Unconventional policies during the crisis and expectations of inflation and growth: a cross-country analysis

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During the global recession of 2008-2009, several central banks implemented a range of highly "unconventional" policies, including changes in the size and composition of their balance sheets. At the same time, fiscal authorities in many countries responded to the deep recession by enacting large fiscal stimulus programs. Evaluating the effectiveness of these measures is of key importance for policymakers. In this article we investigate the effects of unconventional policies implemented during the crisis by comparing experiences across a range of countries. We present evidence consistent with the view that unconventional monetary policies – measured by above-trend growth in central banks' balance sheets – and fiscal expansions implemented in 2008-2009 had a stabilizing effect on expectations of inflation and GDP growth.

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The global recession of the years 2008-2009 produced a significant loss of output, a large increase in unemployment and a deflationary scare in many countries. The depth, scale and duration of the crisis triggered monetary and fiscal policies that were unconventional in terms of both size and scope of the interventions. Many central banks with policy rates at or near the lower bound responded by expanding the size and changing the composition of their balance sheets. In addition, fiscal authorities in several countries implemented large-scale fiscal expansions involving both tax cuts and higher public spending. As seen in Figure 1, expectations of inflation and GDP growth deteriorated in fall 2008, in particular in the aftermath of the collapse of the investment bank Lehman Brothers in September 2008. In spring 2009 – after several countries had announced large fiscal stimulus packages, and after some central banks (for example, the Federal Reserve and the Bank of England) had implemented large-scale asset purchase programs – inflation and output growth expectations showed signs of stabilization. Stock markets and other risky assets also experienced a rebound around that time.

In this edition of *Current Issues* we use cross-country experiences to investigate whether there is evidence of a relationship between unconventional policies put in place during the global recession and the evolution of output and inflation expectations. We find evidence consistent with the view that these policies had a stabilizing effect on expectations.

Evaluating the effects of policies during the financial crisis

Our focus on the effect of policies on *expectations* reflects two main considerations. First, any potential effect of policy on inflation and output is likely to occur with long and variable lags. However, to the extent that policy is perceived as successful, it should have an immediate impact on expectations. Second, economic theory assigns a key role to expectations in the policy transmission mechanism. For example, with very low *nominal* interest rates, an additional way to stimulate the economy is to engineer an increase in inflation expectations in order to reduce the *real* cost of borrowing costs for firms, thus stimulating economic activity. Assessing the role of unconventional policies in helping the stabilization process is a key challenge and the subject of an intense ongoing debate among academics, policymakers, and the public.

Several previous studies have looked at the effect of policy interventions on financial markets during the crisis, focusing mainly on liquidity facilities and asset purchases introduced by central banks around the globe in 2008-2009. The literature concentrates on the financial market impact of policy interventions because many of these policies were designed to lower borrowing costs for the private sector, and if successful should therefore be associated with a decrease in various interest rates. Furthermore, policy interventions aimed to ease financial stress and if successful should result in decreases of measures of risk such as LIBOR-OIS spreads.

To distinguish movements in asset prices due to changes in policy from asset price movements caused by other factors, one strand of the literature has employed the event-study methodology, looking at changes in asset prices during a narrow time window around the policy announcement or the actual policy intervention.[2] The underlying assumption needed to identify the effect of policy is that during this

[2] See for example Gagnon et.al. (2010), Neely (2010), Aït-Sahalia et.al. (2010) and Joyce et.al. (2010).

short window – typically ranging from a few minutes to a few days – any changes in financial markets will solely reflect the impact of the policy announcement, as the economic environment is otherwise unchanged. One difficulty with the event study approach is the choice of the length of the time window around the policy announcement during which changes in financial markets are measured. On the one hand, choosing a suitably short window may successfully isolate the effects of the policy announcement under consideration, but may miss adjustments in financial markets that occur over longer horizons. If market participants take some time to digest the news – which seems possible in particular in the case of policy actions during the financial crisis that were unprecedented in nature and scale – the short horizon may over- or underestimate the effects of policies. On the other hand, choosing a longer window around the specific event date allows one to fully capture the impact of policy actions, but then the estimated effects may be contaminated by changes in the market environment and by data releases that came out around the same time. Other studies focus on the effect of policy interventions on financial markets over a longer period of time.[3] Finally, Baumeister and Benati (2010) and Cúrdia and Ferrero (2011) analyze the effect of central bank interventions during the crisis on inflation and economic activity.

