Monetary Policy, Liquidity, and Growth*

Philippe Aghion[†], Emmanuel Farhi[‡], Enisse Kharroubi[§]

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Abstract

In this paper, we use cross-industry, cross-country panel data to test whether industry growth is positively affected by the interaction between the reactivity of real short term interest rates to the business cycle and industry-level measures of financial constraints. Financial constraints are measured, either by the extent to which the domestic industry is prone to being "credit constrained", or by the extent to which it is prone to being "liquidity constrained". Our main findings are that: (i) the interaction between credit or liquidity constraints in an industry and monetary policy countercyclicality in the domestic country, has a positive, significant, and robust impact on the average annual rate of labor productivity in the domestic industry; (ii) these interaction effects tend to be more significant in downturns than in upturns; (iii) finally, while in downturns both, high-tech and low-tech sectors seem to benefit from more countercyclical monetary policies, in upturns it is the high-tech sectors which benefit most.

1 Introduction

Macroeconomic textbooks usually draw a clear distinction between long run growth and its main determinants on the one hand, and macroeconomic policies (fiscal and monetary) aimed at achieving short run stabilization on the other. In this paper we argue instead that more countercyclical monetary policies, whereby real short term interest rates are lower in recessions and higher in booms, have a more positive long run growth effect in industries that are more prone to being credit-constrained or in industries that are more prone to being liquidity-constrained.

In the first part of the paper, we present a simple model of an economy populated by entrepreneurs who must borrow from outside investors to finance their investments. At the initial investment stage, entrepreneurs may borrow on the credit market if they need to invest more than their initial wealth. Credit markets are imperfect due to the limited pledgeability of the returns from the project to outside investors (as

*The views expressed here are those of the authors and do not necessarily represent the views of the Bank for International Settlements, the Banque de France nor any institution belonging to the Eurosystem.

[†]Harvard University and NBER

[‡]Harvard University and NBER

[§]Bank of International Settlements

in Holmstrom and Tirole, 1997). Once they are initiated, projects may either turn be "fast" and yield full returns within one period after the initial investment has been sunk, or they may turn out to be "slow" and require some reinvestment in order to yields returns within two periods. The probability $1-\alpha$ of a project being slow, and therefore requiring reinvestment, measures the degree of potential liquidity dependence of the economy in the model. However, the actual degree of liquidity dependence will also depend upon the aggregate state of the economy. More precisely, we assume that if the economy as a whole is in a boom, then short-run profits are sufficient for entrepreneurs to finance the required reinvestment whenever they need to do so (i.e whenever their project turns out to slow); in contrast, if the economy is in a slump, then reinvesting requires that the entrepreneur downsize and delever her project (and therefore reduce her expected end-of-project returns) in order to generate cash to pay for the reinvestment. However, the entrepreneur can somewhat reduce the need for deleveraging in case the project is slow, if she decides ex ante to invest part of her initial funds in liquid assets. Hoarding more liquidity reduces the need for ex post downsizing but this comes at the expense of reducing the initial size of the project.

A more countercyclical interest rate policy enhances ex ante investment by reducing the amount of liquidity entrepreneurs need to hoard to weather liquidity shocks when the economy is in a slump. The model generate two main predictions. First, the lower the fraction of returns that can be pledged to outside investors, the more investment enhancing it is for the government to implement a more countercyclical interest policy. Second, the higher the liquidity risk measured by the probability $(1-\alpha)$, the more investment enhancing it is for the government to conduct a more countercyclical interest rate policy. Third, the differential effect of more countercyclical interest rates across firms with different degrees of liquidity dependence, is stronger in recessions than in expansions.

In the second part of the paper, we take these predictions to the data. Specifically, we build on the methodology developed in the seminal paper by Rajan and Zingales (1998) and use cross-industry, cross-country panel data to test whether industry growth is positively affected by the interaction between domestic monetary policy cyclicality (i.e the domestic reactivity of short-run real interest rates to the business cycle, which is computed at country level) and industry-level measures of financial constraints that computed for each corresponding industry in the United States. This approach provides a clear and net way to deal with causality issues. Indeed, any negative correlation one might observe between the countercyclicality of macroeconomic policy and average long run growth of an industry (or a country), might equally reflect the effect of countercyclical interest rate policy on growth or the effect of growth on a country's ability to pursue more countercyclical interest rate policies. However, what makes us reasonably confident that our regression results capture a causal link from domestic countercyclical monetary policy to industry growth, is the fact that: (i) we look at the effect of macroeconomic policies implemented at the country level on industry-level growth; (ii) individual industries are small compared to the overall economy so that we can confidently rule out the possibility that growth at the industry level should affect the cyclical pattern of macroeconomic policy at country level; (iii) our financial constraint variables are computed for US industries and therefore

are unlikely to be affected by policies and outcomes in other countries.

Financial constraints at industry level are measured, either by the extent to which the corresponding industry in the US is dependent on external finance or displays low levels of asset tangibility (these two measures capture the extent to which the domestic industry is prone to being credit constrained), or by the extent to which the corresponding industry in the US shows high labor costs to sales or high inventories to sales ration (i.e the extent to which the industry is prone to being liquidity constrained). Our main empirical finding is that the interaction between credit or liquidity constraints in an industry and monetary policy countercyclicality in the domestic country, has a positive, significant, and robust impact on the average annual rate of labor productivity in the domestic industry. More specifically, the higher the extent to which the corresponding industry in the United States relies on external finance, or the lower the asset tangibility of the corresponding sector in the United States, or the more liquidity dependent the corresponding US industry is, the more growth-enhancing in the domestic industry it is to pursue a more countercyclical monetary policy. Moreover, we show that the interaction effects between monetary policy countercyclicality and each of these various measures of credit and liquidity constraints, tend to be more significant in downturns than in upturns, and that these effects are robust to controlling for the interaction between these measures of financial constraints and country-level economic variables such as inflation, financial development, and the size of government which are likely to affect the country's ability to pursue more countercyclical macroeconomic policies. Finally, we find that while in downturns both, high-tech and low-tech sectors seem to benefit from more countercyclical monetary policies, i.e from lower real short-run interest rates in downturns, in upturns it is the high-tech sectors which benefit most from more countercyclical monetary policy, i.e from higher short-run interest rates. In other words, there is a cost of having low short-run interest rates in booms, namely that of allocating to much capital to low-tech sectors at the expense of high-tech sectors.

The paper relates to several strands of literature. First, to the literature on macroeconomic volatility and growth. A benchmark paper in this literature is Ramey and Ramey (1995) who find a negative correlation in cross-country regressions between volatility and long-run growth. A first model to generate the prediction that the correlation between long-run growth and volatility should be negative, is Acemoglu and Zilibotti (1997) who point to low financial development as a factor that could both, reduce long-run growth and increase the volatility of the economy. Acemoglu et al (2003) and Easterly (2005) hold that both, high volatility and low long-run growth do not directly arise from policy decisions but rather from bad institutions. Our paper contributes to this debate by showing a significant growth effect of more countercyclical monetary policies on industries which are all located in OECD countries with similar property right and political institutions.[1]

Second, we contribute to the literature on monetary policy design. In our model, monetary policy operates through a version of the credit channel (see Bernanke and Gertler 1995 for a review of the credit

[1] See also Aghion et al (2006) who analyze the relationship between long-run growth and the choice of exchange-rate regime; and Aghion, Hemous and Kharroubi (2009) who show that more countercyclical fiscal policies affect growth more significantly in sectors whose US counterparts are more credit constrained.

channel literature).[2] But more specifically, our model builds on the macroeconomic literature on liquidity (e.g Woodford 1990 and Holmstrom and Tirole 1998). This literature has emphasized the role of governments in providing possibly contingent stores of value that cannot be created by the private sector. Like in Holmstrom and Tirole, liquidity provision in our paper is modeled as a redistribution from consumers to firms in the bad state of nature; however, here it is an ex post redistribution rather than an ex ante one in Holmstrom and Tirole. This perspective is shared with Farhi and Tirole (2011), however their focus is on time inconsistency and ex ante regulation; also in their model, unlike in ours, there is no liquidity premium and therefore, under full government commitment, there is no role for a countercyclical interest rate policy.

The paper is organized as follows. Section 2 outlays the model. Section 3 presents the empirical analysis. It first details the methodology and the data used. Then it presents the main empirical results. Section 4 concludes. Finally, proofs and sample and estimation details are contained in the Appendix.

2 Model

2.1 Model setup

There are three periods, $t = 0, 1, 2$. Entrepreneurs have utility function $U = \mathbb{E}[c_2]$, where c_2 is their date-2 consumption. They are protected by limited liability and their only endowment is their wealth A at date 0. Their technology set exhibits constant returns to scale. At date 0 they choose their investment scale $i > 0$.

At date 1, uncertainty is realized: the aggregate state is either good (G) or bad (B), and the firm is either intact or experiences a liquidity shock. The date-0 probability of the good state is μ, and the date-0 probability of a firm experiencing a liquidity shock is $1 - \alpha$. Both events are independent.

At date 1, a cash flow πi accrues to the entrepreneur where, depending on the aggregate state, $\pi \in \{\pi^G, \pi^B\}$. This cash flow is not pledgeable to outside investors. If the project is intact, the investment delivers at date 1; it then yields, besides the cash flow πi, a payoff of $\rho_1 i$, of which $\rho_0 i$ is pledgeable to investors.[3] If the project is distressed, besides the except for the cash flow πi, it yields a payoff at date 2 if fresh resources $j \leq i$ are reinvested. It then delivers at date 2 a payoff of $\rho_1 j$, of which $\rho_0 j$ is pledgeable to investors. The variable ρ_0 we take as an inverse measure of credit-constraint. In particular a lower ρ_0 is likely to be associated with lower asset tangibility.

The following assumption is necessary to ensure that entrepreneurs are liquidity constrained and must invest at a finite scale.

Assumption 1 *(liquidity constraint)* $\rho_0 < \min\{R_0, R_1^G, R_1^B\}$.

[2] There are two versions of the credit channel : the "balance sheet channel" and the "bank lending channel". Our model features the balance sheet channel, focusing more on the effect of interest rates on firms' borrowing capacity.

[3] As usual, the "agency wedge" $\rho_1 - \rho_0$ can be motivated in multiple ways, including limited commitment, private benefits or incentives to counter moral hazard (see for example Holmström and Tirole 2010).

The interest rate is a key determinant of the collateral value of a project. It plays an important role in determining the initial investment scale i as well as the reinvestment scale j. The gross rate of interest is equal to R_0 between dates 0 and 1, and R_1 between dates 1 and 2, where $R_1 \in \{R_1^G, R_1^B\}$ depending on the aggregate state.

The following assumption will guarantee that: (i) in the good state, date-1 cash flows will be enough to cover liquidity needs and reinvest at full scale in the event of a liquidity shock, even with no hoarded liquidity or issuance of new securities; and (ii) in the bad state, date-1 cash flows will not be enough to cover liquidity needs and reinvest at full scale so that downsizing will take place if no liquidity is hoarded at date 0.

Assumption 2 *(cash-flows)* $\pi^G > 1$ *and* $1 - \rho_0/R_1^B > \pi^B$.

Because cash flows are not enough to cover liquidity shocks in the bad state, entrepreneurs might wish to engage in liquidity policy. They can purchase an asset that pays off xi at date 1 in case of a liquidity shock in the bad state. The date-0 cost of this liquidity is $q(1-\mu)(1-\alpha)xi/R_0$, where $q \geq 1$. When $q > 1$, the date-0 cost of this liquidity is greater than $(1-\mu)(1-\alpha)xi/R_0$. The corresponding liquidity premium is denoted by $q - 1$. This captures a situation where aggregate liquidity is scarce as in Holmström and Tirole (1997). Alternatively, one can imagine that liquidity needs to be hoarded in the form of an instrument with a high degree of market liquidity: the entrepreneur needs to be able to sell it quickly, without its losing much value. Such instruments typically command a liquidity premium, for which $q - 1$ could be a stand in.

Assumption 6 in the Appendix guarantees that the projects are attractive enough that entrepreneurs will always invest all their net worth.

At the core of the model is a maturity mismatch issue, where a long-term project requires occasional reinvestments. The entrepreneur has to compromise between initial investment scale i and reinvestment scale j in the event of a liquidity shock. Maximizing initial scale i requires minimizing hoarded liquidity and exhausting reserves of pledgeable income. This in turn forces the entrepreneur to downsize and delever in the event of a liquidity shock. Conversely, maximizing liquidity to mitigate maturity mismatch requires sacrificing initial scale i.

Besides short term profits πi, liquidity xi represents cash available at date 1 in the event of a liquidity shock (x is the analog of a liquidity ratio). We assume that any potential surplus of cash over liquidity needs for reinvestment is consumed by entrepreneurs. The policy of pledging all cash that is unneeded for reinvestment is always weakly optimal. Pledging less is also optimal (and leads to the same allocation) if the entrepreneur has no alternative use of the unneeded cash to distributing to investors. However, if the entrepreneur can divert (even an arbitrarily small) fraction of the extra cash for her own benefit, then pledging the entire unneeded cash is *strictly* optimal.

At date 1, in the bad state, if a liquidity shock hits, the entrepreneur can dilute initial investors by issuing

new securities against the date-2 pledgeable income $\rho_0 j$, and so its continuation $j \in [0, i]$ must satisfy:

$$j \leq (x + \pi^B)i + \frac{\rho_0 j}{R_1^B}$$

yielding continuation scale:

$$j = \min \left\{ \frac{x + \pi^B}{1 - \frac{\rho_0}{R_1^B}}, 1 \right\} i.$$

This formula captures the fact that lower interest rates facilitate refinancing. An entrepreneur would never choose to have excess liquidity and so we restrict our attention to $x \in [0, 1 - \rho_0/R_1^B - \pi^B]$.

The entrepreneur needs to raise $i - A$ from outside investors at date 0. If no liquidity shock hits, the entrepreneur returns $\rho_0 i$ to these investors at date 1. If a liquidity shock hits in the good state, the entrepreneur returns $\rho_0 i$ to these investors at date 2. If a liquidity shock hits in the bad state, these investors are committed to inject additional funds xi; moreover, they are fully diluted. As a result, its borrowing capacity at date 0 is given by:

$$i - A = \alpha \frac{\rho_0 i}{R_0} + \mu(1-\alpha)\frac{\rho_0}{R_0 R_1^G} i - (1-\mu)(1-\alpha)\frac{qxi}{R_0}$$

i.e.

$$i = \frac{A}{1 - \alpha \frac{\rho_0}{R_0} - \mu(1-\alpha)\frac{\rho_0}{R_0 R_1^G} + (1-\mu)(1-\alpha)\frac{qx}{R_0}}.$$

Assumption 7 in the Appendix guarantees that the entrepreneur optimally chooses to hoard enough liquidity $x = 1 - \rho_0/R_1^B - \pi^B$ to withstand a liquidity shock in the bad state without downsizing.

