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Macroprudential Policy Calibration for Greece: Simulations for Borrower- Based Measures

Marco Gross, Shiqing Hua, Mariusz Jarmuzek, and Wei Shi

SIP/2024/008

IMF Selected Issues Papers are prepared by IMF staff as background documentation for periodic consultations with member countries. It is based on the information available at the time it was completed on December 15, 2023. This paper is also published separately as IMF Country Report No 24/24.

2024
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SELECTED ISSUES PAPER

IMF Selected Issues Paper
European Department

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Authorized for distribution by Joong Shik Kang
February 2024

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RECOMMENDED CITATION: Gross, Marco, Shiqing Hua, Mariusz Jarmuzek, and Wei Shi (2023). Macprudential Policy Calibration for Greece: Simulations for Borrower-Based Measures. IMF Selected Issues Paper (SIP/2024/008). Washington, D.C

JEL Classification Numbers:	C53, E58, G21, G28, R38
Keywords: [Type Here]	Greece; macroprudential policy; borrower-based measures; household micro data and modeling; policy simulation
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SELECTED ISSUES PAPERS

Macroprudential Policy Calibration for Greece: Simulations for Borrower- Based Measures

Greece

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MACROPRUDENTIAL POLICY CALIBRATION FOR GREECE: SIMULATIONS FOR BORROWER-BASED MEASURES¹

The Greek financial system has remained resilient underpinned by strengthening banks' balance sheets, but still faces significant challenges ahead including the re-emergence of imbalances in the real estate market. Recognizing these imbalances, the authorities have recently introduced the necessary legal framework for setting borrower-based measures (BBMs), paving the way to activate both income- and collateral-based measures in near term. Simulations, which employ a quantitative framework combining micro- and macro-level data, show that BBMs would help enhance household resilience, with synergies when caps on debt service-to-income (DSTI) and loan-to-value (LTV) ratios are jointly implemented, leading over time to the more resilient banking system against potential risks. Caps could initially be set at less binding levels and gradually tightened based on a systemic risk assessment.

A. Introduction

1. The authorities have embarked on policy initiatives to strengthen macroprudential policy toolkit against emerging vulnerabilities in the real estate market. In line with IMF (2022) and ESRB (2022), the Bank of Greece (BoG) has been monitoring the developments in the real estate markets, having identified rapid increases in residential prices as one of the important albeit still emerging systemic risks. The systemic importance of real estate markets stems from the strong link between them and significant parts of the economy, underscoring the importance of real estate markets from a macroeconomic and financial stability perspective. (ESRB, 2019). In an effort to address these risks, the underlying legal framework has recently come into effect granting the BoG the power to enact macroprudential borrower-based measures (BBMs) to be implemented in Greece (BoG, 2023a).

2. The toolkit embedding BBMs can help reduce systemic risk by enhancing the resilience of households and banks. These measures directly constrain new credit flows by imposing limits on the amount of credit that a specific borrower can obtain, typically in relation to the value of the underlying collateral and/or the borrower's income. While BBMs do not have an immediate impact on banks' capacity to absorb losses, they gradually reduce the magnitude of potential future bank losses by making households more resilient to income, interest-rate, and house-price shocks (Behn and others, 2022). BBMs could complement capital-based measures (CBM), which are unlikely to have a material impact on borrower risk characteristics or the

¹ Prepared by Marco Gross, Shiqing Hua, Mariusz Jarmuzek, and Wei Shi, with inputs from Katherine Dai. The authors would like to thank, without implicating, Heather Gibson, Dimitris Malliaropoulos, Eleftherios Manarolis, Michael Massourakis, Paavo Miettinen, Erlend Nier, Spyros Pantelias, Ellen Ryan, Nikos Stavrianou, and Ioannis Tsikripis, as well as participants of the workshop held at the Bank of Greece for useful discussions, comments, and suggestions.

magnitude of expected future losses, but, importantly, they enhance banks' capacity to absorb losses.²

3. The paper presents key trade-offs and some initial benchmark calibration of BBMs for Greece. After a select dive into systemic risk in the household sector and real estate markets along with providing basic rationale for and modalities of BBMs, the study focuses on answering two policy questions: (1) what could be the impact of introducing BBMs on household resilience taking into account negative macroeconomic feedback loop effects? (2) what could be the impact of introducing BBMs on bank resilience?

B. Select Systemic Risk Assessment

4. There are emerging signs of imbalances in the real estate sector (Figure 1). Residential real estate prices have increased significantly across the board of indicators since its trough in 2017, exceeding 50 percent in nominal terms and 35 percent in real terms and not yet visibly decelerating, supported by strong employment and real disposable income growth. Demand also stemmed from nonresidents who increased significantly their investment in the real estate market taking inter alia advantage of the Golden Visa program, which came on top of structural issues pointing to Greece as being one of the countries with the lowest number of rooms per person and the highest share of population living in overcrowded homes in the EU. But there was a significant supply response, with housing investment as a share of GDP and building permits doubling since 2016, although admittedly from a low base. Various metrics suggest moderate overvaluation in 2023, with the price-to-income and price-to-rent ratios exceeding their historical long-term averages by 6 and 29 percent, respectively, which is broadly confirmed by the results of the econometric model suggesting 8 percent.

5. While the household sector leverage and banking exposure to the real estate sector have declined since the sovereign debt crisis, there appear to be some vulnerabilities requiring close monitoring (Figure 2). The household sector debt was subject to a pronounced deleveraging process following the global financial crisis (GFC), resulting in much lower leverage levels compared to other EA countries. Reflecting the credit boom legacy, net credit growth to households is still subdued, but the household debt service remained one of the highest in the EU, as demonstrated by housing costs in disposable income and the debt service ratio. While lending standards have not been visibly tightened by banks, there is already some increase in the debt service-to-income (DSTI) ratio (BoG, 2023b), with Greece recording the highest share of loan-to-value (LTV) ratio exceeding 80 percent among the EU countries (EBA, 2022), although evidence from the joint distribution of risk indicators does not suggest reasons for significant concern (BoG, 2023b).³ The exposure of banks to the real estate market is below the EU average and less significant compared to the pre-GFC levels.