In this article we take a different approach. First, we provide an assessment of the potential effects of policies on expectations of inflation and output growth. Second, we exploit data from a cross-section of countries to evaluate the effects of policy. As an example, consider an expansion in central banks' balance sheets during the crisis: if it is the case that stronger balance sheet growth – corresponding to looser monetary policy – increased expectations of future inflation, then one should expect to find that countries with higher balance sheet expansions on average experienced larger increases (or smaller decreases) in inflation expectations. By exploiting differences in the evolution of expectations across countries that are associated with differences in policy, we provide a measure of the effects of policies during the crisis. However, we stress that this type of analysis is subject to well-known limitations that we discuss in detail below.

Measures of expectations of inflation and output growth

To measure expectations of inflation and output growth we use data from Consensus Economics. Every month, Consensus Economics collects forecasts for a set of macroeconomic and financial variables from a range of financial analysts, for both advanced economies and selected emerging economies. From this dataset, we use the mean of analysts' forecasts of inflation and GDP growth. The forecasts collected by Consensus Economics are for year-over-year growth rates in the consumer price index (CPI) and real GDP.[4] Our sample includes the G20 economies with the exception of Indonesia[5] and the euro area countries except Cyprus, Luxembourg, Malta, Slovenia and Slovakia. In addition we include Denmark, Hungary, Israel, New Zealand, Norway, Sweden, Switzerland and Thailand.

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[3] See for example Frank and Hesse (2009), Stroebel and Taylor (2009), Taylor and Williams (2009), D'Amico and King (2010) Gagnon et.al. (2010) and Hamilton and Wu (2010).

[4] Except for Argentina, Brazil, Mexico and Russia where inflation forecasts are for December/December. For India the forecasts are for average inflation and growth over the fiscal year (which begins on April 1).

[5] No central bank balance sheet data are available for Indonesia.

A measure of unconventional monetary policy

In late 2008 and 2009, the outlook in many countries was for a deep recession and low and falling inflation, while the financial system was exceptionally fragile. With policy rates at or close to the lower bound, central banks resorted to a variety of "unconventional" policy actions to continue supporting the financial sector, boost economic growth, and prevent inflation from falling uncomfortably low. Unconventional measures included providing larger amounts of liquidity to the financial sector, for longer periods, and changing the terms of liquidity provision; extending the range of financial institutions that have access to central bank liquidity, and accepting a broader range of assets as collateral; changing the composition of central bank balance sheets ("credit easing") by purchasing long-duration government bonds and private sector assets in order to improve liquidity and lower borrowing costs, or by purchasing foreign exchange to prevent "excessive" appreciation of the currency in the face of safe-haven inflows; and expanding the balance sheet to boost the money supply and raise nominal spending ("quantitative easing").[6] While it is difficult to account for these various policies in our empirical analysis, it is notable that many of these policies were associated with unusually large balance sheet expansions. Therefore we base our measure of unconventional monetary policies during the crisis on changes in the size of central banks' balance sheets.

Figure 2 shows the evolution of the size of balance sheets of selected central banks during the financial crisis. The balance sheet expansions after September 2008 were in many cases a direct response to the escalation of the financial crisis after the failure of Lehman Brothers. Around that time several central banks introduced new credit facilities which provided unprecedented access to central bank liquidity to the financial sector. Notice that starting in early spring 2009 there is an additional, steadier increase in the size of balance sheets, which typically involved new or increased asset purchase programs.

