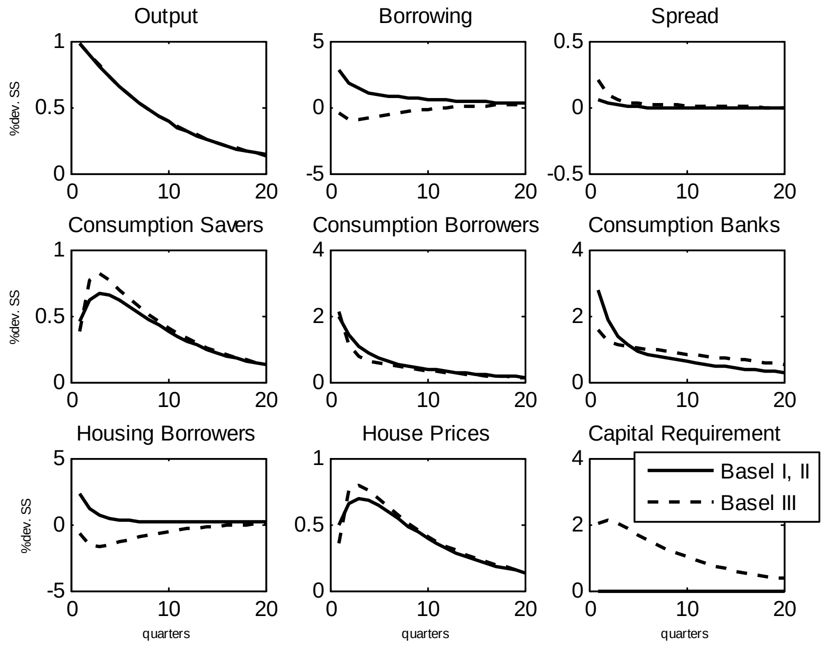

Figure 4: Impulse responses to a technology shock. Basel I, II versus Basel III.

section.

Figure 4 presents the model impulse responses to a technology shock for the two alternative scenarios: Basel I, II and Basel III. We see that under Basel III, following the technology shock, the capital requirement increases about 2% with respect to its steady state, while it remains at the steady state under Basel I, II. This higher capital requirement under Basel III makes that borrowing does not increase as much with the shock. Then, borrowers and banks can consume less under Basel III but this is compensated by an increase in consumption by savers, which offsets aggregate differences. However, we obtain a more stable financial scenario and a higher welfare.

6 Concluding Remarks

In this paper, we take as a baseline a dynamic stochastic general equilibrium (DSGE) model, which features a housing market and a financial intermediary, in order to evaluate the welfare achieved by Basel I, II, and III. Therefore, in the model, there are three types of agents: savers, borrowers and banks. Borrowers are constrained in the amount they can borrow. Banks are constrained in the amount they can lend, that is, there is a capital requirement ratio for banks.

First, we evaluate how the model responds to changes in the capital requirement. We observe that higher capital requirements decrease the quantity of borrowing in the economy and as a consequence, both borrowers and banks can consume less. This is offset by higher consumption by savers. In terms of welfare, savers are better off if capital requirements increase, while borrowers are worse off. For banks, welfare increases a great deal after a capital requirement threshold because for very high capital requirements, they can consume all their assets.

Then, we compare Basel I and II with respect to Basel III in terms of dynamics and welfare. In order to do that, we propose a rule for the capital buffer of Basel III. Following this rule, capital requirements would respond to credit growth, output and house prices. We find the optimal parameters of the rule that maximize welfare. Using the optimized parameters, we simulate the model and observe that, after a technology shock, capital requirements increase further in Basel III, given the macroprudential measure. This extra increase in capital requirements cuts borrowing further, achieving the goal of the regulation. In terms of welfare, we see that the macroprudential component of Basel III delivers higher welfare for society than a situation with no regulation.

Appendix

Steady-State of the main model

$$C_s + D = R_s D + W_s N_s, \tag{26}$$

$$R_s = \frac{1}{\beta_s} \tag{27}$$

$$\frac{qH_s}{C_s} = \frac{j}{(1-\beta_s)} \tag{28}$$

$$W_s = (N_s)^{\eta-1} C_s \tag{29}$$

$$C_b = \frac{\beta_s - 1}{\beta_s} B + W_b N_b, \tag{30}$$

$$B = \beta_s kq H_b, \tag{31}$$

$$\lambda_b = (\beta_s - \beta_b), \tag{32}$$

$$\frac{1}{C_b}(q - (\beta_s - \beta_b)\beta_s kq - \beta_b q) = \frac{j}{H_b}, \tag{33}$$

$$W_b = (N_b)^{\eta-1} C_b, \tag{34}$$

$$C_f + B_t = \frac{\beta_s - 1}{\beta_s} D + R_b B, \tag{35}$$

$$\frac{D}{B} = \gamma, \tag{36}$$

$$\lambda_f = (\beta_s - \beta_f), \tag{37}$$

$$\frac{1 - \gamma(\beta_s - \beta_f)}{\beta_f} = R_b,$$

$$Y = AN_s^{\alpha} N_b^{1-\alpha}, \tag{38}$$

$$W_s = \alpha A \left(\frac{N_s}{N_b} \right)^{\alpha - 1}, \tag{39}$$

$$W_b = A \left(1 - \alpha \right) \left(\frac{N_s}{N_b} \right)^{\alpha}. \tag{40}$$

