On the (non-)equivalence of capital adequacy and monetary policy: A response to Cechetti and Kohler

STAN DU PLESSIS AND GIDEON DU RAND

Stellenbosch Economic Working Papers: 04/11

KEYWORDS: MONETARY POLICY, INSTRUMENT PROBLEM, INTEREST RATES, ALTERNATIVE MONETARY POLICY INSTRUMENTS, BALANCE SHEET OPERATIONS, POLICY CO-ORDINATION
JEL: E52, E58, E61

STAN DU PLESSIS
DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH
PRIVATE BAG X1, 7602
MATIELAND, SOUTH AFRICA
E-MAIL: STAN@SUN.AC.ZA

GIDEON DU RAND
DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH
PRIVATE BAG X1, 7602
MATIELAND, SOUTH AFRICA
E-MAIL: GIDEONDURAND@SUN.AC.ZA

A WORKING PAPER OF THE DEPARTMENT OF ECONOMICS AND THE
BUREAU FOR ECONOMIC RESEARCH AT THE UNIVERSITY OF STELLENBOSCH

On the (non-)equivalence of capital adequacy and monetary policy: A response to Cechetti and Kohler

STAN DU PLESSIS AND GIDEON DU RAND

ABSTRACT

The instrument problem in monetary policy is back on the agenda. Until recently interest rate policy was widely thought to be sufficient for the attainment of appropriate monetary policy goals. No longer. In the wake of the international financial crisis there is much pressure on monetary authorities to incorporate the goal of financial stability more explicitly in policy. This requires an expansion of the instruments typically used by central banks. Cechetti and Kohler (2010) recently considered this new version of the instrument problem in monetary policy by analysing the distinct role and potential for co-ordinating (i) interest rates and (ii) capital adequacy requirements. In this paper we connect this modern debate with an earlier version of the instrument problem, famously discussed by Poole (1970). Then, as now (we claim), the main message of the analysis is the non-equivalence of these instruments and the structural features of the economy on the basis of which one would prefer a particular combination of these instruments. These results are demonstrated with a set of simulations. We also offer a theoretical criticism of the modelling approach used by Cechetti and Kohler (2010).

Keywords: Monetary policy, Instrument problem, Interest rates, Alternative monetary policy instruments, Balance sheet operations, Policy co-ordination

JEL codes: E52, E58, E61

1. Introduction

Forty years ago, William Poole published a paper titled "Optimal choice of monetary policy instrument in a simple stochastic macro model" that would later become famous. The paper addressed a controversy of the early 1970s that echoes in 2010: the choice of the appropriate monetary policy instrument or, specifically, the extent to which other instruments in addition to a short-term interest rate are necessary or desirable. The question is, if anything, even more important in the wake of the international financial crisis.

Following a financial crisis that has undermined a monetary policy consensus that drew at least partly on Poole's results, Cechetti and Kohler (2010) return to this theme, but with a twist . We offer a reading of the Cechetti and Kohler (2010) paper by starting with Poole's and then exploring how the concerns of the day found their way into their paper, before offering minor criticisms of their approach and suggesting some tentative alternatives.

2. The instrument problem in 1970

William Poole wrote his famous paper at a time of considerable uncertainty for monetary economists and central bankers: the Bretton-Woods system was in terminal decline, inflation was rising and the confidence of central bankers was ebbing. Of course, the decade would unfold with what Arthur Burns (1979) called the "anguish of central banking": the disconcerting realisation that central bankers had both the desire to attain the goals of monetary policy and apparently powerful policy tools at their disposal, and yet they failed dramatically to achieve these ends. The story of how central bankers overcame their anguish over the subsequent two decades has been told many times, especially by Marvin Goodfriend (e.g., 2007) and others (Svensson, 2006; Mishkin, 2007). There is no need for a repetition of the story, apart from mentioning that the move towards the systemic policy procedure that characterises the modern approach to monetary policy built in an important way on the formal approach to the instrument problem in papers such as that of Poole (1970).

The question on Poole's table was whether central banks should (i) use money stock, (ii) a short-term interest rate as a policy instrument or (iii) a combination of the two. We see the problem statement in Cechetti and Kohler (2010) as quite similar to this as they consider the policy instrument choice between (i) an interest rate, (ii) a balance sheet instrument, specifically capital adequacy ratios, or (iii) a combination of the two. A balance sheet instrument can be any policy instrument aimed at affecting the balance sheet of banks and/or that of the central bank.

It is this similarity that upon reading Cechetti and Kohler (2010) reminds one of Poole's (1970) paper. Similar to Cechetti and Kohler (2010), the older paper also opened with an equivalence result: in an investment/saving curve and the liquidity preference/money supply equilibrium curve (ISLM) model similar to that of Cechetti and Kohler (2010) but without stochastic disturbances, the two monetary policy instruments are equivalent. But that is not the message of Poole's (1970) paper, and we argue that it is not the message of Cechetti and Kohler (2010) either[1].

In both papers, the major results are that the equivalence of the instruments holds only in an unlikely special case, not in general, and hence there is potential for their co-ordinated use. This is why we pencilled in the word "non" in front of "equivalence" in the title. It is the non-equivalence of these instruments that challenges monetary authorities: they have to choose between, or co-ordinate the use of these instruments, and models such as those of Cechetti and Kohler (2010) help one to understand the choice.

In the earlier paper, the model is a stochastic ISLM model with a quadratic loss function. The important result derived with that model was that the structural parameters of the model (the slopes of the IS and LM curves), and the relative sizes of the stochastic disturbances in the real economy and the asset markets determined the most efficient policy tool. Our view of the structural characteristics of the economy will accordingly affect our choice of policy instrument. Poole (1970) showed that, in his model, the interest rate was the preferred instrument when shocks to the monetary sector were relatively large compared to shocks to aggregate expenditure. The money stock was preferred when shocks to the monetary sector were relatively smaller.

His next step was to investigate the scope for the co-ordinated use of the interest rate and money stock to improve policy outcomes. This joint optimisation outperformed what could be attained by using either of the two instruments individually, but subject to the monetary authority having knowledge about more structural parameters than is required for the single instrument alternatives. Based on this result, Poole (1970:209) suspected that "a combination policy based on intuition may be worse than either of the pure policies". The bias against intuition in monetary policy-making has deepened since then, as Alan Blinder (1998: 9) observed almost 30 years later: "You can get your information about the economy from admittedly fallible statistical relationships, or you can ask your uncle. I for one," he continued, "never hesitated over this choice".

[1] Even though the title of their paper suggests that it is.

3. The instrument problem in 2010

Before the financial crisis, central banks implemented the modern consensus – perhaps the most widely known formulation is Bernanke and Gertler (1999) – that they should not respond *ex ante* to asset market fluctuations over and above the consequences of these fluctuations for the outlook on inflation and real output. Financial stability and price stability are complementary under (explicit or implicit) flexible inflation targeting in this view (Bernanke and Gertler, 1999: 18, 22).

While there were good reasons for not incorporating asset prices as a distinct objective of the interest rate policy of monetary authorities, the severity of the international financial crisis has encouraged a revision of this "mop-up-afterwards" approach to asset bubbles (e.g., Mishkin, 2008; Blinder, 2008). A finer distinction is now being drawn between types of asset price bubbles, with the old consensus still believed to be applicable to bubbles on the stock market and where bank credit played a small part ("equity bubbles" in the terminology of Mishkin (2008)), but not for asset bubbles where the provision of cheap credit by banks plays a central role ("credit bubbles" in the terminology of Mishkin (2008)).