We choose to focus on the period between February and December 2009. This is a compromise between a narrow window around March 2009 when expectations appear to have stabilized (see Figure 1) and a window that is sufficiently long to cover increases in asset purchase programs that occurred throughout 2009 but were already announced or anticipated earlier. Moreover, March 2009 coincides with the introduction or extension of major asset purchase programs. For example, while the Federal Reserve initially announced that it would purchase up to $100 billion of agency debt and up to $500 billion of mortgage-backed securities (MBS) in November 2008, a major extension of its large-scale asset purchases occurred in March 2009, with purchases still taking place at the end of 2009. Also, the Bank of England began its asset purchase program financed by the creation of central bank reserves ("quantitative easing") in March 2009.[7] As another example, the increase in the balance sheet of the Swiss National Bank during the crisis reflects partly its purchases of foreign currency, initiated in March

[6] Timelines of the policy responses to the global financial crisis are available at http://www.newyorkfed.org/research/global_economy/policyresponses.html.

[7] In March 2009 the Fed announced it would increase its MBS purchases by a further $750 billion, and would also purchase further agency debt and begin purchasing long-term US government debt. The Bank of England initially announced asset purchases worth £75 billion in March 2009, and increased that amount to £200 billion by November (asset purchases were completed in January 2010).

2009, in an attempt to prevent further appreciation of the Swiss franc in the face of safe-haven flows.[8] Similarly, the gradual increase in the Bank of Israel's balance sheet throughout 2008 reflects its foreign exchange interventions. Perhaps surprisingly, the ECB balance sheet shows a slight decline between February and December 2009. This could reflect diminished demand for funds by the banking system following the massive supply of long-term liquidity in the fall of 2008. The key results of our analysis are robust to changes in the time window over which central bank balance sheet expansions are measured.[9]

Monetary authorities in some of the countries in our sample had been experiencing strong balance sheet expansions for a few years prior to the 2008-2009 recession, likely as a by-product of their monetary and exchange rate arrangements. Therefore, to measure the extent to which balance sheet expansions during the crisis were "unconventional", we look at deviations from average rates of balance sheet expansion calculated in a pre-crisis period – what we refer to as detrended balance sheet growth. Concretely, for each monetary authority we calculate the annual rate of balance sheet expansion between January 2005 and June 2007, and subtract ten months of average growth from the February to December 2009 balance sheet change. For euro area countries we use the detrended balance sheet growth of the euro system, since monetary decisions are taken centrally by the European Central Bank (ECB).

Finally, we collect measures of fiscal stimulus as a percentage of GDP from policy announcements made by national authorities in 2008 and up to April 2009. Fiscal stimulus is likely to have both an immediate effect on expectations upon announcement and an additional effect on expectations once stimulus is actually implemented and seen as affecting the real economy. Fiscal policy expansions typically take some time to be implemented, so we also include announcements made in 2008.

A first look at the relationship between unconventional monetary policy during the crisis and changes in expectations

Figure 3 illustrates the relationship between unconventional monetary policies and changes in expectations about 2009 inflation. Each data point represents a country, with the size of the data points reflecting the size of the (detrended) central bank balance sheet increase from February to December 2009.[10] The chart plots the change in expectations between September 2008 – the month of the Lehman bankruptcy – and March 2009 on the vertical axis, and the change in expectations between March 2009 and July 2009 on the horizontal axis. These dates are chosen because September 2008 - March 2009 roughly corresponds to the period when expectations of inflation and growth declined dramatically, while expectations stabilized / rebounded afterwards (see Figure 1). An additional reason to focus on March 2009 as a break point is that this roughly corresponds to the introduction of several asset

[8] In March 2009 the Swiss National Bank announced that it would begin to intervene in the currency market to prevent a further appreciation of the Swiss Franc against the Euro. This intervention, which continued into 2010, was only partially sterilized. In addition, the Swiss National Bank purchased bonds issued by the private sector and lowered its target range for 3-month Libor to 0-0.75%, aiming for the lower end of the target band.
[9] For details, see Carvalho, Curdia, Eusepi and Grisse (2011).
[10] The size of the data points is equal to a constant plus the size of the detrended balance sheet expansion (note that several central banks experience a balance sheet decline between February and December 2009 once the trend growth is subtracted). The constant is added so that all data points become visible.

purchase programs implemented by central banks, as discussed above. The choice of July 2009 for the end of the time window allows us to capture the changes in expectations that we are trying to explain, while at the same time keeping the window relatively short. The results using windows ending in adjacent months are broadly consistent with the findings we report below.