References

[1] Acharya, V. V. (2009), 'A Theory of Systemic Risk and Design of Prudential Bank Regulation', Journal of Financial Stability, 5(3), pp. 224-255

[2] Agénor, P., Pereira da Silva, L., (2011), Macroeconomic Stability, Financial Stability, and Monetary Policy Rules, Ferdi Working Paper, 29

[3] Angelini, P., Neri, S., Panetta, F., (2011), Monetary and macroprudential policies, Bank of Italy Working Paper

[4] Angeloni, I. and Faia, E. (2013). Capital regulation and monetary policy with fragile banks, Journal of Monetary Economics, Vol. 60, Issue 3

[5] Bank of England (2009), 'The Role of Macroprudential Policy', A Discussion Paper

[6] Bank of England (2011), 'Instruments of macroprudential policy', A Discussion Paper

[7] Borio, C. (2003). Towards a macroprudential framework for financial supervision and regulation? BIS Working Paper No 128, February.

[8] Borio, C. (2011). Rediscovering the macroeconomic roots of financial stability policy: journey, challenges and away forward. BIS Working Papers No 354, September.

[9] Brunnermeier, M., Crockett, A., Goodhart, C., Persaud, A. and Shin, H. (2009), 'The Fundamental Principles of Financial Regulation', Geneva Report on the World Economy 11, ICBM, Geneva and CEPR, London

[10] Domeij, D., Flodén, M., (2006) "The Labor-Supply Elasticity and Borrowing Constraints: Why Estimates are Biased." Review of Economic Dynamics, 9, 242-262

[11] Iacoviello, M., (2005) "House Prices, Borrowing Constraints and Monetary Policy in the Business Cycle." American Economic Review, 95 (3), 739-764

[12] Iacoviello, M., (2013), Financial Business Cycles, Mimeo, Federal Reserve Board

[13] Iacoviello, M. , Neri, S., (2010), "Housing Market Spillovers: Evidence from an Estimated DSGE Model," American Economic Journal: Macroeconomics, 2, 125–164.

[14] IMF, Monetary and Capital Markets Division, (2011), Macroprudential Policy: An Organizing Framework, mimeo, IMF

[15] Kannan, P., Rabanal, P. and A. Scott (2012): “Monetary and Macroprudential Policy Rules in a Model with House Price Booms”, The B.E. Journal of Macroeconomics, Contributions, 12 (1)

[16] Kant, R. and Jain, S.(2013), Critical assessment of capital buffers under Basel III. Indian Journal of Finance, Vol. 7, Issue 4

[17] Lawrance, E., (1991), "Poverty and the Rate of Time Preference: Evidence from Panel Data", The Journal of Political Economy, 99 (1), 54-77

[18] Longworth, D. (2011), ‘A Survey of Macro- prudential Policy Issues’, Mimeo, Carleton University

[19] Mendicino, C., Pescatori, A., (2007), Credit Frictions, Housing Prices and Optimal Monetary Policy Rules, mimeo

[20] Official Journal of the European Union (14-02-2012). RECOMMENDATION OF THE EUROPEAN SYSTEMIC RISK BOARD of 22 December 2011 on the macroprudential mandate of national authorities

[21] Official Journal of the European Union, (15-06-2013). RECOMMENDATION OF THE EUROPEAN SYSTEMIC RISK BOARD of 4 April 2013 on intermediate objectives and instruments of macroprudential policy

[22] Repullo, R. and Suarez, J. (2013), The procyclical effects of bank capital regulation Review of Financial Studies,Vol. 26, Issue 2.

[23] Repullo, R. and Saurina, J. (2012). The Countercyclical Capital Buffer of Basel III: A Critical Assessment. In the Crisis Aftermath: New Regulatory Paradigms. Edited by Mathias Dewatripont and Xavier Freixas. Centre for Economic Policy Research (CEPR), London

[24] Rubio, M. (2011), Fixed- and Variable-Rate Mortgages, Business Cycles, and Monetary Policy, Journal of Money, Credit and Banking, Vol. 43, Is. 4

[25] Rubio, M. (2013), Housing Markets Heterogeneity in a Monetary Union. Journal of International Money and Finance, forthcoming.

[26] Rubio, M. and Carrasco-Galllego, J. (2013a), Macroprudential Measures, Housing Markets, and Monetary Policy, Moneda y Crédito

[27] Rubio, M. and Carrasco-Galllego, J. (2013b), Macroprudential and Monetary Policies: Implications for Financial Stability and Welfare, Centre For Finance and Credit Markets, Working Paper 13/05