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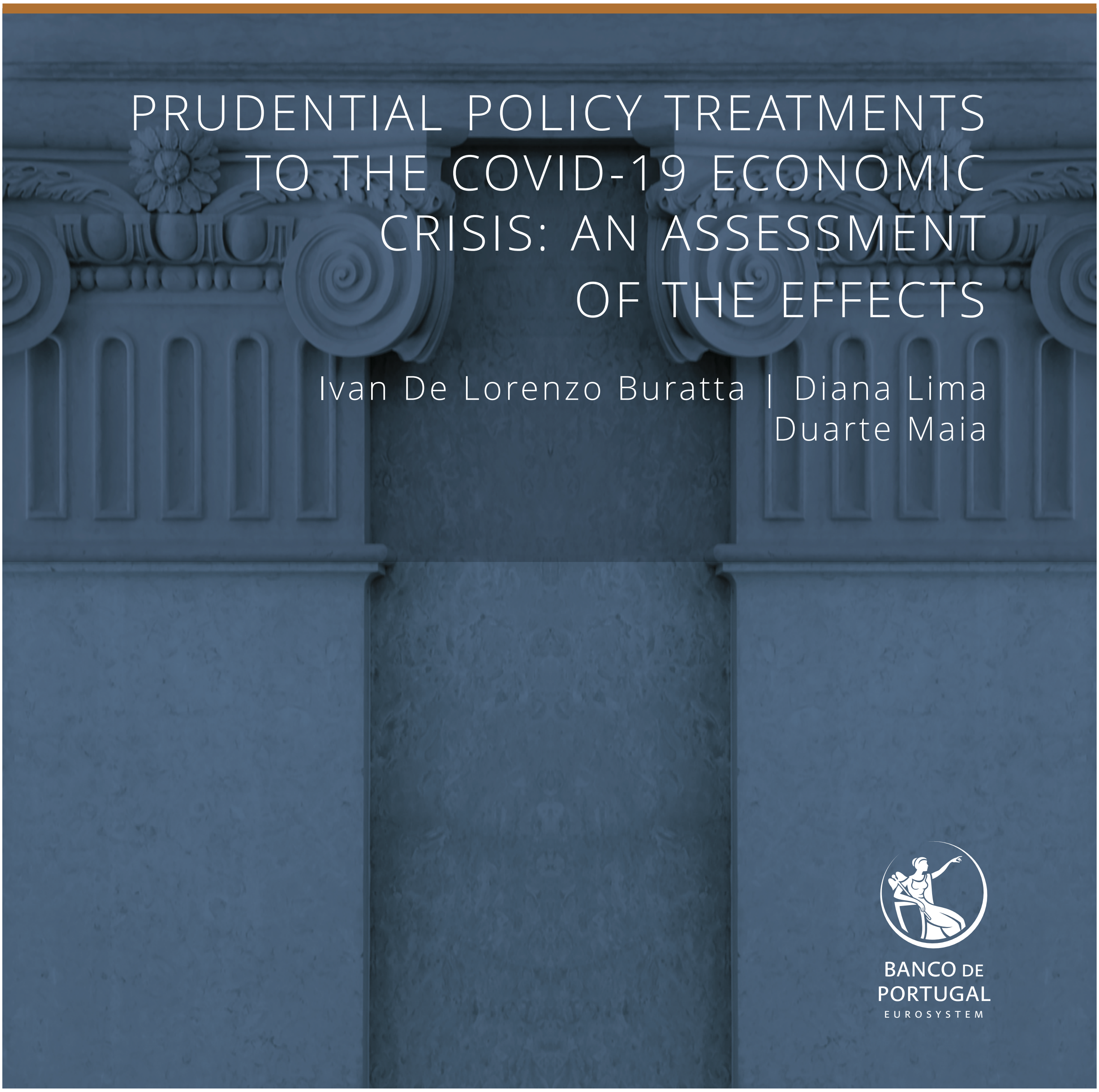

PRUDENTIAL POLICY TREATMENTS TO THE COVID-19 ECONOMIC CRISIS: AN ASSESSMENT OF THE EFFECTS

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The analyses, opinions and findings of these papers represent the views of the authors, they are not necessarily those of the Banco de Portugal or the Eurosystem.

Please address correspondence to
Banco de Portugal
Rua do Comércio 148, 1100-150 Lisboa, Portugal
Tel.: +351 213 130 000, email: info@bportugal.pt

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Prudential policy treatments to the COVID-19 economic crisis: an assessment of the effects

Ivan De Lorenzo Buratta
Banco de Portugal

Diana Lima
Banco de Portugal

Duarte Maia
Banco de Portugal

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Abstract
At the onset of the COVID-19 pandemic shock, several policy measures were adopted to mitigate the severe effects on economic and financial activities. In this paper we focus on the assessment of the economic and financial impacts of prudential policy measures, namely the flexibility measure – i.e. a temporary relaxation of the Pillar 2 Guidance and the combined buffer requirement – and the dividends pay-out restriction. As the economy recovers from the pandemic crisis and measures are being withdrawn, we are also interested in understanding the implications of distinct paths for the replenishment of capital buffers. For these purposes we use a dynamic general equilibrium model with banks, households and firms default, calibrated for the Portuguese economy. Our main conclusions are that the measures were effective in achieving their main policy objectives of maintaining the credit flow in the economy. Importantly, results also suggest that the joint use of the flexibility measure and the dividends pay-out restrictions reinforces the benefits that were achieved by using the flexibility measure only. We also show that the joint use of measures reduce the effort of the banking system to rebuild their capital buffers once the pandemic crisis vanishes. Lastly, transition periods for the replenishment of capital buffers should be carefully considered, since shorter transition periods may be more effective at reinforcing banks' resilience, but longer transitions may be more adequate for ensuring that lending flows smoothly to the economy.

JEL: E3, E44, G01, G21, 052

Keywords: Macroprudential policy, COVID-19 pandemic, capital-based instruments, Portugal.

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E-mail: ilorenzo@bportugal.pt; dlima@bportugal.pt; dmaia@bportugal.pt

1. Introduction

Several policy measures have been adopted worldwide to dampen the severe effects of the COVID-19 pandemic crisis on economic and financial activities. Central bank interventions, government support measures and supervisory/regulatory action helped mitigate this economic and financial impact to a large extent. Although the financial system has entered the COVID-19 pandemic crisis with high resilience, the risks posed by the pandemic remained elevated. In particular, vulnerabilities related to the deterioration of credit quality of non-financial borrowers could increasingly affect banks and, more generally, the supply of financing to the real economy (Financial Stability Board 2020).

In Europe, the policy package approved by the Single Supervisory Mechanism of the European Central Bank (hereafter ECB/SSM) included two measures specifically targeting the banking sector. First, in March 2020 the micro and macroprudential authorities allowed for a temporary relaxation of the requirements regarding the Pillar 2 Guidance and the Combined Buffer Requirement (henceforth the flexibility measure).[1] The main goal of this measure was to support banks to continue to fulfil their role in funding the real economy in the face of significant economic effects of the COVID-19 pandemic. Second, at the end of the same month, another measure was taken and concerned the recommendation not to pay dividends and refrain from buying back shares (henceforth dividends pay-out restriction).[2] According to the ECB/SSM, this measure aimed at preserving banks capacity to absorb losses and support the economy in an environment of exceptional uncertainty. This extraordinary and temporary recommendation helped strengthen the temporary relief in capital requirements. The prudential measures, together with other government and monetary policy measures, prevented potential deleveraging resulting from banks' procyclical behavior, ensuring the maintenance of an adequate flow of credit to the economy.

In July 2020 the ECB/SSM announced that it would not require European banks to start rebuilding their capital buffers, at least until the end of 2022.[3] This decision was intended to ensure that the banking system would contribute to a sustainable economic recovery. In February 2022, the ECB/SSM confirmed the path for the capital replenishment and that, therefore, it would not extend

1. For additional information regarding the flexibility measure, see the press release of the ECB announcement. The European Banking Authority (EBA) statement on 12 March 2020 also aligns with the ECB announcement.

2. The suspension of dividends pay-out was implemented with the Recommendation ECB/2020/19 adopted on 27 March 2020. The restriction remained active until the third quarter of 2021 as set out in Recommendation ECB/2020/62 adopted on 15 December 2020. The decision was further reinforced by the ESRB Recommendation ESRB/2020/7 adopted on 27 May 2020. The aforementioned EBA statement also recommends to "follow prudent dividend and other distribution policies".

3. For additional information regarding the expected timeline to restore buffers, see the press release of the ECB/SSM announcement.

capital relief for banks beyond the end of 2022.[4] All the aforementioned measures were also applied to less significant institutions (LSIs) in Portugal, following the decisions taken by Banco de Portugal.[5]

The flexibility measure has not been generally used by Portuguese banks. The enhanced resilience of the financial system in the run-up to the crisis was a key factor in the sector's responsiveness. This enhancement increased the ability to absorb unexpected losses but also the space for macroprudential policy action in crises. However, it should be considered that rebuilding capital buffers may have procyclical effects on lending, especially when insufficient information on losses incurred by banks are available. The magnitude of these effects will depend, among other factors, on the size of banks' management capital buffers (i.e., the level of capital buffers above the requirements set by supervisory authorities) and the actions taken by banks to comply with higher buffer levels in the aftermath of the crisis and the withdrawal of the measures. These latter actions include equity issuance, deleveraging, reducing the management capital buffer, or a combination of the three possible strategies. For these reasons, the adoption of different paces and periods for the transition to the pre-crisis level of capital buffers may be relevant in terms of the impact on financial stability and economic recovery.

This paper aims at (i) assessing the economic and financial impacts of the flexibility measure and the dividends pay-out restriction over the Covid-19 pandemic crisis, and (ii) understanding the implications for financial stability and economic activity of different periods and paces for the gradual rebuilding of capital buffers (henceforth the replenishment of capital buffers). The focus of this assessment is to understand, from a theoretical perspective, whether the implementation of these policy measures are effective in attaining their own objectives. These measures can be seen as a test to the efficacy and effectiveness of macroprudential policy. Evaluating the effects of these two policy measures on the financial system and the impact of their withdrawal enhances our knowledge about the functioning of macroprudential policy, as it can contribute to a more effective use of the macroprudential toolkit to ensure financial stability. The analysis is therefore centered in this period of broadly two years and does not intend to explain the effects of prudential regulation and structural changes on the Portuguese banking system before the pandemic crisis hit.

For these purposes, we use a dynamic stochastic general equilibrium model (DSGE) where banks, impatient households and entrepreneurs can default, based on Clerc *et al.* (2015) and calibrated for the Portuguese economy, in line with Lima

4. ECB/SSM Press release, 10 of February 2022.

5. We conduct a partial analysis of the prudential policy measures that were applied as a response to the Covid-19 pandemic, e.g. we do not assess the liquidity relief measure that allowed banks to operate with a liquidity coverage ratio below 100%, nor the decision to allow banks to also use Additional Tier 1 and Tier 2 instruments to comply with their P2Rs, in line with the arrangements for Pillar 1.

et al. (2023). In this model, micro and macroprudential capital requirements play a role in mitigating the financial distortions.