In these credit bubbles, neither the knowledge problem nor the instrument problem is thought to be as severe as previously suspected, or so the argument goes. A central bank that also plays the role of bank regulator and supervisor has much better information about bank lending and potentially about the prudence of that lending compared with knowledge about the fundamental support for stock market prices. In addition, central banks have a range of regulatory powers that can be used to reign in credit lending that is supporting an asset bubble; instruments that act directly on the behaviour of banks.

This distinction is sensible and is a lens through which plausible *ex post* readings of cases such as the "Great crash" of 1929, the Japanese asset price boom and bust, and the recent financial crisis have been offered by Mishkin (2008). However, to act against credit bubbles requires an *ex ante* analysis of the bubble, and there is not much evidence that the United States Federal Reserve System (US Fed) (or other major central banks) was able to do that with respect to the recent crisis. Indeed, former US Fed Deputy Governor Alan Blinder considered the risks to various dimensions of US monetary policy at Jackson Hole in August 2005 (when the credit bubble was well under way) and summarised his results in a risk management matrix. It indicated moderate risks to inflation, employment and aggregate demand, and a high risk of a supply-side shock. Crucially, he identified the level of risk for both the banking sector and credit risk to be low, stable and covered by strong risk management (Blinder, 2005: Table 1).

This demonstrates the need for better monetary policy models so that an observer in Blinder's (2005) position would have identified the emerging credit and banking-sector risks. Without these changes, the distinction between credit and equity bubbles brings central banks no closer to a practical engagement with the risks of asset bubbles. This also provides the motivation for the kind of model proposed by Cechetti and Kohler.

3.1 Cechetti and Kohler's (2010) model

The starting point for the Cechetti and Kohler (2010) paper is the recognition that financial stability is widely recognised as a critical objective for monetary authorities. Indeed, this objective is now, as it has been in the past, a major reason for having a monetary authority at all. This was certainly part of the policy consensus before the crisis, as is reflected in almost any list of prescriptive statements about what central banks should do, for example, the following list from Mishkin (2007):

1. Price stability should be the long-run goal of monetary policy
2. Central banks should adopt an explicit nominal anchor
3. The central banks should be goal-dependent and held accountable to the public
4. However, the central bank should have instrument independence
5. A central bank should be transparent, especially through an extensive communication strategy
6. A central bank should have the goal of financial stability.

Number 6 stands somewhat apart from the first five suggestions and is only implicitly captured by the consensus on inflation targeting. The connection between inflation targeting and financial stability is perhaps closest to explicit in the literature on appropriate responses to asset price bubbles where, for example, Bernanke and Gertler (1999:18) connected the "sustained damage to the economy" by an asset price collapse with a failure by central banks to act against deflationary pressures.

Notwithstanding the aforementioned, the goal of financial stability is widely recognised (Crockett, 1997; Goodhart, 2005; Svensson, 2009) and brings particular modelling challenges. The central bank's role in prudential supervision implies an ability to identify risks to financial stability in a forward-looking manner, and the ability to assess the risks associated with the current and likely future circumstances of the financial sector, conditional on policy actions such as (i) the stance of monetary policy, (ii) the lender-of-last-resort facility and (iii) 'softer' instruments such as financial stability reports by financial firms (Bårdsen et al., 2006).

While all central banks assess these risks, they often do so without the aid of formal models that connect economic developments, policy and financial fragility. Before the crisis, the policy decision with respect to the nominal anchor was often separated from regulatory decisions aimed at financial stability. This "division of responsibility", as Cechetti and Kohler (1970:2) rightly observe, "has not survived the crisis". One now has to find a way to co-ordinate these two aspects in a more or less explicit manner.

It is at this point that the Cechetti and Kohler paper enters the debate: it is an excellent step towards a rigorous inclusion of financial stability in the systematic part of monetary policy. A brief summary of their approach follows.

Instead of an ISLM model, Cechetti and Kohler start with a log-linearised stochastic aggregate demand–aggregate supply ((AD–AS) model with bank capital, where AD is a function of the short-term real interest rate and the real short-term loan rate at banks. Bank lending in this model is constrained by bank capital, with the capital requirement a policy variable. To capture an aspect of the financial accelerator, bank capital is a positive function of real output. The demand for loans is a function of real output as well as the real loan rate at banks. Meanwhile, AS is simply a positive function of unexpected inflation. Cechetti and Kohler (1970) solved the model under rational expectations.

3.2 The equivalence result

Their model is used first to derive an equivalence result between interest rate policy and reserve requirements for a monetary authority that tries to obtain (only) low inflation and stable output around its long-run potential. The optimal policy yields identical outcomes under both policies. The title of the paper derives from this result, but we think the really interesting results follow in subsequent sections, where the equivalence results no longer hold – which occurs when a monetary authority explicitly cares about more than just low inflation and stable output.

3.3 Including financial stability

The next step is to include financial stability in this monetary policy model. This is easier said than done, as there are a number of rival definitions of financial fragility and many of them are not easy to capture in a model.

One important and intuitively appealing tradition in this literature conceptualises financial fragility in institutional terms, with 'stability' defined in terms of (i) the stability and credibility of key institutions and (ii) the stability of key markets, such that prices reflect underlying fundamentals (see, for example, Crockett, 1997). In contrast with this emphasis on institutions, Mishkin (1994) and others have conceptualised financial instability as a disruption in the flow of information in financial markets, with shocks – or asset price bubbles – preventing the markets from allocating resources efficiently. The focus on information, and especially asymmetric information, highlights the risks of moral hazard and adverse selection.

The measure of financial instability used by Cechetti and Kohler (1970) falls into this broad category, where they follow one of the proposals used by Curdia and Woodford (2010) to suggest that changes in the spreads between the interest rates charged to various classes of borrowers might be a useful barometer of financial instability. The idea in Cechetti and Kohler (1970) is to include the spread between the loan rate and the short-term policy rate in the loss function for the monetary authorities. We return to the wisdom of this decision later on.

Again, they derive the optimal interest rate and capital-adequacy policy reaction functions. An analogous result to Poole's emerges at this point, namely using both instruments leads to a better overall result than can be achieved with either of the two instruments independently. The reason for this is that both instruments move the traditional first two terms of the loss function in the same direction, while the new third term (the credit spread) is moved in the opposite direction. Using a second instrument to respond to the third term therefore improves the outcome.

Hence, the equivalence result between the two polices no longer holds. As with Poole's earlier result, the preferred policies will depend on the structural parameters of the model. If demand shocks are relatively larger, then interest rate policy will be preferred and, conversely, the capital-adequacy ratio will be the preferred policy tool when AS shocks dominate.

3.4 Policy co-ordination

The final question examined in the Cechetti and Kohler (2010) paper is whether, and if so how, the two policy instruments might best be co-ordinated given the concern for financial stability. They consider the following three alternatives:

1. The two policy instruments are set independently, with the policy-maker in charge of each instrument setting it independently.

