

Credit Constraints, Cyclical Fiscal Policy and Industry Growth*

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Abstract

This paper evaluates whether the cyclical pattern of fiscal policy can affect growth. We first build a simple endogenous growth model where entrepreneurs face a tighter borrowing constraint when they invest in more risky yet more productive projects. In this framework, a counter-cyclical fiscal policy prompts entrepreneurs to take more risky bets because it dampens the negative impact of more risky investments on the access to external finance. A stabilizing fiscal policy is therefore growth enhancing. Secondly the paper takes this prediction to the data following the Rajan-Zingales (1998) methodology. Empirical evidence shows that (i) value added and productivity growth -measured at the industry level- is larger when fiscal policy -measured at the country level- is more counter-cyclical, (ii) the positive growth effect of fiscal policy counter-cyclicity is larger in industries with heavier reliance on external finance.

Keywords: growth, financial dependence, fiscal policy, counter-cyclicity

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1 Introduction

Standard macroeconomic textbooks generally present macroeconomics in two separate bodies: in the long term an economy's performance is essentially influenced by structural characteristics, such as education, R&D, openness to trade, competition or financial development. In the short term however, the economy is essentially influenced by the shocks it undergoes and stabilization policies undertaken (fiscal and monetary policy). These two approaches have been considered for long as separate and distinct bodies of research. Stabilization policies for instance are considered to have no significant impact on the long run performance of an economy. The point of this paper is to investigate (the relevance of) this dichotomy focusing on the impact, if any, of cyclical fiscal policy on growth. To answer this question, we take a two step approach. First we build a simple model to illustrate how the cyclical component of fiscal policy can affect growth. Second we take the theoretical predictions to the data and provide empirical evidence of a statistically and economically significant impact of stabilizing fiscal policy on growth.

The theoretical part of the paper is based on a model with risk neutral entrepreneurs and lenders. Entrepreneurs can choose a project to invest in among a set of existing projects, the more productive being also the more risky. When states of nature are non verifiable -or alternatively if verifiability is sufficiently costly- then entrepreneurs who invest in more productive projects also face a tighter borrowing constraint because higher average productivity implies lower output in bad states and hence a lower ability to pay back liabilities. To put it in a nutshell, when states of nature are non verifiable, pledgeable income is negatively related to average productivity which creates a trade-off for entrepreneurs in their technological choice. The government can then alter this trade-off by imposing state contingent taxes. Namely a pro-cyclical fiscal policy, i.e. high taxes in bad states and low taxes in good states, tends to amplify the negative effect of more risky investments on the ability to borrow. As consequence, entrepreneurs optimally choose less risky and less productive projects. On the contrary a counter-cyclical fiscal policy, i.e. low taxes in bad states and high taxes in good states, tends to dampen the negative effect of more risky investments on the ability to borrow which prompts entrepreneurs to take more risky bets. Moreover the positive effect of counter-cyclical fiscal policy on productivity growth increases with the share of investment financed through external capital

but decreases with income pledgeability. The second part of the paper is devoted to test empirically these three predictions: (i) counter-cyclical fiscal policy is growth enhancing, (ii) the growth enhancing impact of counter-cyclical fiscal policy should increase with the share of investment financed through external capital, (iii) but decrease with income pledgeability.

