

CENTRE FOR APPLIED MACROECONOMIC ANALYSIS

The Australian National University



CAMA Working Paper Series

January, 2009

FINANCIAL INSTABILITY PREVENTION

Andrew Hughes Hallett
George Mason University

Jan Libich
La Trobe University

Petr Stehlik
University of West Bohemia

CAMA Working Paper 14/2009
<http://cama.anu.edu.au>

Financial Instability Prevention¹

Andrew Hughes Hallett²

George Mason University, School of Public Policy, and CEPR

Jan Libich³

La Trobe University and CAMA

Petr Stehlík⁴

University of West Bohemia

Abstract

The paper attempts to assess to what extent the central bank or the government should respond to developments that cause *financial instability*, such as housing or asset bubbles, overextended fiscal policies, or excessive public or household debt. To analyze this question we set up a simple reduced-form model in which monetary and fiscal policy interact, and consider several scenarios with both benevolent and idiosyncratic policymakers. The analysis shows that the answer depends on certain characteristics of the economy, as well as on the degree of ambition and conservatism of the two policymakers. Specifically, we identify circumstances under which financial instability prevention is best carried out by: (i) both monetary and fiscal policy ('sharing'), (ii) only one of the policies ('specialization'), and (iii) neither policy ('indifference'). In the former two cases there are circumstances under which either policy should be more pro-active than the other, and also circumstances under which fiscal policy should be ultra-active: ie care about nothing but the prevention of financial instability. These results are important in the context of the current crisis. We also show that neither the government nor the central bank should be allowed to freely select the degree of their activism in regard to financial instability threats. This is because of a moral hazard problem: both policymakers have an incentive to be insufficiently pro-active, and shift the responsibility to the other policy. Such behaviour has strong implications for the optimal design of the delegation process.

Keywords: financial instability, fiscal-monetary policy interaction, asset prices, public debt, deficit. **JEL classification:** E42, E61

¹We gratefully acknowledge the support by the Australian Research Council (DP0879638), and the Ministry of Education, Youth and Sports of the Czech Republic (MSM 4977751301).

²School of Public Policy, George Mason University Fairfax, VA 22030, USA, phone: 703-993-9123, fax: 703-993-2284; and University of St Andrews. Email: ahughesh@gmu.edu.

³Corresponding author: La Trobe University, School of Business, Melbourne, Victoria, 3086, Australia. Phone: (+61) 3 94792754, Fax: (+61) 3 94791654, Email: j.libich@latrobe.edu.au.

⁴University of West Bohemia, Univerzitní 22, Plzeň, 30614, Czech Republic. Phone: (+420) 777 846 682, Fax: (+420) 377 632 602, Email: pstehlik@kma.zcu.cz.

1. INTRODUCTION

Policymakers have long been concerned with the issue of whether fluctuations of various classes of asset prices, as an indicator of inflation, or of financial fragility, should be taken into account when setting monetary or fiscal policies. And if so, how?

The current global financial crisis has highlighted the importance of re-examining these questions. The main objective of the paper is therefore to formally model them, and assess to what extent, if at all, the central bank and the government should take into account potentially destabilizing developments such as bubbles in the asset and housing markets, or excessive public and household debt.

In doing so our focus is ex-ante rather than ex-post. We attempt to derive the optimal degree of ‘financial instability (pro)activism’ of monetary and fiscal policies that avoids a potential crisis. Our analysis will therefore not provide insights into how to deal with the current situation, or previous episodes such as the 1930s slump or the Japanese depression of the 1990s.

Whether policymakers should respond to asset prices has been examined a number of times in the academic literature, and the consensus view has been remarkably clear. Movements in asset prices should not be included in monetary policy rules since, if inflation is being targeted and predicted correctly, the additional welfare benefits of doing so are minimal. Indeed it could have damaging side effects. Perhaps the most definitive statement of this view comes from Bernanke and Gertler (2001) who argue that: *‘Once the predictive content of asset prices for inflation has been accounted for, there should be no additional response of monetary policy to asset price fluctuations’*. Many other papers reach the same view: for example Vickers (2000), Filardo (2000) who tests the ideas put forward in Goodhart (1995), Mishkin (2001), Gilchrist and Leahy (2002), Faia and Monacelli (2007).

Based on the findings of this stream of literature, financial instability has been given little role institutionally as far as real world policymakers are concerned. Nevertheless, as Bernanke and Gertler (2001) themselves note, there are various qualifiers to this standard view. Some authors have stressed that these qualifiers could prove important under certain circumstances; and that having policies react to asset price changes, misalignments or bubbles is likely to be helpful for that reason. Cecchetti et al (2002) for example argue that central banks need to react differently to asset price misalignments than to changes that are driven by fundamentals (‘normal’ times). Since central banks can presumably detect fundamentals, this should be possible without imposing target values for asset prices.

Similarly Bordo and Jeanne (2002), in investigating the circumstances in which asset price reversals can have a serious effect on real activity, find that whether including asset prices in the policy rule is helpful or not depends on the prevailing economic conditions in a complex, non-linear way; and the European Central Bank, at least, appears to have reacted to asset prices (Silklos and Bohl (2009)).

Implicitly Bean (2003) comes to a similar conclusion when he argues that monetary policy needs only adequate inflation forecasts, but comments that a credit crunch or financial imbalances might affect policy in subtle ways since price stability does not in itself ensure financial stability or a low impact on activity levels. Bean therefore recommends a closer look at cases where credit expansion and asset price movements signal financial imbalances rather than a response to changes in the fundamentals.

