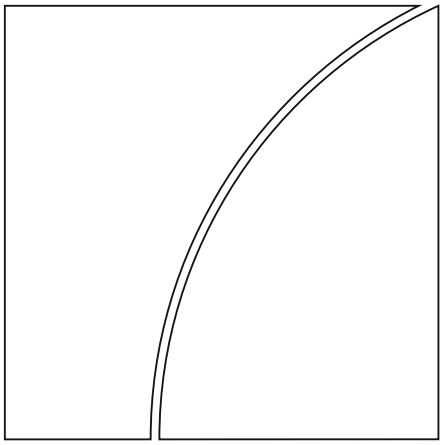

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Cyclical macroeconomic policy, financial regulation and economic growth

by Philippe Aghion and Enisse Kharroubi

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Foreword

The 12th BIS Annual Conference took place in Lucerne, Switzerland on 20–21 June 2013. The event brought together a distinguished group of central bank governors, leading academics and former public officials to exchange views on the conference theme of "Navigating the Great Recession: what role for monetary policy?". The papers presented at the conference and the discussants' comments are released as *BIS Working Papers* 434 to 437.

BIS Papers No 74 contains the opening address by Stephen Cecchetti (former Economic Adviser, BIS), a keynote address by Finn Kydland (University of California, Santa Barbara) and the contributions of the policy panel. The participants in the policy panel, chaired by Jaime Caruana (General Manager, BIS), were Zeti Akhtar Aziz (Bank Negara Malaysia), Thomas Jordan (Swiss National Bank) and Glenn Stevens (Reserve Bank of Australia).

Cyclical macroeconomic policy, financial regulation and economic growth[1]

Philippe Aghion[2] and Enisse Kharroubi[3]

Abstract

This paper investigates the effect of cyclical macroeconomic policy and financial sector characteristics on growth. Using cross-country, cross-industry OECD data, it yields two main findings. First, countercyclical fiscal and monetary policies foster growth disproportionately in more credit/liquidity-constrained industries. Second, while higher bank capital ratios may contribute to reducing the benefit of a countercyclical monetary policy, countercyclical credit enhances growth disproportionately in more credit/liquidity-constrained industries and this complements the growth effects of countercyclical monetary policy. Raising regulatory requirements for bank capital can therefore help achieve financial stability and preserve economic growth if complemented with more countercyclical macroeconomic and regulatory policy.

JEL codes: E32, E44, E52, E62, G28, O43.

Keywords: Growth, financial constraints, fiscal policy, monetary policy, financial regulation.

1. Introduction

Macroeconomic textbooks tend to present the analysis of long-term growth and the study of macroeconomic policies (eg fiscal and monetary policies) aimed at achieving short-run stabilisation as distinct bodies of research. Indeed, the common wisdom among economists sees little connection between how stabilisation policies are being implemented and the average speed at which the affected economy grows. At most, it highlights the importance of stable and consistent policies as exemplified by recommendations to run prudent fiscal and monetary policies through balanced fiscal accounts or moderate inflation.

Yet, recent studies have suggested moving further and looking explicitly at the relationship between macroeconomic volatility and the long-run growth performance of an economy. Thus Ramey and Ramey (1995) provided some preliminary empirical evidence of a negative correlation between growth volatility and long-run average growth based on cross-country regressions. More recently, Aghion et al (2010) claimed that greater business cycle volatility could be

[1] The views expressed here are those of the authors and do not necessarily represent those of the BIS. We are very grateful to Steve Cecchetti for his invaluable guidance and encouragement.

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detrimental to growth because credit-constrained firms are forced to cut back on productivity-enhancing investments during downturns as they lack the ability to levy capital to finance these investments. They also used cross-country panel analysis to show that higher macroeconomic volatility does indeed discourage long-term, growth-enhancing investments in countries that are less financially developed.[4]

A natural implication of this line of research is that cyclical stabilisation policies could help enhance growth in countries or sectors where firms are more credit-constrained. For example, a monetary policy that reduces the cost of short-term refinancing in recessions – a typical example of what we refer to as countercyclical monetary policy – can help firms overcome recessions without having to cut back on productivity-enhancing investments. Moreover, it may also provide firms with larger incentives to engage in such investments ex ante, as the likelihood of cuts being necessary ex post during downturns is reduced. Similarly, productivity growth could be enhanced by countercyclical fiscal policies that allow governments to subsidise R&D investments in recessions by, for instance, issuing public debt during recessions and repaying it during booms.

Yet, with the exception of some specific forms of policy that have a direct effect on economic agents, such as raising taxes, macroeconomic policy is usually intermediated before it reaches its final recipients. This is particularly true for monetary policy. Changes in policy rates do not directly affect lending/borrowing decisions, as the final cost of borrowing charged to households or firms also depends on banking/financial sector characteristics and in particular on how the banking/financial sector reacts to changes in policy rates.[5] Consequently, how successful monetary policy stabilisation can be in fostering growth is likely to depend significantly on such characteristics.

In this paper, we analyse the interplay between the extent to which an industry is prone to be credit-constrained or liquidity-constrained and: (i) cyclical monetary and fiscal policy; and (ii) financial sector characteristics. In particular, we are interested in understanding whether tightening (loosening) capital adequacy rules – insofar as it prompts banks to hold more (less) capital – can dampen or amplify the effects of countercyclical monetary policy on growth. Conversely, can the introduction of countercyclical capital buffers for banks – insofar as it makes credit less procyclical or more countercyclical – provide another source of macroeconomic stabilisation besides fiscal and monetary policy to foster long-run growth?

This paper lies at the intersection between several important policy debates. There is first the debate on whether or not governments should intervene with a stimulus package during recessions. Keynesian economists advocate government intervention during downturns to stimulate demand and thereby short-term growth and employment. Others question the importance of a "multiplier" effect and instead advocate minimum tax and public spending to maximise firms' incentives to invest and hire. The analysis in the first part of this paper suggests a third – more Schumpeterian – approach, namely to implement countercyclical fiscal/budgetary

[4] See also Aghion, Askenazy et al (2012) for firm-level evidence on the impact of credit constraints on the cyclicality of R&D investment.

[5] A similar argument can be made about the ability to raise aggregate demand using a fiscal stimulus if households that get public money use it to pay back previously accumulated debts instead of raising their consumption because the financial sector is unwilling to extend new loans.

policies to enhance innovation and growth especially in sectors that are more credit-constrained. This has implications for the design of budgetary policies. In particular, it might be helpful to correct public deficit objectives for the business cycle, ie expressing them in structural terms and no longer in nominal terms. This also has implications for fiscal prudence as, empirically, soundness in fiscal accounts happens to be a key difference between those countries which manage to run countercyclical fiscal policies and those which run acyclical or even procyclical fiscal policies.[6]

Second, there is the issue as to how monetary policy should or should not adapt to the business cycle, and more specifically whether interest rate setting along the cycle can affect long-run growth. The conservative view argues that monetary policy should focus exclusively on inflation because pursuing other goals – like financial stability – is a straightforward recipe for jeopardising price stability. An alternative view is that inflation is no longer a sufficient statistic to evaluate critical developments in the economy, like overheating or credit booms, so that monetary policy decisions should also reflect the economy's position in the business and financial cycles. In the second part of the paper, we show that more countercyclical monetary policies – ie interest rate rules where business cycle conditions are given a larger weight, inducing lower short-term interest rates in recessions but higher short-term interest rates in booms – generate greater growth for sectors that face either tighter credit constraints or tighter liquidity constraints (or are more prone to be subject to liquidity shocks).[7] More generally, this part of the analysis vindicates the view that making things easier during recessions, in particular by lowering nominal interest rates and also by engaging in further easing when cutting interest rates reaches a limit, may yield significant benefits.[8]

There is finally the debate on optimal financial regulation, which we analyse in the third part of the paper. Recent influential work by Admati et al (2010) advocates higher minimum capital ratios for financial institutions.[9] Moreover, the idea of introducing countercyclical capital buffers also lies at the top of the banking reform agenda (see Drehmann et al (2010)). While we have no regulatory data, we investigate these two aspects separately by looking at cross-country differences in bank capital ratios and credit countercyclicality, assuming that such differences can help in understanding the effects of a change in regulation. First, while acknowledging that higher capital ratios for banks help mitigate systemic risks stemming from the financial system, we show that they can have two types of adverse consequences. First, they tend to inhibit growth in sectors with lower asset tangibility (typically the most innovative sectors). Second, they adversely affect the growth-enhancing effects of countercyclical monetary policy in such sectors.[10] To put it differently, higher regulatory bank capital ratios should certainly contribute to

[6] See Aghion et al (forthcoming) for empirical evidence on the positive relationship between fiscal policy countercyclicality and fiscal soundness.

[7] This section draws on Aghion, Farhi and Kharroubi (2012).

[8] This analysis also shows that the benefits of monetary policy stabilisation are cultivated equally in bad and good states. This means that raising interest rates in good times is as important as cutting them in bad times. See Aghion, Farhi and Kharroubi (2012) for more details.

[9] See also Macroeconomic Assessment Group (2010, 2011) for extensive studies of the impact of higher capital requirements on growth.

[10] Cecchetti and Li (2008) confirm that optimal monetary policy implies cutting interest rates more aggressively during a downturn to counteract the procyclical effect of prudential capital regulation.

making the aggregate economy safer and more immune to large adverse shocks. At the same time, such tighter regulation, insofar as it leads banks to choose to hold more capital, would call for monetary policy to be more countercyclical so as to maintain growth in sectors that face tighter credit constraints or tighter liquidity constraints.[11]

Next, we show that countercyclical credit provision enhances growth more in sectors with tighter liquidity constraints, on top of the growth-enhancing effects of monetary policy countercyclicality in such sectors. Hence, introducing countercyclical capital buffers, insofar as this translates into more countercyclical (less procyclical) bank credit, can help undo the detrimental effects of higher bank capital ratios on growth.[12]

Overall, our analysis suggests that there is a trade-off between, on the one hand, mitigating the risks and consequences of financial crises and financial instability with higher bank capital and, on the other hand, reducing the effectiveness of countercyclical monetary policy in enhancing growth in more liquidity-constrained sectors. Yet, this latter effect can be circumvented by adopting (i) more countercyclical monetary policy and (ii) more countercyclical capital buffers.

The empirical analysis in this paper uses cross-industry, cross-country panel data regressions. We build on the methodology developed in the seminal paper by Rajan and Zingales (1998). Using cross-industry, cross-country panel data, we test whether industry growth is positively affected by the interaction between fiscal or monetary policy cyclicality (computed at the country level) and industry-level measures of financial constraints (computed for each corresponding industry in the United States). The main reason we favour such an approach is because it provides a clear and net way to deal with causality issues.

Above, we mentioned evidence of a negative relationship between business cycle volatility and long-run growth (eg in Ramey and Ramey (1995) and Aghion et al (2010)). Yet, this is only indicative of a negative co-movement: it does not determine whether high volatility tends to reduce growth or whether low growth contributes to raising business cycle volatility. By looking at the effect of macroeconomic policies conducted at the country level on long-term growth at the industry level and acknowledging that individual industries are small compared with the total economy, we can confidently rule out the possibility that growth at the industry level affects the cyclical pattern of macroeconomic policy. Instead, we focus on the causality link from macroeconomic policy to industry growth. In other words, to the extent that macroeconomic policy and financial sector characteristics can affect industry growth, the opposite (industry growth affecting macroeconomic policy or financial sector characteristics) is much less likely to hold.

[11] See Cecchetti and Kohler (2012) for an analytical model on the substitutability and potential coordination issues between capital adequacy ratios and interest rate policy.

[12] While no data exist on the cyclicality of capital ratios, we can still use the cyclicality of credit provision to understand the would-be effects of introducing countercyclical capital buffers. Policy can indeed affect the cyclicality of credit provision through two main channels: the cyclicality of monetary policy and the cyclicality of bank capital ratio. Cross-country differences in credit provision cyclicality can hence be interpreted as differences in capital ratio cyclicality once monetary policy countercyclicality has been controlled for. Note, however, that there may be other reasons for cross-country differences in credit cyclicality, such as the extent to which financial intermediaries' balance sheets are marked to market (see Adrian and Shin (2010)).

Based on this empirical analysis, we can assess the economic magnitude of the difference-in-difference effects corresponding to the adoption of different fiscal or monetary policies. To the extent that we can draw a relationship between regulatory policy and financial sector characteristics, we can also assess the effect of a change in financial regulation. We first look at the effect of cyclical fiscal and monetary policy, evaluating the magnitude of the growth effects for an industry facing tight credit or liquidity constraints and located in a country running countercyclical policy compared with an industry facing lax credit or liquidity constraints and located in a country running procyclical policy. We then similarly assess the effect of financial sector characteristics. In particular, we compute the growth loss for an industry facing lax credit or liquidity constraints and located in a country with a low bank capital to asset ratio compared with an industry facing tight credit or liquidity constraints and located in a country with a high bank capital to asset ratio.[13] We find economically large effects of cross-country differences in fiscal and monetary policy as well as in financial sector characteristics.

The remaining part of the paper is organised as follows. Section 2 describes the empirical methodology and the data used to study the effect of cyclical fiscal and monetary policy. Section 3 presents the main empirical findings. Section 4 extends the previous analysis to investigate the effect of financial sector characteristics. Finally, conclusions are drawn in Section 5. Appendices A and B supply details on the sample and the estimations.