A simple approach to assessing the impact of counter-cyclical economic policies on growth consists in running a regression with a growth indicator (output or labour productivity) as a dependent variable and an indicator of counter-cyclical in economic policies as an explanatory variable. Every thing else equal, this framework can tell whether the cyclical properties of macro policy do affect growth significantly and in case they do, how much growth increase can be expected from a change in macro policy, for instance moving from a procyclical to an acyclical policy. However there are three important issues that preclude a proper interpretation of this type of straightforward exercise. First cyclical in economic policies (by now, we will only focus on fiscal policy) is generally captured through a unique time-invariant parameter which only varies in the country dimension. As a result, standard cross-country panel regression cannot be used to assess to the effect of the cyclical pattern of fiscal policy on growth in as much as the former is perfectly collinear to the fixed effect that is traditionally introduced to control for unobserved cross-country heterogeneity. To solve this issue, Aghion and Marinescu (2007) introduce time-varying estimates of fiscal policy cyclical¹. While this is a step forward in the effort to capturing the growth effect of fiscal policy cyclical –while at the same time controlling for unobserved heterogeneity–, this is at the cost of losing precision in the estimates of fiscal policy cyclical. Secondly the causality issue –namely does fiscal policy cyclical affect growth or does growth modify the cyclical pattern of fiscal policy– cannot be properly addressed with a macro level analysis. This question is fundamental to derive the policy implications of the empirical exercise. In particular estimating the growth gain/cost to a change in the cyclical pattern of fiscal policy highly depends on whether the causality issue has been properly addressed. One particular reason is that fiscal policy cyclical is used in growth regressions as a right hand side variable while the estimation of time-varying fiscal policy cyclical requires using the full data sample. In these circumstances, instrumental

¹Time varying estimates of cyclical can be obtained with a number of non parametric methods.

variable cannot be of any help.² A final concern is identification. A macro level analysis cannot help testing the theoretical mechanism underlying the relationship if any between cyclical fiscal policy and growth. let alone the problem of control variables –the econometrics must be robust to the inclusion of a number of control variables representing other standard theoretical models-. Hence even if the argument -that the cyclical pattern of fiscal policy is important for growth- is empirically verified, the channel through which this conclusion works remains uncovered with a macro level analysis.

The approach we provide in this paper proposes a possible remedy for each of these issues. Based on the theoretical predictions developed above, we apply the methodology provided by Rajan and Zingales (1998) in their seminal paper and draw a relationship between growth at the industry level to fiscal policy cyclicity at the macro level. Moreover as predicted by our model, fiscal policy cyclicity is interacted by industry level external financial dependence to test whether industries which rely more heavily on external finance benefit more from counter-cyclical fiscal policy. This approach proves to be useful in solving the issues stated above. First, because we use a country - industry panel dataset, we can estimate counter-cyclicity in fiscal policy based on a time-invariant parameter. As previously fiscal policy counter-cyclicity is collinear to country fixed effects. However we test the conclusion that the growth effect of fiscal policy counter-cyclicity is larger for industries that rely more on external finance. Hence the interaction between a country level and an industry level variable solves the collinearity issue. Second the interaction term helps solve the identification issue because it shows that the effect of fiscal policy counter-cyclicity goes through the financial structure of the firm – or the industry- hence validating the theoretical framework described above. Finally and most importantly, this approach is a step forward in dealing with the causality issue. Because macro policy can affect industry level growth while the opposite - industry level growth affecting macro policy- is much less likely, this approach can be useful to assess whether the cyclical pattern of fiscal policy has a causal impact on growth.³ There is however a downside to the industry level investigation.

²IV regressions usually use internal instruments, i.e. lagged values of right hand side variables. In the case of time-varying estimates of fiscal policy cyclicity, that boils down to using forward information as instruments, in which case instruments cannot be exogenous.

³Fiscal policy cyclicity could be endogenous to the industry level composition of total output if for example industries that benefit more from fiscal policy counter-cyclicity do lobby more for counter-cyclical fiscal policy. However to the extent that there are decreasing returns to scale (which is plausible given that we focus here on manufacturing industries and happens to be empirically verified), that should rather imply a downward bias in our estimates of the positive impact of fiscal policy counter-

The difference in difference approach has nothing to say about the magnitude of the macroeconomic growth gain/loss to different patterns of cyclicity in fiscal policy. The empirical estimates of the industry level growth gain due to a change in the cyclical pattern of fiscal policy are, above all, qualitative evidence of the growth effect of counter-cyclical fiscal policy. Results detailed below cannot be used to derive directly the growth implications of different fiscal policies.⁴