Given these qualifiers, and in the light of the unusual financial instability of the past two years, it is important to look again at the desirability of giving various asset price movements a role in the setting of macroeconomic policies. To do so we use a simple theoretical model, as the above cited papers do, although for reasons of transparency and simplicity we use a reduced-form model rather than the structural models of those references. This is motivated by what we know from past work which shows that, if there is a role for financial instability activism, it is likely to be complex and nonlinear. Hence transparency and the ability to generate analytic insights from our results will be at a premium. In addition, we adopt a general instability measure that could be interpreted broadly as a monetary aggregate; or asset prices, house prices, public or private debt, budget deficit etc.

While the details of the model will be given later, let us note that there will be no additional policy instrument to achieve the financial stability goal (in the spirit of Tinbergen (1952)). Nevertheless, we are able to show that under some (but not all) circumstances social welfare can still be improved using the existing two instruments: monetary and fiscal policy. The improvement is achieved by a change in the optimal responses of the two policies to main macroeconomic variables.

Our analysis emphasizes four key conclusions. First, any need for policies designed to safeguard financial stability will be generated by the government's (public's) 'ambition' for outcomes in the real economy that cannot be sustained over the long-term. In a reduced-form analysis, these can be modelled as the society's and/or government's output target above the potential level. In the absence of excessive ambition no extra instability activism is needed, as in the standard view.

Second, financial instability affects the policymakers' utility both directly and indirectly. In terms of the indirect effect, a policy of leaning against instability alters macroeconomic outcomes, and hence the utility of the policymakers. In terms of the direct effect, if policymakers admit that financial stability is important (by attending to it), then a given deviation from it will cause great disutility to them – as we can see in the present crisis. This is how we incorporate financial instability activism in the model - it enters as a parameter in the policy objective function (and hence expresses both the degree of activism and aversion to financial instability).

Third, we show that whether or not it is socially optimal that monetary and fiscal policies should respond to financial instability factors depends on a number

of variables describing the economy and the policymakers' (society's) preferences. In particular, we find that under some circumstances the threat of financial instability is best countered by: (i) both monetary and fiscal policy (sharing scenario), (ii) only one of the two policies (specialization scenario), (iii) neither policy (indifference scenario). Interestingly, in scenarios (i)-(ii), under some circumstances monetary policy should be more instability pro-active than fiscal policy, and under others the reverse is true. In fact, under some parameter values we find that the optimal fiscal policy is 'ultra-active', and should respond to nothing but potential financial instability determinants.

Fourth, we show that the implementation of such optimal setting may be 'difficult'. By difficult we mean that the natural aversion to further interventions (a combination of the cost of an additional use of the existing instruments, and the diversion of policy effort from the core targets of inflation and output) may lead both the government and central bank to be insufficiently pro-active in avoiding financial instability, and to try to shift the responsibility to the other policy. Put differently, due to the inherent moral hazard problem, neither the monetary nor the fiscal policymakers should be allowed to select the degree of their financial instability pro-activism freely.

We consider two alternatives for the delegation process from the perspective of social welfare. In the scenario with monetary dependence, the government selects the degree of pro-activism for itself as well as for the central banker. But in our independence scenario the central banker chooses its own degree of financial instability pro-activism. It is shown that while each delegation scenario may Pareto-dominate the other in terms of social welfare under certain circumstances, the independence scenario is a more robust regime because the central bank can then 'force' the government to become pro-active, and therefore help in the defence of financial stability.

The rest of the paper is structured as follows. Section 2 presents the model. Section 3 describes the delegation scenarios of interest and their timing. Section 4 reports the results, separately for the various scenarios, and provides their comparison from the social welfare point of view. Section 5 summarizes and concludes.

2. MODEL

Our aim is to provide some basic insights into financial instability activism of the policymakers - both from the normative and positive perspective. The former perspective refers to the socially optimal levels of activism, whereas the latter refers to the levels that are likely to obtain in the real world under existing delegation procedures.

In order to be able to derive clear analytical results, we will use a reduced-form macroeconomic framework rather than a general equilibrium model. This is a deliberate choice. The model we use has well-known micro foundations, and its parameters can be derived from (are functions of) the deep parameters of

the underlying microeconomic relations. Put differently, there exists a mapping between the micro-founded and reduced-form models.⁵

2.1. Preferences. The policymakers' and society's period utility functions feature three 'stabilization' components⁶

$$(1) \quad u_{i,t} = -\beta_i(x_t - x_i^T)^2 - (\pi_t - \pi_i^T)^2 - \lambda_i(g_t - g_i^T)^2,$$

where i is the set of players, $i \in \{F, M, S\}$, such that F is the fiscal policymaker (the government), M is the monetary policymaker (the central bank), and S is the social planner (the public). The x, π, g variables denote the output gap, inflation, and *asset growth in real terms* (as described above), and x^T, π^T, g^T denote the respective targets. We will refer to the relative weights between them, $\beta > 0, \lambda \geq 0$, as the degrees of *conservatism* and *financial instability (f-instability) activism* respectively.

The fact that the policymakers are averse to f-instability can also be interpreted as *future* considerations about the former two objectives - an attempt to avoid potential imbalances. Specifically, excessively volatile or rapid growth in some financial and real variables is likely to cause more volatile inflation and output further down the track, and hence is already a reason for concern in the present. We will refer to the cases $\lambda = 0$, $\lambda \in (0, \infty)$, and $\lambda = \infty$ as the policymaker being *passive*, *active*, and *ultra-active* (in regards to f-instability prevention) respectively.⁷

In order to limit the degree of heterogeneity, and better identify the main driving forces, let us assume that the latter two targets are common across players, and normalize them to zero

$$(2) \quad \forall i, \pi_i^T = 0 = g_i^T.$$

In contrast, we allow for $x^T \geq 0$, referring to x^T as the degree of *ambition*, and distinguishing two types of players (from a Friedmanite perspective): *responsible* with $x^T = 0$, and *ambitious* with $x^T > 0$. We will further streamline the analysis by focusing on the scenario which is typically of most concern, in which the central bank is responsible, but the government is ambitious. The society may be responsible or ambitious, ie

$$(3) \quad x_S^T \geq x_M^T = 0 < x_F^T.$$

⁵While there are limitations of such reduced-form approach (which we fully acknowledge), and potential implications for robustness, it will nevertheless become apparent that our main insights are independent of the structure of the macroeconomic setting. Therefore, we believe that in the interests of simplicity, and to maximize the insights that can be derived, the reduced-form model is justified.