2. Methodology and data

The empirical framework uses the average annual growth rate of real value added in industry *j* in country *k* as the dependent variable. As explanatory variables, we introduce industry and country fixed effects $\{\alpha_j;\beta_k\}$ to control for unobserved heterogeneity across industries and across countries. The variable of interest, $(ic)_j \times (pol)_k$, is the interaction between industry *j*'s intrinsic characteristics $(ic)_j$ and the cyclicality of macroeconomic policy in country *k* $(pol)_k$ observed over the same period for which the average industry growth rate is computed. Finally, we control for initial conditions by including the ratio of real value added in industry *j* in country *k* to the total real value added in the manufacturing sector in country *k* at the beginning of the period. Denoting y^t_{jk} (y^t_k) real value added in industry *j* (in manufacturing) in country *k* at time *t* and ε_{jk} the error term, our main estimation equation can then be expressed as:

$$\frac{\ln\left(y_{jk}^{t+n}\right)-\ln\left(y_{jk}^{t}\right)}{n}=\alpha_j+\beta_k+\gamma(ic)_j\times(pol)_k-\delta\log\left(\frac{y_{jk}^{t}}{y_k^{t}}\right)+\varepsilon_{jk} \qquad (1)$$

Using a similar approach, we can also estimate the effect on industry labour productivity growth, defined as real value added per worker (or per hour worked).

[13] Interpreting the results for financial sector characteristics in terms of regulation policy would require an assumption that cross-country differences in financial sector characteristics are entirely driven by country differences in regulatory policy. From that point of view, the estimates of the difference-in-difference effect we obtain represent an upper bound. The effective implications of changing the regulatory policy are likely to be smaller than the estimated effect.

2.1 Macroeconomic policy

We start by looking at fiscal and monetary policy. We will turn to financial sector characteristics in a second step. The cyclical pattern of policy (fiscal or monetary) in country *k* is estimated as the marginal change in the considered policy (fiscal or monetary) following a change in the domestic output gap. For fiscal policy, we estimate the following equation:

$$fb_{kt} = \eta_k + (\mathrm{fp})_k z_{kt} + u_{kt} \quad (2)$$

where fb_{kt} is either total or primary fiscal balance to GDP in country *k* at time *t*; z_{kt} is the output gap in country *k* at time *t*, which represents the country's current position in the cycle; η_k is a constant; and u_{kt} is an error term.[14] We estimate this equation over the period 1980–2005 using annual data. The estimated coefficient $(\mathrm{fp})_k$ therefore measures fiscal policy cyclicality in country *k* during the period 1980–2005: a positive (negative) regression coefficient $(\mathrm{fp})_k$ reflects a countercyclical (procyclical) fiscal policy as the country's fiscal balance improves (deteriorates) in expansions and deteriorates (improves) in recessions. A larger coefficient therefore indicates a more countercyclical fiscal policy. The cyclicality index of macroeconomic policy $(pol)_k$ used in equation (1) is thus based on the set of estimated parameters $(\mathrm{fp})_k$ when we investigate the effect of fiscal policy countercyclicality on growth in industry real value added (labour productivity).

Turning to monetary policy, we consider the real short-term interest rate as the policy indicator[15] and estimate the following equation:

$$rsir_{kt} = \eta_k + \theta_k rsir_{kt-1} + (\mathrm{mp})_k z_{kt} + u_{kt} \quad (3)$$

where $rsir_{kt}$ is the real short-term interest rate in country *k* at time *t*, z_{kt} is the output gap in country *k* at time *t*, θ_k and η_k are parameters to estimate and u_{kt} is a residual. We estimate this equation over the period 1999–2005 using quarterly data. The estimated coefficient $(\mathrm{mp})_k$ therefore measures monetary policy cyclicality in country *k* for the estimation period: a positive (negative) regression coefficient $(\mathrm{mp})_k$ reflects a countercyclical (procyclical) monetary policy, as the central bank tends to make short-term credit more (less) costly in expansions and less (more) costly in recessions. A larger coefficient therefore indicates a more countercyclical monetary policy. As a complement to equation (3), we also use an alternative approach which allows the monetary policy rule specification to differ across countries. By choosing the specification which best fits a country's specific characteristics, we can get a better idea of the monetary policy cyclicality.[16, 17] The cyclicality index of macroeconomic policy $(pol)_k$ used in equation (1) is thus based on the set of

[14] Throughout the paper, the output gap is the percentage difference between actual and trend GDP, trend GDP being estimated applying an HP filter on the log of the real GDP. The smoothing parameter is adapted according to the data frequency.

[15] The real short-term interest rate is the difference between the nominal interest rate and annualised quarter-on-quarter CPI inflation.

[16] More precisely, we choose for each country the specification which minimises the root mean square error (RMSE).

[17] Appendix B provides two histograms reflecting the estimation results of the country-by-country "auxiliary" regression (2).

estimated parameters $(mp)_k$ when we investigate the effect of monetary policy countercyclicality.

2.2 Financial sector characteristics

We now turn to the analysis of the effect of financial sector characteristics. Here we adopt a similar approach to that used for studying the effect of cyclical macroeconomic policy and estimate the following specification:

$$\frac{\ln\left(y_{jk}^{t+n}\right)-\ln\left(y_{jk}^{t}\right)}{n}=\alpha_j+\beta_k+\gamma\left(ic\right)_j\times\left(\mathrm{fsc}\right)_k-\delta\log\left(\frac{y_{jk}^{t}}{y_k^{t}}\right)+\varepsilon_{jk} \quad (4)$$

where $(fsc)_k$ is the indicator for financial sector characteristics in country *k*, other notation being unchanged. As explained above, we look at two different dimensions of the financial sector, namely capital and cyclicality.

First, we compute the average bank capital to asset ratio for each country *k* over the period 1999–2005 and use this as our index for financial sector characteristics $(fsc)_k$ in equation (4).

Second, we consider the cyclicality of credit to non-financial firms. Specifically, we estimate for each country the following equation:

$$pc_{kt}=\eta_k+\left(\mathrm{rp}\right)_k z_{kt}+u_{kt} \quad (5)$$

where pc_{kt} represents the cyclical component of private credit to non-financial firms to GDP in country *k* at time *t*, η_k is a constant, z_{kt} is the output gap in country *k* at time *t* and u_{kt} is a residual.[18] We estimate this equation over the period 1999–2005 using quarterly data.[19] The estimated coefficient $(rp)_k$ therefore measures credit cyclicality in country *k* for the estimation period: a positive (negative) regression coefficient $(rp)_k$ reflects procyclical (countercyclical) credit, as the deviation from trend credit tends to be larger (lower) in expansions and lower (larger) in recessions.

2.3 The relationship between macroeconomic policy and financial sector characteristics

Finally, we want to investigate the interplay between cyclical macroeconomic policy and financial sector characteristics. For that purpose, we run two additional sets of estimations. First, we include the interaction of industry liquidity/credit constraints and financial sector characteristics, on the one hand, and cyclical macroeconomic policy, on the other. This is equation (6).

[18] The cyclical component pc_{kt} is estimated using an HP filter on the log of private credit to non-financial firms to GDP. This trend/cycle decomposition is helpful for focusing on the higher-frequency changes in private credit to GDP and abstracting from the lower-frequency changes which are likely to reflect more structural factors such as financial deepening.

[19] We estimate average bank capital ratios as well as credit cyclicality for the period 1999–2005 mainly because data prior to this period are not available for the full cross section of countries in our sample.

$$\frac{\ln\left(y_{jk}^{t+n}\right)-\ln\left(y_{jk}^{t}\right)}{n}=\alpha_j+\beta_k+\gamma_m\left(ic\right)_j\times\left(pol\right)_k+\gamma_r\left(ic\right)_j\times\left(reg\right)_k-\delta\log\left(\frac{y_{jk}^{t}}{y_k^{t}}\right)+\varepsilon_{jk} \quad (6)$$

Using such an estimation, one can test whether the growth effects of financial sector characteristics complement or counteract the growth effects of a more countercyclical macroeconomic policy. Estimating equation (6) may also help figure out whether the effect of cyclical macroeconomic policy is or is not simply capturing cross-country differences in bank capital to asset ratios or vice versa.

In a second part of our analysis, we include a triple interaction between industry liquidity/credit constraints, financial sector characteristics and cyclical macroeconomic policy:

$$\frac{\ln\left(y_{jk}^{t+n}\right)-\ln\left(y_{jk}^{t}\right)}{n}=\alpha_j+\beta_k+\gamma_m\left(ic\right)_j\times\left(pol\right)_k+\gamma_{mr}\left(ic\right)_j\times\left(pol\right)_k\times\left(fsc\right)_k-\delta\log\left(\frac{y_{jk}^{t}}{y_k^{t}}\right)+\varepsilon_{jk} \quad (7)$$

Estimating this equation should allow us to see, for example, whether a higher bank capital to asset ratio actually amplifies or dampens the growth effect of a more countercyclical macroeconomic policy on industry growth in more financially constrained sectors. We can also evaluate whether cyclical macroeconomic policy has an effect on growth independently of financial sector characteristics or if it essentially depends on financial sector characteristics.

Last, we will mix equations (6) and (7) to check whether the effects of macroeconomic policy and financial sector characteristics on growth are either independent of each other or complementary to each other, or both.[20] We will therefore estimate the following equation:

$$\begin{aligned}\frac{\ln\left(y_{jk}^{t+n}\right)-\ln\left(y_{jk}^{t}\right)}{n}&=\alpha_j+\beta_k+\gamma_m\left(ic\right)_j\times\left(pol\right)_k+\gamma_r\left(ic\right)_j\times\left(reg\right)_k\\&\quad+\gamma_{mr}\left(ic\right)_j\times\left(pol\right)_k\times\left(reg\right)_k-\delta\log\left(\frac{y_{jk}^{t}}{y_k^{t}}\right)+\varepsilon_{jk}\end{aligned} \quad (8)$$

2.4 Industry characteristics and estimation methodology

Now turning to industry-specific characteristics, we follow Rajan and Zingales (1998) in using firm-level data pertaining to the United States. In our case, these characteristics are designed to capture two sets of constraints affecting firms: borrowing constraints, on the one hand, and liquidity constraints, on the other. We use asset tangibility as a proxy for borrowing constraints, measured as the median ratio, across firms in a given industry, of the value of net property, plant and equipment to total assets. As for liquidity constraints, we consider the median ratio, across firms in a given industry, of labour costs to total sales. The first measure gives an indication of the difficulty an industry has in raising external finance and as such can be considered as a proxy for industry borrowing constraints. The second measure gives an indication of an industry's need for short-term financing. Industries with a larger ratio of labour costs to sales actually have larger payments

[20] Note that, given the limitations we face in terms of financial data, we will only be able to estimate equations (6), (7) and (8) for monetary policy. Running a similar exercise for fiscal policy is currently not possible.

to make on a regular basis and should therefore have greater needs for short-term refinancing.

This methodology, which consists in using US firm data to compute industry characteristics, is predicated on the assumptions that (i) differences across industries are driven largely by differences in technology; (ii) technological differences persist over time across countries; and (iii) countries are relatively similar in terms of the overall institutional environment faced by firms. Under these three conditions, the US-based industry-specific measure is likely to be a valid measure for industries in countries other than the United States. We believe that these assumptions are satisfied especially given our restriction to a set of rich countries that all belong to the Organisation for Economic Co-operation and Development (OECD). For example, if pharmaceuticals require proportionally more external finance or have lower labour costs than do textiles in the United States, this is likely to be the case in other OECD countries as well.[21] Moreover, to the extent that the United States is more financially developed than other countries worldwide, US-based measures are likely to provide the least noisy measures of industry borrowing or liquidity constraints.

Following Rajan and Zingales (1998), we estimate equations (1), (4), (6), (7) and (8) with a simple ordinary least squares (OLS) procedure, correcting for heteroskedasticity bias when needed. In particular, the interaction term between industry-specific characteristics and stabilisation policy cyclicality is likely to be largely exogenous to the dependent variable. There are two reasons for assuming this. First, our variable for industry-specific characteristics pertains to industries in the United States, whereas the dependent variable involves other countries. Hence, reverse causality, whereby industry growth outside the United States could affect industry-specific characteristics in the United States, seems quite implausible. Second, stabilisation policy cyclicality is measured at a macro level, whereas the dependent variable is measured at the industry level, which again reduces the scope for reverse causality as long as each individual industry represents a small share of the total output in the domestic economy.

2.5 Data sources

Our data sample focuses on 15 industrial OECD countries. The sample does not include the United States, as doing so would be a source of reverse causality problems.[22] Our data come from various sources. Industry-level real value added and labour productivity data are drawn from the European Union (EU) KLEMS data set and are restricted to manufacturing industries.[23] The primary source of data for measuring industry-specific characteristics is Compustat, which gathers balance sheets and income statements for US-listed firms. We draw on Rajan and Zingales (1998), Braun (2003), Braun and Larrain (2005) and Raddatz (2006) to compute the industry-level indicators for borrowing and liquidity constraints. Finally,

[21] In addition, little convergence has occurred among OECD countries over the past 20 years. Hence, cross-country differences are likely to persist over time.

