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Trade-offs between Inflation Targeting and Financial Stability Objectives: Drivers of Gains from Coordinating Monetary and Macroprudential Policies*

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Abstract: This paper studies the trade-offs that can arise between inflation targeting and financial stability objectives. We use a simple framework to conduct macroeconomic policy analysis under three strategies: (1) a benchmark case where monetary policy pursues traditional price stability objectives; (2) monetary policy leaning against the wind; and (3) a case of policy coordination between monetary and macroprudential instruments. We find that, under certain circumstances, having financial stability objectives as an additional macroeconomic policy increases the volatility of inflation. We identify cases in which the tradeoffs in terms of macroeconomic volatility between policy objectives create scope for improvement when monetary and macroprudential policies are coordinated. These improvements are generally larger when financial shocks are the main driver of macroeconomic fluctuations.
Keywords: Price and Financial Stability, Leaning Against the Wind, Monetary and Macroprudential Policy Coordination
JEL Classification: E44, E52, E61, G28

Resumen: Este trabajo estudia la disyuntiva que puede surgir entre los objetivos del esquema de metas de inflación y de estabilidad financiera. Utilizamos un marco conceptual sencillo para conducir análisis de política macroeconómica bajo tres estrategias: (1) un caso base en el que la política monetaria persigue objetivos tradicionales de estabilidad de precios; (2) una política monetaria que se "inclina contra el viento"; y (3) un caso de coordinación entre instrumentos de política monetaria y macroprudencial. Se encuentra que, bajo ciertas circunstancias, tener objetivos de estabilidad financiera como una política macroeconómica adicional puede incrementar la volatilidad de la inflación. Asimismo, se identifican casos en los cuales los costos en términos de volatilidad macroeconómica entre los objetivos de política crean espacio para mejoras cuando las políticas monetaria y macroprudencial están coordinadas. Estas mejoras son generalmente mayores cuando los choques financieros son la principal fuente de fluctuaciones macroeconómicas.
Palabras Clave: Estabilidad de Precios y Financiera, Inclinarse contra el Viento, Coordinación entre Política Monetaria y Macroprudencial

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1 Introduction

The 2008–09 financial crisis shook the global economic landscape in a significant way. The need to take immediate actions to solve time-pressing problems left policymakers –especially central bankers in both advanced and emerging economies– with the difficult task of restoring or maintaining macroeconomic and financial stability without much guidance on how to do so. Indeed, the existing macroeconomic policy toolkit was generally inadequate to address the challenges that arose, while the effectiveness and externalities of unconventional tools remained largely unknown. The aftermath of the crisis inevitably led to a rethinking of the conduct of macroeconomic policy, in general, and monetary policy, in particular.[1] As pointed out by Blanchard and Summers (2017), one of the main lessons from the last decade is that current macroeconomic thinking cannot abstract from deepening its understanding of the financial system. Indeed, one of the main challenges for central bankers in the years ahead will be to advance their understanding of how their respective financial systems work in order to modify and adapt their macroeconomic policy frameworks.

Two issues that received the most attention in reexamining the conduct of macroeconomic policy are the recognition that (1) price stability does not necessarily imply financial stability; and (2) a broader perspective in prudential supervision and regulation is needed to prevent the accumulation of financial imbalances. With regard to the latter issue, a new field of macroeconomic policy, namely macroprudential policy, emerged in recognition of the fact that regulatory policy focused on individual institutions was ill-equipped to prevent the buildup of macro-financial and systemic risks. Nevertheless, given the inherent links between the real and financial sectors of the economy and the feedback loops between monetary and macroprudential policies, some basic questions arose. Should monetary policy be responsible for attaining financial stability objectives in addition to price stability objectives? In other words, should monetary policy lean against the wind? Alternatively, should macroprudential policy be tasked with pursuing financial stability objectives? And if so, what should be its relation with monetary policy?

The question on whether monetary policy should lean against the wind is not new. The possible dangers associated with asset-price bubbles had already been pointed out, even before the crisis, by a series of economists among which Cecchetti and others (2000), Borio and Lowe (2002) and Borio, English, and Filardo (2003) stand out. They argued that central banks should at times lean against the financial wind by raising interest rates to dampen the

[1] See Blanchard, Dell'Ariccia, and Mauro (2010, 2013), Blanchard and Summers (2017), Borio (2011), and Mishkin (2011).

accumulation of imbalances in the upturn of the financial cycle. In their view, raising interest rates to dampen financial imbalances would produce better outcomes either because it would prevent their build-up or because it would result in a less severe bursting of it, with far less damage to the economy. In contrast, an opposing dominant view argues that given monetary policy has limited effects in reducing the occurrence of financial crises, avoiding the build-up of imbalances or at least dampening them requires significantly large fluctuations in the interest rate. Thus, according to this view, monetary policy should not try to lean against financial imbalances or asset-price bubbles, but rather just clean up after they burst, since monetary policy is, at best, ineffective in dealing with them (Mishkin 2011). More recently, arguments in favor of monetary policy leaning against the wind emphasize its broader effects against the "perhaps too narrow" scope of macroprudential policy, whose tools are more difficult to adjust and prone to regulatory arbitrage. These arguments hold that, unlike macroprudential regulatory instruments, monetary policy affects the costs and returns of every borrower and lender in the economy, making it harder for these agents to overpass its effects through the appearance of non-banking activities or intermediaries. This contrasts with opponent views claiming that financial stability could be better delivered by an appropriate set of state-dependent macroprudential policies that would allow for monetary policy to focus on its traditional objectives (Gourio and Kashyap 2017).

In this paper we study the trade-offs that arise between the pursuit of price stability objectives through a flexible inflation-targeting regime and financial stability objectives. To do so, we estimate a standard, reduced-form, small open economy model (commonly used to conduct monetary policy analysis in emerging markets), which we extend to consider a stylized financial sector. Within this framework, we study the performance of the model economy under different policy strategies. Specifically, three cases are examined: (1) a benchmark "prior to crisis" case in which monetary policy actions focus exclusively on price stability objectives; (2) a leaning-against-the-wind case in which monetary policy sets the short-term nominal interest rate in order to attain certain predetermined financial stability objectives, in addition to price stability, in the context of a flexible inflation-targeting regime;[2] and (3) a coordination case in which monetary and macroprudential policies jointly set their instruments in order to attain both objectives. Following the literature, we relate traditional inflation-targeting objectives to a particular specification of monetary policy's loss function defined in terms of macroeconomic variables. Likewise, we associate financial

[2] Woodford (2012) argues that it is possible to incorporate financial stability considerations into a model in a way that it represents a natural extension of "flexible inflation-targeting." We associate the leaning-against-the wind case examined in this chapter with his definition of flexible inflation-targeting.

stability objectives with a loss function that considers the stabilization of financial variables. To assess each case's relative effectiveness to attain its policy objectives, we compare the volatility that each case entails for a set of relevant macroeconomic and financial variables.

The purpose of this work is twofold: first, to provide a simplified framework within which to account for the trade-offs that arise when an inflation-targeting central bank also pursues financial stability objectives; and, second, to identify cases where these trade-offs allow for improvements in macroeconomic performance under coordination of monetary and macroprudential policies. We do so by comparing the relative effectiveness of the leaning-against-the-wind case vis-à-vis the benchmark case and of the coordination case vs. the leaning-against-the-wind case, respectively. In addition, we compare the effectiveness of the coordination case relative to the benchmark case and interpret these results as the tradeoffs that a central bank focused on attaining price stability faces in the light of a new macroeconomic objective, i.e. financial stability, pursued by means of a new –macroprudential– instrument.

The results suggest that including financial stability considerations as an additional objective of monetary policy indeed reduces the volatility of financial variables. However, this improvement comes at the expense of increasing the volatility of macroeconomic variables. This cost is present regardless of the type of shocks that affect the economy, but tends to increase when fluctuations are driven by financial shocks. These results provide evidence that support the views of those who do not favor leaning against the wind because of the costly tradeoffs involved and advocate for the use of macroprudential policy to address financial stability objectives.[3] Moreover, in our estimated model, coordination of monetary and macroprudential policies yields little improvement in terms of reducing inflation volatility. Accordingly, when examining the implications for price stability of adding financial stability objectives through a macroprudential instrument as a new domain of macroeconomic policy, our results suggest that inflation volatility can be somewhat increased as a result of the interaction between monetary and macroprudential policy.

We then perform a sensitivity analysis with the aim of further understanding these results. In particular, we explore the importance of the ability of monetary and macroprudential instruments to affect financial variables through changes in credit spreads. When identifying

[3] See Williams (2015). For Borio (2014), attaining monetary and financial stability simultaneously calls for monetary policy that leans more deliberately against booms and eases less aggressively during busts, within a context where all macroeconomic policies play a mutually supportive role. To this respect, Svensson (2014) argues that monetary an macroprudential instruments/policies vary much from country to country and thus, each economy must be scrutinized before judging if there is a case for leaning against the wind or not.

the cases where there is an improvement in macroeconomic performance owing to a coordination of monetary and macroprudential policies, our findings emphasize the importance of assessing the relative effectiveness and interactions of the different instruments/policies that policymakers have at their disposal. We find that having financial stability objectives as an additional macroeconomic policy increases the volatility of inflation in two situations: either when the macroprudential instrument is less effective to attain financial stability objectives or when the monetary instrument possesses a greater ability to affect financial variables so that it is optimal that it reacts to financial shocks. Moreover, our framework features room for gains from coordination relative to monetary policy leaning against the wind, even when macroeconomic shocks are the only type of shocks affecting the economy, either when monetary policy is not an effective tool to address vulnerabilities in the financial sector or when it conflicts with macroprudential policy (i.e. when one instrument responds in a countercyclical way and the other in a procyclical way).