⁶The players can be thought of as discounting the future in a multiperiod criterion, but it will become apparent that this does not affect the nature of our results. Further, see Woodford (2003) on how the first two elements can be derived from microfoundations.

⁷Note that our meaning is different from the active/passive labels used by Leeper (1991).

2.2. **Economy.** The analysis requires a model in which both M and F policies can affect, either directly or indirectly, all three targeted variables. Many macroeconomic models would satisfy this requirement. For reasons explained above we will use the simplest possible setting with these properties, specifically the following Lucas type supply curve⁸

$$(4) \quad x_t = \mu(\pi_t - \pi_t^e) + \rho(G_t - \pi_t).$$

The π^e variable denotes inflation expectations that are formed rationally by private agents. The G variable is the instrument of F policy, which should be interpreted broadly as the *long-run stance* of F policy. It can be thought of as all the F settings that affect *present* or *future* revenues and expenditures. The former could be summarized by the average size of the budget deficit, or the growth rate of nominal debt as a percentage of GDP. The latter should also include demographic factors that affect future welfare, medicare and pension expenditures, as well as the expected value of potential government guarantees for private firms etc).

The specification in (4) postulates that the real economy is affected by F policy in real terms, which is the case in most models. Intuitively, inflation reduces the purchasing power of the government's handout, lowering its income effect, and hence the stimulus made to consumption and investment. The specification also implicitly assumes that the economy exhibits some non-Ricardian features (eg naïve voters or borrowing constraints).

In terms of M policy, we assume the central bank to directly use π as its instrument, which is reasonable due to our focus on the steady-state outcomes. The parameters $\mu > 0$ and $\rho > 0$ will hence be referred to as the *potency of M* and F policy respectively. Excessively expansionary, excessively contractionary, and balanced F and M policy can therefore be described by $G > 0$, $G < 0$, and $G = 0$ respectively for the former policy, and $\pi > 0$, $\pi < 0$, and $\pi = 0$ for the latter.

The final relationship needed is a linkage between the policies and f-instability. This is provided by assuming that asset growth is directly fueled by excessive F policy in real terms, ie

$$(5) \quad g_t = G_t - \pi_t.$$

Instead of directly modeling the long-term budget constraint of the government, the fact that F policy cannot boost output forever is indirectly summarized in the f-instability aversion of the players.⁹

Let us sum up the influence of the policies on the three targeted variables. Both M and F policies affect x through (4), and g through (5). Because of these two effects, the policies also indirectly (through their reaction functions) influence each

⁸Since we are interested in steady-state outcomes, including a shock in (4) would not alter our conclusions in any way.

⁹This is realistic. Due to the short political cycle, many current governments (even in industrial countries) do not behave as if they were factoring in the long-term budget constraint.

other's optimal instrument setting, π^* and G^* , as will become evident in Section 4.1.

3. SCENARIOS AND TIMING

We assume that the central bank has *full instrument-independence* from the government, ie it can choose π optimally given its own objectives. In terms of either player's f-instability activism λ_M and λ_F , we assume that those parameters are chosen simultaneously at the beginning of the game, and then apply throughout the whole game (ie they are constant). We will consider three different scenarios in terms of which player chooses these values.

- (1) *Welfare scenario, W*: Both λ_M and λ_F are chosen by S ;
- (2) *(Goal)-Independence scenario, I*: λ_M is chosen by M and λ_F is chosen by F ;
- (3) *(Goal)-Dependence scenario, D*: Both λ_M and λ_F are chosen by F .

In all scenarios, observing the λ choices, the players set their instruments each period in a discretionary fashion. This again happens under imperfect information, ie simultaneously, and gets repeated every period.¹⁰

The welfare scenario provides the normative benchmark case. This is because the social planner optimally chooses to delegate the degree of f-instability activism to M and F in the proportion that maximizes social welfare. Put differently, these are the values that would win an election, see Demertzis et al. (2004).

The I and D scenarios present the positive view, ie provide two alternatives of how f-instability activism can and has been implemented institutionally in the real world. The former seems more likely to be the case in industrial countries, whereas the latter in developing countries. We will see below that the socially optimal values derived in the W scenario often do *not* obtain in the I and D scenarios due to a *moral hazard* problem on the part of the policymakers.

This is because they not only take into account the effect of their λ on macroeconomic outcomes (and hence *indirectly* on their utility), but also the effect on the magnitude with which their utility will be *directly* affected by their λ - for a given set of macroeconomic outcomes. Therefore, a higher λ may lead to an improvement in social welfare, but still lower the utility of the respective policymaker, who hence has an incentive to choose a suboptimally low λ .

This can happen in two ways. A higher λ may produce higher social welfare but affect the distribution of gains in utility to the disadvantage of some players. Or a higher λ may decrease the spillovers between players, but not by enough to compensate for the loss in their private objectives (Hughes Hallett, (1992)).

¹⁰In our companion work without f-instability activism, Libich, Hughes Hallett and Stehlik (2007) and Libich and Stehlik (2008), we allow for a more general timing that whereby the players' actions may feature some rigidity and/or commitment, ie they do not necessarily happen simultaneously every period. In order to separate the impact of such asynchronous timing from the effect of f-instability activism we do not pursue this avenue here.