[22] The sample consists of the following countries: Australia, Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

[23] See Appendix A for the list of industries in the sample.

macroeconomic variables used to compute stabilisation policy cyclicality are drawn from the OECD (2008) *Economic Outlook* data set. Fiscal policy data exist only at an annual frequency. We therefore use a relatively long time span – beginning in 1980 and ending in 2005 – in order to reduce uncertainty around fiscal policy cyclicality estimates. By contrast, there are quarterly data for monetary policy variables. We choose to concentrate on a more recent period (1999–2005), during which monetary policy was essentially conducted through short-term interest rates, to make sure that our auxiliary regression captures the bulk of monetary policy decisions.[24] Finally, the data for bank capital ratios come from Bankscope, while data on credit to non-financial firms come from the Bank for International Settlements (Dembiermont at al (2013)).[25]

3. Results

3.1 Fiscal policy

We first investigate the effect of fiscal policy countercyclicality. To this end, we estimate our main regression equation (1) using asset tangibility as the industry-specific characteristic and two sets of fiscal policy indicators. The first set is built around the total fiscal balance variable, which we consider either as a ratio of current GDP or as a ratio of potential GDP.[26] The second set of fiscal policy indicators is built around the primary fiscal balance variable.[27] As in the previous case, we consider it either as a ratio of current GDP or as a ratio of potential GDP. The empirical results show that growth in industry real value added is significantly and negatively correlated with the interaction of asset tangibility and fiscal policy countercyclicality (see Table 1): a larger sensitivity to the output gap of the total fiscal balance to GDP tends to raise growth in industry real valued added disproportionately for industries with lower asset tangibility. This result holds irrespective of whether total or primary fiscal balance is considered and whether it is a ratio to actual or potential GDP. As in the previous case, this result holds independent of the precise measure of fiscal policy countercyclicality. Applying the same methodology to industry labour productivity provides similar qualitative results: growth in industry labour productivity is significantly and negatively correlated with the interaction of asset tangibility and fiscal policy countercyclicality (see Table 2).

[24] Starting in 1999 also makes it possible to focus on the period following the establishment of the ECB for euro area countries.

[25] These data are available at http://www.bis.org/statistics/credtopriv.htm.

[26] The reason why fiscal indicators are considered as a ratio of potential GDP is to make sure that changes in fiscal policy indicators come from fiscal policy itself and not from changes in GDP. Otherwise there could be fluctuations in fiscal policy indicators even if the fiscal balance is constant simply because of fluctuations in GDP. In this case, estimating equation (2) would point towards countercyclical fiscal policy, even if fiscal policy is actually acyclical.

[27] The primary fiscal balance excludes net interest payments to or from the government as opposed to total fiscal balance which includes all government revenues and expenditure.

Dependent variable: real value added growth

Table 1

	(i)	(ii)	(iii)	(iv)
Log of initial share in manufacturing value added	**–0.528**	**–0.530**	**–0.508**	**–0.510**
	(0.350)	*(0.350)*	*(0.351)*	*(0.352)*
Interaction (asset tangibility and total fiscal balance to GDP countercyclicality)	**–13.30*** **			
	(4.406)			
Interaction (asset tangibility and total fiscal balance to potential GDP countercyclicality)		**–13.24*** **		
		(4.251)		
Interaction (asset tangibility and primary fiscal balance to GDP countercyclicality)			**–8.942*** **	
			(2.895)	
Interaction (asset tangibility and primary fiscal balance to potential GDP countercyclicality)				**–9.039*** **
				(2.830)
Observations	528	528	528	528
R-squared	0.560	0.561	0.560	0.560

The dependent variable is the average annual growth rate in real value added for the period 1980–2005 for each industry in each country. Initial share in manufacturing value added is the ratio of industry real value added to total manufacturing real value added in 1980. Asset tangibility is the fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Total fiscal balance to (potential) GDP countercyclicality is the coefficient of the output gap when total fiscal balance to (potential) GDP is regressed on a constant and the output gap for each country. Primary fiscal balance to (potential) GDP countercyclicality is the coefficient of the output gap when primary fiscal balance to (potential) GDP is regressed on a constant and the output gap for each country. The interaction variable is the product of variables in parentheses. Estimated coefficients are given as percentages. Standard errors – clustered at the country level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

Dependent variable: labour productivity growth

Table 2

	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity	**–2.512*** **	**–2.510*** **	**–2.505*** **	**–2.502*** **
	(0.503)	*(0.503)*	*(0.533)*	*(0.533)*
Interaction (asset tangibility and total fiscal balance to GDP countercyclicality)	**–13.03*** **			
	(4.011)			
Interaction (asset tangibility and total fiscal balance to potential GDP countercyclicality)		**–12.81*** **		
		(3.971)		
Interaction (asset tangibility and primary fiscal balance to GDP countercyclicality)			**–8.118*** **	
			(2.656)	
Interaction (asset tangibility and primary fiscal balance to potential GDP countercyclicality)				**–8.220*** **
				(2.642)
Observations	523	523	523	523
R-squared	0.538	0.538	0.535	0.535

The dependent variable is the average annual growth rate in labour productivity for the period 1980–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry labour productivity to total manufacturing labour productivity in 1980. Asset tangibility is the fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Total fiscal balance to (potential) GDP countercyclicality is the coefficient of the output gap when total fiscal balance to (potential) GDP is regressed on a constant and the output gap for each country. Primary fiscal balance to (potential) GDP countercyclicality is the coefficient of the output gap when primary fiscal balance to (potential) GDP is regressed on a constant and the output gap for each country. The interaction variable is the product of variables in parentheses. Estimated coefficients are given as percentages. Standard errors – clustered at the country level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively).

Three remarks are worth making at this point. First, the estimated coefficients are highly significant, in spite of the relatively conservative standard-error estimates, which we cluster at the country level. Second, the estimated coefficients remain essentially the same whether the fiscal balance is considered as a ratio of actual or potential GDP. This suggests that we are capturing the effect of fiscal policy rather than just the effect of changes in actual GDP. Using real value added or labour productivity as a growth variable actually provides very similar estimated coefficients for the interaction terms. This suggests that the gain stemming from more countercyclical fiscal policy is essentially a productivity growth gain and not merely higher employment growth.

3.2 Monetary policy

We now turn to investigate the effect of monetary policy countercyclicality. To this end, we estimate our main regression equation (1) using either an industry measure of borrowing constraints or an industry measure of liquidity constraints. In the former case, we use industry asset tangibility while in the latter case we use the ratio of industry labour costs to sales. Moreover, we use two measures for monetary policy cyclicality. The first one is based on a specification common to all countries. It is the sensitivity to the output gap of the real short-term interest rate, controlling for the one-quarter-lagged real short-term interest rate in order to take into account some possible persistence in monetary policy decisions (cf equation (3)). A second measure of monetary policy cyclicality is derived as the sensitivity of the real short-term interest rate to the output gap, but using country-specific specifications. The specification is chosen for each country from among a set of six different equations using a minimising RMSE criterion.[28]

The empirical results in Table 3 show that growth in industry real value added is significantly and negatively correlated with the interaction of industry asset tangibility and monetary policy countercyclicality: a larger sensitivity to the output gap of the real short-term interest rate tends to raise growth in industry real valued added disproportionately for industries with lower asset tangibility. A similar but opposite type of result holds for the interaction between monetary policy cyclicality and the ratio of industry labour costs to sales: a larger sensitivity of the real short-term interest rate to the output gap raises growth in industry real valued added disproportionately for industries with a higher ratio of labour costs to sales. These results are consistent with the view that a countercyclical monetary policy raises growth disproportionately in sectors that are more liquidity dependent or that face larger difficulties in raising capital, by easing the process of refinancing. Note that these two results extend to the case where monetary policy countercyclicality is estimated using a rule that is allowed to differ across countries. We now repeat the same estimation exercise, but moving the focus to growth in labour productivity (see Table 4). Our basic conclusion is unchanged, as results obtained for value added growth extend to labour productivity growth without difficulty.

[28] Ideally, we would like to measure monetary policy countercyclicality by means of estimating a Taylor rule. The problem with such an estimation, however, is that short-term nominal interest rates and inflation rates are not stationary over the period we consider for our estimation (1995–2005).

Dependent variable: real value added growth

Table 3

	(i)	(ii)	(iii)	(iv)
Log of initial share in manufacturing value added	**–0.0448**	**–0.0745**	**–0.0312**	**–0.0678**
	(0.719)	*(0.719)*	*(0.731)*	*(0.731)*
Interaction (asset tangibility and real short-term interest rate countercyclicality I)	**–18.37***			
	(9.88)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)		**–15.44****		
		(6.43)		
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)			**20.48****	
			(9.23)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)				**15.73****
				(7.25)
Observations	550	550	550	550
R-squared	0.306	0.307	0.305	0.306

The dependent variable is the average annual growth rate in real value added over the period 1999–2005 for each industry in each country. Initial share in manufacturing value added is the ratio of industry real value added to total manufacturing real value added in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Real short-term interest rate countercyclicality I is the coefficient of the output gap when the real short-term interest rate is regressed on a constant, the output gap and the one-quarter-lagged real short-term interest rate for each country. Real short-term interest rate countercyclicality II is the coefficient of the output gap in the regression which minimises the RMSE for each country. The interaction variable is the product of variables in parentheses. Standard errors – clustered by industry – are in parentheses. Estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

Dependent variable: labour productivity growth

Table 4

	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity	**–1.085**	**–1.122**	**–1.226**	**–1.158**
	(1.319)	*(1.294)*	*(1.273)*	*(1.243)*
Interaction (asset tangibility and real short-term interest rate countercyclicality I)	**–17.89***			
	(9.469)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)		**–15.65****		
		(6.926)		
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)			**22.64****	
			(8.656)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)				**16.82****
				(6.829)
Observations	550	550	550	550
R-squared	0.248	0.251	0.249	0.249

The dependent variable is the average annual growth rate in hour labour productivity over the period 1999–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry hour labour productivity to total manufacturing hour labour productivity in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Real Short-term interest rate countercyclicality I is the coefficient of the output gap when the real short-term interest rate is regressed on a constant, the output gap and the one-quarter-lagged real short-term interest rate for each country. Real short-term interest rate countercyclicality II is the coefficient of the output gap in the regression which minimises the RMSE for each country. The interaction variable is the product of variables in parentheses. Standard errors – clustered by industry – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

At this point, it is worth making two remarks. First, the correlation between the measures of liquidity and borrowing constraints is around –0.6. Liquidity and borrowing constraints are therefore two distinct channels through which monetary policy countercyclicality affects industry growth. Second, as was the case for regressions using fiscal policy cyclicality, estimated coefficients for the interaction terms are very stable whether the dependent variable is value added growth or labour productivity growth. This confirms that macroeconomic policy cyclicality is a source of long-run growth as it essentially affects labour productivity.[29]

3.3 Financial sector characteristics

We lastly investigate the effect of financial sector characteristics. To do so, we estimate the regression equation (4) using, as we did for monetary policy, either an industry measure of borrowing constraints (industry asset tangibility) or an industry measure of liquidity constraints (ratio of industry labour costs to sales). We start the investigation by looking at the effects of the bank capital to asset ratio. The results in columns (i) and (iii) in Table 5 show that industries with higher asset tangibility tend to grow disproportionately faster in economies where banks maintain a higher capital to asset ratio. This finding is logical. When banks have more of their own money at stake in the loans they extend, they are likely to require stronger guarantees when lending to firms, which is inevitably more difficult to satisfy for firms whose assets are less tangible.[30] Hence, in economies where banks hold more capital, high-tangibility industries should grow faster to the detriment of low-tangibility industries. However, there is no evidence of a significant effect on industries when considering their labour costs to sales ratio. Industries with a higher ratio of labour costs to sales do not grow more slowly if banks choose to hold more capital.

Turning now to the cyclicality of credit, columns (ii) and (iv) show that procyclical credit (ie less credit in recessions and more in expansions) to non-financial enterprises is more detrimental to industries with larger liquidity needs: in countries where credit is less procyclical, industries with larger liquidity needs tend to grow faster. However, there is no evidence of a significant effect on industries according to the tangibility of their assets. Industries with lower asset tangibility do not grow more slowly if credit is more procyclical.[31]

[29] A discrepancy between the results for real value added and those for labour productivity growth would have implied that macroeconomic policy cyclicality essentially operates through employment, which cannot constitute a source of growth in the long run.

[30] There is one important point to keep in mind with respect to this finding. Since we focus on the manufacturing sector, we can only say that industries with lower asset tangibility in that specific sector get hurt. However, it is also clear that asset tangibility is probably higher in manufacturing than in other sectors like the service sector. So applying the same argument across sectors could imply that manufacturing as a whole actually grows faster relative to the service sector when banks maintain higher capital ratios. On the other hand, this result highlights the risks of imposing high capital to asset ratios, as this could allow high-tangibility sectors such as construction to outgrow the economy.

[31] While the result for liquidity-dependent industries makes sense, the absence of a significant effect according to asset tangibility is more surprising, especially given that we have already found a significant effect of monetary policy countercyclicality. This discrepancy may have to do with a firm's financial structure, intangible firms being essentially equity-financed and hence relatively unaffected by fluctuations in credit.