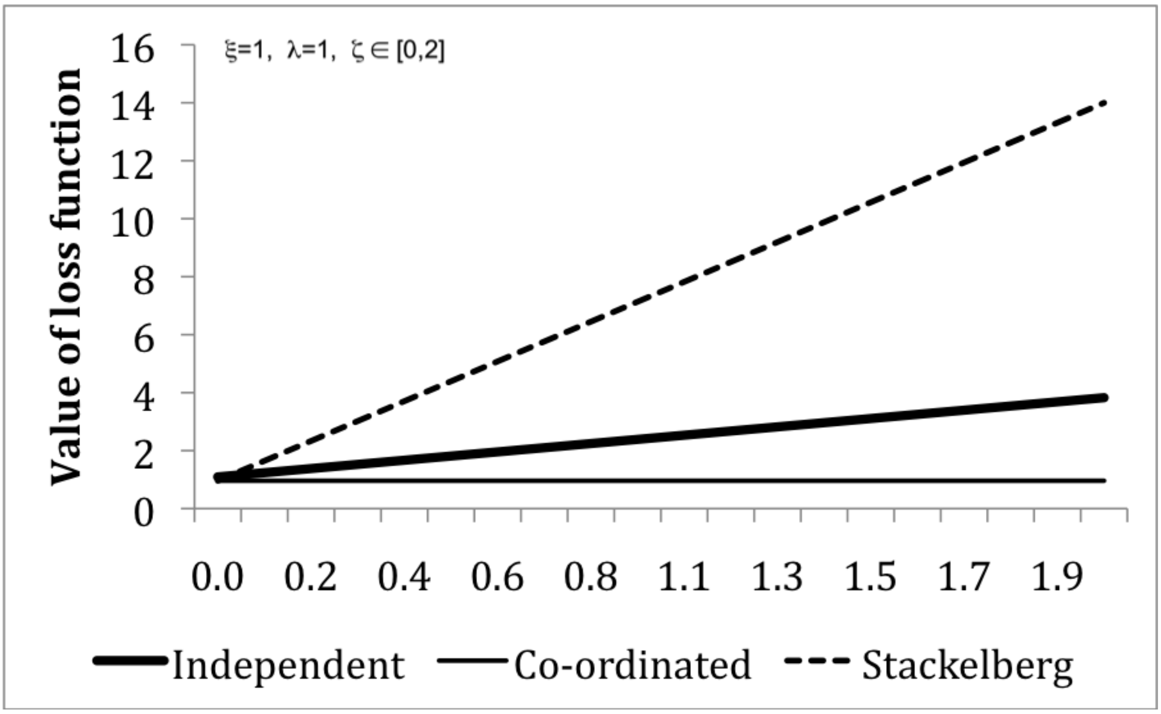
2. The two policy-makers jointly optimise the setting of their instruments in pursuit of the combined objective.
3. A Stackelberg strategy is followed whereby one policy-maker optimises first (ignoring the consequences of that decision for the other policy-maker), after which the second instrument is set taking the setting of the first instrument as given.

In an echo of Poole's result, they show that the structure of the model, in this case whether AS or AD shocks dominate, affects the relative ranking of these three strategies. While Cechetti and Kohler (2010) provided analytical results, we simulated the outcomes for the loss function in their model to demonstrate the results, by calibrating their model and calculating the outcomes over various ranges of the parameters in the loss function.[2] These simulations are presented below[3].

Case 1: Aggregated demand shocks dominate

Figure 1 shows the outcomes for the loss function under the three strategies for a range of relative weights on the credit spread. Unsurprisingly, the co-ordinated strategy is the best, but when demand shocks dominate, the Stakelberg strategy performs least well. Not only is the Stackelberg strategy the worst in this case, the losses pull further apart as the weight on financial stabilisation rises.

Figure 1: Aggregated demand shocks dominate, over a range of weights for the credit spread

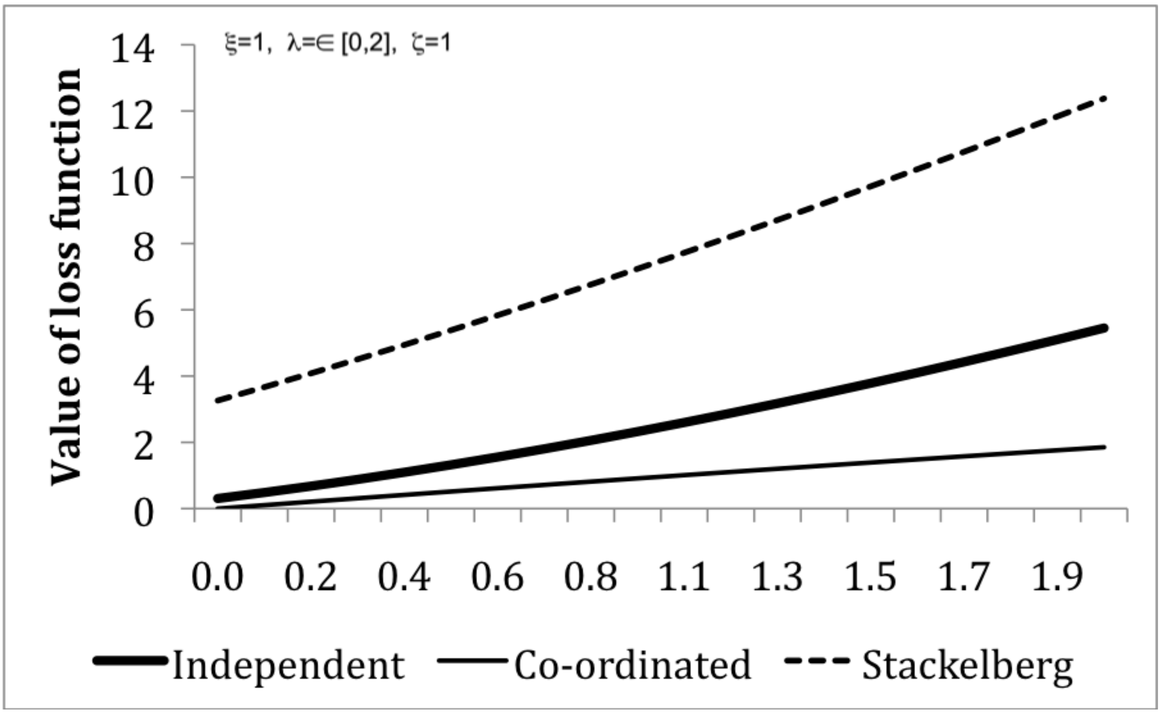


[2] The calibration satisfies the necessary conditions given in Cecchetti and Kohler (2010), but was chosen for illustrative purposes and is not rigorously motivated to represent any view on the strength of various interactions.

[3] In the graphs, ξ is the weight on inflation, λ the weight on the output gap and ζ is the weight on the credit spread in the loss function.

Figure 2 shows the outcomes for the loss function under the three strategies for a range of relative weights on output stabilisation.