To the extent of our knowledge, this work represents the first attempt to assess the impact of the flexibility measure, the dividends pay-out restriction, and different replenishment periods for capital buffers for Portugal. More generally, this is one of the first papers analyzing the combined effect of the flexibility measure and the dividends pay-out restriction in a COVID-19 pandemic context. Muñoz (2021) represents the closest reference in this regard, as the author shows in a DSGE model how jointly-calibrated dividends restriction and the countercyclical capital buffer (CCyB) improve the effectiveness of macroprudential capital measures in smoothing the financial and the business cycle when financial shocks hit the economy.[6] The work in Dautović *et al.* (2023) also serves as a benchmark for our results, as authors find that the COVID-19 dividends pay-out restriction positively impacted lending to financially constrained firms, increased capital space for banks, and reduced pro-cyclical behaviors. Moreover, our work is among the first ones to address the replenishment of capital buffers,[7] and specifically the issue of exploring different path regimes for the replenishment of capital buffers. Darracq Pariès *et al.* (2011) first approach this topic, highlighting the importance of smoothing out the transition to new (higher) capital requirement levels. The analysis developed in Budnik *et al.* (2020b) is more in line with our work, as it quantifies the effects of four different replenishment scenarios using a mix of three different micro and macro models.[8] The authors find that replenishing capital buffers too early or too aggressively could prolong the economic downturn. Consequently, weaker macroeconomic conditions would recommend a later and more gradual restoration of capital buffers.

Our work leads to conclusions in line with the aforementioned literature. First of all, we find that the flexibility measure limits the transmission of the COVID-19 pandemic shock to the economy, as it mitigates the negative impact on credit granted to both firms and households. This measure is especially beneficial for corporate loans, inducing higher corporate investment. The better ability of the banking sector to finance the economy translates into a milder reduction in GDP in the short-to-medium term and overall in the simulation sample considered. In this assessment, we assume that banks are able to fully use the flexibility measure, without any restrictions. However, as stressed in the ESRB (2021) report, banks might not always be able or willing to use their buffers. The ability or willingness of

6. Muñoz (2020) also provides evidence that the results hold in a COVID-19 pandemic scenario.

7. A number of papers can be considered as addressing indirectly the replenishment, as they investigate the effects of raising capital requirements, see for example Angelini *et al.* (2014), Cozzi *et al.* (2020) and Muñoz (2021).

8. The ECB analysis employs three models: (i) a non-linear DSGE model as proposed in Darracq Pariès *et al.* (2020); (ii) the Banking Euro Area Stress Test (BEAST) model described in Budnik *et al.* (2019) and Budnik *et al.* (2020a); (iii) the DSGE model with cross-border banking features presented in Darracq Pariès *et al.* (2019)

banks to use capital buffers may depend on several factors, including overlap with other minimum requirements and stigma effects.

When we consider both the dividends pay-out restriction and the flexibility measure, the beneficial effects on credit and GDP are higher than in the case where only the flexibility measure is active. Moreover, the dividends pay-out restriction allows banks to avoid using the flexibility measure entirely, with desirable consequences on banks' default rate. This result also implies a smaller effort for banks to replenish capital buffers, i.e. to return to the pre-flexibility-measure level of capitalization.

Finally, analyzing different transition paths for the replenishment of capital buffers, we conclude that the choice depends on policymakers' priorities, as it presents trade-offs. Shorter transition horizons are better at strengthening the banking system resilience, while longer time horizons maintain a higher flow of credit to the economy. This evidence is robust to linear and non-linear specifications of the replenishment paths, even though, in the non-linear path regime, the differences in the responses for each transition period shrink as horizons extend.

The remaining of this paper is organized as follows. Section 2 frames our work in the current COVID-19-related economic literature, section 3 summarizes the main features of the model and section 4 describes the calibration we use. The results for the impact of the flexibility measure and the dividends pay-out restriction are presented in section 5, while the implications of different replenishment periods for capital buffers are discussed in section 6. Finally, section 7 concludes.

2. Literature review

Our paper can be traced back to the growing literature concerning the impacts of the COVID-19 pandemic on the economy and the attenuating role of the policy measures put in place in response to it. COVID-19 pandemic was detrimental to several economic sectors, eroded the productivity and profitability of firms, and exposed them to a higher risk of bankruptcy overall (Augusto *et al.* 2022; Cella 2020; Bloom *et al.* 2020). Some empirical evidence focuses on the impact of the mitigating policies implemented by governments on households and firms. MacGee *et al.* (2022) analyze the effects of the pandemic on household debt and unplanned savings in Canada and suggest that the implemented policies have only partially achieved their aim to sustain household consumption. Ebeke *et al.* (2021) argue that corporate sector policy measures have significantly curbed liquidity shortfalls, layoffs and output losses of European firms. Guth *et al.* (2020) and De Socio *et al.* (2020) find similar results for Austria and Italy, respectively. Other authors focus on the impact of COVID-19 sovereign loan guarantees, documenting an increase in lending (Falagiarda *et al.* 2020; Budnik *et al.* 2021), higher support for high productivity firms at the expense of zombie firms (Demmou and Franco 2021; Mateus and Neugebauer 2022), and an aggregate positive effect on GDP (Budnik *et al.* 2020b) and financial stability (De Lorenzo Buratta and Pinheiro 2023).

Our work also relates to the more specific literature considering the impact of macroprudential policy measures in the context of the pandemic. Avezum *et al.* (2021) and Dursun-de Neef *et al.* (2023) find that the release of the CCyBs was effective in promoting bank lending during the pandemic. Avezum *et al.* (2021) also concludes that the release of the CCyB reduced the procyclicality of credit. Igan *et al.* (2022) show that tightening macroprudential policies prior the COVID-19 pandemic outbreak reduced bank risk observed in the first quarter of 2020. In a similar way, Bergant and Forbes (2021) argue that tightening macroprudential policy more aggressively before the COVID-19 pandemic and easing during the outbreak increased the likelihood of experiencing less financial and economic stress. Forbes (2021) shows that countries having a tighter macroprudential stance[9] experienced significantly better equity market performance during the COVID-19 pandemic shock period. Finally, in Banco de España (2020) authors suggest that countries that fully or partly released their macroprudential buffers have mitigated the deterioration in the lower percentiles of the conditional GDP growth distribution (*growth-at-risk*) better than the countries that did not.

We complement the above-mentioned literature by exploring the impact of COVID-19 prudential policy measures on economic and financial activity in a general equilibrium framework that allows households, firms and banks to default. This methodological choice allows us to effectively analyze the transmission of the pandemic shock from firms and households to the banking sector and quantify the impact of measures on relevant variables such as credit, banks' default probabilities and output. In addition, when exploring how capital buffers should be restored after their release, our model framework allows for the comparison of different replenishment paths.

3. The model

We describe a macroeconomic environment with three layers of default (henceforth 3D model) calibrated for the Portuguese economy. The model builds on Clerc *et al.* (2015) and it has been designed to incorporate the main features that motivate the need to adopt policies regulating the capital ratios of banks at micro and macroprudential levels. The model does not include monetary policy. However, we consider that incorporating it would have minimal impact, as Portugal is a small open economy and the effect on prices - if any - of the flexibility measure, the dividends pay-out restriction, and the replenishment of capital buffers would not affect the Euro Area. Figure 1 illustrates the fundamental characteristics of the model, emphasizing the key relationships between economic agents.[10]

9. The stance of macroprudential policy is computed combining three macroprudential tools: the Countercyclical Capital Buffer (CCyB), the Loan-to-Value ratio (LTV) and a measure of the foreign exchange (FX) macroprudential stance.

10. For any additional detail regarding the model, please refer to Lima *et al.* (2023).

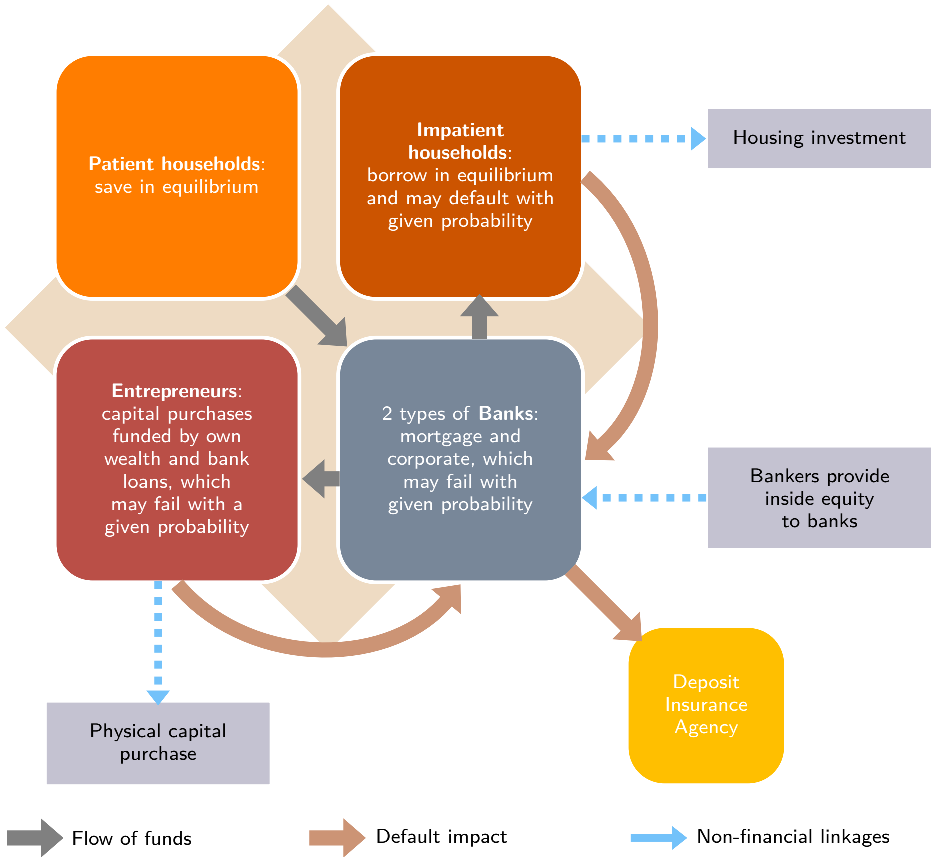


Figure 1: Main features of the 3D model

The economy represented in the model comprises households, entrepreneurs, and banks. Households can be patient, saving in equilibrium, depositing their savings in banks and holding part of the stock of physical capital, or impatient, taking out loans to finance investments in residential real estate. Except for these differences, households behave similarly, consuming, investing in housing, and working in the productive sector.