What emerges from this chart is that countries that implemented larger central bank balance sheet expansions between February and December 2009 tended to also experience larger expectations reversals: larger declines before March 2009 and/or larger increases after March 2009. This is illustrated with "warmer" colors (from dark to light blue, light red, and dark red) corresponding to larger expectations reversals. While this chart suggests a relationship between central bank balance sheet expansions and changes in expectations, correlation of course does not imply causality.

Regression analysis

To investigate this relationship further we run cross-country regressions of changes in expectations of inflation and GDP growth between March and July 2009 on measures of detrended central bank balance sheet growth and fiscal expansions. Table 1 summarizes our benchmark results. Detrended balance sheet expansions are associated with higher consensus expectations of 2009 and 2010 inflation. Quantitatively our results suggest that a balance sheet expansion of 10% above trend is associated with an 18.2 basis points increase in expectations of 2009 inflation and a 7.8 basis points increase in expectations of 2010 inflation. Fiscal stimulus does not have a statistically significant link with inflation expectations. In contrast, fiscal stimulus is associated with expectations of higher growth for 2009, although the coefficient is not significant for expectations of 2010 growth. For 2009 the results suggest that a fiscal stimulus of 1% of GDP is associated with 0.12% higher expected growth.

Note that the size of the coefficients on fiscal stimulus is not directly comparable to the estimates of fiscal multipliers that have been discussed in the academic and policy debate: we look at the effect of fiscal expansions on *expectations* of economic growth rather than economic outcomes. Also, we do not distinguish between fiscal expansions consisting of tax cuts or spending increases, which could potentially have different effects on economic activity.

Focusing only on the post-March 2009 changes in survey forecasts might understate the strength of the relationship between policies and expectations. In some countries, expectations of inflation and growth deteriorated more rapidly in late 2008 than in others. In these countries, unconventional policies may not have led to an increase in expectations in spring 2009, but may have still succeeded in halting the decline in expectations. By looking at expectations reversals – in line with Figure 2 defined as the change in expectations between March and July 2009, minus the change in expectations between September 2008 and March 2009 – one can allow for this possibility. Table 2 shows a new set of regression results using expectations reversals as dependent variables. The relation between unconventional monetary policies and changes in inflation expectations appears to be stronger, while the results on the effects of fiscal policies are weaker. However, these findings are also somewhat more difficult to interpret than the previous set of results: a positive link between reversals and unconventional policies can occur both because (1) policy affects expectations, as suggested by the previous regression, and because (2)

countries that experienced more rapid deteriorations in expectations leading up to February 2009 were more likely to adopt more aggressive unconventional policies.

The impact of fiscal policy at the lower bound

Economic theory suggests that under normal conditions, expansionary fiscal policy crowds out private spending: higher government purchases imply lower public saving, which should raise interest rates. With higher borrowing costs, private sector spending declines and offsets some of the stimulative impact of higher government spending. However, when policy rates are at the lower bound[11] and conditions would typically have warranted even lower policy rates – as was arguably the case for several countries in our sample during the financial crisis – interest rates may not be raised in response to expansionary fiscal policy. In this case there is no crowding out effect, implying that the economic impact of expansionary fiscal policy should be larger.[12]

To investigate these ideas we adapt our baseline regression to allow the impact of fiscal stimulus to depend on whether policy rates were at the lower bound or not. To determine which countries were at the lower bound we look at how policy rates evolved over time. In particular, we assume that to be included in the lower-bound group the central bank must have left the policy rate unchanged or cut the policy rate by at most 25 basis points in the period between March and July 2009, and that afterwards the policy rate must have remained unchanged through the end of 2009. With this definition Canada, Japan, Switzerland, the United States, and the United Kingdom are classified as lower-bound countries.[13]

Table 3 reports the results. In line with our previous findings, only unconventional monetary policy has a significant relationship with inflation expectations. In countries where policy rates were at the lower bound fiscal stimulus is associated with an increase in expectations of GDP growth in 2009 and 2010. The estimated effects are highly significant. In contrast, for countries that are not in the lower-bound group, fiscal expansions are not associated with a statistically significant effect on growth expectations. Quantitatively, the results suggest that for countries whose policy rates were at or close to the lower bound, a fiscal stimulus worth 1 percent of GDP is associated with a cumulative increase in expectations between March and July 2009 of 0.20 percent for 2009 GDP growth and 0.13 percent for 2010 growth. These results are consistent with the view that fiscal stimulus is more effective when interest rates are at the lower bound.

