ISSN: 3070-4030

Review Article

World Journal of Tourism Management

Macroprudential Tool Proliferation and its Adverse Effects on Macroeconomic Investment, Productivity, Growth and Employment

Gazi Arif*

Westminster Business School, University of Westminster Fordham University, New York, United States

[*]Corresponding Author
Gazi Arif, Westminster Business School, University of Westminster Fordham University, New York, United States. **Email:** gmarif2005@yahoo.com

Submitted: 2026, Feb 10; **Accepted:** 2026, Mar 25; **Published:** 2026, Apr 03

Citation: Arif, G. (2026). Macroprudential Tool Proliferation and Its Adverse Effects on Macroeconomic Investment, Productivity, Growth and Employment. *World J Tourism Mgm, 2*(1), 01-11.

Abstract

This paper examines whether the proliferation of macroprudential tools deployed by central banks generates adverse macroeconomic consequences that offset their intended financial stability benefits. Drawing on a theoretical framework grounded in New Keynesian finance–macro models and a panel dataset covering 42 economies over the period 2000–2023, we document a robust, non-linear relationship between the breadth of macroprudential instrument use and key macroeconomic outcomes: gross fixed capital formation, total factor productivity (TFP), real GDP growth, and employment. Our results indicate that countries operating more than a moderate threshold of simultaneous macroprudential tools experience statistically significant reductions in private investment (1.8 to 3.2 percentage points of GDP), slower TFP growth (0.4 to 0.9 percentage points per annum), lower output growth (0.5 to 1.1 percentage points), and elevated unemployment (0.3–0.8 percentage points above baseline). The adverse effects are amplified in small open economies, countries with shallow financial markets, and periods of global financial tightening. We identify three principal transmission channels: credit supply compression, regulatory uncertainty rent extraction, and compliance cost diversion of managerial resources. Policy simulations suggest that a rationalized, targeted macroprudential framework— applying the minimum effective combination of instruments—dominates aggressive multi-tool regimes on both financial stability and macroeconomic welfare grounds. Our findings call for a fundamental reassessment of the "more-is-better" approach to macroprudential regulation.

Keywords: Macroprudential Policy, Regulatory Proliferation, Investment, Total Factor Productivity, Economic Growth, Employment, Financial Stability

1. Introduction

The global financial crisis of 2007–2009 catalysed a paradigm shift in financial regulation. Pre-crisis thinking held that monetary policy, operating primarily through the short-term interest rate, was the appropriate and sufficient instrument for maintaining macroeconomic stability, provided that microprudential supervision ensured individual bank soundness. The crisis exposed the inadequacy of this framework: systemic risk can accumulate even when each individual financial institution appears healthy, and monetary policy instruments are poorly suited to addressing the build-up of financial imbalances across the cycle [1,2].

The post-crisis regulatory response was sweeping. Basel III introduced higher capital buffers, countercyclical capital requirements, leverage ratios, and liquidity coverage ratios. National authorities layered additional domestic instruments on top of the Basel framework: loan-to-value (LTV) caps, debt-service-to-income (DSTI) limits, sectoral capital requirements, dynamic loan-loss provisioning, systemic risk surcharges, and an expanding array of borrower-based tools [3,4]. By 2023, the International Monetary Fund's Integrated Macroprudential Policy (iMaPP) database recorded that the average advanced economy maintained fifteen or more distinct macroprudential measures simultaneously, with some jurisdictions deploying upwards of twenty-five instruments [4,5].

This proliferation raises a fundamental question that has received insufficient analytical attention: does the simultaneous deployment of many macroprudential tools generate macroeconomic costs that partially or wholly offset the financial stability benefits? The purpose of this paper is to provide a rigorous empirical and theoretical answer to that question. We argue that excessive macroprudential tool use operates through three distinct channels to harm the real economy.

First, when credit supply instruments are stacked—for example, simultaneous LTV caps, DSTI limits, sectoral capital requirements, and higher minimum capital ratios—the cumulative tightening of credit conditions can exceed what is warranted by systemic risk considerations, compressing investment financing for productive but leveraged activities. *Second*, regulatory proliferation generates substantial compliance costs and management attention costs that divert resources from productive investment into regulatory administration. *Third*, the interaction of multiple partially overlapping tools creates complex, sometimes contradictory incentive structures that generate uncertainty, raise required rates of return for investment, and can produce "regulatory arbitrage" dynamics that reduce allocative efficiency. Our empirical analysis uses a panel of 42 economies from 2000 to 2023 and exploits variation in the number and type of macroprudential tools activated as the key independent variable.

We control for standard macroeconomic determinants of investment, productivity, growth, and employment, as well as for financial cycle conditions, monetary policy stance, and country fixed effects. Identification exploits exogenous policy adoption triggered by Financial Stability Board (FSB) peer review obligations and IMF Article IV consultation recommendations, which created quasi-random variation in the timing and scope of macroprudential tool adoption across otherwise comparable countries. The paper proceeds as follows. Section 2 reviews the existing literature. Section 3 develops the theoretical framework. Section 4 describes the data and empirical methodology. Section 5 presents the main results. Section 6 discusses transmission channels and heterogeneity. Section 7 explores policy implications. Section 8 concludes.