Our proxy for long-run investment in this model is the firm equilibrium investment, which is equal to $i = sA$, where:

$$s = \frac{1}{1 - \alpha \frac{\rho_0}{R_0} - \mu(1-\alpha)\frac{\rho_0}{R_0 R_1^G} + (1-\mu)(1-\alpha) q \left(\frac{1-\pi_B}{R_0} - \frac{\rho_0}{R_0 R_1^B} \right)}.$$

This variable captures long run growth in this model.

2.2 Illiquidity, pledgeability, and countercyclical interest rate policy

We want to derive comparative static results with respect to the cyclicality of interest rate policy. For this purpose, it will prove useful to adopt the following parametrization: $R_B = R\gamma$, $R_G = R/\gamma$, and $R_0 = R$. We take $\gamma \leq 1$ to be our measure of the cyclicality of interest rate policy: a low γ indicates a countercyclical interest rate policy. We can then compute size

$$s = \frac{1}{1 - \alpha \frac{\rho_0}{R} - \mu(1-\alpha)\frac{\rho_0 \gamma}{R^2} + (1-\mu)(1-\alpha) q \left(\frac{1-\pi_B}{R} - \frac{\rho_0}{R^2 \gamma} \right)}. \tag{1}$$

First, we look at the interaction between countercyclical interest rate policy and firms' vulnerability to

liquidity shocks. Countercyclical interest policy helps the refinancing of firms that experience a liquidity shock in the bad state. It also hurts the refinancing of firms that experience a liquidity shock in the good state. However, it helps the former more than it hurts the later, since firms do not need to hoard costly liquidity for the good state but do for the bad state. Indeed, in the good state, they can finance their liquidity needs with their short term cash flows. It is then natural to expect more liquidity dependent firms (with a higher probability $1-\alpha$ of a liquidity shock) to benefit disproportionately from a more countercyclical interest rate policy if the probability of the bad state $1-\mu$ is high enough, and if the liquidity premium $q-1$ is high enough. The following proposition formalizes this insight.

Proposition 1 *Suppose that* $\mu < \hat{\mu} \equiv q/(q+\gamma^2)$. *Then* $\frac{\partial^2 \log s}{\partial(1-\alpha)\partial\gamma} < 0$.

Proof. We start again from:

$$\frac{\partial \log s}{\partial \gamma} = -\frac{(1-\alpha)\left[-\mu\frac{\rho_0}{R^2} + (1-\mu)q\frac{\rho_0}{R^2\gamma^2}\right]}{1-\frac{\rho_0}{R} + (1-\alpha)\left[\frac{\rho_0}{R} - \mu\frac{\rho_0\gamma}{R^2} + (1-\mu)q\left(\frac{1-\pi_B}{R} - \frac{\rho_0}{R^2\gamma}\right)\right]}.$$

This implies that

$$\frac{\partial^2 \log s}{\partial(1-\alpha)\partial\gamma} = -\frac{\left(1-\frac{\rho_0}{R}\right)\frac{\rho_0}{R^2}\left[-\mu + (1-\mu)q\frac{1}{\gamma^2}\right]}{\left\{1-\frac{\rho_0}{R} + (1-\alpha)\left[\frac{\rho_0}{R} - \mu\frac{\rho_0\gamma}{R^2} + (1-\mu)q\left(\frac{1-\pi_B}{R} - \frac{\rho_0}{R^2\gamma}\right)\right]\right\}^2}.$$

The result immediately follows. ■

A more countercyclical interest rate policy reduces the amount of liquidity $\frac{1-\pi_B}{R} - \frac{\rho_0}{R^2\gamma}$ that entrepreneurs need to hoard to weather liquidity shocks in the bad state. This releases more pledgeable income for more liquidity dependent firms (with a higher $1-\alpha$) as long as the probability of the bad state $1-\mu$ and the liquidity premium $q-1$ are both sufficiently high. As a result, those firms can expand in size more.

We now want to investigate how this comparative static result is affected by the state of the business cycle. We view expansions and recessions as corresponding to different values of μ: in an expansion, the probability μ of the good state is high and it is low in a recession. The next proposition establishes that the differential effect of countercyclical interest rate policy across firms with different degrees of liquidity dependence is stronger in recessions than in expansions.

Proposition 2 *There exists* $\tilde{\mu} < \hat{\mu}$ *such that for all* $\mu \in (\tilde{\mu}, \hat{\mu})$, $\frac{\partial^3 \log s}{\partial\mu\partial(1-\alpha)\partial\gamma} > 0$.

Proof. We have

$$\frac{\partial^2 \log s}{\partial(1-\alpha)\partial\gamma} = -\frac{\left(1-\frac{\rho_0}{R}\right)\frac{\rho_0}{R^2}\left[\frac{q}{\gamma^2} - \mu\left(1+\frac{q}{\gamma^2}\right)\right]}{\left\{1-\alpha\frac{\rho_0}{R} + (1-\alpha)q\left(\frac{1-\pi_B}{R} - \frac{\rho_0}{R^2\gamma}\right) - \mu(1-\alpha)\left[\frac{\rho_0\gamma}{R^2} + q\left(\frac{1-\pi_B}{R} - \frac{\rho_0}{R^2\gamma}\right)\right]\right\}^2}.$$

This expression is first decreasing in μ and then increasing in μ. The minimum occurs at $\mu = \tilde{\mu}$ where

$$\tilde{\mu} = \frac{-\left(1+\frac{q}{\gamma^2}\right)\left[1-\alpha\frac{\rho_0}{R}+(1-\alpha)q\left(\frac{1-\pi_B}{R}-\frac{\rho_0}{R^2\gamma}\right)\right]+2\frac{q}{\gamma^2}(1-\alpha)\left[\frac{\rho_0\gamma}{R^2}+q\left(\frac{1-\pi_B}{R}-\frac{\rho_0}{R^2\gamma}\right)\right]}{\left(1+\frac{q}{\gamma^2}\right)(1-\alpha)\left[\frac{\rho_0\gamma}{R^2}+q\left(\frac{1-\pi_B}{R}-\frac{\rho_0}{R^2\gamma}\right)\right]}.$$

It is easily verified that $\tilde{\mu} < \hat{\mu}$. ■

Next, we look at the interaction between countercyclical interest rate policy and firms' income pledgeability. One can first show:

Proposition 3 *Suppose that $\mu < \hat{\mu} \equiv q/(q+\gamma^2)$. Then $\frac{\partial^2 \log s}{\partial\rho_0\partial\gamma} > 0$.*

Proof. It is easy to see that

$$\frac{\partial \log s}{\partial \gamma} = -\frac{(1-\alpha)\left[-\mu\frac{\rho_0}{R^2}+(1-\mu)q\frac{\rho_0}{R^2\gamma^2}\right]}{1-\frac{\rho_0}{R}+(1-\alpha)\left[\frac{\rho_0}{R}-\mu\frac{\rho_0\gamma}{R^2}+(1-\mu)q\left(\frac{1-\pi_B}{R}-\frac{\rho_0}{R^2\gamma}\right)\right]}.$$

Dividing the numerator and denominator of this expression by ρ_0, we have

$$\frac{\partial \log s}{\partial \gamma} = -\frac{(1-\alpha)\left[-\mu\frac{1}{R^2}+(1-\mu)q\frac{1}{R^2\gamma^2}\right]}{\frac{1}{\rho_0}-\frac{1}{R}+(1-\alpha)\left[\frac{1}{R}-\mu\frac{\gamma}{R^2}+(1-\mu)q\left(\frac{1-\pi_B}{R\rho_0}-\frac{1}{R^2\gamma}\right)\right]}.$$

But then

$$\frac{\partial^2 \log s}{\partial\rho_0\partial\gamma} = \frac{\frac{1}{R^2}[1+(1-\alpha)(1-\mu)q(\frac{1-\pi_B}{R})]\left[\frac{q}{\gamma^2}-\mu\left(1+\frac{q}{\gamma^2}\right)\right]}{\left\{1-\alpha\frac{\rho_0}{R}+(1-\alpha)q\left(\frac{1-\pi_B}{R}-\frac{\rho_0}{R^2\gamma}\right)-\mu(1-\alpha)\left[\frac{\rho_0\gamma}{R^2}+q\left(\frac{1-\pi_B}{R}-\frac{\rho_0}{R^2\gamma}\right)\right]\right\}^2}.,$$

which is positive whenever $\mu < \hat{\mu} \equiv q/(q+\gamma^2)$. This establishes the proposition. ■

Thus countercyclical interest rate policy encourages investment more by firms with lower fractions of pledgeable income ρ_0. As discussed above, these fractions are an inverse measure of the extent to which firms are credit-constrained, and they may also reflect the nature of firms' activities. For example, high-tech firms are more likely to display lower pledgeability as their assets are presumably less tangible.

We now investigate how this comparative static result is affected by the state of the business cycle, again viewing expansions and recessions as corresponding to different values of μ: in an expansion, the probability μ of the good state is high and it is low in a recession.

Proposition 4 *There exists $\tilde{\mu} < \hat{\mu}$ such that for all $\mu \in (\tilde{\mu}, \hat{\mu})$, $\frac{\partial^3 \log s}{\partial\mu\partial\rho_0\partial\gamma} > 0$.*

Proof. From the proofs of Proposition 1 and 2, note that

$$\frac{\partial^2 \log s}{\partial\rho_0\partial\gamma} = -\kappa[1+(1-\alpha)(1-\mu)q(\frac{1-\pi_B}{R})]\frac{\partial^2 \log s}{\partial(1-\alpha)\partial\gamma},$$

where κ is a positive constant. Thus

$$\frac{\partial^3 \log s}{\partial\mu\partial\rho_0\partial\gamma} = \kappa q(\frac{1-\pi_B}{R})\frac{\partial^2 \log s}{\partial(1-\alpha)\partial\gamma} -\kappa[1+(1-\alpha)(1-\mu)q(\frac{1-\pi_B}{R})]\frac{\partial^3 \log s}{\partial\mu\partial(1-\alpha)\partial\gamma}.$$

The proposition then immediately follows from the fact that $\frac{\partial^2 \log s}{\partial(1-\alpha)\partial\gamma} < 0$ and that $\frac{\partial^3 \log s}{\partial\mu\partial(1-\alpha)\partial\gamma} > 0$ for all $\mu \in (\tilde{\mu}, \hat{\mu})$. ■

One implication from this latter result is that projects with lower asset tangibility, in particular high-tech projects, should benefit more from more countercyclical monetary policy in expansions than projects with higher degree of asset tangibility, in particular low tech projects.

Propositions 1,2, 3 and 4 summarize the key comparative statics of the model that we wish to confirm in the data. But before we turn to the empirical analysis, let us briefly look at sufficient conditions under which higher countercyclicality of monetary policy is welfare improving.

2.3 Welfare analysis

So far, we have maintained a positive focus. This allowed us to keep some aspects of the economy in the background. In order to explore the normative implications of our model, those aspects now need be fleshed out.

Closing the model. Suppose that the economy involves a continuum of firms which may differ in their probability of facing a liquidity shock or in their level of income pledgeability , i.e with respect to α andρ_0. Firms might also differ with respect to the share of income that accrues to owners-consumers. We denote by F the corresponding cumulative distribution function.

We introduce investors in the following way. There are overlapping generations of consumers: generation 0 lives between dates 0 and 1, and generation 1 lives between dates 1 and 2. We model those two generations slightly differently. There are also two short-term storage technologies between dates 0 and 1, and between dates 1 and 2. We explain in turn how we specify consumers and storage technologies between dates 0 and 1, and between dates 1 and 2.

We assume that consumers born at date 0 have linear utility $c_0 + \delta\mathbb{E}_0[c_1]$. They are endowed with a large amount or resources S when born. There are also short-term storage technologies corresponding to different sets of states of the world at date 1. For a set of date-1 states of probability p, these technologies are such that $q \geq 1$ units of goods invested at date 0 yield δ/p units of goods at date 1. The interest rate between dates 0 and 1 is pinned down by the preferences of consumers at $R_0 = 1/\delta$. However this interest rate is not available to firms. The reason is that, following Holmström and Tirole (1997), we assume that consumers lack commitment. In particular, they cannot commit the pay back at date 1 a firm that would try to lend them resources at date 0. As a result, firms which desire to save have to use a costly storage technology with

rate of return $R_0/q < R_0$.

We assume that consumers born at date 1 have utility $\mathbb{E}_1[c_2]$. They are endowed with a large amount or resources S when born. We introduce a short-term *storage technology* between dates 1 and 2 that yields R_1 at date 2 for 1 unit of good invested at date 1. For the date-1 interest rate to be $\tilde{R}_1 \neq R_1$, the storage technology must be taxed at rate $1-\tilde{R}_1/R_1$ (see below for an interpretation). The proceeds are rebated lump sum to consumers at date 2. We assume that S is large enough to finance all the necessary investments in the projects of entrepreneurs at each date t. As a result, consumers always invest a fraction of their savings in the short-term storage technology.[4]

Assumption 3 *(interest rate distortion): The set of feasible interest rates is $[\underline{R}_1, \overline{R}_1]$ where $\underline{R}_1 > \rho_0$ for all ρ_0 in the support of F and $\overline{R}_1 \leq R_1$. Furthermore, there exists a fixed distortion or deadweight loss $L(\tilde{R}_1) \geq 0$ when the interest rate $\tilde{R}_1$ diverges from its natural rate R_1 defined by: $L(R_1) = L'(R_1) = 0$, and L is decreasing on $[\underline{R}_1, \overline{R}_1]$.*

The upper bound $\overline{R}_1$ for the interest rate $\tilde{R}_1$ is not crucial but simplifies the analysis. One can justify this assumption by positing arbitrage (foreigners or some long-lived consumers would take advantage of $\tilde{R}_1 > \overline{R}_1$) or by assuming that marginal distortions $L'(\tilde{R}_1)$ are very high beyond R_1. But again, we want to emphasize that this particular assumption only simplifies the exposition and plays no economically substantive role in the analysis. The lower bound at $\underline{R}_1$ for the interest rate $\tilde{R}_1$ also simplifies the analysis at little economic cost.

Assumption 4 *(consumers): Suppose that date-0 investment is equal to i, that firms hoard liquidity x and thus can salvage $j = xi/(1-\rho_0/R)$ in case of crisis. Up to a normalizing constant, date-1 consumer welfare is $V = -L(\tilde{R}_1) - (R_1 - \tilde{R}_1)\rho_0 j/\tilde{R}_1$.*

The second term in V stands for the implicit subsidy from savers to borrowing firms. Indeed date-1 consumers' return on their savings $\widetilde{S}$ is $R\widetilde{S} + (1-R)\left(\widetilde{S} - \rho_0 j/R\right)$ (the last term representing the lump-sum rebate on the amount $\widetilde{S} - (\rho_0 j/R)$ invested in the storage technology), or $\widetilde{S} - (1-R)\rho_0 j/R$.[5] Finally, we ignore the welfare of date-0 consumers as they have constant utility $u_0 = s$.