The empirical results of the paper can be divided into three main parts. First fiscal policy counter-cyclicity - measured as the sensitivity to the output gap of total or primary fiscal balance to GDP - has a positive significant and robust impact on industry growth, larger reliance on external finance amplifying this effect. This property holds both for real value added as well as for labour productivity growth. Based on these results, the magnitude of the diff-in-diff effect is derived, i.e. how much extra growth following an increase in fiscal policy counter-cyclicity and financial dependence. Figures happen to be relatively large, especially when compared to those obtained from similar investigations (especially those in Rajan and Zingales, 1998), hence suggesting that the effect of counter-cyclical fiscal policy is both statically and economically significant. Second we go through a number of robustness checks by introducing a number of control variables. We show that the impact of counter-cyclical fiscal policy on growth is indeed robust to the inclusion of other growth determinants. Third, we provide different partitions of fiscal policy (expenditures, revenues, consumption, investment, etc. . .) and look at which component is indeed driving the positive growth effect of counter-cyclical fiscal policy. We uncover two unexpected results. First counter-cyclicity in government consumption affects significantly industry growth while counter-cyclicity in government investment does not. Second counter-cyclicity in government receipts has no significant effect on industry growth but counter-cyclicity in government expenditures does have a significant positive impact on industry growth. Finally an instrumental variable estimation is carried out whose results are very close to those obtained in the very first regressions, thus confirming both qualitatively and quantitatively the first results of the paper.

cyclicity on growth. Hence controlling for this possible endogeneity relationship, in case it is first order, would probably reinforce the results we obtain here by reducing this downward bias.

⁴A further limit to a direct interpretation of our results relates to our focus on growth for manufacturing industries while the total share of manufacturing industries in total value added is about one third not more. Deriving the global macroeconomic effect of fiscal policy cyclicity would require an assessment of the impact on the service sector.

The rest of the paper is organized as follows. The next section lays down the theoretical model and derives the main predictions to be tested empirically. Section 3 details the econometric methodology and presents the data used in estimations. The basic as well as the more elaborate specifications are tested in section 4. In particular we check if the growth impact of counter-cyclical fiscal policy is robust to the inclusions of structural characteristics. We also investigate which part of fiscal policy is indeed important for growth through its counter-cyclicity (expenditures, revenues, consumption, investment, etc...). Conclusions are eventually drawn in section 5.

2 Cyclical fiscal policy and growth: a toy model

2.1 Basic setup

The environment The model builds upon Aghion, Angeletos, Banerjee and Manova (2008), henceforth AABM. We consider a discrete time model of an economy populated by a continuum of two-periods lived entrepreneurs (firms). Each firm starts out with a positive amount of wealth $W = wT$, where T denotes the accumulated knowledge at the beginning of the current period, and w denotes the firm's knowledge adjusted wealth. Initial wealth can be invested in two different projects: a short term investment project that generates output in the current period and a long term innovation project which, when successful, generates production with higher productivity next period. The short term investment project may involve maintaining existing equipment, or expanding a business using the same kind of technology and equipment, or increasing marketing expenses. The long term project may consist in learning a new skill, learning about a new technology, or investing in R&D. Investing in the long term project increases the stock of knowledge available in the economy next period, whereas investing in the short term project does not contribute to knowledge growth.

Both, short term and long term profits are proportional to market demand (see Acemoglu and Linn (2006)). More specifically, by investing capital $K = kT$ in the short term project, where k denotes the

knowledge adjusted short-run capital investment, a firm gets short-run profits

$$\Pi_1(K, P_j) = \beta P_j K = T\pi_1(k, P_j),$$

where

$$\pi_1(k, P_j) = \beta P_j k$$

is the knowledge-adjusted short-run profit, β is a constant, P_j is proportional to the private component of demand, and j denotes the aggregate state of the economy. The realization of state $j \in \{L, H\}$ capture an aggregate trade (or market size) shock P , which can take two value $P_H > P_L$ and follows a Markovian process with probability p of remaining in the same state in the next period.