This paper relates to a growing literature that explores the interaction between monetary and macroprudential policy and that contributes to the debate on whether monetary policy should be in charge of financial stabilization in the aftermath of the financial crisis (Angelini, Neri, and Panetta 2014; Angeloni and Faia 2013; Beau, Clerc, and Mojon 2014; Carrillo and others 2017; De Paoli and Paustian 2013; Kannan, Rabanal, and Scott 2012; and Lambertini, Mendicino, and Punzi 2013). Our exercise follows closely the approach in Angelini, Neri, and Panetta (2014), who study the benefit of the interaction between capital requirements and monetary policy in a dynamic general equilibrium model featuring a banking sector. They find that an overall improvement in economic stability is attained when monetary and macroprudential policies are coordinated in the presence of financial shocks. Unlike previous studies, which consider a Taylor-type rule to account for monetary policy actions and distinguish between cooperative and noncooperative interactions between monetary and macroprudential policies, we consider optimal policy rules and assume that when monetary and macroprudential policies coexist they do so under a coordination scheme. Although the results of both approaches are similar, our model is much simpler. This allows us to focus on the broad intuition rather than on specific channels driving our results. Hence, our main contribution is to provide a common ground for thinking about the interaction between optimal monetary and macroprudential policies, even in cases when country-specific circumstances call for specific ways to model an economy. It is important to stress that, as in many other proposed frameworks –including the ones of the papers mentioned above–, our model does not capture potential nonlinear effects capable of producing financial crises, and thus only features economic fluctuations under “normal times”. This feature implies that our empirical estimations may be underestimating the relative weight of financial stability considerations in the objective function of a central bank. Nonetheless, beyond this caveat, we believe that our work contributes to understanding the tension between instruments and goals faced by monetary authorities, particularly in the era initiated by the global financial crisis.

The remainder of the paper is organized as follows. Section 2 outlines the different policy strategies considered to examine the trade-offs between inflation targeting and financial stability objectives. Section 3 describes the model used in the analysis. Section 4 presents the main results. Section 5 provides a sensitivity analysis of the results. Section 6 provides some final remarks.

2 Policy strategies

There are two possible policy objectives: one that is associated with standard inflation targeting, and another that adds a financial stability goal. These goals can be attained by using at most two policy instruments. The short-term nominal interest rate, i_t, the instrument of monetary policy (henceforth the policy rate); and the coverage ratio, crr_t, defined as the ratio of loan-loss reserves to nonperforming loans that banks are required to bear, which serves as the instrument for macroprudential policy.[4] We study the following policy strategies throughout the analysis:

I. A *benchmark* case in which monetary policy is guided by a flexible inflation targeting regime and as such, it sets the policy rate aiming at stabilizing inflation around its target, the output gap, and changes in the policy rate. Hence, the monetary policy's optimization problem is to set i_t to minimize the following loss function:

$$L^{benchmark} = \sigma_\pi(\pi_t - \pi^*)^2 + \sigma_x x_t^2 + \sigma_{\Delta i}(i_t - i_{t-1})^2, \tag{2.1}$$

Where σ_π, σ_x and $\sigma_{\Delta i}$ represent the monetary authority's relative preferences for stabilizing deviations of inflation from its target, $(\pi_t - \pi^*)$; the output gap, x_t; and

[4] More details about the coverage ratio and the rationale for its role as a macroprudential policy instrument are provided in the next section of this chapter.

changes in the reference rate, $(i_t - i_{t-1})$, respectively, subject to the dynamics of the economy.[5]

II. A *leaning against the wind* case considers that monetary policy aims to stabilize both the traditional objectives of inflation targeting and financial stability objectives by setting the optimal level of its policy rate. The monetary policy's optimization problem in this case is to set i_t to minimize the following loss function:

$$L^{LAW} = L^{benchmark} + \sigma_{spread}(spread_t - spread^*)^2 + \sigma_{crgap} crgap_t^2, \qquad (2.2)$$

where σ_{spread} and σ_{crgap} represent the monetary authority's relative preferences for stabilizing the credit spread, denoted by *spread*, around its long-term average and the credit-to-GDP gap, *crgap*, respectively. These variables will be further explained when we describe the model.[6]

III. The *monetary and macroprudential policies coordination* case considers that monetary and macroprudential policies aim to attain inflation targeting and financial stability objectives by setting their respective policy instruments—namely, the policy rate and the coverage ratio. These two instruments are jointly and optimally set in order to minimize the following loss function:

[5] Woodford (2003) shows that a loss function determined by inflation deviations from its target and the output gap can be justified as a quadratic approximation to the goal of maximizing the representative agent's utility in a simple version of a New Keynesian model. As estimated central bank reaction functions also incorporate some degree of partial-adjustment dynamics of the interest rate itself, the last term in equation (2.1) ensures that movements in the policy rate are not excessively volatile. σ_π and σ_x are functions of deep parameters of the economy and reflect the degree by which distortions affect economic welfare. A framework characterized by the use of a semi-structural model, like ours, is not able to trace down the effects of deep parameters on economic welfare. Instead we assume that these weights characterize policymakers' preferences, which ultimately should be associated with the deep parameters of the economy. Angelini, Neri, and Panetta (2014), who analyze the interaction between monetary and macroprudential policies, use loss functions like the ones described in this work.

[6] Cúrdia and Woodford (2009) show that a loss function with the usual inflation and output gap stabilization goals and other terms that represent the welfare consequences implied by financial frictions and/or the loss in resources incurred by the financial intermediary sector, can be justified as a quadratic approximation to the goal of maximizing the average expected utility of households. In our case, given our reduced-form model, we cannot identify specific misallocations of resources. We hence decide to introduce credit spreads and the credit-to-GDP gap as measures of those misallocations. The value for $spread^*$ is given by the average observed in the data.

$$L^{coord} = L^{benchmark} + \sigma_{spread}(spread_t - spread^*)^2 + \sigma_{crgap} crgap_t^2 + \sigma_{\Delta crr}(crr_t - crr_{t-1})^2 \tag{2.3}$$

where $\sigma_{\Delta crr}$ represents the relative preference for stabilizing changes in the macroprudential instrument.[7] When considering the coexistence of monetary and macroprudential policies, we restrict our analysis to the case where both of them interact in a coordinated manner. This assumption acknowledges an important result found in the literature, namely, the fact that since both policy instruments work less than perfectly, one cannot ignore the limitations of the other and, hence, should account for its effects on the economy (Blanchard, Dell'Ariccia, and Mauro 2013). According to De Paoli and Paustian (2013), this way of interaction between monetary and macroprudential policies is consistent with a first-best solution. Importantly, notice that when defining this case we do not take a stance on whether both policies are conducted by the central bank or by different policy institutions.

3 The model

A growing literature emphasizing the role of macro-financial linkages in macroeconomic models for monetary policy analysis has emerged in recent years.[8] Most of these models build on the work developed by Bernanke, Gertler, and Gilchrist (1999) and Iacovello (2005) that introduce endogenous financial frictions—which arise due to the presence of agency costs (à la Bernanke and Gertler 1989) or the lack of financial-contract enforceability (à la Kiyotaki and Moore 1997)—into general equilibrium frameworks with real and nominal rigidities. In general, these types of models focus on understanding factors affecting the demand for credit that tend to propagate and amplify the transmission of shocks through a "financial accelerator" mechanism, leaving no relevant role for financial intermediaries to play. In response to this, macroeconomic models emphasizing the role of credit supply factors (e.g., the market structure of the banking system, the rate-setting strategy of banks, the role of banks' balance sheet composition and management, etc.) in the transmission of

[7] Angelini, Neri, and Panetta (2014) propose a loss function in the same spirit as the one proposed here when studying the interaction between monetary and macroprudential policies in the case of cooperation. The last term in equation (2.3) represents policymakers' concern with the variability of the macroprudential policy instrument.

[8] Vlcek and Scott (2012) provide an extensive survey of models featuring financial frictions and/or financial intermediation in use by central banks.

macroeconomic and financial shocks have also been developed.[9] Despite these contributions, no canonical framework is yet available within which to study the relationship between financial frictions, financial intermediation, and macroeconomic activity and its implications both for monetary and macroprudential policies.[10]

Given this lack of consensus, we use a simple model that accounts for the interaction between a standard macroeconomic setup and some financial variables as the basis for our analysis. Specifically, we follow the approach taken by Sámano (2011), who augments a reduced-form New Keynesian small and open economy model, that is, the macroeconomic block, by appending a macroeconometric financial sector or financial block. This approach allows for the introduction of macro-financial linkages into an otherwise standard macroeconomic model—commonly used to analyze monetary policy in emerging markets—to study the propagation of macroeconomic shocks into the financial sector and vice versa. Admittedly, the nature of this framework has limitations, including: (1) the lack of micro-foundations, which makes the model sensitive to the Lucas critique and inadequate for welfare analysis; (2) it is based on a representative agent setup, leaving out specific wedges that arise due to heterogeneity among agents and that characterize models where financial frictions are present; and (3) it is a linearized representation around the steady state of the economy. As a result, the model does not capture potential nonlinear effects of sufficiently large shocks capable of producing financial instability, and thus only features macroeconomic fluctuations under "normal times" (i.e., it is not a model where financial crises occur). Regardless, we consider it useful to provide guidelines about relevant trade-offs between policy objectives.

3.1 The macroeconomic block

The structure of the macroeconomic block is characterized by aggregate supply and demand relationships that include the effect of economic openness (via the impact of the real

[9] See Andrés and Arce (2012), Cúrdia and Woodford (2011), Gerali and others (2010), Gertler and Karadi (2011), and Meh and Moran (2010).

