DISCUSSION PAPER SERIES

No. 7815

BANKING CRISES, OUTPUT LOSS AND FISCAL POLICY

Alessandro Turrini, Werner Röger
and Istvan Pal Székely

INTERNATIONAL MACROECONOMICS and INTERNATIONAL TRADE AND REGIONAL ECONOMICS

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP7815.asp** _

ISSN 0265-8003

BANKING CRISES, OUTPUT LOSS AND FISCAL POLICY

Alessandro Turrini, European Commission and CEPR
Werner Röger, European Commission
Istvan Pal Székely, European Commission

Discussion Paper No. 7815
May 2010

Centre for Economic Policy Research
53–56 Gt Sutton St, London EC1V 0DG, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 7815

May 2010

ABSTRACT

Banking crises, Output Loss and Fiscal Policy*

This paper analyses the role fiscal policy plays during banking crises in supporting short-term GDP growth and the growth potential. Using a database covering 56 advanced and emerging economies for the period 1970-2008, it is found that fiscal policy, whether it is expansionary or contractionary, appears to matter for the impact of banking crises on headline growth but not on potential output. The stronger expansionary impact of fiscal policy during banking crises does not seem to be driven by the fact that resources are largely underutilized in those periods. DSGE model simulations help provide an interpretation of these findings. If agents are constrained in their borrowing by the value of their collateral (e.g., Kiyotaki and Moore, 1997), fiscal multipliers during banking crises are higher because the fiscal expansion has the additional effect of increasing the value of the collateral constrained households have, thus boosting demand also via a relaxation of lending constraints by banks.

JEL Classification: E6, G01 and H3
Keywords: banking crises, DSGE models and financial market imperfections and fiscal policy

Alessandro Antonio Turrini
DG Economic and Financial Affairs
European Commission
200 rue de la Loi
B-1049 Brussels
BELGIUM M
Email:
alessandro.turrini@ec.europa.eu

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=133932

Werner Röger
DG Economic and Financial Affairs
European Commission
200 rue de la Loi
B-1049 Brussels
BELGIUM
Email: Werner.Roeger@ec.europa.eu

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=149853

Istvan Pal Székely
DG Economic and Financial Affairs
European Commission
200 rue de la Loi
B-1049 Brussels
BELGIUM
Email: Istvan-Pal.Szekely@ec.europa.eu

* The views expressed in this paper do not reflect necessarily those of the European Commission. The paper has benefited from comments received by participants at the 2010 ASSA Congress in Atlanta.

Submitted 16 April 2010

1. Introduction

Following the collapse of Lehman Brothers, a widespread consensus emerged that the crisis would have had a major impact on the real economy. Reflecting this consensus, the governments of the major world economies revised their fiscal policies, taking a more pro-active stance to fight the incipient recession. At the global level, the largest fiscal expansion of the post-war period is currently being implemented.[1]

A debate on the fiscal response to the crisis has taken place over the past months, and the jury is still out as regards the effects of discretionary fiscal stimulus. Moreover, the emphasis in the debate is gradually shifting from the urgency of implementing measures to counter the collapse in aggregate demand to the need to ensure that the fiscal measures taken are sustainable over the medium-to-long term and that a credible exit strategy from the current exceptional fiscal stimulus is put in place.

While the assessment on the desirability and design of fiscal stimulus and fiscal exit strategy needs to take on board a series of considerations related, inter-alia, to the outlook for global recovery, developments in the financial sector, and the state of public finances, a fundamental issue is whether fiscal policy is actually effective in triggering a response of economic activity and, if so, whether it matters that there is a financial crisis.

The aim of this paper is to assess fiscal policy effectiveness during banking crises. Compared with the relatively few existing work on the subject (e.g., Eggertson, 2008; Spilimbergo et al., 2008; Auerbach, 2009; Eggertson, 2009; Taylor, 2009) our aim is to tackle the issue both from an empirical viewpoint, looking at the experience of a panel of countries during past banking crises, and from the perspective of the predictions arising from New-Keynesian Dynamic Stochastic General Equilibrium models incorporating key features of financial markets that permit to model the presence of a banking crisis. The analysis of the data permits us to distil a series of important stylised facts and basic findings, which are further interpreted using DSGE models.

[1] The US authorities have used fiscal policy to counter the weakening economy since the early phase of the crisis. A stimulus package (The Economic Stimulus Act), worth 1.2% of GDP, was enacted already in February 2008 (Congressional Budget Office, 2008). A much larger stimulus package, the American Recovery and Reinvestment Act, was signed into law in February 2009, which is expected to increase the federal deficit by 2.1% of GDP in 2009 and by 2.4% in 2010, with further measures to be taken in subsequent years. The most significant stimulus measures carried out in EU countries were proposed and approved not earlier than Autumn 2008. The European Commission urged the EU countries to use fiscal stimulus to counter the crisis, recommending measures to be timely, temporary, targeted, and co-ordinated, so that their impact on demand is maximised and sufficiently large aggregate stimulus is achieved. The aggregate stimulus in the EU is estimated to be at 1.1% of GDP in 2009, while the stimulus in 2010 is estimated at 0.8% of GDP (see European Commission 2009a and 2009b). A large fiscal package was announced in November 2008 and enacted in 2009 by China. Japan approved a major fiscal stimulus package in 2009.

The recent revival of discretionary fiscal policy has renewed the debate about the effectiveness of short term fiscal stabilisation. Until about a decade ago, the prevailing view was that it was best to "let fiscal policy have its main countercyclical impact through the automatic stabilizers" and that "…discretionary fiscal policy to be saved explicitly for longer term issues, requiring less frequent changes" (Taylor, 2000).

This scepticism on the effectiveness of fiscal policy might have been justified by specific factors. First, there was mounting disillusion about the feasibility of fiscal fine-tuning, in light of the well-known identification and implementation lags with the use of discretionary fiscal measures and distorted incentives by fiscal authorities.[2] Second, in the recent decades, supply shocks were more frequent than demand shocks in advanced economies.[3] When the economy is hit by supply shocks there is little active discretionary fiscal policy can do. Finally, the growing scepticism in this regard could have been related to the fact that, as a result of institutional and technological developments, the effectiveness of discretionary fiscal policy has been declining over time. On the one hand, deepening real and financial integration among economies has contributed to a reduction in the size of fiscal multipliers by raising the extent to which fiscal expansion could leak through net exports and by raising the sensitivity of capital flows to interest rate changes resulting from discretionary fiscal shocks. On the other hand, as a result of financial liberalisation, deregulation, and the development of new financial markets and instruments, the scope for consumption smoothing via financial markets has widened, thus implying less powerful effects of fiscal policy on aggregate demand.

Regarding the existing estimates of fiscal multipliers, there is a certain consensus that fiscal policy may have effects on the level of economic activity, but results vary widely according to the methodology employed. Approaches based on micro studies of the effects of large expenditure and tax shocks suggest that fiscal multipliers could be sizable.[4] Estimates from

[2] The analysis of the past experience of many countries shows indeed that, either because fiscal policy cannot correctly assess the economic cycle in real time, or because of the long and variable lags in fiscal policy, or because of non-aligned incentives, fiscal policy often turned out being pro- rather than counter-cyclical (e.g., Fatas and Mihov (2003), Gali and Perotti (2004)).

[3] Blinder and Rudd (2008) provide empirical evidence on the importance of supply factors for explaining the stagflation period from the beginning of the 1970s to the mid-1980s, with two recessions in 1973-74 and 1982 heavily influenced by strong increases in oil prices. The sudden increase in oil prices associated with the first Iraq war in 1991 also contributed to the recession in the early 1990s.

[4] As a consequence of tax rebates, roughly half to two-third of the income effect is spent on higher consumption (e.g. Broda and Parker, 2008). Narrative studies of the effects of tax changes find very large effects, like a (permanent) 1 per cent of GDP tax increase leading to a 3 per cent contraction in GDP (Romer and Romer, 2007), while narrative studies of episodes of extraordinary spending have tended to find much weaker or negative effects on output (Ramey and Shapiro, 1998).

structural VAR studies also support the view that fiscal policy can have significant output effects, but results vary widely as regards the magnitude of multipliers.[5]

Regarding results from DSGE models, there is some agreement that government spending crowds out private investment, but there is little consensus on the effect of government spending on private consumption. In general, positive consumption effects, and therefore sizable fiscal multipliers, are obtained by assuming a sufficiently large share of "rule of thumb" households that cannot borrow on financial markets as a result of the presence of liquidity constraints.[6]

In the current debate, the usual scepticism about discretionary fiscal policy that prevailed in the last decades seems misplaced in several respects. First of all, discretionary action in the current context does not appear to be a matter of fine-tuning. The current negative shocks hitting the world economy are large, originate on the demand side, and are expected to be long-lasting on the basis of the past experience with banking crises (e.g., Reinhart and Rogoff; 2008). Second, monetary policy is constrained in its action by policy rates hitting the zero bound, which poses a greater responsibility in the hands of fiscal authorities as regards ouput stabilisation. Finally, fiscal multipliers are likely to be higher, for a series of reasons. First, during large and protracted demand-induced recessions, fiscal policy could play a role in reversing agents' pessimistic expectations, thus entailing a stronger stimulus on aggregate demand (e.g., Eggertsson, 2008). Moreoever, in the presence of large negative output gaps, downward nominal price rigidities may imply a flat Phillips curve and therefore a limited offsetting of fiscal shocks by monetary policy (Akerlof et al., 1996). Second, during banking crises the supply of lending could fall due to a tightening of collateral (or other) constraints by the banking sector. In this respect, banking crises corresponds to periods where banks tighten their lending conditions, by raising more steeply the required interest rate premium in response to deteriorations in loan to value ratios. If this is the case, fiscal policy could exert a further positive effect on output by limiting the fall in the value of

[5] Blanchard and Perotti (2002) analyse US fiscal policy and find multipliers often close to one. Gali et al. (2007) report VAR estimates for the US using data back to the 1950s and report a spending multiplier of 0.78 on impact and of 1.74 at the end of the second year. Mountford and Uhlig (2005) estimate the effects of a “balanced budget” and a “deficit spending” shock and find that government spending shocks crowd out investment, but hardly change consumption. Perotti (2005) looks at five OECD countries and finds that fiscal multipliers are generally weaker when including interest rates in the VAR and that multipliers have been shrinking over time.

[6] Gali et al. (2007) show that a positive effect on private consumption can be obtained by introducing liquidity constrained "rule of thumb" households. Ratto et al. (2009a) estimate a first-year multiplier for government consumption shocks of around 0.6 with an estimated share of liquidity constrained households of about 30% for the euro area, a similar multiplier for government investment but a lower one for transfers. Coenen and Straub (2005) also find a temporary increase in consumption for a similar share of liquidity-constrained households. As regards alternative mechanisms that generate a positive response of consumption to fiscal shocks, Ravn et al. (2007) introduce a market structure into the model which implies a strong decline in mark ups in the case of a government spending shock, while Monacelli et al. (2008) introduce a utility function which implies a stronger co-movement between hours worked and consumption..

the collateral used by banks to set lending rates, thus relaxing collateral constraints and exerting an additional expansionary effect on demand. Finally, the fact that monetary policy could find itself at the zero-interest rate bound could imply, per-se, higher fiscal multipliers due to the more muted response of monetary policy to fiscal stimulus.

This paper analyses first the interaction between banking crises and fiscal policy in a sample of 56 advanced and emerging economies over the 1970-2008 period. On the basis of information in existing analyses of banking crises episodes (Demirgüç-Kunt and Detragiache, 2005; Reinhard and Rogoff, 2008; Laeven and Valencia, 2008) and of statistical analysis of the behaviour of bank credit following the start of financial crises, we constructed a banking crisis variable indicating both the start and the duration of banking crisis episodes. We also constructed a measure of the fiscal stance was built on the basis of changes in cyclically-adjusted primary balances. Following an approach akin to Cerra and Saxena (2008), it shown by means of augmented autoregressive models that banking crises have a significant impact on both real GDP growth and potential growth, while an expansionary fiscal stance has a significant effect on GDP growth but not on the growth rate of potential output. More interestingly, the growth impact of fiscal policy turns out being significantly larger during banking crises, irrespective of whether the impulse is on the expenditure or the revenue side, and being unrelated to the mere presence of large negative output gaps during banking crises.

These findings are interpreted in light of predictions from a New-Keynesian dynamic stochastic general equilibrium (DGSE) model in which credit constraints play an important role. On top of unconstrained ("Ricardian") and rule of thumb liquidity-constrained households (Gali et al., 2007), the model includes households that find a constrained in the value of their collateral in line with the literature on the financial accelerator mechanism (as in e.g., Kiyotaki and Moore, 1997; and as implemented in DSGE models as in, e.g., Iacoviello, 2005; Monacelli, 2007). A situation where banking crises are present is modelled as an increase in the share of collateral constrained households. It is shown that the presence of credit constrained households makes fiscal policy a more powerful tool for short run stabilisation because it raises the marginal propensity to consume out of current net income via a simultaneous relaxation of the collateral constraint. The model also shows that fiscal policy effectiveness also increases as a result of the presence of a zero bound for monetary policy.

The remainder of the paper is organised as follows. The next section discusses the main channels through which banking crises might be associated with larger fiscal multipliers byu

means of stylised small New-Keynesiam macro model. Section 3 presents the findings from the empirical analysis. It first illustrated some prima-facie descriptive evidence and proceeds further with regression-based analysis. Section 4 describes the main features of the DSGE model and presents the results from model simulations. Section 5 concludes.