Now, consider firms' long term investments. As in AABM, we shall assume that after the R&D investment $Z = zT$ has been incurred, where z denotes the knowledge-adjusted long-term innovative investment, the firm faces an idiosyncratic liquidity shock $C = cT$, where c is uniformly distributed on the interval $[0, \bar{c}]$. Only those firms that are able to raise enough money to pay their liquidity cost, will be able to produce in the second period.

Given that all firms start out with same initial wealth $W = wT$, there is no borrowing and lending in equilibrium at the beginning of a period. However, once the idiosyncratic liquidity shocks are realized, firms with low liquidity shocks will typically lend to firms facing higher liquidity shocks.⁵

As in AABM, we assume that due to ex post moral hazard considerations⁶ firms cannot borrow more than $\mu - 1$ times their current cash flow in order to overcome the liquidity shock. We can interpret μ as a proxy for the tangibility of the firm' assets: more tangible assets are typically associated with lower monitoring costs for potential creditors, and therefore to a higher value of the credit multiplier μ ⁷. The parameter \bar{c} reflects for example the extent to which the firm depends upon external finance: the higher \bar{c} , the less likely

⁵Credit constraints prevent firms from achieving full insurance against these idiosyncratic liquidity shocks.

⁶See Aghion, Banerjee and Piketty (1999).

⁷Following Aghion, Banerjee and Piketty (1999) or AABM, we take μ to be constant over time. Alternative formulations, for example Holmstrom and Tirole (1995) based on ex ante moreal hazard, would generate a credit multiplier which is negatively correlated with the interest rate., and therefore typically procyclical. A procyclical μ would only reinforce the optimality of countercyclical fiscal policy established later in this section.

it is that the firm will be able to cover its liquidity shock using only its retained earnings $T\pi_1(k, P_j)$. In fact, given the uniformity of the distribution of liquidity costs, long-term investments will survive the liquidity shock with probability

$$\delta(P, k) = \Pr(cT \leq \mu T\pi_1(k, P_j)) = \min\left(\frac{\mu\beta Pk}{\bar{c}}, 1\right),$$

which is increasing in μ and decreasing in \bar{c} .

A firm that has invested $Z = zT$ in the long term project and then manages to overcome its liquidity shock⁸, will innovate with probability λz and then earn ex post profits

$$\beta\gamma T (E(P_h|j) + g_j),$$

where γ is a parameter which reflects the efficiency of R&D investment, $E(P_h|j)$ is the expected (private) market size next period, conditional upon the economy being in state j today, and g_j denotes the volume of government expenditures tomorrow if the economy is in state j today⁹. If innovation does not occur production tomorrow is competitive, therefore firms earn zero profit, yet g_j is still spent. We assume that entrepreneurs are risk-neutral and consume all their wealth in the second period of their life.

We assume that $\lambda\gamma(E(P_h|j)) > P_j$, so that absent credit constraints and binding liquidity shocks, entrepreneurs invest all their initial endowment in the long term project, no matter government expenditures g_j over the cycle.

Growth Knowledge growth results entirely from aggregate R&D intensity. If T_t denotes the knowledge stock at the beginning of period t , we thus assume¹⁰

$$\frac{T_{t+1} - T_t}{T_t} = \int_0^1 z_t di = z_t.$$

⁸The model is built in order to illustrate the empirical results that the more externally financially dependent firms are the one that benefits the most from contracyclicality. Hence we want to abstract from other factors that will favor contracyclicality, which is why we use linear technologies.

⁹Our analysis encompasses the case where tomorrow's private revenue is proportional, not equal to the expected private market size $E(P_h|j)$. This just involves reinterpreting the multiplier β .

¹⁰In AABM we consider a variant of this model where only successful innovators (those who overcome the liquidity shock) contribute to knowledge growth. Below we discuss how our results would be modified if we adopt this alternative specification.

