

Remarks at a Panel on the Monetary Policy Implications of the Global Crisis

By

John B. Taylor¹

Presented at the *International Journal of Central Banking* Conference
Hosted by the Bank of Japan
16 and 17 September 2010

Summary: These remarks examine the implications of the global financial crisis for monetary policy. I speak mainly from the perspective of monetary policy in the United States where I have done most of my research relating to the crisis. I start by describing the monetary framework that was generally in place before the financial crisis and show that that framework worked well. I then argue that the crisis occurred after policy makers deviated from that framework. I also report on an evaluation of monetary policy during the crisis by dividing the crisis into three periods: pre-panic, panic and post-panic. I show that the extraordinary measures did not work well in the pre-panic or the post-panic periods, but that they had a positive impact during the panic. Proposals to change the monetary framework, including pro-cyclical capital buffers, higher inflation targets, and specific efforts to burst bubbles are also considered. The policy conclusion is that monetary policy should return to the framework that worked, though with greater emphasis on international monetary issues, and that policy makers should develop an explicit exit strategy to do so.

¹ The author is the Mary and Robert Raymond Professor of Economic at Stanford University and the George P. Shultz Senior Fellow in Economics at Stanford's Hoover Institution. These remarks are based on testimony before the U.S. House of Representatives, Committee on Financial Services on March 25, 2010 (Taylor (2010d)), a lecture given at the Warsaw School of Economics on June 23, 2010 (Taylor (2010e)), and commentary presented at Jackson Hole Conference on August 28, 2010 (Taylor (2010f)).

I start from the position that we had a good monetary framework for monetary policy making that worked well for many years before the crisis. Let's call it the "framework that worked." In the first three sections below I briefly summarize the framework, describe the large deviation from it leading up to and during the crisis, and draw the main policy implication. In the following sections I then delve into some of the counter-arguments to this view of the crisis, discuss legacy effects of the policies, propose a specific exit strategy, consider other proposals for change in policy, and examine key international issues.

1. The Framework that Worked in Theory and Practice

The theory underlying this framework is embodied in models now sitting at many central banks. Volker Wieland (2009) and his colleagues at the University of Frankfurt are performing a valuable public service by assembling these models in an on-line database to encourage transparency, model comparisons, and policy robustness research. I list these models by name in Table 1 simply to give a sense of their scope. An earlier representative list of models is found in Taylor (1999). While the models differ in some ways, they are all dynamic and stochastic, and the impact of monetary policy is surprisingly similar in the different models, as shown in Taylor and Wieland (2009).

The framework is based on some key principles. First, it incorporates inflexibilities, usually price and wage rigidities, that make monetary policy effective, or as Robert Lucas (2007) puts it, "can make bad monetary policy so dangerous." Second, monetary policy is evaluated as a *policy rule*. One of the reasons that policy rules come into play in this framework is that expectations are usually rational, so "forward-looking optimizing behavior" might be another way to characterize this second principle. However, the rational expectations assumption does not necessarily imply a focus on policy rules, as discussed in Taylor and Williams (2010), so "policy rules" may be a more appropriate way to describe this second principle. By the term policy rule I include both rules for the policy instruments and rules based on the first-order conditions of an optimization problem. The two types of rules are closely related, as laid out transparently by the Norges Bank in their monetary policy reports.

Along with this monetary framework goes an approach to monetary policy in which the central bank adjusts the supply of money to bring about systematic changes in the short term interest rate. The central bank's strategy, or rule, for adjusting the money supply, and thus the interest rate, depends on economic conditions. In general, the interest rate rises by a certain amount when inflation increases above its target, and the interest rate falls by a certain amount when the economy goes into a recession. The so-called Taylor rule is an example of how interest rates are changed in this framework.

Empirical research and economic history has shown that such an approach has worked well in the real world. Performance was good, as argued for example by Bernanke (2004), when policy was close to the rule as in the 1980s and 1990s, as shown by Poole (2007). Performance was poor when policy was far away from the policy rule as in the Great Inflation of the 1970s, as shown in Judd and Trehan (1995). Meltzer (2010, p. 1255) reviews the evidence across the span of the history of the Federal Reserve and comes to this same conclusion. Rarely in economics is there so much empirical and theoretical evidence in support of a particular policy framework. More details are provided in Taylor (2010a).

2. *Deviating from the Framework*

Empirical work on monetary policy leading up to and during the recent crisis shows that monetary policy deviated from this rules-based framework, and that has been a major factor in the crisis. Interest rates were held below what a policy rules framework suggests worked in the past. Indeed as one can see this deviation very clearly in Figure 1, drawn from William Poole (2007). At the annual Jackson Hole conference three years ago (Taylor (2007)), I showed with a simple model that these low interest rates helped accelerate the housing boom and thus made the bust more serious.