2. Fiscal multipliers with banking crises. A discussion of alternative channels

Why may the presence of banking crises have implications for the effectiveness of with fiscal policy? To highlight the working of alternative channels of interaction between banking crises and fiscal policy and fix ideas to be further explored in the subsequent analysis this section of the paper discusses the size of fiscal multipliers on the basis of a small, stylised New Keynesian model (see for example Clarida et al., 1999). We extend the standard model slightly by adding a loan supply decision of a financial intermediary, where commercial banks are imposing an external finance premium. The structure of the model is made of the following equations.

$$x_t = -\rho(i_t^B - E_t\pi_{t+1}) + E_t x_{t+1} + g_t + u_t^d \quad (1)$$

$$\pi_t = \lambda x_t + \beta E_t \pi_{t+1} + u_t^s \quad (2)$$

$$i_t = \max[0, \tau_1(\pi_t - \bar{\pi}) + \tau_2 x_t] \quad (3)$$

$$i_t^B = i_t + \mu(d_t - x_t) \quad (4)$$

Equation (1) is a forward-looking aggregate demand schedule derived from the Euler equation for the solution of the optimal consumption path of inter-temporally maximising agents, where x_t is the output gap, i_t^B is the nominal interest rate charged by the banking sector, π_t is inflation, g_t [7] is a government expenditure shock, u_t^d is a demand shock, and "*E*" is the expectation operator. Equation (2) is a standard forward-looking new-Keynesian Phillips curve derived from inter-temporal profit maximisation by firms, where prices in

[7] In the derivation of the fiscal shock it is implicitly assumed that there is government expenditure rule, where government expenditure fluctuates around a constant share gs with an iid shock U(t) with mean equal to one. For a small value of gs, the fiscal shock g(t) can be approximated by g(t)=(gs+log(U(t))-gs-E(log(U(t))=log(U(t)) under the iid assumption. Thus, g(t) represents the deviation of government expenditure to GDP ratio from its steady state value.

period *t* are determined by current cost conditions, which are an increasing function of the output gap, future price expectations, and a cost push shock u_t^s. Equation (3) gives the standard Taylor rule summarising the behaviour of monetary policy, with i_t being the policy interest rate and $\bar{\pi}$ representing the target inflation rate. Since nominal interest rates are defined only when they are positive, a zero-bound on interest rates constrains monetary policy. Finally, equation (4) gives a bank interest rate decision rule with an external finance premium which depends possibly on deviations of the loan to value ratio from their target value. The stock of loans d_t is exogenous, and the value of the assets financed by banks is assumed to be positively correlated with the output gap.

Notice under the assumption of i.i.d. shocks it always holds $E_t x_{t+1} = E_t \pi_{t+1} = 0$, which makes it easy to solve the above model for the output gap x_t. It is straightforward to show that the expression for the government expenditure multiplier is linear and takes the following form under standard operation of the Taylor rule:

$$\frac{\Delta x_t}{\Delta g_t} = \frac{1}{1+\rho(\tau_1\lambda + \tau_2 - \mu)}, \tag{5a}$$

while at the zero bound the multiplier is given by:

$$\frac{\Delta x_t}{\Delta g_t} = \frac{1}{1-\rho\mu} \ . \tag{5b}$$

Two remarks are in order. First, under normal conditions, the multiplier is independent of demand and supply shocks, i. e. countercyclical fiscal policy effectiveness does not depend on the source of the shock. Second, the size of the multiplier depends on three factors, namely the interest elasticity of demand, the strength of the monetary policy feed back and the slope of the Phillips curve.

Now we look at the government expenditure multiplier under three different scenarios. Each of these scenarios may imply different values for the model parameters and then for the multipliers of fiscal policy.

(i) Large negative demand shocks. This is the case of "standard" demand-drive recessions where the functioning of credit markets or the reaction of monetary policy is not modified. In terms of the parameters of the model, there is the possibility is that during periods of largely negative output gaps the reaction of prices is more muted, i.e., the Philips curve is flatter, an eventuality stressed in traditional Keynesian theory and based on downward nominal wage rigidity, revived recently in the macroeconomic debate (e.g., Akerlof et al., 1996), and tested in a series of empirical papers (e.g., Laxton et al., 1995; Laxton et al., 1999). With a flatter Phillips curve parameter λ is lower and the multiplier of fiscal policy is higher. Additionally, it has been shown that under episodes of large negative output gaps resulting from large and protracted demand shocks, if agents' expect negative shocks also in the future (which would imply pessimistic expectations on the output gap and expected low inflation which translates into high real interest rates, which would in turn contribute to keep consumption demand low) the fiscal policy multiplier could be particularly high if expansionary fiscal policy manages to affect the expectations of agents on the future state of the economy (Eggertsson, 2008). (This possibility is not consistent with the assumption $E_t x_{t+1} = E_t \pi_{t+1} = 0$ and cannot be straightforwardly analysed in terms of the simple above model).

(ii) (ii) Credit crunch. Under this scenario, the banking sector requires a larger premium to compensate higher loan-to-value ratios. In the model, this corresponds to a large value for parameter μ. Banks respond to a negative output gap and the ensuing value of collateral by lowering the supply of loans. This corresponds to an increase in the loan interest rate which offsets the reduction of the policy rate implied by the Taylor rule and thereby diminishes the stabilising role of the Taylor rule for any negative demand shock. The fiscal multiplier is therefore increased by the presence of a credit crunch because a positive fiscal shock helps containing the fall in the output gap and the market value of assets, thereby relaxing the collateral constraint. This channel provides a rationale to the argument often put forward in the policy debate that fiscal policy in time of banking crises could contain the negative feed-back from the real to the financial sector, thus being particularly effective in helping the recovery (e.g., Auerbach, 2009).

(iii) (iii) Monetary policy at the "zero bound". Under this scenario the Taylor rule in equation (3) would yield negative desired policy interest rate. [8] Hence, i_t is set to zero and there is no standard reaction to inflation and the output gap. Hence, since at the zero bound there is no feed back by the central bank in terms of policy rates, there is no offsetting response of the policy rate to a demand shocks which results into a larger fiscal multiplier (e.g., Eggertsson and Woodford, 2004; Eggertsson, 2009). Indeed, as can be seen from eq. 5b, the multiplier is larger than one with a collateral constraint. It is important to stress that the derivation of the multiplier at the zero bound assumes that the deflationary shock which drives nominal interest rates to the zero bound is temporary and does not affect inflation expectations.

Notice that during banking crises some or all the above effects could be present at the same time. In the subsequent analysis we will try to isolate those channels to the extent possible. In the empirical analysis, we will analyse separately the interaction of fiscal multipliers with situations of large output gaps from those in which episodes of banking crises are recorded. In the analysis based on DSGE model simulations, the channel operating via the collateral constraint and that associated with monetary policy at the zero bound will be analysed separately.

3. Empirical analysis

3.1. Data and stylised facts

We analyse data on growth, banking crises and fiscal policy in sample of 56 advanced and emerging economies over the period 1970-2008.[9] The sample includes most of the recent banking crises and permits to analyse meaningful measures of fiscal policy (whose availability is scarcer for developing economies).

[8] A zero bound could be reached with a negative demand shock that reduces current inflation to such a level where the nominal interest rate would have to fall to a negative value. Notice that this scenario depends crucially on the assumption of unchanged inflation expectations, i. e. on the assumption that the economy is leaving the zero bound in t+1.

[9] The countries included in the sample are as follows: Albania, Argentina, Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Macedonia (FYR), Malaysia, Malta, México, Morocco, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, United States, Uruguay.

Data on the starting year of banking crises taken from the Laeven and Valencia (2008) database were complemented with information on the duration of banking crises episodes. This information is not easily available. Hence, a "banking crisis dummy" taking value one during the whole period in which the banking sector is affected by a banking crisis episode was constructed both on the basis of existing case studies and in depth analyses of past crises (Demirgüç-Kunt and Detragiache, 2005; Reinhard and Rogoff, 2008; Laeven and Valencia, 2008) and on the basis of statistical analysis of the behaviour of the credit to the private sector originating from the banking sector and other financial institutions (source, World Bank, World Development Indicators) following the start of financial crises (see Annex). Disposing of information on the duration of banking crises permits to quantify the average impact of banking crises on output growth taking into account the fact that some crisis episodes were short-lived while others were very protracted in time. This is a step forward compared with existing analysis only including data on the start of the banking crisis (Cerra and Saxena, 2008; Furceri and Mourougane, 2009). It also permits to assess whether, on average, during banking crisis episodes, the fiscal stance was mostly expansionary or contractionary, and whether the fiscal stance taken by the country mattered for the growth impact of the crisis.

Data on real GDP growth are taken from the European Commission DG ECFIN database, the OECD Economic Outlook Database, and the IMF World Economic Outlook Database. With a view to analyse whether the output loss associated with a crisis was mostly cyclical or also impinging on potential output, potential output growth figures are also constructed and analysed (see Annex). Regarding fiscal variables, the source is European Commission DG ECFIN database, and the IMF Government Finance Statistics Database. In order to dispose of meaningful measures of the fiscal impulse, primary budget balances are adjusted for the effect of the cycle (see Annex).

In the whole sample there are 52 episodes of banking crises (23 taking place in EU or OECD countries) with an average duration of 4.7 years, a median of 4 years, a minimum duration of 1 year and maximum of 10 years. Information is available for GDP growth for 49 of these 52 episodes (20 in EU or OECD countries). Data are available for both growth and the fiscal stance (as measured by the change in the primary cyclically-adjusted government budget balance (CAB)) for 27 episodes (14 taking place in EU or OECD countries).

On average, 8 per cent of the country/year combinations for which data on both growth and the fiscal stance are available are characterised by the presence of a banking crisis; 13 per cent of the cases for emerging economies, 6 per cent of the cases for advanced economies

(EU or OECD countries). Graph 1 reports the frequency of banking crisis periods separately in emerging and advanced economies distinguishing for the fiscal stance taken by the government (contractionary if the year-on-year change in the primary CAB/GDP ratio is positive, expansionary if non-negative). It appears that while in a majority of cases fiscal policy was contractionary in emerging economies, in EU or OECD countries during periods of strong distress for banks the government adopted more frequently an expansionary rather than contractionary fiscal stance. All country / year combinations characterised by banking crises are reported in Table A.1. in the Annex distinguishing for the behaviour of fiscal policy.

Graph 1 here

Graph 2 reports the average GDP growth and potential growth (the growth rate of potential output) during periods with and without banking crises. It shows that both in emerging and advanced economies GDP growth during banking crises is almost half that during periods without financial distress. The difference is highly statistically significant and equal to 1.6 per cent for emerging economies and 2.3 per cent for advanced economies (EU or OECD countries). As for potential growth, there is also indication that banking crises could have dented on the growth rate of potential output. Although the difference between average potential growth rates with and without banking crises is more limited (about 1 per cent in emerging countries; about 0.6 per cent in EU or OECD countries) it is statistically significant at the 1 per cent level.

Graph 2 here

In order to dispose of prima-facie evidence on whether the stance of fiscal policy matter for the impact of banking crises on output, Graph 3 displays average GDP and potential growth distinguishing both between cases where banks were affected or not by crises and between cases where fiscal policy was expansionary of contractionary. It turns out that banking crises are associated with statistically significantly lower average GDP growth (at 1 per cent level) irrespective of fiscal stance taken, and that average GDP growth is higher when fiscal policy is expansionary and significantly so (at the 5 per cent level) irrespective of whether banking

crises are present or not. However, fiscal policy appears to matter particularly in the presence of banking crises: the fact that fiscal policy is expansionary is associated with about 2 percentage points of additional growth during banking crises periods, while the difference is about 0.7 percentage points when crises are not present. A broadly qualitatively similar picture emerges when limiting the sample to EU or OECD countries only (Graph 4).

Graph 3 and 4 here

Moreover, it appears from Graphs 3 and 4 that while banking crises are associated with a reduced potential growth on average, the fiscal stance does not appear to matter for the growth rate of potential output.

Overall, prima facie evidence suggests a series of stylised facts as follows:

- both real GDP growth and the growth potential are on average significantly lower during banking crisis periods;
- the fiscal stance seems to matter on average for real GDP growth but not for potential growth;
- the fiscal stance appears to matter for real GDP growth especially during banking crisis periods.

The aim of the remainder of the empirical analysis is to further check the above findings controlling for other factors affecting growth and potential growth.

3.2. Empirical strategy

We assess the impact of banking crises on real GDP growth and potential growth via a panel autoregressive model of the following type:

$$y_{it} = \sum_{j=1}^{4} \beta_j y_{it-j} + \gamma BC_{it} + \alpha_i + \varepsilon_{it}, \qquad (1)$$

where y_{it} is either GDP or potential growth in country *i* and year *t*, BC_{it} is a dummy variable taking value 1 if a banking crisis takes place in country *i* and year *t*, while α_i and ε_{it} are, respectively, fixed effects and disturbance terms. The selection of four lags for

output growth follows existing analogous work (Cerra and Saxena, 2008; Furceri and Mourougane, 2009). In the above specification, however, the presence of banking crisis is captured by a (dicotomous) indicator of the state of the banking system, while in both Cerra and Saxena (2008) and Furceri and Mourougane (2009) the presence of banking crises is captured by a dummy signalling the start of a crisis and four of its lags. Hence, in our analysis the interpretation of the regression coefficient γ is the average impact on growth of each year during which the economy is affected by a crisis of the banking system.

The analysis of the impact of banking crises on output involves a potentially serious issue of reverse causation. Not only banking crises may affect output growth but current or past values of output growth affect the probability of the occurrence of banking crises. Moreover, growth expectations, possibly related to current actual growth, could trigger crises in the financial sector, thus adding a further channel of possible reverse causation. In the subsequent analysis, we will not aim at addressing this issue for two main reasons. First, it has been shown in previous analyses that adopting techniques to address this reverse causation issue is unlikely to lead to an insignificant estimate of the impact of banking crises on growth. Papers that identify the impact of banking crises using information on the industry-level degree of dependency on exernal finance (an approach inspired by the analysis of financial development on growth by Rajan and Zingales, 1998) find that the sectors that are more dependent on external finance are also those that are more affected by banking crises, this confirming a causation running from banking crises to growth (Krozner et al., 2007; Dell' Ariccia et al., 2007). Cerra and Saxena (2008) also show that reverse causation generated by negative growth forecast in the presence of banking crises is unlikely in light of a tendency for forecast to be excessively optimistic rather than pessimistic before and immediately after the burst of banking crises. The same authors show instead that neglecting a possible negative feed-back from the fall in output growth following crises to the probability of a new banking crises may lead to an underestimation of the overall impact of banking crises on growth. The second reason why do not embark into an attempt to control for the endogeneity of the banking crisis variable is that our main goal is that of assessing whether fiscal policy matters for the impact of banking crises on growth, not that of having an unbiased estimate of the impact of banking crises. The neglect of a possible reverse causation issue may lead to a bias in estimated regression coefficient γ in equation (1). However, as long as this bias is not systematically associated with the stance of fiscal policy, estimates of the interaction between banking crises and fiscal policy are unlikely to be seriously misleading.