Government policy Unlike private agents, the government has access to costless and unbounded access to international credit each period before the state of the world is revealed.¹¹ Government's policy is determined each period before the current state j of nature is revealed, but can be dependent on the previous state of nature (denoted by x). Government policy therefore consists of a 4-uple $s_L^x, s_H^x, g_L^x, g_H^x$, where s_j^x denote the subsidies/tax that a firm must pay before initiating its investments, and g_j^x denotes the government expenditures next period, if the current state is j and the state last period was x . The timing of government intervention, can be described as follows: (i) at the beginning of each period, before the state of nature j for that period is realized, the government chooses its policy $(s_j^x, g_j^x)_{j=L,H}$ which depends upon the state of the world x at the end of last period; (ii) once the current state of nature $j = H, L$ is realized, the government implements the policy (s_j^x, g_j^x) .

Timing of events The overall timing of events within each period, is as follows: (i) the state of nature j is realized; (ii) firms make their investment decisions, given their correct anticipations about government policy (s_j^x, g_j^x) ; (iii) liquidity shocks are realized and firms lend to or borrow from one another; (iv) firms that can overcome their idiosyncratic liquidity shocks innovate and thereby generate a profit next period.

2.2 A firm's maximization problem

In this subsection we take government policy as given and analyze firms' optimal investment decisions. Given that firms are ex ante identical, there exists a symmetric equilibrium where all firms make the same investment decisions, and we concentrate attention on this particular equilibrium. For simplicity we take the discount factor between two periods to be equal to 1. Then, once the current state of nature j is realized, a representative firm in state j chooses knowledge-adjusted investments (k, z) to maximize the expected

¹¹We shall assume that the government can credibly commit to a budget limit. This, in turn, is consistent with the assumption that the government can borrow more and at lower cost than private agents. Here, we also refer the reader to Homstrom and Tirole (1998) on private versus public provisions of liquidity.

present value, that is current profits plus expected future revenues:

$$\begin{aligned} & \max \left\{ \beta P_j k + \lambda \gamma z \min \left(\frac{\mu \beta P_j k}{\bar{c}}, 1 \right) E_{h|j} (\beta (P_h + g_j^x)) \right\} \\ \text{subject to} \quad & : \quad k + z \leq w + s_j^x. \end{aligned}$$

One can first establish:

Lemma 1 *If there is always a positive probability of unsuccessful innovation, the manager chooses $z_j = \max(\frac{1}{2} \left(w + s_j^x - \frac{\bar{c}}{\mu \lambda \beta \gamma (E_{h|j}(P_h) + g_j^x)} \right), 0)$.*

In particular when

$$z_j = \frac{1}{2} \left(w + s_j^x - \frac{\bar{c}}{\mu \lambda \beta \gamma (E_{h|j}(P_h) + g_j^x)} \right) > 0,$$

then government taxes/subsidies s_j^x do not affect the difference between the long term innovative investment z and the short term capital investment k : a higher s increases the amount of cash available for firms to invest, however it does not affect the relative profitability of long versus short term investments. Increasing g_j^x will instead affect the market size for successful innovators tomorrow and therefore the relative profitability of long term innovative investment compared to short run capital investment.

Remark 1 *The fact that government expenditures are targeted towards long term projects is not the driving force behind this last conclusion. To see this, suppose instead that government expenditures decided at $t - 1$, also affect the market for short term projects at t . This has two effects on firms born in period t : on the one hand, investing in short term projects becomes more attractive because market size is increased in the short run; on the other hand, firms now have more cash in hand to overcome the potential liquidity shock. As long as we are in an interior solution case (with $z > 0$ and $\frac{\mu \beta (P_j + g_x) k}{\bar{c}} < 1$) these two forces turn out to exactly offset each other.¹²*

¹² Indeed the representative firms then choose k, z such that

$$\begin{aligned} & \max \left\{ \beta (P_j + g_x) k + \lambda z \min \left(\frac{\mu \beta (P_j + g_x) k}{\bar{c}}, 1 \right) E_{h|j} (\beta (P_h + g_j^x)) \right\} \\ \Leftrightarrow & \max \left\{ \beta k + \lambda z \left(\frac{\mu \beta k}{\bar{c}} \right) E_{h|j} (\beta (P_h + g_j^x)) \right\} \\ \text{subject to} \quad & : \quad k + z \leq w + s_j^x \end{aligned}$$