4. RESULTS

In presenting the results of our analysis, Section 4.1 will first derive the optimal setting of the policy instruments and the resulting macroeconomic outcomes - treating λ s as exogenous. Sections 4.2-4.4 then endogenize the λ s and report their equilibrium values and related outcomes - separately for the three considered scenarios W , I , and D .

4.1. Instrument Setting and Macroeconomic Outcomes. In order to derive the macroeconomic outcomes, under all scenarios, we need to solve backwards, treating the λ s as exogenous. Using the players' preferences in (1)-(3) together with the supply constraints (4)-(5), we get the following policy reaction functions under rational expectations

$$(6) \quad \pi_t = \frac{G_t [\rho\beta_M(\rho - \mu) + \lambda_M]}{1 + \rho\beta_M(\rho - \mu) + \lambda_M} \quad \text{and} \quad G_t = \frac{\pi_t(\lambda_F + \rho^2\beta_F) + \rho\beta_F x_F^T}{\lambda_F + \rho^2\beta_F}.$$

Note that even if the policies are formally instrument-independent as we assume, they are still inter-dependent - through spillovers in the economic outcomes. Put differently, the optimal setting of each policy is, for almost all parameter values, a function of the other policy's choice. Solving the reaction functions jointly we obtain the equilibrium macroeconomic outcomes as follows

$$(7) \quad \pi_t^* = [\beta_M\rho(\rho - \mu) + \lambda_M] \frac{x_F^T\beta_F\rho}{\beta_F\rho^2 + \lambda_F} \quad \text{and} \quad G_t^* = [\beta_M\rho(\rho - \mu) + 1 + \lambda_M] \frac{x_F^T\beta_F\rho}{\beta_F\rho^2 + \lambda_F},$$

$$(8) \quad g_t^* = \frac{x_F^T\beta_F\rho}{\beta_F\rho^2 + \lambda_F} \quad \text{and} \quad x_t^* = \frac{x_F^T\beta_F\rho^2}{\beta_F\rho^2 + \lambda_F},$$

Note that if $x_F^T = 0$, all variables are at their optimal long-run values, and thus there exist no imbalances. Since the driving force of financial instability disappears in such case, there is no need for policy activism. The rest of the results section therefore considers the $x_F^T > 0$ case.

4.2. Welfare Scenario, S . To derive the equilibrium outcomes of this benchmark case, move backwards and substitute all equilibrium values from (7)-(8) into $u_{S,t}$. Then take derivatives with respect to both λ_M and λ_F , set them equal to zero, and solve them jointly. Doing so yields the following socially optimal degrees of M and F f-instability activism

$$(9) \quad \lambda_M^W = \begin{cases} \beta_M\rho(\mu - \rho) & \text{if } \rho < \mu, \\ 0 & \text{if } \rho \geq \mu. \end{cases}$$

$$(10) \quad \lambda_F^W = \begin{cases} \beta_F \left[\frac{x_F^T(\lambda_S + \beta_S\rho^2)}{x_S^T\beta_S} - \rho^2 \right] & \text{if } x_S^T > 0, \\ \infty & \text{if } x_S^T = 0. \end{cases}$$

Our first proposition summarizes the possible types of outcomes.

Proposition 1. *In the welfare scenario, there are circumstances under which: (i) both policies should be passive (the **indifference** region), (ii) one policy should be active and the other passive (the **specialization** region); (iii) both policies should be active (the **sharing** region), and in the latter two regions, (iv) either policy should be **more active** than the other, and (v) fiscal policy should be **ultra-active**.*

Proof. The proposition claims that there exist parameter values under which we obtain (i) $\lambda_M^W = 0 = \lambda_F^W$, (ii) $\lambda_M^W > 0 = \lambda_F^W$ or $\lambda_M^W = 0 < \lambda_F^W$, (iii) $\lambda_M^W > 0 < \lambda_F^W$, (iv) $\lambda_M^W > \lambda_F^W$ or $\lambda_M^W < \lambda_F^W$, and (v) $\lambda_F^W = \infty$. It is straightforward to derive these from (9)-(10), setting up the relevant inequalities.

Specifically, the indifference region (i) obtains if and only if $x_F^T < x_S^T$ and $\rho \geq \max \left\{ \mu, \sqrt{\frac{\lambda_S x_F^T}{\beta_S (x_S^T - x_F^T)}} \right\}$. The specialization region (ii) in which F policy is active and M policy is passive occurs either if $x_F^T \geq x_S^T > 0$ and $\mu \leq \rho$; or if $x_F^T < x_S^T$ and $\rho \in \left[\mu, \sqrt{\frac{\lambda_S x_F^T}{\beta_S (x_S^T - x_F^T)}} \right)$; or if $x_F^T < x_S^T$ and $\rho < \sqrt{\frac{\lambda_S x_F^T}{\beta_S (x_S^T - x_F^T)}}$. The specialization region (ii) in which the roles are reversed occurs if $x_F^T < x_S^T$ and $\rho \in \left(\sqrt{\frac{\lambda_S x_F^T}{\beta_S (x_S^T - x_F^T)}}, \mu \right)$. The sharing region (iii) obtains either if $\mu > \rho$ and $x_F^T \geq x_S^T > 0$; or if $x_F^T < x_S^T$ and $\rho < \min \left\{ \mu, \sqrt{\frac{\lambda_S x_F^T}{\beta_S (x_S^T - x_F^T)}} \right\}$. In terms of (iv), for F policy to be more active than M policy it is - in addition to the conditions ensuring the specialization or sharing regions (ii)-(iii) - required that

$$\lambda_S > \tilde{\lambda}_S = \frac{\beta_S \beta_M x_S^T \rho (\mu - \rho) + \beta_F \beta_S \rho^2 (x_F^T + x_S^T)}{\beta_F x_F^T}.$$