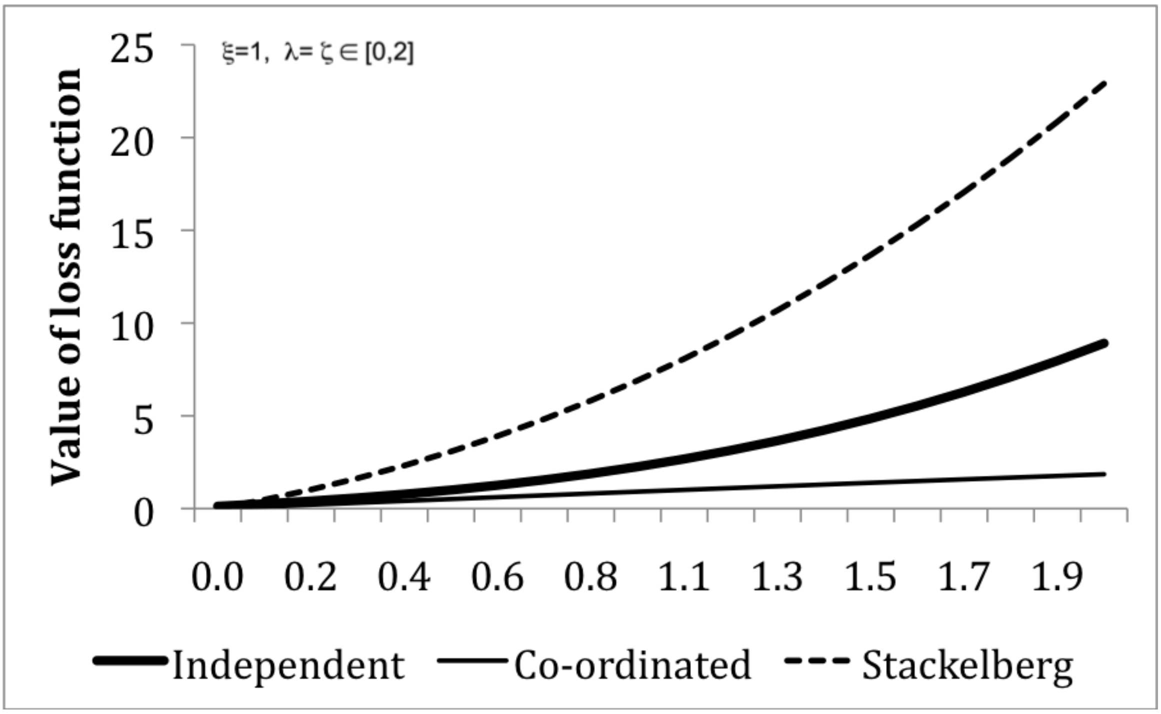
Figure 2: Aggregated demand shocks dominate, over a range of weights for output stabilisation



Again, the Stackelberg strategy is the worst, co-ordination is by far the best, and the gap between co-ordination and the other two widens as the weight on output stabilisation rises.

In Figure 3 we plot the outcomes for the loss function when the weights on output and financial stabilisation vary together.

Figure 3: AD shocks dominate, over a range of weights for output and financial stabilisation



Case 2: Aggregated supply shocks dominate

We repeat the simulations above, but under a scenario where AS shocks are dominant. The co-ordinated strategy is clearly preferable, but in contrast with the earlier result, the independent strategy performs least well when AS shocks dominate, as shown in Figure 4. Not only is the independent strategy the worst in this case, but the losses pull further apart as the weight on financial stabilisation rises.

Figure 4: Aggregated supply shocks dominate, over a range of weights for financial stabilisation

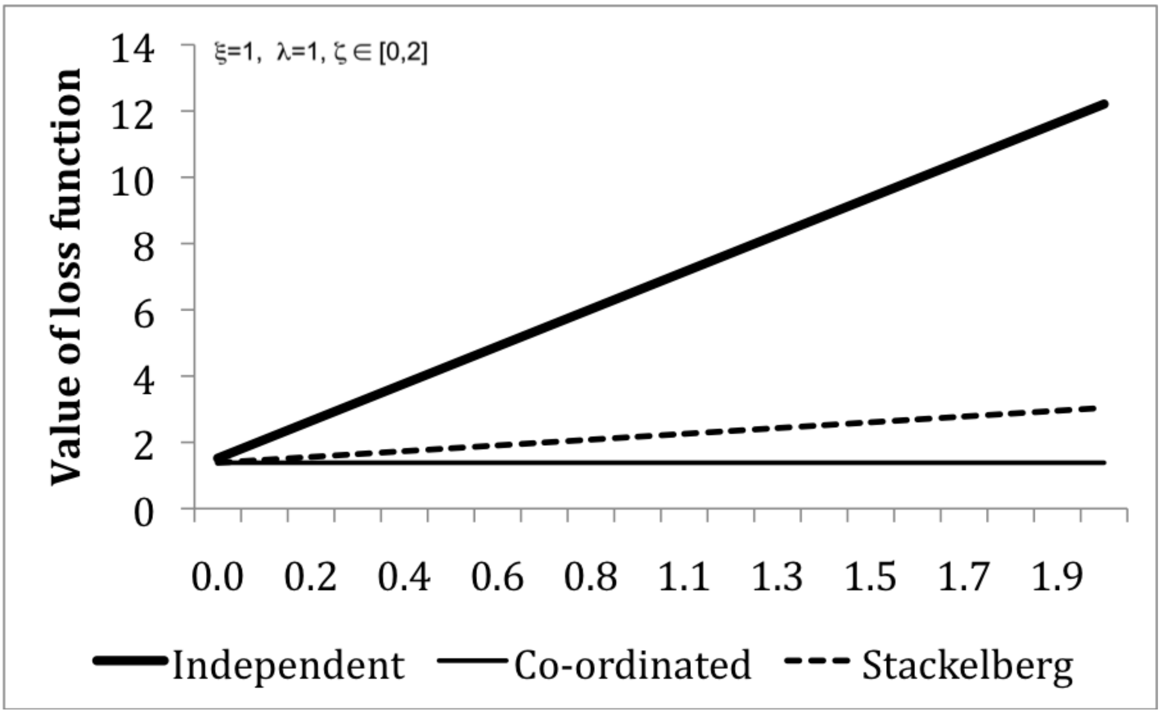
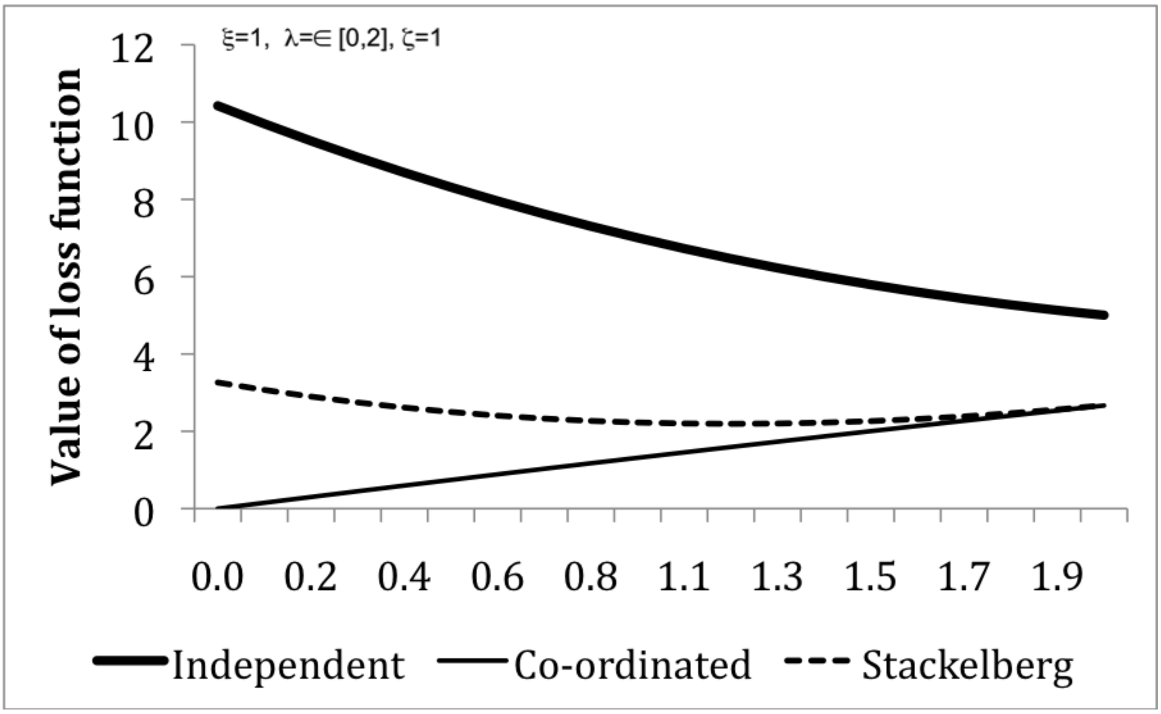