Dependent variable: real value added growth

Table 5

	(i)	(ii)	(iii)	(iv)
Log of initial share in manufacturing value added	**0.0161**	**0.0232**	**–0.00562**	**0.0116**
	(0.711)	*(0.716)*	*(0.702)*	*(0.727)*
Interaction (asset tangibility and bank capital to asset ratio)	**1.488***			
	(0.803)			
Interaction (asset tangibility and credit to NFC procyclicality)		**1.839**		
		(2.296)		
Interaction (labour costs to sales and bank capital to asset ratio)			**–1.208**	
			(0.844)	
Interaction (labour costs to sales and credit to NFC procyclicality)				**–5.461****
				(2.335)
Observations	550	550	550	550
R-squared	0.305	0.300	0.302	0.303

The dependent variable is the average annual growth rate in real value added for the period 1999–2005 for each industry in each country. Initial share in manufacturing value added is the ratio of industry real value added to total manufacturing real value added in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Bank capital to asset ratio is the average bank capital to asset ratio over the period 1999–2005 for each country. Credit to NFC procyclicality is the coefficient of the output gap when the deviation from trend of credit to non-financial corporations to GDP is regressed on a constant and the output gap for each country. The interaction variable is the product of variables in parentheses. Standard errors – clustered at the industry level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

Dependent variable: labour productivity growth

Table 6

	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity	**–0.867**	**–1.039**	**–0.993**	**–0.984**
	(1.241)	*(1.240)*	*(1.218)*	*(1.235)*
Interaction (asset tangibility and bank capital to asset ratio)	**1.840***			
	(0.972)			
Interaction (asset tangibility and credit to NFC procyclicality)		**0.729**		
		(3.763)		
Interaction (labour costs to sales and bank capital to asset ratio)			**–1.464**	
			(1.001)	
Interaction (labour costs to sales and credit to NFC procyclicality)				**–6.773****
				(3.062)
Observations	550	550	550	550
R-squared	0.251	0.241	0.246	0.247

The dependent variable is the average annual growth rate in labour productivity per hour for the period 1999–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry labour productivity per hour to total manufacturing labour productivity per hour in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Bank capital to asset ratio is the average bank capital to asset ratio over the period 1999–2005 for each country. Credit to NFC procyclicality is the coefficient of the output gap when the deviation from trend of credit to non-financial corporations to GDP is regressed on a constant and the output gap for each country. The interaction variable is the product of variables in parentheses. Standard errors – clustered at the industry level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

Finally, Table 6 extends this analysis to growth in labour productivity, with the results being both qualitatively and quantitatively very similar to those obtained when using real value added growth as the dependent variable.

3.4 Magnitude of the effects

How large are the effects implied by the regressions? To get a sense of the magnitudes involved in these regressions, we compute the difference in growth between, on the one hand, an industry at the third quartile (75th percentile) in terms of borrowing or liquidity constraints located in a country at the third quartile in terms of fiscal or monetary policy or financial sector characteristics and, on the other hand, an industry at the first quartile (25th percentile) in terms of borrowing or liquidity constraints located in a country at the first quartile in terms of fiscal or monetary policy or financial sector characteristics.[32, 33]

As it turns out, in the case of fiscal policy countercyclicality, the approximate gain in labour productivity growth is between 1 and 2 percentage points per year, depending on the fiscal policy indicator considered.[34] For monetary policy, the growth gain in labour productivity ranges between 0.5 and 1.5 percentage points, the latter figure being obtained when the liquidity dependence indicator is considered. Last, differences in financial sector characteristics can have significant effects on growth in industry labour productivity since moving from the first to the third quartile for the bank capital to asset ratio can redistribute as much as 2.5 percentage points of productivity growth from low- to high-tangibility sectors. Yet, as we will see below, this effect actually captures part of the complementarity between financial sector characteristics and monetary policy and is hence overstating the implications of cross-country differences in financial sector characteristics.

Note that these magnitudes are fairly large, especially when compared with the corresponding figures in Rajan and Zingales (1998). According to their results, the gain in growth in real value added registered when moving from the 25th to the 75th percentile, both in a country's level of financial development and in an industry's level of external financial dependence, is roughly equal to 1 percentage point per year.

However, the following considerations are worth pointing out here. First, these are difference-in-difference (cross-country or cross-industry) effects, which are not directly interpretable as countrywide effects. Second, we are just looking at manufacturing sectors, which represent no more than 40% of the total GDP of the

[32] In this case, we compute the difference in growth between, on the one hand, an industry at the first quartile in terms of asset tangibility located in a country at the third quartile in terms of fiscal policy countercyclicality and, on the other hand, an industry at the third quartile in terms of asset tangibility located in a country at the first quartile in terms of fiscal policy countercyclicality.

[33] Given our difference-in-difference specification, it is impossible to infer the economic magnitudes of the estimated coefficients differently. In particular, the presence of industry and country fixed effects precludes investigating the impact of a change in the cyclical pattern of fiscal policy for a given industry or conversely the effect of a change in industry characteristics (asset tangibility or the ratio of labour costs to sales) in a country with a given cyclical pattern of fiscal policy. Both of these effects are absorbed by our country and industry dummies.

[34] The larger growth gain from a change in fiscal policy cyclicality is obtained using the primary balance and the lower using the total balance.

countries in our sample. Third, irrespective of the indicator for countercyclicality considered, there is a high degree of dispersion across countries in our sample. Hence, moving from the 25th to the 75th percentile in macroeconomic policy corresponds to a radical change in the design of stabilisation policies along the cycle, which, in turn, is unlikely to take place in any individual country over a short period of time. Fourth, this simple computation does not take into account the possible costs associated with the transition from a steady state with low policy countercyclicality to a steady state with high policy countercyclicality. Yet, the above exercise suggests that differences in the cyclicality of fiscal and monetary policy are an important driver of the observed cross-country, cross-industry differences in growth performance.

3.5 Financial sector characteristics and their interplay with the cyclicality of monetary policy

So far we have analysed separately the effects of macroeconomic policy (fiscal/monetary policy countercyclicality) and of financial sector characteristics (bank capital ratios and the cyclicality of credit). We now investigate the potential interactions between the two. Our idea is that the transmission of stabilisation policies to the real economy could depend on the characteristics of the banking/financial sector. Thus, one may wonder whether high capital ratios are an obstacle to a rapid and swift transmission of policy stimuli, or instead a guarantee that banks are sound and safe, which in turn could ease transmission of stabilisation policies to the real economy.[35] Similarly, the cyclicality of credit cannot be examined independently of the cyclicality of monetary policy, as the former is likely to reflect (be influenced by) the latter, hence the importance of investigating the interaction between monetary policy cyclicality and financial sector characteristics. This is our next step.[36]

3.5.1 Monetary policy cyclicality and bank capital

Table 7 regresses labour productivity growth on the interaction between industry asset tangibility (ratio of labour costs to sales) and monetary policy countercyclicality, but adds the interaction between industry asset tangibility (ratio of labour costs to sales) and the average bank capital to asset ratio as an extra explanatory variable. As the table shows, a higher bank capital to asset ratio enhances growth disproportionately in sectors with higher asset tangibility: or put differently, higher bank capital ratios tend to be more detrimental for growth in sectors with lower asset tangibility (columns (i) and (ii)). The evidence for industries with a higher ratio of labour costs to sales is more mixed (columns (iii) and (iv)), thus confirming the absence of results found previously in Tables 5 and 6.[37] The conclusion to be drawn is, therefore, that imposing higher capital to asset ratios on

[35] Bech et al (2012) provide evidence that policy stimuli are less effective when the economy experiences a downturn associated with a financial crisis, which presumably implies that banks then face significant problems.

[36] We will restrict the study to the interaction of financial sector characteristics and monetary policy countercyclicality. Owing to data limitations, it is not possible to carry out a similar exercise for fiscal policy countercyclicality.

[37] Performing the same regression exercise using real value added growth as the dependent variable provides identical results.

banks can have detrimental effects on sectors with relatively intangible assets. However, as is clear from the table, this adverse effect can be undone if, in the meantime, monetary policy becomes more countercyclical.

Dependent variable: growth in labour productivity per hour — Table 7

	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity	**–0.880**	**–0.929**	**–1.174**	**–1.099**
	(1.394)	*(1.347)*	*(1.289)*	*(1.257)*
Interaction (asset tangibility and real short-term interest rate countercyclicality I)	**–21.30****			
	(9.547)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)		**–16.70****		
		(6.978)		
Interaction (asset tangibility and average bank capital to asset ratio)	**2.103****	**1.965***		
	(0.983)	*(0.982)*		
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)			**25.00*****	
			(9.087)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)				**17.5****
				(7.085)
Interaction (labour costs to sales and average bank capital to asset ratio)			**–1.719***	**–1.573**
			(0.986)	*(1.007)*
Observations	550	550	550	550
R-squared	0.257	0.259	0.254	0.253

The dependent variable is the average annual growth rate in labour productivity per hour for the period 1999–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry labour productivity per hour to total manufacturing labour productivity per hour in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Real short-term interest rate countercyclicality I is the output gap sensitivity of the real short-term interest rate, controlling for the one-quarter-lagged real short-term interest rate. Real short-term interest rate countercyclicality II is the output gap sensitivity of the real short-term interest rate in the regression which minimises the RMSE. The interaction variable is the product of variables in parentheses. Standard errors – clustered at the industry level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

Yet, one may ask whether the effect of bank capital to asset ratios just comes on top of the effect of monetary policy countercyclicality or whether bank capital to asset ratios actually affect the relationship between monetary policy countercyclicality and growth. Could it be, for instance, that high capital ratios reduce the effectiveness of monetary policy in promoting growth in sectors with the lowest asset tangibility?

Table 8 answers this question. It tests whether the relationship between industry growth and the interaction between industry asset tangibility (ratio of labour costs to sales) and monetary policy cyclicality is different between countries with relatively large bank capital to asset ratios and countries with relatively low bank capital to asset ratios. To do so, we build a dummy variable which is equal to one for countries with bank capital to asset ratios above the sample median. We then estimate whether there is a significant extra effect of the interaction between industry asset tangibility (ratio of labour costs to sales) and monetary policy cyclicality on growth when the dummy variable equals one.

We see that the growth-enhancing effect of a countercyclical monetary policy on sectors with lower asset tangibility (higher ratio of labour costs to sales) is

dampened in countries where the bank capital to asset ratio is above the sample median. In other words, high bank capital to asset ratios tend to reduce the benefit of a more countercyclical monetary policy in sectors that are more prone to be credit-constrained or liquidity-constrained. This result suggests that higher bank capital to asset ratios limit the ability of the financial system to respond to changes in interest rates and reduces the effectiveness of the monetary policy transmission channel. This result also implies that the adverse implications of high bank capital to asset ratios might be undone by adopting a more countercyclical monetary policy. However, as is clear from the estimated coefficients, the interaction of industry asset tangibility (ratio of labour costs to sales) and monetary policy cyclicality is not significant for countries with a bank capital to asset ratio above the sample median, which would suggest that monetary policy simply becomes ineffective when banks maintain a large capital to asset ratio.

Dependent variable: growth in labour productivity per hour — Table 8

	Above median	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity		**–1.257**	**–1.217**	**–1.318**	**–1.259**
		(1.345)	*(1.289)*	*(1.290)*	*(1.247)*
Interaction (asset tangibility and real short-term interest rate countercyclicality I)		**–33.56****			
		(13.97)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)			**–24.62****		
			(9.373)		
Interaction (asset tangibility and real short-term interest rate countercyclicality I)	Average bank capital to asset ratio	**28.49****			
		(11.13)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)			**19.29****		
			(8.657)		
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)				**45.30*****	
				(14.19)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)					**30.70*****
					(10.69)
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)	Average bank capital to asset ratio			**–39.24*****	
				(13.08)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)					**–28.82*****
					(9.943)
Observations		550	550	550	550
R-squared		0.257	0.255	0.261	0.256

The dependent variable is the average annual growth rate in labour productivity per hour for the period 1999–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry labour productivity per hour to total manufacturing labour productivity per hour in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Real short-term interest rate countercyclicality I is the output gap sensitivity of the real short-term interest rate, controlling for the one-quarter-lagged real short-term interest rate. Real short-term interest rate countercyclicality II is the output gap sensitivity of the real short-term interest rate in the regression which minimises the RMSE. The interaction variable is the product of variables in parentheses. Standard errors – clustered at the industry level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

Table 9 runs a horse race between the different interaction terms to get a comprehensive view of the interaction between monetary policy countercyclicality and bank capital to asset ratios. It includes the interaction between industry asset

tangibility (ratio of labour costs to sales) and the average bank capital to asset ratio; the interaction between industry asset tangibility (ratio of labour costs to sales) and monetary policy cyclicality; and this last interaction for countries with bank capital to asset ratios above the sample median.

The table yields three different results which confirm the previously obtained results in Tables 7 and 8. First, a higher bank capital to asset ratio tends to disproportionately benefit industries with more tangible assets, which can then grow faster. Second, a higher bank capital to asset ratio tends to reduce the benefit that less tangible industries can derive from a countercyclical monetary policy. Third, a high bank capital to asset ratio tends to reduce the benefit that industries with a higher ratio of labour costs to sales can derive from a countercyclical monetary policy.