In addition, holding interest rates too low for too long caused a search for yield and additional risk taking. Recent empirical research by Beckaert, Hoerova and Lo Duca (2010) has shown that when monetary policy lets real interest rates get very low, there is an increase risk as measure by market based risk indicators derived from options prices in the equity markets.

Then, after the crisis flared-up in August 2007, policymakers engaged in many discretionary credit operations which were clearly deviations from the policy framework. Some helped halt the panic in the fall of 2008, but others brought on the panic in the first place, as I described more fully in my review of the crisis in Taylor (2008).

3. *Policy Implication*

The policy implication of this research for monetary policy in the future is thus very simple. Get back to the rules-based policy framework that was working before the crisis (Taylor (2010b)) and develop an exit plan to do so (Taylor (2009a, 2009b)). Those central banks that deviated from good policy should get back to what they were doing before the crisis. They need to earn back credibility and preserve their independence. Systematic monetary policies focusing on a credible goal for inflation worked well in the past and they will work well in the future. Of course those central banks that continued to follow sound policies—and credit should be given to the many emerging market central banks—they should continue to do so.

In the next two sections I consider counter-arguments that have been raised about these ideas with the purpose of generating discussion and ultimately resolving disagreements. I then discuss the legacy effects of recent policy that make an exit plan for the Fed very difficult to carry out, and show, using results from Taylor (2010d), that the exit strategy will be easier if it is designed as a policy rule.

4. *Were Rates Really So Low and Did They Have Such a Large Impact?*

It is possible to cite considerable empirical work in the past few years which supports the view that interest rates were too low for too long and that this was a major factor in the boom and bust. Much of this work has been completed since the 2007 Jackson Hole conference where the issue was first seriously discussed publicly by policymakers. For example, Jarocinski and Smets (2008) of the European Central Bank estimated a Vector Auto-regression (VAR) for the United States and found evidence that “monetary policy has significant effects on housing investment and house prices and that easy monetary policy designed to stave off perceived risks of deflation in 2002-04 has contributed to the boom in the housing market in 2004 and 2005.”

In a more recent study George Kahn (2010) of the Federal Reserve Bank of Kansas City takes a different approach focusing directly on deviations from policy rules and gets similar results. He shows that they are highly correlated with housing bubbles. In counterfactual simulations without such deviations he finds that the booms largely go away. As he puts it “When the Taylor rule deviations are excluded from the forecasting equation, the bubble in housing prices looks more like a bump.”

Some of the most convincing empirical work comes from international comparisons of what happened in different countries, including a series of studies at the OECD which looks at all OECD countries. Rudiger Ahrend (2010) nicely summarizes his empirical work in this area and that of his colleagues at the OECD (Ahrend et al., 2008). He writes that “‘below Taylor’ episodes have generally been associated with the build-up of financial imbalances in housing markets.” Ahrend’s work also addresses one of the counterarguments to this view that asks why there was a housing boom in Spain but not in Germany and they are both in the euro zone. The answer is that the different directions in housing prices in Spain and Germany are explained by policy rule deviations even though they are both part of the euro zone.

Where else do people come out differently? In a study completed recently at the Bank of England, Bean et al. (2010) for example argue that the low policy rates were a factor in the crisis, but only a “modest” factor, apparently not large enough or damaging enough to suggest that such deviations from policy rules should be avoided in the future if we want to avoid crises. As they state “although monetary policy may have played a role in the credit/house-price boom that preceded the crisis, it is rather more Rosencrantz than Hamlet.”

Like Jarocinski and Smets (2008), Bean et al. (2010) estimate a VAR. Theirs has somewhat different variables, but they also find that policy rule deviations had an effect on housing prices: 46 percent of the price increase in the UK and 26 percent in the US. But they then say that the effect is modest. I do not find these numbers to be so modest. Recall the bust in house prices since the peak of the boom was about 30 percent in the United States. And according to their “impulse response functions” the impact of the policy rule deviations on housing is significantly different from zero, and the largest impact of monetary policy of all the variables in the VAR is on housing prices.

Bean et al. also find that monetary policy during 2002-2005 was loose relative to estimated policy rules in both the United States and the United Kingdom. In sum, when combined with the other papers mentioned above, I think the effects of low rates are significant and quite large.