Starting from the basic framework in equation (1), our objective is to analyse the interaction between fiscal policy and banking crises in driving output growth. The fact that banking crises are discrete and rare events complicates seriously this analysis in principle. Ideally, in light of the feed-backs between budget balances and output, fiscal policy should be modelled as co-determined together with output, with structural VARs being the standard tool to identify the impact of fiscal policy shocks on output. However, easy solutions does not seem available to capture the different effects that fiscal policy could have on output with and without banking crises because any sample splitting would leave an insufficient amount of data to estimate a structural VAR in the presence of banking crises.

Our strategy to analyse the interaction between banking crises and fiscal policy is therefore to estimate the following equation:

$$y_{it} = \sum_{j=1}^{4} \beta_j y_{it-j} + \gamma BC_{it} + \delta \Delta CAPB_{it} + \phi BC_{it} \Delta CAPB_{it} + \alpha_i + \varepsilon_{it}, \qquad (2)$$

where $\Delta CAPB_{it}$ is the year-on-year change in the cyclically adjusted primary government budget balance, our measure of the fiscal stance. A positive effect on growth of fiscal expansions requires a negative value for the regression coefficient δ (fiscal expansions correspond to deteriorations in the primary CAB). Parameter ϕ measures the interaction between banking crises and fiscal policy in affecting output growth. It can be interpreted in two alternative ways. First, it measures by how much a 1 per cent of GDP contraction in the fiscal stance affects the average impact on growth of banking crisis periods. Second, it captures the difference between the impact of fiscal policy on growth with and without banking crises. As for the regression coefficients γ and δ in equation (2), the are interpreted, respectively, as the impact of banking crises with neutral fiscal policy ($\Delta CAPB_{it}$=0), and the impact of fiscal policy without banking crises (BC_{it}=0). With a view to gauge the separate impact of expenditure and revenue shocks we also estimate equation (2) replacing $\Delta CAPB_{it}$ with the year-on-year change in the primary expenditure / GDP ratio and in the cyclically-adjusted government revenues / GDP ratio.

Aware that there could be an issue with the measurement of fiscal policy due to the well-known limitations with standard methods for adjusting budget balances for cyclical effects, and that, more generally, there could be an issue of endogeneity of any fiscal policy measure relating to the behavioural reaction of fiscal authorities to growth (e.g., Bohn (1998), Gali and Perotti (2004)), we check robustness of results arising from equation (2) using an

alternative measure of the fiscal stance.[10] Rather then using a continuous variable, we construct a dummy taking value one whenever fiscal policy is clearly expansionary according to the change in the primary CAB. Taking the 25 percentile of the whole dataset as a benchmark, with this alternative variable we define fiscal policy to be expansionary whenever $\Delta CAPB_{it}$ <=-1 per cent of GDP. This definition is less likely to include among fiscal expansion episodes those cases in which the change in the primary CAB is mostly driven by incorrect measurement of the cyclical effects of the budget balance (relating inter-alia to fluctuation budgetary elasticities). It is also more likely to restrict fiscal expansions to genuinely exogenous shocks to the behaviour of fiscal authorities, over and above the standard reaction to cyclical fluctuations.

A further check we are interested about is whether the different effects of fiscal policy during banking crises are mostly due to the presence of demand slumps leading to large output gaps or to other causes. A difficulty with controlling for the output gap is a possible endogeneity due to the fact that there could be two-way causation between the output gap and output growth. With a view to partially address this issue, rather than controlling for the output gap per-se we use a "output loss dummy" taking value 1 for sufficiently largely negative values of the output gap variable. Since our aim is to control for the effect of demand slumps during banking crises, the benchmark selected for constructing this dummy variable is the average value for the output gap during banking crisis episodes (-2 per cent).

We therefore estimate a variation of specification (2) also including interactions with an output loss dummy, set equal to 1 whenever the output gap is below the average value recorded during banking crises (-2 per cent). This interaction is performed with both the fiscal impulse variable and the banking crisis dummy and with the interaction between the fiscal impulse and banking crises. This permits to fully separate the effects of banking crises from those of large and protracted drops in demand. The specification to be estimated is therefore as follows:

$$y_{it} = \sum_{j=1}^{4} \beta_j y_{it-j} + \gamma BC_{it} + \delta \Delta CAPB_{it} + \phi BC_{it} \Delta CAPB_{it} + \kappa OL_{it} + \lambda OL_{it} BC_{it} + \\ + \mu OL_{it} \Delta CAPB_{it} + \nu OL_{it} BC_{it} \Delta CAPB_{it} + \alpha_i + \varepsilon_{it} \quad (3)$$

[10] A further source of endogeneity could be related to self-selection. Not all countries may be in the position to carry out fiscal stimulus in response to banking crises. Those countries that are more likely to engage into expansionary fiscal programmes are those with sounder public finances. However, the severity of the recession itself could be a key factor affecting deficit and debt ratios.

where OL_{it} is the output loss dummy. The interpretation of the variables is in this case different compared with specification (2). The non-interacted banking crisis variable measures the impact on growth of banking crises when the output loss is above the average value recorded during banking crises. The interaction $OL_{it}BC_{it}$ captures the increase in the growth effect when banking crises are accompanied by a higher than average output loss. The coefficient of the non-interacted fiscal impulse variable is interpreted as the impact of fiscal policy when there are no banking crises and the output loss is above the average recorded during banking crises, while $OL_{it}\Delta CAPB_{it}$ measures by how much the impact of fiscal policy is bigger when output loss is above average. The interaction $BC_{it}\Delta CAPB_{it}$ to banking crises periods with output loss below average, while the double interaction $OL_{it}BC_{it}\Delta CAPB_{it}$ is the difference in the interaction $OL_{it}BC_{it}$ when the output loss is above average.

The estimation of equation (2) permits to derive a synthetic gauge of the interaction between banking crises and fiscal policy on average. However, it does not permit an assessment of the role of fiscal policy during the whether the presence of the different impact of allow making Hence, as a final check we modify our baseline specification (2) to include lags (up to the 4th order) not only of the dependent variable itself, but also of a dummy variable reporting the start of the banking crisis episode and of the fiscal stance variable. The specification below

$$y_{it} = \sum_{j=1}^{4}\beta_j y_{it-j} + \sum_{j=1}^{4}\gamma_j SC_{it-j} + \sum_{j=1}^{4}\delta_j \Delta CAPB_{it-j} + \sum_{j=1}^{4}\phi_j SC_{it-j}\Delta CAPB_{it} + \alpha_i + \varepsilon_{it}, \quad (4)$$

thus permits to assess not only banking crises have a stronger impact immediately or after some time (as, inter-alia, in Cerra and Saxena, 2008), but also on how the effectiveness of fiscal policy is affected as banking crisis protracts. Note that only the current fiscal impulse is interacted with the dummy for the crisis start and its lags. This permits to have a more parsimonious specification and save on degrees of freedom, including in light of the fact that the lagged values of the fiscal impulse turn out being either insignificant or barely significant (this is the reason why only the current fiscal impulse is included in the baseline sepecification (2)).

3.3. Empirical results

Tables 1-9 report regression results. In each table, results are reported separately for regressions involving real GDP growth and potential growth and the full sample versus a sample of advanced economies only (EU or OECD countries). The estimation method employed is least square dummy variables (country fixed effects included) with standard errors robust with respect to heteroschedasticity and error correlation within countries. Specifications including also time effects and interactions of fiscal impulse variables with trade openness measures have been estimated, with qualitatively unchanged results (unreported).

3.3.1. Impact of banking crises on output

Table 1 reports results for specification (1), an autoregressive model for output growth augmented with the banking crisis dummy. The presence of a banking crisis reduces on average real GDP growth by about 2 percentage points in a significant way. Results appear to be robust with respect to the definition of the sample: very similar findings are obtained for the whole sample and for a sample only including advanced economies. Note that the reduction of 2 per cent refers to the average reduction in growth during a year of banking crisis at impact. Since GDP growth is persistent, the steady-state impact is stronger than that.

Table 1 here

Regarding potential growth, the impact of banking crises is much smaller and not robust with respect to the definition of the sample. Using the whole sample including both emerging and advanced economies, it turns out that banking crises have no significant impact on potential output growth, while the impact is negative, significant, and close to 0.4 per cent in a sample including only EU or OECD countries. The result for advanced economies is broadly in line with the findings in Furceri and Mourougane (2009) whose analysis is also focused on relatively high-income countries (OECD).

3.3.2. Impact of fiscal policy on output

Results on the growth impact of fiscal policy, measured by the change in the cyclically-adjusted primary balance, are displayed in Table 2. A regressive model for growth is

augmented with the fiscal impulse variable. Note that the regression coefficient of the fiscal impulse variable is akin to the fiscal multiplier reported in most DSGE model simulations. Notably, it has the same interpretation as that in the simulations that are reported in section 4, i.e, the additional growth associated with a discretionary fiscal expansion corresponding to a deterioration of 1 per cent of GDP in the budget balance.[11]

For the whole sample, it turns out that loosening fiscal policy in such a way to reduce the primary CAB by 1 per cent of GDP would lead to an additional 0.27 per cent of growth at impact. A very similar result is obtained for the sample restricted to EU or OECD countries. Conversely, fiscal policy does not appear to have any significant impact on potential growth. Actually, the sign is the opposite of that obtained for real GDP growth, with fiscal relaxations associated with a reduction of potential output growth at impact.

Table 2 here

Table 3 repeats the same exercise using a fiscal expansion dummy as an indicator of fiscal policy. As discussed previously, the regression coefficient for this proxy for expansionary fiscal policy is likely to be less affected by measurement or endogeneity issues. The variable is constructed in such a way to take value 1 whenever the change in the primary CAB is equal or lower than -1 per cent of GDP. Results indicate that the presence of a fiscal expansion so-defined raises growth by 0.6 per cent on average across the whole sample and by 0.35 per cent when restricting the sample to advanced economies. Note that when the fiscal expansion dummy is equal to 1, the average value of the change in the primary CAB is -2.2 per cent of GDP. Hence, this evidence is broadly consistent with multipliers of fiscal expansions in line with those estimated using the baseline fiscal impulse variable. Again, also using the fiscal expansion dummy to measure the impact of fiscal policy, no significant impact on potential growth is found.

Table 3 here

[11] This is true up to an approximation. In the empirical exercise the fiscal impulse variable is measured as the change in the share of the (cyclically-adjusted) budget balance over GDP; in the DSGE model simulations the fiscal impulse is measured as a change in the budget balance ensuing from discretionary action as a share of ex-ante GDP.

3.3.3. The interaction between banking crises and fiscal policy

Table 4 reports results for the estimation of specification (2) above. The non-interacted coefficients appear close to those found in the regressions in Tables 1 and 2, thus suggesting that the inclusion of both banking crises and fiscal policy in the same equation does not lead to significant multicollinearity issues (neither that the exclusion of one of the two has repercussions on the other in terms of omitted variable bias). This finding also suggests that, unsurprisingly, the coefficient of the banking crisis dummy over the whole sample is close that that in correspondence of a neutral fiscal stance and that the fiscal multiplier over the whole sample is not very different from that in absence of banking crises.

The coefficient of interest is that of the banking crisis dummy interacted with the fiscal impulse variable. The coefficient appears to be negative and statistically significant. The fact that banking crises are accompanied by an accommodating fiscal policy leading to a 1 per cent of GDP budgetary deterioration implies a significantly lower deterioration in output growth by about ½ percentage point. Alternatively, the coefficient can be read as the increase in the fiscal multiplier when banking crises are present. While in absence of banking crises the fiscal multiplier is just about 0.2 per cent, the presence of crises raises the multiplier to almost 0.8 per cent (2.12+0.574). This result confirms the prima-facie evidence presented in section 2 of the paper and points to a quantitatively very remarkable difference in the size of multipliers in the presence of banking crises, that appear to become almost four times larger. Results appear qualitatively robust with respect to the definition of the sample; no relevant difference regarding the interaction between banking crises and fiscal policy is found when restricting the sample to EU or OECD countries.

Table 4 here

Turning the interaction between banking crises and fiscal policy in driving potential output growth, it appears to be negative (fiscal expansions reducing the negative impact on potential growth) but non statistically significant irrespective of whether the sample includes emerging economies.

The same exercise is repeated in Table 5 using the fiscal expansion dummy to measure fiscal policy. Using this variable to capture fiscal policy it turns out that the interaction of banking crises with the fiscal policy expansion dummy is very large in size, pointing to a lower effect

of crises on growth by about 1 percentage point. The interaction effect, however, is estimated imprecisely (with limited variation for the dicotomic dummy variable and on the basis of a small set of observations, i.e., those for which a banking crisis is taking place and a large fiscal expansion is enacted) and is therefore statistically insignificant.

Table 5 here

3.2.4. Composition of the fiscal adjustment

Does it matter for the interaction of fiscal policy with banking crises whether the adjustment is mainly expenditure or revenue based? This question is addressed in Table 6, where it is estimated a same specification as in (2) but disentangling the change in the CAPB into two variables: the change in primary expenditures as a share of GDP, and the change in cyclically-adjusted revenues as a share of GDP.

In line with expectations, the expenditure multipliers is (about twice) higher than the revenue multiplier, values being about 0.7 for the expenditure multiplier and 0.35 for the multiplier of expenditure.[12] Analogous estimates are found restricting the sample to EU or OECD countries. These values refer to cases where no banking crises are present. The interaction of the expenditure and the revenue impulse variables with the banking crisis dummy reveals that both multipliers become significantly larger when banking crises are present, in both cases above unity. No significant impact is found for potential output neither for expenditures nor for revenues.

Table 6 here

3.3.5. Controlling for output loss

The evidence suggests that fiscal multipliers are bigger in time of crisis. Why this is so is not clear from our simple exercise. With a view to disentangle alternative channels that may lead to large fiscal multipliers, in Table 7 we report results from the estimation of specification (3) above, which includes an output loss variable and interactions with it.

[12] The expenditure multiplier appears close to the military spending multiplier recently estimated on a long time series for the Unites States (Barro and Redlick, 2009).