Dependent variable: labour productivity growth — Table 9

	Above median	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity		**–1.033**	**–1.014**	**–1.274**	**–1.198**
		(1.402)	*(1.336)*	*(1.302)*	*(1.259)*
Interaction (asset tangibility and real short-term interest rate countercyclicality I)		**–31.27****			
		(14.08)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)			**–23.18****		
			(9.375)		
Interaction (asset tangibility and real short-term interest rate countercyclicality I)	Average bank capital to asset ratio	**19.20***			
		(11.03)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)			**14.04**		
			(0.087)		
Interaction (asset tangibility and average bank capital to asset ratio)		**1.722***	**1.804***		
		(1.009)	*(0.999)*		
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)				**43.46*****	
				(13.76)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)					**29.47*****
					(10.27)
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)	Average bank capital to asset ratio			**–33.64*****	
				(10.98)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)					**–25.04*****
					(8.497)
Interaction (labour costs to sales and average bank capital to asset ratio)				**–1.012**	**–1.264**
				(0.906)	*(0.955)*
Observations		550	550	550	550
R-squared		0.265	0.265	0.263	0.255

The dependent variable is the average annual growth rate in labour productivity per hour for the period 1999–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry labour productivity per hour to total manufacturing labour productivity per hour in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Real short-term interest rate countercyclicality I is the output gap sensitivity of the real short-term interest, controlling for the one-quarter-lagged real short-term interest rate. Real short-term interest rate countercyclicality II is the output gap sensitivity of the real short-term interest rate in the regression which minimises the RMSE. The interaction variable is the product of variables in parentheses. Standard errors – clustered at the industry level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively).

Overall, we can summarise our above discussion as follows. First, high bank capital asset ratios provide a disproportionate growth benefit to industries with high asset tangibility, at the expense of industries with lower asset tangibility. Second, high bank capital asset ratios make monetary policy countercyclicality less beneficial to industries with less tangible assets or a larger ratio of labour costs to sales. In other words, a key effect of high bank capital to asset ratios is that they dampen the growth-enhancing effect of a more countercyclical monetary policy on sectors that are more prone to be credit constrained or liquidity constrained.

3.5.2 Monetary policy cyclicality and the cyclicality of credit provision

We now investigate the extent to which the cyclicality of credit provision could complement or substitute for the cyclicality of monetary policy in enhancing growth in more credit-constrained or liquidity-constrained sectors. We focus on credit to non-financial corporations and ask the two questions raised for bank capital to asset ratios. First, does countercyclical credit affect industries according to their asset tangibility (their labour costs to sales ratio)? Second, does the effect of monetary policy countercyclicality on industry growth get affected by cross-country differences in credit cyclicality?

Table 10 provides answers to these two questions. There are essentially two takeaways from these estimations. First, the cyclicality of credit does not affect industries according to the tangibility of assets, neither directly nor indirectly, ie through the cyclicality of monetary policy. More precisely, the cyclicality of credit does not have any effect beyond that of monetary policy countercyclicality. Second, the cyclicality of credit does affect industry growth according to their labour costs to sales ratio: industries with a larger labour costs to sales ratio get hurt disproportionately when credit to non-financial firms becomes more procyclical. Yet, there is no interaction between monetary policy and credit countercyclicality. In other words, monetary policy and credit countercyclicality play similar but independent roles: raising growth disproportionately for industries with a larger labour costs to sales ratio.

Dependent variable: labour productivity growth — Table 10

	Above median	(i)	(ii)	(iii)	(iv)
Log of initial relative labour productivity		**–1.085**	**–1.131**	**–1.203**	**–1.113**
		(1.341)	*(1.301)*	*(1.321)*	*(1.286)*
Interaction (asset tangibility and real short-term interest rate countercyclicality I)		**–21.74****			
		(0.0849)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)			**–18.7****		
			(0.0768)		
Interaction (asset tangibility and real short-term interest rate countercyclicality I)	Private credit to NFC cyclicality	**10.08**			
		(13.25)			
Interaction (asset tangibility and real short-term interest rate countercyclicality II)			**13.90**		
			(18.14)		
Interaction (asset tangibility and private credit to NFC cyclicality)		**–1.053**	**–1.000**		
		(4.366)	*(3.896)*		
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)				**16.85***	
				(0.0873)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)					**13.60***
					(0.0696)
Interaction (labour costs to sales and real short-term interest rate countercyclicality I)	Private credit to NFC cyclicality			**12.48**	
				(12.60)	
Interaction (labour costs to sales and real short-term interest rate countercyclicality II)					**6.055**
					(15.14)
Interaction (labour costs to sales and private credit to NFC cyclicality)				**–7.297****	**–5.566***
				(2.967)	*(2.879)*
Observations		550	550	550	550
R-squared		0.249	0.252	0.255	0.253

The dependent variable is the average annual growth rate in labour productivity per hour for the period 1999–2005 for each industry in each country. Initial relative labour productivity is the ratio of industry labour productivity per hour to total manufacturing labour productivity per hour in 1999. Asset tangibility is the median fraction of assets represented by net property, plant and equipment for US firms in the same industry for the period 1980–89. Labour costs to sales is the median ratio of labour costs to shipments for US firms in the same industry for the period 1980–89. Real short-term interest rate countercyclicality I is the output gap sensitivity of the real short-term interest, controlling for the one-quarter-lagged real short-term interest rate. Real short-term interest rate countercyclicality II is the output gap sensitivity of the real short-term interest rate in the regression which minimises the RMSE. The interaction variable is the product of variables in parentheses. Standard errors – clustered at the industry level – are in parentheses. All estimations include country and industry dummies. Significance at the 1%, 5% and 10% level is indicated by ***, ** and * respectively.

4. Conclusions

We have analysed the extent to which macroeconomic policy over the business cycle in combination with financial sector characteristics can affect industry growth, focusing on fiscal and monetary policy, on the one hand, and on bank capital ratios and the cyclicality of credit, on the other. Following the Rajan and Zingales (1998) methodology, we have interacted these policy measures at the country level with industry-level financial and liquidity constraints (measured by asset tangibility and

the ratio of labour costs to sales in US industries) to assess the impact of this interaction on output growth at the industry level. We have derived four main results. First, a more countercyclical macroeconomic policy (fiscal or monetary) significantly enhances output growth in more financially/liquidity-constrained industries, that is, in industries whose US counterparts display lower asset tangibility or a larger ratio of labour costs to sales. Second, a higher bank capital to asset ratio tends to raise growth disproportionately more in industries with higher asset tangibility (and therefore disproportionally less in industries with lower asset tangibility). Third, more countercyclical credit to non-financial firms tends to raise growth disproportionately in industries with larger labour costs to sales ratios. Fourth and last, a higher bank capital to asset ratio tends to reduce the effect of monetary policy countercyclicality.

This new approach to the study of growth versus macroeconomic policy and financial sector characteristics suggests at least two avenues for future research. First, the evidence on the effect of countercyclical macroeconomic policy on growth calls for going beyond the debate between supply side and demand side economists. While demand considerations can affect the market size for potential innovations, our effects are fundamentally supply side-driven, as they operate through their influence on innovation incentives.[38] Second, the evidence produced in this paper on the effects of bank capital and the cyclicality of credit to non-financial firms on growth suggests non-trivial trade-offs for regulatory policy: in particular, higher capital adequacy ratios, insofar as they become binding, can be helpful in reducing systemic risk. However, they may also adversely affect industries with the lowest asset tangibility, which we typically think of as being the main engines for growth in developed economies. This, in turn, opens up the issue of how to optimally design financial regulations together with fiscal/monetary policy so as to reconcile financial stability and growth.

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[38] Thus a more countercyclical macroeconomic policy has both an ex ante and an ex post effect: ex ante, it increases innovation incentives by reducing the risk that the innovation will fail in the future because of adverse macroeconomic shocks; ex post, it helps to reduce the proportion of firms that will have to cut productivity-enhancing investments following a bad shock.

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Appendix A

Industries in the sample

The first column provides the industry code based on the International Standard Industrial Classification (ISIC) revision 3. The second column provides a brief industry description. If an industry description is valid for more than one industry code, the relevant industry codes are reported separated by an ampersand ("&"). The industry codes noted "x-y" represent industries with industry code "x" excluding industries with industry code "y".

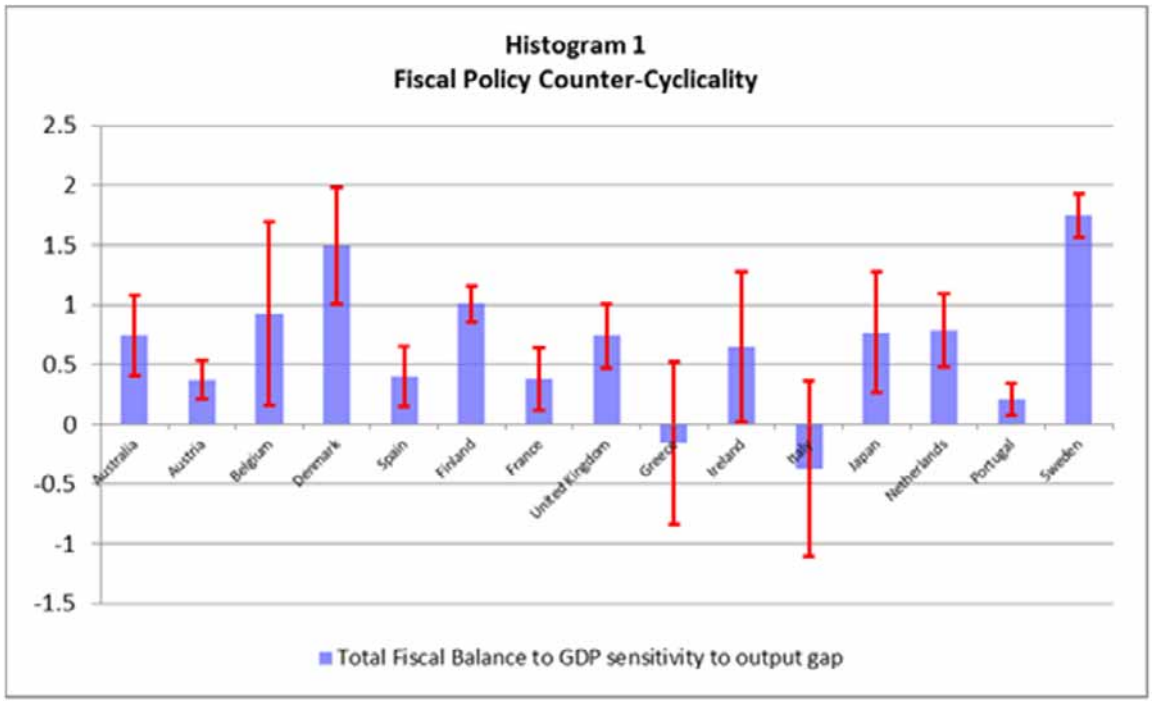
Industry code	Industry title
15&16	FOOD, BEVERAGES AND TOBACCO
15	Food and beverages
16	Tobacco
17&18&19	TEXTILES, TEXTILE, LEATHER AND FOOTWEAR
17&18	Textiles and textile
17	Textiles
18	Wearing apparel, dressing and dying of fur
19	Leather, leather and footwear
20	WOOD AND OF WOOD AND CORK
21&22	PULP, PAPER, PAPER, PRINTING AND PUBLISHING
21	Pulp, paper and paper
22	Printing, publishing and reproduction
221	Publishing
22–221	Printing and reproduction
23&24&25	CHEMICAL, RUBBER, PLASTICS AND FUEL
23	Coke, refined petroleum and nuclear fuel
24	Chemicals and chemical
244	Pharmaceuticals
24–244	Chemicals excluding pharmaceuticals
25	Rubber and plastics
26	OTHER NONMETALLIC MINERAL
27&28	BASIC METALS AND FABRICATED METAL
27	Basic metals
28	Fabricated metal
29	MACHINERY not elsewhere classified
30&31&32&33	ELECTRICAL AND OPTICAL EQUIPMENT
30	Office, accounting and computing machinery
31&32	Electrical engineering
31	Electrical machinery and apparatus not elsewhere classified
313	Insulated wire
31–313	Other electrical machinery and apparatus not elsewhere classified
32	Radio, television and communication equipment

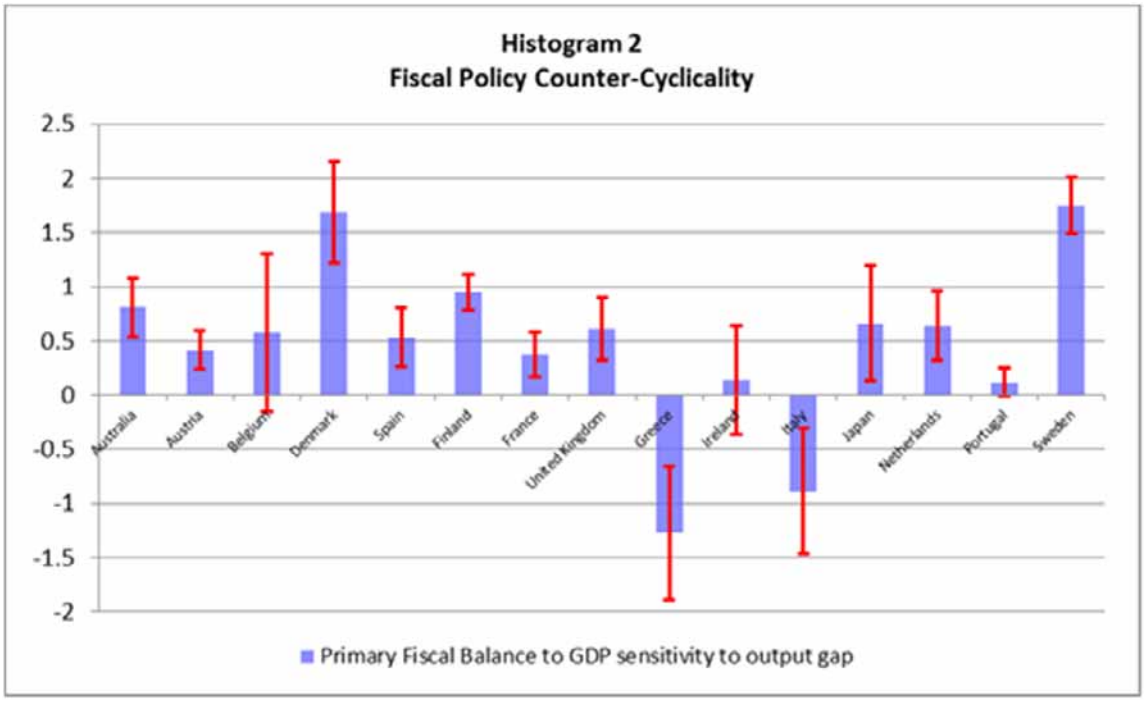
321	Electronic valves and tubes
322	Telecommunication equipment
323	Radio and television receivers
33	Medical, precision and optical instruments
331&332&333	Scientific instruments
334&335	Other instruments
34&35	TRANSPORT EQUIPMENT
34	Motor vehicles, trailers and semi-trailers
35	Other transport equipment
351	Building and repairing of ships and boats
353	Aircraft and spacecraft
35–(351&353)	Railroad equipment and transport equipment not elsewhere classified
36&37	MANUFACTURING NOT ELSEWHERE CLASSIFIED, RECYCLING
36	Manufacturing not elsewhere classified
37	Recycling