The roles are reversed if $\lambda_S < \tilde{\lambda}_S$, and the policies are equally active if $\lambda_S = \tilde{\lambda}_S$. Finally, (v) can be seen by inspection of (10). \square

Corollary 1. *There exist a range of circumstances under which society finds it optimal appointing M and F policymakers that are both: (i) active even if society fully disregards f -instability, $\lambda_S = 0$, and (ii) passive even if society is averse to f -instability, $\lambda_S > 0$.*

The proposition and the corollary suggest that it is by no means obvious which policy, if any, *should* react to f -instability, and how strongly so.¹¹ They demonstrate that the answer depends on several variables describing the economy and the preferences of the players (as discussed above, in a richer micro-founded model all these reduced-form variables are further functions of the deep parameters).

¹¹This is the normative conclusion. The next section presenting the Independence scenario will show that the positive conclusion is analogous. It demonstrates that it is by no means obvious which policy, if any, *will* react to f -instability, since all the three regions can still obtain.

The following results help us understand better the intuition behind the optimal degrees of f-instability activism - by highlighting its macroeconomic role and effects.

Proposition 2. *In the welfare scenario, the degree of M f-instability activism is weakly decreasing in the bank's conservatism, implying their **substitutability**.*

Proof. By inspection of (9). □

Intuitively, λ_M is a substitute for M policy conservatism as it brings inflation closer to the inflation target, see (7). Note that since all three elements of the utilities are quadratic, it is optimal to 'spread the load' between the three stabilization objectives.

Proposition 3. *In the welfare scenario, the degree of F f-instability activism is weakly: (i) increasing in λ_S , $\frac{x_F^T}{x_S^T}$, ρ , and β_F (the latter implying its **substitutability** with F conservatism); (ii) decreasing in β_S (implying its **complementarity** with society's conservatism); and (iii) independent of M policy preferences (including M f-instability activism).*

Proof. By inspection of (10). □

Intuitively, the greater the potency and ambition of F policy, and the lower the government's conservatism, the greater degree of F f-instability activism λ_F^W will be delegated. This is because such government tends to run a more expansionary F policy, ceteris paribus, and only a higher λ_F^W will tame the government's expansionary (and financial sector destabilizing) efforts.

The optimal λ_F^W is further increased if the society is more averse to f-instability, and less ambitious. In the case in which the society is responsible, it finds it optimal to delegate an ultra-active government in terms of f-instability (and this is can be even under $\lambda_S = 0$). Fiscal activism then offsets F ambition, and achieves both real asset growth and inflation on target.

It is important to note that if the government's preferences are fully in line with society's, $x_F^T = x_S^T$ and $\beta_F = \beta_S$, then we obtain $\lambda_F^W = \lambda_S$, which is intuitive. The results however demonstrate that society may find it difficult to 'institutionalize' the socially optimal objectives, and legislate certain λ_F and λ_M values. This is because these values depend on a number of parameters that may change over time. Therefore, in the real world the degrees of M and F activism are chosen either both by the government (the dependence scenario), or by the central bank and the government respectively (the independence scenario).

4.3. Independence Scenario, I. In this scenario each policymaker chooses independently (and simultaneously) their own λ values. Analogously to the welfare case, to do this substitute all equilibrium outcomes from (7)-(8) into $u_{M,t}$ and $u_{F,t}$, differentiate with respect to λ_M and λ_F respectively, and set equal to zero to

obtain the reaction functions (we only report the F policy one that will be used below)

$$(11) \quad \lambda_F = 2\lambda_M^2 + 4\beta_M\lambda_M\rho(\rho - \mu) + k \quad \text{where} \quad k = \rho^2 (2\beta_M^2 (\mu - \rho)^2 - \beta_F),$$

Solving the reaction functions jointly yields

$$(12) \quad \lambda_M^I = \begin{cases} \lambda_M^W - \frac{1}{2} & \text{if } \rho < \mu, \\ 0 & \text{if } \rho \geq \mu. \end{cases}$$

$$(13) \quad \lambda_F^I = \begin{cases} \frac{1}{2} - \beta_F\rho^2 & \text{if } \rho < \sqrt{\frac{1}{2\beta_F}}, \\ 0 & \text{if } \rho \geq \sqrt{\frac{1}{2\beta_F}}. \end{cases}$$

Proposition 4. *The indifference, specialization, and sharing regions reported in Proposition 1 for the welfare scenario can all obtain in the Independence scenario as well. In the latter region either policy may be more active than the other, but it is never the case that a policy is ultra-active.*

Proof. These existence claims are proven by inspection of (12) and (13). In particular, the indifference region obtains under $\rho \geq \max\left\{\mu, \sqrt{\frac{1}{2\beta_F}}\right\}$. The specialization region of F policy obtains if $\rho \in \left[\mu, \sqrt{\frac{1}{2\beta_F}}\right)$, whereas M policy specialization obtains under $\rho \in \left[\sqrt{\frac{1}{2\beta_F}}, \mu\right)$. The sharing region occurs iff $\rho < \min\left\{\mu, \sqrt{\frac{1}{2\beta_F}}\right\}$. Intuitively, the three regions obtain under large, medium, and small values of ρ respectively.