Comments. The deadweight loss function L can also be interpreted as a reduced form of a more standard distortion associated with conventional monetary policy, as emphasized in the New-Keynesian literature. Here we have in mind not a short-term intervention, but a prolonged reduction of interest rates (a year to several years, for example thinking of Japan). Even though our model is entirely without money balances,

[4] Although we think of this as roughly capturing interest rate policy, this modelling device could more generally be thought of as a way of capturing a range of policy interventions that reduce borrowing costs for firms. For instance, taxing the short-term storage technology and rebating the proceeds lump-sum to consumers is essentially equivalent to subsidizing investment in the firms and financing this subsidy by a lump-sum tax on consumers. We do not introduce any other instrument.

[5] Note that we use the notation $\widetilde{S}$ instead of S for the savings of date-1 consumers. This is because under our Interpretation 1 below, some of the savings s of date-1 consumers are invested in alternative wasteful investment projects. As a result, only a part $\widetilde{S}$ of their savings are split between reinvestment in banks and the short-term storage technology.

sticky prices or imperfect competition, it captures a key feature of monetary policy in New-Keynesian models routinely used to discuss and model monetary policy. In New-Keynesian models, the nominal interest rate is controlled by the central bank. Prices adjust only gradually according to the New-Keynesian Phillips Curve, and the central bank can therefore control the real interest rate. The real interest rate regulates aggregate demand through a version of the consumer Euler equation—the dynamic IS curve. Without additional frictions, the central bank can achieve the allocation of the flexible price economy by setting nominal interest rates so that the real interest rate equals to the "natural" interest rate. Deviating from this rule introduces variations in the output gap together with distortions by generating dispersion in relative prices. To the extent that these effects enter welfare separately and additively from the effects of interest rates on banks' balance sheets—arguably a strong assumption—our loss function $L(R)$ can be interpreted as a reduced form of the loss function associated with a real interest rate below the natural interest rate in the New-Keynesian model.[6 7] Under this interpretation, monetary policy works both through the usual New-Keynesian channel and through its effects on firms via a version of the "credit channel".[8]

The asymmetric treatment of the first and second periods is meant to build the simplest possible model that allows us to capture the following features. First we want a model embodying the key friction in Holmström and Tirole (1997), namely, that consumers cannot commit to reinvest funds in the firm in subsequent periods generates a liquidity premium $q-1$. Second, we need the interest rate $\tilde{R}_1$ between dates 1 and 2 to be a policy variable. Because our focus is not on the interest rate between dates 0 and 1, this interest rate is exogenous in our model.

Optimality of countercyclical interest rate policy. Before moving on to computing welfare, we make one more assumption:

Assumption 5 *(short-term profits and reinvestment): Short-term profits generated at date* 1 *by firms can only be used to reinvest in the firm. If they are not reinvested in the firm, these profits are dissipated.*

Welfare is then given by

$$W(R_1^G, R_1^B) = w(R_1^G, R_1^B) - \mu L(R_1^G) - (1-\mu)L(R_1^B),$$

where

$$w(R_1^G, R_1^B) = \int \frac{\beta(\rho_1-\rho_0) - (1-\alpha)(1-\mu)(\frac{R_1}{R_1^B}-1)\rho_0}{1-\alpha\frac{\rho_0}{R_0} - \mu(1-\alpha)\frac{\rho_0}{R_0 R_1^G} + (1-\mu)(1-\alpha)q\left(\frac{1-\pi_B}{R_0} - \frac{\rho_0}{R_0 R_1^B}\right)} dF$$

[6]Yet another cost, absent in cashless New Keynesian models, is the so called inflation tax which arises when money demand is elastic.

[7]Because they are not our focus, we imagine here that the traditional time-inconsistency problems associated with monetary policy in the New-Keynesian model have been resolved. As is well known, this is the case if a sales subsidy is available to eliminate the monopoly price distortion.

[8]There are two versions of the credit channel (see Bernanke-Gertler 1995 for a review): the "balance sheet channel" and the "bank lending channel". Our model is consistent with the former in its emphasis on the effect of interest rates on collateral value.

and β is the relative welfare weight on the utility of entrepreneurs.

Proposition 5 *There exists $\overline{\mu}$ and $\overline{q}$ such that for $\mu \geq \overline{\mu}$ and $q \geq \overline{q}$, we have $\frac{1}{1-\mu}\frac{\partial w}{\partial R_1^B} < \frac{1}{\mu}\frac{\partial w}{\partial R_1^B} < 0$, so that it is optimal to have a countercyclical monetary policy, i.e $R_1^B < R_1^G$.*

Proof. Let N and D be the numerator and denominator on the right-hand side of:

$$w(R_1^G, R_1^B) = \int \frac{\beta(\rho_1 - \rho_0) - (1-\alpha)(1-\mu)(\frac{R_1}{R_1^B} - 1)\rho_0}{1 - \alpha\frac{\rho_0}{R_0} - \mu(1-\alpha)\frac{\rho_0}{R_0 R_1^G} + (1-\mu)(1-\alpha)\, q\left(\frac{1-\pi_B}{R_0} - \frac{\rho_0}{R_0 R_1^B}\right)} dF.$$

The partial derivatives $w_{R_1^G}$ and $w_{R_1^B}$ can be expressed as:

$$w_{R_1^G} = -\int \mu(1-\alpha)\frac{\rho_0}{R_0(R_1^G)^2}\frac{N}{D^2} dF,$$

and

$$w_{R_1^B} = \int (1-\mu)(1-\alpha)\frac{\rho_0 q}{R_0(R_1^B)^2 D^2} X dF,$$

where

$$X = (1-\mu)(1-\alpha)(2 - \pi_B - \frac{\rho_0}{R_1^B} - \frac{R_0}{R_1^B}) + \frac{1}{q}(R_0 - \alpha\rho_0 - \mu(1-\alpha)\frac{\rho_0}{R_1^G}) - \beta(\rho_1 - \rho_0).$$

If μ is sufficiently large so that for all α, β and ρ_0 in the support of F

$$(1-\mu)(1-\alpha)(2-\pi_B) < \beta(\rho_1 - \rho_0),$$

then for q sufficiently large, we immediately obtain that:

$$\frac{1}{1-\mu}\frac{\partial w}{\partial R_1^B} < \frac{1}{\mu}\frac{\partial w}{\partial R_1^B} < 0.$$

This establishes the proposition. ■

The intuition for this proposition is simple. Firms need to hoard liquidity in order to weather liquidity shocks if the aggregate state is bad. This liquidity hoarding is costly (the rate of return on hoarded liquidity is equal to $R_0/q < R_0$) because of the lack of commitment of consumers. Reducing interest rates in bad times lowers the amount of hoarded liquidity, by increasing the ability of firms to leverage their net worth. This effect is weaker when the aggregate state is good because in that state, short-term profits are enough to cover reinvestment needs so that no liquidity needs to be hoarded to weather liquidity shocks that occur in that aggregate state of the world. Hence a higher marginal benefit of reducing interest rates in bad times relative to good times. This effect is strong enough to overcome a countervailing effect arising from the fact that lowering interest rates in bad times leads to an implicit susbsidy from consumers to entrepreneurs, explaining that optimal interest rate policy is countercyclical.

3 Empirical analysis

3.1 Methodology and data

Our dependent variable is the average annual growth rate in labor productivity in industry j in country k for the period 1995-2005.[9] 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, $(ic)_j \times (mpc)_k$, is the interaction between industry j's intrinsic characteristic and the degree of (counter) cyclicality of monetary policy in country k over the same time period of time as that over which industry growth rates are computed, here 1995-2005. Finally, we control for initial conditions by including the ratio of labor productivity in industry j in country k to labor productivity in the overall manufacturing sector in country k at the beginning of the period, i.e. in 1995. Denoting y^t_{jk} (resp. y^t_k) labor productivity in industry j (resp. in total manufacturing) in country k at time t, and letting ε_{jk} denote the error term, our baseline estimation equation is expressed as follows:

$$\frac{\ln(y^{05}_{jk}) - \ln(y^{95}_{jk})}{10} = \alpha_j + \beta_k + \gamma(ic)_j \times (mpc)_k - \delta \ln\left(\frac{y^{95}_{jk}}{y^{95}_k}\right) + \varepsilon_{jk}. \quad (2)$$

Now, turning to the stabilization policy cyclicality measure, $(mpc)_k$, in country k, it is estimated as the change in monetary policy due a change in the domestic output gap. We therefore use country-level data to estimate the following country-by-country "auxiliary" equation over the time period 1995-2005:

$$rsir_{kt} = \eta_k + (mpc)_k.z_{kt} + u_{kt}, \quad (3)$$

where $rsir_{kt}$ is the real short term interest rate in country k at time t –defined as the difference between the three months policy interest rate set by the central bank and the 3-months annualized inflation rate- ; z_{kt} measures the output gap in country k at time t (that is, the percentage difference between actual and potential GDP). It therefore represents the country's current position in the cycle;[10] η_k is a constant; and u_{kt} is an error term. For example, a positive (resp. negative) regression coefficient $(mpc)_k$ reflects a countercyclical (pro-cyclical) monetary policy as the short term cost of capital tends to increase (resp. decrease) when the economy's outlook improves (resp. deteriorates).

It has become standard in the literature to estimate Taylor rules where the nominal short term interest rate ($nsir$) is a function of inflation π and the output gap z.

$$nsir_{kt} = \eta_k + \theta\pi_{kt} + (mpc^{tr})_k.z_{kt} + u_{kt} \quad (4)$$

[9] We will be using two measures of labor productivity, either per worker or per hour workers. Both measures will provide very consistent results. Some results where the dependent variable is real value added will also be presented.

[10] The output gap is estimated as the difference between the log of real GDP and the HP filtered series of the log of real GDP, using the standard smoothing parameter for quarterly data. Moreover the time sample ends up in 2005 in order to avoid end-of-sample problems in the estimated of trend GDP and output gap. In other words, we have enough data both at the before the beginning and after the end of our sample to estimate properly the cycle by the beginning and the end of our sample period.

We have made the choice of using Taylor rules as auxiliary -robustness- equations, our reason being that for most countries, interest rates and inflation rates are not stationary variables, while the difference between the interest rate and the inflation rate is stationary. Hence, the cyclicality estimates obtained from our procedure are less likely to be biased than those we would obtain from using Taylor rules as auxiliary equations. This also explains why we focused on a relatively recent period, namely 1995-2005. Had we extended the sample period to the early nineties, even the real short term interest rate would become non-stationary.

Yet, as alternative robustness checks, we introduce two different alternative auxiliary regressions designed to take into account either past or future persistence. In the first variant (4), we control for the one-quarter-lagged real short term interest rate:

$$rsir_{kt} = \eta_k + \theta rsir_{kt-1} + (mpc)_k.z_{kt} + u_{kt}. \tag{5}$$

In the second variant, we control for the one-quarter-forward real short term interest rate:

$$rsir_{kt} = \eta_k + \theta rsir_{kt+1} + (mpc)_k.z_{kt} + u_{kt}. \tag{6}$$

Last, when two countries differ in their monetary policy cyclicality estimates, it is worth knowing whether this difference comes mainly from what happens in upturns versus downturns. To this end, we shall estimate the following third variant of the auxiliary equation:

$$rsir_{kt} = \eta_k + (mpc^+)_k.z^+_{kt} + (mpc^-)_k.z^-_{kt} + u_{kt}. \tag{7}$$

Here, z^+_{ktq} is equal to the output gap if the output gap is higher than its historical median and it is equal to zero otherwise. Similarly, z^-_{ktq} is equal to the output gap if the output gap is lower than its historical median and it is equal to zero otherwise. The estimated coefficient mpc^+ (resp. mpc^-) measures how strongly the real interest rate reacts to variations in the output gap during an upturn (respectively during a downturn). This regression will then helps us determine whether the growth effect of monetary policy cyclicality, if any, comes from what happens during upturns versus downturns.

Turning now to industry-specific characteristics, we follow Rajan and Zingales (1998) in using firm-level data pertaining to the United States. We concentrate two set of financial constraints affecting firms, borrowing constraints and liquidity constraints. We consider two different proxies for borrowing constraints, namely external financial dependence and asset tangibility. External financial dependence is measured as the median ratio across firms belonging to the corresponding industry in the US of capital expenditures minus current cash flow to total capital expenditures. Asset tangibility is measured as the median ratio across firms in the corresponding industry in the US of the value of net property, plant, and equipment to total assets. To measure liquidity constraints, we consider two alternative indicators. First, the median ratio

across firms belonging to the corresponding industry in the US of inventories to total sales.[11] Second, the median ratio across firms in the corresponding industry in the US of labor costs to total sales. The first two measures give an indication about an industry need or difficulty to raise external finance and as such can be considered as proxies for the industry's borrowing constraints. The last three measures give an indication about an industry's need for short term financing. For example, industries with a larger ratio of labor costs to sales have larger payments to make on a monthly basis and should therefore face larger needs for short term refinancing. Similarly, industries have higher needs for liquidity when they need to maintain larger inventories as inventories are the most liquid physical assets firms can hold. Confirming that view, the data shows a very high correlation across industries between the inventories to sales ratio and the cash conversion cycle variable.

This methodology, which consists in using US industry-level data to compute industry characteristics, is predicated on the assumptions that (a) differences across industries are driven largely by differences in technology and therefore industries with higher levels of credit or liquidity constraints in one country are also industries with higher level levels of credit or liquidity constraints in another country within our country sample; (b) technological differences persist over time across countries; and (c) countries are relatively similar in terms of the overall institutional environment faced by firms. Under those three assumptions, our US-based industry-specific measures are likely to be valid measures for the corresponding industries in countries other than the United States. We believe that these assumptions are satisfied for industries within our OECD country sample. For example, if pharmaceuticals require proportionally more external finance or have lower labor costs than textiles in the United States, this is likely to be the case in other OECD countries as well. Moreover, since little convergence has occurred among OECD countries over the past 20 years, cross-country differences are likely to persist over time. Finally, 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-level credit or liquidity constraints.

Following Rajan and Zingales (1998), we estimate our baseline equation (2) using a simple ordinary least squares (OLS) procedure, and correcting for heteroskedasticity bias whenever needed, without worrying further about endogeneity issues. In particular, the interaction term between industry-specific characteristics and country-specific monetary countercyclicality is likely to be largely exogenous to the dependent variable. First, our variable for industry specific characteristics pertains to industries in the United States, while the dependent variable involves countries other than the United States. Hence reverse causality, whereby industry growth outside the United States could affect industry specific characteristics in the United States, seems quite implausible. Second, monetary policy cyclicality is measured at a macroeconomic level, whereas the dependent variable is measured at the industry level, which again reduces the scope for reverse causality

[11] Liquidity dependence can also be proxied with a cash conversion cycle variable which measures the median time elapsed between the moment a firm pays for its inputs and the moment its is paid its output across firms in the corresponding industry in the US. Results available upon request are very similar to those obtained with the inventories to sales ratio, which is not surprising since the correlation coefficent between the two variables is around 0.9.

as long as each individual industry represents a small share of total output in the domestic economy.