[10] In this respect, Galati and Moessner (2013, 854) point out that "[w]hile the literature on monetary policy has provided a common conceptual framework over the past two or three decades, research on macroprudential policy is still in its infancy and appears far from being able to provide an analytical underpinning for policy frameworks. . . . [This may be due to, among other reasons, the fact that] we lack a thorough understanding and established models of the interaction between the financial system and the macroeconomy."

exchange rate and foreign output, inflation, and interest rates on domestic activity and inflation):

$$\pi_t^{core} = a_1 E_t[\pi_{t+1}^{core}] + a_2 x_{t-1} + a_3\left(\Delta e_{t-1} + \pi_{t-1}^f\right) + a_4 \pi_{t-1}^{core} + \varepsilon_t^{core} \tag{3.1}$$

$$\begin{aligned} x_t = {} & b_1 E_t[x_{t+1}] - b_2(i_{t-1} - E_{t-1}[\pi_t]) + b_3 x_{t-1}^f + b_4 rer_{t-1} + b_5 x_{t-1} \\ & - b_6 spread_{t-1} + \varepsilon_t^x \end{aligned} \tag{3.2}$$

$$rer_t = c_1 rer_{t-1} + c_2\left(E_t[rer_{t+1}] + \left(r_t^f - r_t\right)\right) + \varepsilon_t^{rer} \tag{3.3}$$

Equation (3.1) is a hybrid Phillips curve that explains core inflation as a linear combination of expected and lagged inflation (with E_t representing the time-*t* rational expectations operator), the output gap and changes in the nominal exchange rate, $\Delta e = \Delta rer + \pi - \pi^f$, and foreign inflation, π^f. Equation (3.2) is a hybrid investment-saving (IS) curve that establishes that the output gap depends on its expected and lagged values, the real ex-ante interest rate, $i - E[\pi]$, (with the policy rate set according to the different cases under analysis, described in the previous section), the real exchange rate, *rer,* and the credit spread, *spread*. The latter variable, not present in the standard New Keynesian model, arises with the introduction of financial considerations into the model. It accounts for the distortions on the allocation of expenditures imposed by the presence of financial frictions and/or financial intermediation.[11] The spread, for which we provide further details later, is what drives the feedback mechanism between the financial sector and the rest of the economy. Lastly, equation (3.3) models the real exchange rate dynamics imposing uncovered interest rate parity.

The set of exogenous variables of the macroeconomic block include noncore inflation (recall that the loss functions in the previous section are defined in terms of the deviations of headline inflation from its target), foreign output, inflation, and interest rates. Noncore inflation is assumed to follow an autoregressive process of order 1 while foreign variables are modeled using a vector autoregressive model of order 2.

Before proceeding with the financial block, an additional remark deserves to be made. Note in the system of Equations (3.1)-(3.3) that the extension of the traditional New-

[11] Alternatively, credit volumes or lending standards could have been used instead of the credit spread. However, according to Sámano (2011), preliminary evidence for the case of Mexico points out that credit volumes do not Granger-cause the output gap. Furthermore, for the case of Mexico, lending standards are available for a very short period, making it highly imprecise to perform statistical inference with the latter variable.

Keynessian model to incorporate the potential impact of financial variables affects only the IS curve. In particular, neither the spread nor any other financial variable has been included in the Phillips curve. This feature of our reduced-form model contrasts with the modeling proposed by some structural approaches, such as Cúrdia and Woodford (2009) and Christiano, Trabandt and Walentin (2010), which are based on the possibility that firms' costs, and thus their price-setting behavior, are affected by credit market conditions.[12] Nonetheless, while this possibility seems certainly relevant from a conceptual point of view, as well as for other economies, its empirical relevance seems small relative to the channel operating through the IS curve for the case of the Mexican economy. Hence, our proposed framework considers a case in which financial variables are only included in the IS curve, which seems the most empirically relevant for Mexico, and leave further extensions for future work.

3.2 The financial block

A financial block (sketched in Figure 1) is appended to the rest of the economy in order to capture, in a stylized fashion, the credit channel of monetary policy. Specifically, we consider a financial sector, characterized by the existence of banks, in charge of intermediating resources among borrowers and lenders. This intermediation is done at a cost, represented by the credit spread. We further capture vulnerabilities in the financial sector by introducing credit dynamics into the model.[13]

We assume that there is an intermediation technology that transforms real deposits into real loans subject to costs associated with loan monitoring activities. These costs are related to the presence of some financial friction on the demand side of credit, which gives rise to an external financing premium imposed on borrowers, as in Cúrdia and Woodford (2009). Following Gerali and others (2010), banks devote some of their resources to managing their balance sheet and/or to fulfilling costs associated with regulatory requirements. We also assume that banks enjoy some degree of market power due to the presence of monopolistic competition. This allows banks to charge a markup over the policy rate—that is, the relevant rate at which banks intermediate resources in the interbank market absent other

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[12] In some of the cases analyzed by Cúrdia and Woodford (2009), which vary depending on the value of the parameters they consider, credit frictions exert "cost-push" effects on the short run aggregate supply. Christiano, Trabandt and Walentin (2010) show that in a model with a working capital channel, the Taylor principle may be a source of instability as the nominal interest rate now affects marginal costs.

[13] According to Dell'Ariccia and others (2012), who analyze the characteristics of financial booms that end up in busts or crises, credit growth can be a powerful predictor of financial crises.

intermediation costs—when setting loan (or active) rates, on the one hand, and a markdown with respect to the policy rate when setting deposit (or passive) rates, on the other.

The active interest rate, i_t^{loan}, whose dynamics evolve as follows,

$$i_t^{loan} = \beta_1 i_t + \beta_2 delinq_t + \beta_3 crr_t + \varepsilon_t^{i^{loan}} \tag{3.4}$$

and is directly affected by monetary policy, with $\beta_1 (< 1)$ representing a limited pass-through from policy rates to active rates that arise from market power; it is affected by a finance premium channel, *delinq*, to be defined below, and the potential macroprudential policy tool or costs associated with the management of the bank's balance sheet, *crr*. For the passive rate we assume a similar structure:

$$i_t^{deposit} = \gamma_1 i_t + \gamma_2 delinq_t - \gamma_3 crr_t + \varepsilon_t^{i^{deposit}} \tag{3.5}$$

where γ_1 determines the pass-through of the policy rate to funding costs that arise from banks' market power on deposit markets. Thus, the credit spread is given by the following expression:

$$spread_t = i_t^{loan} - i_t^{deposit} \tag{3.6}$$

We capture the buildup of risks in the financial sector through the evolution of the credit-to-GDP gap, which is positively related to economic activity (i.e., credit booms generally start after periods of rapid economic growth), and negatively related to the credit spread. The latter relationship lets us account for the linkage between financial conditions and credit booms:[14]

$$crgap_t = \delta_1 crgap_{t-1} + \delta_2 x_{t-1} - \delta_3 spread_t + \varepsilon_t^{crgap} \tag{3.7}$$

The delinquency index is assumed to depend on economic activity, the credit-to-GDP gap and its own lagged value:

$$delinq_t = \eta_1 delinq_{t-1} - \eta_2 x_t + \eta_3 crgap_{t-1} + \varepsilon_t^{delinq} \tag{3.8}$$

[14] Drehmann and Juselius (2014) find that the credit-to-GDP gap is a good early warning indicator of banking crises.

The rationale behind this specification is, on one hand, that episodes of economic expansion lead to a reduction in nonperforming loans as debtors' defaults decline. On the other hand, an accelerated credit expansion, captured by a positive credit-to-GDP gap, may lead to vulnerabilities via a reduction in the quality of new loans as a result of looser lending standards during credit booms. This eventually translates into an increase of the delinquency index.

The coverage ratio rule, *crr*, has two possible interpretations depending on the policy strategy being considered. In the benchmark case and the leaning against the wind case, where macroprudential policy is not present, it is interpreted as a cost associated with banks' balance sheet management. In these cases, we simply assume that it follows an autoregressive process of order 1:

$$crr_t = \mu_1 crr_{t-1} + \varepsilon_t^{crr} \tag{3.9}$$

The second interpretation of *crr* is that of a regulatory requirement imposed by the macroprudential authority. This interpretation becomes relevant when we analyze the case in which monetary and macroprudential policies coordinate. In this case, *crr* is defined as follows:

$$crr_t = argmin\{L^{coord}\} \tag{3.10}$$
$$\textit{s.t. the rest of the economy}$$

This ratio should be understood as a dynamic-provisioning-type instrument that reduces the procyclicality of the financial system by forcing banks to build a buffer against losses when the financial cycle is booming and allows for a softer landing when it goes bust. Banks are forced to put aside resources to account for the possible losses incurred as credit quality deteriorates. Hence, the adoption of dynamic provisioning typically pursues three objectives: (1) to allow during good times for the buildup of reserves that would serve as a buffer in bad times; (2) to smooth credit growth over the business cycle; and (3) to shield the real economy from shocks originated in the financial sector.

The financial block is hence represented by system (3.4) to (3.7) where the delinquency rate and the coverage ratio evolve according to equations (3.8) and (3.9) or (3.10), respectively.

3.3 Model estimation

For illustrative purposes, we estimate the proposed model for the Mexican economy. Since our aim is to understand the potential trade-offs that arise from the policy strategies described in Section 2, we do not focus on whether the results presented are due to some particular feature of the Mexican economy. However, the analysis presented in Section 5 allows us to understand the main forces driving our results. The dataset used in the estimation includes core and noncore inflation (π^c and π^{nc}), the policy rate (i), the output gap (x), the real exchange rate (*rer*), the nominal exchange rate (*e*); and the U.S. output gap, inflation and policy rate (x^f, π^f and i^f) for the macroeconomic block.[15] For the financial block we use an aggregate loan rate (i^{loan}), the average cost of bank term-deposits ($i^{deposit}$), a delinquency index for aggregate credit (*delinq*), the credit-to-GDP-gap, which considers financing to the non-financial private sector (*crgap*), and the coverage ratio (*crr*). The aggregate loan rate is calculated as the weighted average of the interest rates to consumption, corporate and mortgage loans.[16] The delinquency index is an adjusted index constructed by Banco de México which consists of the sum of overdue loans and loans written off in the prior 12 months divided by total loans plus loans written off in the last 12 months. The credit-to-GDP gap is calculated using a Hodrick-Prescott filter with a smoothing parameter of 400,000. Finally, the variable capturing the coverage ratio rule (*crr*) is the ratio of loan-loss reserves to nonperforming loans for the Mexican banking system.[17] The sources of all data are Banco de México, Comisión Nacional Bancaria y de Valores (CNBV) and Instituto Nacional de

[15] Inflation is calculated as the quarter-over-quarter percent change of the corresponding indexes. The nominal interest rate is the short-run inter-bank funding rate. The output gap is estimated with a tail-corrected Hodrick-Prescott filter over real log GDP. For the real exchange rate, we consider a bilateral index between Mexico and the United States constructed by Banco de México; the change in the nominal exchange rate is thus the quarter-over-quarter percent change in its nominal counterpart.