Another recent counterargument has been put forth by Bernanke (2010) in a speech dedicated to the policy deviation given at the American Economic Association meeting last January. Bernanke, citing research done by the staff at the Federal Reserve Board, showed that if you change the Taylor rule—putting in expectations of inflation rather than the actual inflation rate—there is not such a big deviation. Bernanke finds that substituting inflation forecasts from the Fed’s Greenbook for actual inflation in a Taylor rule reduces the size of the deviation. But as I argued in my reply (Taylor (2010c)) to Bernanke last January, I think that it is inappropriate to put in forecasts in this way. That is not how the Taylor rule was derived, and there are problems with using forecasts, including that they are neither objective nor accurate. Indeed, in the episode in question, the Fed’s inflation forecasts were lower than what actually happened and lower than the private sector.

5. *How Effective Were the Unorthodox Policies?*

Much of the work evaluating the so-called unorthodox programs implemented by the Fed and other central banks has focused on the asset purchase programs such as those in the UK and the US. Many of the evaluations reported publicly by central banks conclude that the asset purchases were an effective monetary instrument and can be again in the future. However, most of these studies, such as Gagnon et al. (2010), are based on “announcement effects” which I think can be quite misleading. In contrast, it is possible to look at the programs themselves—at the amount purchased and the timing—not just the announcement effect.

For example, consider the impact of the Fed’s mortgage backed securities (MBS) purchase program, which at \$1.25 trillion is the largest single unorthodox program. My assessment of that program, based on Stroebel and Taylor (2009), is that the MBS program had a rather small and uncertain effect on mortgage rates once we control for prepayment risk and default risk. If so, such a program is not an effective monetary instrument. Figures 1 and 2, drawn from Stroebel and Taylor (2009), illustrate the reason for the result. They show that the major movements up and down in either the swap Option Adjusted Spread (OAS) or the Treasury OAS—mortgage yield spreads which controls for prepayment risk—is explained by changes in default risk.

Figures 3 and 4 show how misleading it can be to judge the effectiveness of asset purchase programs by looking at announcement effects. The initial announcement of the MBS program on November 25, 2008 had a noticeable effect on both Treasury OAS and swap OAS, but the effects soon disappeared, especially for the Treasury OAS. The March 18, 2009 announcement effect of the extension of the program, also shown in Figures 3 and 4, has the wrong sign, but it too was soon reversed. The March announcement was accompanied by an announcement to buy longer term Treasuries, which may explain the reverse effect.

Regarding the rest of the unorthodox programs, I think it is useful to divide the crisis into three phases: (1) the period between the flare-up of the crisis in August 2007 and the panic in late September 2008 and (2) the panic itself from late September through October 2008, and (3) the post-panic period, which started after the panic subsided. See Figure 5 which uses the Libor-OIS spread to measure crisis conditions in the money markets. I discussed the third period above and now focus on the first and second.

My assessment of the extraordinary measures taken in the year before the panic is that they did not work, and that some were harmful. The Term Auction Facility (TAF) did little to reduce tension in the interbank markets during this period, as I interpret research reported at that time by Taylor and Williams (2008a, 2008b, 2009)), and it drew attention away from counterparty risks in the banking system. The extraordinary bailout measures, which began with Bear Stearns, were the most harmful in my view. The Bear Stearns actions led many to believe that the Fed’s balance sheet would again be available in the case that another similar institution failed. But the Fed closed its balance sheet in the case of Lehman Brothers, and then reopened it again in the case of AIG. It was then closed off again for such bailouts and the TARP was proposed. Event studies reported in Taylor (2008) show that the roll out of the TARP coincided with the severe panic. So I have to disagree with those who view all the unorthodox interventions as having worked.

The panic period is the most complex to analyze because the Fed's main measures during this period—those designed to deal with problems in the money market mutual fund and the commercial paper markets—were intertwined with the FDIC bank debt guarantees and the clarification that the TARP would be used for equity injections, which was a major reason for the halt in the panic. In any case, a detailed examination of micro data by Duygan-Bumput et al. (2010) shows that the Fed's asset backed commercial paper money market mutual fund liquidity facility (AMLF) was effective. And I have argued that the Federal Reserve should also be given credit for rebuilding confidence by quickly starting up these complex programs from scratch in a turbulent period and for working closely with central banks abroad in setting up swap lines.

6. *Legacy Problems from the Unorthodox Policies*

Whether one believes that these programs worked or not, there are reasons to believe that their consequences going forward are negative. First, they raise questions about central bank independence. The programs are not monetary policy as conventionally defined, but rather fiscal policy or credit allocation policy because they try to help some firms or sectors and not others and are financed through money creation rather than taxes or public borrowing. Unlike monetary policy, there is no established rationale that such policies should be run by an independence agency of government. By taking these extraordinary measures, the Fed has risked losing its independence over monetary policy.