Interpreting the results

The key question when interpreting our findings is whether the link documented above between policies implemented during the crisis and the stabilization of inflation and growth expectations observed after March 2009 reflects a causal relationship. To answer this question two issues need to be considered.

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[11] The lower bound is the lowest policy rate that the central bank is willing to set. Due to considerations of financial market functioning this need not be zero.

[12] See Woodford (2011) for a discussion of the conditions under which the fiscal multiplier is below or above one in alternative theoretical frameworks.

[13] The ECB is not classified as belonging to the zero-bound group because it cut its policy rate by 50 basis points between March and May 2009.

First, it is possible that in the regressions we have omitted variables that drive both changes in expectations and policymakers' decision to adopt or not adopt specific policies. If this is the case, the estimated effect of policy on changes in expectations may in fact reflect the influence of other factors that are not accounted for in the regression. The question is therefore whether there exist omitted variables that affect the behavior of inflation expectations and at the same time are systematically correlated with the likelihood of policy adoption. Variables that come to mind include the economic situation before the adoption of policy – for example, the degree of deterioration in expectations before March 2009 – and the level of policy rates before the adoption of unconventional monetary policy.

Intuitively, one could argue that countries that initially experienced a larger deterioration in expectations were inherently more likely to experience a larger rebound or a stabilization in expectations later, for example because the extent of the decline in expectations in late 2008 and early 2009 was an overreaction to the escalation of the financial crisis following the Lehman bankruptcy, or because the deterioration and subsequent stabilization of expectations was driven mainly by some other factor, such as energy prices. And a low level of policy rates, corresponding to more expansive monetary policy, could also have been associated with stabilization of expectations about inflation and growth. At the same time, central banks in countries that experienced a less severe decline in the economic outlook may have been less likely to adopt unconventional policies, and central banks whose policy rates remained well above the lower bound are likely to have responded to the crisis by lowering interest rates further rather than implementing asset purchase programs or similar unconventional policy measures.

Second, we have measured central bank balance sheet expansions from February to December 2009, and have included fiscal policy announcements from both 2008 and 2009. The rationale for measuring size of policy programs over an extended time window was that both fiscal stimulus packages and unconventional monetary policies during the crisis – in particular, central banks' asset purchase programs – were implemented throughout 2009, even though in most cases the overall size of policy interventions was announced or at least anticipated earlier. Therefore, to capture the actual size of policy interventions, we lengthened the time horizon over which they are measured. A potential problem arises again because the decision by monetary and fiscal authorities to adopt certain policies is endogenous, and may be directly influenced by the evolution of expectations that we have used as dependent variables in the regressions. If this is the case then the estimated coefficients in our regressions will be affected because of simultaneous equation bias. However, we argue that even if this is the case, the effect of this bias is likely to work against finding a positive link between policy and stabilization in expectations. This is because arguably policymakers would have been less likely to expand the size of their interventions if they observed a rebound of expectations. Therefore, our results may well understate the true impact of policy interventions during the crisis.

One limitation of our analysis is that our sample includes only a limited number of observations. We therefore cannot sensibly control for the multitude of variables that could potentially have affected the evolution of expectations of inflation and growth during the crisis. However, as long as these omitted variables are not systematically correlated with our measures of unconventional monetary and fiscal policy, as discussed above, the point estimates of the coefficients in our regressions should not be

affected. However, including potentially relevant control variables would lead to smaller standard errors and more precisely estimated coefficients.