Results show that the non-interacted fiscal impulse variable keeps a magnitude close to that in the specification that does not control for output loss. Moreover, fiscal policy still results more effective when banking crises take place. The interaction of the fiscal impulse variable with output loss is negative, thus confirming that large demand slumps are associated with a more effective fiscal policy, but not significantly so. Note that the simple interaction between the fiscal impulse and banking crises in this case represents the differential effect of fiscal policy for banking crises where the output loss is below average. The full effect is obtained by adding to this term also the double interaction fiscal impulse*banking crisis*output loss. Quite surprisingly, this double interaction is positive, and significantly so when restricting the sample to advanced economies, meaning that, in the presence of banking crises, the fact that the output loss is above average has the effect of reducing rather than increasing the size of fiscal multipliers. Understanding why is it so is left to further research. For our purposes, the main message from results in Table 7 is that banking crises appear to significantly increase the size of fiscal multipliers irrespective of the size of the output gap.

Table 7 here

3.3.6. Interaction between banking crises and fiscal policy: timing

A final set of regressions investigates how the interaction between banking crises and fiscal policy evolves over time. For this purpose, rather than using our baseline banking crisis dummy, we employ dummies reporting the first year of the crisis and number of years that has passed since then. We also control for the lagged effects of fiscal impulse.

Table 8 here

Table 8 reports results in absence of interactions. Banking crises have a significant impact on output growth that could last several years. The impact reaches a peak in the year after the start of the crisis. Up to the fourth year there is no significant rebound in the growth rate. Actually, four year after the crisis the impact is negative and significantly so when regressions pertain to the whole sample. It also appears that fiscal the effects of fiscal policy are produced almost fully in the first year. The regressions coefficient of fiscal impulse lags are insignificant or barely so. This finding justifies restricting to the simultaneous fiscal

impulse our baseline specifications. It also justifies interacting banking crises only with the simultaneous fiscal impulse. It is also to notice that the positive coefficient of the fiscal stance on potential output (indicating a reduction in potential growth associated with fiscal expansions), which is found insignificant at impact, becomes significant after three years.

Results for a specification admitting interactions are displayed in Table 9. The interaction is performed only for the simultaneous fiscal impulse but extends to up fours lags since the beginning of the fiscal crisis. The aim is to check at what stage of the crisis the interaction with fiscal policy is stronger. It appears that fiscal policy is most effective in the second year after the crisis. However, the sign of the interaction suggests that in general, up to the fourth years since the inception of the crisis fiscal policy is more effective than in absence of crises (the exception is the third year since the start of the crisis in the regression referring to the whole sample).

Table 9 here

3.3.7. Summary

Overall, the empirical analysis uncovers a series of findings that can be summarised as follows.

- Banking crises have a significant negative impact both on real GDP growth and potential growth.
- Expansionary fiscal policy has a significant positive impact on real GDP growth, stronger at impact (in the first of the expansion), and larger for government expenditure than for revenue. The impact on potential growth of fiscal expansions is instead negative, small and generally non significant, but getting significant after some years.
- An expansionary (contractionary) fiscal policy significantly reduces (increases) the negative impact of banking crises on growth. Equivalently, fiscal multipliers appear to be higher during banking crises, a result that appears to be confirmed for both government expenditure and revenue.
- The effect of banking crises on fiscal policy effectiveness seems to be unrelated to the large output loss occurring during banking crises.

- The increase in the value of fiscal multipliers is the strongest in the second year after the start of the crisis, but appears to characterise the whole banking crisis period.

4. Model-based analysis

4.2 Model description

In this section we present results on the effects of fiscal shocks using a two-country version (European Union vs. the Rest of the World) of the European Commissions global DSGE model QUEST III (Ratto et al. 2009). The model version used is described in Roeger and in't Veld (2009) and extends the New-Keynesian, open-economy structure of QUEST III in such a way to allow, in addition to "rule-of-thumb" liquidity constraint households, also households that are constrained in their borrowing by the value of their collateral, along the lines suggested in Kiyotaki and Moore (1997) and already implemented in DSGE models in, inter-alia, Iacoviello (2005) and Monacelli (2007).

There are three production sectors in each region, namely a sector producing tradables, non tradables and houses. All firms are monopolistically competitive. Output in the tradable and non-tradable sectors is produced with a CES production function nesting a Cobb Douglas technology for value added using capital, production workers, public capital, and intermediates. Firms in the residential construction sector use new land and non tradable goods to produce houses Total employment is an aggregate of labour types which are imperfectly substitutable and supplied by individual households behaving as monopolistic competitors. Firms maximise profits inter-temporally by choosing production, capacity utilisation and the combination of production factors and inputs, subject to nominal rigidities and costs for adjusting labour and the utilisation of capital. Moreover, in line with empirical evidence, a fraction of firms is assumed to index price increases to previous-period inflation. Both production functions and preferences are subject to shocks.

The household sector consists of a continuum of households with a fraction that are liquidity constrained (i.e., do not trade on asset markets and consume their disposable income each period), and another fraction that are Ricardian, i.e, can lend and borrow freely in financial markets (government and private bonds, both domestic and foreign) in order to finance consumption, residential investment as well as investment in equipment and structures ('corporate investment'). In a version of the model, a third type of consumers is added: collateral constrained consumers. This type of households differ from Ricardian households because have a higher rate of time preference (which make them net borrowers also in the

steady state) and because they face a constraint on their debt which is proportional to the ratio between loans and the market value of their housing stock. The only stock these households own is residential housing. In their decision problem they optimally allocate spending between consumption and residential investment subject to an intertemporal budget constraint and a collateral constraint. All investment spending of both types of households is subject to adjustment costs.

Monetary policy sets short-run nominal interest rates on the basis of a standard Taylor rule allowing for a smooth response of interest rates and subject to shocks. The government collects revenues from consumption and factor income taxes and spends on government consumption (unproductive), investment, and household transfers. Labour taxes adjust to ensure the stability of the government debt / GDP ratio.

The two economies are linked via trade and financial flows. Concerning trade it is assumed that consumers, 'corporate' investors and the government have identical CES preferences over domestic and foreign goods and services and there is producer pricing in export markets. There is an internationally traded which can be exchanged between domestic and foreign households. Nearly perfect capital mobility is assumed with a risk premium which is a negative function of the countries' net foreign asset position. Consequently interest rates are linked via an interest parity condition plus a risk premium.

4.3. Model simulations

In the following simulation exercises we compare outcomes for fiscal policy under two alternative settings for financial constraints:

- (a) 40 per cent of agents liquidity constrained, 60 per cent of unconstrained Ricardian agents;
- (b) 40 per cent of agents liquidity constrained, 30 per cent collateral constrained agents, 30 per cent of unconstrained Ricardian agents

The case where a fraction of agents is collateral constrained corresponds to a case in which the banking sector is operating a credit crunch. Note that in light of the fact that the model solution is approximated linearly, what matters to capture the effects of the credit crunch is not so much the absolute value of the fraction of collateral constrained agents, but by how much they increase compared with a where there is no significant financial distress.

Regarding the behaviour of monetary policy, the following two cases are considered:

- (c) monetary policy setting short-term official interest rates on the basis of a standard Taylor rule;
- (d) monetary policy constrained by the zero bound constraint in the current year.

A matrix of four cases is obtained. The presence of banking crises corresponds to case (b, c) and (b, d). Simulations for the effects of fiscal shocks are performed for all combination of cases to analyse the interaction between credit constraints and monetary policy.

The fiscal shocks we consider are as follows:

- a temporary (one year) global (applied to both regions) government consumption shock amounting to 1 per cent of baseline GDP.
- a temporary (one year) 1 per cent of GDP shock in labour taxes

The fiscal rule that returns the debt to GDP ratio to baseline levels is turned off for the first year to permit the assessment of the impact of the shock on budget balances, but labour taxes are raised to ensure the debt / GDP ratio stabilises back at baseline from the second year onwards (hence, all fiscal shocks are budgetary neutral in the medium run).

Results are shown in Graphs 5- 8 and refer to the EU. The horizontal axis of the Graphs reports the number of quarters since the occurrence of the shock. The vertical axis reports percentage changes in the variable considered compared with baseline.

4.2.1 Temporary government consumption shock

The first scenario, shown in Graph 5, is a temporary increase in government consumption where monetary policy is not constrained by the zero bound. The Graph compares the outcome of the simulation between case (a), where no collateral constraints are present and agents are either liquidity constrained or Ricardian, with case (b), where a fraction of households is bound by collateral constraints. The temporary fiscal impulse raises GDP by 0.97 per cent in the model with credit constraints and by 0.95 per cent in the model without. The effects are temporary, with no significant impact on steady-state output. Liquidity-constrained consumption reacts positively to the spending shock, as employment and real wages rise, but reduce their consumption in the long-run as labour taxes need to be raised to stabilise debt. As in many similar DSGE models, consumption of Ricardian agents fall. Looking at the behaviour of the variables in the model with collateral constraints one checks that the consumption of collateral agents fall considerably, while that of Ricardian

households fall but less than in a model without collateral constraints. This is explained as follows. First, collateral constrained consumers are relatively more concerned than Ricardian households (which dispose of alternative income sources other than labour) by the increase in labour taxation to stabilise debt. Moreover, Ricardian households are less relatively concerned by the increase in labour taxes to stabilise debt the smaller their share in total economy (because the weight of non-labour income on total income increases), which explains the fact that they reduce consumption by less in the model where there is also a share of collateral constrained consumers. Second, government spending triggers a reaction by monetary authorities and interest rate rise. As a result of higher real interest rates the price of houses and residential investment fall. But since houses are used as collateral, this induces a reduction in the consumption of collateral-constrained agents. Third, the QUEST model incorporates an additional mechanism which is not present in the simple illustrative model in section 2, namely the presence of an interest income effect that weighs on consumption and investment decisions of collateral-constrained households. The fact that these households are net debtors makes their current consumption and residential investment spending sensitive to changes in interest rates. This happens because a collateral constraint on their debt does not allow them to shift consumption over time to the same extent as Ricardian households. This interest income effect, by increasing the interest elasticity of consumption, partially offsets the effect arising from the relaxation of the collateral constraint associated with the fiscal shock.

Graph 5 here

Graph 6 shows results for the same shocks assuming that interest rates are at their zero lower bound and interest rates remain unchanged over the period in which the fiscal stimulus occurs (1 year). The effects of a fiscal stimulus are significantly stronger in this case (Graph6) because there is a sharp fall in the *real* interest rate and this increases aggregate demand. Collateral-constrained consumers react strongly, with a large increase in consumption, larger than that of liquidity-constrained consumers, as there is both a stronger loosening of the collateral constraint due to an increase in the value of the housing stock (more collateral available), and because the interest income effect now works in the direction of increasing spending of financially constrained households. Notice that although also in the model without collateral constraints there is an increase in aggregate consumption, the model

with credit constraints displays a larger increase in consumption due to the response of collateral-constrained agents. Moreover, compared with the case in which monetary policy follows the standard Taylor rule, now there is an increase in corporate and residential investment due to the fall in real interest rates, which is stronger in the model with credit constraints.

Graph 6 here

4.2.2 Temporary labour tax reduction

Graph 7 confirms the expectation of a smaller GDP effect of a temporary reduction in labour taxes as compared with that of an increase in spending. Again, since the shock is temporary, its effects on steady-state GDP are negligible. The difference lies mostly in the fact that in this case there is no direct activation of demand by the government. There is a relatively strong reaction in the consumption of liquidity constrained agents, which explains most of the increase in GDP (the reaction of investment being more muted).

Another difference compared with the government consumption shock is that in this case the presence of collateral constrained agents matters much more for the overall growth impact of fiscal policy. With a credit crunch, the tax multiplier is about twice as large. Ricardian households do not respond to the temporary reduction in taxes as permanent income is not much affected. In contrast, credit constraint households now respond more strongly. The difference in their response to the previous scenario is due first of all by the fact that in this case fiscal policy directly raises disposable incomes, thereby boosting consumption of the individuals that would like to spend more but that find themselves constrained by the value of their collateral. In addition to that, the real interest rate response is in this case milder. With a tax reduction, real interest rates increase less compared to the expenditure increase, therefore the stronger response of credit constrained households to a temporary increase of net income is not so much offset by a negative income effect from interest payments.

Graph 7 here

When monetary policy is constrained by the zero bound, the tax reduction is accompanied by a fall in real interest rates (Graph 8) and the effects are significantly larger. The response of liquidity constrained consumers is identical, but credit-constrained consumers raise their consumption by more, as the additional effect from lower real interest rates, which leads to reduced interest payments by collateral-constrained households, boosts their disposable income. Corporate and residential investment are higher due to the fall in real interest rates, and this effect is stronger in the model with credit constraints.

Graph 8 here

4.2.3 Summary

Overall, the following results stand out from DSGE model simulations:

- Government consumption multipliers are considerably higher than labour tax multipliers;
- The presence of a credit crunch corresponding to collateral constraints on households implies a slightly higher multiplier for government consumption and a considerably higher multiplier for labour taxes;
- Monetary policy expenditure at the zero bound leads to higher multipliers for both government spending and taxes, especially in the presence of a credit crunch.

5. Conclusions

This paper has analysed the interaction between the impact of fiscal policy on headline and potential growth and banking crises. Data from emerging and advanced economies suggest that banking crises have a considerable negative impact on headline and potential GDP growth. Fiscal policy, however, can significantly reduce the impact of banking crises on headline GDP growth, but its impact on potential growth is relatively smal. This finding also implies that fiscal multipliers appear to be significantly higher during banking crises, a finding that holds for both, government spending and taxes. It also turns out that the increase in the size of fiscal multiplier during banking crises is not associated with the fact that these periods are characterised by large degrees of underutilization of production factors resulting

in big negative output gaps, but rather it has to do with other factors that are peculiar to crisis periods.

Simulations with the QUESTIII DSGE model of the European Commission help digging into the causes of large multipliers during banking crisis periods. This model has/includes households that are credit constrained (as, e.g., in Kiyotaki and Moore, 1996). Assuming that a sufficiently large fraction of households is subject to collateral constraints, the model can capture the impact of a credit crunch. Moreover, replacing a standard Taylor rule to describe the behaviour of fiscal authorities with a zero-bound on interest rates allows capturing a distinguishing condition often associated with banking crises that tend to be accompanied by depressed economic activity and demand-induced low inflation rates. It is shown that both, credit crunches and a monetary policy constrained by a zero bound, can explain the increase in multipliers, especially regarding the revenue side. These findings are broadly in line with the empirical evidence presented in the paper, and help provide an explanation of the underlying mechanisms that can explain what is found in the data.