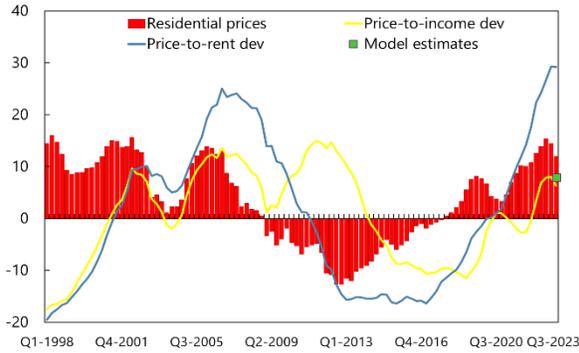
² See IMF (2022) Selected Issues Paper, Enhancing Macprudential Capital Buffers in Greece, for a discussion on the rationale for the countercyclical capital buffer (CCyB) in Greece.

³ Based on the BoG data, the share of new loan disbursements with an LTV>80% stood at 5.7% in Q2 2023.

Figure 1. Greece: Real Estate Sector

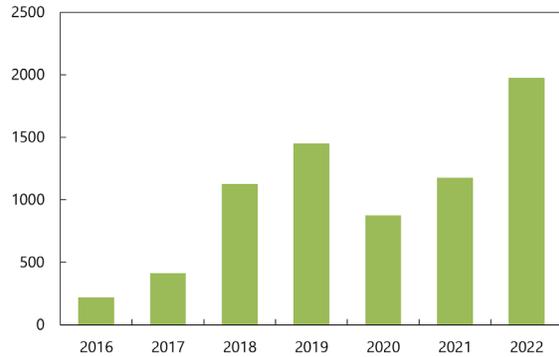
Residential Prices and Valuation

(Percent, year-on-year, deviations from long-term average)



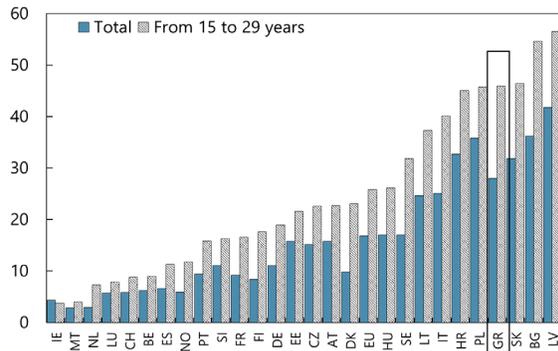
Net Foreign Direct Investment in Real Estate

(Million euros)



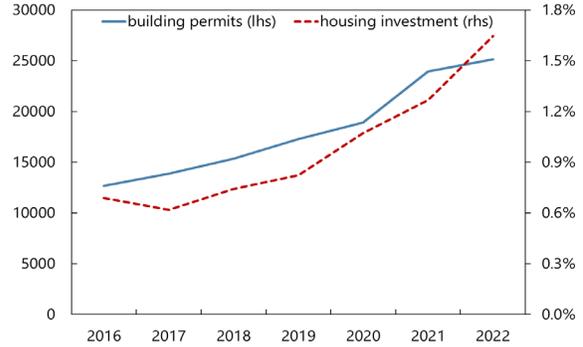
Overcrowding Rate, 2022

(Percentage)



Housing Investment and Building Permits

(LHS units; RHS percent of GDP)

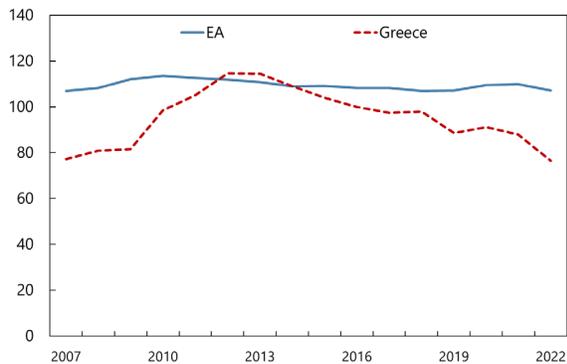


Sources: OECD; BOG; Eurostat; Haver Analytics; EU-SILC Survey; and IMF staff calculation.