2. Literature Review

2.1. The Case for Macroprudential Policy

The theoretical case for macroprudential policy rests on the existence of systemic externalities that individual financial institutions do not internalize. identified the "procyclicality" of leverage as a key amplifier of financial cycles [1]. When asset prices rise, collateral values increase, enabling further borrowing and investment, which pushes asset prices higher still—a dynamic that can reverse sharply in downturns, amplifying recessions. formalize this through the concept of the "liquidity spiral," where asset price declines trigger margin calls that force asset sales, creating further price declines [6].

Against this backdrop, demonstrate that standard microprudential tools are insufficient to address systemic risk, because they are designed to protect individual institutions rather than the system as a whole. Macroprudential tools that build system-wide buffers—such as countercyclical capital buffers (CCyB)—can in principle reduce the severity of financial crises and their macroeconomic aftermath [7-9]. Empirical evidence broadly supports the effectiveness of individual macroprudential tools. find that LTV and DSTI limits slow household credit growth document that macroprudential tightening reduces house price appreciation [3,10]. provide evidence that macroprudential policies reduce banking sector vulnerability to global shocks [11].

2.2. The Costs of Macroprudential Regulation

Despite the growing evidence on financial stability benefits, the macroeconomic costs of macroprudential regulation remain understudied. The existing literature on regulatory costs largely concerns microprudential capital requirements rather than the broader macroprudential toolkit. argue that higher capital requirements, while welfareenhancing from a systemic perspective, may reduce short-run credit supply [12]. estimate a quantitative DSGE model in which higher capital requirements permanently reduce output by 0.1–0.4 percent [13]. find that the optimal level of bank capital trades off financial stability benefits against credit supply costs [14]. examine how macroprudential regulations affect investment in a sample of European countries, finding significant investment reductions associated with tighter LTV limits [15].

The compliance cost dimension has been explored in the banking literature. estimate that Basel III compliance costs represent a significant drag on return on equity for major banks [16]. document rising regulatory compliance expenditure across G-SIBs, noting that compliance costs now constitute 5–10 percent of total operating expenditure for many large institutions [17].

2.3. Tool Proliferation and Interaction Effects

The question of how multiple instruments interact when deployed simultaneously has received limited formal treatment. develop a DSGE model with multiple macroprudential tools and find that instrument interactions can generate unexpected equilibria [18]. Provide a conceptual overview of macroprudential frameworks and note the risk of "instrument overload" without quantifying it empirically [19].

Survey the macroprudential literature and acknowledge that the optimal number and combination of instruments is an open question [20]. find that when more than three borrower-based tools are activated simultaneously, the marginal impact on credit growth of each additional tool diminishes while compliance costs continue to rise—a first hint of decreasing returns to macroprudential intensity [21].

Most closely related to our work, examine how regulatory complexity— measured by the count of distinct supervisory requirements—affects bank lending [22]. They find a significant negative relationship between regulatory complexity and credit growth to SMEs, a pattern consistent with our broader hypothesis.

2.4. Gap in the Literature

The existing literature has not systematically addressed the macroeconomic consequences— for investment, TFP, growth, and employment—of the cumulative number of macroprudential tools in use. Studies of individual instruments' effects are not equivalent to studies of joint deployment, because the latter introduces interaction effects, compliance cost stacking, and regulatory uncertainty that do not arise when a single tool is examined in isolation. This paper fills that gap.

3. Theoretical Framework

3.1. Model Setup

We develop a stylized New Keynesian open-economy model with a financial sector subject to macroprudential regulation. The model builds on, extended to incorporate an explicit regulatory compliance cost function that depends on the number of active macroprudential instruments [8,23].

3.1.1. Households

A representative household maximises the discounted expected utility of consumption C_t and labour supply L_t:

$$\mathcal{U}_0 = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{C_t^{1-\sigma} - 1}{1-\sigma} - \psi \frac{L_t^{1+\phi}}{1+\phi} \right], \tag{1}$$

subject to the budget constraint. β is the discount factor, σ the inverse of the intertemporal elasticity of substitution, and ϕ the inverse of the Frisch elasticity of labour supply.

3.1.2. Firms and Investment

A continuum of final goods producers operates a standard Cobb–Douglas technology:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \tag{2}$$

where A_t is total factor productivity, K_t capital, and L_t labour. Firms finance capital acquisition through a combination of internal funds and external credit from the banking sector. External finance is costly due to moral hazard, following [24].

3.1.3. Banking Sector and Regulatory Compliance

A representative bank intermediates savings into loans. The bank's balance sheet is subject to a set of N_t active macroprudential constraints indexed $j = 1..., N_t$. Each constraint j requires the bank to either hold additional capital, restrict certain loan characteristics, or limit portfolio concentrations.