Entrepreneurs and patient households hold the stock of the physical capital of this economy. Entrepreneurs rent it directly to other companies in the productive sector, while patient households rely on the help of specialized capital management firms, paying a fee. Entrepreneurs finance the acquisition of physical capital with their inherited net worth and the credit provided by the banking sector.

There are two bank specializations in the model. One type of bank grants credit to impatient households for investment in housing (mortgage loans) and the other type grants credit to entrepreneurs (corporate loans). Banks use deposits and net worth to finance themselves, which can be generated internally through retained earnings, and externally by raising equity from bankers. Banks are subject to regulatory capital constraints and operate with limited liability. They may default due to both idiosyncratic and aggregate shocks to the performance of their loan portfolios.

Deposits are formally guaranteed by a deposit guarantee system, which covers the amount deposited and the corresponding interest. When necessary, the deposit guarantee system is financed through a fixed tax levied on households.This feature of the model creates incentives for banks to engage in excessive risk-taking practices, as it allows banks with a business model more focused on granting credit to higher-risk borrowers to implicitly benefit from a subsidy against banks with a more conservative lending profile. However, the model assumes that patient households do not know the risk profile of each bank, observing only the average risk of the sector. In addition, patient households require a risk premium that depends on the default probability of banks, thus increasing the banking sector's funding costs when the default risk is high.

Impatient households and entrepreneurs can default with a given probability, which can affect their ability to meet their debt obligations. Bank failure occurs when the observed return on their credit portfolio is lower than the obligations arising from the repayment of deposits and associated interest. The factors that determine bankruptcy are related to fluctuations in aggregate profitability, which, in turn, depend on the default rates of impatient households and entrepreneurs, and by idiosyncratic shocks that affect the ability of each bank to withdraw the proceeds from its granted loans. Bank shareholders benefit from liability limited to the amount of capital, as their income cannot be negative, even in a bankruptcy situation. Finally, banks are subject to a regulatory capital restriction determined by the prudential authorities which adds to a management capital buffer and becomes binding on balance. Thus, capital ratios are a function of capital requirements set by authorities (which may be constant or vary over time) and management capital reserves (i.e., the portion of capital ratio above the minimum requirement set by the regulator). The specific capital requirements for each type of bank are different: in this model, we assume that mortgage loans have a 50% risk weight[11] and corporate loans have a 100% risk weight.

Despite the deposit guarantee system, patient households bear a cost associated with the time and effort dedicated to recovering the amount and interest on deposits when bank failure occurs. This aspect links the cost of financing to the risk of the banking sector.

Perfectly competitive firms producing the final good, new physical capital, and housing close the model in the production sector. In equilibrium, the total output in the economy is equal to the aggregate statistics of consumption, capital investment, housing investment, and wealth of bankers before dividends.

11. This choice follows Clerc *et al.* (2015) and models the less stringent risk weights for mortgage loans defined in the regulation without reflecting exactly the value for the Portuguese banking sector. Nevertheless, setting different risk weights for mortgage loans would not change qualitatively our results.

Several financial distortions motivate the role of capital regulation policy in the banking sector. First of all, the possibility of bankruptcy of economic agents, which translates into costs arising from bankruptcy and limited access to credit. Secondly, the presence of a deposit guarantee system and the incentives it promotes for excessive risk-taking when granting credit. Finally, there are externalities at the level of bank financing costs, which arise from the hypothesis that the interest rate on deposits is determined by the risk of the banking sector as a whole and not by the risk profile of each bank. In equilibrium, the last two distortions may imply excessive credit granting, while the first distortion may lead to its scarcity when compared to an optimal social situation in which these costs would be internalized.

The model sums up the main interconnections between the banking sector and the economy, while considering a set of distortions that affect how the banking sector performs its financial intermediation function, with potentially adverse consequences in the allocation of resources by the economy. For example, the possibility of bank default is an innovative feature of the model that allows assessing its consequences for financial stability and the economy.

Such a framework is, therefore, an appropriate tool for analyzing the effects of micro and macroprudential policy instruments, namely in terms of determining capital requirements. Although capital requirements reinforce the resilience of the banking sector, making it less vulnerable to shocks and reducing incentives to over-grant credit, they may also entail costs in the form of lower GDP. It is thereby important to acknowledge that the costs of higher bank capital requirements may surpass the benefits, after a certain optimal level is achieved (Mendicino *et al.* 2020; Soederhuizen *et al.* 2021; Malherbe 2020, among others). As such, capital requirements should increase up to the level where net benefits are maximized. This model allows for the quantification of both benefits and costs of higher capital requirements.

4. Calibration of the model

This section reports the results of the calibration of the 3D model for the Portuguese economy using quarterly data from 2001Q1 to 2020Q1. The Common Equity Tier 1 capital ratio was calibrated based on a shorter time span, from 2017Q4 to 2019Q4. The main reason underlying this option is that the overall time span does not reflect the higher capitalization level of the Portuguese banking system in the periods ahead of the COVID-19 pandemic crisis.[12] The increased capitalization of banks resulted from stricter capital requirements put in place due to changes in capital regulation and the introduction of a macroprudential policy in the aftermath of the 2008 financial crisis and the sovereign debt crisis. Since the prudential measures we

12. The results presented in the next sessions are robust to a calibration of the 3D model where a longer time span of the Common Equity Tier 1 capital ratio is considered. The results are available upon request.

are assessing in this study are mainly related to capital buffers and requirements and given that the pandemic shock hit a more resilient banking system than the overall time span would suggest, we consider that the calibration of the model should reflect a better capitalized Portuguese banking system. The calibration strategy follows Lima *et al.* (2023). We start with a first group of parameters that are preset according to the existing literature and conventions. Having fixed the first set of parameters, the calibration of the remaining ones takes into account the first and second moments of several macro-financial variables, that are used as targets to be matched by the model.

Description	**Definition**	**Data**	**Model**	**Diff.**
(A) Means				
Fraction of impatient households (%)	$[1 - 1/(1 + n^m)] \cdot 100$	45.93	45.93	-
Return on average bank equity (%, ann)	$\rho \cdot 400$	6.44	6.44	-
CET1 capital ratio (%)	$\varphi \cdot 100$	13.87	13.87	-
Write-off rate for mortgage loans (%, ann)	$\Upsilon^m \cdot 400$	0.37	0.31	0.06
Write-off rate for corporate loans (%, ann)	$\Upsilon^e \cdot 400$	1.55	1.34	0.21
Mortgage loans to GDP (ratio)	$n^m b^m / GDP$	2.94	2.87	0.07
Corporate loans to GDP (ratio)	$n^e b^e / GDP$	2.16	2.16	-
Housing investment to GDP (ratio)	I^H / GDP	0.04	0.04	-
Impatient HH housing wealth share	$n^m q^H h^m$	0.53	0.55	0.02
Spread mortgage loans (pp., ann)	$(R^H - R^d) \cdot 400$	0.01	0.01	-
Spread corporate loans (pp., ann)	$(R^F - R^d) \cdot 400$	0.02	0.03	0.01
Average bank default (%)	$\mathcal{F}^{H,F}(\bar{\omega}^{H,F}) \cdot 100$	2.00	2.00	-
(B) Standard deviations $[\sigma(\cdot)]$				
STD(House prices)/STD(GDP)	$\sigma(q_t^H)/\sigma(GDP_t)$	0.03	0.03	-
STD(Mortgage loans)/STD(GDP)	$\sigma(b_t^m)/\sigma(GDP_t)$	1.34	1.43	0.09
STD(Corporate loans)/STD(GDP)	$\sigma(b_t^e)/\sigma(GDP_t)$	0.74	0.55	0.19
STD(Mortgage spreads)/STD(GDP)	$\sigma(R_t^M - R_t^d)/\sigma(GDP_t)$	0.02	0.01	0.01
STD(Corporate spreads)/STD(GDP)	$\sigma(R_t^F - R_t^d)/\sigma(GDP_t)$	0.03	0.03	-
STD(GDP)	$\sigma(GDP_t) \cdot 100$	2.77	2.39	0.38

Note: The Return on Average Bank Equity (ROAE) is based on positive values of the return on equity (ROE) and results from the time series average of the cross-sectional median ROE. Aggregate values for the banking sector consist of weighted averages across banks, with weights given by the share of each individual bank's assets in total assets. HH stands for households, GDP for Gross Domestic Product, CET1 for Common Equity Tier 1, STD for standard deviation and Ann is short for annualized. The differences between the data and the model (*Diff.* column) are in absolute terms. Appendix A presents the details on data sources and frequencies.

Table 1. Calibration targets

Table 1 reports the calibration targets, defined in terms of means and standard deviations, along with the values obtained from the model. Overall, the model matches the data well, since the theoretical first (mean) and second (volatility) moments computed from the model are equal, or very close, to the targeted empirical moments.

Table 2 reports the parameter values obtained from the calibration exercise. Panel (A) focuses on the parameters that were preset while panel (B) shows the parameters that were calibrated using the data targets from Table 1.

Description	**Par.**	**Value**	**Description**	**Par.**	**Value**
		(A) Preset parameters			
Housing weight in s utility	υ^s	0.1	HH bankruptcy cost	μ^m	0.3
Disutility of labor ($\varkappa = s, m$)	$\varphi^{\varkappa}$	1	Entrep. bankruptcy cost	μ^e	0.3
Frisch elasticity of labor	η	1	Bank M bankruptcy cost	μ^H	0.3
Physical Cap. share in prod.	α	0.3	Bank F bankruptcy cost	μ^F	0.3
Physical Cap. depreciation	δ^K	0.03	Productivity shock persistence	ρ^A	0.548
Patient HH discount factor	β^s	0.995	Cap. ratios for mortgage loans	ϕ^H	6.93%
Banks' capital persistence	ρ^ϕ	0.9	Cap. ratios for corporate loans	ϕ^F	13.87%
Response of flexibility	$\bar{\vartheta}$	$\{0, 0.82\}$			
		(B) Calibrated parameters			
Share of impatient HH	n^m	0.8496	HH transaction cost	γ	0.0003
Impatient HH discount factor	β^m	0.985	Entrepreneurs' endowment	χ^e	0.043
Housing weight in m utility	υ^m	0.2994	Bankers' endowment	χ^b	0.0158
Housing adjustment cost	ξ^H	0.25	Physical Cap. adjust. cost	ξ^K	9.915
Housing depreciation	δ^H	0.0034	STD productivity shock	σ^z	0.0064

Note: The disutility of labour is the same for patient and impatient households. HH stand for households, STD stands for standard deviation s and m stand for the households' type, patient and impatient, respectively.