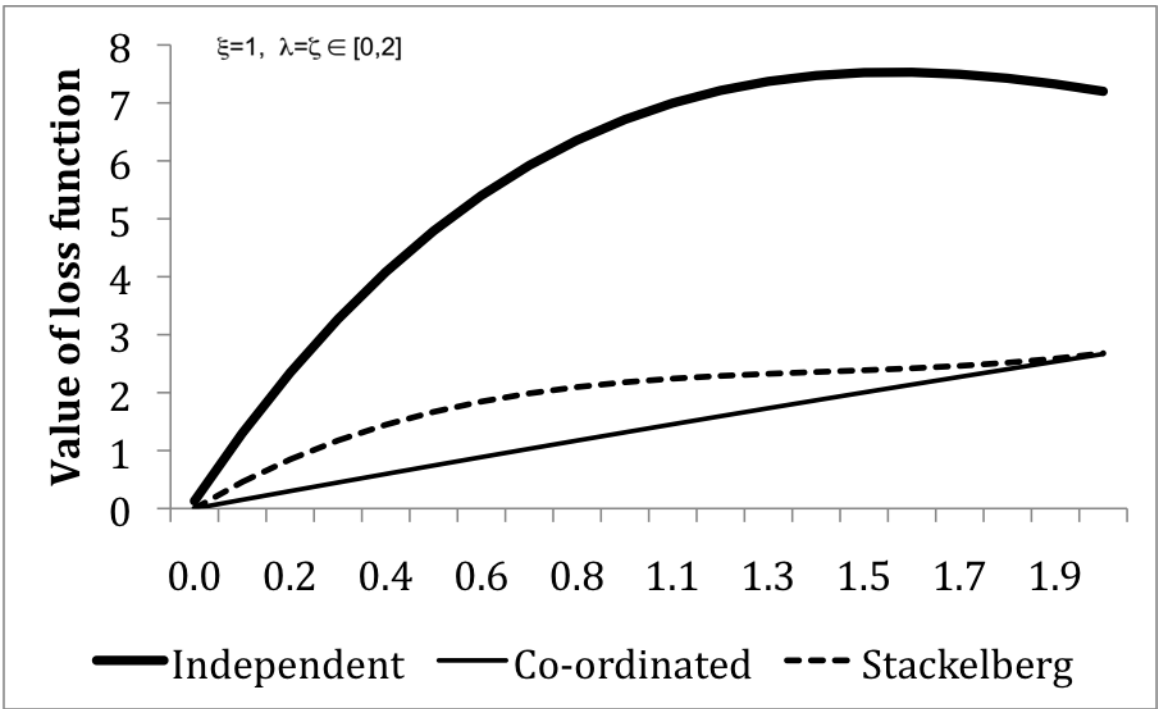
Figure 5 shows the outcomes for the loss function under the three strategies for a range of relative weights on output stabilisation. In this case, the results are more interesting. While the independent strategy is the worst, the gap between the strategies declines as the weight on output rises.

Figure 5: Aggregated supply shocks dominate, over a range of weights for output stabilisation



In Figure 6, we plot the outcomes for the loss function when the weights on output and financial stabilisation vary together. The ranking observed in the other AS dominant cases is preserved here.

Figure 6: Aggregated demand shocks dominate, over a range of weights for output and financial stabilisation



Case 3: Neither aggregated demand nor aggregated supply shocks dominate

Finally, we consider what happens when neither AD nor AS shocks dominate and were surprised to observe the sensitivity of the outcomes in this case, especially that relative rankings of the independent and Stackelberg strategies may reverse depending on the parameter values.

Figure 7 shows the outcome when we vary the weight on output stabilisation under conditions where neither of the two macro shocks dominate. The outcome in this case is comparable to those for the dominant AD shocks, with the Stackelberg strategy clearly being the worst for the greatest portion of the investigated range.

Figure 7: No dominant shocks, over a range of weights for financial stabilisation