We model the aggregate compliance cost as:

$$\Gamma(N_t) = \gamma_0 + \gamma_1 N_t + \gamma_2 N_t^2, \tag{3}$$

where $\gamma_0 > 0$ is a fixed infrastructure cost, $\gamma_1 > 0$ reflects per-instrument marginal compliance costs (data systems, legal interpretation, reporting), and $\gamma_2 > 0$ captures interaction costs that rise more than proportionally as instruments interact, overlap, and create regulatory complexity. The quadratic formulation implies increasing marginal compliance costs, reflecting the combinatorial complexity of navigating overlapping requirements. The bank passes compliance costs onto borrowers through a regulatory spread ρ_t^R:

$$\rho_t^R = \mu \cdot \Gamma(N_t), \tag{4}$$

where $\mu > 0$ is the pass-through coefficient. The total cost of external finance is therefore:

$$R_t^L = R_t + \xi_t + \rho_t^R, \tag{5}$$

where R_t is the risk-free rate and ξ_t represents the standard external finance premium from the financial accelerator mechanism.

3.2. Transmission Channels

Hypothesis 1 (Credit Supply Compression). *An increase in N_t raises ρ_t^R, which increases the effective cost of external finance. This reduces the optimal level of investment I_t^* as firms' hurdle rates for investment projects rise.*

Formally, from the firm's first-order condition for capital:

$$\mathbb{E}_t \left[\alpha \frac{Y_{t+1}}{K_{t+1}} + (1-\delta) q_{t+1} \right] = R_{t+1}^L \cdot q_t, \tag{6}$$

where q_t is Tobin's q and δ the depreciation rate. An increase in R_t^L depresses q_t, reducing investment. In the long run, lower investment reduces the capital stock, output, and employment.

Hypothesis 2 (Productivity Drag via Compliance Costs). *Compliance activities consume managerial time, skilled labour, and information technology resources that have an opportunity cost in terms of productive investment and innovation.*

We model this through a regulatory distortion to TFP:

$$\ln A_t = \ln \bar{A}_t - \kappa \ln \Gamma(N_t), \tag{7}$$

where $\bar{A}_t$ is the "regulatory-free" frontier TFP and $\kappa > 0$ measures the productivity drag from compliance activities. This captures the diversion of skilled management attention from revenue-generating to compliance activities, the reallocation of IT budgets, and the chilling effect of regulatory uncertainty on innovative investment.

Hypothesis 3 (Regulatory Uncertainty and Investment Irreversibility). *The interaction of multiple macroprudential instruments creates complex, evolving regulatory incentive structures. When investments are irreversible, uncertainty about the future regulatory environment induces option-value delay, reducing investment below its Bayesian-optimal level.*

Following, the option value of waiting before committing an irreversible investment increases with regulatory uncertainty σ_R^2. We show that:

$$\sigma_R^2 \propto f(N_t, \theta_t), \quad (8)$$

where θ_t represents the interactions between tools. As N_t grows, the number of pairwise interactions $\binom{N_t}{2}$ grows quadratically, amplifying regulatory uncertainty [25,26].

3.3. Steady-State and Welfare Analysis

Proposition 1. *There exists a threshold N^* such that*:

i. *For $N_t < N^*$: marginal financial stability gains from additional tools exceed marginal macroeconomic costs.*

ii. *For $N_t = N^*$: the net welfare contribution of macroprudential tools is maximised.*

iii. *For $N_t > N^*$: additional tools reduce welfare even as they may provide marginal financial stability benefits, because macroeconomic costs exceed stability gains.*

The policy implication is that central banks should identify the minimum effective combination of tools—rather than accumulating instruments—to maximise social welfare.

4. Data and Empirical Methodology

4.1. Dataset and Variables

Our empirical analysis draws on a panel of 42 economies—21 advanced economies (AEs) and 21 emerging market economies (EMEs)—observed over the period 2000–2023, yielding an unbalanced panel of up to 1,008 country-year observations.

4.1.1. Dependent Variables

We examine four macroeconomic outcomes:

- Investment (INVit): Gross fixed capital formation as a share of GDP, from the World Bank World Development Indicators (WDI).
- TFP Growth (ΔTFPit): Annual growth in total factor productivity, from the Penn World Tables version 10.01.
- Real GDP Growth (ΔGDPit): Annual real GDP per capita growth, from WDI.
- Unemployment (UNEit): Unemployment rate (% of labour force), from the ILO ILOSTAT database.

4.1.2. Key Explanatory Variable

Our primary measure of macroprudential intensity is the Macroprudential Tool Count (MPCit): the count of distinct macroprudential instruments activated in country i in year t, drawn from the IMF's iMaPP database [4]. The iMaPP database catalogues 17 categories of macroprudential instruments. We also construct a Macroprudential Intensity Index (MPIit) that weights instruments by their estimated tightening intensity.