Table 2. Parameters

The labor disutility parameter, $\varphi^{\varkappa}$, is normalized to one for both households' type, as it only affects the scale of the economy, while the weight of housing in patient households' utility function is set at 0.1. The Frisch elasticity of labor, η is normalized as well.[13] The share of capital in the production function, α, is set equal to 0.3, and the physical capital depreciation, δ^K, is equal to 0.03. The capital ratios for mortgage and corporate loans, ϕ^H and ϕ^F, are set to 6.93% and 13.87%, respectively. These targets are associated with a risk weight of 100% for corporate loans and of 50% for mortgages (loans to households), as in Clerc *et al.* (2015), to reflect the less stringent risk weights defined in the regulation for the former type of loans.[14]

Despite the calibrated parameters in panel (B) of Table 2 being set simultaneously, some can be directly linked to one of the targets. The share of impatient households in total households, n^m, matches the fraction of impatient households (proportion of indebted households). The bankers' endowment, χ^b, matches the median return on average equity (ROAE) for the O-SII group of the Portuguese banking sector. The households' transaction cost (or bankruptcy cost parameter), γ, is set in order to account for losses of 10% of face value of deposits at failed banks. The housing weight in the utility of impatient households, υ^m, is calibrated by targeting the share of housing held by the indebted households

13. As for the Frisch elasticity of labor supply, there is a debate in the literature about its value. We follow Brinca *et al.* (2016) who sets it equal to 1, similarly to other studies.

14. Despite being in line with the literature, it does not reflect the exact level of risk weights practiced in the Portuguese banking sector.

(value of the main residence of impatient households) in Portugal. The impatient households' discount factor, β^m, and the new entrepreneurs' endowment, χ^e, are used to match the household mortgage to GDP and corporate loans to GDP ratios, respectively. The housing depreciation rate, δ^H, is calibrated in order to match the ratio of housing investment to GDP. The standard deviations along with the housing and physical capital adjustment costs are used to match the remaining targets in panel (B) of Table 2.

5. The impact of the flexibility measure and the dividends pay-out restriction

In this section, we quantify the impact of the flexibility measure and the dividends pay-out restriction in an economic environment affected by the COVID-19 pandemic. Given the sequential announcements of the prudential measures, we start by considering the individual effects of the flexibility measure. Then, we assess the joint effects of the flexibility measure and the dividends pay-out restriction, since the latter was announced after the flexibility measure but with the same purpose of ensuring that banks keep supporting the economy.

It is important to stress that the results obtained do not factor in other policy measures that were also applied as a response to the pandemic, such as monetary and government policies adopted to mitigate the consequences of the pandemic, which are also transmitted through the banking sector.[15] Notwithstanding, the purpose of this exercise is to estimate the partial effect of the flexibility and of the dividends pay-out restriction measures in the variables analyzed and not to predict the evolution of output and credit.

To simulate a shock with the magnitude and dynamics of the pandemic, we analyze the effects of a perturbation stemming from the supply side of the economy. We focus specifically on negative shocks to productivity to simulate a generalized adverse impact on the production of final goods and reproduce the GDP contraction observed in 2020. The use of the productivity shock is justified by the conclusions of a study for the Portuguese economy (Banco de Portugal 2020), suggesting that the GDP contraction was, to a large extent, determined by supply-side factors, and especially by the fall in global productivity. As referred in such analysis, the productivity shock reflects the partial or total closure of firms and lockdown of certain economic activities at the global level and efficiency disruptions, affecting both labour and capital. Although the shocks considered operate through the supply side of the economy, they also have significant effects on the demand-side through the impact on income. This option has also been adopted in related literature that

15. Among the set of policies put in place by the government, we highlight the moratoria and grants to households and of public loans guarantees to non financial corporations, which played an important role in mitigating the impact of the pandemic on households' and firms' default rates.

studies the economic consequences of the pandemic.[16] However, as the model does not take into account other measures implemented to mitigate the impact of the pandemic, the response of income to the shock in terms of magnitude may not be the same as the one observed in reality.

To simulate a supply disruption close to the size and dynamics observed in 2020 and 2021, we consider a series of productivity shocks that negatively affect output and set their magnitude to replicate the drops that occurred in the two lockdown periods starting in March 2020 and January 2021 (panel B of Figure 2). The persistence of the productivity shocks (see Table 2) was calibrated to follow (partially) the recovery observed before the second lockdown. Panel A of Figure 2 presents the observed dynamics of GDP from 2019Q4 to 2021Q4 and compares them with the ones obtained from the model, as a result of the productivity shocks that were considered in the simulation exercise. This comparison shows that the model replicates considerably well, not only the significant drop in GDP over the first 2020 quarters immediately after the onset of the pandemic crisis, but also the subsequent recovery as public policies helped mitigate its impact.

The banks' response to the flexibility measure is simulated through a rule on the response of the capital ratio to deviations in total credit (the sum of loans granted to households and firms) from its steady-state level as:

$$\phi_t^j = \rho^\phi \phi_{t-1}^j + \left(1 - \rho^\phi\right) \bar{\phi}^j + \underbrace{\bar{\vartheta}\left[\log(b_t) - \log(\bar{b})\right]}_{\text{Flexibility measure}}, \tag{1}$$

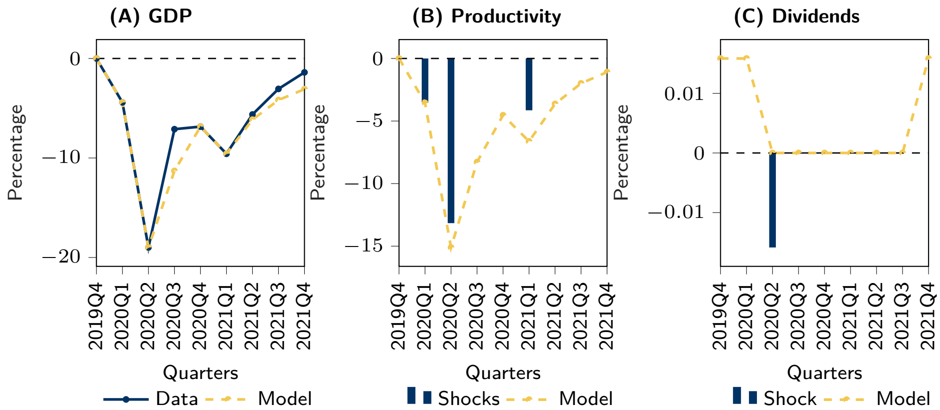
where ϕ_t^j refers to the capital ratio of banks of type j, ρ^ϕ is the persistence of changes in banks' capital ratio, $\bar{\phi}^j$ is banks of type j's capital ratio held in steady state, $\bar{\vartheta}$ sets the degree of response of the flexibility measure to total credit, b_t, and $\bar{b}$ the respective steady-state level. The persistence of changes in banks' capital ratio is set to 0.9, as we assume that any replenishment of capital buffers will not be required immediately but the decrease will not be permanent either. In this sense, the banks' capital ratios are allowed to adjust to developments in the credit dynamics with some degree of rigidity.

The rule reproduces the aims of the flexibility measure, namely to ensure that banks continue to finance the economy. The response coefficient, $\bar{\vartheta}$, was defined in such a way as to ensure that banks make full use of the flexibility provided by the measure throughout the projection period (2020Q1 to 2024Q4). The parameter is set to 0 in the scenario where the policy measure is not active, and to 0.82 – to generate a 4 percentage points (p.p.) capital ratio reduction – when the policy measure is active. This calibration value assumes the full use of the Pillar 2 guidance and the combined buffer requirement by banks.[17]

16. Fornaro and Wolf (2021) claim that the COVID-19 pandemic shock is analogous to a negative shock to productivity growth. Guerrieri *et al.* (2020) and Bodenstein *et al.* (2021) model the COVID-19 pandemic impact as negative labour supply shocks.

17. A release of this magnitude was far from being used in Portugal or other countries.

The dividends pay-out restriction is modeled as a shock on the share of bankers' wealth transferred to patient households (owners of the banks). In line with the ECB/SSM Recommendations, the suspension of dividends pay-out is implemented in the model in the second quarter of 2020 and remains active until the third quarter of 2021 (panel C of Figure 2).[18] In terms of the model, transfers from banks to households in the form of dividends are eliminated from the 2^{nd} quarter to the 7^{th} quarter, and additional profitability is used to provide credit to the economy.[19] This specification also entails that banks' profitability is always non-negative over the time horizon of the simulation exercise.



Note: The empirical GDP in panel (A) (blue line) shows the deviation (in percentage) from the value observed in 2019Q4. The match in the model is set to the deviations of GDP from the equilibrium (steady state).

Figure 2: GDP dynamics, productivity and dividends shocks

5.1. The flexibility measure

We consider two scenarios to assess the effects on economic variables of using the flexibility measure. In the first one, the policy measure is not available. In the second one, the policy measure is in place, reacting to deviations of total credit and allowing credit institutions to use capital buffers. Moreover, we assume that banks fully utilize the flexibility measure in the active policy scenario. A comparison of the results (Figure 3) allows us to assess the measure's effectiveness in promoting the financial intermediation function of the banking system and in stabilising the economy.

In the first scenario, where the measure is assumed not to be available, the results obtained from the shocks applied in the model simulate a output path

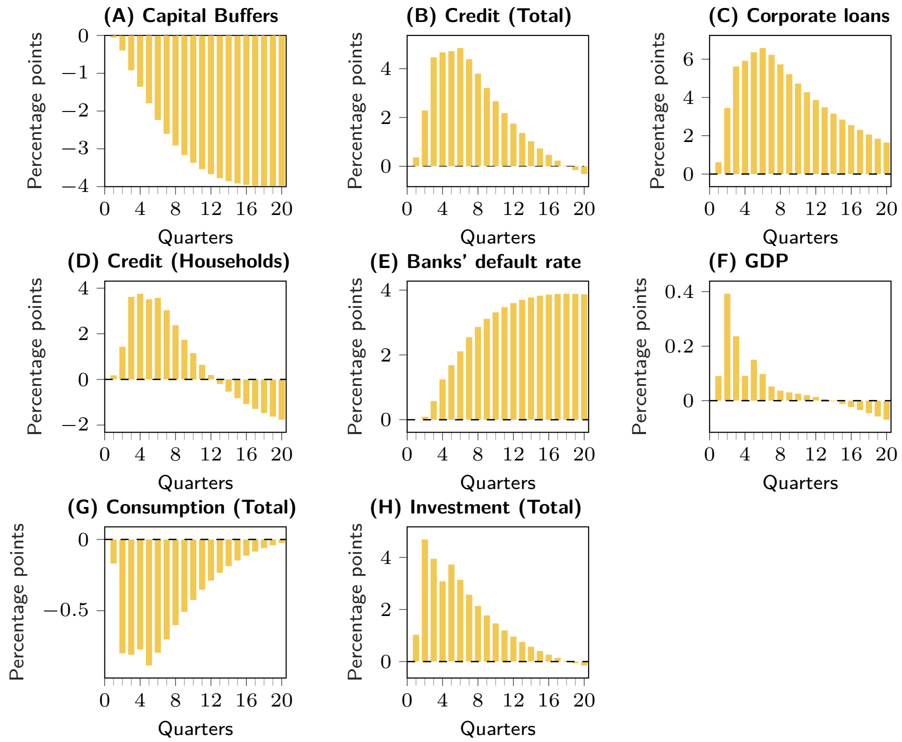
18. As set out in Recommendation ECB/2020/62 adopted on 15 December 2020.