Figure 2. Greece: Household Sector

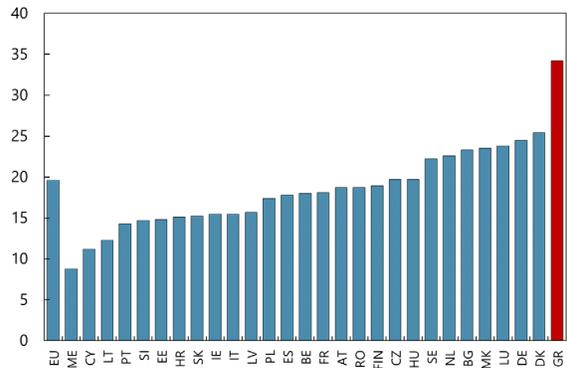
Household Debt to Disposable Income

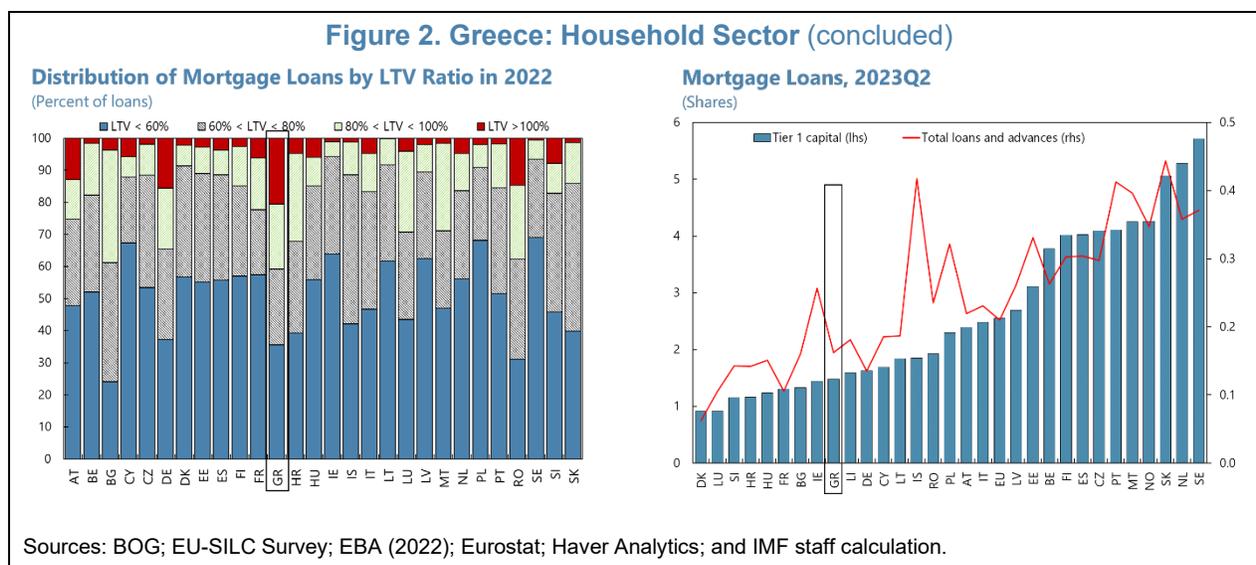
(Percentage)



Share of Housing Costs in Disposable Household Income, 2022

(Percentage)





C. Macroprudential Policy Options

Policy Toolkit in Greece

6. Recognizing growing imbalances in the real estate market, the BoG has recently introduced the necessary legal framework to activate BBMs. Given the protracted distress period involving a substantial household deleveraging and real estate market correction, there was no policy framework for BBMs in place until 2023.¹ But the BoG has recently identified vulnerabilities in the real estate market as an important source of systemic risk, currently assessing the merits of implementing BBMs in near term (BoG, 2023b). Paving the way to address this risk, the legal framework was amended in 2023, so the BoG now has the power to enact BBMs for financial institutions established and operating in Greece, as well as branches of foreign institutions in Greece, in connection with credit secured by real estate located in Greece. These measures may include caps on ratios related to the credit or the borrower or specific features of the credit. At its full discretion, the BoG may adopt a decision regarding the type of BBMs, the types of credit to which such BBMs apply, where it imposes caps, the ratios or features of credit to which limits apply, as well as the cap percentages, the terms and conditions of implementation of BBMs, and the data and information to be submitted by the financial institutions.

Modalities and Trade-offs

7. Income- and collateral-based measures constitute key and complementary elements of the BBM toolkit. Income-based measures help enhance the resilience of new borrowers through reducing the probability of default (PD) among households thanks to relating loans to the overall debt repayment and/or servicing capacity of households, with the primary instrument defined in

¹ While CBMs in the form of CCoB, O-SII, and CCyB have been implemented in Greece, CCyB has not yet been activated (BoG, 2023b).

terms of caps on the DSTI ratio. Collateral-based measures help shield against house price corrections through containing the loss given default (LGD) on loans granted owing to reducing the unsecured portion of a loan, with the cap on the LTV ratio employed as the most common instrument. Taking into account that income- and collateral-based measures operate through complementary transmission channels, they should be considered being implemented jointly, which would increase borrower resilience to income and interest-rate shocks, limit portfolio loss rates in terms of PDs and LGDs, and ultimately reduce bank defaults given the increased resilience of household loan portfolios over the medium term (ESRB, 2019). Other complementary measures could include *inter alia* maturity limits, loan amortization, risk weights, and targeted CBMs.²

8. When considering BBM activation, it is vital to take into account trade-offs. BBM caps are typically set weighting the benefits of risk mitigation in the form of excluding or reducing the proportion of riskier loans against the cost of limiting credit intermediation and market access for lower-income borrowers. Ampudia and others (2021) present evidence from a panel VAR framework for the EU countries suggesting that BBMs help contain house prices, with an adverse impact on credit and GDP, consistent with evidence from Cerutti and others (2015) and Araujo and others (2020). These findings are also broadly in line with evidence from Giannoulakis and others (2023) who based on a model combining household- and country-level data for the EU countries confirm a positive impact of BBMs on household resilience, although the authors also point to some reduction in mortgage loan volumes. Georgescu and Vila Martin (2021) examine the impact of BBMs on income and wealth inequality using household-level data for the EU countries, finding only limited distributional effects.

Other Considerations

9. The timing for BBM activation should take into consideration the real estate market cycle and policy lags. By acting on in the early stages of the real estate cycle, vulnerabilities can be addressed through BBMs when they are still building up, effectively smoothing cyclical swings compared to the counterfactual of late policy response. When the real estate cycle is more mature, a combination of BBMs and CBMs could be considered, with the overarching objective of enhancing resilience, as the former affect only the flow of new lending, while the latter have an impact on the resilience of lenders. Beyond institutional arrangements that may have some impact on implementation, there might also be lags associated with the time needed for a policy to have the desired effects.