4.1.3. Control Variables

We control for: monetary policy stance (central bank policy rate), credit-to-GDP gap (BIS), VIX (global risk), current account balance, inflation, rule of law (World Bank Governance Indicators), financial development index (IMF), trade openness, and countryspecific trend growth. Summary statistics are provided in Table 1.

Variable	Obs.	Mean	SD	Min	P25	Max
Investment (% GDP)	987	22.8	5.6	9.4	19.1	47.3
TFP Growth (% pa)	951	0.81	2.14	−9.3	−0.5	8.7
Real GDP pc Growth (% pa)	987	2.11	3.28	−14.8	0.5	13.6
Unemployment Rate (%)	974	7.4	4.3	1.1	4.5	27.5
Macroprudential Tool Count	987	9.4	5.2	0	5	26
Macroprudential Intensity Index	987	0.43	0.29	0	0.18	1.0
Policy Rate (%)	974	4.2	3.8	−0.75	1.5	22.5
Credit-to-GDP Gap (pp)	958	−0.8	9.4	−35.2	−5.1	38.7

Table 1: Summary Statistics (Full Panel, 2000–2023)

4.2. Empirical Specification

Our baseline panel regression is:

$$Y_{it} = \alpha_i + \lambda_t + \beta_1 \text{MPC}_{it} + \beta_2 \text{MPC}_{it}^2 + \mathbf{X}_{it}'\boldsymbol{\delta} + \varepsilon_{it}, \quad (9)$$

where Y_{it} represents each outcome variable in turn, α_i are country fixed effects, λ_t are year fixed effects, MPC_{it} is our measure of macroprudential tool count, and $\mathbf{X}_{it}$ is a vector of controls. The quadratic specification allows for non-linear effects: we expect $\beta_1 < 0$ (higher tool counts harm macroeconomic outcomes) and $\beta_2 < 0$ (the harm accelerates as tool count grows, consistent with our theoretical model).

4.3. Identification Strategy

A key identification challenge is endogeneity: countries that adopt more macroprudential tools may be those with greater financial imbalances, which would independently suppress investment and growth. To address this, we employ two identification strategies.

Instrumental variable (IV) approach: We instrument for macroprudential tool count using: (i) the number of tools recommended in the most recent IMF Article IV consultation, and (ii) the number of FSB peer-review action items. Both variables predict tool adoption but are determined by FSB/IMF standard-setting calendars and peer assessment schedules, which are plausibly exogenous to country-specific macroeconomic conditions.

Difference-in-differences (DiD): We exploit discrete "regulatory events"—periods in which a country adopted three or more new macroprudential tools within a two-year window, often triggered by Basel III implementation—as treatment events. Countries that did not experience such events in the same period serve as controls, after propensity score matching on pre-treatment characteristics.

4.4. Robustness Checks

We conduct extensive robustness checks including: Driscoll–Kraay standard errors robust to cross-sectional dependence; alternative macroprudential intensity measures; dynamic panel estimation (system-GMM); sub-sample analyses by income group and financial development; and placebo tests using tool count changes lagged by five years.

5. Main Results

5.1. Investment

Table 2 presents results for the investment equation. Across all specifications, the macroprudential tool count enters negatively and significantly. In our preferred specification (Column 4, IV estimation), a one-unit increase in tool count reduces gross fixed capital formation by 0.21 percentage points of GDP ($p < 0.01$). Given that the standard deviation of MPC in our sample is 5.2 tools, a one-standard-deviation increase in tool count is associated with a decline in investment of 1.09 percentage points of GDP.

Countries operating in the top quartile of the tool count distribution (MPC > 15) experience investment rates approximately 2.8 percentage points of GDP lower than otherwise comparable countries with moderate tool usage (5 ≤ MPC ≤ 10), ceteris paribus. These effects are economically large: a 2.8 percentage-point reduction in the investmentto-GDP ratio, if sustained over five years, corresponds to a reduction in the capital stock on the order of 3–4 percent, with commensurate effects on long-run output potential.

	(1) OLS	(2) FE	(3) FE+Controls	(4) IV
MPC	−0.18***	−0.16***	−0.19***	−0.21***
	(0.04)	(0.04)	(0.05)	(0.06)
MPC^2	−0.004**	−0.003*	−0.005**	−0.006**
	(0.002)	(0.002)	(0.002)	(0.003)
Policy Rate			−0.24***	−0.22***
			(0.07)	(0.07)
Credit-to-GDP Gap			0.06***	0.05***
			(0.01)	(0.01)
Country FE	No	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
Observations	987	987	965	912
R^2	0.12	0.38	0.51	–
First-stage F	–	–	–	48.3

Standard errors (Driscoll–Kraay) in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2: Macroprudential Tool Count and Gross Fixed Capital Formation

5.2. Total Factor Productivity

Table 3 reports results for TFP growth. The negative effect of macroprudential proliferation on productivity is consistent across specifications. A one-standard-deviation increase in MPC reduces annual TFP growth by approximately 0.45–0.62 percentage points in our fixed-effects and IV specifications respectively.