19. The degree of utilization of the profitability for granting credit is affected by the flexibility measure, as it contributes to positive deviations of credit from the steady state.

characterized by a sharp fall in the second quarter of 2020 followed by a gradual recovery, which is temporarily halted in the first quarter of 2021 as a result of new lockdown measures. Thereafter, a gradual recovery towards steady-state values is simulated (see Figure B.1 in Appendix).The shock transmission mechanism initially leads to a decline in spending and production, which brings down the relative price between housing and physical capital. In the labour market, working hours and wages decline. The default of firms and households increases, which results in an increase in bank interest rates and a decrease in credit. The increase in banks' default induces a higher cost of deposits, which in turn is passed through to households and firms via increased spreads in credit operations that further increase bank interest rates.[20] These effects spill over to the economy in the following periods, as they have a negative impact on investment, thereby amplifying the initial impact of the shocks. The recovery process is slow, in particular for credit. The increase in banks' default induces additional costs on deposit insurance, supported by households, while overall deterioration of wealth reduces patient households' income from owning banks and firms. This set of occurrences frames a strong, and moderately persistent, contraction in consumption – which after 5 years is still below its steady-state level.

In the second scenario, banks make use of the flexibility they are provided with, using the capital buffers in response to deviations of total credit from its initial pre-shock value. Compared to the first scenario, the flexibility measure mitigates the reduction in credit to households and firms. The effect is more pronounced in corporate loans, as this segment has higher risk weights. The credit smoothing effect is mainly reflected in investment, particularly in investment in physical capital by firms whose decline is mitigated in the first quarters. The improvement in the capacity to finance the economy dampens the fall in GDP over the first 13 quarters, although to a lesser extent than in investment. After that, due to a lower recovery rate, the effect of the flexibility measure becomes negative. Nonetheless, the net effect of the flexibility measure on GDP is still positive and although the effects on GDP of a reduction in capital ratios are relatively subdued, given that the shock is exogenous to the banking system, these results as well as those related to credit smoothing are in line with the aim of the capital requirements. Such regulation should in fact improve the resilience of banks preventing the propagation of shocks in the financial sector to the real economy, and smooth adverse outcomes in the financial system from stress events with outside origination, avoiding amplification effects. The higher leverage of banks due to the flexibility measure is perceived as an increased risk in the banking system which is translated into higher bank default rates. This increase in the probability of banks default imposes a higher cost on households with deposit insurance, which motivates a greater reduction

20. These dynamics in credit spreads were not observed in the Portuguese economy. Spreads in corporate and mortgage loans remained favourable overall due to the impact of other policy measures, such as state-guaranteed credit lines and low interbank market interest rates. The model, however, cannot take those measures into account.



Note: The impact is measured as the difference between the scenario with the flexibility measure and the scenario without the flexibility measure.

Figure 3: Impact of the flexibility measure

in consumption. Consequently, the flexibility measure moderately intensifies the contraction in consumption that was registered under the first scenario.

The introduction of capital requirements, together with the possibility of using part of them in a situation of stress in the financial system, reduces the materialization of risks from spreading into the economy, as they provide the banking system with greater capacity to absorb losses. However, the effectiveness in containing the transmission of disruptions that arise first in the economy and only then in the banking system is lower (see also Lima *et al.* (2023)). It may thus be necessary, depending on the magnitude of the shock, to implement other support measures that complement each other and allow the economy to recover from the pandemic crisis.

To sum up, results indicate that a prudential measure that introduces flexibility in banks' capital use in situations of stress is effective in promoting the financing of the economy. By being able to make full use of this flexibility, banks mitigate the transmission effect of the shock to credit granted to both firms and households. This measure is particularly beneficial for corporate loans, resulting in more favourable dynamics for corporate investment.

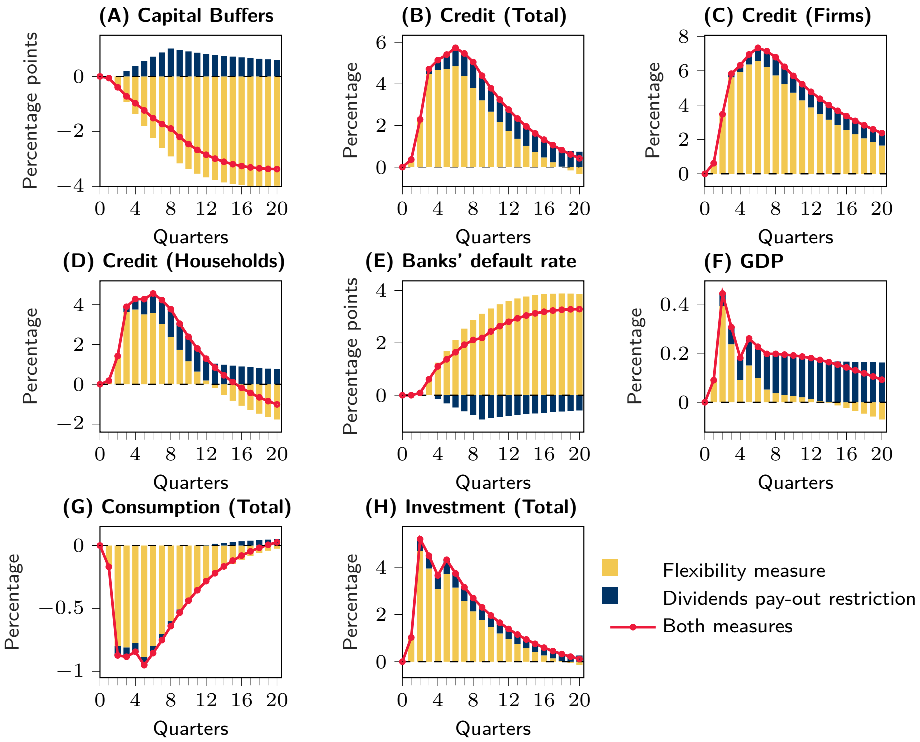
5.2. The flexibility measure and the dividends pay-out restriction

This subsection presents the results of a simulation exercise of the joint effects from the combined implementation of the flexibility measure and the dividends pay-out restriction. Following the steps of the previous section, two scenarios are considered in this exercise: a first one where the measures are not implemented to mitigate the effects of economic slowdown due to the COVID-19 pandemic; and a second one where both measures are in force. A comparison of results between scenarios makes it possible to assess the effectiveness of the measures.

In the second scenario, banks use the flexibility measure and refrain from distributing part of their profits in the form of dividends. The dividends pay-out restriction allows banks to increase their management capital buffers, becoming more resilient to adverse shocks (Figure 4). Strengthening capital ratios in this manner allows banks to have additional resources that are at the outset fully used to finance the economy, which contributes positively to dampening the contraction in credit to households and firms that follows the shock. Banks apply a higher spread to corporate credit than household credit as, in our calibration, corporate loans are associated with a higher risk weight.[21] This characteristic is reflected in the different magnitude of the impact of shocks (see Figure B.3 in Appendix). This leads to the measure having a greater impact on smoothing the decline in corporate loans than in mortgage loans, i.e. the reduction in the cost of financing for firms is greater than the reduction in the cost of financing for households.

The smaller contraction in corporate loans is passed on to the economy through higher investment in physical capital, mitigating the effects of shocks and actively contributing to the faster recovery of GDP against a scenario in which no measures are implemented. For consumption, the impact of the two combined measures does not differ much from the case where we only consider the flexibility measure, meaning that the dividends pay-out restriction barely affects the consumption decisions of agents. The slightly worse combined effect of the measures on consumption between the third and the ninth quarter is motivated by a reduction in households' income due to the dividends pay-out restriction. After this period, the combined effect becomes positive and contributes to a slightly faster convergence of consumption to its pre-pandemic level. The dividends pay-out restriction has also the additional effect of reducing the need for banks to use the flexibility measure to mitigate the effects of the shock and keep financing the economy. This outcome reflects how the two measures complement each other and shows that by restricting dividends pay-out, banks have to make a smaller effort to return to the level of capitalization that existed before the shock materialized. Although the flexibility measure was only partially used, its relative impact on all variables is decisive. The banking sector plays an active role in the economic

21. The differences in risk weights are key determinants of the spreads, but the probability of default of corporate and household loans also play a role, among other factors.



Note: The impact is measured as the difference between the scenario with policy measures and the scenario without policy measures.

Figure 4: Impact of the measures to shocks simulating a contraction in GDP

recovery contributing to a less pronounced contraction in corporate investment compared to the first scenario, which has an impact on the performance of economic activity.

The results of this simulation exercise highlight the complementary effect of the dividends pay-out restriction on mitigating the spillover of risk events to the economy. The effects of the two measures analyzed in this paper are transmitted to the economy through the credit channel resulting in a faster economic recovery.

6. The replenishment of capital buffers

As shown in the previous section, there are benefits for the economy from the combined use of the supervisory measures that were implemented at the outset of the pandemic crisis. As the peak of the pandemic crisis is overcome and policymakers start to plan the exit strategy of policy measures, considering potential procyclical effects on lending driven by the replenishment of capital buffers becomes fundamental. In this section, we follow a conceptual approach to analyze this question. We consider different time spans for the replenishment of capital buffers and assess their implications for financial stability and economic activity. We assume that the replenishment paths are known to the financial system, given the decisions communicated by the supervisory authorities in due time. We focus on (i) potential costs and benefits of a smoother versus a more abrupt transition and (ii) potential costs of different paces in each transition period. Thus, this section flags the importance for the financial system to trigger an efficient adjustment to these buffers.

In this exercise, and differently from the previous section's exercises, we abstract from a specific COVID-19 pandemic shock as we simulate an economy with released capital buffers in equilibrium that need to be replenished. Nevertheless, to be consistent with the magnitude of the flexibility measure discussed before, we consider replenishment paths leading to a 4 p.p. permanent change in capital buffers.[22] During the replenishment period banks are not subject to a dividend payout restriction. The macroprudential authority requires banks to raise capital, which gives rise to a new economic equilibrium once the higher level of capital buffers is achieved.[23]

In the model, there are two transmission channels of capital buffers. On the one hand, a permanent increase in capital buffers driving the economy to a new steady state enhances the banking sector's resilience by reducing bank failure probabilities and associated social welfare costs. Decreasing bank failure risk leads to a fall in deposit interest rates, which, ceteris paribus, reduces the average cost of bank financing and lending interest rates, besides stimulating credit. For this reason, an increase in capital buffers can lead to long-run increases in investment, consumption, output, and social welfare. On the other hand, increasing capital buffers can also trigger deleveraging and higher funding costs for borrowers, specifically when transitioning to higher levels. Strengthening capital buffers increases the demand for capital, making the average cost of bank funding more expensive. The higher average bank funding cost is transferred to borrowers through higher interest rates, causing a drop in lending. The final impact of an increase in capital buffers on interest rates and loans will thus depend on the relative magnitude of these two effects.