In terms of the degree of activism, F is more active than M if, in addition to the sharing region constraints, $\beta_F < \beta_M \left(1 - \frac{\mu}{\rho}\right) + \frac{1}{2\rho^2}$. Reversing the inequality also reverses the relative magnitudes of activism. Finally, the expressions in (12)-(13) show that $\max\{\lambda_M^I, \lambda_F^I\} < \infty$ for all parameter values, ie there exist no circumstances under which the degree of activism is infinite. \square

Proposition 5. *In the independence scenario: F f-instability activism is, from the government's perspective, a **complement** to F conservatism, which is **in contrast** to society's perspective of Proposition 2. M f-instability activism meanwhile is, from the central bank's perspective, a **substitute** to M conservatism, which is **in line** with to society's perspective of Proposition 3.*

Proof. In terms of F policy, (13) shows that λ_F^I is non-increasing in β_F whereas (10) shows that λ_F^W is non-decreasing in β_F . In terms of M policy, (9) and (12) show that both λ_M^W and λ_M^I are non-decreasing in β_M . \square

The difference in the setting of F policy is due to the fact that in the independence scenario λ_F affects F 's utility not only indirectly (through macroeconomic outcomes), but also directly (via the magnitude with which a given outcome is

‘felt’ by the government). If F is ambitious and insufficiently conservative, she will produce inferior outcomes - excessively volatile asset growth to achieve its output objectives. She will therefore choose a low λ_F to ‘avoid responsibility’ for these outcomes.

As a matter of practical M policy making, the central banker may utilize the substitutability and find it ‘politically more convenient’ to select a higher λ_M rather than a lower β_M . This is especially true in turbulent situations such as the current financial crisis in which the society’s f-instability aversion, λ_S , is high.

Proposition 6. *In the independence scenario, M can indirectly induce F policy to be active.*

Proof. To see this existence claim, examine the F reaction function λ_F reported in (11). The fact that λ_F is a function of λ_M , and that for all parameter values there exist a sufficiently large λ_M that yields a positive λ_F , completes the proof. \square

In order to better understand this inducement, and more generally the incentives of the government in setting λ_F^I , let us examine (11) in more detail. We can also think of the following exercise as the case in which the government knows that the central bank does not choose λ_M optimally, but in some arbitrarily fashion.¹²

The reaction function (11) shows that the optimal λ_F^I is a quadratic function of λ_M . It implies that under some parameter values λ_F^I is monotonically increasing in λ_M , whereas under others the relationship is *non-monotone*.

Specifically, in the case of $\rho < \mu$ and $k > 0$ (which can obtain for any combination of β_M and β_F), the quadratic equation has two positive roots, meaning that λ_F^I is: (i) decreasing in λ_M for values below a certain threshold, (ii) increasing in λ_M for values above a certain threshold, and (iii) independent of λ_M for values between the thresholds. An example is plotted in Figure 1.

Let us discuss the intuition behind the λ_F^I vs λ_M relationship - from the government’s perspective - by using the π_t^* , x_t^* and g_t^* values derived in (7)-(8). Each change in λ_F generally impacts the government’s utility in four respects - three indirect and one direct.

In terms of the indirect effects, λ_F determines π_t^* , x_t^* and g_t^* , and hence the gaps of these variables from their targets. In terms of the direct effect, λ_F is the magnitude with which the latter gap is felt by the government. Whether λ_F^I is positive or zero, and whether it is increasing or decreasing in λ_M , depends on the relative magnitudes of these four effects.

1) *Complementarity:* λ_F^I is increasing in λ_M . In this case (that obtains for a large part of the parameter space), λ_M is sufficiently high so that it tends to increase π_t^* . The government does not like that but faces a tradeoff. By increasing λ_F the government counter-acts this and reduces π_t^* closer to the target. Another

¹²This has arguably been the case in the real world up until the current financial crisis, whereby central banks have commonly chosen to be passive and disregard financial instability.

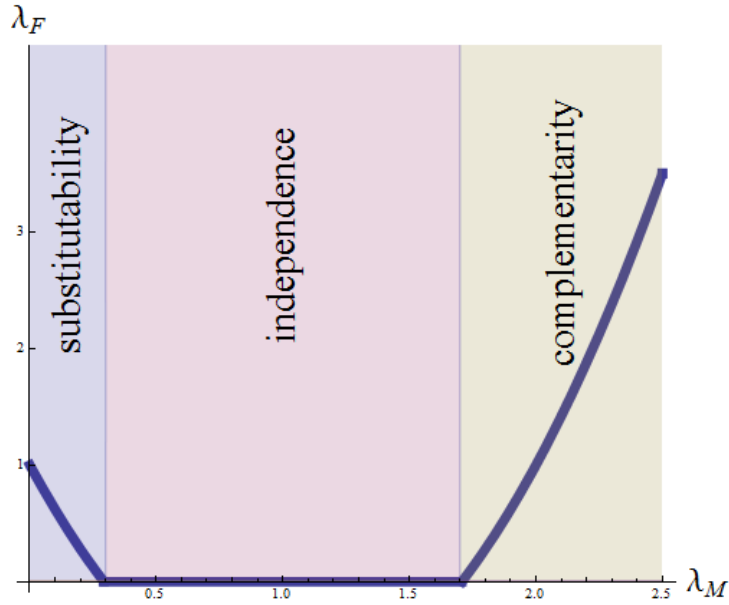


FIGURE 1. An example of λ_F^I as a function of λ_M for values $\beta_M = 1$, $\beta_F = 1$, $\rho = 1$, and $\mu = 2$.

positive side-effect of such action is that a higher λ_F reduces real asset growth, and hence brings it closer to its target g_F^T . But by raising λ_F a unit deviation from this target now causes a higher disutility. Furthermore, a higher λ_F reduces x_t^* and moves it further away from the target x_F^T (it can be easily shown that $x_t^* \leq x_F^T$ for all $\lambda_F \geq 0$). We can therefore conclude that in this region the former two effects dominate the latter two, and F hence ‘helps’ M achieve the inflation target.