Our data sample focuses on 15 industrial OECD countries. In particular, we do not include the United States, as this would be a source of reverse causality problems[12]. Industry-level labor productivity data are drawn from the European Union (EU) KLEMS data set and is restricted to manufacturing industries.[13] These industry level data are available on a yearly frequency. 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) and Braun and Larrain (2005), and Raddatz (2006) to compute industry-level indicators for borrowing and liquidity constraints. Finally, macroeconomic variables -such as those used to compute monetary policy cyclicality estimates- are drawn from the OECD Economic Outlook data set (2008). Data relating to monetary policy, like interest rates, inflation or output gap, are available or computed based on quarterly data.[14] The frequency for do exist on a quarterly frequency for our set of countries. We choose to concentrate on the most recent period 1995-2005, during which monetary policy was essentially conducted through short term interest rates to make sure that our auxiliary regression does capture the bulk of monetary policy decisions.[15]

3.2 Results

3.2.1 First stage estimates

The histogram depicted in Figure 1 shows the results from the auxiliary regression (3). In particular it shows that Great Britain and Sweden are the OECD countries with the most countercyclical real short term interest rates over the period we consider. A natural explanation for this, is that both countries conduct their own monetary policies, and through independent central banks. The least countercyclical among the countries in our sample are Japan, Spain, Portugal and Finland. As for the latter three, they are all part of the Euro area; moreover, all three are "small economies" in GDP terms compared to the Euro area as a whole, therefore they are unlikely to have much influence on the European Central Bank's policy; finally, inflation is notoriously pro-cyclical in these countries, which in turn results in a real short term interest rate which is higher in recessions than in booms. Japan is a separate story: there, the procyclicality of real short term interest rates appears to be directly linked to a zero bound problem.

FIGURE 1 HERE

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

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

[14] Nominal interest rates and inflation rates are directly available on a quarterly frequency. The output gap is computed on the basis of real GDP series with quarterly frequency.

[15] Yet, it is fair to say that even during this period, some countries like Japan did conduct monetary policy mainly though other means than short term interest rates as the country went through a long period of "unconventional" monetary policy during which the central bank was monetizing fiscal deficits. In that particular case, equation (4) may provide a biased picture of monetary policy cyclicality.

Alternatively we consider the results of the auxiliary regression (4) which provide the country-by-country estimate for the output gap coefficient in the Taylor rule (see figure 2). The results are fairly comparable to those from the previous estimation exercise. In particular, Great Britain and Sweden are still the most counter-cyclical countries while Spain and Portugal are still (the most) procyclical countries.

FIGURE 2 *HERE*

Next we investigate variables that may correlate with the estimate for monetary policy countercyclicality. First, the cross country evidence shows that countries that have run a more countercyclical monetary policy have also experienced a higher cost of capital, both in the short and in the long run. This means that the real short term interest rate as well as the real long term interest rate were higher in countries where monetary policy was more countercyclical.

FIGURE 3 *HERE*

Then splitting the real cost of capital between the nominal interest rate and the inflation rate, the cross country evidence shows that they have played a similar role in terms of magnitude. This means that the positive cross-country correlation between monetary policy counter-cyclicality and the average real cost of capital is due, in equal terms, to a positive correlation between monetary policy counter-cyclicality and the average nominal interest rate on the one hand and to a negative correlation between monetary policy counter-cyclicality and the average inflation rate on the other hand. The cross country evidence is hence that countries that maintain high inflation rates and/or low interest rates tend to run procyclical monetary policies while countries that maintain low inflation rates and/or high interest rates tend to run counter-cyclical monetary policies.

FIGURE 4 *AND* 5 *HERE*

Second, we investigate the correlation between monetary policy counter-cyclicality and macroeconomic volatility. In theory, a country which runs a more counter-cyclical monetary policy should experience a lower volatility since monetary policy would then help dampen cyclical fluctuations. Yet, the counter-cyclical pattern of monetary policy is only one possible determinant of macroeconomic volatility. It hence could be that a country runs a more countercyclical monetary policy because its "natural" volatility is higher, so that overall it would still be more volatile than a country that runs a procyclical monetary policy. The empirical evidence shows that even in the absence of such a control for the "natural" volatility, there is a negative correlation between macroeconomic volatility and monetary policy counter-cyclicality.

FIGURE 6 *HERE*

Last, we look at the evidence on the correlation between monetary policy counter-cyclicality and fiscal policy. If anything, the data shows that there is no correlation between the cyclical pattern of monetary policy

and fiscal discipline understood as the average fiscal balance to GDP. Yet there is some positive correlation with government size: countries where fiscal expenditures represent a larger fraction of GDP tend also to run more counter-cyclical fiscal policies. Last there is a strong association between the stabilizing pattern of fiscal and monetary policies. Countries which run countercyclical (resp. procyclical) fiscal policies also tend to run countercyclical (resp. procyclical) monetary policies.

FIGURE 7 *AND* 8 *HERE*

3.2.2 Baseline regressions

The subsequent tables show the results from the main (second-stage) regressions. Table 1 shows the results of (2) with the average annual growth rate in real value added over the period 1995-2005, as the left hand side variable, and with financial dependence or asset tangibility as measures of financial constraints, and with the countercyclicality measure $(mpc)_k$ being derived first from (3), then from (5), and finally from (6). Standard errors are clustered at the industry level. The first three columns show that growth in industry real value added growth is significantly and positively correlated with the interaction of financial dependence and monetary countercyclicality: a larger sensitivity to the output gap of the real short term interest rate tends to raise industry real value added disproportionately for industries with higher financial dependence. A similar type of results holds for the interaction between monetary policy cyclicality and industry asset tangibility: a larger sensitivity of real short term interest rate to the output gap raises industry labor productivity growth per worker disproportionately for industries with lower asset tangibility.

TABLE 1 *HERE*

We now repeat the same estimation exercise, but moving the focus to measures of industry liquidity constraints. As noted above, a counter-cyclical monetary policy should contribute to raise growth in the sectors that are most liquidity dependent by easing the process of refinancing. Indeed the empirical evidence in Table 2 shows that for each of our two measures of liquidity constraints, the interaction of counter-cyclical monetary policy and liquidity constraints does have a positive effect on industry labor productivity growth per worker. Moreover, as in the case of borrowing constraints, these results do not depend upon the way in which monetary policy countercyclicality is estimated, in particular they are robust to taking into account possible time persistence in the real short term interest rate. At this point it is worth making two remarks. First the correlations between the two different measures of liquidity constraints is around 0.6, which means these two variables are not simply replicating a unique result. Moreover, the correlation between indicators of borrowing constraint and liquidity constraint is also far from being one. It ranges actually between 0.4 and 0.7 (when borrowing constraints are measured with external financial dependence, correlations being opposite when using asset tangibility). Liquidity and borrowing constraints are therefore two distinct channels through which monetary policy countercyclicality can affect industry growth.

TABLE 2 *HERE*

Tables 3 and 4 below, replicate the same regression exercises as Table 1 and 2 respectively, but with average annual growth in labor productivity *per hour* as the left hand side variable. We therefore aim at understanding whether the positive effect of countercyclical monetary policy on real value added growth for financially/liquidity dependent industries comes from a true enhancement in productivity growth or if it is simply reflecting an increase in employment growth in which case, the growth effect would simply be related to factor accumulation.[16] What Tables 3 and 4 show is that the interactions between financial or liquidity constraints on the one hand and the countercyclicality of monetary policy on the other hand has a significantly positive effect on labor productivity per hour growth.

TABLES 3 *AND* 4 *HERE*

3.2.3 Disentangling interest rate and inflation cyclicality

Up to now we have focused on the real short term interest rate to assess whether monetary policy could affect growth through its cyclical component, which as has been noted above, is the difference between the nominal short term interest rate and inflation. Hence a given cyclicality in the real short term interest rate could uncover different patterns: a country where inflation is less procyclical than another could well exhibit a similar real short term interest rate cyclical pattern if the nominal interest rate is less countercyclical. To determine whether it makes a difference that real short term interest rate countercyclicality stems from countercyclical nominal interest rates or from countercyclical inflation rates, we have extended the analysis by separating these two effects and estimating them separately. Columns i and ii in Table 5 typically show that inflation procyclicality -interacted with industry financial dependence- does not have any significant effect beyond that embedded in the real short term countercyclicality. This means that what is important for labor productivity growth is the cyclical pattern of the real short term interest rate, no matter whether it comes from nominal interest rate or inflation counter-cyclicality. Column iii in table 5 proposes another way to answer this question since it runs a horse race between the cyclicality on nominal interest rates, for given inflation (like in a standard Taylor rule) and the cyclicality of inflation (like in a standard Phillips curve). If anything the empirical evidence is that these two effects are of similar magnitude (i.e. there are not statistically different from each other) which is indeed consistent with the view that what matters is the extent to which the real short term interest rate is counter-cyclical, not the source of its counter-cyclicality. The remaining columns in table 5 -which run a similar exercise using asset tangibility as an industry measure of financial constraints- typically provide very consistent results in the sense that they confirm the view that

[16] Looking moreover at productivity *per hour* is important to filter out fact that the number of hours per worker tends to be procyclical in upturns while acyclical in downturns. Looking just at the effect of the interaction of financial constraints with monetary policy countercyclicality on average growth in productivity per worker may therefore simply reflect the (asymmetric) effect of that interaction on the number of hours per worker.

countercyclical real short term interest rates do help foster productivity growth for industries with the least tangible assets, irrespective of the source for countercyclicality (i.e. nominal interest vs. inflation).

Next, table 6 provides the results of a similar analysis focusing now on industry measures of liquidity dependence. Focusing on columns i-iii, results are somewhat different from those obtained in table 5 since regressions show that inflation countercyclicality is indeed the driving force for the effect of real short term interest rate countercyclicality on labor productivity growth. To be fair, the evidence is that nominal short term interest rate countercyclicality does play a role. However it is either small (less than one fourth of the effect of inflation countercyclicality, according to column i & ii) or not significantly different from zero (column iii). Actually this result is not unexpected. To the extent that firms use their inventories as a collateral or guarantee for credit, a procyclical inflation will tend to reduce the value of inventories during downturns, which is likely the time at which firms most need to borrow. By contrast, a countercyclical inflation will raise the value of inventories during downturns, which will likely enhance firms ability to borrow. It is hence not surprising that the cyclicality of inflation be key in determining the growth performance of industries maintaining a high level for inventories.

3.2.4 Dealing with the uncertainty around the monetary policy cyclicality index

An important limitation to the empirical analysis carried out so far, is that monetary policy cyclicality cannot be directly observed, it can only be estimated. Yet, in the analysis carried out up to now, the index for monetary policy cyclicality -obtained from first stage regressions- has been considered as a variable that is observed, not estimated while in reality, monetary policy cyclicality is estimated which means that we only know the first and second moments for the distribution of monetary policy cyclicality for each country. In other words, monetary policy cyclicality is a generated regressor. It could hence be that the significant effect obtained above simply relates to the abstraction from the uncertainty around monetary policy cyclicality. Taking this uncertainty into account would then make the interaction insignificant. To check if this is the case, we adopt the following procedure.

First, instead of considering the average coefficient $(mpc)_k$ estimated in the first stage regression as an explanatory variable in our second stage regression, we draw for each country k a monetary policy cyclicality index $(mpc)_{k,i}$ from a normal distribution with mean $(mpc)_k$ and standard deviation $\sigma_{(mpc)_k}$, where $\sigma_{(mpc)_k}$ is the standard error for the coefficient $(mpc)_k$ estimated in the first stage regression. Typically the larger the estimated standard deviation $\sigma_{(mpc)_k}$ the more likely the monetary policy cyclicality index $(mpc)_{k,i}$ drawn for country k will be different from the average coefficient $(mpc)_k$. Second, we run the second stage regression using the randomly drawn fiscal policy cyclicality indexes $(mpc)_{k,i}$:

$$\frac{\ln(y_{jk}^{05}) - \ln(y_{jk}^{95})}{10} = \alpha_j + \beta_k + \gamma (ic)_j \times (mpc)_{k,i} - \delta \ln\left(\frac{y_{jk}^{95}}{y_k^{95}}\right) + \varepsilon_{jk} \tag{8}$$

Running this regression yields an estimated coefficient γ and an estimated standard deviation σ_γ. We repeat this same procedure 2000 times, and thereby end up with a series of (2000) estimated coefficients γ and standard errors σ_γ. As a last step, we average across all draws to obtain an average $\overline{\gamma}$ of estimated coefficients and $\overline{\sigma_\gamma}$ of estimated standard errors. The statistical significance can eventually be tested on the basis of the averages $\overline{\gamma}$ and $\overline{\sigma_\gamma}$. The results of this estimation procedure are provided in table 7 (for credit constraints) and table 8 (for liquidity constraints). It appears that the interaction of monetary policy cyclicality and industry financial constraints still has a significant effect on industry growth. Yet, the estimated parameters are somewhat smaller -in absolute value- than their counterpart in the simple OLS regressions in table 3 and table 4. Note however that the difference is by no means statistically significant. We can hence conclude that the interaction of industry financial constraints and monetary policy cyclicality has a genuine significant effect on industry growth which is not due to a possible bias stemming from the use of a generated regressor as a standard regressor. In other words, the simple OLS regression does not seem to provide significantly biased results.