In the analysis, we put forward several transition scenarios. In the first scenario, capital buffers rise sharply. In the second scenario, we set four transition periods to assess whether they can mitigate the effects of a potential procyclical role for banks. The shorter and longer transition periods last 4 and 16 quarters, respectively.

22. By permanent shock, we mean "a shock with permanent effects that build up gradually" (Blanchard *et al.* 2013). The shock generates a permanent 4 p.p. reduction in banks' default rate, which is compatible in absolute terms with our previous exercises. The flexibility measure in fact would generate an increase in banks' default rate close to 4 p.p..

23. It must be noted that we are only looking at first-order approximation effects in this exercise. This approximation excludes, for example, the possibility to have a replenishment path that triggers decreasing marginal effects for the bank failure rate as its value approaches 0.

The choice of a one-year replenishment period as a minimum is coherent with countercyclical capital buffer regulation, which allows banks to comply with the buffer rate within one year. The maximum four-year period builds on the regulatory framework for the capital conservation buffer and the O-SIIs (Other Systemically Important Institutions) buffer.

In addition to the length of the adjustment period, it is also relevant to examine the pace at which capital buffers increase. Authorities have been favoring linear path regimes over time. In the following sections, we present the results of a linear regime and a non-linear regime, in which we assume a faster pace of convergence to higher levels of capital buffers.

6.1. Linear path regime

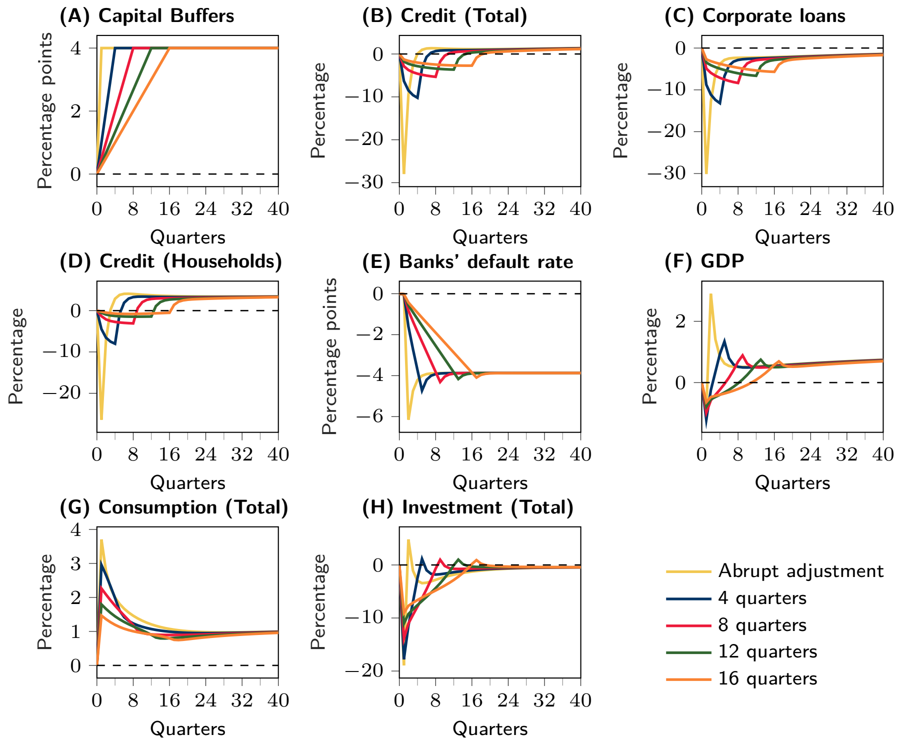
The impulse response functions (thereafter IRFs) for an abrupt increase in capital buffers and for the linear replenishment paths are presented in Figure 5. Before analyzing the results for the different transition periods, we focus on the responses to an abrupt increase of 4 p.p. in capital buffers, which represent a relevant reference point for the following considerations.

An abrupt adjustment in capital buffers has positive effects by reducing the probability of bank failure quickly, increasing the banking system resilience. However, it also induces high bank financing costs translating into higher spreads for borrowers.[24] The significant increase in interest rates is associated with a considerable reduction in total credit granted to the economy, in particular, in loans to businesses, as they bear the brunt of higher interest rates. This behavior also stems from the risk weights for housing credit being smaller than for corporate loans. These effects spill over to the economy: on the one hand, a greater resilience of the banking system has positive effects on household income, consumption and output, while, on the other hand, the sharp fall in credit triggers a significant drop in investment.[25] The effects of an abrupt increase in capital buffers unwind after a few quarters, and the economy quickly converges to a new equilibrium, where total credit and output are higher, and bank resilience is strengthened.

Results indicate that the permanent increase in capital buffers considered in the model, even if abrupt, has beneficial effects on financial stability and economic activity in the long run, but may trigger severe disruptions in banks' financial intermediation function throughout the process of convergence to the new equilibrium. Therefore, we now consider longer transition periods in order to assess whether they allow the mitigation of the procyclical response of the banking

24. IRFs for spreads and other relevant variables are provided in Figure C.1 of Appendix.

25. Even if investment falls and converges to a slightly lower equilibrium level when compared to the initial one, the other components of GDP – namely consumption, housing investment, and wealth of bankers before dividends – end up in a better equilibrium level. This effect outweighs the negative impact on investment.



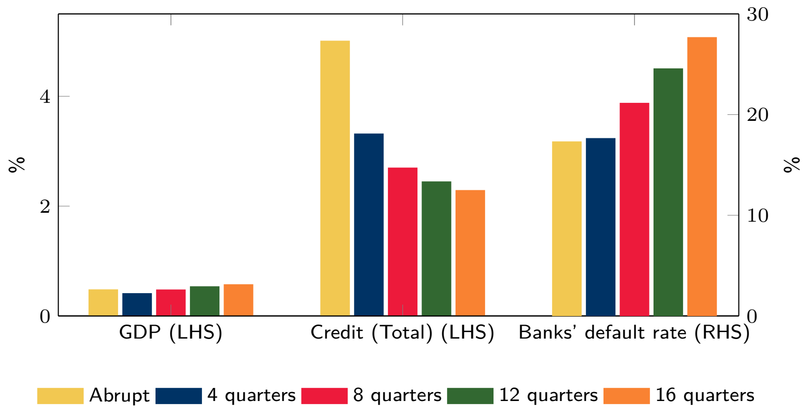
Note: Impulse responses from a 4 p.p. capital buffers' replenishment. Deviations from the initial steady state.

Figure 5: IRFs of capital buffers' replenishment (linear path regime)

system without significantly compromising the benefits arising from replenishing capital buffers.

In the linear replenishment paths, we observe how in general, predictable timing and speed of transition allow banks to anticipate the necessary adjustment in each period, smoothing the rise in spreads and the fall in lending, compared with an abrupt increase. The smoothing effect on corporate loans also leads to a less sharp decline in business investment. The longer the transition period, the more significant the smoothing effect. However, the fall in business investment is still more significant than the increase in residential investment, which benefits from house purchases by households that are not dependent on bank financing. This evidence determines that overall investment remains below – although closer to – its initial value throughout the convergence process to the new equilibrium. Longer transitions also mitigate the positive effects on the banking system resilience, if compared with an abrupt adjustment. Longer transition periods reduce the bank failure rate, but to a lesser extent than an abrupt adjustment. Moreover, they postpone the convergence of this variable to the new equilibrium.

The less favorable behavior of the bank failure rate has macroeconomic impacts due to a lower increase in consumption, as households must bear higher costs associated with deposit guarantees, and, consequently, in GDP. The speed of adjustment towards equilibrium is also slower. The choice of the transition path thus entails macroprudential policy trade-offs. The model favours shorter transition horizons if the macroprudential policy's purpose is mainly to strengthen the banking system resilience. If the focus is mainly on maintaining the flow of credit to the economy, then longer time horizons are preferable.



Note: The volatility for each variable is obtained by calculating the standard deviation of the impulse response functions from their final steady-state values.

Figure 6: Volatility measures for the capital buffers' replenishment paths (Linear path regime)

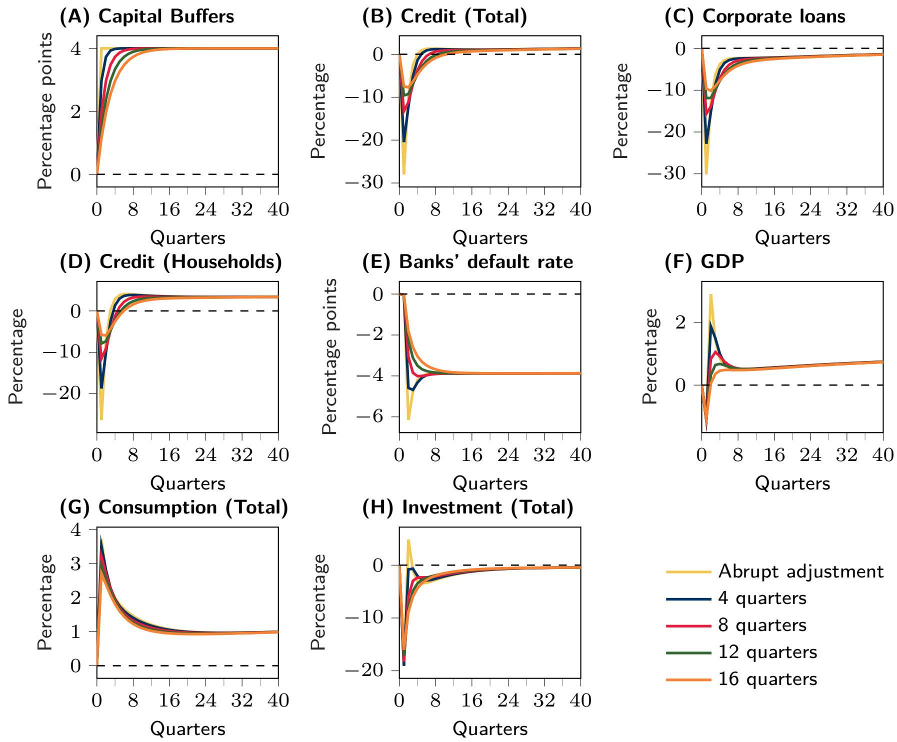
In addition to the previous analysis, we compute volatility metrics for the variables considered relevant for macroprudential policy: bank failure rate, credit, and output. We calculate the volatility associated with each of the three variables on the basis of the impulse response functions arising from the abrupt adjustment and the four transition periods adopted considering a linear pace of capital buffer accumulation (Figure 6).