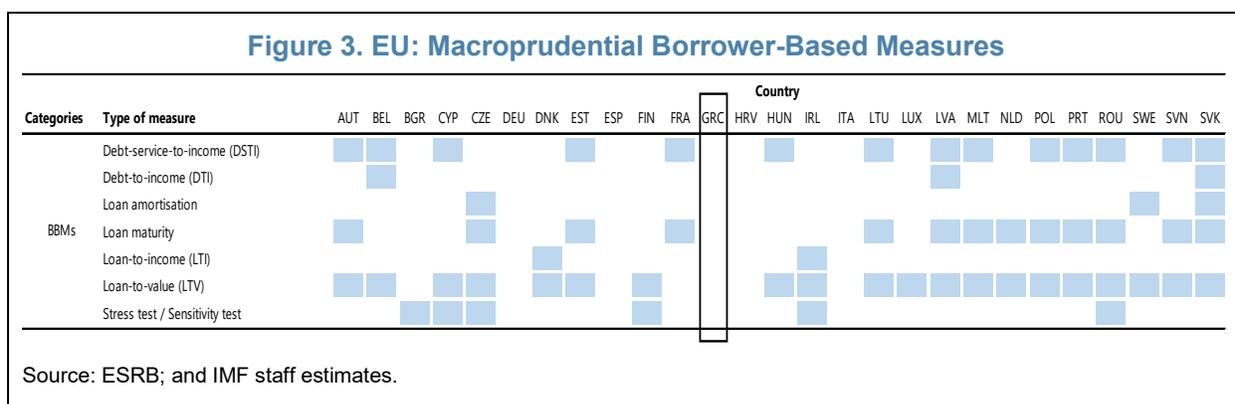
10. BBMs should be designed and calibrated considering the nature of potential vulnerabilities. Depending on the prevailing level of lending standards and the specific policy objectives, instruments may be calibrated in a binding or nonbinding way, with the former aiming at taming cyclical risks and the latter being suitable when the current lending standards are considered sufficiently prudent, and policymakers are aiming to curb structural vulnerabilities in lenders and borrowers' balance sheets. In addition, depending on the nature of the identified vulnerabilities and

² See IMF (2014) and ESRB (2019) for a comprehensive coverage of macroprudential measures.

the policy objectives, the calibration of instruments may be static or dynamic over the cycle. Furthermore, speed limits and exceptions can be used to target specific segments of the borrower population, given that BBMs may have distributional consequences restricting access to the credit market among young households with low wealth, but otherwise good income prospects. Exceptions may be considered to allow a given fraction of the flow of new lending to exceed the macroprudential limits, thus giving banks some flexibility to grant more favorable borrowing conditions to those borrowers considered less risky (Lo Duca and others, 2023).

Implementation in the EU Countries

11. BBMs have been very widely implemented in the EU, with the prominent role played by DSTI and LTV caps. Following the ESRB recommendation on BBMs, the vast majority of the EU countries have activated them in some form, typically more than two instruments and predominantly covering both income- and collateral-based dimensions. Caps on DSTI and LTV are the most commonly used instruments among the EU countries, with 14 countries having implemented DSTI and 20 countries LTV. Greece is one of the very few countries that have not yet implemented any BBMs, which is in contrast with countries such as Cyprus, Ireland, and Portugal that introduced BBMs much earlier despite being subject to the similar private sector deleveraging.