TABLE 7 AND 8 HERE

3.2.5 Instrumenting monetary policy cyclicality

The empirical methodology used in this paper is precisely designed to address the reverse causality problem. As has been said above, to the extent that monetary policy cyclicality is estimated at the country level while growth is measured at the industry level, and to the extent that each individual industry is too small to affect the design of monetary policy -which should be concerned with developments in the whole economy-, causality should in principle run from monetary policy cyclicality to industry growth. However in spite of this argument, there could cases for reverse causality. For instance, monetary policy makers could choose to run more countercyclical policies in economies where industries with largest contribution to macroeconomic growth face tighter financial or liquidity constraints. To overcome this problem, we can rely on instrumental variable estimations. Basically by taking variables that are known to be exogenous -in the sense that they can affect monetary policy cyclicality while monetary policy cyclicality cannot affect them- we can get rid of the possible endogeneity problem and the uncertainty around the estimate for monetary policy cyclicality. To this end, we restrict the set of instruments to variables such as the legal origin of the country (French, English, Scandinavian, and German), the population's deep characteristics (share of Catholics in total population in 1980, share of Protestants in total population in 1980 and degree for ethnolinguistic fractionalization) and the number of years since the country's independence.[17] Running the regressions with this set of instruments -table 9 and table 10- actually shows that there is a truly significant effect of the interaction between monetary policy counter-cyclicality and industry financial or liquidity constraints on industry labor productivity growth. In other words, previous results are not related to the existence of a

[17] Following Persson, Tabellini and Trebbi (2003), the independence year is set at 1748 for countries that have never been colonized.

reverse causality bias. Nor are they related to the uncertainty around the estimates for monetary policy cyclicality. Actually a striking feature of the IV regressions is the similarity in the estimated coefficients when compared with those obtained in the OLS estimations, which actually confirms the prior that the cyclical pattern of monetary policy is likely to be exogenous to industry labor productivity growth. A last remark has to do the test for the validity of instruments which is clearly passed both in the case of industry financial constraints and in the case of liquidity constraints.[18]

TABLES 9 *AND* 10 *HERE*

3.2.6 Competing stories and omitted variables

We have established that monetary policy cyclicality does enhance disproportionately the growth rate of sectors that face tighter financial or liquidity constraints. Yet a concern is to which extent aren't we picking up other factors or stories when looking at the correlation between industry growth and the cyclicality of fiscal policy? The next four tables address this issue. First, it could be that a more countercyclical monetary policy reflects a higher degree of financial development in the country, and financial development in turn is known to have a positive effect on growth, particularly for industries that are more dependent on external finance (Rajan and Zingales, 1998). Second, the higher inflation, the higher the cost of capital, which in turn should penalize more financially constrained sectors more in the absence of suitable macroeconomic policies; at the same time, higher inflation is likely to affect the government's ability to implement countercyclical monetary policies. Third, monetary countercyclicality may also be related to the size of government or its degree of fiscal discipline.

Table 11 performs horse-races between the effect of the interaction between asset tangibility and the countercyclicality of monetary policy and the interaction of asset tangibility with measures of financial development, inflation, and government size/budgetary discipline, on average growth in labor productivity per hour. The first column shows that when controlling for the interaction between asset tangibility and inflation in the second stage regression with the growth of labor productivity per hour as left hand side variable, the coefficient for the interaction between asset tangibility and countercyclical monetary policy, remains unaffected. Moreover, the coefficient for inflation interacted with countercyclical monetary policy is not significant. The next four columns control for asset tangibility interacted with different measures of financial development. Once again, adding these controls leaves the magnitude and significance of the interaction term between asset tangibility and monetary countercyclicality unaffected. The next two columns control for the interaction between asset tangibility and the average government debt and average government expenditure to GDP ratios (two measures of government size), and the last column controls for the interaction between asset tangibility and the average government surplus to GDP ratio (our measure of fiscal discipline):

[18] Note that in the regressions incorporating liquidity constraints, there may a weak instruments problem, which can solved by restricting the set of instruments used for estimation. The point here is to show that a unique set of instrument can go a long way to dealing with potential endogeneity and measurement error issues with a set of relatively different industry characteristics.

again, controlling for these interactions does not affect the magnitude and significance of the interaction coefficient between asset tangibility and monetary countercyclicality.

TABLE 11 *HERE*

Table 12 repeats the same exercise, but using external financial dependence as the measure of financial constraint. The basic conclusions are the same as in the previous Table, namely that controlling for the interaction between financial dependence and inflation, financial development of government size/budgetary discipline does not impact on the magnitude and significance of the interaction term between financial dependence and monetary countercyclicality. Note however the importance and significance of the interaction term between inflation and financial dependence in this regression, which goes in the direction predicted above.

TABLE 12 *HERE*

Tables 13 and 14 perform the same horse race exercises as the previous two tables, but using liquidity constraint measures -labor costs to sales and inventories to sales ratios respectively- as financial interactors. As one can see in these two tables, the interaction between these two measures of liquidity constraints and the countercyclicality of monetary policy overwhelms the interaction of the same liquidity constraints measures with inflation, financial development and government size/budgetary discipline in the sense that none of these other interactions ever comes out significant. This in turn suggests that monetary policy countercyclicality is of paramount importance especially for those sectors that are more prone to be liquidity constrained.

TABLES 13 *AND* 14 *HERE*

These results do not imply that inflation, financial development or government size/fiscal discipline do not matter for industry growth in industries that are more liquidity constrained. It rather means that if they matter, it is primarily through their effects on the government's ability to implement countercyclical monetary policies.

3.2.7 Upturns versus downturns, high-tech versus low-tech sectors

Table 15 runs the second stage regression (2), separately for country-years where the output gap is respectively below and above its median value over the whole period for the corresponding country (thus we look separately at upturns and downturns). The interaction effects between financial constraints and monetary countercyclicality are always significant in downturns, no matter if we use financial dependence, asset tangibility, the labor to sales ratio or the inventories to sales ratio. Moreover, except when asset tangibility is used as the financial interactor, the interaction between financial constraints and monetary countercyclicality tend to be more significant in slumps than in booms (when asset tangibility as the financial interactor, the interaction coefficient is comparable in upturns and downturns). This in turn is consistent with the

idea that more countercyclical real short term interest rates have a more significant effect on average labor productivity growth of industries during downturns when financial constraints are more likely to be binding.

TABLE 15 *HERE*

Table 16 runs the second stage regression (2) separately for high-tech and for low-tech industries. Except when asset tangibility is used as the measure of financial constraint, the interaction term between financial constraints and monetary policy countercyclicality, is slightly higher for high-tech industries. Why does the opposite conclusion obtain when using asset tangibility as the financial interactor? Our tentative explanation is that the distinction between high-tech and low-tech sectors is collinear with asset tangibility: high-tech sectors typically show lower degree of asset tangibility than low-tech sectors. This in turn suggests that what the interaction term between asset tangibility and monetary countercyclicality policy captures once we control for high- versus low-tech sectors, is in fact essentially a country fixed effect.

TABLE 16 *HERE*

Tables 17 and 18 combine the breakdowns between upturns and downturns and between high- and low-tech sectors. Table 17 considers credit constraints measures (financial dependence and asset tangibility) as financial interactors, whereas Table 18 looks at liquidity constraint measures (inventories to GDP and labor costs to GDP ratios) as financial interactors. The most interesting finding from these two tables, is that while in downturns both, high-tech and low-tech sectors seem to benefit from more countercyclical monetary policies, i.e from lower real short-run interest rates in downturns, in upturns it is the high-tech sectors which benefit most from more countercyclical monetary policy, i.e from higher short-run interest rates. In other words, there is a cost of having low short-run interest rates in booms, namely that of allocating to much capital to low-tech sectors at the expense of high-tech sectors.

TABLES 17 *AND* 18 *HERE*

4 Conclusion

In this paper we have developed a simple framework to look at how the interaction between the cyclicality of (short-run-) interest rate policy and firms' credit or liquidity constraints, affects firms' long-term growth-enhancing investments. Three main predictions came out of our mode, namely: (i) the more credit-constrained an industry, the more growth in that industry benefits from more countercyclical interest rates; (ii) the more liquidity-constrained an industry, the more growth in that industry benefits from more countercyclical interest rates; (iii) the growth enhancing effect of countercyclical interest rate policies in more credit- or liquidity-constrained sectors, is more significant in downturns than in upturns. Then, we have successfully confronted these predictions to quarterly cross-industry, cross-country OECD data over the period 1995-2005.

The approach and analysis in this paper could be extended in several interesting directions. First, one could revisit the costs and benefits of monetary unions, i.e of the potential credibility gains from joining the union versus the potential costs in terms of the reduced ability to pursue countercyclical monetary policies. Here, we think for example of countries like Greece or Spain where interest rates went down after these countries joined the Eurozone but which at the same time were becoming subject to cyclical monetary policies which were no longer set with the primary objective of maximizing investment and growth in these countries.

Second, one could look at the interplay between cyclical monetary policy and cyclical fiscal policy: are those substitutes or complements?

Third, one could embed our analysis in this paper into a broader framework where interest rate policy would also affect the extent of collective moral hazard among banks as in Farhi and Tirole (2010). Lowering interest rates in a downturn would then have the counteracting effect of encouraging excessive short-term debt borrowing by banks.

Finally, one could look deeper into the potential inefficiencies of setting low interest rates during upturns. In particular, to which extent can that lead to sectoral misallocation of funds between high-tech and low-tech sectors, and how do the corresponding allocative inefficiencies compare to the inefficiency associated with excessive risk-taking by banks? All these extensions await further research.

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5 Appendix

Assumption 6 *(high return)*

$$\frac{\mu\left[\alpha\left(\rho_1-\rho_0\right)R_1^G+(1-\alpha)\left(\rho_1-\rho_0\right)+\pi^G R_1^G+(1-\alpha)\left(\pi^G-1\right)R_1^G\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}+(1-\mu)\left(1-\alpha\right)q\left(\frac{1-\pi_B}{R_0}-\frac{\rho_0}{R_0R_1^B}\right)}$$
$$+\frac{(1-\mu)\left[\alpha\left(\rho_1-\rho_0\right)R_1^B+(1-\alpha)\left(\rho_1-\rho_0\right)+\alpha\pi^B R_1^B\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}+(1-\mu)\left(1-\alpha\right)q\left(\frac{1-\pi_B}{R_0}-\frac{\rho_0}{R_0R_1^B}\right)}>R_0(\mu R_1^G+(1-\mu)R_1^B).$$

Assumption 7 *(demand for liquidity):*

$$\frac{\left(\rho_1-\rho_0\right)}{1-\frac{\rho_0}{R_1^B}}\frac{R_0}{q}\geq\frac{\mu\left[\alpha\left(\rho_1-\rho_0\right)R_1^G+(1-\alpha)\left(\rho_1-\rho_0\right)+\pi^G R_1^G+(1-\alpha)\left(\pi^G-1\right)R_1^G\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}}$$
$$+\frac{(1-\mu)\left[\alpha\left(\rho_1-\rho_0\right)R_1^B+(1-\alpha)\left(\rho_1-\rho_0\right)\frac{x+\pi^B}{1-\frac{\rho_0}{R_1^B}}+\alpha\pi^B R_1^B\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}}.$$

Proof that Assumption 7 implies that entrepreneurs hoard enough liquidity to weather liquidity shocks. The entrepreneur therefore maximizes over $x\in[0,1-\rho_0/R_1^B-\pi^B]$:

$$A\frac{\mu\left[\alpha\left(\rho_1-\rho_0\right)R_1^G+(1-\alpha)\left(\rho_1-\rho_0\right)+\pi^G R_1^G+(1-\alpha)\left(\pi^G-1\right)R_1^G\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}+(1-\mu)\left(1-\alpha\right)\frac{qx}{R_0}}$$
$$+\frac{(1-\mu)\left[\alpha\left(\rho_1-\rho_0\right)R_1^B+(1-\alpha)\left(\rho_1-\rho_0\right)\frac{x+\pi^B}{1-\frac{\rho_0}{R_1^B}}+\alpha\pi^B R_1^B\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}+(1-\mu)\left(1-\alpha\right)\frac{qx}{R_0}}.$$

This expression is increasing in x if and only if Assumption 7 holds.

Proof that Assumption 6 implies that entrepreneurs invest all their net worth in their project. By investing in his own project, the entrepreneur gets an expected return of:

$$\frac{\mu\left[\alpha\left(\rho_1-\rho_0\right)R_1^G+(1-\alpha)\left(\rho_1-\rho_0\right)+\pi^G R_1^G+(1-\alpha)\left(\pi^G-1\right)R_1^G\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}+(1-\mu)\left(1-\alpha\right)q\left(\frac{1-\pi_B}{R_0}-\frac{\rho_0}{R_0R_1^B}\right)}$$
$$+\frac{(1-\mu)\left[\alpha\left(\rho_1-\rho_0\right)R_1^B+(1-\alpha)\left(\rho_1-\rho_0\right)+\alpha\pi^B R_1^B\right]}{1-\alpha\frac{\rho_0}{R_0}-\mu(1-\alpha)\frac{\rho_0}{R_0R_1^G}+(1-\mu)\left(1-\alpha\right)q\left(\frac{1-\pi_B}{R_0}-\frac{\rho_0}{R_0R_1^B}\right)}$$

which Assumption guarantees is greater than the return he gets by investing his net worth at the risk-free rate and rolling it over.