Finally, the key findings presented in this article are robust to alternative specifications of the time windows used to measure changes in the growth of central bank balance sheets and fiscal stimulus. For details we refer the interested reader to Carvalho, Curdia, Eusepi and Grisse (2011).[14]

Conclusion

In this article we have provided some evidence to help to answer a question that is of key importance to policymakers: were the monetary and fiscal policy actions implemented during the financial crisis effective? We document a positive link between expansionary monetary and fiscal policies during the financial crisis and measures of expectations of inflation and real GDP growth. However, one should be cautious in interpreting the results as showing a causal relationship between those policies and expectations. The policies themselves cannot be considered as exogenous variables in the regressions, as they likely reflect a response to country-specific economic conditions. Addressing the issue of causality remains an important task for a definitive assessment of the effects of the policies considered here.

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Figure 1.

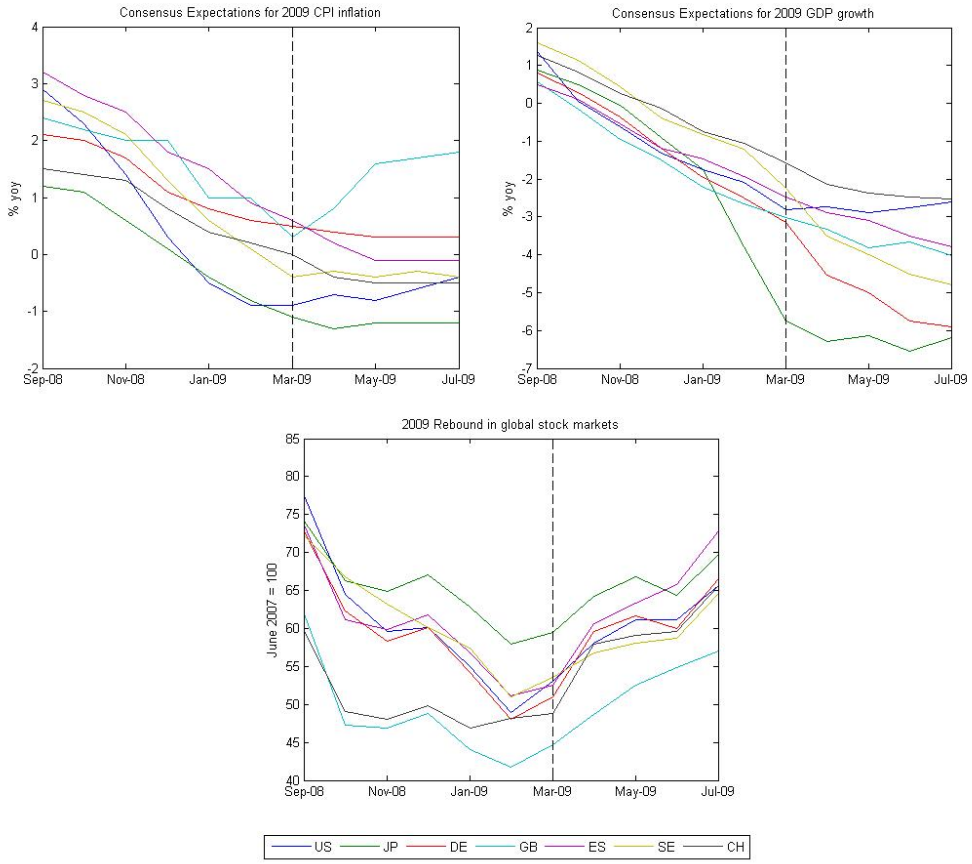


Figure 2.