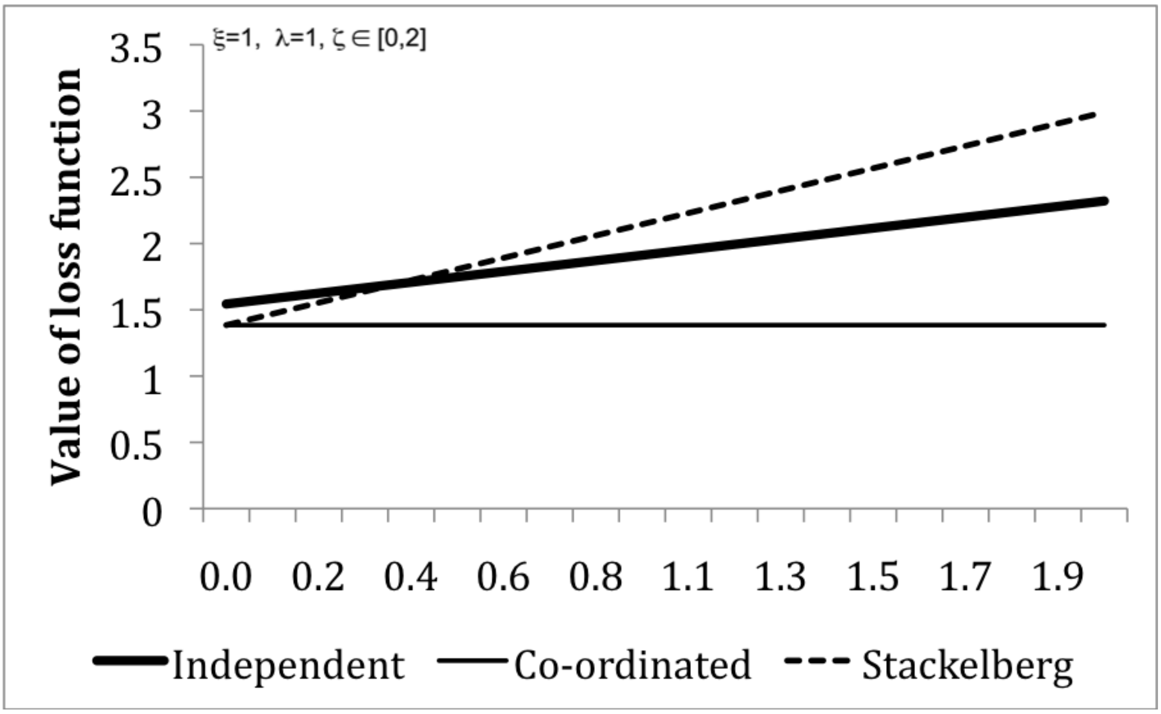
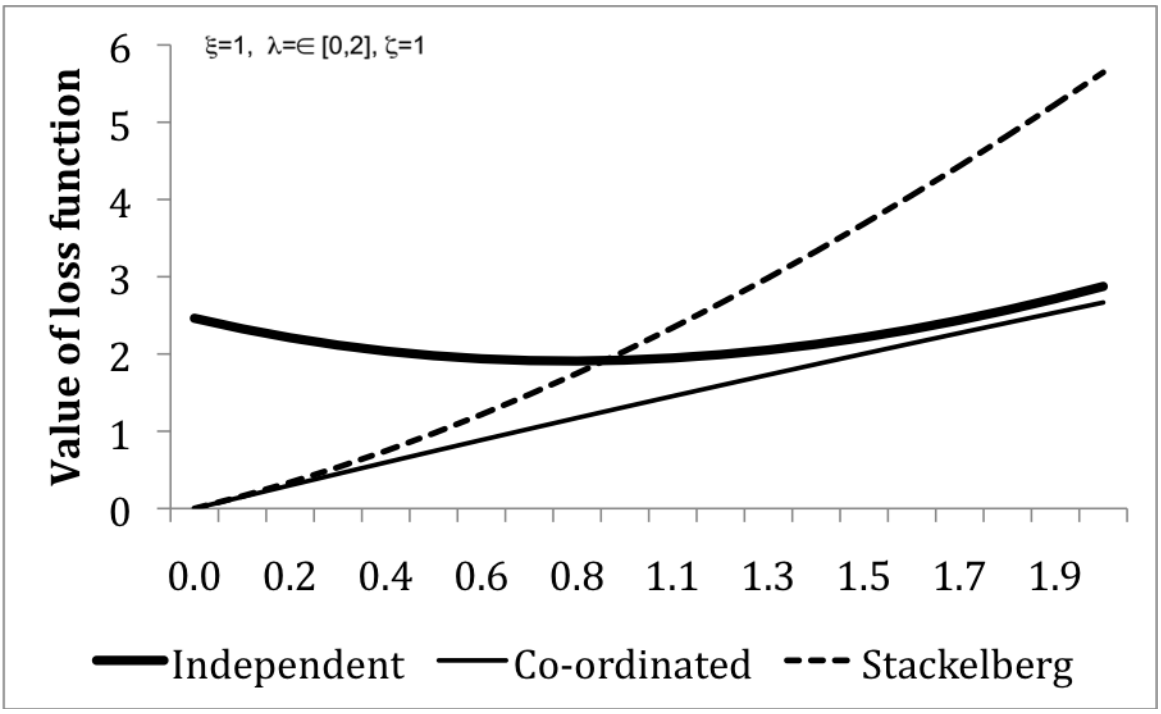


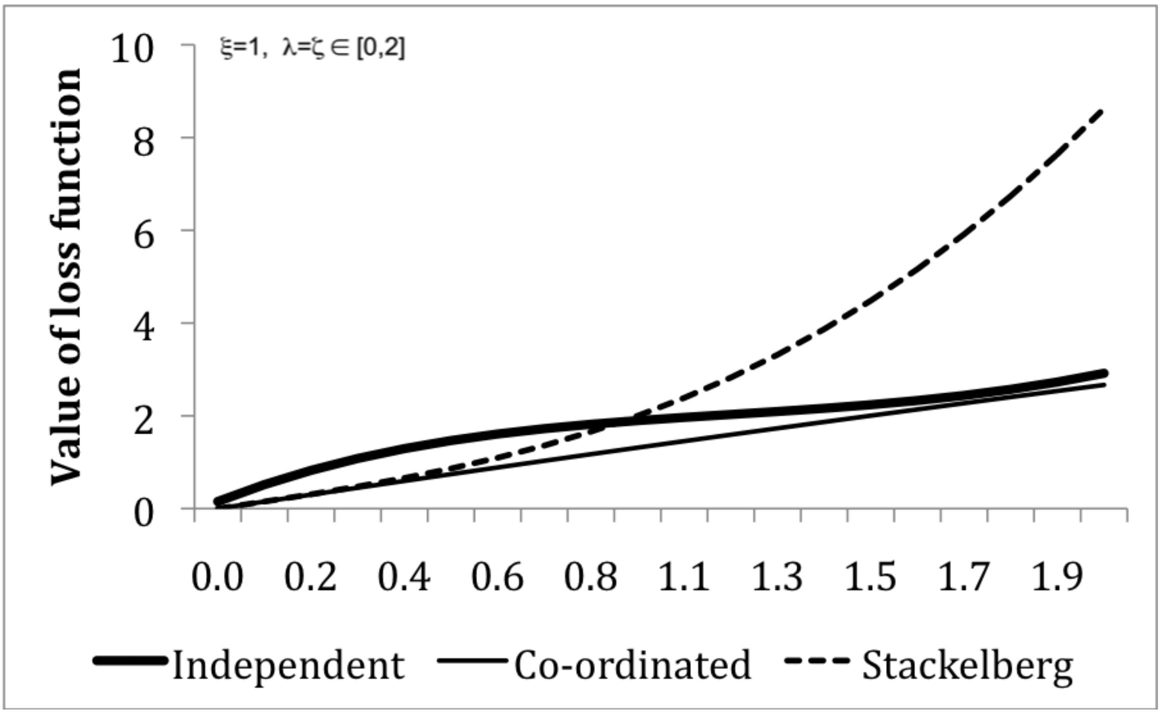
Figure 8 shows the outcomes for the loss function under the three strategies for a range of relative weights on output stabilisation. Here we find a crossover, with the independent strategy being the worst at very low weights on output stabilisation, but better than the Stackelberg strategy at higher weights.

Figure 8: No dominant shocks, over a range of weights for output stabilisation



Finally, we plot the outcomes for the loss function when the weights on output and financial stabilisation vary together (Figure 9). In this final scenario, the outcomes are not very different when the weights on output and financial stabilisation are jointly small, but as they rise, a substantial gap between the co-ordinated strategy (best) and Stackelberg strategy (worst) opens up.