[16] The credits considered for the calculation of each loan rate correspond to loans denominated in national currency and that are not overdue. The active interest rate considered in the model refers to the interest rate at which new loans are granted. Ideally, this would be the type of interest rate that we should consider when estimating the model. However, data on interest rates to new loans in Mexico are not available neither for all types of loans nor for a long period of time. To overcome this problem we use interest rates on new consumption, mortgage and non-financial corporate loans whenever possible and their implicit counterparts (calculated as the income from interests paid on credits divided by average credit stocks) in the rest of the cases. Figure (2) depicts the evolution of each one of these loan rates and of the active rate (i^{loan}) and compares the former with an alternative measure that uses only implicit rates for all sectors. The credit spread is defined according to equation (3.6). Figure (3) shows its evolution.

[17] Notice that to account for the crr we consider a realized measure of the ratio of loan-loss reserves to nonperforming loans as opposed to a legal actual requirement (the Mexican banking regulation does not include a dynamic provisioning requirement; instead it considers an expected loss approach consistent with the Basel III framework).

Estadística y Geografía (INEGI).[18] All data are at quarterly frequency. We estimate equations (3.1) to (3.9) using the generalized method of moments and ordinary least squares.[19] Our sample ranges from the first quarter of 2002 to the fourth quarter of 2014. All coefficients are summarized in Table 1.

4 Results

Trade-offs between inflation targeting and financial stability objectives arise when growing financial risks warrant a higher interest rate than the one necessary to tame inflation. In contrast, no trade-offs arise when higher interest rates due to an expansion of economic activity are also sufficient to contain financial stability risks. This section examines the trade-offs between policy objectives that result from the policy arrangements described in Section 2 using our estimated model for the Mexican economy. To do so, we examine the model's transmission mechanism and policy implications under each case. In particular, we assess the cases' relative effectiveness in attaining their policy objectives (inflation targeting in the benchmark case and inflation targeting and financial stability in the leaning-against-the-wind and coordination cases) by comparing the volatility that each of them entails for a set of relevant macroeconomic and financial variables.[20] We conduct this analysis for two economic environments: one in which the economy is only affected by macroeconomic shocks, and another in which the economy is only affected by financial shocks.[21]

The general procedure used consists in feeding the model with 1,000 draws of shocks and simulating it 10,000 times to obtain the model's invariant distribution. The variances of the relevant variables and the values of the loss functions are then compared across cases and economic environments. To derive optimal policy rules for each case, we need to choose specific weights for the "preference parameters" in the loss functions (i.e., to assign values for σ_i, for all *i* in equations (2.1), (2.2), and (2.3)).[22] Unlike micro-founded models that assign

[18] All but rates for new loans and the delinquency index are public data.

[19] Equations (3.4) and (3.5) are simple representations for loan and deposit rate setting in the Mexican banking system. We chose to estimate them by GMM in order to maintain a simple, parsimonious model, since financial and macro variables present a lagged relationship in the data.

[20] For this and all cases presented below, each of the terms in the loss function is weighed out by the inverse of the variance of the corresponding historical series from 2002 to 2014.

[21] Evidently, the overall effectiveness of each particular policy strategy is a combination of its effectiveness in both environments and depends on the relative importance of macroeconomic versus financial shocks in the economy. However, separating the studied effects by type of shock makes it easier to understand the sources of the results.

[22] Optimal policy rules are calculated following Söderlind (1999).

welfare-based weights, our choice is arbitrary. In particular, we set all weights equal to 1 so that, in principle, the results are not distorted by a given preference for stabilizing one particular variable over another.

4.1 Macroeconomic shocks

Table 2 shows our results when the economy is affected only by macroeconomic shocks. A monetary policy response that leans against the wind is effective in reducing fluctuations in financial variables, and even in output, relative to the case where monetary policy has traditional objectives (labeled “Benchmark” in the table). Intuitively, in the former case, monetary policy recognizes the effect that movements in the policy rate entail for the financial sector and internalizes this when setting the rate. As a result, the volatility of the policy rate is also reduced. However, this improvement does not come without a cost. A less reactive interest rate also entails somewhat larger inflation fluctuations. In this respect, Smets (2014) points out that incorporating financial consideration into the central bank’s objectives may lead to an inflationary bias problem, since monetary policy is kept looser than necessary for price stability. In particular, for the estimated version of our model and the specific “preference parameters” that we consider, the differences between the model dynamics in the two cases are relatively small: output and financial variables are between 8 and 6 percent less volatile, while inflation volatility increases by 3 percent.

When comparing the model dynamics where monetary and macroprudential policies coordinate (labeled “Monetary and Macroprudential Coordination”) vis-à-vis those where monetary policy leans against the wind, we observe a further reduction in the volatility of output and of financial variables but no improvement in inflation volatility.

Accordingly, when assessing the more general question regarding the implications for price stability of considering financial stability as an additional macroeconomic objective pursued by means of a macroprudential policy, the fact that inflation fluctuations are somewhat larger holds. As will be discussed when we perform our sensitivity analysis, this lack of improvement can be related to the relative ability of both the monetary and the macroprudential policy instruments to affect the financial sector’s spread in a significant way.

Figures 4 and 5 depict the model’s response to a positive demand shock and a positive cost-push shock, respectively. In the first case, inflationary pressures call for a restrictive monetary policy reaction. The policy rate increases to raise the real interest rate and moderate the increased economic activity. In the second case, inflation expectations increase mechanically due to the increase in inflation, which calls for a mild increase in the policy rate. Although these responses are the same in all cases, notice that the increase in the policy rate in the benchmark case exceeds that in the other two. This confirms the intuition described above. When internalizing the effect of movements in the policy rate on the stabilization of the financial sector, monetary policy's responses are toned down. This policy reaction comes along with a tepid increase in the coverage ratio—the macroprudential instrument—in the coordination case. Notice, however, that the difference in the response of all variables across cases is negligible, as expected from the magnitudes of the changes in volatilities previously described.

4.2 Financial shocks

Table 3 shows our results when the economy is only affected by financial shocks. In particular, we examine two shocks: (1) a shock to credit spreads due to changes in the loan rate, which can be interpreted as a reduction in the risk premium, and (2) a shock to the credit-to-GDP gap, which will allow us to analyze the policy response to an exogenous buildup of financial imbalances.

A monetary policy that leans against the wind implies larger volatility for both inflation and output relative to one with only traditional objectives. The reason why output volatility increases when the economy faces financial shocks is that, in this environment, the policy rate aims at stabilizing the financial sector not only through its effect on economic activity but also through its effect on the credit channel (i.e., the credit spread). Inflation volatility is affected in a twofold manner. First, when monetary policy has an additional objective, the room for maneuver to temper the volatility of more variables declines, and this in turn affects inflation expectations. Second, larger output volatility necessarily translates into more inflation volatility. Additionally, this increase in output volatility translates into larger fluctuations in the credit-to-GDP gap, which leaves the monetary policy instrument at odds when trying to stabilize both objectives. In particular, for the case that we analyze, inflation and output volatility increase by 38 and 9 percent, respectively, while the credit-to-GDP gap increases by nearly 7 percent. The credit spread is less volatile by around 3 percent.

To further understand these responses, we examine the model dynamics when the economy is affected by a reduction in the risk premium that decreases the loan rate, which fuels economic activity through lower credit spreads (Figure 6). In the benchmark case, the responses of variables are straightforward. A decrease in credit spreads increases output and inflation. The improvement in economic activity initially translates into a lower delinquency index (i.e., a decrease in nonperforming loans), but the higher credit-to-GDP gap eventually offsets this effect, leading to a higher delinquency index. Monetary policy response is countercyclical in order to moderate economic activity and inflation. When monetary policy leans against the wind, the policy rate is set as to contain the initial decrease in the credit spread through the credit channel. Since in our baseline estimation monetary policy has a negative net effect on credit spreads, the policy rate is set in a procyclical manner, which implies a reduction in the rate. This response amplifies the mechanism described in the benchmark case and leads to even higher levels of the credit-to-GDP gap and the delinquency index.

Figure 7 illustrates the model's response to an increase in the credit-to-GDP gap. In the benchmark case, this shock implies higher levels for the delinquency index, which leads to an increase in credit spreads due to an upward adjustment in the loan rate. The policy reaction is merely to tone down output and inflation. On the other hand, a monetary policy that leans against the wind counteracts the effect on the credit-to-GDP gap through lower economic activity, which implies a higher level for the policy interest rate and thus a decrease in inflation.

After examining monetary policy responses to financial shocks, one can easily understand why macroeconomic variables become more volatile when monetary policy has to lean against the wind. In our model, the policy rate goes above and beyond what would be required in absence of financial stability objectives, in order to affect credit and the credit spreads. These dynamics suggest that the increase in the volatility of macroeconomic variables in our simulation exercise depends on the relative strength of the credit channel, that is, the effect of the policy rate on credit spreads, and on the feedback of output fluctuations into the financial sector. We will return to this point in the next section.

Table 3 also shows the results of the model's dynamics when both monetary and macroprudential policies coordinate. Coordination of the two instruments leads to a subtle improvement in the effectiveness of monetary and macroprudential policies to attain price and financial stability relative to the case in which monetary policy leans against the wind. These results are illustrated in Figures 6 and 7 as well, where it can be seen that the introduction of a macroprudential policy tool (*crr*) entails more favorable dynamics for financial variables under the shocks described above and hence less distortions in traditional objectives. Nonetheless, the fact that inflation volatility remains larger relative to the benchmark case confirms that, in our estimated model, the coexistence of two instruments in order to achieve both price and financial stability can make the attainment of the former more difficult.