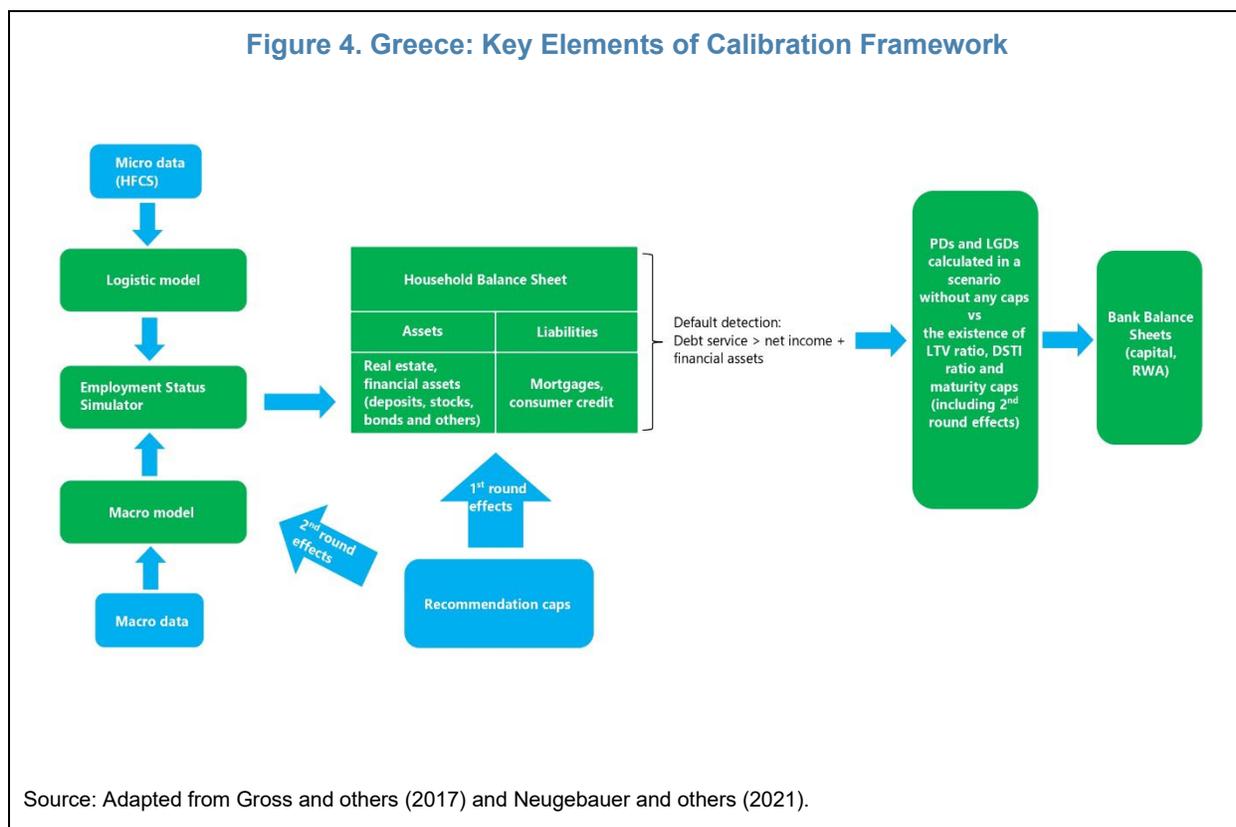


D. Policy Calibration

Calibration Framework

12. We employ an established quantitative framework combining micro- and macro-economic dimensions to assess the impact of BBMs. Following Gross and Poblacion (2016, 2017) and subsequent refinements by Giannoulakis and others (2023), we use the framework that quantifies the extent to which BBMs enhance the resilience of households and banks. The framework combines micro-level data on key household financial and sociodemographic characteristics in Greece from the Household Finance and Consumption Survey (HFCS) with macro-level quarterly data covering key macroeconomic and financial variables for Greece from the ECB and national sources (Appendix 1). The model captures the dynamics of household debt service and consumption expenditure along with labor income and unemployment benefits, depending on

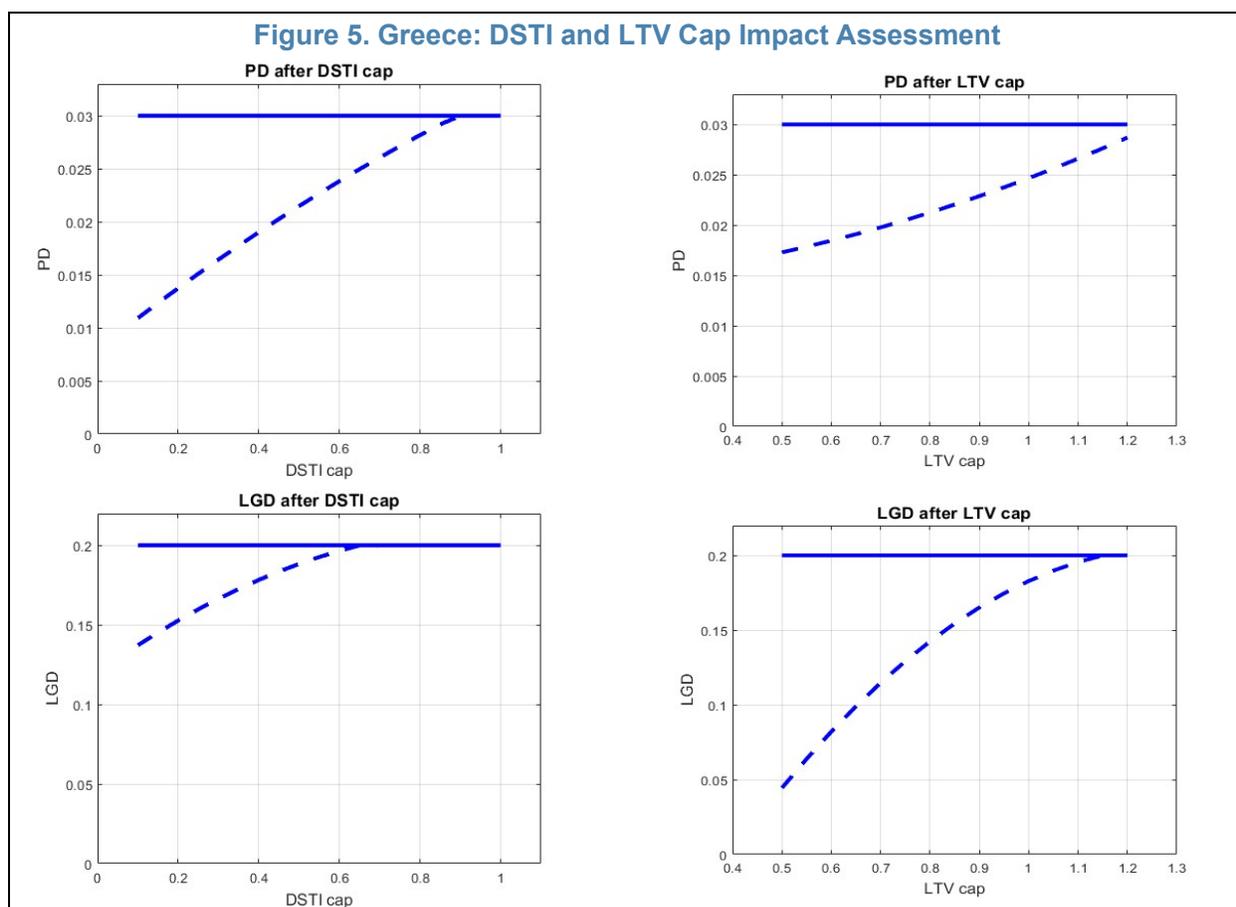
household members' simulated employment status. The primary outputs of the model are individual households' simulated PDs, LGDs, and loss rates (LRs), which are subsequently linked to bank mortgage portfolios to assess their capital impact. The model also accounts for macro-financial feedback of policies, which result from their drag on credit demand. The framework has been extensively used for assessing impact of the BBMs in advanced economies, with examples including Slovakia by Jurca and others (2020), Portugal by Neugebauer and others (2021), and USA and EA by Gross and others (2022). The schematic presenting the key elements of the framework is below.