Appendix B

Estimation results of the country-by-country fiscal policy regression (2)

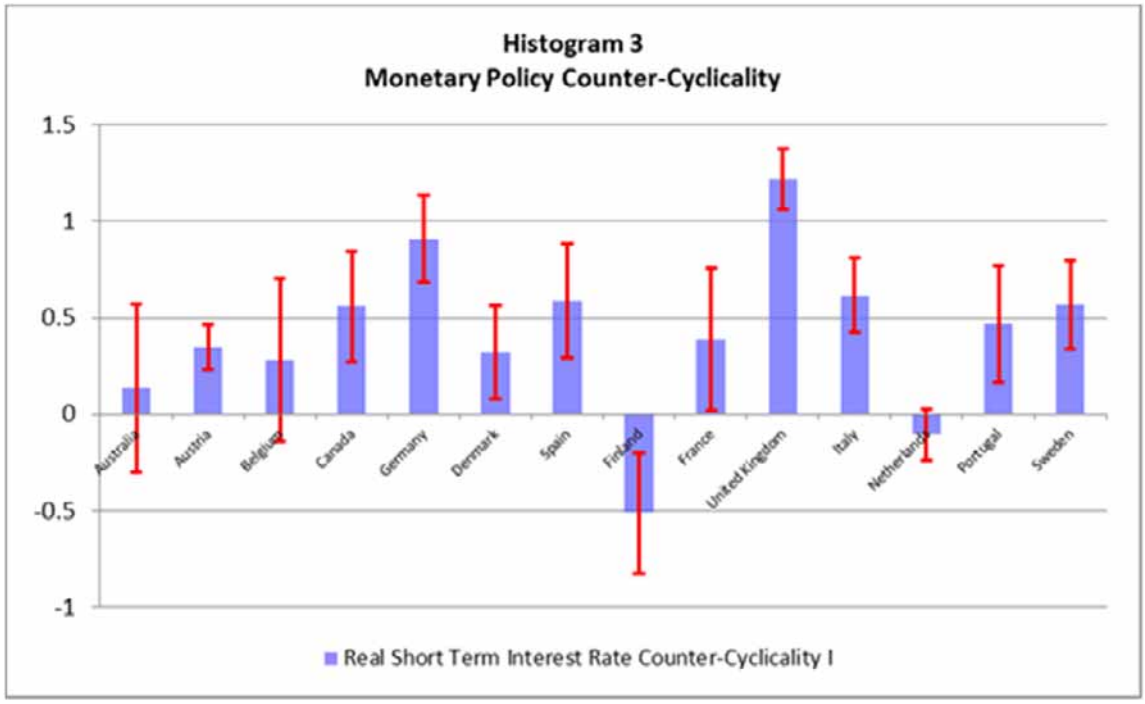
Bars represent the coefficient $(fp)_k$ estimated in regression (2), for each country. Red lines indicate the confidence interval at the 10% level around the mean estimate of $(fp)_k$, based on the standard errors estimated in regression (2).

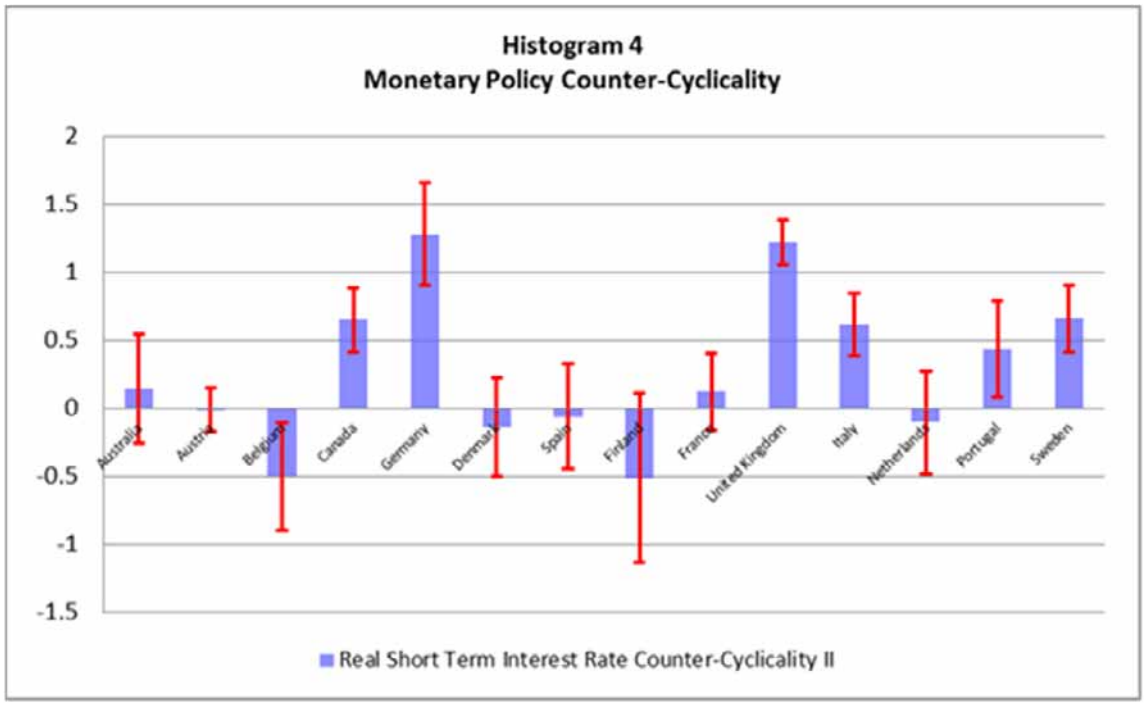




Estimation results of the country-by-country monetary policy regression (3)

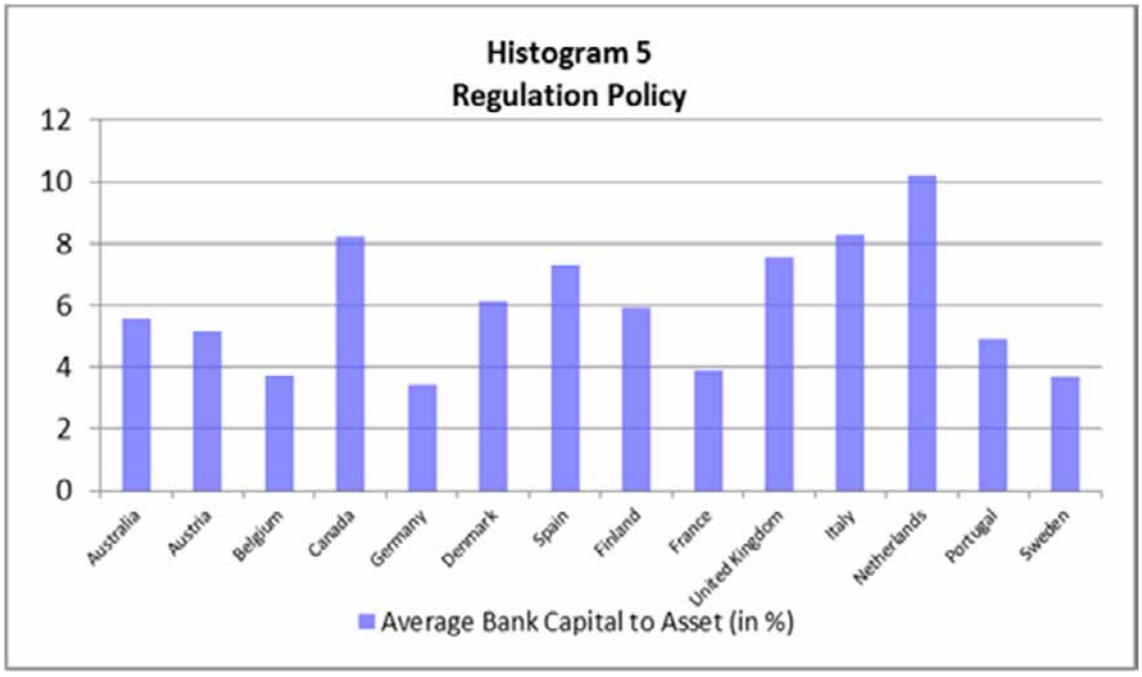
Bars represent the coefficient $(mp)_k$ estimated in regression (3), for each country. Red lines indicate the confidence interval at the 10% level around the mean estimate of $(mp)k$, based on the standard errors estimated in the regression (3).

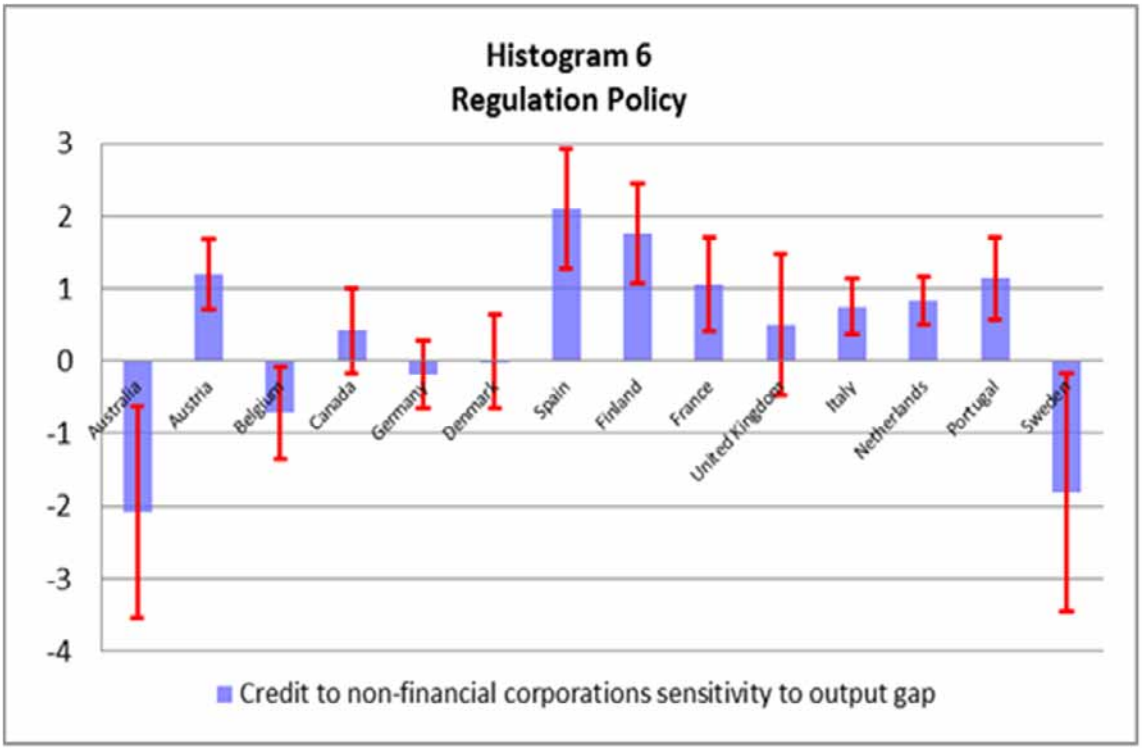




Average bank capital to asset ratio and estimation results of the country-by-country credit provision cyclicality regression (5)

Bars in Histogram 5 represent the average bank capital to asset ratio for each country over the period 1999–2005. Bars in Histogram 6 represent the coefficient $(rp)_k$ estimated in regression (5), for each country. Red lines indicate the confidence interval at the 10% level around the mean estimate of $(mp)_k$, based on the standard errors estimated in regression (5).





Discussion on "The Great Recession: What Recovery?"

Robert E Hall[1]

The Great Recession – and the persistent slump that followed – have proven to be the most important challenge to stabilisation policy since the Great Depression. My discussion will focus on data from the United States, but the experiences of other advanced economies over the past five years have been similar, so the conclusions are more general, I believe.