Figure 1

Monetary Policy Counter-Cyclicality Estimates

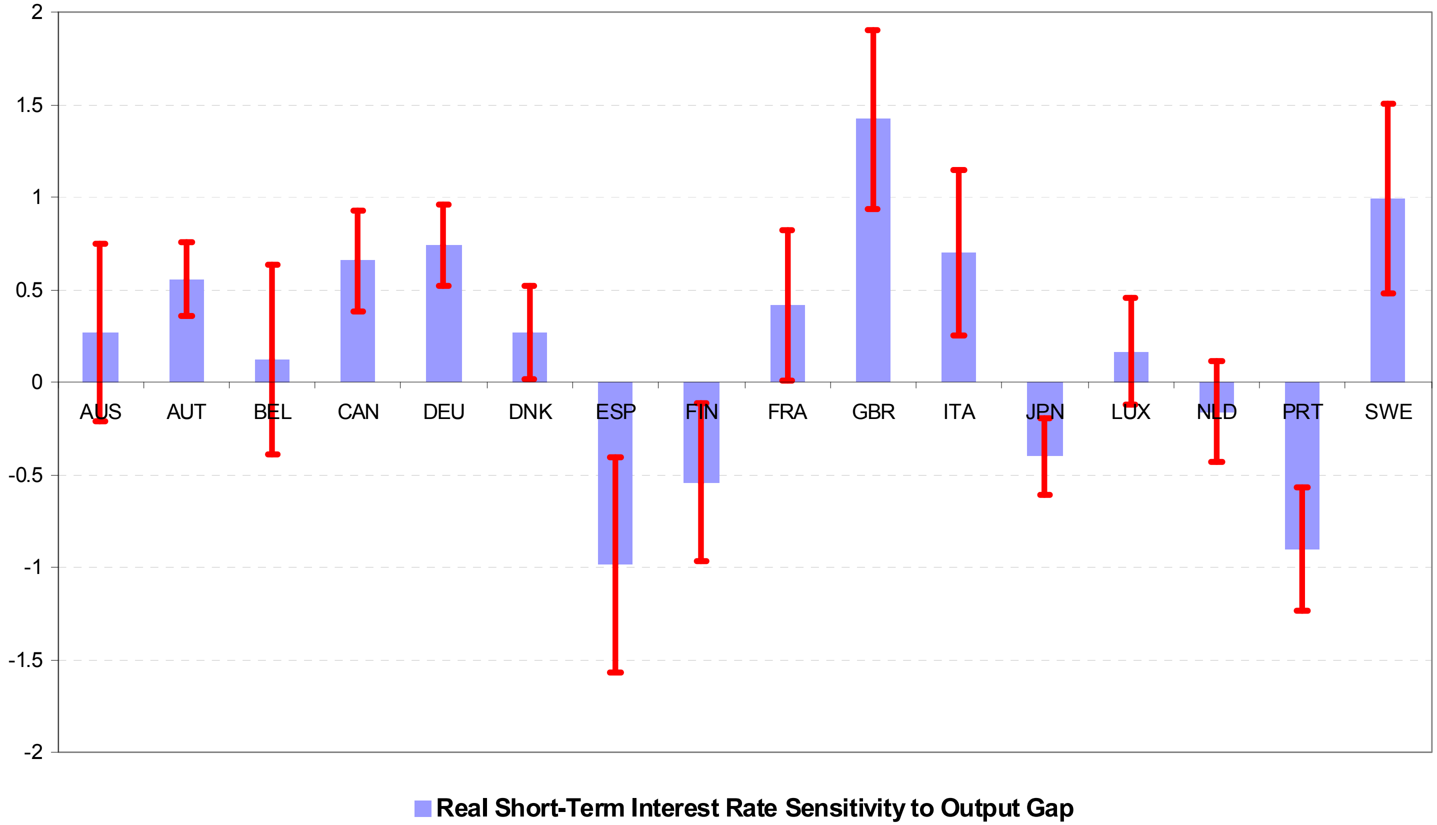

Figure 2

Monetary Policy Counter-Cyclicality Estimates

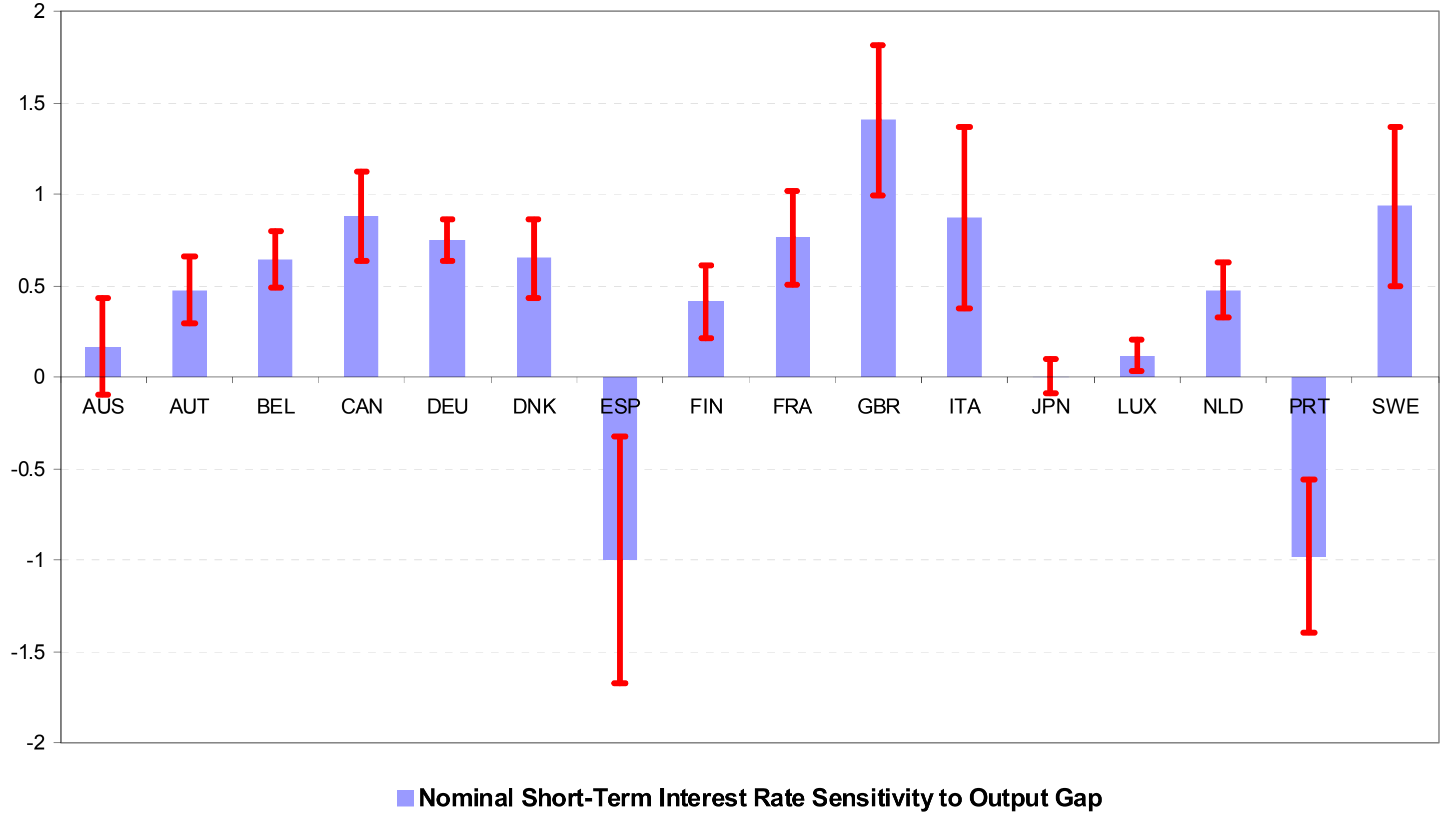

Figure 3

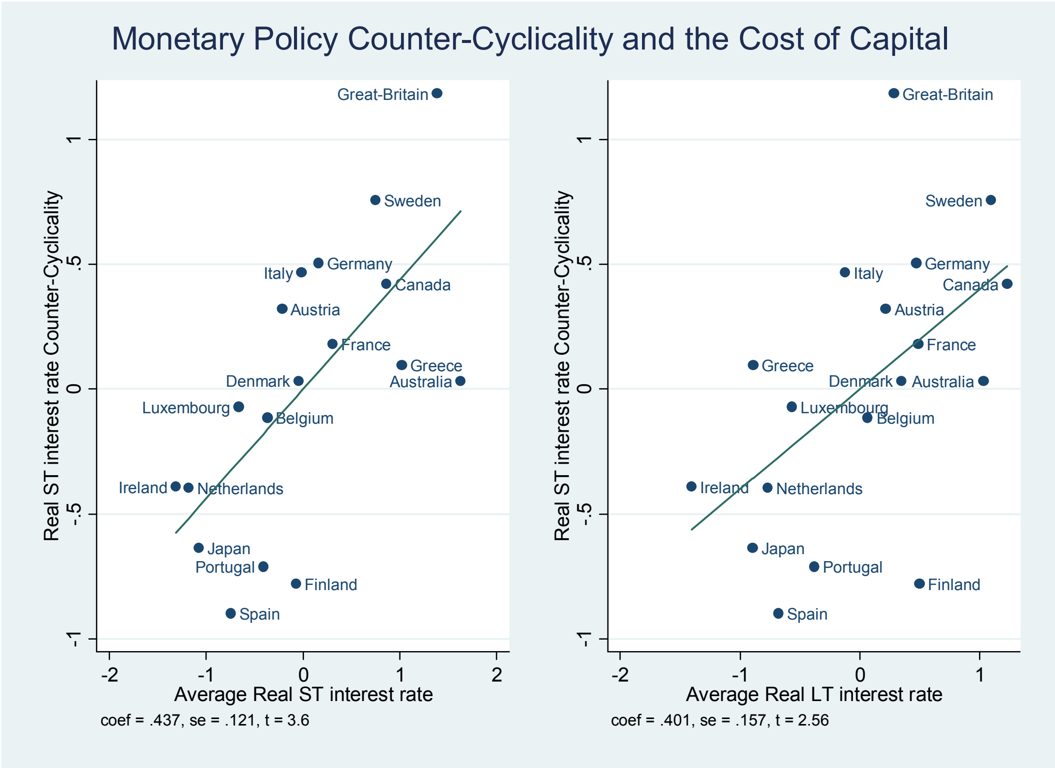

Figure 4

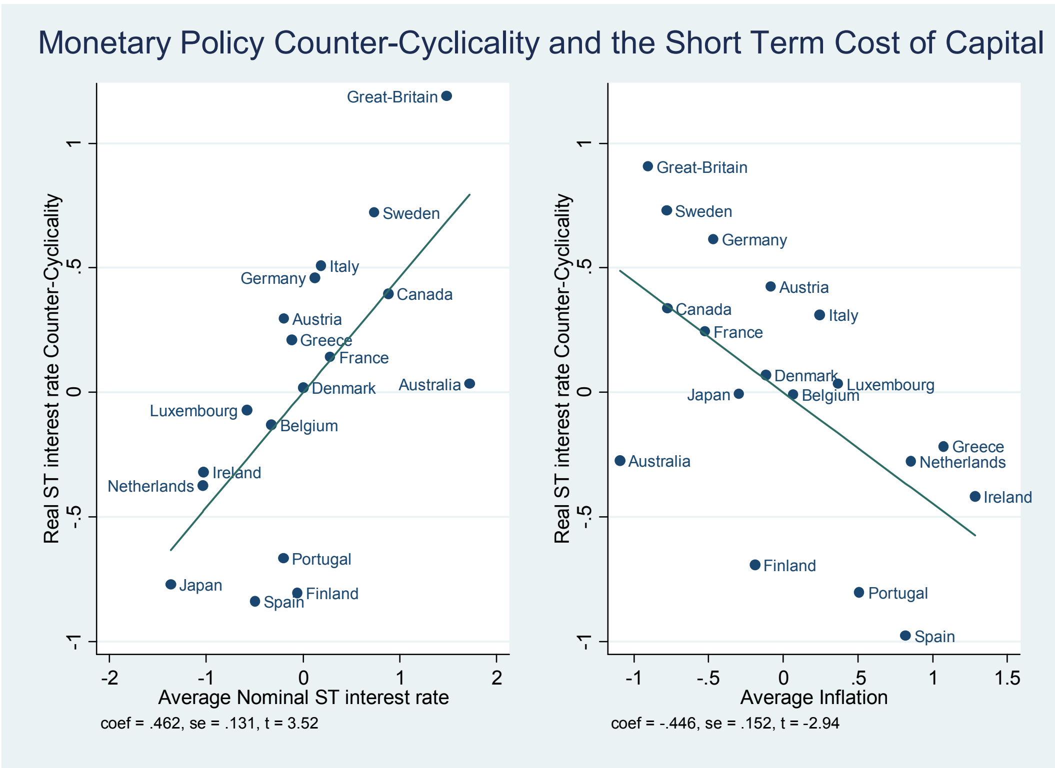

Figure 5

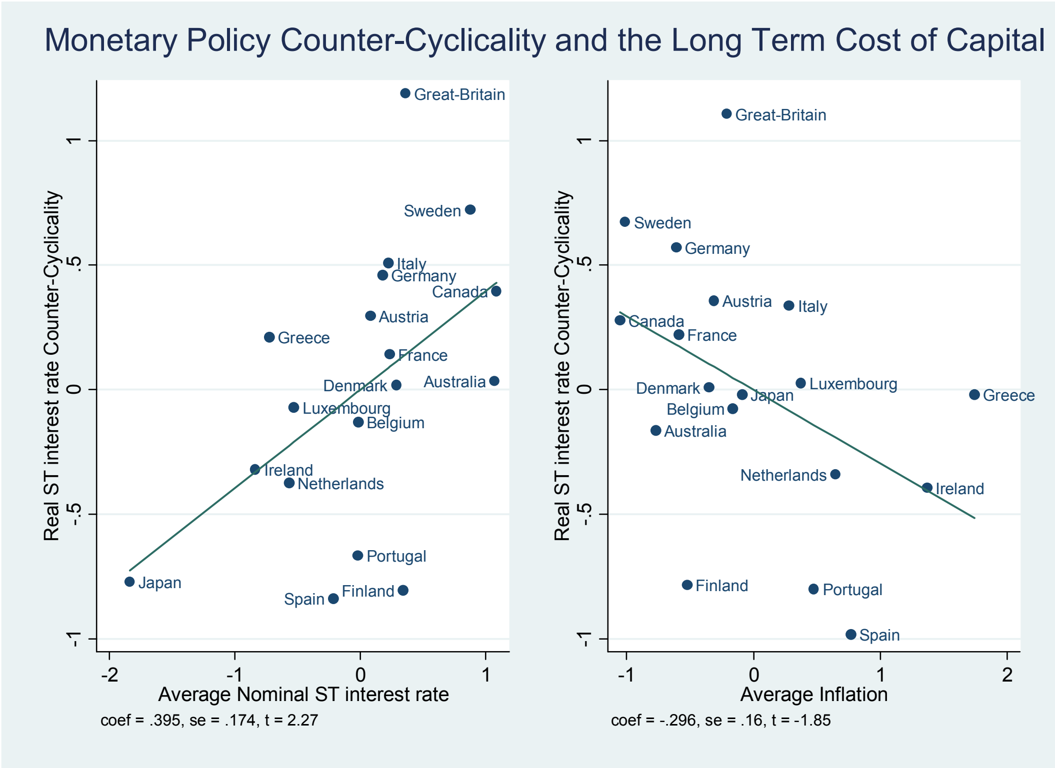

Figure 6

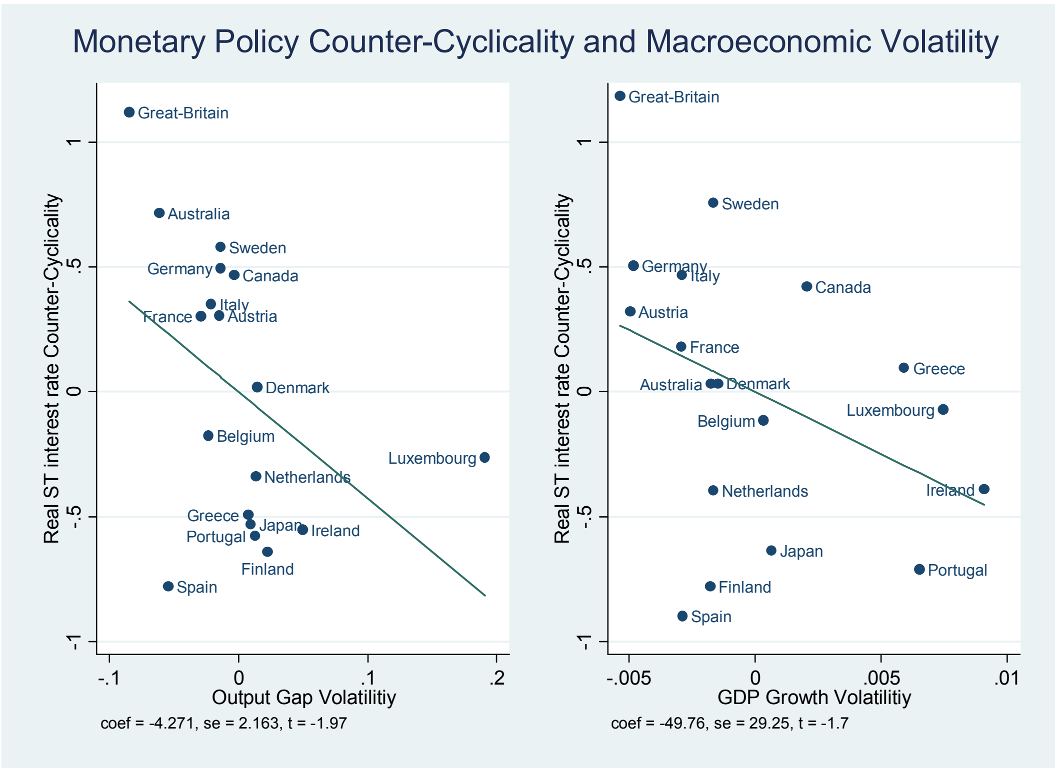

Figure 7

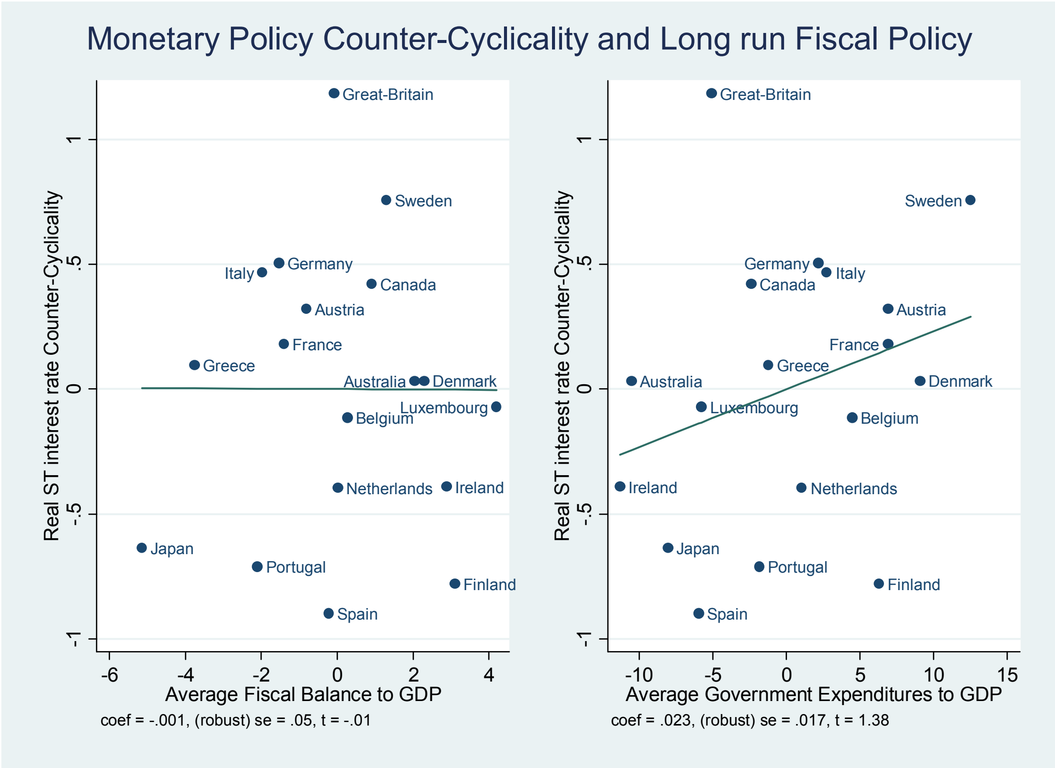

Figure 8

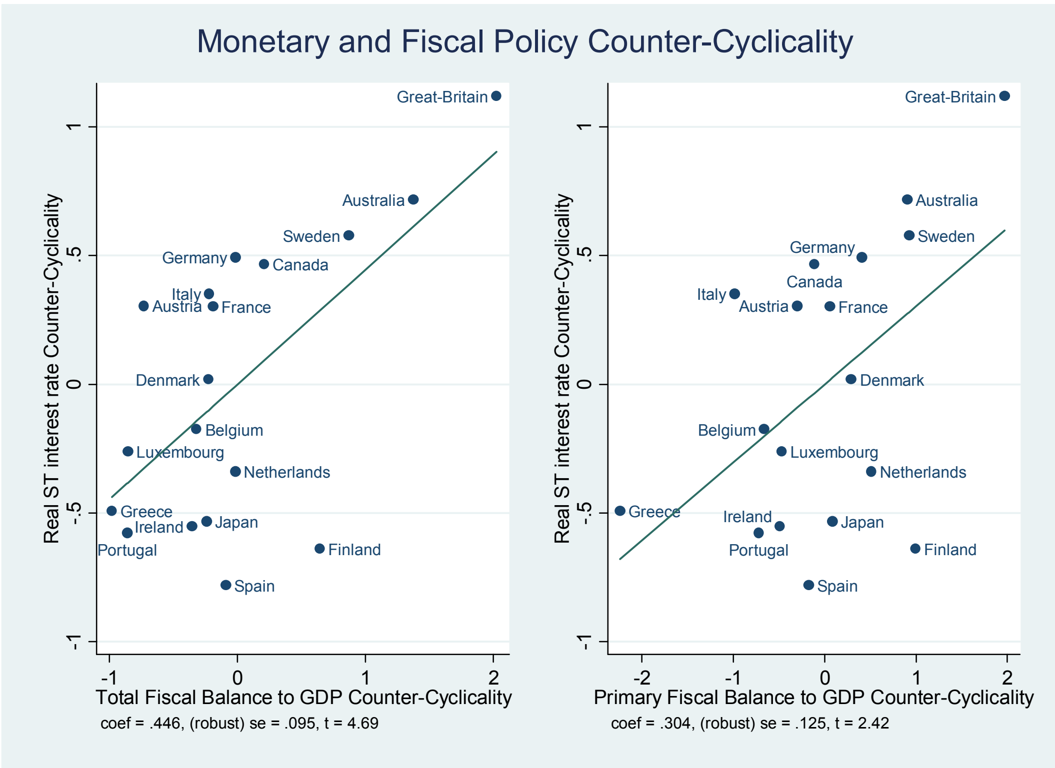

Table 1

Dependent variable: Real Value Added Growth						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Share in Manufacturing Value Added	**-1.240*** *(0.627)*	**-1.244*** *(0.632)*	**-1.256*** *(0.646)*	**-1.217*** *(0.625)*	**-1.227*** *(0.626)*	**-1.215*** *(0.632)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality I)	**4.654***** *(1.148)*					
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality II)		**6.892***** *(1.856)*				
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality III)			**7.220***** *(2.520)*			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality I)				**-16.13***** *(4.535)*		
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality II)					**-23.92***** *(6.511)*	
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality III)						**-23.56***** *(7.910)*
Observations	624	624	624	624	624	624
R-squared	0.400	0.401	0.403	0.396	0.397	0.397

Note: The dependent variable is the average annual growth rate in real value added for the period 1995-2005 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 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 2

Dependent variable: Real Value Added Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Share in Manufacturing Value Added	**-1.198*** *(0.634)*	**-1.211*** *(0.637)*	**-1.201*** *(0.643)*	**-1.191*** *(0.629)*	**-1.188*** *(0.631)*	**-1.184*** *(0.641)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality I)	**26.49**** *(10.66)*					
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality II)		**40.82**** *(15.84)*				
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality III)			**46.04**** *(17.58)*			
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality I)				**16.96***** *(5.374)*		
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality II)					**25.45***** *(8.076)*	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality III)						**21.93*** *(11.07)*
Observations	624	624	624	624	624	624
R-squared	0.393	0.394	0.396	0.395	0.395	0.394

Note: The dependent variable is the average annual growth rate in real value added for the period 1995-2005 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 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 3

Dependent variable: Labor Productivity per hour Growth						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.528***** *(0.877)*	**-3.599***** *(0.904)*	**-3.574***** *(0.91)*	**-3.544***** *(0.888)*	**-3.578***** *(0.91)*	**-3.584***** *(0.907)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality I)	**3.713***** *(1.224)*					
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality II)		**5.692**** *(2.248)*				
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality III)			**5.994**** *(2.643)*			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality I)				**-12.98***** *(4.095)*		
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality II)					**-20.16***** *(6.862)*	
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality III)						**-21.02***** *(6.916)*
Observations	624	624	624	624	624	624
R-squared	0.364	0.365	0.367	0.36	0.362	0.363

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 4

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.677*****	**-3.721*****	**-3.743*****	**-3.589*****	**-3.594*****	**-3.586*****
	(0.884)	*(0.905)*	*(0.909)*	*(0.864)*	*(0.88)*	*(0.866)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality I)	**29.48*****					
	(8.774)					
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality II)		**47.40*****				
		(13.87)				
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality III)			**52.74*****			
			(14.56)			
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality I)				**17.42*****		
				(4.244)		
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality II)					**28.03*****	
					(7.143)	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality III)						**25.16*****
						(9.145)
Observations	624	624	624	624	624	624
R-squared	0.362	0.365	0.368	0.363	0.365	0.363

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 5

Dependent variable: Labor Productivity per hour Growth						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.561*****	**-3.590*****	**-3.586*****	**-3.532*****	**-3.536*****	**-3.556*****
	(0.896)	*(0.901)*	*(0.902)*	*(0.886)*	*(0.894)*	*(0.896)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality)	**3.023*****	**2.747****				
	(1.061)	*(1.063)*				
Interaction (Financial Dependence and Taylor Rule Counter-Cyclicality)			**3.199*****			
			(1.122)			
Interaction (Financial Dependence and Inflation Pro-Cyclicality I)	**-2.965**					
	(2.585)					
Interaction (Financial Dependence and Inflation Pro-Cyclicality II)		**-2.967**	**-5.204****			
		(1.883)	*(2.079)*			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality)				**-11.55*****	**-10.60****	
				(4.241)	*(3.986)*	
Interaction (Asset Tangibility and Taylor Rule Counter-Cyclicality)						**-11.97*****
						(3.962)
Interaction (Asset Tangibility and Inflation Pro-Cyclicality I)				**5.755**		
				(9.740)		
Interaction (Asset Tangibility and Inflation Pro-Cyclicality II)					**6.858**	**15.49***
					(8.812)	*(8.194)*