A second negative consequence of the programs is that unwinding them involves considerable risks. In order to unwind the programs in the current situation, for example, the Fed must reduce the size of its MBS portfolio and reduce reserve balances. But there is uncertainty about how much impact the purchases have had on mortgage interest rates, and thus there is uncertainty about how much mortgage interest rates will rise as the MBS are sold. There is also uncertainty and disagreement about why banks are holding so many excess reserves now. If the current level of reserves represents the amount banks desire to hold, then reducing reserves could cause a further reduction in bank lending.

A third negative consequence is the risk of inflation. If the Fed finds it politically difficult to reduce the size of the balance sheet as the economy recovers and as public debt increases, then inflationary pressures will undoubtedly increase.

7. *An Exit Rule*

How and when should policy makers return to the framework that worked? The timing and the pace should depend on economic conditions. Of course, interest rates will have to increase as the economy recovers. If the economy weakens, the tightening should be postponed. If inflation picks up, tightening should be accelerated.

But it is crucial to announce a clear and predictable exit strategy. By definition an exit strategy is a policy describing how the instruments will be adjusted over time until the normal monetary framework is reached. It is analogous to a policy rule for the interest rate in a monetary framework except that it also describes the level of reserves and the composition of the balance sheet of the central bank. Hence, an exit strategy for monetary policy is essentially an *exit rule*.

How would such an exit rule work? One possible rule would link the Fed's decisions about the interest rate with its decisions about the level of bank reserves held at the Fed. In other words, when the Fed decides to start increasing the federal funds rate target, it would also reduce

reserve balances. One reasonable exit rule for Fed would reduce reserve balances by \$100 billion for each 25 basis point increase in the federal funds rate. By the time the funds rate hits 2 percent, the level of reserves would be reduced by \$800 billion and would likely be near the range needed for supply and demand equilibrium in the money market.

Where does the “\$100 billion per quarter point” come from? We do not know much about the reserve-interest rate relationship, but \$100bn per 25bps is close to what was observed when the Fed started increasing reserves in the fall of 2008. The funds rate fell from 2 percent to 0 percent as the Fed increased the supply of reserves by \$800 billion. Of course we do not know if this relationship will hold now with changed circumstances in the banking sector, but it is a reasonable place to begin. In addition, these dollar amounts are not so large that they should constrain banks or put upward pressure on mortgage rates or other long term rates as the Fed’s MBS or other assets are sold to enable the reduction in reserves. An attractive feature of this approach is that the Fed would exit unorthodoxly at the same 2 percent interest rate as it entered unorthodoxly: The federal funds rate was at 2 percent when it started financing its loans and securities purchases by increasing reserves and the balance sheet.

This exit rule could be announced to the markets with a degree of precision that the Fed deems appropriate for preserving flexibility. Of course, the Fed would not reduce reserves by the full amount on the day of the interest rate decision. Rather it would be spread out over weeks or months. Policy makers could treat this exit rule as an exit guideline rather than a mechanical formula to be followed literally. They would vote on how much to reduce reserves at each meeting along with the interest rate vote.

Perhaps the biggest advantage of such an exit strategy is that it is predictable. It would reduce uncertainty about the central bank’s unwinding while providing enough flexibility to adjust if the exit appears to be too rapid or too slow. The strategy would likely have a beneficial effect on bank lending and thereby remove a barrier to more rapid growth: Some banks are apparently reluctant to buy mortgage securities because of uncertainty about the prices of the securities during an exit. This strategy would reduce that uncertainty and allow market participants to start pricing securities with some basis for predicting monetary policy during the exit.

8. *Problems with Some Proposed Changes in the Framework*

Some who argue that we should not go back to the framework that worked have argued that monetary policy framework needs to be changed in particular ways. One proposal is to introduce a new countercyclical instrument such as *pro-cyclical capital buffers*. These new instruments would work along with the interest rate instrument of monetary policy to cool credit or asset price booms.

Unfortunately there has been very little analytical or empirical work on this subject, and I do not see evidence that such instruments are needed. Yes, capital requirements should be higher and commensurate with the risk that a financial institution takes; and effective supervision and regulation is essential.

However, the rationale for discretionary changes in capital requirements to attenuate booms is based on the view that simply keeping the interest rate instrument from deviating from the policy framework that worked would not have prevented the worst of the housing bubble (and earlier bubbles). If one believes that low policy rates were a large factor in the recent boom and the bust leading to the crisis, then there is still much that one can do with the interest rate

instrument before being drawn to these alternatives. In any case, we are far from a monetary framework needed to evaluate such policies.