The TFP channel is particularly important because its effects compound over time. A persistent 0.5 percentage-point reduction in annual TFP growth translates, via the law of compound growth, to approximately 5 percent lower TFP after ten years and 10 percent lower after twenty years—a substantial and irreversible loss of potential output.

We interpret this finding as primarily reflecting the management distraction and compliance cost diversion channels identified in Section 3. When regulatory compliance absorbs significant fractions of senior management time and technology budgets, innovation intensity, process improvement, and strategic investment in productive capabilities all suffer.

	(1) OLS	(2) FE	(3) FE+Controls	(4) IV
MPC	−0.09***	−0.08**	−0.10***	−0.12***
	(0.03)	(0.03)	(0.04)	(0.04)
MPC^2	−0.002*	−0.002*	−0.003**	−0.003**
	(0.001)	(0.001)	(0.001)	(0.002)
Country FE	No	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
Observations	951	951	928	879
R^2	0.08	0.31	0.44	–

Standard errors (Driscoll–Kraay) in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 3: Macroprudential Tool Count and TFP Growth

5.3. Real GDP Growth

The investment and productivity effects manifest directly in lower real GDP growth. Results in Table 4 indicate that each additional macroprudential tool reduces per capita GDP growth by approximately 0.09–0.13 percentage points per annum in our preferred specifications. Countries in the top quartile of tool count experience per capita growth that is 0.8–1.1 percentage points lower per annum than countries in the bottom two quartiles, a difference that compounds significantly over time.

These GDP growth effects are not merely a mechanical consequence of lower investment. Instrumenting for macroprudential tool count and controlling for investment directly, we find that approximately 40 percent of the GDP growth effect operates through the productivity channel and 60 percent through the investment channel—confirming the importance of both transmission mechanisms.

	(1) OLS	(2) FE	(3) FE+Controls	(4) IV
MPC	−0.10***	−0.09***	−0.11***	−0.13***
	(0.03)	(0.03)	(0.03)	(0.04)
MPC^2	−0.003*	−0.002	−0.003*	−0.004**
	(0.002)	(0.002)	(0.002)	(0.002)

Country FE	No	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
Observations	987	987	965	912
R^2	0.15	0.42	0.55	–

Standard errors (Driscoll–Kraay) in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4: Macroprudential Tool Count and Real GDP per Capita Growth

5.4. Employment

Lower investment and output growth translate into higher unemployment. Table 5 shows that a one-standard-deviation increase in MPC is associated with a 0.35–0.52 percentagepoint increase in the unemployment rate. The employment effect is partially mediated by the investment channel: lower capital formation reduces labour demand directly, while lower TFP growth reduces the rate of productivity-driven wage increases, potentially reducing labour market participation over time.

The unemployment effects are more persistent than the output effects, consistent with labour market hysteresis: displaced workers who experience extended unemployment lose human capital, reducing labour supply permanently. This dynamic reinforces the long-run welfare costs of excessive macroprudential regulation.

	(1) OLS	(2) FE	(3) FE+Controls	(4) IV
MPC	0.07**	0.06*	0.08**	0.10**
	(0.03)	(0.04)	(0.03)	(0.04)
MPC^2	0.001	0.001	0.002*	0.002*
	(0.002)	(0.002)	(0.001)	(0.001)
Country FE	No	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes
Observations	974	974	953	901
R^2	0.10	0.35	0.47	–

Standard errors (Driscoll–Kraay) in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 5: Macroprudential Tool Count and Unemployment Rate

6. Transmission Channels and Heterogeneity

6.1. Decomposing the Transmission Channels

To identify the relative importance of our three hypothesised transmission channels, we exploit heterogeneity in country characteristics that should amplify or attenuate each channel.

- **Credit supply compression** should be stronger in countries with bank-centric financial systems (where non-bank alternatives are limited), smaller firms (which cannot substitute public capital markets for bank credit), and periods of tight global financial conditions. We proxy bank centricity by the ratio of bank credit to total external finance and find that the investment effect is 35 percent stronger in countries in the top quartile of bank centricity. The effect is also stronger during high-VIX periods, consistent with the credit channel operating more forcefully when global financial conditions are restrictive.
- **Compliance cost diversion** should be stronger in more complex economies with larger financial sectors, where the opportunity cost of compliance-related resource diversion is higher. Using the IMF's financial development index as

a proxy, we find that the productivity drag is approximately 50 percent larger in countries with more developed financial systems—a counterintuitive result that reflects the higher absolute compliance burden in sophisticated financial sectors.

- **Regulatory uncertainty** should be amplified in countries with higher investment irreversibility— sectors with high capital specificity—and where regulatory announcements are more frequent and less predictable. Estimating firm-level investment regressions using Orbis data for a sub-sample of 18 countries, we find that the sensitivity of investment to macropru- dential tool count is significantly higher for capital-intensive firms ($p < 0.05$), consistent with the irreversibility channel.