The analysis indicates that longer transition periods lead to a significant reduction in overall credit volatility, which can be considered a benefit associated with longer time horizons. On the contrary, GDP and bank failure rate take more time to converge to the new equilibrium when the replenishment period is longer. Thus, as the transition period is extended, the volatility of GDP and bank failure rate increases. This result can be perceived as a cost associated with longer transition periods.

6.2. Non-linear path regime

This section examines the effects of implementing non-linear replenishment paths. In particular, we consider a decreasing rate for the required replenishment of the capital buffers (Figure 7).[26] This scheme may prove more effective in booming periods in the business and/or credit cycle, where higher buffer requirements can be more easily met by banks, by retaining profits and/or issuing capital, without disrupting lending activity.

The main conclusion drawn from the previous exercise still holds. Considering longer transition periods - compared to an abrupt adjustment - mitigates the costs of increasing capital buffers, yet it also curtails the development of a more resilient banking system. In a non-linear path regime of capital buffer accumulation, the differences in the responses of the variables for each transition period are evident for the shorter horizons but fade out as horizons lengthen.

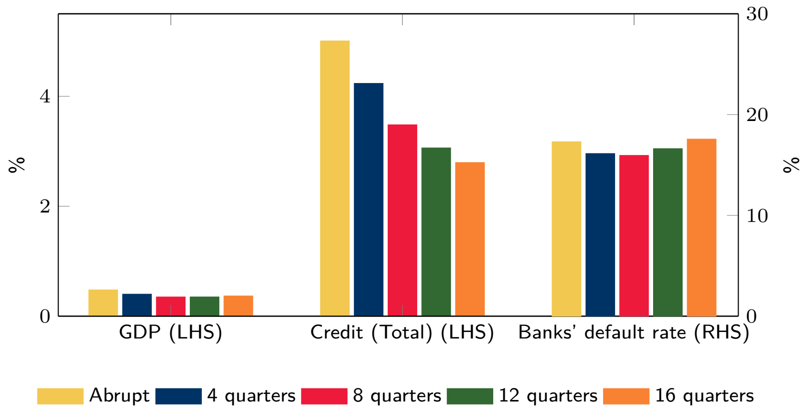


Note: Impulse responses from a 4 p.p. capital buffers' replenishment. Deviations from the initial steady state.

Figure 7: IRFs of capital buffers' replenishment (Non-linear path regime)

Compared with the results of the linear path regime for the corresponding transition periods, the non-linear path regime leads to higher credit volatility (Figure 8). On the contrary, the volatility of output and bank failure rate are lower in the non-linear path regime. Moreover, comparing the two path regimes, we can observe that changing the replenishment periods has a smaller effect on bank failure rate in

26. IRFs for additional variables are provided in Figure C.2 of Appendix.



Note: The volatility for each variable is obtained by calculating the standard deviation of the impulse response functions from their final steady-state value.

Figure 8: Volatility measures for the capital buffers' replenishment paths (non-linear path regime)

the non-linear regime. Additional simulation exercises for non-linear path regimes suggest no significant benefits from choosing transition periods longer than 16 quarters.[27]

7. Conclusions

Among other policies, European prudential authorities adopted the flexibility measure and the dividends pay-out restriction to mitigate the detrimental effects of the COVID-19 pandemic to the economic and financial situation. These measures prevented the potential deleveraging of banks and supported the financing of the real economy at a time of severe supply and demand contraction. As the most disruptive crisis phase is over, rebuilding capital buffers becomes a fundamental task for policymakers who plan the exit strategy of policy measures.

Our work seeks to evaluate the economic and financial impacts of the flexibility measure and the dividends pay-out restriction and comprehend the implications for financial stability and economic activity of different periods and paces for the replenishment of capital buffers in the aftermath of the measures' withdrawal. The assessment of the outcomes of these policy measures on the financial system can contribute to a more effective use of the macroprudential policy tools that policymakers can use to promote financial stability.

To achieve our objective, we adopt a dynamic stochastic general equilibrium model calibrated for the Portuguese economy where banks, impatient households,

27. The additional simulation exercises are available upon request.

and entrepreneurs can default. In the model, micro and macroprudential capital regulation contributes to dampening the financial distortions.

Our results suggest that the flexibility measure is effective in promoting the flow of credit in the economy. The transmission of the COVID-19 pandemic shock to households and firms credit is restrained, especially for corporate loans. The credit smoothing effect translates into a smaller decrease of investment, particularly in physical capital. The flexibility measure has a positive net impact on GDP, reducing its fall as the COVID-19 pandemic materializes.

The joint use of the flexibility measure and the dividends pay-out restriction strengthens the favorable aforementioned effects. By preventing the distribution of part of the profits in the form of dividends, banks raise their management capital buffers, improving resilience to adverse shocks, and use all additional resources to finance the economy. The measure thus contributes to mitigate the reduction in credit to households and firms caused by the COVID-19 pandemic shock. In addition to complementing the flexibility measure, the dividends pay-out restriction has the benefit of easing the effort of the banking system - and therefore the impact on the economy - to subsequently rebuild capital buffers. This measure reduces the magnitude of the capital buffers drop that banks generate when applying the flexibility measure, which will constitute the extent of the replenishment.

Results for the replenishment of capital buffers show that a permanent increase in capital buffers is beneficial for financial stability and economic activity in the long run, but may be detrimental to the financial and economic system throughout the process of convergence to the new equilibrium depending on the transition periods. In general, shorter and more abrupt transitions are more effective at reinforcing banks' resilience, and longer transitions are more appropriate for ensuring a higher flow of credit to the economy. We conclude that the choice of the most suitable transition path entails trade-offs, and depends on the primary and contingent objectives of policymakers. Adopting linear or non-linear path regimes does not influence this main result, even if the longer transition paths seem to have a small additional impact with respect to the shorter transition paths in the non-linear regime.

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Appendix A: The data

Description	Frequency	Sample	Source
Total mortgage loans	Monthly	2001M1 - 2020M7	ECB SDW
Total corporate loans	Monthly	2001M1 - 2020M7	ECB SDW
Mortgage loans write-offs	Monthly	2001M1 - 2020M7	ECB SDW
Corporate loans write-offs	Monthly	2001M1 - 2020M7	ECB SDW
Spread on mortgage loans	Monthly	2001M1 - 2020M7	ECB SWD and OC
Spread on corporate loans	Monthly	2001M1 - 2020M7	ECB SWD and OC
GDP	Quarterly	2001Q1 - 2020Q2	ECB SDW
Housing investment	Quarterly	2001Q1 - 2020Q2	ECB SDW
House prices	Quarterly	2001Q1 - 2020Q1	BIS and SP
Return on average equity (ROAE)	Annual	2001 - 2019	Banco de Portugal
Capital ratio (CET1)	Annual	2017 - 2019	Banco de Portugal
Fraction of impatient HH	–	{2010, 2013}	HFCS
Housing wealth held by imp. HH	–	{2010, 2013}	HFCS

Notes: SWD stands for Statistical Data Warehouse, OC stands for own calculations, SP stands for Statistics Portugal, HFCS stands for Household Finance and Consumption Survey, ECB stands for European Central Bank, and BIS stands for Bank for International Settlements.

Table A.1. Data used in the calibration exercise

Appendix B: The impact of the flexibility measure and the dividends pay-out restriction: Impulse response functions (IRF)

B.1. The flexibility measure

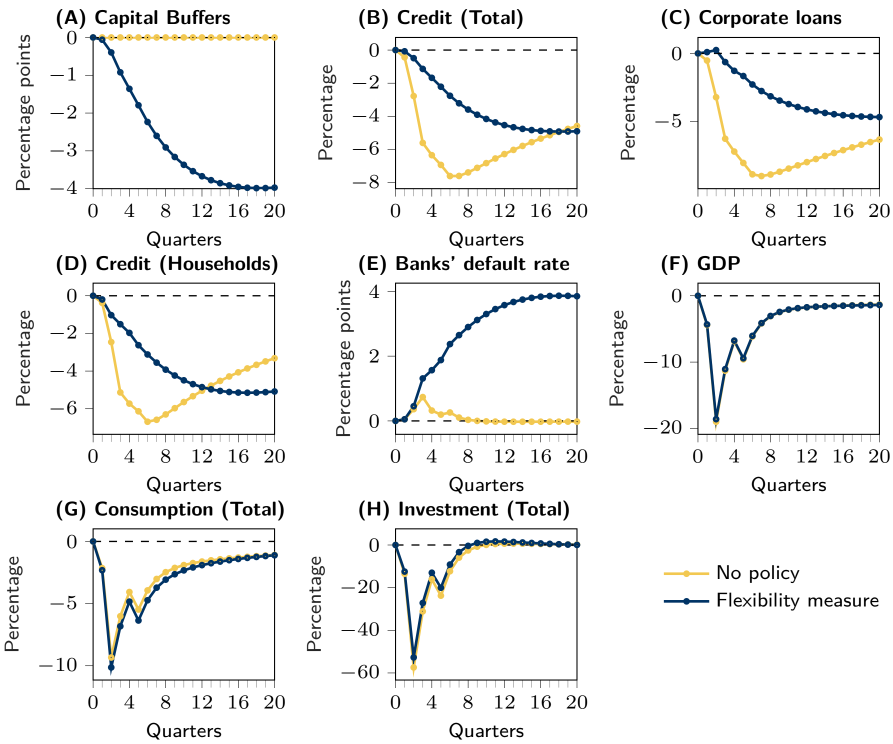


Figure B.1: IRF for the scenarios with and without flexibility measure to the shocks simulating a contraction in GDP

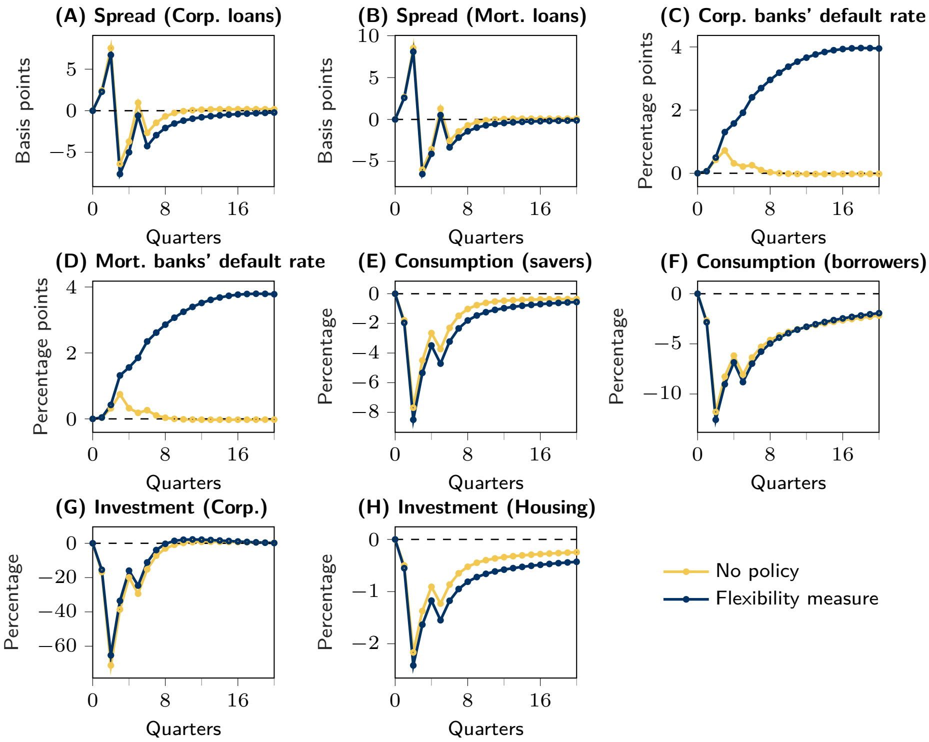


Figure B.2: IRF for the scenarios with and without flexibility measure to the shocks simulating a contraction in GDP