These findings may have important policy implications. The effectiveness of the fiscal stimulus adopted by many governments after the acute phase of the crisis is likely to be effective exactly because of the key elements of the financial crisis itself, namely the tightening of lending conditions by banks. By extension, the findings have also implications for the design and timing for reversing the stimulus via an opportune exit strategy. Maintaining an overly expansionary fiscal stance for too long has clear costs in terms of growing debt levels, higher interest rates, and falling capital accumulation, not to mention risks to debt solvency and financial stability. Our analysis suggests that the health of the financial sector, including its capitalisation and the size of impaired assets on banks' balance sheets, should be among the elements to consider when designing the timing for the reversing of the stimulus, because this could influence the extent to which a fiscal exit strategy would slow the recovery. In this respect, a relatively early exit by monetary policy could result in more persisting balance-sheet problems for the banking sector, higher fiscal multipliers, and therefore a larger output cost of the reversing of fiscal stimulus. On the other hand, a relatively early exit by fiscal authorities would imply that, in light of still prevalent large output gaps and subdued inflation, monetary authorities, constrained by the zero bound, might not be in the position to accommodate effectively the fiscal contraction. Further analysis is needed to assess, conceptually and empirically, these trade-offs, as well as to gather a better understanding of the political economy implications.

Annex. Data sources and variable construction.

Banking crises start and duration. Basic information on the starting year of banking crises is provided by the database developed by Laeven and Valencia (2008) who define systemic banking crises as episodes with difficulties of the corporate and financial sectors in repaying contracts on time, large numbers of defaults and non-performing loans, as well as exhaustion of most of the banking system capital. Since the Laeven and Valencia (2008) database does not report the duration of the different crises episodes, a duration variable was constructed as follows.

- The first criterion followed is on the basis of information on the year in which crises resolved in Demirgüç-Kunt and Detragiache (2005), Reinhard and Rogoff (2008) Laeven and Valencia (2008). In the majority of cases, the year of the resolution of the crisis is identified by evidence of falling non-performing loans and bank credit recovering
- Whenever direct information on crisis resolution is not available, the banking crisis is assumed to end in the year in which the ratio of the mass of domestic credit by banks and over GDP (source: World Bank, World Development Indicators) recovers. Since it occurs quite often that credit/GDP ratios still rise for some years after the start of a banking crisis, no account is taken of cases where the credit/GDP ratio is rising for up to three years after the crisis and then falling (in those cases, the end date of the crisis is the first year after t+x where the credit/GDP recovers, where t is the starting date of the crisis, and x=[1,2,3]). In few cases the end date of the crisis is assumed not to be the first year when credit recover but the subsequent one if the recovery in this year is much larger.

Real GDP and potential output. The source of the data on GDP growth are the European Commission DG ECFIN AMECO Database and IMF, World Economic Outlook Database. Data on potential output are taken from the AMECO database for European Union countries and the US and from OECD, OECD Economic Outlook Database, for other OECD countries. For both the above sources potential output is obtained via a production function approach. For non-EU, non-OECD countries, potential output is computed as an HP filter on GDP data (smoothing parameter set to 100).

Fiscal data. Data on cyclically-adjusted primary balance, cyclically-adjusted revenues, and primary expenditure for European Union countries are taken from the European Commission DG ECFIN AMECO Database. The method used for adjusting budget balances for the cycle applies budgetary elasticities for revenues and expenditures estimated in Andre and Girouard (2005). The cyclically adjusted budget balance is obtained as follows: $CAB/Y = BB/Y - \varepsilon OG$, where CAB stands for cyclically adjusted budget balance in nominal terms, Y is nominal GDP, $OG = (Y - Y^*)/Y^*$ is the output gap (Y^* being potential output expressed in nominal terms) and $\varepsilon = \sum_i \eta^R{}_i (R_i/Y) - \eta^G G/Y$ is the sensitivity of the budget balance to the output gap. The sensitivity of the budget is equal to the difference between the average revenue (R) sensitivity and the expenditure (G) sensitivity, with the sensitivities being in turn obtained as the product of the elasticity to income of the budgetary item (η_i^R and η^G, respectively, for revenue of type i and expenditure) times its share in output. In Andre and Girouard (2005) unemployment subsidies are the only expenditure item assumed to fluctuate systematically with output.

For non-EU countries, the source of fiscal data is IMF, Government Finance Statistics. Budget balances are adjusted for the cycle as follows: $CAB/Y = BB/Y - (R/Y)OG$. This turns out being a reasonable approximation because revenue elasticities are generally close to one and because unemployment subsidies play only a minor role in driving the wedge between overall and cyclically-adjusted budget balances.

The fiscal impulse variable used in the analysis is the year on year change in the primary CAB as a share of GDP. The expenditure impulse variable is the year-on-year change in primary expenditure as a share on GDP. The revenue impulse variable is the year-on-year change in the share of cyclically-adjusted revenues on GDP. While the fiscal impulse and the revenue impulse variables denote fiscal expansion for negative values, the expenditure impulse variable denotes fiscal expansions when it non negative.

Dummy variables.

- The "banking crisis dummy" is set equal to one whenever a banking crises has started and not yet ended.
- The "crisis start dummy" is set equal to one in the year in which a banking crisis starts.

- The "fiscal expansion dummy" is set equal to one whenever the fiscal impulse vaiable (change in the primary CAB) is below or equal 1 per cent of GDP. This benchmark corresponds to the 25 percentile of the fiscal impulse variable.
- The "output loss dummy" is set equal to one whenever the output gap is below -2 per cent of potential output. The benchmarks is chosen on the basis that this is the average value observed during banking crises across the whole sample.

References

Afonso A., Sousa R. M. (2009), “The macroeconomic effects of fiscal policy”, ECB Working Paper 991, January 2009.

Akerlof, G., W. Dickens, and G. Perry, (1996), “The macroeconomics of low inflation”, *Brookings Papers on Economic Activity*, 1, 1-9.

Auerbach A. (2009), "Implementing the new fiscal policy activism", Annual Meeting of the American Economic Association Session “The revival of fiscal policy”, January 2009.

Barro, R. J., and C. Redlick (2009), "Macroeconomic effects from government purchases and taxes", NBER Working Paper Series No. 15369.

Blanchard, O., Perotti R. (2002), "An empirical characterization of the dynamic effects of changes in government spending and taxes on output", *Quarterly Journal of Economics*, 117, 1329-1368.

Blinder A. S. and J. B. Rudd (2008) The supply shock explanation of the great stagflation revisited. NBER Working Paper No. 14563.

Bohn, H. (1998), "The behaviour of US public debt and deficits", *Quarterly Journal of Economics*, 113, 949-63.

Cerra, V. and S.C. Saxena (2008), 'Growth dynamics: the myth of economic recovery', *American Economic Review* 98, 439-457.

Coenen G. , R. Straub (2005), Does government spending crowd in private consumption? Theory and empirical evidence for the euro area, International Finance, 8(3), 435-470, 2005.

Dell' Ariccia, G., E. Detragiache, and R. Rajan, (2007), "The real effect of banking crises", *Journal of Financial Intermediation*, 17, 89-112.

Demirgüç-Kunt, A. and E. Detragiache (2005), "Cross-country empirical studies of systemic bank distress: a survey", *IMF Working Paper* 05/96.

Eggertsson, G. (2004), "Great expectations and the end of the depressions", *American Economic Review*, 98, 1476-1516.

Eggertsson, G. (2009), " What fiscal policy is effective at zero interest rate?", Federal Reserve Bank of New York, mimeo.

Gauti B. Eggertsson and Michael Woodford, (2003) "The zero bound on interest rates and optimal monetary policy," *Brookings Papers on Economic Activity*, , The Brookings Institution, 34, 139-235.

Fatas, A., and I. Mihov, (2003), "The case for restricting fiscal policy discretion", *Quarterly Journal of Economics*, November, 1419-47.

Feldstein, M. (2002). “The role for discretionary fiscal policy in a low interest rate Environment,” NBER Working Paper No. 9203.

Furceri, D. and A. Mourougane (2009), 'The effect of financial crises on potential output: new empirical evidence from OECD countries', *OECD Economics Department Working Papers* 699.

Gali, J., and R. Perotti (2003), "Fiscal policy and monetary integration in Europe", *Economic Policy*, 18, 533-572.

Gali, J., Valles J. and Lopez-Salido J. D. (2007), “Understanding the effects of government spending on consumption”, Journal of the European Economic Associaton, 5(1), 227-270.

Girouard, N., and C. André (2005), "Measuring cyclically-adjusted budget balances for OECD countries," OECD Economics Department Working Papers 434, OECD, Economics Department.

Iacoviello, M. (2005): "House prices, collateral constraints and monetary policy in the business cycle", American Economic Review, 95(3), 739—764.

IMF (2009), *World Economic Outlook*, April 2009, IMF Washington DC.

Kiyotaki, N. and J. Moore (1997): "Credit cycles", Journal of Political Economy, 105(2), 211-248.

Krozner, R., L. Laeven, D. Klingebiel (2007), "Banking crises, financial dependence, and growth", *Journal of Financial Economics*, 84, 187-228.

Laeven, L. and F. Valencia (2008), 'Systemic banking crises: A new database', *IMF Working Paper* 08/224.

Laxton, D., G. Meredith, and D. Rose, (1995), “Asymmetric effects of economic activity on inflation: Evidence and policy implications”, *IMF Staff Papers*, 42, 344-374.

Laxton, D., D. Rose, and D. Tambakis (1999), “The US phillips curve: The case for asymmetry”, *Journal of Economic Dynamics and Control*, 23, 1459-1485.

Monacelli T. (2007), "New Keynesian models, durable goods and collateral constraints", CEPR discussion paper 5916.

Mountford, A., Uhlig H. (2005), "What are the effects of fiscal policy shocks?", Humboldt-Universität zu Berlin Working Paper SFB 649.

Perotti R. (2005), "Estimating the effects of fiscal policy in OECD countries", CEPR Discussion Paper 4842.

Ratto M, W. Roeger and J. in ’t Veld (2009) , “QUEST III: An Estimated Open-Economy DSGE Model of the Euro Area with Fiscal and Monetary Policy”, *Economic Modelling*, 26, pp. 222-233.

Ravn, M., S. Schmitt-Grohe and M. Uribe (2006). "Deep Habits." *Review of Economic Studies*, 73, 95-118

Reinhart, C. and K. Rogoff (2008), "Banking crises: An equal opportunity menace", NBER Working Paper No. 14587.

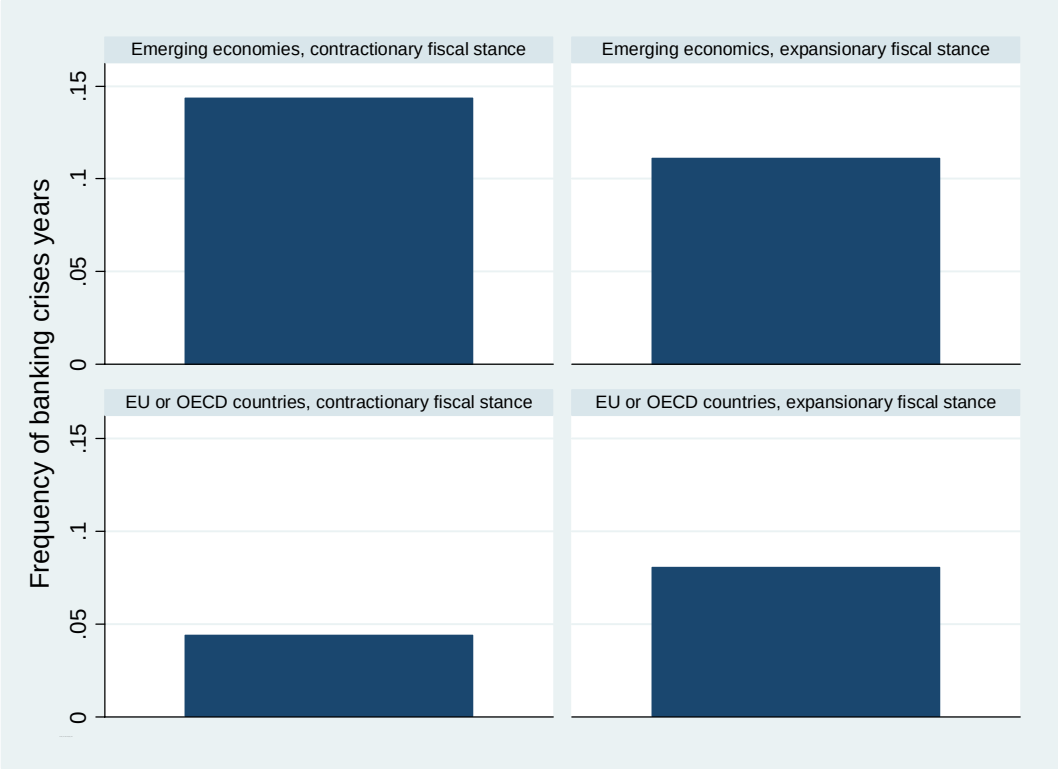
Roeger W. and J. in 't Veld (2009) , "Fiscal Policy with credit constrained households", European Commission European Economy Economic Paper no. 357.

Romer , C. and Romer D. H. (2007), "The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks", NBER Working Paper 13264.