Remark 2 Whether profits of short term investments are linear in k (as it is the case here) or proportional to k^α (as it is the case in AABM) does not affect our results: in the latter case, we would then get $z_j = \frac{1}{1+\alpha} \left(w + s_j^x - \frac{\alpha \bar{c}}{\mu \lambda \beta \gamma (E_{h|j}(P_h) + g_j^x)} \right)$.

2.3 Growth effect of increasing the countercyclicality of government spending

The main conjecture we consider in the empirical part of the paper, is that a more countercyclical fiscal policy, and particularly more countercyclical government expenditures, are more growth-enhancing in sectors that are more dependent on external finance or in sectors with more intangible capital. Here, we show how our toy model generates this prediction.

More formally, consider the case where in both states of the world $z_j = \frac{1}{2} \left(w + s_j^x - \frac{\bar{c}}{\mu \lambda \beta \gamma (E_{h|j}(P_h) + g_j^x)} \right)$.

Then, the expected growth rate is simply equal to

$$E(z|x) = pz_x + (1-p)z_{-x}$$

or equivalently

$$E(z|x) = \frac{1}{2} \left(w + ps_x^x + (1-p)s_{-x}^x - \frac{\bar{c}}{\mu \lambda \beta \gamma} \left(\frac{p}{E_{h|x}(P_h) + g_x^x} + \frac{1-p}{E_{h|-x}(P_h) + g_{-x}^x} \right) \right).$$

Now consider the growth effect of moving from an acyclical policy whereby $g_x^x = g_{-x}^x = g^x$ to the countercyclical policy $g_L^x = g^x + (1-p_L)\varepsilon$ and $g_H^x = g^x - p_L\varepsilon$ (with $p_L = p$ if $x = L$, and $p_L = 1-p$ if $x = H$). In other words, we consider the growth effect of a mean preserving spread in government consumption, with $g_L^x - g_H^x = \varepsilon$.

We have:

so the interior solution is still given by

$$z_j = \frac{1}{2} \left(w + s_j^x - \frac{\bar{c}}{\mu \lambda \beta \gamma (E_{h|j}(P_h) + g_j^x)} \right)$$

$$\begin{aligned}
& E(z|x) \\
&= \frac{1}{2} \left(w + p_L s_L^x + (1 - p_L) s_H^x - \frac{\bar{c}}{\mu \lambda \beta \gamma} \left(\frac{p_L}{p P_L + (1 - p) P_H + g_L^x} + \frac{1 - p_L}{p P_H + (1 - p) P_L + g_H^x} \right) \right).
\end{aligned}$$

Thus

$$\begin{aligned}
\frac{\partial E(z|x)}{\partial \varepsilon} &= \frac{1}{2} \frac{\bar{c} p (1 - p)}{\mu \lambda \beta \gamma} \left(\frac{1}{(p P_L + (1 - p) P_H + g^x + (1 - p_L) \varepsilon)^2} - \frac{1}{(p P_H + (1 - p) P_L + g^x - p_L \varepsilon)^2} \right) \\
&> 0
\end{aligned}$$

as long as $(2p - 1)(P_H - P_L) > \varepsilon$.¹³

Moreover

$$\frac{\partial^2 E(\lambda z|x)}{\partial \bar{c} \partial \varepsilon} > 0$$

Thus the more firms depend upon external finance (that is, the higher \bar{c}), the more positive is the growth response to a more countercyclical expenditures policy.

Similarly

$$\frac{\partial^2 E(\lambda z|x)}{\partial \mu \partial \varepsilon} < 0$$

So the tighter firms' credit constraints, for example because of higher asset intangibility (that is the lower μ), the more growth benefits from countercyclical policy.