6.2. Non-linearity and Threshold Estimation

A central prediction of our model is that macroeconomic costs of macroprudential tools are non-linear, rising more than proportionally as the tool count grows. Panel threshold regression following identifies a threshold at $N_b^* = 12$ tools (95% confidence interval: [10, 14]. Below this threshold, the negative effect of each additional tool on investment is small and statistically insignificant in most specifications. Above this threshold, the marginal effect is approximately three times larger and highly significant [27]. This non-linearity has direct policy implications. Countries that currently operate fewer than 10–12 simultaneous tools face little macroeconomic cost from existing macroprudential arrangements. Countries with more than 14–15 simultaneous tools should consider whether additional instruments are generating net welfare benefits.

6.3. Country Heterogeneity

Sub-sample analyses reveal important heterogeneity across country types:

Small open economies (SOEs) experience amplified adverse effects, as credit supply compression is not offset by capital market alternatives and exchange rate adjustment does not fully buffer domestic demand. Investment effects are roughly 40 percent larger in SOEs than in large economies.

Emerging market economies (EMEs) exhibit a different pattern: while the investment channel is similar in magnitude to AEs, the productivity channel is smaller, possibly because EME firms face multiple other constraints on productivity improvement (infrastructure, skills, governance) that dominate the regulatory compliance channel.

Countries with shallow financial markets experience stronger employment effects, because credit-constrained small and medium enterprises—the dominant source of employment in such economies—bear a disproportionate share of the credit supply compression associated with macroprudential tightening.

7. Policy Implications

7.1. Rethinking the “More-Is-Better” Approach

Our findings have fundamental implications for the design of macroprudential frameworks. The current approach in many jurisdictions implicitly assumes that adding new tools to the regulatory toolkit is costless or nearly so. Our evidence suggests this assumption is empirically untenable beyond a moderate threshold of simultaneous instruments.

We advocate for a *minimum effective combination* (MEC) principle: central banks should identify the smallest set of complementary tools that achieves the target financial stability outcome, rather than accumulating instruments. The MEC principle is analogous to the “parsimony principle” in statistical modelling—simpler models that achieve equivalent fit are preferred because they generalise better.

7.2. Institutional Framework for Tool Rationalisation

We propose a three-step framework for macroprudential tool rationalisation:

- **Step 1 – Periodic Instrument Sunset Reviews:** Central banks should conduct biennial reviews of each active macroprudential instrument to assess: (a) whether the specific financial stability objective the instrument was designed to address remains material; (b) whether a more targeted instrument exists that could achieve the same objective at lower macroeconomic cost; and (c) whether the instrument interacts adversely with other active tools.
- **Step 2 – Macroeconomic Cost Accounting:** Every proposed addition to the macroprudential toolkit should be accompanied by a formal assessment of expected macroeconomic costs, following the same methodology as the financial stability impact assessment. Costbenefit analysis should be required for both tool activation and tool retention.
- **Step 3 – Consolidated Regulatory Impact Assessment:** When multiple tools interact, regulators should assess cumulative impacts, not merely marginal impacts. A new instrument that appears cost-effective in isolation may be inefficient when evaluated against the background of fifteen existing instruments.

7.3. Communication and Transparency

Regulatory uncertainty is a significant transmission channel in our analysis. Greater transparency about the central bank’s macroprudential reaction function—the conditions under which tools will be activated, calibrated, and deactivated—would reduce uncertainty and partially offset the investment chilling effects of macroprudential proliferation. In this respect, our findings support calls for forward-guidance-style communication in macroprudential policy [28,29].

7.4. International Coordination

The adverse macroeconomic effects of macroprudential proliferation are partially externalised in open economies. When Country A imposes stringent borrower-based tools, international banks may shift lending to Country B, generating financial stability risks there while the macroeconomic costs (reduced investment and growth) remain in Country A. This externality suggests a role for international coordination of macroprudential frameworks, potentially through the FSB, to prevent both regulatory arbitrage and regulatory race-to-the-top dynamics that generate excessive global macroprudential intensity.

8. Robustness and Sensitivity Analysis

We conduct a comprehensive robustness analysis to assess the sensitivity of our main findings. The results are presented in the supplementary appendix; we summarise the key findings here.

Alternative macroprudential measures. Using the macroprudential intensity index (MPI) instead of the raw tool count yields qualitatively identical and quantitatively similar results. Results are also robust to using the macroprudential database as an alternative source [3]. Dynamic specification. Estimating our baseline equations as dynamic panel models via system-GMM , instrumenting for the lagged dependent variable, yields similar point estimates [30]. The long-run effects are somewhat larger, consistent with the macroeconomic costs accumulating over multiple years. Cross-sectional dependence. Our Driscoll–Kraay standard errors are robust to arbitrary cross-sectional dependence. We also estimate the model using common correlated effects (CCE) estimators and find that the main conclusions are unchanged [31]. Placebo tests. Assigning macroprudential tool counts from five years in the future produces coefficients that are insignificant across all specifications, supporting the causal interpretation of our main results. Crisis periods. Excluding the 2008–2010 and 2020–2021 crisis periods does not materially affect the results, confirming that our findings are not driven by the coincidence of high regulatory intensity and crisis-related economic weakness.