To sum up, this section has presented several findings. First, adding a financial stability objective to monetary policy reduces the volatility of some financial variables. However, this improvement with respect to financial stability may come at the expense of increasing the volatility of macroeconomic variables. Second, this cost is present regardless of the type of shocks that affect the economy, but tends to increase when fluctuations are driven by financial shocks. This is probably what critics of monetary policy leaning against the wind had in mind prior to the 2008–09 financial crisis when they argued that the costs of such a strategy would likely be high (see Mishkin 2011 and references therein). Third, regardless of the type of shocks hitting the economy, we observe modest gains from coordination between monetary and macroprudential policies to achieve macroeconomic stability relative to having monetary policy leaning against the wind in our estimated model for the Mexican economy.[23] Moreover, as can be seen in Tables 2 and 3, despite the observed reductions in volatility of most variables, inflation volatility remains high relative to the benchmark case, which suggest that, in our proposed framework, the introduction of financial stability as an additional macroeconomic policy objective might make the attainment of price stability more difficult. The next section will shed light on the properties of the model driving this last result.

5 Sensitivity analysis

The results presented above are particular to the estimated model for the Mexican economy and hence cannot be generalized (i.e., it may be the case that country-specific aspects of the transmission of shocks in the Mexican economy are the main drivers of our results). In what follows, we assess the robustness of our findings. We mainly focus on identifying the reasons behind the lack of improvement in the macroeconomic performance under coordination of monetary and macroprudential policies relative to monetary policy leaning against the wind and the benchmark case. Specifically, we explore the importance of the ability of monetary and macroprudential instruments to affect financial variables through changes in credit spreads.

5.1 Ability of monetary and macroprudential instruments to affect financial variables

There is no doubt that the effectiveness of any policy strategy to attain its objective(s) should rest on the ability of the corresponding instrument to affect the economy in the desired way. In our model, this ability is given by the magnitude of the pass-through of the policy rate to

[23] According to these findings, and given that the size of gains from coordination for other variables is relatively small, the risk that financial stability considerations undermine the credibility of the central bank's price stability mandate might eventually generate further welfare losses.

loan and deposit rates—and thus its overall effect on credit spreads—and by the effect of the coverage ratio on the loan rate. Let us first analyze the sensibility of our results to monetary policy's effectiveness to affect credit spreads. To do so, recall equations (3.4) and (3.5) that account for the effect of the policy rate on credit spreads. By substituting (3.4) and (3.5) into (3.6) we obtain the following:

$$spread_t = (\beta_1 - \gamma_1)i_t + (\beta_2 - \gamma_2)delinq_t + (\beta_3 + \gamma_3)crr_t + \varepsilon_t^{i^{loan}} - \varepsilon_t^{i^{deposit}}$$

with β_1 denoting the pass-through of the policy rate to the loan rate, γ_1 to the deposit rate, and $(\beta_1 - \gamma_1)$ its "net effect."

Table 4 illustrates the losses in terms of volatility of our baseline model relative to others with different values for this "net effect" when the economy is affected by financial shocks. First, notice that an economy is better off with a net effect equal to 0, when the loan and deposit rates are equally affected by movements in the policy rate. In such a case, changes in credit spreads are not directly obtained through movements in loan and/or deposit rates but rather through the effect that the policy rate has on other macroeconomic variables such as the output gap. For positive values of the net effect –which can be associated with a countercyclical effect of monetary policy on the financial sector– losses of monetary policy leaning against the wind begin to increase relative to coordination, but not by as much as for negative values of the net effect, where losses can more than double.

Furthermore, notice that, in all cases except that when the net effect equals 0, having financial stability objectives on top of price stability objectives somewhat decreases the ability of monetary policy to achieve price stability. This can be rationalized by the fact that since the reference rate has little ability to influence the credit spread when its net effect is closer to 0, it is not optimal that it responds in order to mitigate the volatility of financial variables. Hence, it can focus on attaining price stability objectives and, thus, in reducing inflation volatility.

We now focus on the case where the impact of macroprudential effectiveness on credit spreads is changed—that is, when we vary $\beta_3$in equation (3.4). Table 5 illustrates the losses in terms of volatility of our baseline model relative to others with different values for this parameter, when the economy is affected by financial shocks. The larger the impact of macroprudential policy on credit spreads, the greater the gains of coordination versus leaning against the wind and, more generally, the less the interference of financial stability objectives on the attainment of price stability ones. Results are straightforward, as in this framework the transmission mechanism of macroprudential policy is quite simple. Figure 8 summarizes the results presented above and shows that our framework features room for gains from coordination between monetary and macroprudential policies, either when monetary policy is not an effective tool for the financial sector or when it enters into clear conflict with macroprudential policy. This result emphasizes the importance of assessing the relative effectiveness of the different tools that policymakers have at their disposal to achieve policy objectives and, as well as the interactions among these tools. The room for improvement is larger when the shocks affecting the economy come from the financial sector.

6 Final remarks

Despite the simplicity of the framework used in this chapter, our findings highlight some important aspects regarding how the interlinkages between the real and financial sectors determine the appropriate policy responses to shocks. In particular, our results suggest that the tradeoffs to attain price and financial stability objectives increase in the presence of financial shocks.

The decision whether to use monetary policy as the main tool to counter the financial cycle by leaning against the wind versus using coordinated monetary and macroprudential policies to do so is ultimately a decision between having one versus two instruments to attain two different but inherently interconnected policy objectives. The fact that under a given situation (i.e., under the presence of financial shocks) there is a trade-off between inflation targeting and financial stability objectives opens up the possibility to improve macroeconomic performance with coordinated monetary and macroprudential policies. The main result of this paper is that the magnitude of these benefits, and even the tradeoffs for price stability that entail the introduction of financial stability as a new macroeconomic policy domain, depends on a wide range of determinants such as the effectiveness of policy instruments to affect credit spreads in the economy.

This result highlights the importance of further research on at least two fronts. The first is the price-setting behavior of banks. In particular, understanding the main determinants of profit margins in the banking system is of vital importance. The second is how the characteristics of the financial system shape the amplification and persistence of financial shocks to the economy. Within this task lies the need to understand the effect of having a particular degree of financial penetration in the economy, and detecting and assessing the importance of the financial frictions that account for the transmission of financial shocks.

A deeper understanding of these topics will lead to developing larger, more complex, and more wide-ranging country-specific macroeconomic models that allow for capturing the main features of the economies, which policymakers attempt to influence.

Acknowledgments and disclamers

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Tables and Figures

Table 1: Estimation Results

Equation$^{a/}$	**Coeff.**	$i = 1$	$i = 2$	$i = 3$	$i = 4$	$i = 5$	$i = 6$	$Adj.R^2$	$J - stat$ (p-value)
(3.1) Phillips curve	a_i	0.621**	0.019**	0.005*	0.249**			0.70	0.53
(3.2) Investemnt-savings equation	b_i	0.508**	0.136**	0.198**	1.823**	0.184**	0.046**	0.90	0.99
(3.3) Real exchange rate	c_i	0.308**	0.674**					0.79	0.66
(3.4) Active rate	β_i	0.625**	0.043**	0.114*				0.53	0.99
(3.5) Passive rate	γ_i	0.778**	0.017**	0.364**				0.95	0.92
(3.7) Credit gap$^{b/}$	δ_i	0.875**	0.708**	0.350				0.91	
(3.8) Delinquency index	η_i	0.750**	0.109**	0.052**				0.96	

Source: Authors' estimates.

a/ Equations (3.1) - (3.5) are estimated by GMM. The instrumental variables used in each case include mainly lags of the explanatory variables. Equation (3.2) also included lags for Oil prices and the Coincident Index for the U.S. as instrumental variables. Equations (3.7) and (3.8) are estimated by OLS.

b/ As mentioned previously, it is difficult to pin down a precise estimate for δ_3. Therefore, we calibrate it so that the credit spread influences the credit-to-gdp gap by as much as half of its influence on output gap.

**,* represent the 5 and 10 percent levels of significance, respectively.

Table 2: Simulation Results: Macro Shocks

	Benchmark (1)	**Leans against the Wind (2)**	**Monetary and Macroprudential Coordination (3)**	**Relative gains**		
				(1)/(2)	**(2)/(3)**	**(1)/(3)**
L_π	0.201	0.207	0.207	**0.972**	**0.999**	**0.971**
L_x	4.770	4.391	4.313	**1.086**	**1.018**	**1.106**
$L_{\Delta i}$	54.300	50.079	50.007	**1.084**	**1.001**	**1.086**
L_{spread}	2.713	2.578	2.097	**1.053**	**1.229**	**1.294**
L_{c_gap}	20.657	19.355	17.948	**1.067**	**1.078**	**1.151**
$L_{\Delta crr}$			0.015			

Source: Authors' estimates.

Table 3: Simulation Results: Financial Shocks

	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains		
				(1)/(2)	(2)/(3)	(1)/(3)
L_{π}	0.001	0.002	0.002	**0.713**	**1.108**	**0.790**
L_{x}	0.408	0.448	0.399	**0.910**	**1.122**	**1.022**
$L_{\Delta i}$	10.290	10.244	9.745	**1.004**	**1.051**	**1.056**
L_{spread}	2.202	2.130	1.699	**1.034**	**1.254**	**1.296**
L_{c_gap}	5.223	5.591	4.181	**0.934**	**1.337**	**1.249**
$L_{\Delta crr}$			0.011			

Source: Authors' estimates.