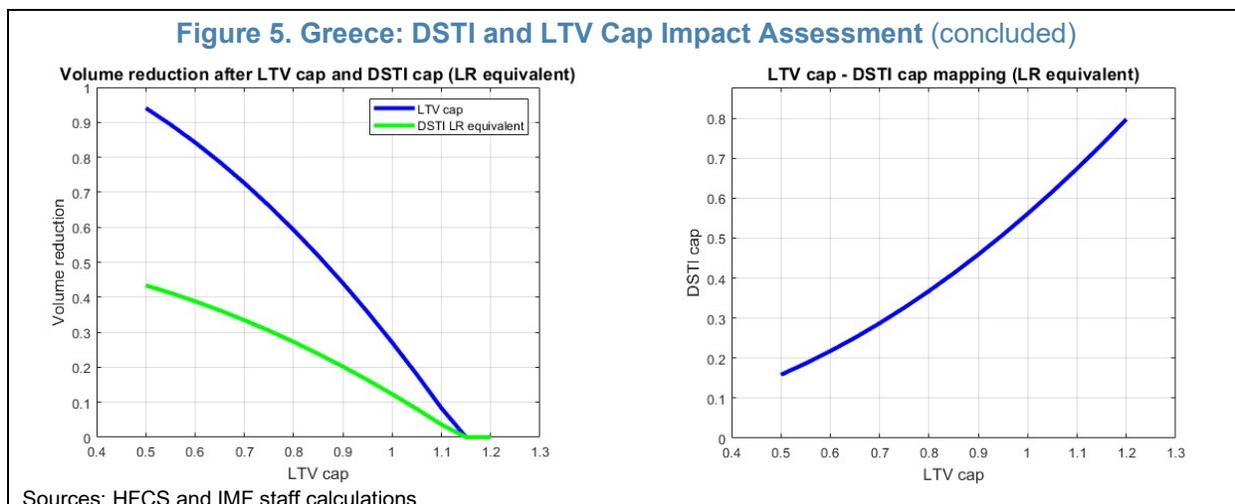


13. The framework allows to assess the impact of BBMs on the resilience of households and banks. In the first step, the aim is to assess by how much DSTI and LTV caps are able to reduce household PDs and LGDs. Furthermore, additional insights are gained through assessing how much of the outstanding mortgage debt would be crowded out as a function of caps and what is the mapping between LTV and the loss rate-equivalent DSTI caps. In the second step, household risk parameters under no policy scenario are compared with the respective post-policy distributions for the DSTI and LTV caps consistent with the mapping. Results are presented for the implementation of individual macroprudential limits to LTV and DSTI separately, as well as for the joint implementation of the limits. The first- and second-round effects are considered, with the former representing an impact of given BBM setting on PDs, LGDs, and LRs and the latter adding an impact of negative loan demand shock on PDs, LGDs, and LRs. In the final step, the model computes an impact of the given BBMs on the capital adequacy ratio of banks through reducing loan losses from mortgage credit portfolio and lower risk weights resulting from lower risk parameters.

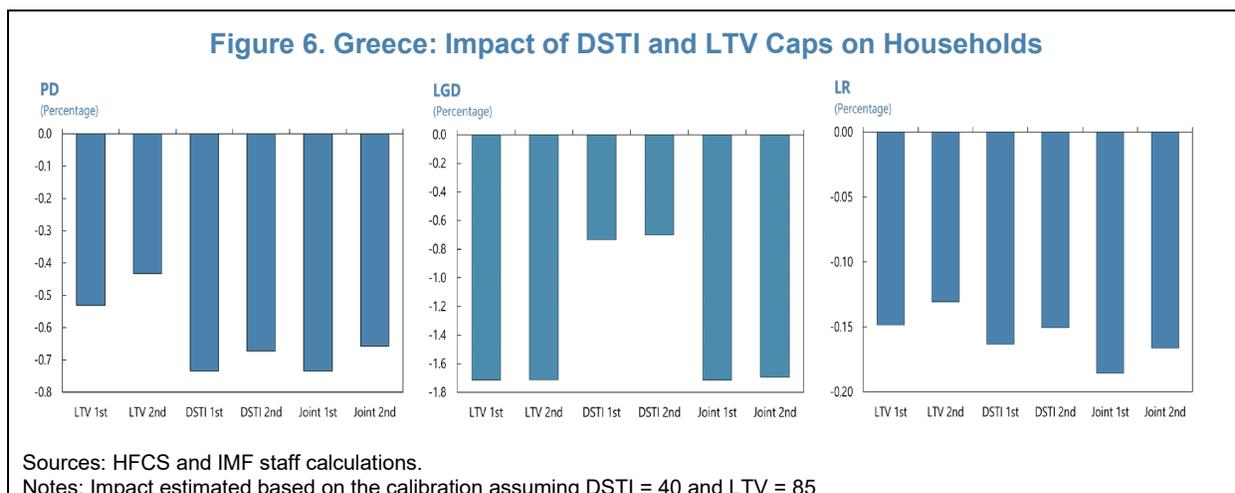
Impact on Household Resilience

14. The analysis suggests important trade-offs for the BBM activation. The evidence shows that the initial PD starts to decline sharply from a DSTI cap at around 90 percent, through an already sizeable impact for the cap at 50 percent, reaching its maximum level at the left end of the DSTI cap, while the impact of LTV caps on PDs is estimated to be smaller. The simulation also demonstrates a significant impact of LTV caps on LGDs that are estimated to decline sharply from an LTV cap at around 90 percent, although DSTI caps do not seem to significantly affect LGDs. The mortgage volume reduction associated with the crowding out effect of imposing caps suggests a stronger impact of LTV caps compared to the loss rate equivalent DSTI caps, which implies that for a smaller share of the population DSTI caps would have been binding to achieve the same loss rate as the corresponding LTV cap. The estimated mapping of the DSTI cap to the LTV cap suggests that for an LTV cap at 85 percent, the equivalent DSTI cap would equal around 40 percent. DSTI caps seem to have a stronger potential to reduce PDs, while LTV caps have a stronger bearing on LGDs.