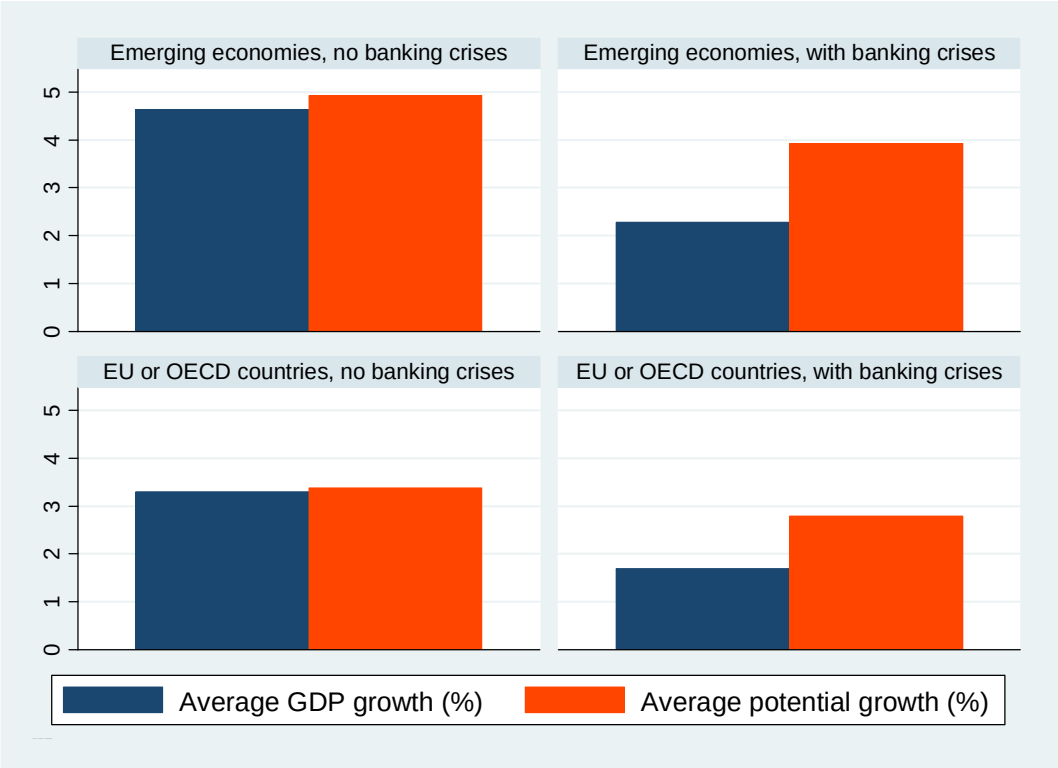
Spilimbergo, A., S. Symansky, O. Blanchard, and C. Cottarelli, "Fiscal policy for the crisis," IMF Staff Position Note, December 29, 2008, SPN/08/01.

Taylor, John B. 2000. "Reassessing discretionary fiscal policy," The Journal of Economic Perspectives, 14 (3): 21-36.

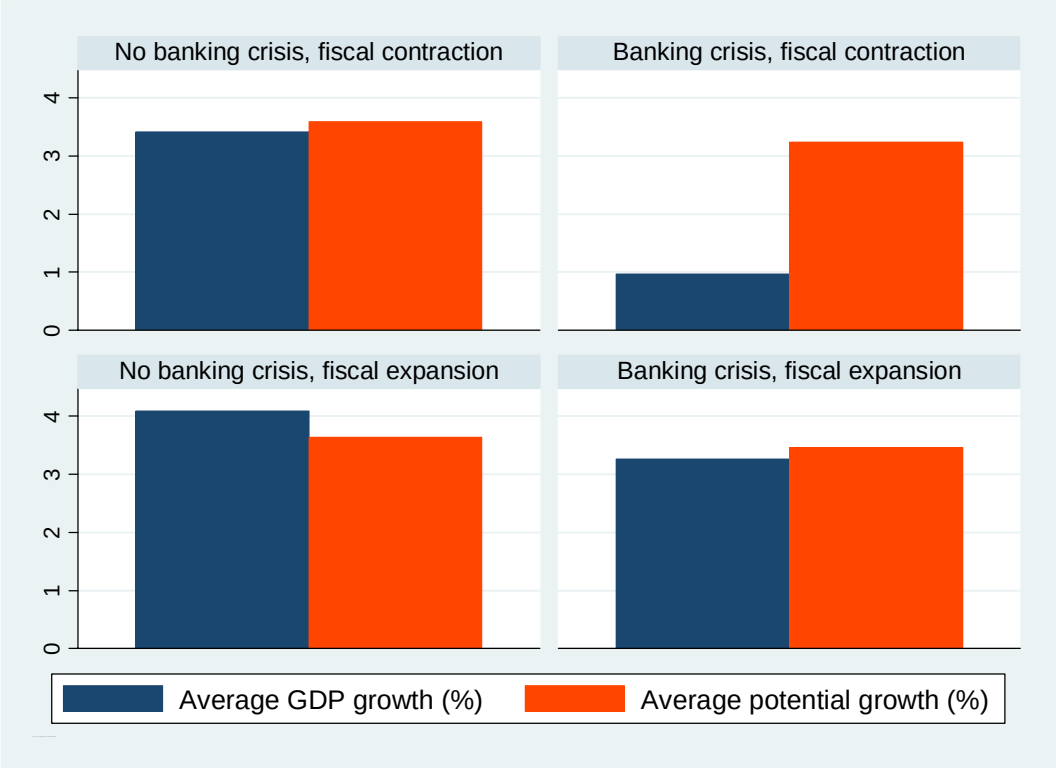
Graph 1. Frequency of baking crises in emerging and advanced economies, distinguishing the fiscal stance taken by the government (56 emerging and advanced economies, 1970-2008)



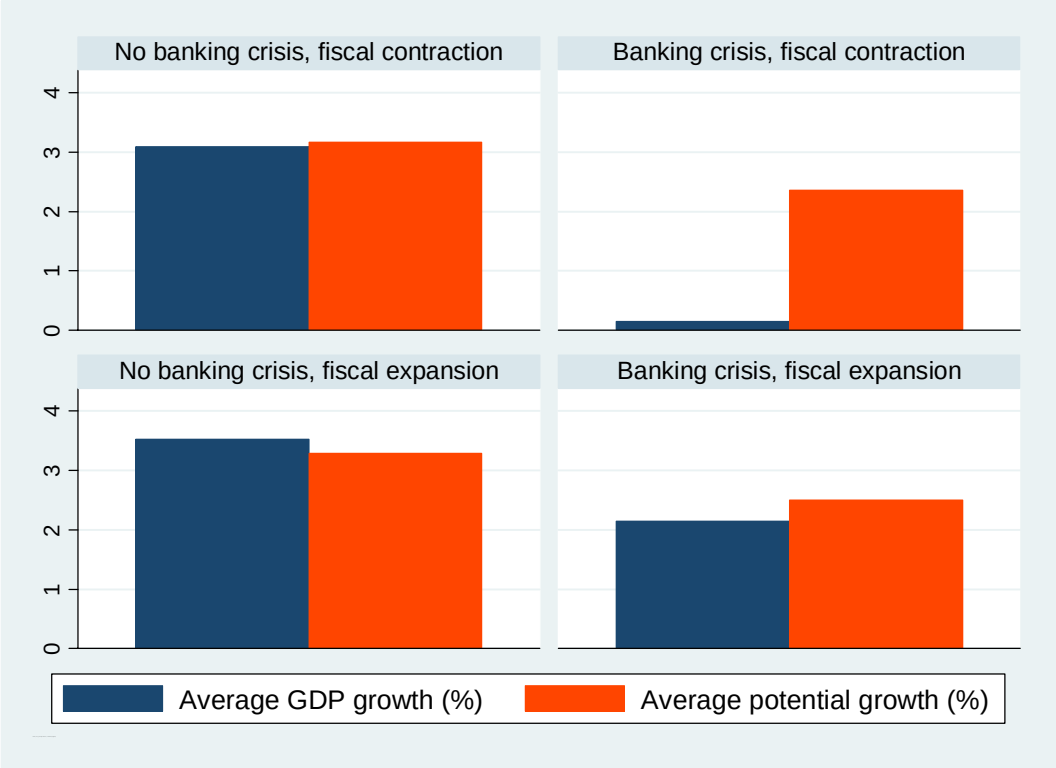
Graph 2. Average GDP and potential growth during crisis vs. non-crisis periods (56 emerging and advanced economies, 1970-2008)



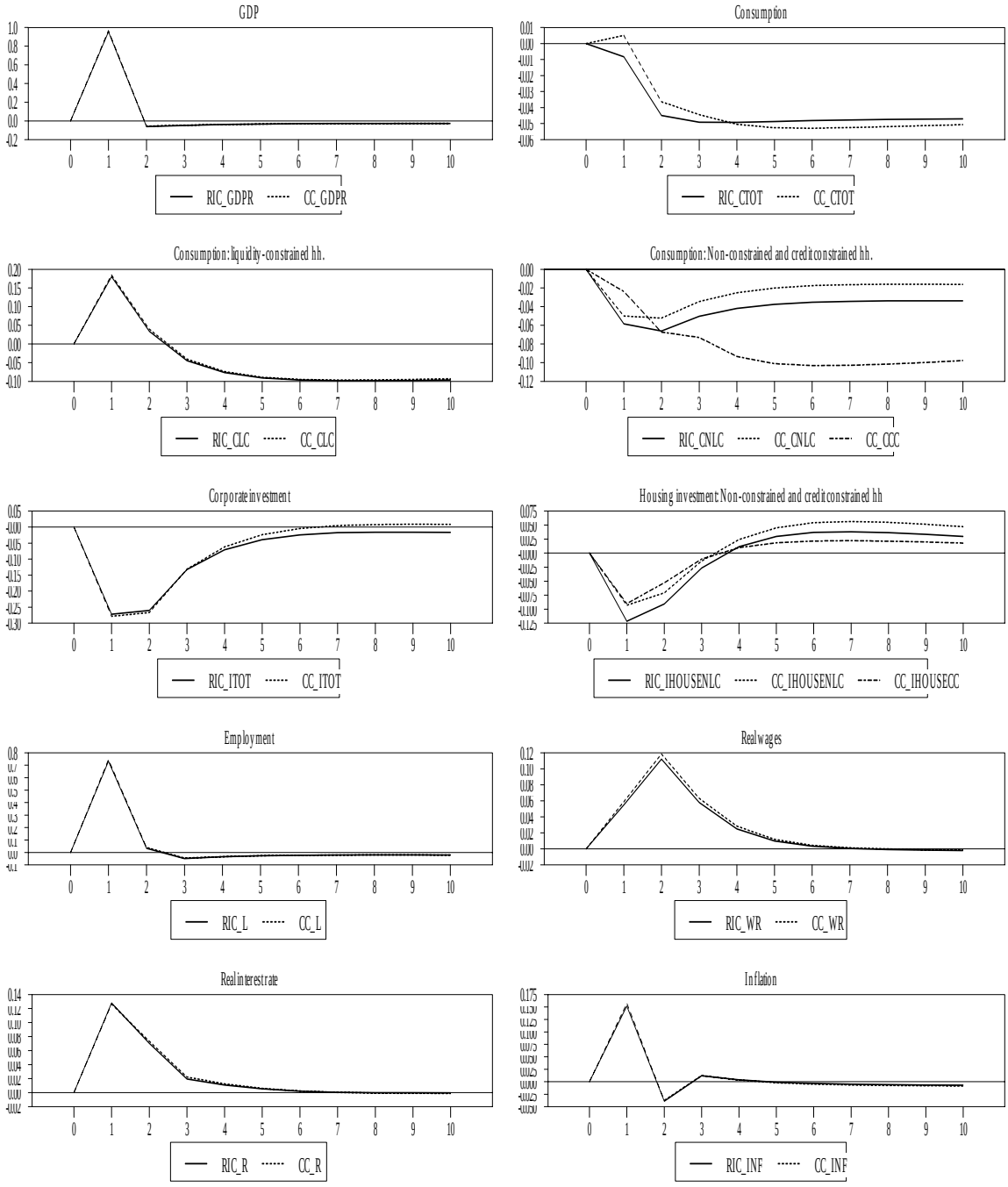
Graph 3. Average GDP and potential growth during crisis vs. non-crisis periods and fiscal expansion vs. fiscal contraction periods (56 emerging and advanced economies, 1970-2008)



Graph 4. Average GDP and potential growth during crisis vs. non-crisis periods and fiscal expansion vs. fiscal contraction periods (36 EU and OECD economies, 1970-2008)