2) *Substitutability*: λ_F^I is decreasing in λ_M . The advantage of a lower λ_F in this case, in addition to the fact that a unit f-instability is less painful, is the fact that a lower λ_F increases x_t^* closer to its target. One disadvantage of lower λ_F is the fact that it reduces π_t^* further away from the target (the parameters of this case generate deflation, and lower λ_F makes the deflation even stronger). Another downside is that g_t^* will move further away from its target. In this case however the former two effects dominate, and F therefore makes it harder for M to achieve the inflation target.

3) *No relationship*: λ_F^I is not a function of λ_M . This case is a combination of the other two, in which the best thing the government can do for itself is to be passive and disregard f-instability altogether.

4.4. Dependence Scenario, D. In this scenario, the government is choosing its own λ_F , while delegating λ_M to the central bank. Analogously to the welfare case, substitute all equilibrium outcomes from (7)-(8) into $u_{F,t}$, differentiate with respect

to λ_M and λ_F , set equal to zero, and solve jointly to obtain

$$(14) \quad \lambda_M^D = \lambda_M^W,$$

$$(15) \quad \lambda_F^D = 0.$$

Proposition 7. *In the dependence scenario, the government will choose its own activism that is **less than** or equal to what the government (i) delegates to the central bank, $\lambda_F^D \leq \lambda_M^D$, and (ii) chooses for itself in the independence scenario, $\lambda_F^D \leq \lambda_F^I$.*

Proof. By inspection of (9), (13), and (14)-(15). \square

The proposition demonstrates that the government has an incentive to ‘pass the buck’, and leave it up to the central bank to deal with the consequences of its excessively ambitious actions. Put differently, the government realizes that it will be necessary to reduce any excessive asset growth of its own making, but refuses to bear the real costs of doing so. An analogous result can now be reported about M policy.

Proposition 8. *In the independence scenario, the central bank will choose its activism that is **less than** or equal to both the socially optimal degree, and the degree chosen by the government under dependence, ie $\lambda_M^D = \lambda_M^W \geq \lambda_M^I$.*

Proof. By inspection of (9), (12), and (14). \square

The following result combines the previous two propositions. It reveals that under some circumstances the government’s self selected λ_F^I may still be above the socially optimal λ_F^W , in order to compensate for the suboptimally low λ_M^I level.

Proposition 9. *The government’s chosen f-instability activism in the independence scenario may be higher than the one delegated in the welfare scenario, $\lambda_F^I > \lambda_F^W$.*

Proof. Inspection of (10) and (13) reveals that $\lambda_F^I > \lambda_F^W$ obtains iff

$$(16) \quad x_S^T \beta_S > 2\beta_F x_F^T (\lambda_S + \rho^2)$$

In words, the values of $\lambda_S, \beta_F, x_F^T$, and ρ have to be (jointly) sufficiently small relative to x_S^T and β_S for this to happen. For all other parameter values the government’s f-instability activism will be below (or equal to) the socially desirable level. \square

Thus while the government tends to delegate some of its own f-instability activism to the central bank in the dependence scenario (Proposition 7), in the independence scenario the government’s influence over the central bank is limited. Since an independent bank is inclined to be less active than it should (Proposition 8), the government sometimes needs to step in and make up for it.

The inequality in (16) implies that such situation for example happens if the government is more conservative and less ambitious than the society (that is not very averse to f-instability). It also implies that if the society is responsible than such situation never occurs.

4.5. Optimal Institutional Design. The following proposition summarizes the welfare implications of the two regimes in terms of f-instability assignments.

Proposition 10. *Assume $\rho < \min \left\{ \mu, \sqrt{\frac{1}{2\beta_F}} \right\}$. There exists a threshold $\bar{\lambda}_S$ such that: (i) for all $\lambda_S > \bar{\lambda}_S$ the independence scenario Pareto-dominates the dependence scenario in terms of social welfare: $u_S^I > u_S^D$; (ii) for all $\lambda_S < \bar{\lambda}_S$ the reverse is true; and (iii) for $\lambda_S = \bar{\lambda}_S$ the two scenarios yield identical welfare outcomes. In that case the institutional setup is irrelevant, which is also true, for any λ_S , under $\rho \geq \max \left\{ \mu, \sqrt{\frac{1}{2\beta_F}} \right\}$.*

Proof. Inspection of (12)-(13) and (14)-(15) shows that under $\rho < \min \left\{ \mu, \sqrt{\frac{1}{2\beta_F}} \right\}$, we have $\min \{ \lambda_F^I, \lambda_M^I, \lambda_M^D \} > 0$. In order to compare social welfare from the two scenarios substitute all the equilibrium outcomes including λ_S into u_S^I and u_S^D respectively. Then to derive the threshold $\bar{\lambda}_S$ that divides the parameter space into the three reported cases impose $u_S^I = u_S^D$. This yields

$$\bar{\lambda}_S = \frac{\beta_S \rho^2 (x_F^T - 2x_S^T + 4x_S^T \beta_F \rho^2) - x_F^T \beta_F^2 \rho^4 (1 + 4\beta_S \rho^2)}{4\beta_F^2 \rho^4 x_F^T - 1}.$$

For illustration, Figure 2 reports social welfare for the two scenarios (under selected parameter values), including the $\bar{\lambda}_S$ threshold. The final claim can again be seen from equations (12)-(13) and (14)-(15). They imply that under $\rho \geq \max \left\{ \mu, \sqrt{\frac{1}{2\beta_F}} \right\}$ the indifference region obtains for both scenarios, $\lambda_F^I = \lambda_F^D = \lambda_M^I = \lambda_M^D = 0$, and this is true for any λ_S . In such case all the macroeconomic outcomes in equilibrium are the same under both scenarios, which completes the proof. \square

Intuitively, under a sufficiently small ρ , the λ_M^I , λ_F^I , and λ_F^D values are positive but too low (below their assigned values in the welfare scenario λ_M^W and λ_F^W). When λ_S is large enough, then the fact that λ_F^D is lower (further away from λ_F^W) than λ_F^I is relatively more important than the fact that λ_M^I is lower than λ_M^D . Therefore, the independence scenario generates higher social welfare than the dependence scenario. For lower values of λ_S this is however reversed.