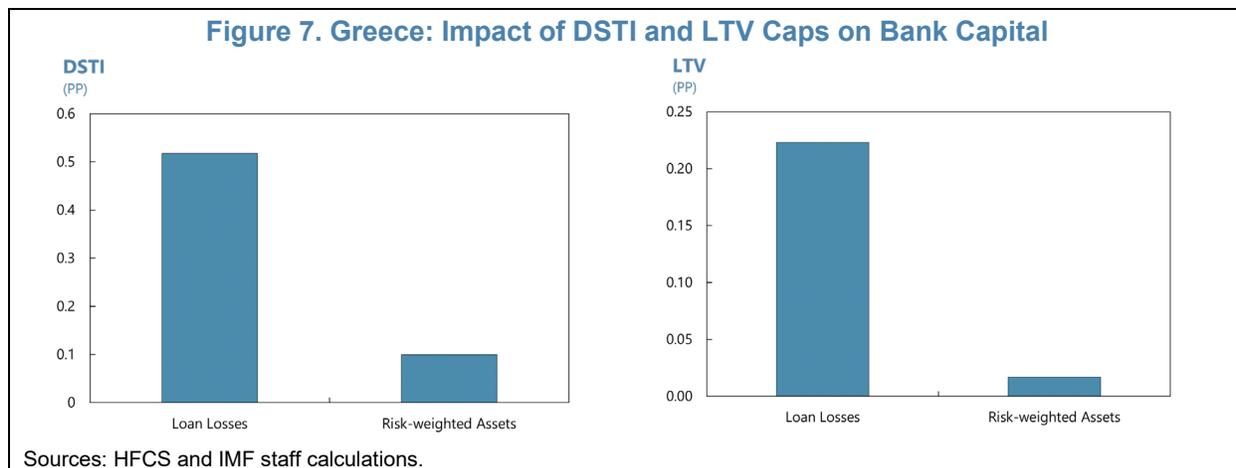
15. BBMs are estimated to enhance household resilience, with stronger effects for the joint implementation of DSTI and LTV caps. Building on the estimated mapping between DSTI and LTV caps and taking into account the implemented calibration of these caps in other European countries, DSTI is set to 40 percent and LTV to 85 percent.³ The evidence suggests that DSTI caps lower PDs more compared to LTV, while LTV caps reduce LGDs more than for DSTI caps. These results are consistent with the priors suggesting DSTI caps are related to such flow variables as income and expense, while LTV caps are related to a stock ratio. The overall impact in terms of LRs is estimated to be sizeable and higher for DSTI caps compared to LTV caps, with only relatively limited second-round effects taking into account a negative loan demand shock. The joint implementation of DSTI and LTV caps demonstrates a stronger impact in terms of increasing borrower resilience when compared to individual limits. This can partly be attributed to the complementarities between income-based measures acting primarily via the PD channel and collateral-based measures acting primarily via the LGD channel and in line with evidence from Gross and Poblacion (2017).



³ Results for an alternative calibration are presented in Appendix 2.

Impact on Bank Resilience

16. BBMs are found to have a positive impact on bank capital. Compared to the starting point for banking system balance sheets, there is an estimated positive impact on CET1 ratios for policy limits, with stronger effect for DSTI caps compared to LTV caps. The estimated impact seems relatively sizeable, given that it reflects only the mortgage loan portfolio. Decomposing the impact into the numerator and denominator effects, the estimated reduced loan losses from mortgage credit portfolio outweigh the lower risk weights owing to lower PDs and LGDs.



E. Conclusions and Policy Implications

17. There are emerging vulnerabilities in the real estate and household sectors requiring close monitoring. Greece experienced a protracted distress period involving a substantial household deleveraging and ensuing real estate market correction. But house prices have increased significantly since its trough in 2017, supported by strong employment and real disposable income growth, as well as demand from nonresidents and lingering structural imbalances in the real estate sector. Although there was a significant supply response, various metrics suggest moderate overvaluation. While the household sector leverage is generally low, the household debt service remained high, pointing to growing vulnerabilities in the sector.

18. Enhancing the macroprudential policy toolkit with BBMs would help increase resilience of households and banks, contributing to the systemic risk reduction. Recognizing growing imbalances in the real estate market, the authorities have recently introduced the necessary legal framework for setting BBMs, paving the way to activating both income- and collateral-based measures. Employing an established quantitative framework combining micro- and macro-economic dimensions based on Greek data, simulations show that BBMs are estimated to enhance household resilience, confirming some complementarities between DSTI and LTV caps. Both caps lower PDs and LGDs, with stronger effects of LTV on LGD and DSTI effects on PD. The impact of DSTI caps is stronger than LTV caps, which come at a cost of lower lending. The joint implementation of DSTI and LTV caps demonstrates a stronger impact on borrower resilience compared to individual caps. Building on increased household resilience, BBMs are also found to increase over time bank

resilience, with stronger effects related to DSTI caps compared to LTV caps. Caps could initially be set at less binding levels and gradually tightened over time.