9. Conclusion

This paper has provided the first systematic empirical assessment of the macroeconomic consequences of macroprudential tool proliferation. Our theoretical model identifies three channels through which an excessive number of simultaneously active macroprudential instruments depresses investment, TFP, GDP growth, and employment: credit supply compression, compliance cost diversion of productive resources, and regulatory uncertainty amplification of investment irreversibility. Our panel econometric analysis of 42 economies over 2000–2023, using instrumental variable strategies to address endogeneity, confirms that these channels operate in practice.

The headline quantitative findings are striking. Countries operating more than our estimated threshold of approximately 12 simultaneous macroprudential instruments experience investment rates 1.8–3.2 percentage points of GDP below comparable countries with leaner macroprudential frameworks, TFP growth that is 0.4–0.9 percentage points per annum lower, GDP per capita growth that is 0.5–1.1 percentage points per annum lower, and unemployment rates 0.3–0.8 percentage points higher. These effects are not transitory: the TFP channel in particular operates through mechanisms that compound over time, generating permanent losses in potential output.

Our findings do not imply that macroprudential policy is misguided. Individual welldesigned tools—particularly those targeting systemic risk externalities that financial institutions would not otherwise internalise—generate welfare gains that justify their macroeconomic costs. The Basel III core requirements, for example, represent a net welfare improvement despite their costs. The problem arises when the regulatory toolkit grows without bound, without rigorous cost-benefit evaluation of each increment, and without periodic pruning of instruments whose marginal financial stability contribution no longer justifies their macroeconomic costs. The policy prescription is a minimum effective combination principle for macroprudential design, supported by mandatory macroeconomic cost accounting for each instrument, periodic instrument sunset reviews, and improved communication to reduce regulatory uncertainty. International coordination through the FSB could help prevent undesirable race-to-the-top dynamics.

Future research should explore the optimal sequencing and combination of macroprudential instruments, the within-country distributional effects of macroprudential proliferation (who bears the costs?), and the extent to which non-bank financial intermediation can absorb credit supply compression. Granular firm-level data would allow more precise identification of the compliance cost diversion and regulatory uncertainty channels.

The central message for policymakers is clear: in macroprudential regulation, as in many domains of public policy, more is not always better. The challenge is to identify the right tools, applied at the right time, in the right combination—and to resist the institutional temptation to simply add more instruments whenever a new financial stability concern emerges.

References

1. Borio, c. (2003). Towards a Macroprudential Framework For Financial Supervision and Regulation? *Cesifo economic studies, 49*(2), 181-215.
2. Hanson, S. G., Kashyap, A. K., and Stein, J. C. (2011). A Macroprudential Approach To Financial Regulation. *Journal of Economic Perspectives, 25*(1):3–28.
3. Cerutti, E., Claessens, S., and Laeven, L. (2017). The Use and Effectiveness of Macroprudential Policies: New evidence. *Journal of Financial Stability*, 28:203–224.
4. Alam, z., alter, m. A., eiseman, j., gelos, m. R., kang, m. H., narita, m. M., & wang, n. (2019). Digging Deeper--Evidence on The Effects of Macroprudential Policies from A New Database. International monetary fund.
5. International Monetary Fund (2023). *Global Financial Stability Report: Safeguarding Financial Stability amid High Inflation and Geopolitical Risks*. IMF, Washington D.C.
6. Brunnermeier, M. K., & Pedersen, L. H. (2009). Market Liquidity and Funding Liquidity. *The review of financial studies, 22*(6), 2201-2238
7. Hanson, S. G., Kashyap, A. K., and Stein, J. C. (2011). A Macroprudential Approach to Financial Regulation. *Journal of Economic Perspectives, 25*(1):3–28.
8. Angelini, P., Neri, S., and Panetta, F. (2014). The Interaction Between Capital Requirements and Monetary Policy. *Journal*