Table 4: Simulation Results: Monetary Policy, Net Effect

	Negative net effect					Positive net effect					Zero net effect				
	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains (2)/(3)	Relative gains (1)/(3)	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains (2)/(3)	Relative gains (1)/(3)	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains (2)/(3)	Relative gains (1)/(3)
L_π	0.002	0.021	0.016	**1.370**	**0.112**	0.001	0.015	0.011	**1.317**	**0.089**	0.001	0.001	0.001	**1.086**	**1.109**
L_x	0.444	1.341	1.115	**1.202**	**0.398**	0.357	0.940	0.816	**1.152**	**0.438**	0.392	0.391	0.349	**1.122**	**1.125**
$L_{\Delta i}$	12.303	11.376	10.172	**1.118**	**1.210**	7.466	6.861	6.570	**1.044**	**1.136**	9.413	9.402	9.024	**1.042**	**1.043**
L_{spread}	18.184	15.683	9.850	**1.592**	**1.846**	12.413	10.409	7.608	**1.368**	**1.632**	0.736	0.735	0.714	**1.029**	**1.031**
L_{c_gap}	37.114	46.507	27.126	**1.714**	**1.368**	19.847	15.214	9.565	**1.591**	**2.075**	1.405	1.360	1.198	**1.136**	**1.173**
$L_{\Delta crr}$			0.171					0.082					0.001		

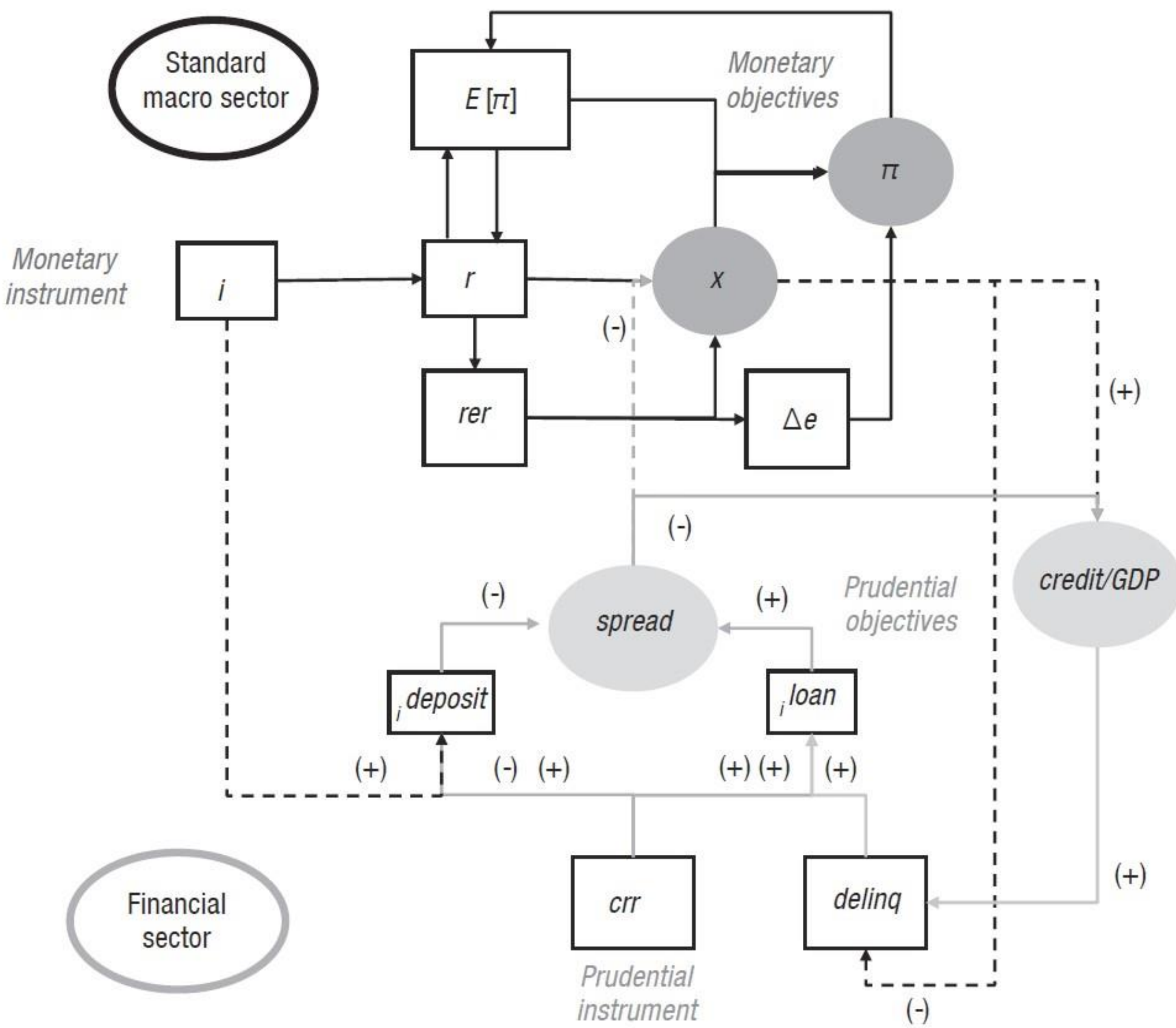
Source:Authors'estimates.

Table 5: Simulation Results: Macroprudential Policy, β_3

	$\beta_3 = 0$					$\beta_3 = 0.5$					$\beta_3 = 0.8$				
	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains (2)/(3)	Relative gains (1)/(3)	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains (2)/(3)	Relative gains (1)/(3)	Benchmark (1)	Leans against the Wind (2)	Monetary and Macroprudential Coordination (3)	Relative gains (2)/(3)	Relative gains (1)/(3)
L_π	0.001	0.002	0.002	**1.099**	**0.674**	0.001	0.002	0.002	**1.208**	**0.741**	0.001	0.002	0.002	**1.287**	**0.789**
L_x	0.408	0.469	0.419	**1.119**	**0.973**	0.408	0.469	0.410	**1.144**	**0.995**	0.408	0.469	0.404	**1.162**	**1.010**
$L_{\Delta i}$	10.29	10.357	9.875	**1.049**	**1.042**	10.29	10.357	9.655	**1.073**	**1.066**	10.29	10.357	9.526	**1.087**	**1.080**
L_{spread}	2.202	2.647	2.225	**1.190**	**0.990**	2.202	2.647	1.497	**1.768**	**1.471**	2.202	2.647	1.167	**2.268**	**1.887**
L_{c_gap}	5.223	6.949	5.515	**1.260**	**0.947**	5.223	6.949	3.748	**1.854**	**1.393**	5.223	6.949	3.022	**2.300**	**1.729**
$L_{\Delta crr}$			0.010					0.029					0.034		

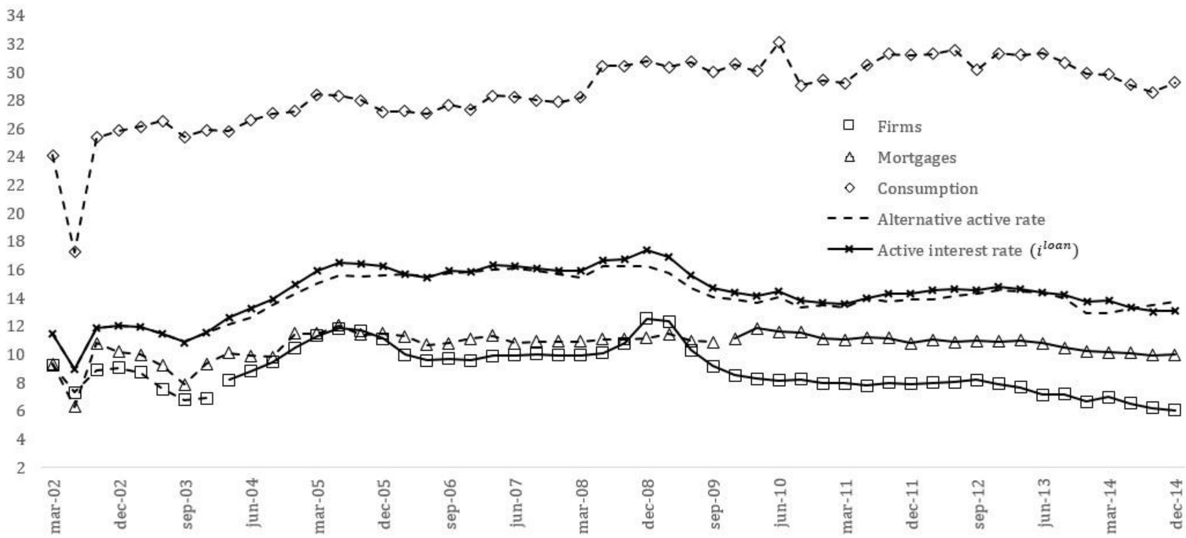
Source:Authors'estimates.

Figure 1: Model Mechanism



Source: Authors' representation.

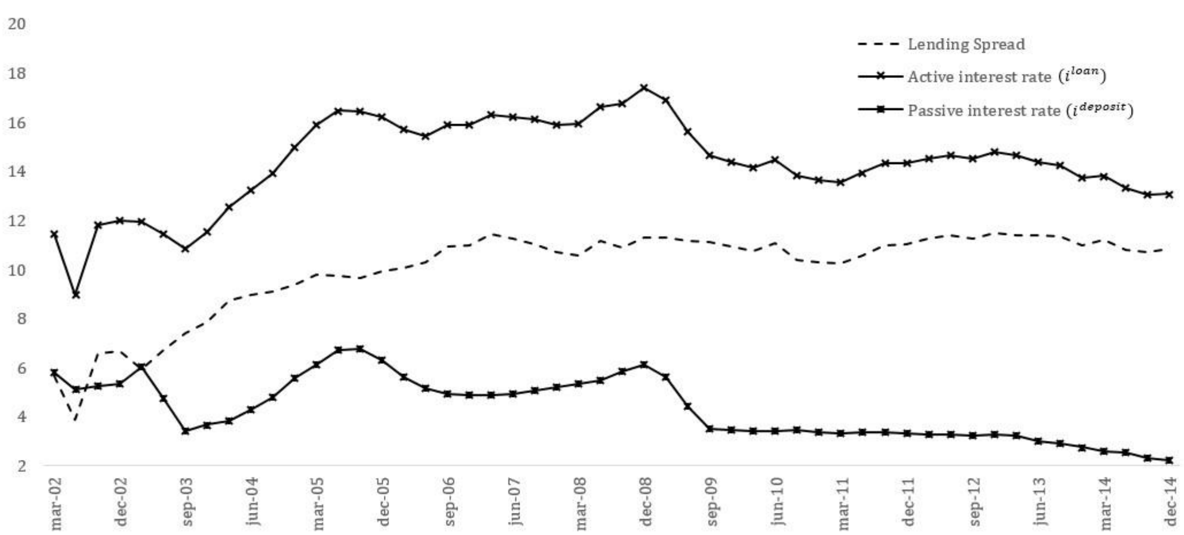
Figure 2: Active interest rates*
(Percent)



Source: Banco de México and CNBV.