B.2. The flexibility measure and the dividends pay-out restriction

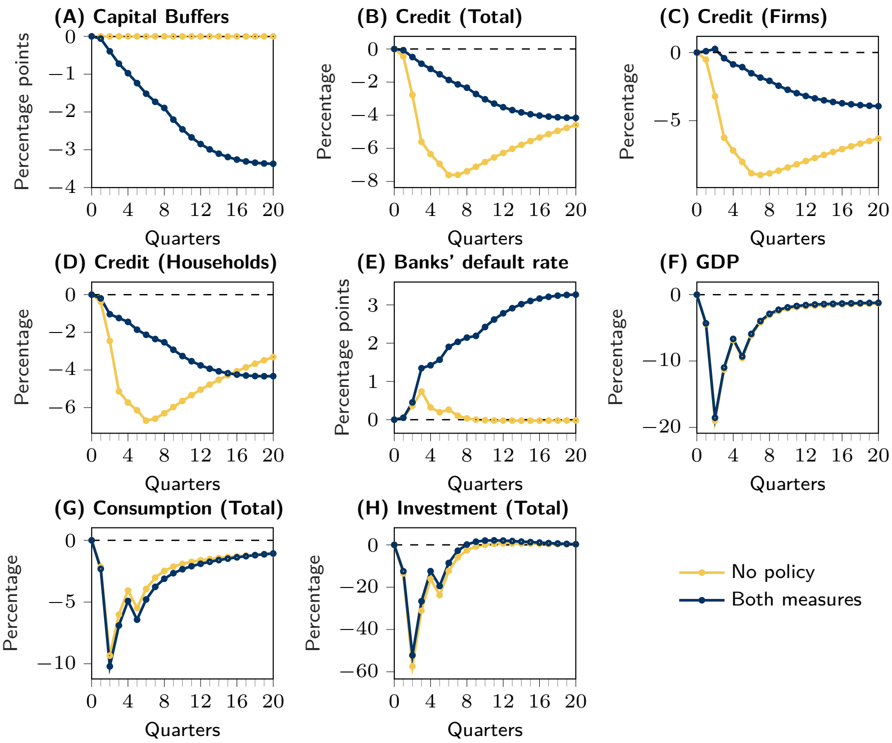


Figure B.3: IRF for the scenarios with and without both measures (flexibility and dividends pay-out restriction) to the shocks simulating a contraction in GDP

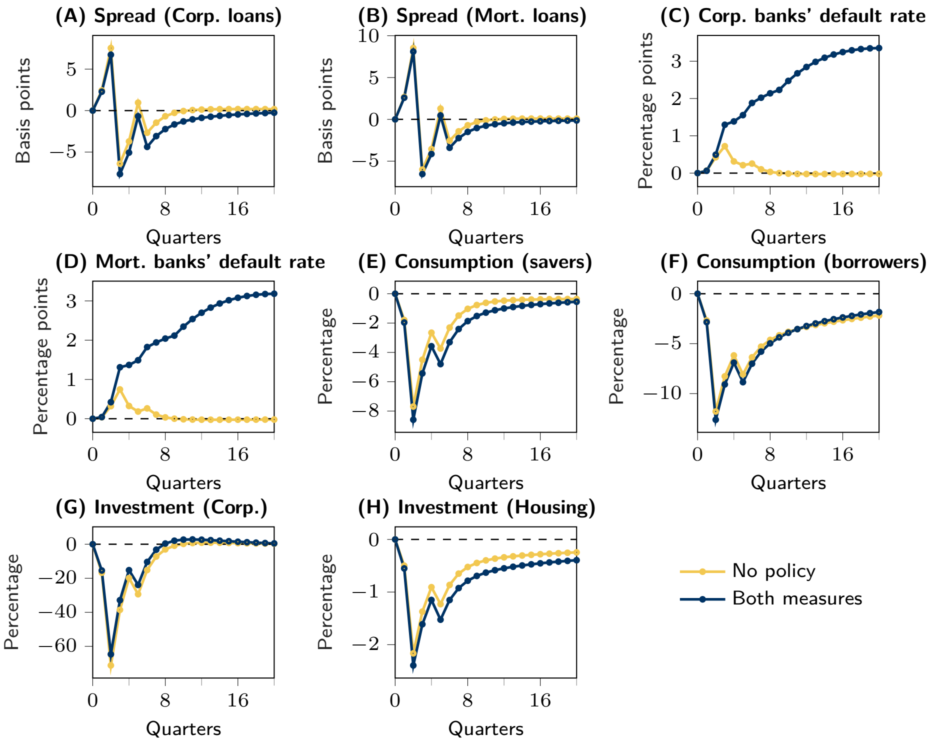
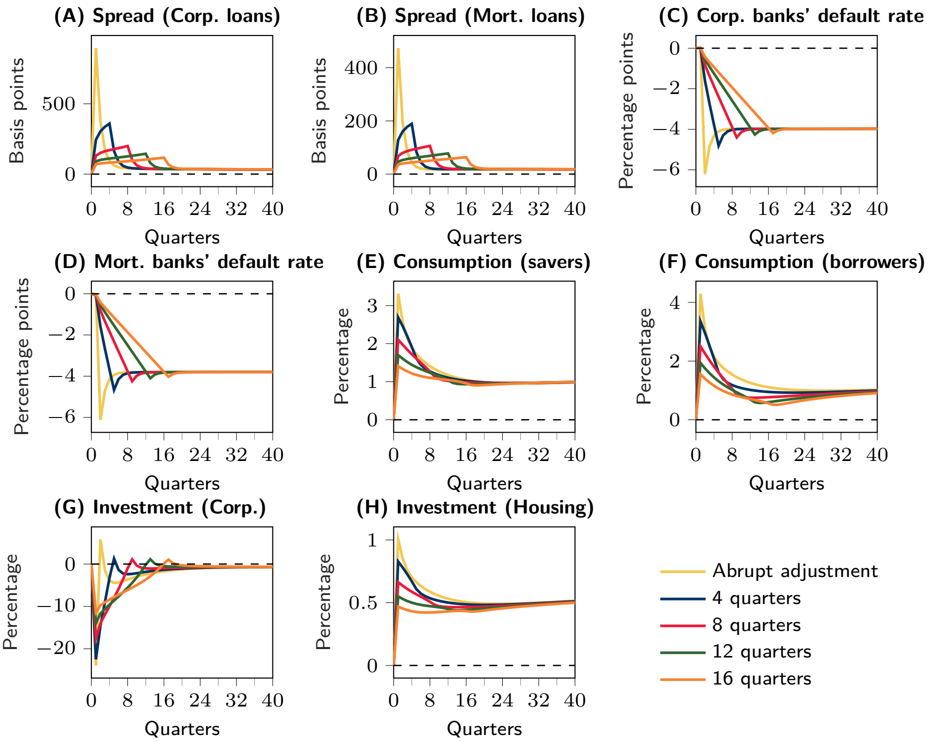


Figure B.4: IRF for the scenarios with and without both measures (flexibility and dividends pay-out restriction) to the shocks simulating a contraction in GDP

Appendix C: The replenishment of capital buffers: additional impulse response functions (IRF)

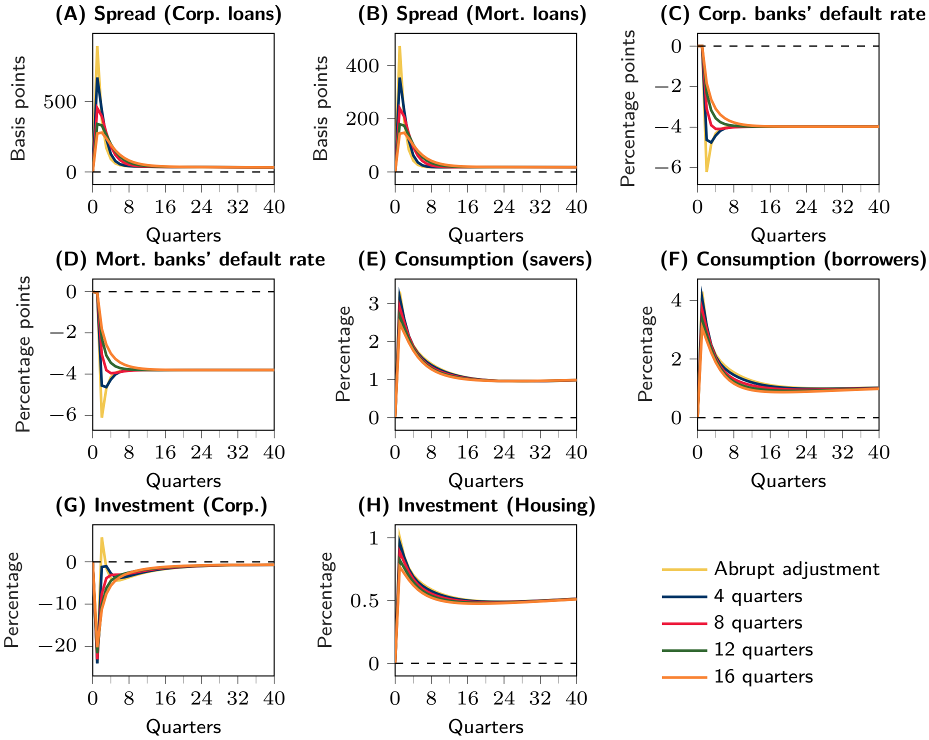
C.1. Linear path regime



Note: Impulse responses from a 4 p.p. capital buffers' replenishment. Deviations from the initial steady state.

Figure C.1: Additional IRFs of capital buffers' replenishment (linear path regime)

C.2. Non-linear path regime



Note: Impulse responses from a 4 p.p. capital buffers' replenishment. Deviations from the initial steady state.

Figure C.2: Additional IRFs of capital buffers' replenishment (non-linear path regime)

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