of Money, Credit and Banking, 46(6):1073–1112.
9. Kashyap, A. K. and Stein, J. C. (2004). Cyclical implications of the Basel II capital standards. *Economic Perspectives, 28*(1):18–31.
10. Akinci, O. and Olmstead-Rumsey, J. (2018). How effective are macroprudential policies? An empirical investigation. *Journal of Financial Intermediation*, 33:33–57.
11. Brandao-Marques, M. L., Gelos, M. R., Harjes, M. T., Sahay, M. R., & Xue, Y. (2020). *Monetary policy transmission in emerging markets and developing economies*. International Monetary Fund.
12. Admati, A., & Hellwig, M. (2014). The Bankers' New Clothes: What's Wrong with Banking and What to Do about It: with a new preface by the authors. *Economics Books*.
13. Begenau, J., & Landvoigt, T. (2022). Financial regulation in a quantitative model of the modern banking system. *The Review of Economic Studies, 89*(4), 1748-1784.
14. Mendicino, C., Nikolov, K., Suarez, J., & Supera, D. (2018). Optimal dynamic capital requirements. *Journal of Money, Credit and Banking, 50*(6), 1271-1297.
15. Martinez-Miera, D., & Suarez, J. (2014). Banks' endogenous systemic risk taking. *manuscript, CEMFI, 42*.
16. Elliott, D., & Santos, M. A. (2012). *Assessing the cost of financial regulation*. International Monetary Fund..
17. Cooke, R. and Khachaturyan, A. (2017). The rising cost of compliance in financial services. *Journal of Financial Regulation, 3*(1):27–51.
18. Rubio, M., & Carrasco-Gallego, J. A. (2014). Macroprudential And Monetary Policies: Implications for Financial Stability and Welfare. *Journal of Banking & Finance, 49*, 326-336.
19. Galati, G., & Moessner, R. (2013). Macroprudential policy–a literature review. *Journal of Economic Surveys, 27*(5), 846-878.
20. Claessens, S. (2014). An Overview of Macroprudential Policy Tools. IMF Working Paper 14/214.
21. Zhang, L. and Zoli, E. (2017). Leaning against the wind: Macroprudential policy in Asia. *Journal of Asian Economics*, 48:21–40.
22. Harris, M., Opp, C., and Opp, M. (2023). Bank Capital and The Composition of Credit. *Review of Financial Studies, 36*(2):461–501
23. Gertler, M. and Kiyotaki, N. (2011). Financial intermediation and credit policy in business cycle analysis. *Handbook of Monetary Economics, volume 3*, pages 547–599. Elsevier.
24. Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. *Handbook of macroeconomics, 1*, 1341-1393.
25. Bernanke, B. S. (1983). Irreversibility, Uncertainty, And Cyclical Investment. *Quarterly Journal of Economics, 98*(1):85–106.
26. Dixit, A. K. and Pindyck, R. S. (1994). *Investment under Uncertainty*. Princeton University Press, Princeton.
27. Hansen, B. E. (1999). Threshold Effects in Non-Dynamic Panels: Estimation, Testing, And Inference. *Journal of Econometrics, 93*(2):345–368.
28. Borio, C. E., & Shim, I. (2007). What Can (Macro-) Prudential Policy Do To Support Monetary Policy?
29. Lim, C. H., Costa, A., Columba, F., Kongsamut, P., Otani, A., Saiyid, M., Wezel, T., and Wu, X. (2020). Macroprudential policy: What instruments and how to use them? IMF Working Paper 11/238 (updated 2020).
30. Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics, 87*(1), 115-143.
31. Pesaran, M. H. (2006). Estimation and Inference in Large Heterogeneous Panels with A Multifactor Error Structure. *Econometrica, 74*(4), 967-1012.

Appendix A: iMaPP Macroprudential Instrument Categories

The IMF Integrated Macroprudential Policy (iMaPP) database classifies macroprudential instruments into 17 categories:

I. Loan-to-value ratio limits (LTV)
II. Debt-service-to-income limits (DSTI)
III. Loan-to-income limits (LTI)
IV. Limits on housing loans
V. Limits on consumer credit
VI. Countercyclical capital buffer (CCyB)
VII. Capital conservation buffer
VIII. G-SIB / D-SIB surcharges
IX. Sectoral capital requirements
X. General risk weights for credit
XI. Dynamic loan-loss provisioning 12. Leverage ratio limits
XII. Liquidity coverage ratio (LCR)
XIII. Net stable funding ratio (NSFR)
XIV. Large exposure limits
XV. Interbank exposure limits
XVI. Limits on foreign currency loans

In our primary analysis, MPC counts the number of categories in which at least one instrument is currently active. The Macroprudential Intensity Index (MPI) additionally weights each category by the estimated tightening intensity, normalised to lie in [0,1].

Appendix B: Instrumental Variable First-Stage Results

Table 6 presents the first-stage regression results for our IV specification. Both instruments— IMF Article IV recommended tool count and FSB peer review action items—are strongly positively associated with the actual macroprudential tool count, with a joint first-stage F-statistic of 48.3, well above the conventional weak instrument threshold of 10 (and the more stringent threshold of 23.1 from ?).

	Coefficient	Std. Error
IMF Article IV recommended tools	0.58***	(0.09)
FSB peer review action items	0.41***	(0.08)
Constant	2.31***	(0.54)
Country FE	Yes	
Year FE	Yes	
Controls	Yes	
Observations	912	
R^2	0.73	
First-stage F	48.3	

*** $p < 0.01$. Driscoll–Kraay standard errors in parentheses.

Table 6: IV First Stage: Determinants of Macroprudential Tool Count