Another proposed change in the framework is that policy has to *do more to burst bubbles* before they get out of hand. In my view, we know little about identifying bubbles let alone popping them without causing more harm than good. A higher priority for monetary policy in the future is to avoid causing the bubbles in the first place. The successful policy during the Great Moderation period did not include such attempts to pop bubbles and the economy functioned very well.

Yet another change in the policy framework, recently suggested by the IMF research department, is that central banks should *raise inflation targets*. The reason is that with a two percent target in policy rules the interest rate would have to go negative in a severe crisis, and this is not possible. But in the current crisis, the Taylor rule had interest rates in some countries going close to zero and remaining there for a while, but not going significantly negative. Moreover, raising inflation targets—especially when government debts are rising and central banks' balance sheets are expanded—could easily reduce credibility about an inflation target at all, further damaging central bank credibility. This would be especially inappropriate for central banks in emerging market countries.

9. *International Monetary Issues*

Although the basic monetary framework is sound, the crisis does reveal some potential new fault lines in the international aspects of monetary policy. The impact of increased globalization and international connection between financial markets was very evident during the panic part of the crisis in late 2008. These interconnections raise questions about the impact of central banks on each other. In the period leading up to the crisis there is evidence that the European Central Bank and other central banks held interest rates lower than they would otherwise be because the Federal Reserve set its interest rate so low. The reason, of course, is the exchange rate. A large gap between interest rates would cause the exchange rate to appreciate with adverse consequences on exports. And during the panic the shock from the developed world on the developing world was severe and central banks had to cope with this.

Is there a better way? Making the movements in the interest rates less erratic in the developed countries would help the emerging market countries. I note that for the most part deviations from policy rules, such as the Taylor rule, have increased interest rate volatility, so keeping interest rates more on track will have the added advantage of reducing their erratic nature. Another possibility, which I recommended before the crisis, is that we think about a global target for the inflation rate, or at least a multi-country target, a G20 target perhaps. If there was a multi-country target and this was at least considered in the deliberations of each central bank then there would be a smaller tendency to swing individual interest rates around by large amounts.

10. *Conclusion*

In these remarks I have argued that the main lesson from the financial crisis is that there is a perfectly good framework for monetary policy that can be used in the years ahead. It is the framework that worked in much of 1980s and 1990s in the United States. It operated without

large deviations from simple policy rules, without pro-cyclical capital buffers, and without unorthodox policies.

Of course, we must continue to seek improvements in the monetary framework as data and knowledge accumulate and as the world changes, and I have given some examples relating to international monetary policy. But I worry that drawing different lessons from the crisis will take monetary policy in the wrong direction to a highly discretionary policy in which large deviations from proven policy rules would be regularly tolerated, in which unproven pro-cyclical capital buffers would be manipulated along with interest rates, and in which unorthodox policies would be called on simply because they are thought (incorrectly in my view) to work.

Because the choice between these two alternative views is so stark, it is of paramount importance that empirical work be aimed at trying to reduce current disagreements. Indeed, this is one of the main purposes of statistical work, to reduce disagreement. Posterior opinions ought to be closer together than prior opinions, and if they are not closer we should be able to explain why.