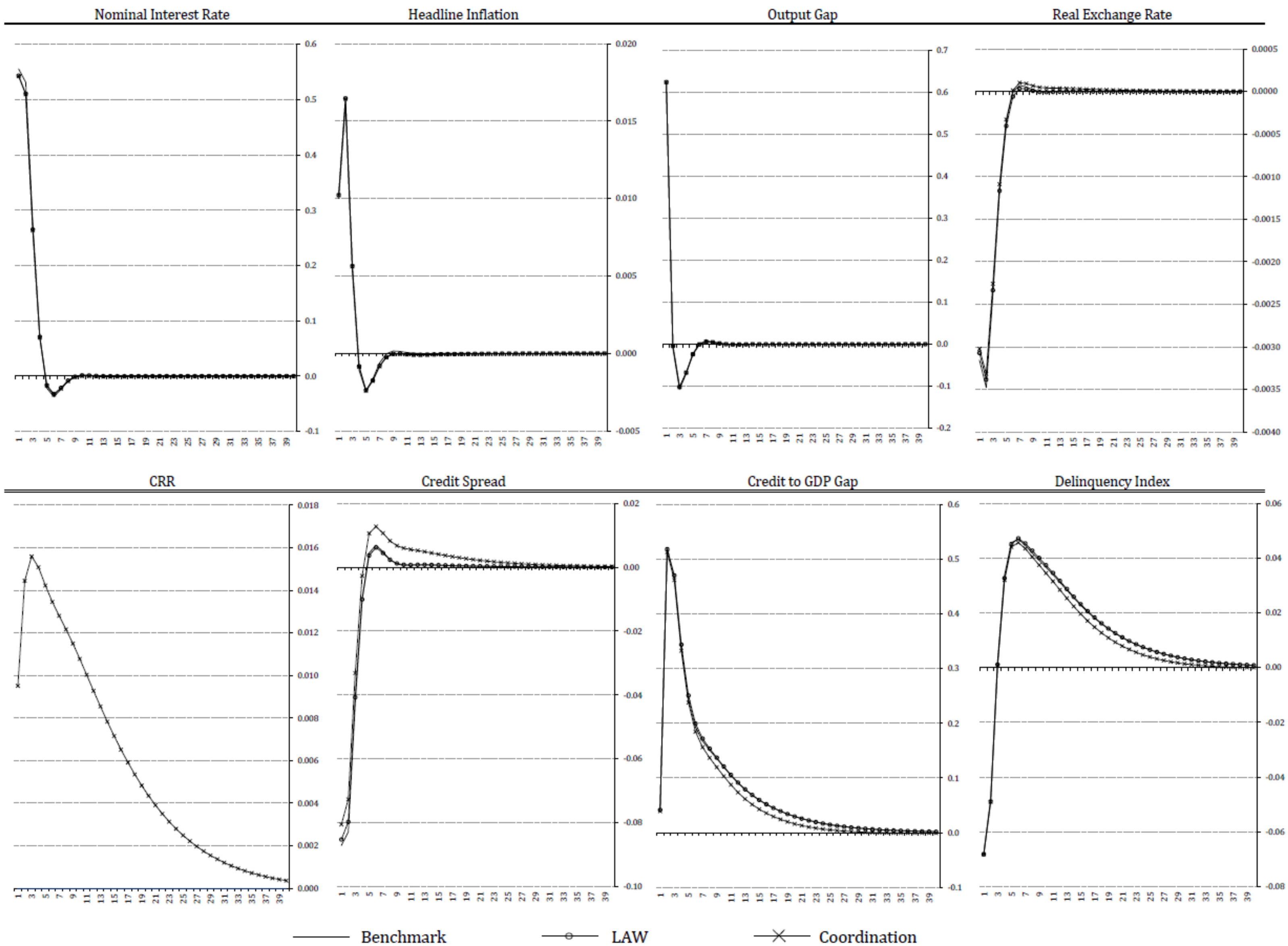
*/ The dashed lines correspond to implicit rates while the continuous lines are weighted average rates on new loans to firms and mortgages (weights are given by the original ammount of the loan written off).

Figure 3: Lending Spread ($i^{loan} - i^{deposit}$)
(Percent)



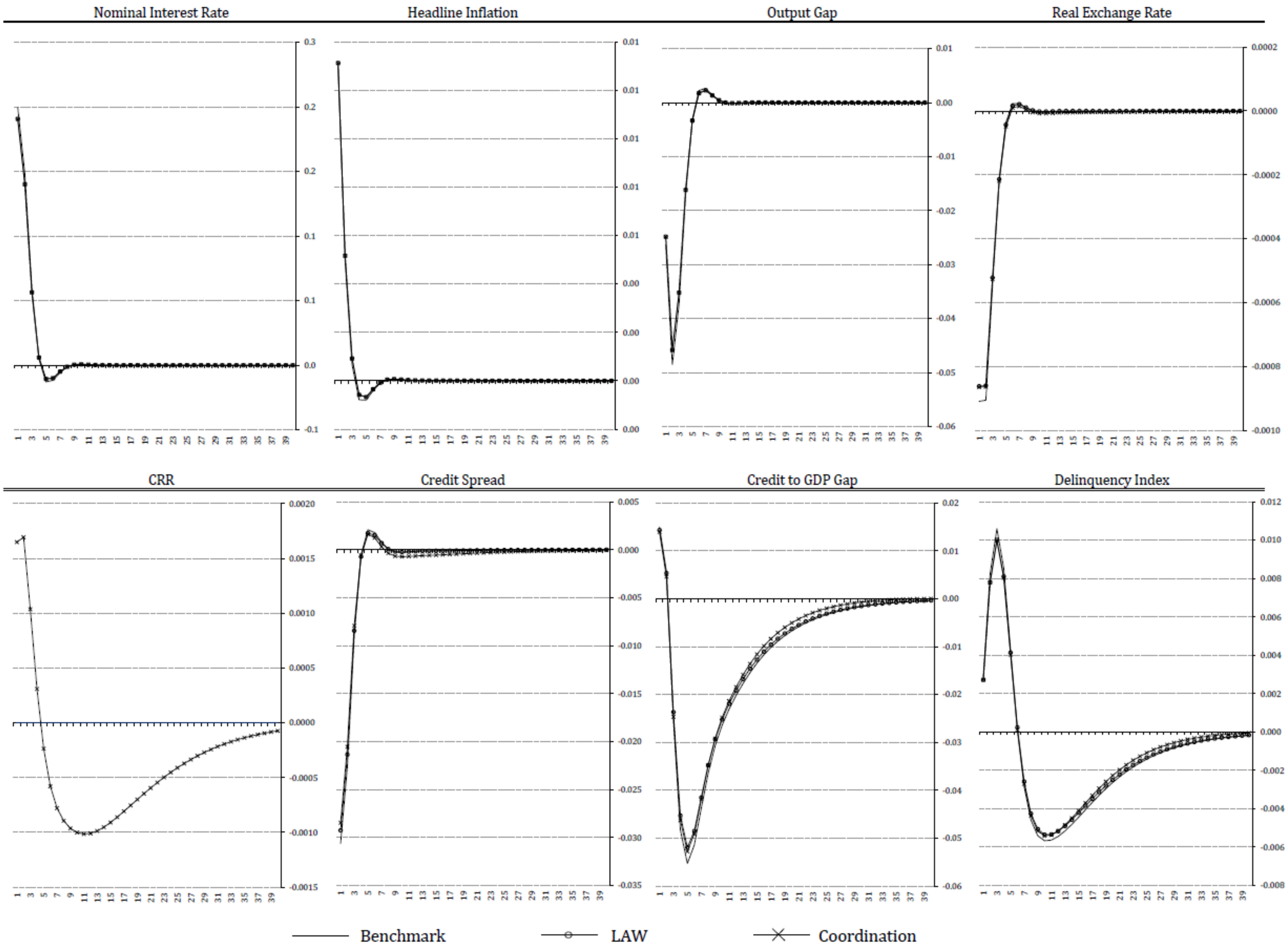
Source: Banco de México and CNBV.

Figure 4: Impulse Response to a One Standard Deviation Demand Shock
(Percentage points from steady state)



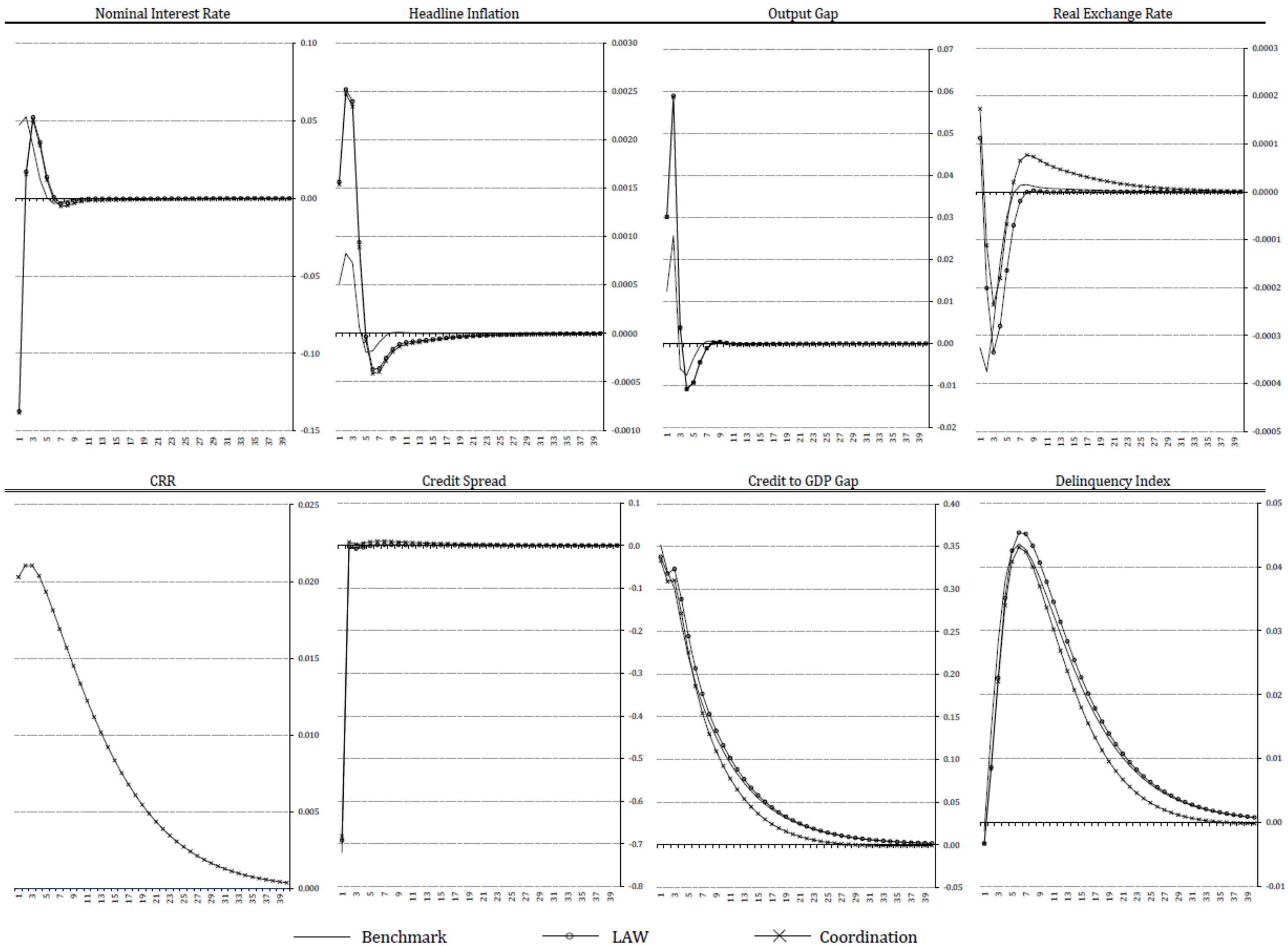
Source:Authors'estimates.