Observations	624	624	624	624	624	624
R-squared	0.365	0.365	0.367	0.360	0.361	0.362

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Taylor Rule Counter-Cyclicality is the coefficient of the output gap when the Nominal Short Term Interest Rate is regressed on a constant, the output gap and inflation for each country. Inflation Pro-Cyclicality I (resp. II) is the coefficient of the output gap when Inflation is regressed on a constant, the output gap (resp. and lagged Inflation). 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 6

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.594*****	**-3.600*****	**-3.601*****	**-3.630*****	**-3.631*****	**-3.649*****
	(0.869)	*(0.875)*	*(0.876)*	*(0.884)*	*(0.891)*	*(0.895)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality)	**19.33***	**16.82***				
	(9.933)	*(9.733)*				
Interaction (Inventories to Sales and Taylor Rule Counter-Cyclicality)			**17.36**			
			(10.46)			
Interaction (Inventories to Sales and Inflation Pro-Cyclicality I)	**-41.97****					
	(20.50)					
Interaction (Inventories to Sales and Inflation Pro-Cyclicality II)		**-37.47****	**-51.39*****			
		(16.19)	*(14.09)*			
Interaction (Labor costs to Sales and Real Short term Interest Rate Counter-Cyclicality)				**15.24*****	**12.14****	
				(4.911)	*(4.807)*	
Interaction (Labor costs to Sales and Taylor Rule Counter-Cyclicality)						**13.19****
						(5.031)
Interaction (Labor costs to Sales and Inflation Pro-Cyclicality I)				**-9.159**		
				(15.26)		
Interaction (Labor costs to Sales and Inflation Pro-Cyclicality II)					**-15.90**	**-25.87*****
					(10.51)	*(9.102)*
Observations	624	624	624	624	624	624
R-squared	0.366	0.366	0.366	0.363	0.364	0.365

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Taylor Rule Counter-Cyclicality is the coefficient of the output gap when the Nominal Short Term Interest Rate is regressed on a constant, the output gap and inflation for each country. Inflation Pro-Cyclicality I (resp. II) is the coefficient of the output gap when Inflation is regressed on a constant, the output gap (resp. and lagged Inflation). 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 7

Dependent variable: Labor Productivity per hour Growth						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.549***** *(0.875)*	**-3.605***** *(0.889)*	**-3.573***** *(0.887)*	**-3.554***** *(0.883)*	**-3.584***** *(0.892)*	**-3.584***** *(0.887)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality I)	**2.899**** *(1.226)*					
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality II)		**3.926*** *(1.974)*				
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality III)			**4.499**** *(2.029)*			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality I)				**-10.53**** *(4.493)*		
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality II)					**-14.57**** *(6.742)*	
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality III)						**-15.20**** *(6.113)*
Observations	624	624	624	624	624	624
R-squared	0.292	0.293	0.296	0.289	0.290	0.291

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate for each country. Estimation results are based on the average for parameters, standard errors and statistics, computed over 2000 OLS regressions using real short term interest rate cyclicality index randomly drawn from the empirical distribution estimated in the first stage regression. 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 8

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.664***	**-3.688***	**-3.688***	**-3.603***	**-3.613***	**-3.586***
	(0.880)	*(0.89)*	*(0.889)*	*(0.862)*	*(0.871)*	*(0.86)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality I)	**25.29***					
	(8.784)					
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality II)		**36.28***				
		(12.90)				
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality III)			**37.25***			
			(13.02)			
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality I)				**14.65***		
				(4.728)		
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality II)					**21.02***	
					(7.169)	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality III)						**18.15**
						(7.788)
Observations	624	624	624	624	624	624
R-squared	0.292	0.294	0.294	0.292	0.294	0.291

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate for each country. Estimation results are based on the average for parameters, standard errors and statistics, computed over 2000 OLS regressions using real short term interest rate cyclicality index randomly drawn from the empirical distribution estimated in the first stage regression. The interaction variable is the product of variables in parentheses. 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 9

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.517*****	**-3.601*****	**-3.574*****	**-3.538*****	**-3.578*****	**-3.584*****
	(0.725)	*(0.748)*	*(0.742)*	*(0.729)*	*(0.750)*	*(0.745)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality I)	**4.553****					
	(1.823)					
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality II)		**6.114****				
		(2.455)				
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality III)			**5.223****			
			(2.191)			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality I)				**-15.26*****		
				(5.496)		
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality II)					**-22.08*****	
					(7.736)	
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality III)						**-19.92*****
						(7.107)
Hansen J. Stat	**8.274**	**8.342**	**8.828**	**6.366**	**5.357**	**6.554**
p. value	*0.219*	*0.214*	*0.184*	*0.383*	*0.499*	*0.364*
Observations	624	624	624	624	624	624
R-squared	0.069	0.072	0.075	0.064	0.067	0.068