References

- Ahrend, Rudiger (2010), "Monetary Ease: A Factor Behind Financial Crises? Some Evidence from OECD Countries," *Economics: The Open Access, Open Assessment E-Journal*," Vol. 4, 2010-12, April 14, 2010
- Ahrend, Rudiger, B. Cournède, and R. Price (2008), "Monetary Policy, Market Excesses and Financial Turmoil," OECD Economics Department Working Paper No. 597, March 2008
- Bean, Charles, Matthias Paustian, Adrian Penalver and Tim Taylor (2010), "Monetary Policy after the Fall," Presented at the Federal Reserve Bank of Kansas Annual Conference Jackson Hole, Wyoming, August 28
- Beckaert, Geert, Marie Hoerova and Marco Lo Duca (2010), "Risk, Uncertainty and Monetary Policy," unpublished paper, Columbia University
- Bernanke, Ben S. (2004), "The Great Moderation," presented at the meetings of the Eastern Economic Association, Washington, DC February 20, 2004
- Bernanke, Ben S. (2010), "Monetary Policy and the Housing Bubble," presented at the American Economic Association Annual meeting, January 3, 2010
- Duygan-Bumpt, B., Parkinson, P. M. , Rosengren, E. S., Suarez, G. A., and Willen, P. S. (2010), "How Effective Were the Federal Reserve Emergency Liquidity Facilities? Evidence from the Asset-Backed Commercial Paper and Money Market Mutual Fund Liquidity Facility," Working Paper QAU10-3, Federal Reserve Bank of Boston, April 29
- Gagnon, Joseph, Matthew Raskin, Julie Remanche, and Brian Sack (2010), "Large-Scale Asset Purchases by the Federal Reserve: Did They Work?" Federal Reserve Bank of New York Staff Report no. 441, March 2010
- Jarocinski, Marek and Frank R. Smets (2008), "House Prices and the Stance of Monetary Policy," Federal Reserve Bank of St. Louis *Review*, July/August 2008, pp 339-365.
- Judd, John P., and Bharat Trehan (1995), "Has the Fed Gotten Tougher on Inflation?" *FRBSF Weekly Letter* 95-13 (March 31)
- Kahn, George A. (2010), "Taylor Rule Deviations and Financial Imbalances," Federal Reserve Bank of Kansas City *Economic Review*, Second Quarter, pp 63-99.
- Lucas, Robert E. Jr. (2007), Luncheon speech, Dallas Federal Reserve Bank Conference, October
- Meltzer, Allan H. (2009), *A History of the Federal Reserve, Volume 2*, University of Chicago Press, Chicago.
- Poole, William (2007), "The Fed's Monetary Policy Rule," Federal Reserve Bank of St. Louis *Review*, January/February
- Stroebel, Johannes C. and John B. Taylor (2009), "Estimated Impact of the Fed's Mortgage-Backed Securities Purchase Program," NBER Working Paper Number 15626, December 2009
- Taylor, John B. (1999), *Monetary Policy Rules*, University of Chicago Press, Chicago
- Taylor, John B. (2007), "Housing and Monetary Policy," in *Housing, Housing Finance, and Monetary Policy* proceedings of FRB of Kansas City Symposium, Jackson Hole, WY, September 2007. pp. 463-476
- Taylor, John B. (2008) "The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong," *A Festschrift in Honour of David Dodge's Contributions to Canadian Public Policy*, Bank of Canada, November 2008, pp. 1-18.

- Taylor, John B. (2009a), "The Need to Return to a Monetary Framework," *Business Economics*, 44 (2), 2009, pp. 63-72.
- Taylor, John B. (2009b), "The Need for a Clear and Credible Exit Strategy," in John Ciorciari and John Taylor (Eds.) *The Road Ahead for the Fed*, Hoover Institution Press, Stanford, 2009.
- Taylor, John B. (2010a), "Better Living through Monetary Economics," in John Siegfried (ed.) *Better Living Through Economics*, Harvard University Press, 2010, pp. 146-163.
- Taylor, John B. (2010b) "Getting Back on Track: Macroeconomic Policy Lessons from the Financial Crisis" *Federal Reserve Bank of St. Louis Review*, May June 2010, 165-176
- Taylor, John B. (2010c), "The Fed and the Crisis: A Reply to Ben Bernanke," *Wall Street Journal*, p A19, January 11, 2010
- Taylor, John B. (2010d), "An Exit Rule for Monetary Policy," Testimony before the Committee on Financial Services U.S. House of Representatives, March 25
- Taylor, John B. (2010e), Does the Crisis Experience Call for a New Paradigm in Monetary Policy?" Prepared for Presentation at the Warsaw School of Economics, June 23
- Taylor, John B. (2010f), "Commentary: Monetary Policy after the Fall" Presented at the Symposium "Macroeconomic Challenges: The Decade Ahead" Sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 28
- Taylor, John B. and Volker Wieland (2009), "Surprising Comparative Properties of Monetary Models: Results from a New Monetary Model Database," NBER Working Paper, No. 14849.
- Taylor, John B. and John C. Williams (2008a), "A Black Swan in the Money Market," Federal Reserve Bank of San Francisco, Working Paper Series, 2008-04, April 2008.
- Taylor, John B. and John C. Williams (2008b), "Further Results on a Black Swan in the Money Market," SIEPR Discussion Paper No. 07-046, May 2008.
- Taylor, John B. and John C. Williams (2009), "A Black Swan in the Money Market," *American Economic Journal: Macroeconomics*, 1 (1), January 2009, pp. 58-83.
- Taylor, John B. and John C. Williams (2010), "Simple and Robust Rules for Monetary Policy," in Benjamin Friedman and Michael Woodford (Eds.), *Handbook of Monetary Economics*, 3, Elsevier, forthcoming
- Wieland, Volker, Tobias Cwik, Gernot Mueller, Sebastian Schmidt and Maik Wolters (2009). "A New Comparative Approach to Macroeconomic Modelling and Policy Analysis" Manuscript, Center for Financial Studies, Frankfurt