Investment/GDP ratio and unemployment rate Figure1

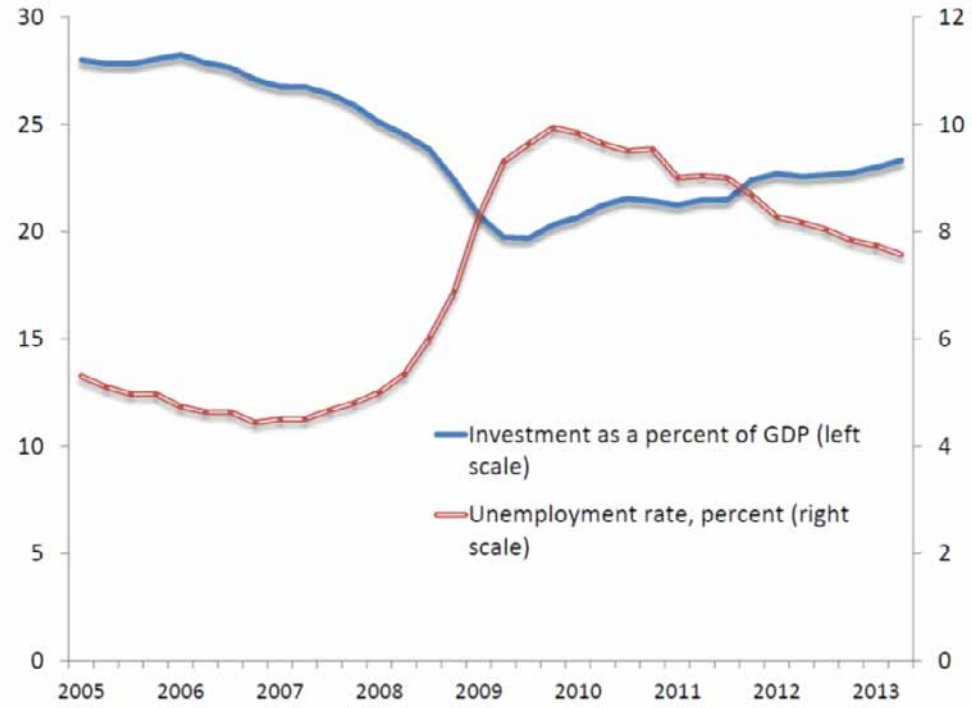


Figure 1 shows two key indicators that illustrate the basic events during and following the recession. The solid line and left scale show the sharp decline in total investment spending as a fraction of GDP. Investment includes consumer investment in cars and other durable goods. The sum of all categories of investment – plant and equipment spending, inventory accumulation, residential construction, and consumer durables purchases – declined relative to total GDP in 2007, plunged at the time of the crisis in late 2008, and has recovered only partly as of this writing, five years after the crisis. The double line and right scale show the unemployment rate, the best measure of unutilised resources and the shortfall in production of goods and services. Unemployment began to rise in 2007, skyrocketed after the

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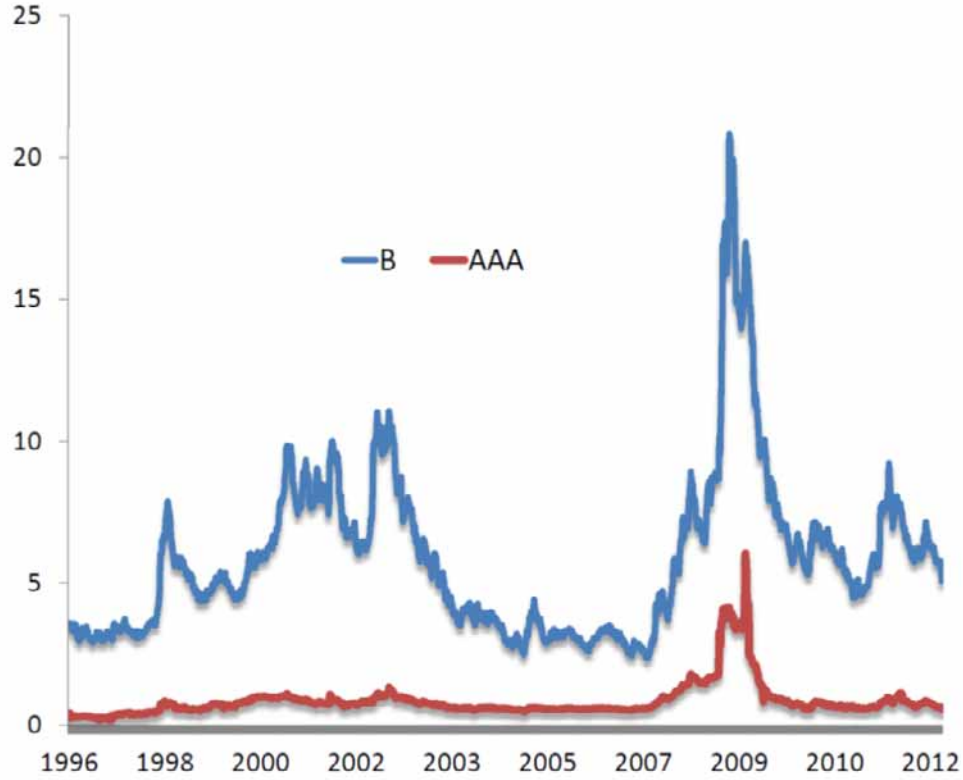
crisis, reached a maximum of 10% at the end of 2009, and has gradually descended but remains well above normal at the fifth anniversary of the crisis.

The other components of domestic spending – consumption of non-durables and services, and government purchases of goods and services – fell by smaller amounts or failed to grow at trend rates, but the collapse of spending and production was concentrated in investment, broadly defined. Given the importance of the financial system for purchasers of investment goods, especially homes and cars, the conclusion that the financial crisis had its main effect through investment seems obvious.

Corporate bond spreads

Figure 2

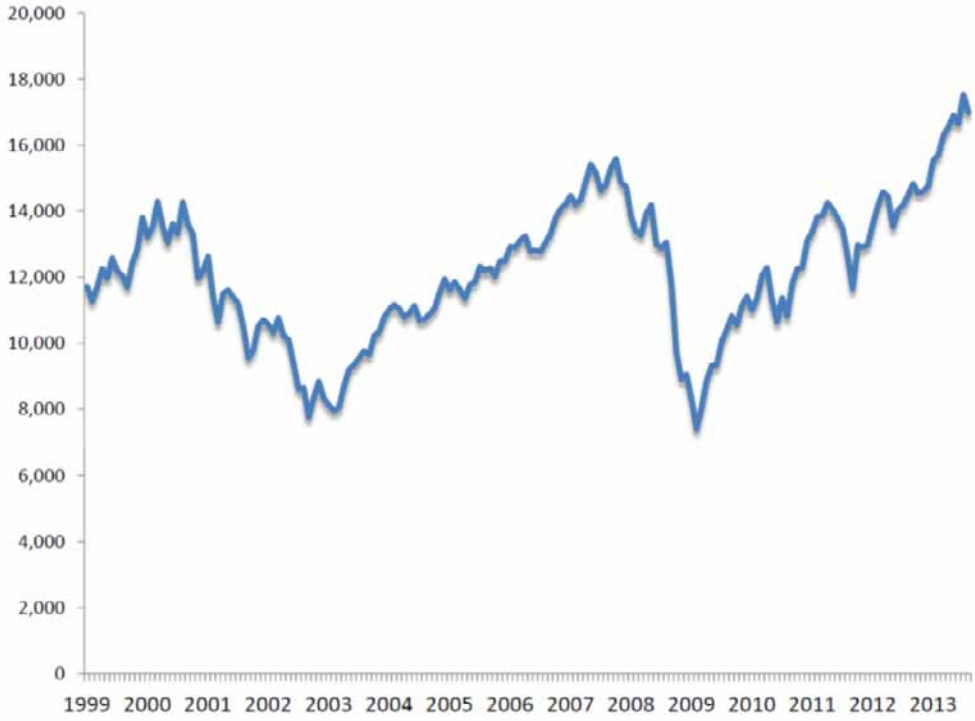


Financial data show many signs of stress around the crisis in September 2008. For example, Figure 2 shows that investors put much lower values on riskier corporate bonds rated single-B compared to safe bonds rated AAA. They required a larger positive spread between the yields of the lower-rated and higher-rated bonds, as shown in the figure. But the spread narrowed fairly soon after the crisis. The spread does not measure a financial force that accounts for the persistence of low investment and high unemployment.

The stock market also showed a strong but transient response to the crisis, as Figure 3 shows, using the Wilshire 5000 comprehensive index of the entire US market. Note that the decline in the stock market was not much greater in 2008 than in the previous recession in 2001. This finding suggests that the reason that the Great Recession was so much worse than the tech recession of 2001 is related to bank-dependent parts of the economy. Publicly traded corporations in the United States are generally suppliers of cash to investors, rather than users of cash from banks or securities markets. On the other hand, smaller privately held businesses and households are heavily dependent on financing from banks.

The Wilshire 5000 Stock-Market Index

Figure 3



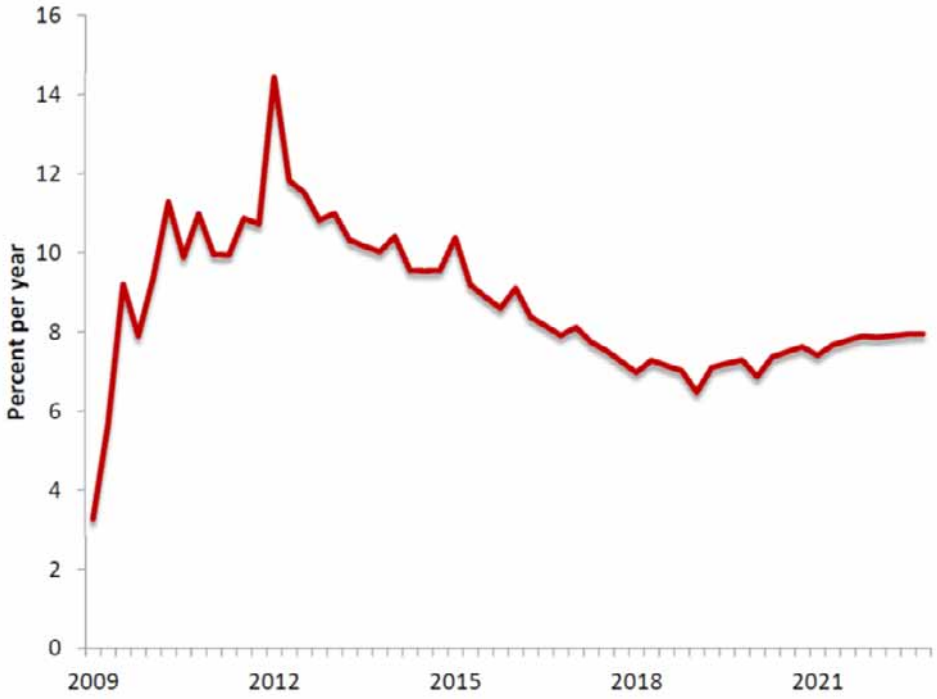
One can construct a comprehensive measure of what is called the financial wedge, which captures all elements of the gap between the return that businesses earn from the use of capital and what savers earn from safe short-term securities or accounts. The wedge is

$$f_t = \frac{1}{q_t}\left[\alpha \frac{y_t}{k_t} + (1-\delta) q_{t+1}\right] - 1 - r_t \qquad (1)$$

Here q_t is Tobin's q, the market price of installed capital, α is the elasticity of the Cobb-Douglas production function with respect to capital, y_t is output, k_t is capital (so $\alpha \frac{y_t}{k_t}$ is the marginal product of capital), δ is the rate of depreciation of capital, and r_t is the safe real interest rate. Figure 4 shows the wedge, calculated from data from the US National Income and Product Accounts and from the real return on short-term federal debt. For future years, I use forecasts from the Congressional Budget Office. The wedge actually grew in the first year after the crisis. Early in the crisis, the market value of capital was expected to fall, which reduced the return to capital temporarily. Unlike the other financial variables, the wedge is highly persistent. The return to capital is fairly high even now, five years after the crisis, but the nominal interest rate is stuck at zero and the real rate is around minus 1% per year.