Figure 5: Impulse Response to a One Standard Deviation Cost Push Shock
(Percentage points from steady state)



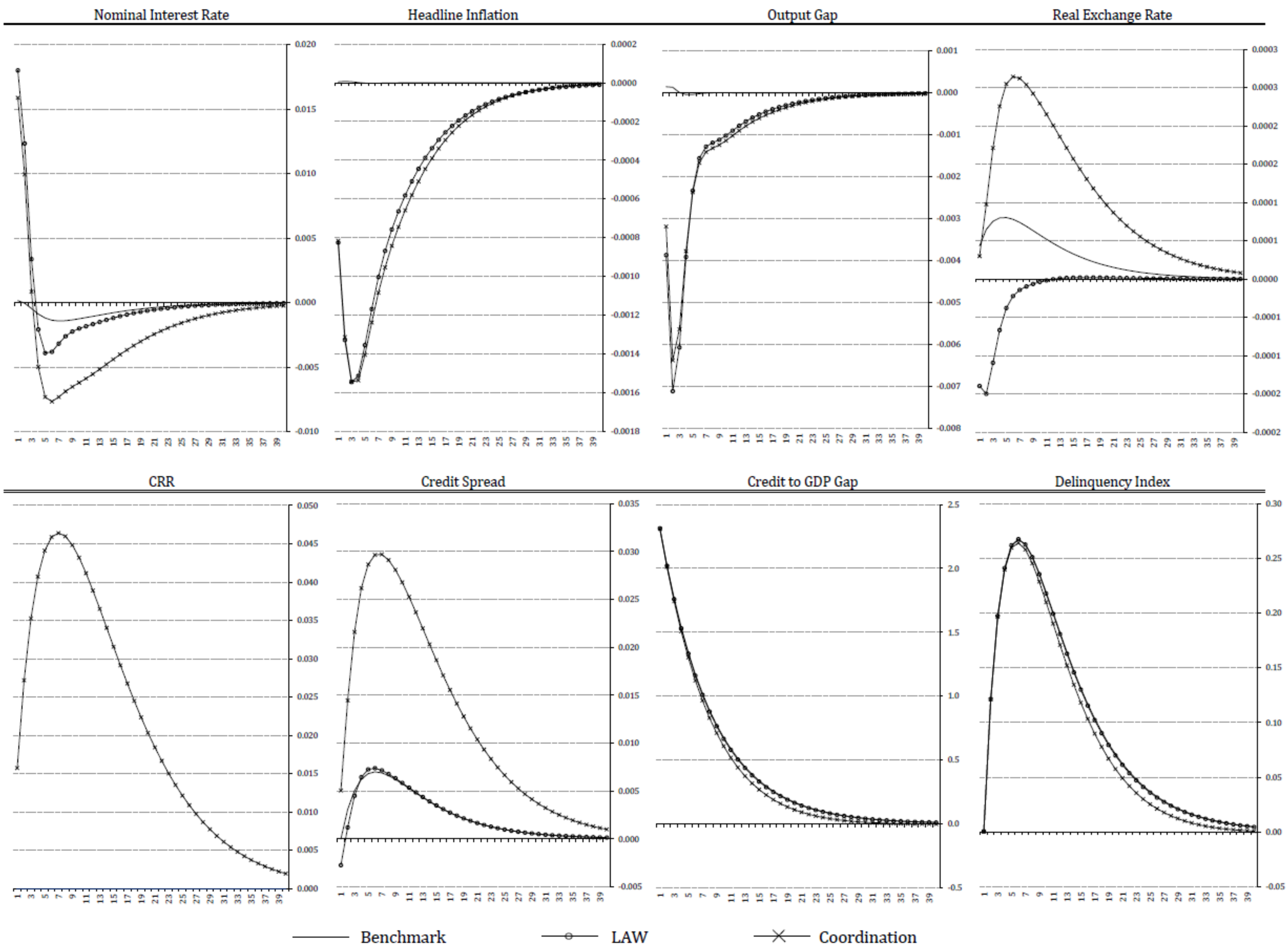
Source:Authors'estimates.

Figure 6: Impulse Response to a One Standard Deviation Spread Shock
(Percentage points from steady state)



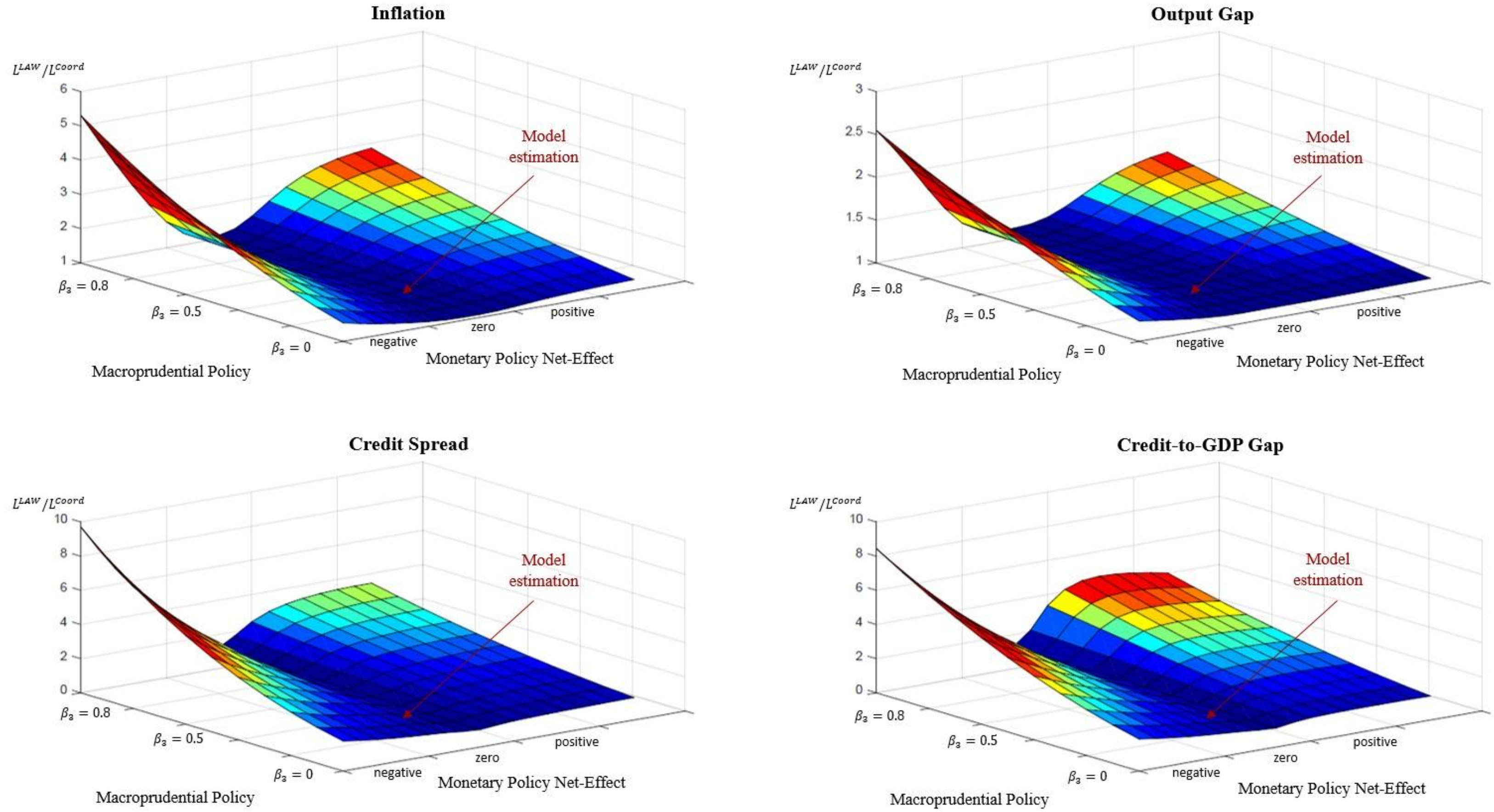
Source:Authors'estimates.

Figure 7: Impulse Response to a One Standard Deviation Credit-to-GDP Gap Shock
(Percentage points from steady state)



Source:Authors'estimates.

Figure 8: Gains from policy instruments, L^{LAW}/L^{Coord}
(Financial shocks)



Source:Authors'estimates.

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