Table 1. List of Models in the Wieland Model Database

1. Small Calibrated Models

- 1.1 Rotemberg, Woodford (1997)
- 1.2 Levin, Wieland, Williams (2003)
- 1.3 Clarida, Gali, Gertler (1999)
- 1.4 Clarida, Gali, Gertler 2-Country (2002)
- 1.5 McCallum, Nelson (1999)
- 1.6 Ireland (2004)
- 1.7 Bernanke, Gertler, Gilchrist (1999)
- 1.8 Gali, Monacelli (2005)

2. Estimated US Models

- 2.1 Fuhrer, Moore (1995)
- 2.2 Orphanides, Wieland (1998)
- 2.3 FRB-US model linearized as in Levin, Wieland, Williams (2003)
- 2.4 FRB-US model 08 linearized by Brayton and Laubach (2008)
- 2.5 FRB-US model 08 mixed expectations, linearized by Laubach (2008)
- 2.6 Smets, Wouters (2007)
- 2.7 CEE/ACEL Altig, Christiano, Eichenbaum, Linde (2004)
- 2.8 New Fed US Model by Edge, Kiley, Laforge (2007)
- 2.9 Rudebusch, Svensson (1999)
- 2.10 Orphanides (2003b)
- 2.11 IMF projection model by Carabenciov et al. (2008)
- 2.12 De Graeve (2008)
- 2.13 Christensen, Dib (2008)
- 2.14 Iacoviello (2005)

3. Estimated Euro Area Models

- 3.1 Coenen, Wieland (2005) (ta: Taylor-staggered contracts)
- 3.2 Coenen, Wieland (2005) (fm: Fuhrer-Moore staggered contracts)
- 3.3 ECB Area Wide model linearized as in Dieppe et al. (2005)
- 3.4 Smets, Wouters (2003)
- 3.5 Euro Area Model of Sveriges Riksbank (Adolfson et al. 2007)
- 3.6 Euro Area Model of the DG-ECFIN EU (Ratto et al. 2009)
- 3.7 ECB New-Area Wide Model of Coenen, McAdam, Straub (2008)

4. Estimated Small Open-Economy Models (other countries)

- 4.1 RAMSES Model of Sveriges Riskbank, Adolfson et al.(2008b)
- 4.2 Model of the Chilean economy by Medina, Soto (2007)

5. Estimated/Calibrated Multi-Country Models

- 5.1 Taylor (1993a) model of G7 economies
- 5.2 Coenen,Wieland (2002, 2003) G3 economies
- 5.3 IMF model of euro area & CZrep by Laxton, Pesenti (2003)
- 5.4 FRB-SIGMA model by Erceg, Gust, Guerrieri (2008)