Appendix I. Data Description

Household Data

		Model Variable		Variable Code in the HFCS + Transformation
	Assets	H	Current value of house	DA1110
		TFA	Total financial assets (incl. cash, stocks, bonds, pensions, life insurance)	DA2100 - DA2104 (value of business) - DA2107 (money owed to others)
		B	Current market value of bonds	DA2103
		S	Current market value of stocks	DA2105
	Liabilities	D ^m	Outstanding balance of mortgage debt	DL1100
		D ^{NM}	Outstanding balance of non-mortgage debt	DL1200
	Income Flows	I	Household income total, quarterly, gross of tax (used only for calculation of DSTI and DTI ratios for MPRU policy exp.; labor income, pensions, and unemployment benefit are used and modeled at HH member-level)	DI2000 / 4
		RI	Rental income, quarterly	HG0310 / 4
		OI	Other regular income, quarterly, e.g. child benefit, alimony, etc.	(HG0110 + HG0210) / 4
	Expense Flows	A = A ^M + A ^{NM}	Annuity for mortgage debt, quarterly	DL2100 * 3
			Annuity for non-mortgage debt, quarterly	DL2200 * 3
		OE	Rental expense, quarterly (needed only if focus is on HHs who rent)	HB2300 * 3
		E	Living expense, excl. annuities and rent, quarterly	DOCOGOOD / 4
	Other	HH_ID	Household ID	SA0010 (made unique across countries)
		HW	Household weight	HW0010
		HH_RES	Country of residence	SA0100
		Myear	Year of 1st mortgage origination; for MPRU exp. Only	HB1301
		MiniDur	Duration of 1st mortgage at origination in years; for MPRU exp. only	HB1601
		DType	Rate type of total debt (variable vs. fixed)	DL1110{a,b,c}i
		i ^M	Current interest rate on mortgage debt; if not reported at HH-level, then filled with country-aggregate consumer debt interest rate	W.A. from mortgages outstanding (HB170x) and their interest rates (HB190x)
		i ^D	Current interest rate on total debt; if not reported at HH-level, then filled with country-aggregate consumer debt interest rate	Total absolute annual interest flow (DI1412) over total current debt (DL1000)
		M ^{RES}	Synthetic residual duration of total debt in months (needed for variable rate loans only)	ceil(log(4*A/(4*A - i ^D *(D ^M +D ^{NM})))/log((i ^D /12)+1))
		Etol	Living expenses (excl. Annuities and rent) as share of gross income	E/I
HM-Level	Income Flows	INC ^E	Labor income (gross of tax) from employment or self-employment	(PG0110 + PG 0210 + PG0310 + PG0410) / 4
		INC ^U	Unemployment benefit, net of tax, quarterly	PG0510 / 4
	Other	HM_ID	Household member ID	ID
		HM_HH_map	Household members' household IDs	SA0010
		HM_RES	Country of residence	SA0100
		LAB	Labor status; see separate table for code mapping	PE0100a
		MAR	Marital status; see separate table for code mapping	PA0100
		EDU	Level of education; see separate table for code mapping	PA0200
		GEN	Gender	RA0200
		AGE	Age	RA0300
DF	Nationality / Domestic-foreign indicator	Generated from country of birth		

Macroeconomic Data

Variable	Comments	Source
URX	Unemployment rate anchor point for the last year (2017)	ECB Statistical Data Warehouse
IR	Short-term interest rate level anchor point for the last year	ECB Statistical Data Warehouse
HPG	Annual house price growth in the last year (log difference-based)	ECB Statistical Data Warehouse
SPG	Annual stock price growth in the last year (log difference-based)	ECB Statistical Data Warehouse
CPG	Annual compensation per employee growth in the last year (log difference -based)	ECB Statistical Data Warehouse
DEPR	Deposit rate in the last sample year	ECB MIR

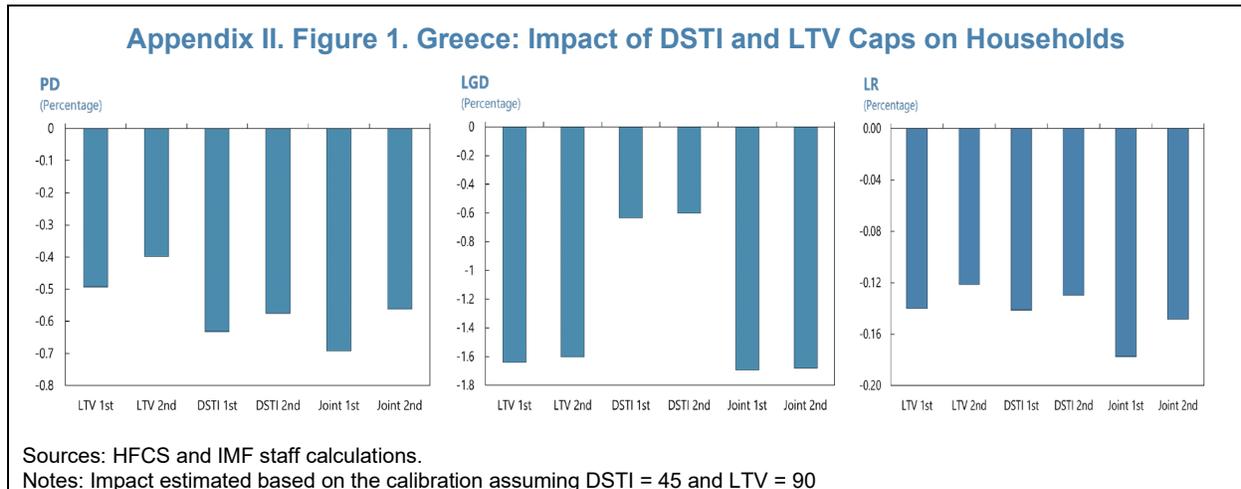
Banking Data

Input Parameters	Explanation	Source
RWA Total	Risk Weighted Assets	ECB Statistical Data Warehouse
CET1 Total	Core Equity Tier 1 Capital	ECB Statistical Data Warehouse
IRB (IRB+STA)	Share of IM mortgages in total mortgage stock	EBA
RW on STA mortgage portfolio	Implied by regulation	BCBS
Mortgage loan stock – performing	Performing mortgage loans	ECB Statistical Data Warehouse
Mortgage loan stock – nonperforming	Non-performing mortgage loans	ECB Statistical Data Warehouse
PiT PD	Mortgage PD anchor point for the last sample year (2017)	EBA Risk Dashboard
PiT LGD	Mortgage LGD anchor point for the last sample year (2017)	EBA Risk Dashboard
TTC PD of mortgages	Through the cycle PD – estimated PD for the upturn of the cycle	EBA
DT LGD of mortgages	Downturn PD – estimate for the downturn of the cycle	EBA
Mortgage loan interest rates		ECB Statistical Data Warehouse

Appendix II. Alternative Calibrations

Alternative Calibration

DSTI = 45 percent and LTV = 90 percent



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