Persistence of the financial wedge

Figure 4

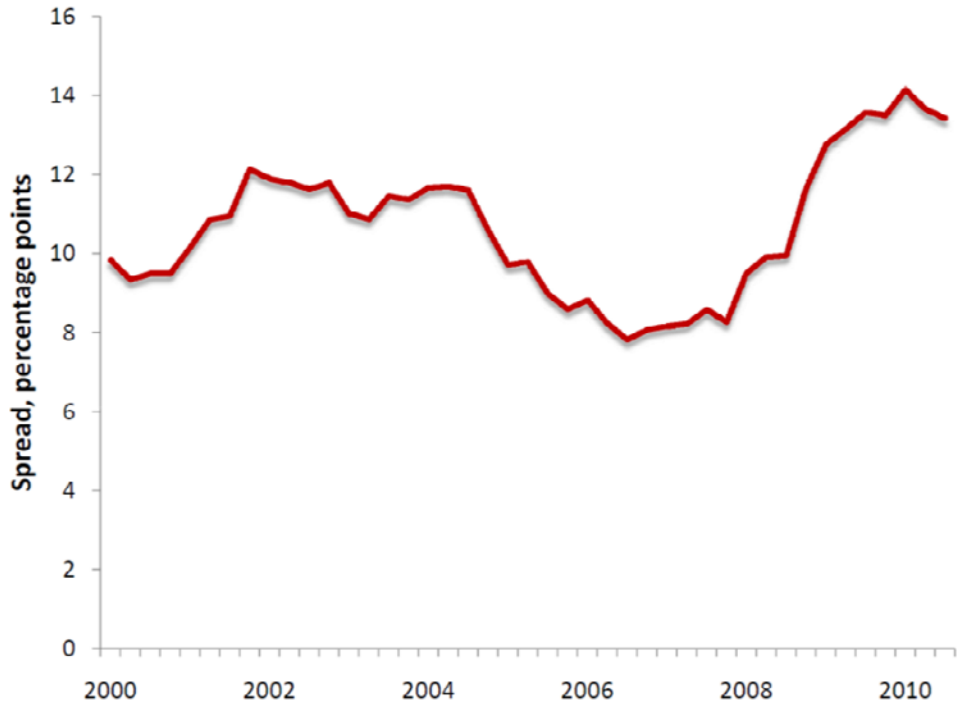


The wedge includes all the forces that stand between the saver and the user of capital. Taxes contribute to the level of the wedge, but did not change much over this period. The risk premium for business activities is surely an important changing component, but there is an interesting question why the premium that applies to business activities is different from the premium in the stock market. With the stock market rebounding to normal levels, one might reasonably infer that the risk premium underlying its valuation is also back to normal. The third component of the wedge is the financial friction that separates savers and capital users if a bank or other financial institution intermediates the flow of capital from one to the other. Much of the commentary about the adverse effects of the crisis has focused on financial frictions.

Credit spreads confirm that the crisis created persistent increases in the difference between the rates borrowers pay intermediaries and the rates that intermediaries pay to their suppliers of capital. The increased spreads appear in both business and consumer lending. Figure 5 shows the widening of the spread in the consumer credit-card market and Figure 6 shows the widening in the business loan market. Of course, these spreads have widened because of increased defaults as well as because of rising frictions.

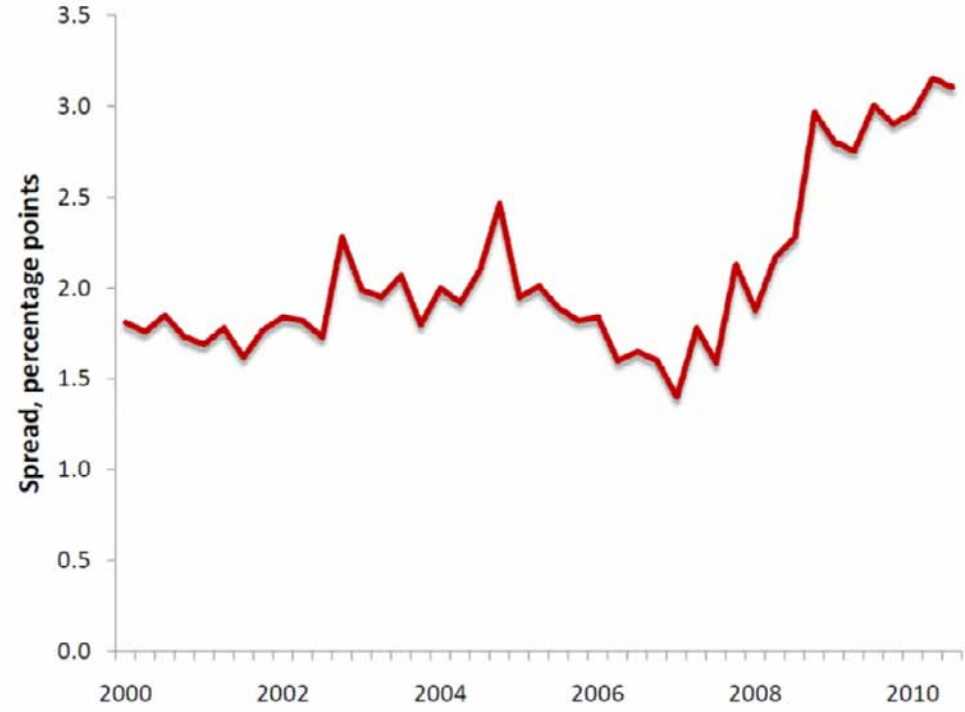
Spread, in percentage points, between credit card rates and banks' borrowing rate

Figure 5



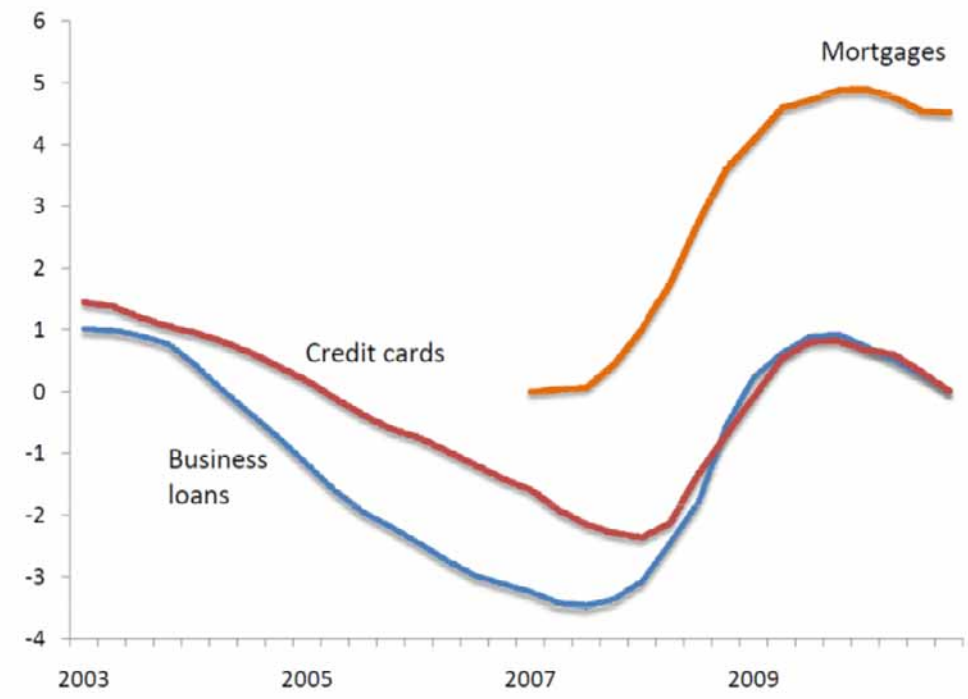
Spread, in percentage points, between business loan rates and banks' borrowing rate

Figure 6



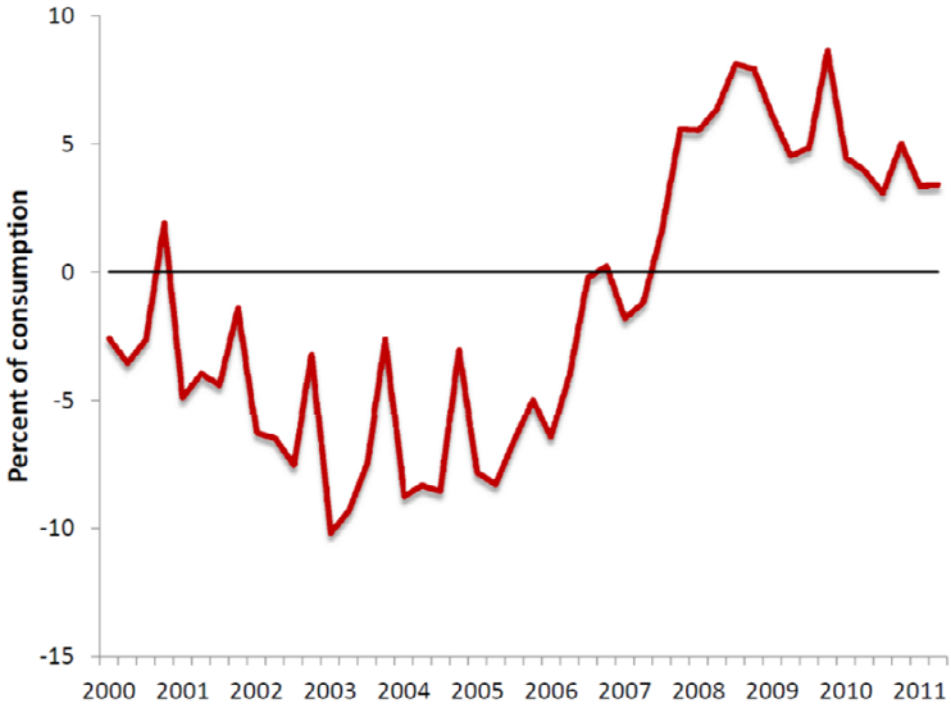
Indexes of lending standards inferred from the FRB Senior Loan Officer Survey

Figure 7



Burden of deleveraging as a percentage of consumption

Figure 8



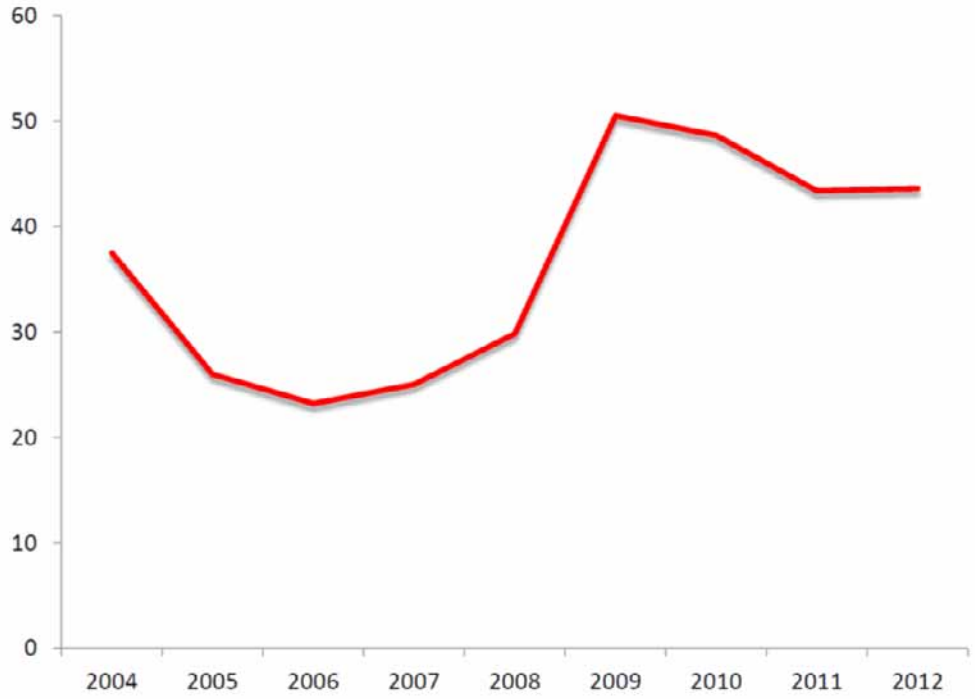
Rationing of credit has adverse effects on economic activity comparable to the effects of elevated lending rates. Figure 7 shows indexes of landing standards calculated from the Federal Reserve Board's survey of Banks' Senior Loan Officers.

Standard for all types of lending tightened substantially and persistently after the crisis.

Much has been written about deleveraging in households, as banks cut off previously generous lending against home equity and cut credit card limits. Figure 8 shows that net cash was flowing from banks to households – they were borrowing more than enough to cover interest charges through 2006. With the real estate crash and then the crisis, the flow reversed sign. Funds began to flow from households back to banks. These calculations attempt to adjust for the fact that not all debt reductions were the result of repayments – defaults on mortgages and other household debt reached high levels.

Data from Google in Figure 9 confirm that households faced financial stress. Searches for the term "withdrawal penalty" almost doubled during the crisis and have remained high.

Google searches for "withdrawal penalty" Figure 9



Based on these findings, the story of the Great Recession and weak recovery seems clear: A collapse of credit-sensitive spending occurred because of the substantial adverse effects of the crisis. Increases in risk premiums were important, at least in the early years after the crisis. Persistent increases in financial frictions, manifested in rising credit spreads, also discouraged spending. Household deleveraging because of the declining collateral value of houses cut consumer spending, especially for durables.

The zero lower bound on the nominal interest rate severely impeded the countercyclical response that would normally have come from the Fed. The central bank responded quickly by pushing short rates down almost immediately after the crisis, but it would have taken a quite negative Fed funds rate to offset the reduction in credit-sensitive spending. The Fed's purchases of mortgage-backed assets appears to have prevented a widening of spreads in the mortgage market

but did not have nearly enough effect on spending to prevent the large decline in output and increase in unemployment. On the fiscal side, automatic stabilisers and discretionary increases in transfers to households probably prevented even larger declines in consumer spending, but also were nowhere near large enough to prevent the big rise in unemployment. And attempts to stimulate government purchases were insufficient to keep those purchases growing at their normal trend – the net effect of purchases was somewhat negative.

The possibility has been widely discussed that special features of today's labour market may be keeping unemployment high despite favourable movements in the rest of the economy. The rate at which employers are filling vacancies – which rose to high levels when unemployment was at its peak – is back down to its historical normal level. In previous experiences, normal filling rates coincide with normal levels of unemployment. One conclusion is that, at least for the next few years, the normal level of unemployment is in the 7% range. But in earlier periods of pessimism about normal unemployment, increases in demand have been able to lower unemployment quickly.