Figure 1. Treasury OAS: Predicted, Actual, and Residual

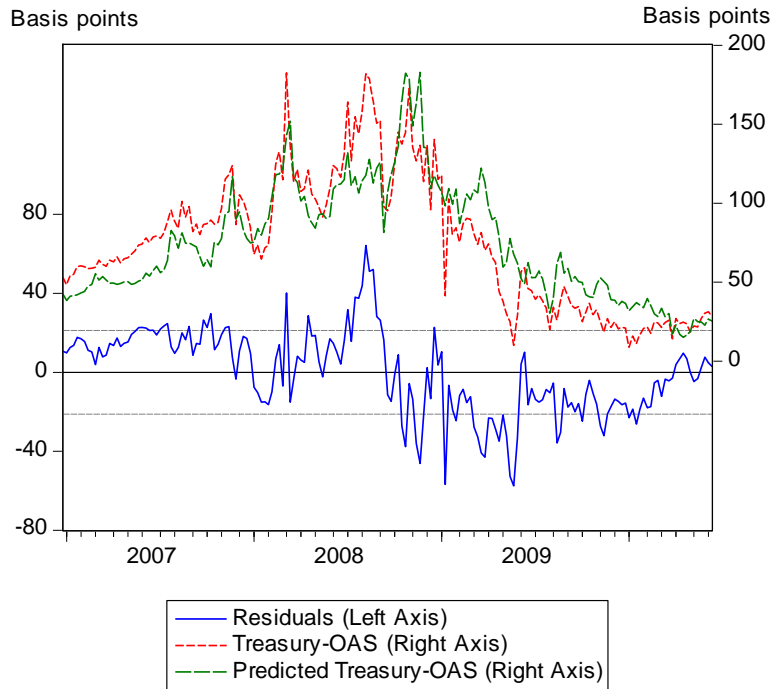


Figure 2. Swap OAS: Predicted, Actual and Residual

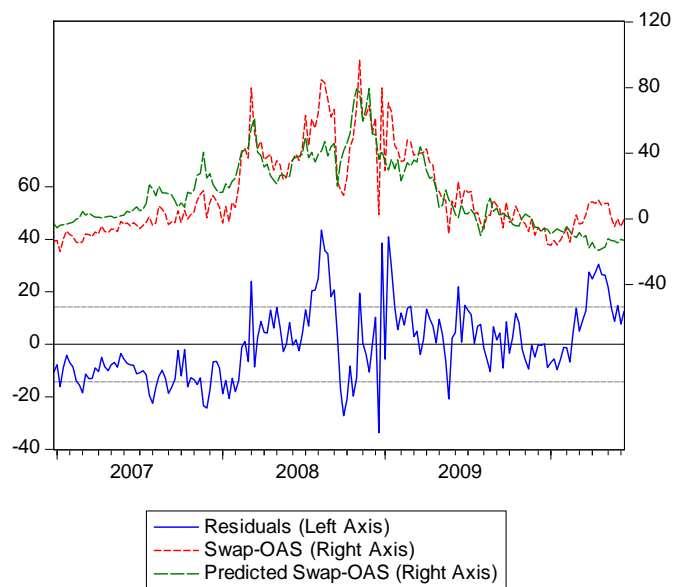


Figure 3. Announcement Effects

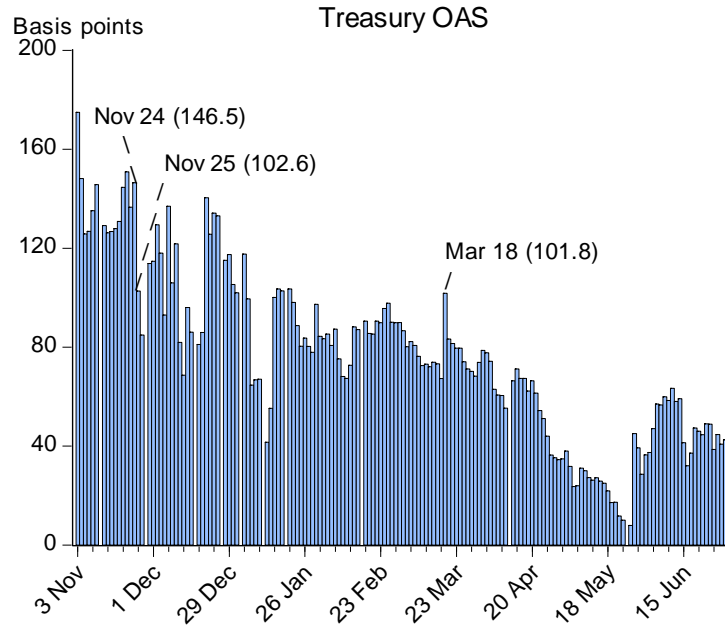


Figure 4. Announcement Effects

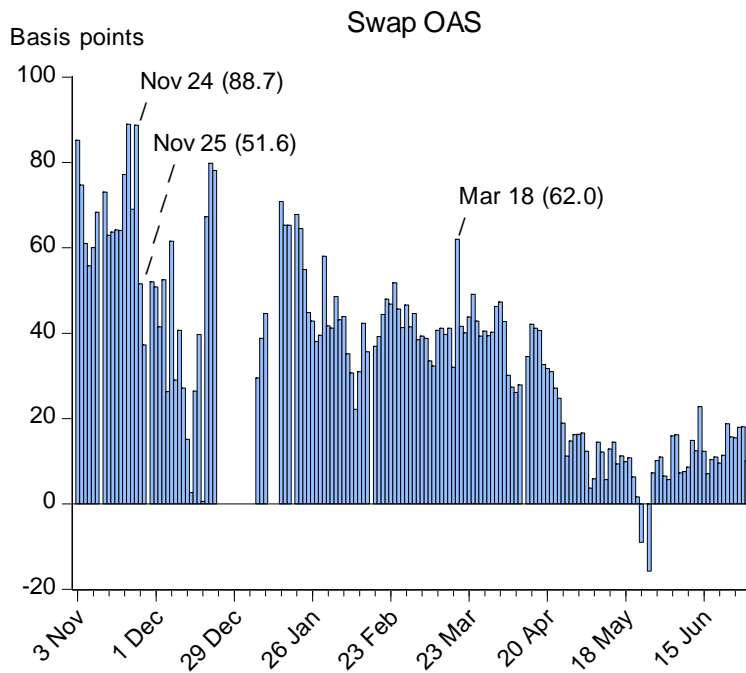


Figure 5

Three Phases of the Crisis: Pre-Panic, Panic, Post-Panic