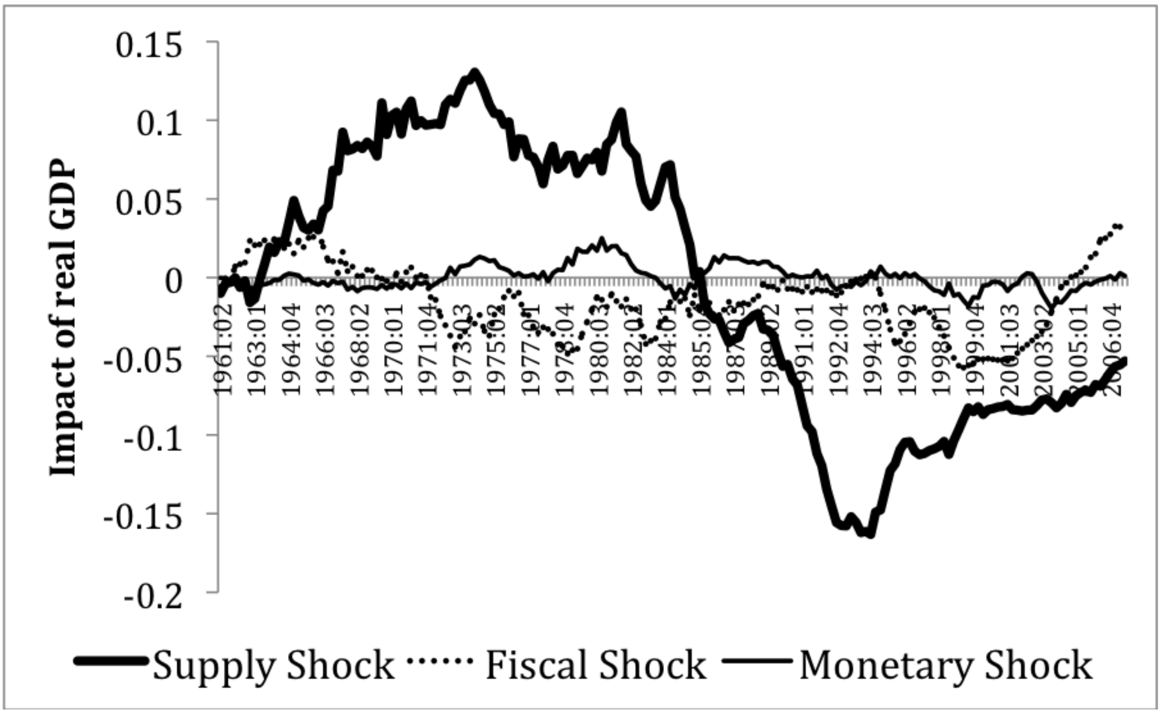
Figure 9: No dominant shocks, over a range of weights for output and financial stabilisation



How do we interpret these graphs? Firstly, a word of caution: these scenarios are dependent on the particular calibration used, and the results should not be over-interpreted. Secondly, it is clear that our understanding of the economy, as expressed in the relative size of demand-and-supply shocks, has an important implication for the desirable co-ordination of these policies. These results echo Poole's (1970) earlier result.

In the South Africa case it is perhaps instructive to think of some evidence about the likely relative size of these shocks. In du Plessis, Smit and Sturzenegger (2008), a structural vector autoregression (VAR) was used to identify aggregate demand-and-supply shocks for the South African economy since the early 1960s. Figure 10 shows the cumulative impact on real output for the identified shocks. It is a visual confirmation of the formal result indicating that AS shocks have been somewhat more important in South Africa over this period. Drawing on the Cechetti and Kohler (2010) results, this suggests that a Stackelberg strategy, whereby the Monetary Policy Committee (MPC) takes into account the prior decision of the financial stability authority, will improve on independence for these two decisions.

Figure 10: The impact of aggregated demand and aggregated supply shocks to real output in SA



Source: Du Plessis, Smit and Sturzenegger (2008)

4. Critical reflection

There is no question that Cechetti and Kohler (2010) is an important and interesting step towards operationalising the emerging consensus that monetary policy needs to incorporate financial stability much more directly in the systematic part of the policy procedure. To do this, one needs to give tractable content to the concept of 'financial stability' or 'instability'.

Cechetti and Kohler followed Curdia and Woodford's (2010) use of the spread between loan and short-term rates as a proxy for financial instability. There is, of course, good reason for this, as Curdia and Woodford (2010:4) observed: "Among the most obvious indicators of stress in the financial sector since August 2007 have been the unusual increases in (and volatility of) the spreads between the interest rates at which different classes of borrowers are able to fund their activities."

They, in turn, followed earlier suggestions by McCulley and Toloui (2008) and Taylor (2008) to use such a spread to adjust the intercept in the Taylor rule. Curdia and Woodford (2010) showed, however, that a simple adjustment of the Taylor rule to include a credit spread would outperform the standard Taylor rule, in their words:

> But flexible inflation targeting, if properly implemented, is superior to even a spread-adjusted rule – at least to simple rules of the kind proposed by Taylor (2008) or McCulley and Toloui (2008). A forecast-targeting central bank will properly take account of many credit spreads rather than just one; it will take account of whether changes in credit spreads indicate disruptions of the financial sector as opposed to endogenous responses to developments elsewhere in the economy, and it will calibrate its response depending on its best guess about the likely persistence of disturbances on a particular occasion. (P. 32.)

Cechetti and Kohler did not simply include the spread in a Taylor rule. Instead, they included it in the loss function, and then solved the optimal policy problem, avoiding some of Woodford's concerns. However, there are a number of potential pitfalls in this approach that require careful attention before using it to rank the optimality of different policy regimes.

First, the use of a quadratic loss function with a linearised economy has a long tradition in monetary economics, as it allows the direct application of familiar and powerful results in a linear quadratic optimal control framework, among other reasons (Woodford, 2003:383). It is, however, important to note that the validity of the answers depends crucially on the structure underlying the linearised approximation. Woodford (2003: Chapter 6) shows that it is not obvious that optimising with such a loss function will lead to aggregate welfare maximising rules. He shows that a quadratic loss function (in inflation and the output gap) can indeed be derived from a second-order approximation of the expected utility of the representative agent,[4] but that it depends on the point around which the approximation is taken. This result hinges, in turn, on structural features of the specific model concerned, for example, equilibrium distortions due to monopolistic competition, sticky prices and so forth.

Second, while Curdia and Woodford's (2010) model is written in linear approximation that appears very similar to that of Cecchetti and Kohler (2010), there are important differences, for example, Curdia and Woodford (2010) derive the linear approximation from micro foundations where there are two types of consumers so that in equilibrium there is borrowing and lending. It also yields a Phillips curve that depends on additional terms (e.g., the marginal utility gap between the two types of agent), which is not present in the stylised economy of Cecchetti and Kohler (2010).

Third, even if a simple loss function adjustment could account correctly for the aggregate utility cost of various policies and the linearised model captures enough of the dynamics to be accurate in the setting, the way the spread enters the loss function (as a quadratic term) is itself problematic. We are sceptical

[4] Which is the axiomatic starting point of the micro foundations of welfare analyses in these types of models

of the claim that credit spreads indicate financial instability as strongly as suggested by a squared term. As is stands, it suggests sharply rising concern about financial fragility, even at faulty low credit spreads.