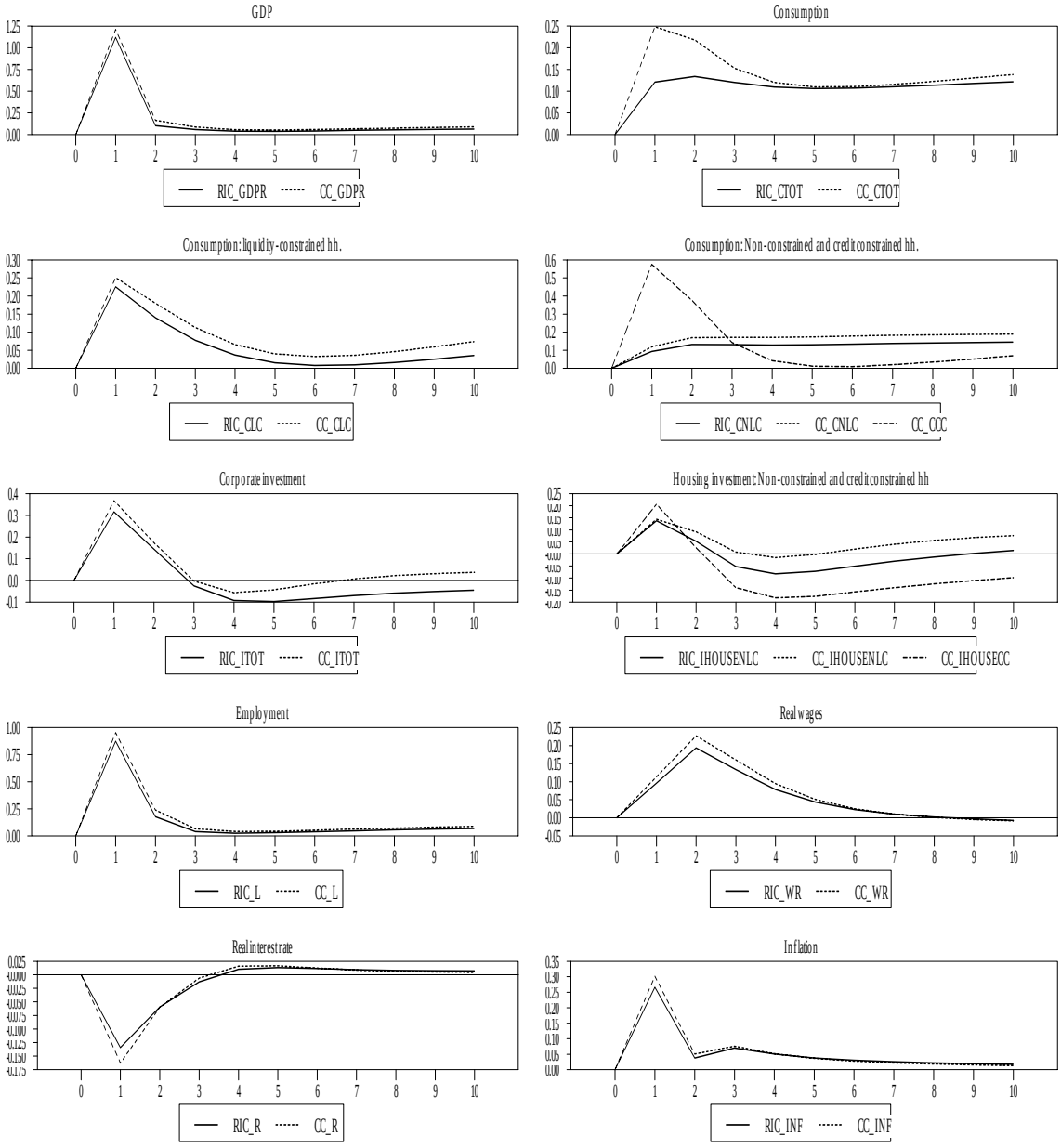


Graph 5 Temporary increase in government consumption



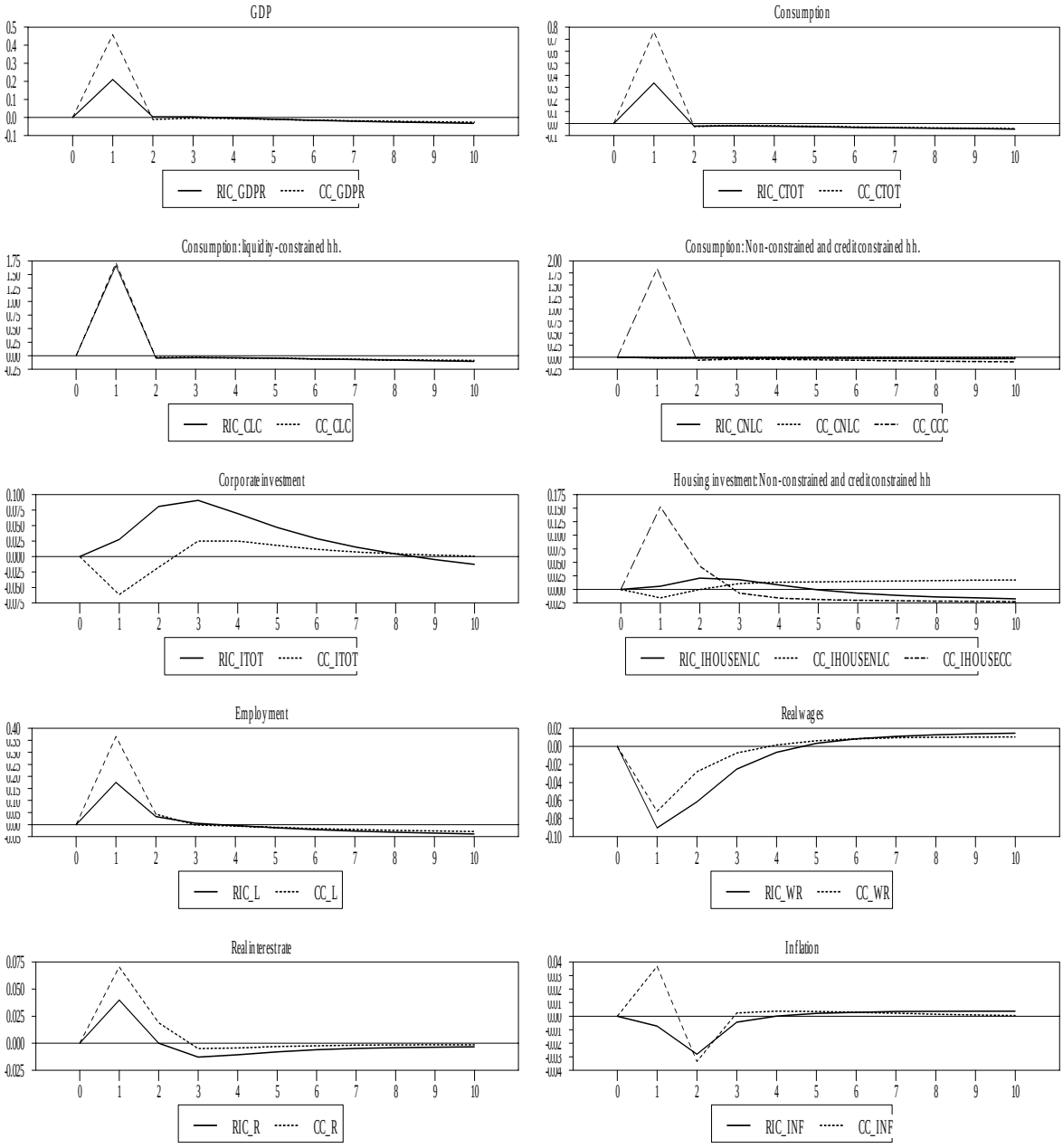
Note: RIC_ : model with 40% liquidity constrained, 60% Ricardian households; CC_ : model with 40% liquidity constrained, 30% Ricardian households and 30% credit-constrained households.

Graph 6. Temporary increase in government consumption with monetary policy at the zero-bound



Note: RIC_ : model with 40% liquidity constrained, 60% Ricardian households;
CC_ : model with 40% liquidity constrained, 30% Ricardian households and 30% credit-constrained households.

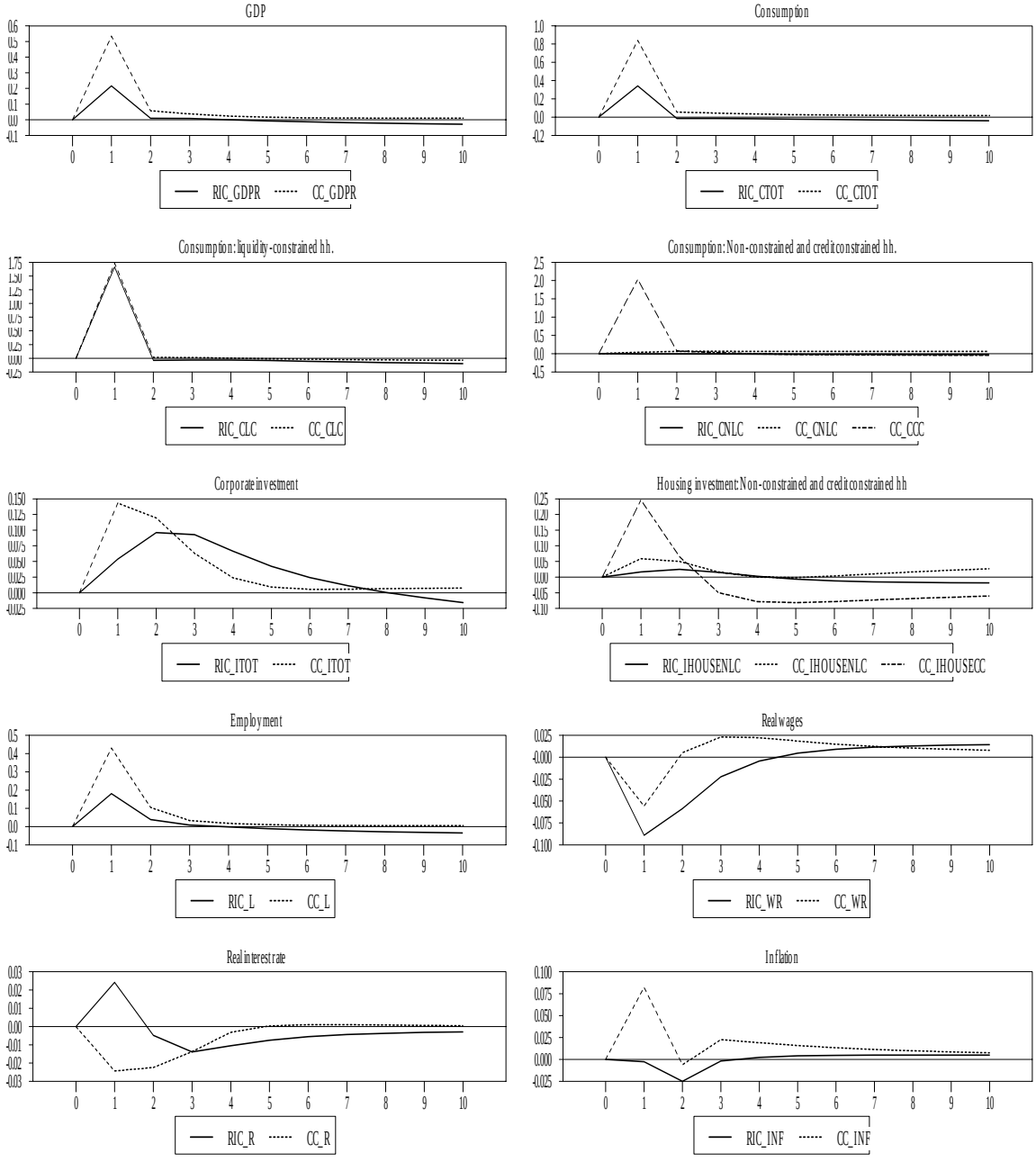
Graph 7. Temporary reduction in labour taxes



Note: RIC_ : model with 40% liquidity constrained, 60% Ricardian households;

CC_ : model with 40% liquidity constrained, 30% Ricardian households and 30% credit-constrained households.

Graph 8. Temporary reduction in labour taxes with monetary policy at the zero-bound



Note: RIC_ : model with 40% liquidity constrained, 60% Ricardian households;
CC_ : model with 40% liquidity constrained, 30% Ricardian households and 30% credit-constrained households.

Table 1. Impact of banking crises on growth

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.261	0.347	0.284	0.301
	[5.48]***	[4.04]***	[5.64]***	[2.63]**
Dependent variable (2 lags)	-0.009	0.268	-0.074	0.264
	[0.22]	[7.02]***	[1.80]*	[6.41]***
Dependent variable (3 lags)	0.083	0.161	0.075	0.179
	[1.63]	[6.26]***	[1.98]*	[5.32]***
Dependent variable (4 lags)	-0.097	-0.051	-0.105	-0.073
	[4.46]***	[0.97]	[4.25]***	[1.40]
Crisis dummy	-1.848	-0.05	-2.045	-0.377
	[5.03]***	[0.48]	[4.89]***	[2.17]**
Constant	3.029	0.983	2.777	1.049
	[10.33]***	[5.72]***	[13.35]***	[5.52]***
Observations	1610	1535	985	945
Number of clusters	62	62	38	38

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis dummy: 1 if the country is affected by a banking crisis in the current year (see Annex).

Table 2. Impact of fiscal impulse on growth

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.18	0.333	0.314	0.048
	[3.21]***	[3.26]***	[4.39]***	[1.41]
Dependent variable (2 lags)	0.026	0.236	-0.059	0.346
	[0.65]	[5.66]***	[1.35]	[2.75]***
Dependent variable (3 lags)	0.058	0.133	0.061	0.247
	[1.79]*	[4.09]***	[1.78]*	[5.59]***
Dependent variable (4 lags)	-0.06	-0.041	-0.079	0.143
	[3.55]***	[0.87]	[2.84]***	[2.85]***
Fiscal impulse	-0.27	0.023	-0.22	0.048
	[3.88]***	[1.16]	[2.25]**	[1.41]
Constant	2.874	1.174	2.349	1.006
	[14.63]***	[4.45]***	[10.79]***	[5.35]***
Observations	1284	1226	894	860
Number of clusters	56	56	36	36
R-squared	0.12	0.36	0.13	0.4

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Fiscal impulse: change in primary CAB (see Annex).

Table 3. Impact of fiscal expansion dummy on growth

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.191	0.332	0.309	-0.185
	[3.32]***	[3.23]***	[4.12]***	[2.30]**
Dependent variable (2 lags)	0.027	0.236	-0.051	0.346
	[0.63]	[6.10]***	[1.08]	[2.69]**
Dependent variable (3 lags)	0.07	0.132	0.061	0.241
	[1.84]*	[4.06]***	[1.86]*	[5.69]***
Dependent variable (4 lags)	-0.062	-0.038	-0.08	0.143
	[3.71]***	[0.78]	[2.80]***	[2.86]***
Fiscal expansion dummy	0.616	-0.159	0.345	-0.185
	[2.30]**	[2.61]**	[1.30]	[2.30]**
Constant	2.635	1.209	2.252	1.061
	[12.54]***	[4.61]***	[9.97]***	[5.35]***
Observations	1284	1226	894	860
Number of clusters	56	56	36	36
R-squared	0.08	0.36	0.1	0.4

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Fiscal expansion dummy: 1 if the change in primary CAB <= -1 % of GDP (see Annex).

Table 4. Interaction between banking crises and fiscal impulse

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.166	-0.012	0.287	-0.348
	[3.23]***	[0.32]	[4.68]***	[2.44]**
Dependent variable (2 lags)	0.014	0.02	-0.095	-0.023
	[0.33]	[0.99]	[2.56]**	[0.52]
Dependent variable (3 lags)	0.032	0.339	0.076	0.04
	[1.11]	[3.11]***	[2.22]**	[1.24]
Dependent variable (4 lags)	-0.08	0.238	-0.093	0.353
	[5.19]***	[5.61]***	[3.87]***	[2.51]**
Crisis dummy	-1.909	-0.095	-2.583	-0.348
	[3.77]***	[0.58]	[4.63]***	[2.44]**
Fiscal Impulse	-0.212	0.02	-0.18	0.04
	[3.63]***	[0.99]	[2.35]**	[1.24]
Crisis dummy * fiscal impulse	-0.574	-0.012	-0.606	-0.023
	[3.18]***	[0.32]	[2.91]***	[0.52]
Constant	3.279	1.163	2.705	0.983
	[13.95]***	[4.39]***	[12.10]***	[4.96]***
Observations	1228	1170	858	824
Number of clusters	56	56	36	36
R-squared	0.17	0.35	0.21	0.41

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis dummy: 1 if the country is affected by a banking crisis in the current year (see Annex).
Fiscal impulse: change in primary CAB (see Annex).