Remark 1. *A two-tier delegation delivers socially optimal outcomes. Society first imposes λ_F onto the government, and the government then imposes λ_M onto the central bank. If either player is allowed to choose their own degree of activism*

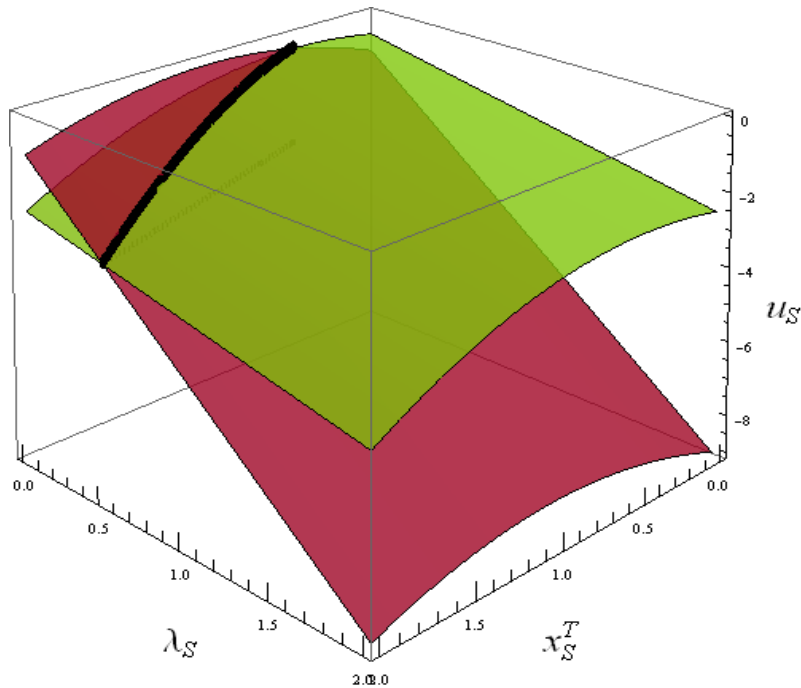


FIGURE 2. An example of social welfare in the D (red) and I (green) scenarios under $\rho = \frac{1}{2}$ and all other parameter values set to one. The threshold $\bar{\lambda}_S$ is indicated by the thick line.

λ , which is the case in both the independence and dependence scenarios, inferior outcomes will typically result.

5. SUMMARY AND CONCLUSIONS

The paper examines how strongly, if at all, monetary and fiscal policymakers should respond to phenomena that can cause imbalances and financial instability. In our reduced-form framework it is shown that the answer depends on a number of variables describing the economy and society's (or policymakers') preferences. It is further shown that if the government and the central bank choose the degree of their financial instability activism, socially inferior outcomes often result due to a moral hazard problem on their part. The precise structure of the delegation process therefore plays an important role in the preservation of financial instability.

6. REFERENCES

BEAN, C. R. (2003): "Asset Prices, Financial Imbalances and Monetary Policy: Are Inflation Targets Enough?," in *Asset Prices and Monetary Policy*. Sydney: Reserve Bank of Australia.

BERNANKE, B., and M. L. GERTLER (2001): "Should Central Banks Respond to Movements in Asset Prices?," *American Economic Review*, 91 (2), 253–257.

BORDO, M., and O. JEANNE (2002): "Monetary Policy and Asset Prices: Does Benign Neglect Make Sense?," *International Finance*, 5, 139-64.

CECCHETTI, S., H. GENBERG, and S. WADHWANI (2002): "Asset Prices in a Flexible Inflation Targeting Framework," in *Asset Price Bubbles: Implications for Monetary, Regulatory and International Policies*, ed. by Hunter, Kaufman, and Pomerleano. Cambridge, MA.: MIT Press.

FAIA, E., and T. MONACELLI (2007): "Optimal Interest Rates, Asset Prices and Credit Frictions," *Journal of Economic Dynamics and Control*, 31, 3228-54.

FILARDO, A. J. (2000): "Monetary Policy and Asset Prices," *Federal Reserve Bank of Kansas City Economic Review*, Q3, 11-37.

GILCHRIST, S., and J. LEAHY (2002): "Monetary Policy and Asset Prices," *Journal of Monetary Economics*, 49, 75-97.

GOODHART, C. (1995): "Price Stability and Financial Stability," in *The Central Bank and the Financial System*, ed. by Goodhart. Cambridge, MA: MIT Press.

LIBICH, J., A. HUGHES HALLETT, and P. STEHLÍK (2007): "Monetary and Fiscal Policy Interaction with Various Degrees and Types of Commitment," CEPR DP 6586.

LIBICH, J., and P. STEHLÍK (2008): "Macroeconomic Games on Time Scales," *Dynamic Systems and Applications*, 5, 274-278.

MISHKIN, F. S. (2001): "The Transition Mechanism and the Role of Asset Prices," Cambridge, MA: NBER Working Paper No 8617.

SIKLOS, P., and M. BOHL (2009): "Asset Prices as Indicators of Euro Area Monetary Policy: An Empirical Assessment of Their Role in a Taylor Rule," *Open Economies Review*, 20, 39-60.

VICKERS, J. (2000): "Monetary Policy and Asset Prices," *Manchester School*, 68, 1-22.