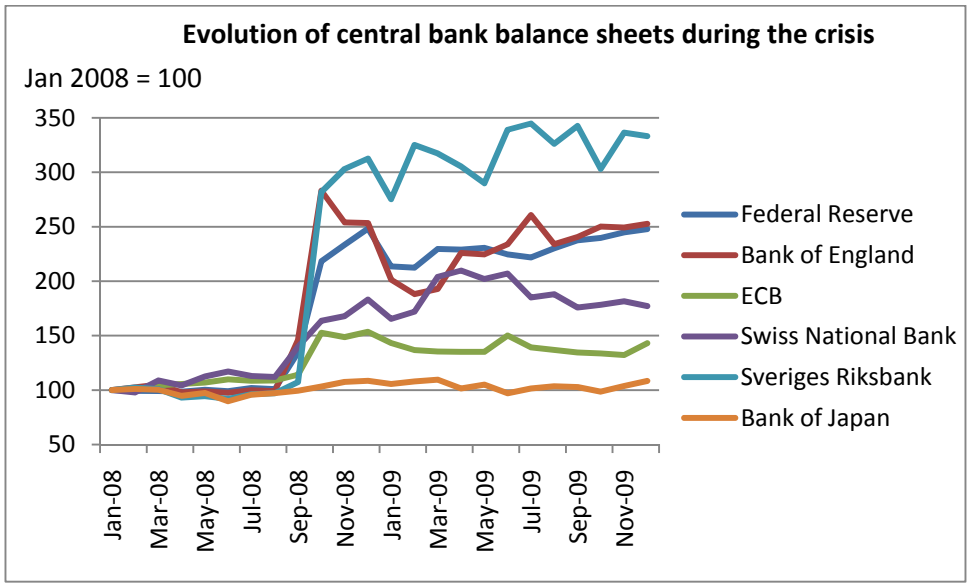
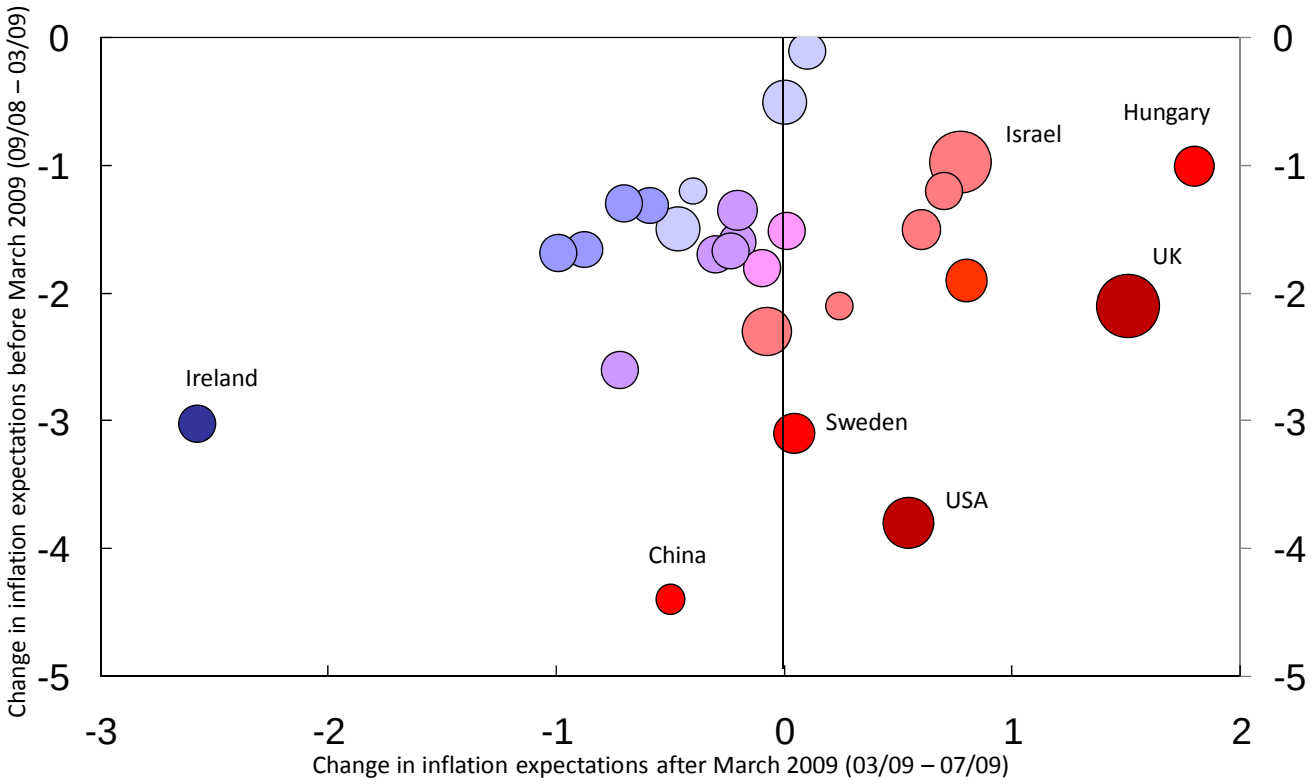


Figure 3.