Fourth, Curdia and Woodford show that the optimal response of the policy rate to various shocks is not simple: in response to a financial sector shock that widens the spread, it is optimal to increase the policy rate, while in response to other shocks (say monetary policy) that increase the spread, it is optimal to decrease the interest rate. Clearly, a simple Taylor rule with only a positive or negative coefficient on the spread cannot capture this. While Ceccheti and Kohler derive rules from the loss function rather than imposing them, it is not clear that this will be enough to allow the rule to approximate the optimal policy path that Curdia and Woodford derive as a benchmark to measure the performance of rules.

As a final word, we would like to encourage readers to think broadly about the inclusion of financial fragility in the policy procedure. An alternative that we find promising follows the work of Goodhart, Sunirand and Tsomocos (2006), who have suggested a new definition of financial fragility that is explicitly aimed at modelling the welfare effect of financial instability, which emerges as an equilibrium outcome in the model. At the heart of their concept of financial instability is the combination of (i) high probability of default for banks and (ii) low profitability for banks. This allows for the formulation of a model that is designed to analyse the consequences of risk taking by individual banks, the possible contagious relationship between banks, and a framework for analysing regulatory policy and its effect on financial fragility (Goodhart et al., 2006). Unfortunately though, these models are still so complex that analytical solutions cannot yet be derived.

5. Conclusion

The instrument problem in monetary policy is back on the agenda. Until recently interest rate policy was widely thought to be sufficient for the attainment of appropriate monetary policy goals. No longer. In the wake of the international financial crisis there is much pressure on monetary authorities to incorporate the goal of financial stability more closely in policy. This requires an expansion of the instruments typically used by central banks.

In recent paper Cechetti and Kohler (2010) analysed this modern version of the instrument problem in a similar manner to Poole's (1970) treatment of same issue. The earlier paper compared the expected impact of (i) the money stock and (ii) a short-term interest rate or (iii) some combination of these as instruments for monetary policy. Cechetti and Kohler (2010) reflects the modern concern with macro-prudential policy by analysing (i) a short-term interest rate, (ii) a change in capital adequacy requirements or (iii) some combination of these as instruments for monetary policy

In both cases, the major results are the non-equivalence of the instruments and the potential for their co-ordinated use. This is why we pencilled in the word "non" in front of "equivalence" in the title. It is the non-equivalence of these instruments that challenges monetary authorities: they have to choose between, or co-ordinate the use of these instruments. In the modern version the need for co-ordination arises from the desire to include financial stability more directly in the monetary policy decision.

Cechetti and Kohler (2010) analysed the policy problem with and AD-AS model with bank capital and the credit spread as a proxy for financial stability. They include the credit spread in the central bank's loss function. We offered some criticism of this modelling decision, the main contours of which are: that (i) the micro-foundations of the quadratic loss function may be weak, (ii) that credit spread should not be treated symmetrically as it is in a quadratic loss function.

Finally, we simulated the output of the Cechetti and Kohler (2010) model to show how the preferred policy combination depends on the underlying structure of the economy. These simulations consider three alternatives:

1. The two policy instruments are set independently, with the policy-maker in charge of each instrument setting it independently.
2. The two policy-makers jointly optimise the setting of their instruments in pursuit of the combined objective.
3. A Stackelberg strategy is followed whereby one policy-maker optimises first (ignoring the consequences of that decision for the other policy-maker), after which the second instrument is set taking the setting of the first instrument as given.

When AD shocks dominate, the model prefers the co-ordinated strategy for all relative weights on output and financial stability in the central bank's loss function. While the fully co-ordinated strategy is also preferable in an economy dominated by AS shocks the preference over the Stackelberg strategy is much smaller and diminished as the weight on output rises in the loss function. However, there is no version of the loss function that yields a preference for independent policy action. This is the tentative practical lesson of this paper: in an economy such as South Africa's where AS shocks are believed to play an important (even dominant) role, the central bank can improve on independent interest rate and capital adequacy decisions by co-ordinating these decisions either fully, or (perhaps more practically) in the manner suggested by the Stackelberg strategy.

References

Bårdsen, G, Lindquist, K G and Tsomocos, D P. 2008. "Evaluation of Macroeconomic Models for Financial Stability Analysis". *Journal of World Economic Review* 3(1) pp 7–32.

Bernanke, B and Gertler, M. 1999. "Monetary policy and asset price volatility". *Federal Reserve Bank of Kansas City Economic Review* (4th quarter): 17–51.

Blinder, A S. 1998. "Central banking in theory and practise". Cambridge, Ma: MIT Press.

___. 2005. "Understanding the Greenspan standard". Wyoming, J H, Paper presented at the Federal Reserve Bank of Kansan City Symposium "The Greenspan Era: Lessons for the Future", Wyoming, J H. 25–27 August.

Blinder, A S. 2008. "Two bubbles, two paths". *The New York Times*, 15 June. New York.

Burns, A F. 1979. "The anguish of central banking". The 1979 Per Jacobsson Lecture. Cirovic, M and Polak, J J. The Per Jacobsson Foundation.

Cecchetti, S G and Kohler, M. 2010. "On the equivalence of capital adequacy and monetary policy". Pretoria paper prepared for the conference "Monetary Policy and Financial Stability in the Post-crisis Era" hosted in Pretoria by the South African Reserve Bank (SARB) from 4 to 5 November 2010.

Crockett, A. 1997. "Why is financial stability a goal of public policy". Wyoming J H. Paper presented at the Federal Reserve Bank of Kansas City's 1997 symposium, "Maintaining Financial Stability in a Global Economy", 28-30 August.

Curdia, V and Woodford, M. 2010. "Credit spreads and monetary policy". *Journal of Money, Credit and Banking* 42(6): 3–35.

Du Plessis, S A, Smit, B W and Sturzenegger, F. 2008. "Identifying aggregate supply and demand shocks in South Africa". *Journal of African Economies* 17(5): 765–793.

Goodhart, C A E. 2005. "The future of central banking". Financial Markets Group Special Paper No. 62. London: London School of Economics.

McCulley, P and Toloui, R. 2008. "Chasing the neutral rate down: Financial conditions, monetary policy and the Taylor Rule, Global Central Bank Focus", *PIMCO,* 20 February 2008.

Mishkin, F S. 2007. *Monetary Policy Strategy*. Cambridge, Ma: MIT Press.

___. 1994. "Global financial instability: Framework, events, issues". *Journal of Economic Perspectives* 13(4): 3–20.

___. 2008. "How should we respond to asset price bubbles?" Speech at the Wharton Financial Institutions Centre and Oliver Wyman Institute's Annual Financial Risk Roundtable, Philadelphia, Pennsylvania. 15 May.

Poole, W. 1970. "Optimal choice of monetary policy instrument in a simple stochastic macro model". *Quarterly Journal of Economics* 84(2): 197–216.

Svensson, L E O. 2006. "The role of science in best-practice monetary policy: In honor of Otmar Issing. Paper Presented at "Monetary Policy: A Journey from Theory to Practice" and European Central Bank Colloquium held in honour of Otmar Issing, 16–17 March.

___. 2009. "Evaluating monetary policy". Upsala, address given at Upsala University on 13 March.

Taylor, J B. 2008. "Monetary policy and the state of the economy". Testimony before the Committee on Financial Services, Washington, US. House of Representatives, 26 February.

Woodford, M. 2003. *Interest and prices: Foundations of a theory of monetary policy*. Princeton: Princeton University Press.