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate for each country. List of instruments for monetary policy cyclicality: share of Catholics in total population in 1980, share of Protestants in total population in 1980, number of years since independence, legal origin. 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 10

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Log of Initial Relative Labor Productivity	**-3.690******	**-3.715******	**-3.712******	**-3.588******	**-3.591******	**-3.584******
	(0.751)	*(0.765)*	*(0.759)*	*(0.726)*	*(0.730)*	*(0.733)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality I)	**33.06******					
	(11.97)					
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality II)		**45.34******				
		(16.62)				
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality III)			**42.79******			
			(15.06)			
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality I)				**15.32****		
				(6.783)		
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality II)					**22.33****	
					(9.144)	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality III)						**18.26****
						(8.445)
Hansen J. Stat	**1.807**	**1.995**	**2.424**	**4.034**	**3.356**	**4.393**
p. value	*0.937*	*0.920*	*0.877*	*0.672*	*0.763*	*0.624*
Observations	624	624	624	624	624	624
R-squared	0.067	0.071	0.075	0.068	0.071	0.068

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality I is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant and the output gap for each country. Real Short term Interest Rate Counter-Cyclicality II is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the lagged Real Short Term Interest Rate for each country. Real Short term Interest Rate Counter-Cyclicality III is the coefficient of the output gap when Real Short Term Interest Rate is regressed on a constant, the output gap and the forward Real Short Term Interest Rate for each country. List of instruments for monetary policy cyclicality: share of Catholics in total population in 1980, share of Protestants in total population in 1980, number of years since independence, legal origin. 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 11

Dependent variable: Labor Productivity per hour Growth									
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Log of Initial Relative Labor Productivity	**-3.554*** **	**-3.536*** **	**-3.510*** **	**-3.511*** **	**-3.581*** **	**-3.448*** **	**-3.544*** **	**-3.574*** **	**-3.549*** **
	(0.876)	*(0.896)*	*(0.898)*	*(0.913)*	*(0.870)*	*(1.010)*	*(0.890)*	*(0.873)*	*(0.894)*
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality)	**-10.19** **	**-12.39** **	**-12.64*** **	**-13.35*** **	**-11.27*** **	**-11.98*** **	**-12.98*** **	**-11.07*** **	**-12.40*** **
	(5.036)	*(4.683)*	*(4.092)*	*(4.606)*	*(3.967)*	*(3.973)*	*(4.114)*	*(4.049)*	*(4.219)*
Interaction (Asset Tangibility and Average Inflation rate)	**6.994**								
	(8.217)								
Interaction (Asset Tangibility and Average Real Short term Interest Rate)		**-0.704**							
		(4.646)							
Interaction (Asset Tangibility and Average Liquid Liabilities to GDP)			**-7.022**						
			(10.48)						
Interaction (Asset Tangibility and Average Private Credit to GDP)				**7.686**					
				(19.05)					
Interaction (Asset Tangibility and Average Bank Credit to Bank Deposit)					**-18.37** **				
					(8.533)				
Interaction (Asset Tangibility and Average Private Bond Market to GDP)						**-19.36**			
						(14.84)			
Interaction (Asset Tangibility Average and Government Debt to GDP)							**-0.151**		
							(10.53)		
Interaction (Asset Tangibility and Average Government Expenditures to GDP)								**-0.887***	
								(0.511)	
Interaction (Asset Tangibility and Average Government Surplus to GDP)									**1.159**
									(1.442)
Observations	624	624	624	624	624	591	624	624	624
R-squared	0.362	0.36	0.361	0.36	0.364	0.362	0.36	0.364	0.361

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 12

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Log of Initial Relative Labor Productivity	**-3.448******	**-3.511******	**-3.474******	**-3.515******	**-3.480******	**-3.562******	**-3.337******	**-3.522******	**-3.470******
	(0.833)	*(0.878)*	*(0.878)*	*(0.876)*	*(0.87)*	*(0.883)*	*(0.983)*	*(0.862)*	*(0.838)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality)	**1.988****	**2.929****	**3.615*****	**4.124*****	**3.340*****	**3.923*****	**3.466*****	**3.733*****	**2.816****
	(0.96)	*(1.181)*	*(1.188)*	*(1.338)*	*(1.124)*	*(1.17)*	*(1.217)*	*(1.241)*	*(1.068)*
Interaction (Financial Dependence and Average Inflation rate)	**-4.133****								
	(1.961)								
Interaction (Financial Dependence and Average Real Short term Interest Rate)		**0.936**							
		(1.539)							
Interaction (Financial Dependence and Average Liquid Liabilities to GDP)			**-2.593**						
			(1.846)						
Interaction (Financial Dependence and Average Private Credit to GDP)				**-5.102***					
				(2.963)					
Interaction (Financial Dependence and Average Bank Credit to Bank Deposit)					**4.171***				
					(2.266)				
Interaction (Financial Dependence and Average Private Bond Market to GDP)						**-2.172***			
						(1.234)			
Interaction (Financial Dependence Average and Government Debt to GDP)							**5.170*****		
							(1.366)		
Interaction (Financial Dependence and Average Government Expenditures to GDP)								**-0.647**	
								(2.998)	
Interaction (Financial Dependence and Average Government Surplus to GDP)									**39.91****
									(15.65)
Observations	624	624	624	624	624	591	624	624	624
R-squared	0.362	0.36	0.361	0.36	0.364	0.362	0.36	0.364	0.361

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 13

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Log of Initial Relative Labor Productivity	**-3.599*** **	**-3.590*** **	**-3.615*** **	**-3.649*** **	**-3.609*** **	**-3.482*** **	**-3.600*** **	**-3.606*** **	**-3.594*** **
	(0.861)	*(0.87)*	*(0.864)*	*(0.867)*	*(0.861)*	*(0.969)*	*(0.864)*	*(0.857)*	*(0.87)*
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality)	**15.52*** **	**17.20*** **	**17.23*** **	**19.32*** **	**16.24*** **	**16.33*** **	**17.14*** **	**15.70*** **	**16.953*** **
	(4.335)	*(4.584)*	*(4.132)*	*(4.984)*	*(3.839)*	*(4.134)*	*(4.33)*	*(3.799)*	*(4.538)*
Interaction (Labor Costs to Sales and Average Inflation rate)	**-4.795**								
	(10.33)								
Interaction (Labor Costs to Sales and Average Real Short term Interest Rate)		**0.27**							
		(5.602)							
Interaction (Labor Costs to Sales and Average Liquid Liabilities to GDP)			**-6.106**						
			(8.271)						
Interaction (Labor Costs to Sales and Average Private Credit to GDP)				**-20.78**					
				(16.13)					
Interaction (Labor Costs to Sales and Average Bank Credit to Bank Deposit)					**13.88**				
					(11.78)				
Interaction (Labor Costs to Sales and Average Private Bond Market to GDP)						**28.28**			
						(17.55)			
Interaction (Labor Costs to Sales Average and Government Debt to GDP)							**8.763**		
							(13.42)		
Interaction (Labor Costs to Sales and Average Government Expenditures to GDP)								**0.836**	
								(0.725)	
Interaction (Labor Costs to Sales and Average Government Surplus to GDP)									**-0.917**
									(1.399)
Observations	624	624	624	624	624	591	624	624	624
R-squared	0.363	0.363	0.363	0.364	0.364	0.366	0.363	0.365	0.363

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 14

Dependent variable: Labor Productivity per hour Growth	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Log of Initial Relative Labor Productivity	**-3.678*****	**-3.667*****	**-3.682*****	**-3.700*****	**-3.730*****	**-3.584*****	**-3.680*****	**-3.683*****	**-3.677*****
	(0.88)	*(0.891)*	*(0.881)*	*(0.895)*	*(0.878)*	*(1.01)*	*(0.879)*	*(0.885)*	*(0.884)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality)	**27.40*****	**23.53****	**29.38*****	**28.29*****	**27.67*****	**28.38*****	**30.31*****	**28.86*****	**29.57*****
	(8.424)	*(11.2)*	*(8.593)*	*(10.19)*	*(8.28)*	*(8.373)*	*(8.658)*	*(7.435)*	*(8.957)*
Interaction (Inventories to Sales and Average Inflation rate)	**-5.161**								
	(17.27)								
Interaction (Inventories to Sales and Average Real Short term Interest Rate)		**7.06**							
		(9.67)							
Interaction (Inventories to Sales and Average Liquid Liabilities to GDP)			**-2.534**						
			(13.98)						
Interaction (Inventories to Sales and Average Private Credit to GDP)				**14.06**					
				(31.06)					
Interaction (Inventories to Sales and Average Bank Credit to Bank Deposit)					**20.43**				
					(19.43)				
Interaction (Inventories to Sales and Average Private Bond Market to GDP)						**27.26**			
						(28.46)			
Interaction (Inventories to Sales Average and Government Debt to GDP)							**-23.56**		
							(21.6)		
Interaction (Inventories to Sales and Average Government Expenditures to GDP)								**0.286**	
								(1.278)	
Interaction (Inventories to Sales and Average Government Surplus to GDP)									**0.183**
									(2.735)
Observations	624	624	624	624	624	591	624	624	624
R-squared	0.362	0.36	0.361	0.36	0.364	0.362	0.36	0.364	0.361

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 15

Dependent variable: Labor Productivity per hour Growth		(i)	(ii)	(iii)	(iv)
Log of Initial Relative Labor Productivity		**-3.523******	**-3.550******	**-3.675******	**-3.617******
		(0.886)	*(0.895)*	*(0.881)*	*(0.882)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality)	Upturn	**2.068**			
		(1.309)			
	Downturn	**1.658******			
		(0.562)			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality)	Upturn		**-6.236****		
			(3.316)		
	Downturn		**-6.918*****		
			(2.884)		
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality)	Upturn			**15.02****	
				(7.529)	
	Downturn			**15.10*****	
				(6.364)	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality)	Upturn				**8.100****
					(4.317)
	Downturn				**9.523******
					(2.655)
Observations		624	624	624	624
R-squared		0.363	0.36	0.362	0.363

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality upturn (resp. downturn) is the coefficient of the output gap when Real Short Term Interest Rate is regressed for each country on a constant and the output gap, the output gap being above (resp. below) median. 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% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 16

Dependent variable: Labor Productivity per hour Growth		(i)	(ii)	(iii)	(iv)
Log of Initial Relative Labor Productivity		**-3.582***** *(0.887)*	**-3.563***** *(0.896)*	**-3.674***** *(0.893)*	**-3.617***** *(0.882)*
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality)	Low Tech	**1.882**** *(0.821)*			
	High Tech	**4.102***** *(1.349)*			
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality)	Low Tech		**-10.16***** *(3.687)*		
	High Tech		**-6.7** *(4.599)*		
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality)	Low Tech			**21.21***** *(7.501)*	
	High Tech			**26.43***** *(7.500)*	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality)	Low Tech				**12.36***** *(2.897)*
	High Tech				**17.17***** *(3.616)*
Observations		624	624	624	624
R-squared		0.366	0.361	0.364	0.365

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality is the coefficient of the output gap when Real Short Term Interest Rate is regressed for each country on a constant and the output gap. The interaction variable is the product of variables in parentheses. The coefficient for the interaction term is estimated separately for high tech and low tech industries. (cf. list of industries in each category in appendix). Standard errors -clustered at the industry level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 17

Dependent variable: Labor Productivity per hour Growth			(i)	(ii)
Log of Initial Relative Labor Productivity			**-3.675***** (0.906)	**-3.615***** (0.912)
Interaction (Financial Dependence and Real Short term Interest Rate Counter-Cyclicality)	Upturn	Low Tech	**-0.496** (0.699)	
		High Tech	**2.662*** (1.437)	
	Downturn	Low Tech	**2.343***** (0.693)	
		High Tech	**1.486**** (0.651)	
Interaction (Asset Tangibility and Real Short term Interest Rate Counter-Cyclicality)	Upturn	Low Tech		**-1.215** (2.724)
		High Tech		**4.902** (3.63)
	Downturn	Low Tech		**-9.056***** (2.991)
		High Tech		**-11.69***** (3.937)
Observations			624	624
R-squared			0.37	0.366

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Financial Dependence is the median fraction of capital expenditures not financed with internal funds for US firms in the same industry for the period 1980-1989. 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 1980-1989. Real Short term Interest Rate Counter-Cyclicality upturn (resp. downturn) is the coefficient of the output gap when Real Short Term Interest Rate is regressed for each country on a constant and the output gap, the output gap being above (resp. below) median. The interaction variable is the product of variables in parentheses. The coefficient for the interaction term is estimated separately for high tech and low tech industries. (cf. list of industries in each category in appendix). Standard errors -clustered at the industry level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).

Table 18

Dependent variable: Labor Productivity per hour Growth				
			(iii)	(iv)
Log of Initial Relative Labor Productivity			**-3.696****** *(0.904)*	**-3.686****** *(0.903)*
Interaction (Inventories to Sales and Real Short term Interest Rate Counter-Cyclicality)	Upturn	Low Tech	**4.29** *(5.712)*	
		High Tech	**11.27*** *(6.594)*	
	Downturn	Low Tech	**17.82**** *(7.936)*	
		High Tech	**15.99**** *(6.891)*	
Interaction (Labor Costs to Sales and Real Short term Interest Rate Counter-Cyclicality)	Upturn	Low Tech		**1.33** *(2.465)*
		High Tech		**7.827**** *(3.824)*
	Downturn	Low Tech		**11.16***** *(2.806)*
		High Tech		**9.558***** *(2.711)*
Observations			624	624
R-squared			0.367	0.369

Note: The dependent variable is the average annual growth rate in labor productivity per hour for the period 1995-2005 for each industry in each country. Initial Relative Labor Productivity is the ratio of industry labor productivity per hour to total manufacturing labor productivity per hour in 1995. Inventories to Sales is the median ratio of total inventories over annual sales for US firms in the same industry for the period 1980-1989. Labor Costs to Sales is the median ratio of labor costs to shipments for US firms in the same industry for the period 1980-1989. Real Short term Interest Rate Counter-Cyclicality upturn (resp. downturn) is the coefficient of the output gap when Real Short Term Interest Rate is regressed for each country on a constant and the output gap, the output gap being above (resp. below) median The interaction variable is the product of variables in parentheses. The coefficient for the interaction term is estimated separately for high tech and low tech industries. (cf. list of industries in each category in appendix). Standard errors -clustered at the industry level- are in parentheses. All estimations include country and industry dummies. Significance at the 1% (resp. 5%; 10%) level is indicated by *** (resp. **; *).