Reversal in 2009 Inflation Expectations



Source: Authors' calculations using data from Consensus Economics and national central banks

Note: Size of each data point reflects % change in detrended balance sheet (Feb-Dec 09)

Table 1: Benchmark results: changes in expectations

Dependent Variables	Inflation 2009	Growth 2009	Inflation 2010	Growth 2010
constant	.06	-1.63***	-.09	-.33**
	(.15)	(.27)	(.10)	(.13)
	[.70]	[.00]	[.37]	[.02]
Balance Sheet	1.82**	1.50	.78**	.18
	(.75)	(1.42)	(.32)	(.42)
	[.02]	[.30]	[.02]	[.67]
Fiscal Stimulus	-3.46	12.04*	-1.08	3.12
	(3.57)	(6.29)	(2.78)	(3.29)
	[.34]	[.07]	[.70]	[.35]
R^2	0.18	0.10	0.11	0.03
Observations	34	34	33	33

Notes: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Huber-White robust standard errors in parentheses, p-values in square brackets. Dependent variables are the March to July 2009 changes in expectations.

Table 2: Results for expectations reversals

Dependent Variables	Inflation 2009	Growth 2009	Inflation 2010	Growth 2010
constant	1.55***	2.61***	.02	.04
	(.29)	(.44)	(.14)	(.14)
	[.00]	[.00]	[.87]	[.80]
Balance Sheet	4.38***	1.11	1.66*	.03
	(1.65)	(1.26)	(.87)	(.61)
	[.01]	[.38]	[.07]	[.96]
Fiscal Stimulus	14.80**	11.21	.77	3.50
	(6.96)	(9.64)	(4.09)	(3.46)
	[.04]	[.25]	[.85]	[.32]
R^2	0.37	0.04	0.23	0.04
Observations	34	34	33	33

Notes: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Huber-White robust standard errors in parentheses, p-values in square brackets. Dependent variables are reversals in expectations, defined as the difference between the March - December 2009 change and the September 2008 - March 2009 change.

Table 3: Fiscal policy at the lower bound - changes in expectations

Dependent Variables	Inflation 2009	Growth 2009	Inflation 2010	Growth 2010
constant	.05	-1.64***	-.09	-.34**
	(.16)	(.28)	(.10)	(.14)
	[.74]	[.00]	[.38]	[.02]
Balance Sheet	1.59*	1.15	.71*	-.29
	(.87)	(1.68)	(.36)	(.38)
	[.08]	[.50]	[.06]	[.46]
Fiscal Stimulus NLB	-5.26	9.34	-1.63	-.01
	(5.01)	(9.04)	(3.63)	(.05)
	[.30]	[.31]	[.70]	[.92]
Fiscal Stimulus LB	1.31	19.21**	.38	12.67***
	(4.65)	(7.37)	(2.97)	(2.20)
	[.78]	[.01]	[.90]	[.00]
R^2	0.20	0.12	0.12	0.18
Observations	34	34	33	33

Notes: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. Huber-White robust standard errors in parentheses, p-values in square brackets. Dependent variables are the March to July 2009 changes in expectations. The variable "Fiscal Stimulus LB" captures fiscal stimulus for countries that were at the lower bound during 2009 according to our criterion (it equals zero for countries that were not at the lower bound), while "Fiscal Stimulus LB" includes fiscal stimulus of countries that were not at the lower bound (it equals zero for countries that were at the lower bound). The lower bound group includes Canada, Japan, Switzerland, the United States, and the United Kingdom.