Table 5. Interaction between banking crises and fiscal expansion dummy

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.176	0.336	0.276	-0.347
	[3.24]***	[3.03]***	[4.08]***	[2.39]**
Dependent variable (2 lags)	0.012	0.239	-0.072	0.015
	[0.28]	[6.10]***	[1.72]*	[0.05]
Dependent variable (3 lags)	0.058	0.135	0.06	-0.149
	[1.54]	[4.09]***	[1.85]*	[1.85]*
Dependent variable (4 lags)	-0.08	-0.042	-0.096	0.352
	[5.44]***	[0.84]	[3.87]***	[2.46]**
Crisis dummy	-2.221	-0.021	-2.711	-0.347
	[3.95]***	[0.10]	[3.80]***	[2.39]**
Fiscal exp. dummy	0.618	-0.125	0.393	-0.149
	[2.40]**	[2.02]**	[1.60]	[1.85]*
Crisis dummy * fiscal exp. dummy	1.052	-0.235	1.29	0.015
	[0.95]	[0.77]	[0.97]	[0.05]
Constant	2.992	1.189	2.62	1.031
	[12.15]***	[4.53]***	[11.32]***	[4.88]***
Observations	1228	1170	858	824
Number of clusters	56	56	36	36
R-squared	0.11	0.35	0.15	0.41

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis dummy: 1 if the country is affected by a banking crisis in the current year (see Annex).
Fiscal expansion dummy: 1 change in primary CAB <=-1% of GDP (see Annex).

Table 6. Interaction between banking crises and fiscal policy, distinguishing for composition of fiscal impulse

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.165	0.338	0.282	0.354
	[3.40]***	[3.07]***	[4.73]***	[2.50]**
Dependent variable (2 lags)	0.023	0.239	-0.063	0.255
	[0.56]	[5.72]***	[1.89]*	[5.73]***
Dependent variable (3 lags)	0.024	0.138	0.063	0.154
	[0.92]	[4.21]***	[1.97]*	[2.99]***
Dependent variable (4 lags)	-0.061	-0.043	-0.054	-0.06
	[3.87]***	[0.89]	[2.14]**	[1.33]
Crisis dummy	-1.762	-0.099	-2.31	-0.268
	[3.61]***	[0.76]	[3.99]***	[1.76]*
Expenditure Impulse	0.667	0.024	0.601	0.019
	[3.74]***	[0.90]	[2.93]***	[0.50]
Revenue Impulse	-0.353	0.006	-0.266	0.03
	[3.92]***	[0.31]	[2.62]**	[1.02]
Crisis dummy * expenditure impulse	0.595	-0.036	0.425	0.085
	[1.73]*	[0.31]	[1.12]	[0.97]
Crisis dummy * revenue impulse	-0.657	0.003	-0.636	-0.059
	[3.18]***	[0.06]	[2.92]***	[1.10]
Constant	3.25	1.146	2.561	0.932
	[14.36]***	[4.28]***	[11.19]***	[4.80]***
Observations	1228	1170	858	824
Number of clusters	56	56	36	36
R-squared	0.23	0.36	0.29	0.42

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis dummy: 1 if the country is affected by a banking crisis in the current year (see Annex).
Expenditure impulse: change in primary expenditure (see Annex).
Revenue impulse: change in cyclically-adjusted revenue (see Annex).

Table 7. Interaction between banking crises, fiscal impulse, and output loss

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.124	0.335	0.184	0.35
	[2.09]**	[2.92]***	[2.55]**	[2.55]**
Dependent variable (2 lags)	-0.003	0.24	-0.128	0.249
	[0.06]	[5.46]***	[4.00]***	[4.97]***
Dependent variable (3 lags)	0.012	0.136	0.025	0.146
	[0.33]	[3.93]***	[0.71]	[2.77]***
Dependent variable (4 lags)	-0.084	-0.042	-0.096	-0.063
	[5.25]***	[0.84]	[3.77]***	[1.42]
Crisis dummy	-1.315	0.097	-2.358	-0.232
	[2.19]**	[0.29]	[3.02]***	[1.92]*
Fiscal impulse	-0.182	0.023	-0.127	0.053
	[2.96]***	[1.38]	[1.85]*	[2.07]**
Output loss dummy	-1.518	0.066	-1.563	-0.014
	[4.28]***	[0.62]	[5.16]***	[0.10]
Crisis dummy * fiscal impulse	-0.922	-0.092	-1.11	-0.126
	[3.17]***	[1.89]*	[3.19]***	[3.29]***
Output loss dummy* crisis dummy	-0.551	-0.415	-0.107	-0.224
	[0.79]	[0.98]	[0.14]	[0.91]
Fiscal Impulse * output loss dummy	-0.014	-0.018	-0.079	-0.036
	[0.27]	[0.85]	[1.28]	[1.03]
Fiscal impulse*output loss dummy* crisis dummy	0.44	0.145	0.76	0.178
	[1.26]	[2.19]**	[1.98]*	[3.63]***
Constant	3.914	1.143	3.635	1.001
	[9.08]***	[3.90]***	[9.87]***	[5.15]***
Observations	1228	1170	858	824
Number of clusters	56	56	36	36
R-squared	0.22	0.36	0.28	0.41

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis dummy: 1 if the country is affected by a banking crisis in the current year (see Annex).
Fiscal impulse: change in primary CAB (see Annex).
Output loss dummy: 1 if output gap<-2% (see Annex).

Table 8. Interaction between banking crises and fiscal impulse, lag structure

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.169	0.401	0.271	0.503
	[1.98]*	[3.21]***	[4.52]***	[3.01]***
Dependent variable (2 lags)	0.006	0.194	-0.042	0.17
	[0.10]	[6.20]***	[1.00]	[2.40]**
Dependent variable (3 lags)	0.007	0.138	0.052	0.161
	[0.22]	[3.57]***	[1.35]	[2.61]**
Dependent variable (4 lags)	-0.118	-0.043	-0.137	-0.099
	[5.81]***	[0.84]	[4.96]***	[3.20]***
Crisis start	-2.118	-0.241	-0.797	-0.209
	[2.08]**	[1.94]*	[0.77]	[1.30]
Crisis start (1 lag)	-4.023	0.673	-4.095	-0.469
	[2.09]**	[0.68]	[3.23]***	[3.50]***
Crisis start (2 lags)	0.207	-0.598	-0.974	-0.374
	[0.22]	[1.62]	[1.14]	[1.74]*
Crisis start (3 lags)	0.069	-0.075	0.583	0.238
	[0.15]	[0.29]	[0.80]	[0.93]
Crisis start (4 lags)	-0.954	-0.101	0.126	-0.031
	[1.93]*	[0.52]	[0.23]	[0.17]
Impulse	-0.236	0.011	-0.188	0.028
	[5.02]***	[0.75]	[3.32]***	[1.56]
Impulse (1 lag)	0.052	0.01	0.054	0.021
	[1.61]	[1.03]	[1.55]	[1.72]*
Impulse (2 lags)	-0.013	0.01	-0.027	-0.007
	[0.36]	[0.84]	[0.89]	[0.63]
Impulse (3 lags)	0.014	0.019	0.023	0.017
	[0.39]	[2.39]**	[0.72]	[2.76]***
Impulse (4 lags)	-0.023	0.017	-0.045	0.002
	[0.61]	[1.40]	[1.05]	[0.14]
Constant	3.434	1.07	2.728	0.828
	[13.64]***	[3.47]***	[10.53]***	[4.12]***
Observations	1079	1079	784	784
Number of clusters	56	56	36	36
R-squared	0.14	0.39	0.17	0.51

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis start: 1 if a banking crisis starts in the country in the current year (see Annex).
Fiscal impulse: change in primary CAB (see Annex).

Table 9. Impact of crisis and fiscal impulse and their interaction, lag structure

	All sample		EU + OECD	
	GDP growth	Potential output growth	GDP growth	Potential output growth
Dependent variable (1 lag)	0.169	0.4	0.284	0.508
	[1.99]*	[3.16]***	[5.04]***	[2.98]***
Dependent variable (2 lags)	0.004	0.2	-0.05	0.172
	[0.08]	[6.82]***	[1.26]	[2.39]**
Dependent variable (3 lags)	0.007	0.137	0.061	0.161
	[0.22]	[3.64]***	[1.62]	[2.60]**
Dependent variable (4 lags)	-0.112	-0.042	-0.139	-0.102
	[5.89]***	[0.86]	[5.00]***	[3.04]***
Crisis start	-2.588	-0.22	-0.144	-0.222
	[2.42]**	[2.13]**	[0.20]	[2.18]**
Crisis start (1 lag)	-2.83	0.841	-3.88	-0.478
	[1.47]	[0.70]	[4.02]***	[3.68]***
Crisis start (2 lags)	0.159	-0.595	-1.358	-0.514
	[0.18]	[1.62]	[1.43]	[2.78]***
Crisis start (3 lags)	0.067	-0.129	0.582	0.088
	[0.14]	[0.47]	[0.74]	[0.37]
Crisis start (4 lags)	-1.082	-0.131	-0.043	-0.028
	[2.04]**	[0.63]	[0.08]	[0.15]
IImpulse	-0.181	0.013	-0.152	0.026
	[3.47]***	[1.20]	[2.56]**	[1.78]*
Impulse (1 lag)	0.057	0.012	0.059	0.022
	[1.72]*	[1.38]	[1.61]	[1.76]*
Impulse (2 lags)	-0.009	0.011	-0.022	-0.006
	[0.24]	[0.85]	[0.67]	[0.56]
Impulse (3 lags)	0.016	0.021	0.017	0.016
	[0.44]	[2.52]**	[0.54]	[2.63]**
Impulse (4 lags)	-0.023	0.016	-0.045	0.001
	[0.63]	[1.37]	[1.01]	[0.07]
Impulse * crisis start	-0.874	0.036	0.569	-0.006
	[1.30]	[0.67]	[1.03]	[0.05]
Impulse *crisis start (1 lag)	-1.201	-0.158	-0.765	0.031
	[2.56]**	[0.68]	[3.90]***	[0.88]
Impulse * crisis start (2 lags)	0.253	0.074	-0.358	-0.114
	[0.81]	[0.79]	[0.67]	[1.46]
Impulse * crisis start (3 lags)	-0.246	0.185	-0.034	0.179
	[0.93]	[1.99]*	[0.17]	[1.59]
Impulse * crisis start (4 lags)	-0.423	-0.12	-0.338	-0.017
	[1.28]	[1.17]	[1.01]	[0.26]
Constant	3.422	1.055	2.688	0.821
	[13.54]***	[3.60]***	[10.64]***	[4.06]***
Observations	1079	1079	784	784
Number of c	56	56	36	36
R-squared	0.17	0.4	0.19	0.51

Notes: Estimation method: Least squares dummy variables. t statistics are reported in parentheses, based on standard errors robust with respect to heteroschedasticity and within-panel (country) autocorrelation. Country fixed effects and constant terms are included but not reported. *, **, *** denotes statistical significance at the 10, 5, 1 per cent level respectively.
Crisis start: 1 if a banking crisis starts in the country in the current year (see Annex).
Fiscal impulse: change in primary CAB (see Annex).

Table A.1 Episodes of banking crisis, distinguishing for fiscal stance

Episodes of fiscal crisis with fiscal contractions (change in CAPB>0)	Episodes of fiscal crisis with fiscal expansion (change in CAPB<=0)	Episodes of fiscal crisis with strong fiscal expansion CAPB<=-1% GDP)
Argentina 1995	Albania 1996	Argentina 1996
Argentina 1997	Argentina 1996	Argentina 2005
Argentina 2002	Argentina 2001	Bulgaria 1997
Argentina 2003	Argentina 2005	Bulgaria 1998
Argentina 2004	Bulgaria 1997	Bulgaria 1999
Bulgaria 1996	Bulgaria 1998	Brazil 1994
Belarus 1996	Bulgaria 1999	Finland 1991
Colombia 1998	Brazil 1994	Finland 1992
Colombia 1999	Brazil 1995	Croatia 1999
Spain 1979	Czech Republic 1996	Indonesia 1997
Finland 1994	Czech Republic 1997	Japan 1999
United States 1988	Spain 1977	Japan 2002
United States 1989	Spain 1978	Mexico 1981
United States 1991	Spain 1980	Mexico 1994
Croatia 2000	Finland 1991	Mexico 1997
Hungary 1994	Finland 1992	Lithuania 1996
Hungary 1995	Finland 1993	Lithuania 1997
Indonesia 2002	United States 1990	Latvia 1999
Japan 1997	Unites States 2007	Malaysia 1999
Japan 2001	United Kingdom 2007	Malaysia 2000
Mexico 1982	China 1998	Norway 1991
Mexico 1995	China 1999	Norway 1992
Morocco 1980	Croatia 1998	Romania 1996
Latvia 1996	Croatia 1999	Sweden 1991
Malaysia 1997	Hungary 1993	Sweden 1992
Malaysia 2001	Indonesia 1997	Sweden 1993
Malaysia 2002	Indonesia 2000	Tunisia 1995
Norway 1993	Japan 1998	Turkey 2000
Romania 1997	Japan 1999	Turkey 2002
Romania 1998	Japan 2000	Slovak Republic 2000
Romania 1999	Japan 2002	
Russia 1998	Mexico 1981	
Russia 1999	Mexico 1994	
Russia 2000	Mexico 1996	
Sweden 1994	Mexico 1997	
Tunisia 1992	Lithuania 1996	
Tunisia 1993	Lithuania 1997	
Tunisia 1994	Latvia 1998	
Turkey 2001	Latvia 1999	
Turkey 2003	Malaysia 1998	
Ukraine 1998	Malaysia 1999	

Ukraine 1999	Malaysia 2000
Ukraine 2000	Norway 1992
Uruguay 2002	Romania 1996
Uruguay 2003	Sweden 1991
Slovak Republic 1998	Sweden 1992
	Sweden 1993
	Tunisia 1991
	Tunisia 1995
	Turkey 2000
	Turkey 2002
	Uruguay 2004
	Uruguay 2005
	Slovak Republic 1999
	Slovak Republic 2000