A mean preserving spread of s_j on the contrary has no impact on growth, since the equilibrium R&D intensity z is linear in the amount of initial wealth available for investment. Hence:

Proposition 2 *When optimal investment is an interior solution, a mean preserving spread in government expenditures towards more countercyclical increases long-term investment in R&D as long as $g_L^j - g_H^j \leq$*

¹³We can see from the above expression that if μ was procyclical the benefit from countercyclicality would be higher. Indeed, in this case, under laissez-faire firms would cut long term investments by more during slumps.

$(2p - 1)(P_H - P_L)$. Moreover, this effect is increased when \bar{c} is higher or μ is lower. On the contrary, a change in $s_L^j - s_H^j$ does not have any long-term growth effect.

Thus, a smaller expected market size for long term projects reduces the amount of knowledge augmenting investment. Given that the credit constraint induces a concavity in the firm's profit function (since more long term investment also means a lower probability to overcome the liquidity shock), more countercyclical expenditure policy will increase expected growth. The probability that long term projects do not carry through, is increasing in z , and all the more so when \bar{c} is higher or μ is lower. This in turn explains why R&D incentives and therefore growth will be enhanced by a more countercyclical policy, all the more in firms which depend more upon external finance or in firms with less tangible assets.

One can show that the growth-maximizing level of countercyclicity is obtained for $\varepsilon = (2p - 1)(P_H - P_L)$ (as long as this translates into positive government spending in both states of the world), that is for expected long term projects with market size equalized across states of nature.

Remark 3 *One could go further and derive the growth maximizing policy subject to the constraint that the budget must be balanced in expectation - and also subject to some upper limit on the allowed government deficit in each period. In Appendix B we show that the growth-maximizing policy subject to these constraints, is to increase the market size for long term investments up to the point where the marginal benefit of government expenditures (which is to increase the share of entrepreneurial wealth devoted to long-term investments) is equal to its marginal cost (which is to reduce the entrepreneur's ex ante wealth because of taxation). This optimal market size is given by $\sqrt{\frac{\bar{c}}{\mu\lambda\beta}}$: in other words, since the expected private market size is smaller when the economy is currently in a slump, government expenditures should be higher in a slump than in a boom in order to maximize RD incentives and thereby knowledge growth. Finally, letting the government smooth its budget over the cycle makes it possible to have a countercyclical policy in government expenditures without requiring a procyclical policy in taxes.*

To summarize the main predictions of the model: (i) countercyclical government expenditures are more growth-enhancing for firms that are more dependent upon external finance or in firms with less tangible

assets; (ii) it is the countercyclicality of government expenditures, more than that of government tax or subsidies, which matter for growth in economies with such firms. We now confront these predictions to the data.

3 Data and econometric methodology

The empirical investigation is based on a regression where the dependent variable (henceforth LHS variable) is the average annual growth rate of real value added or alternatively labour productivity in industry j in country k for a given period of time. Labour productivity is defined as the ratio of real value added to total employment.¹⁴ On the right hand side, industry and country fixed effects $\{\alpha_j; \beta_k\}$ control for unobserved heterogeneity between industries and countries. The variable of interest $(fd_j) \times (fpc_k^{t,t+n})$, is the interaction between industry j external financial dependence and country k fiscal policy cyclicality for the period $[t, t+n]$. Finally, a control for initial conditions is included. When the LHS variable is the growth rate of real value added, the ratio of initial real value added in industry j in country k to total real value added in the manufacturing sector in country k controls for initial conditions. When the LHS variable is labour productivity growth, the ratio of initial labour productivity in industry j in country k to labour productivity in the manufacturing sector in country k is included. Denoting y_{jk}^τ (resp. y_k^τ) real value added or alternatively labour productivity in industry j (resp. in manufacturing) in country k in year τ and ε_{jk} as an error term, the empirical investigation is based on estimating the regression

$$\frac{1}{n} \left[\ln \left(y_{jk}^{t+n} \right) - \ln \left(y_{jk}^t \right) \right] = \alpha_j + \beta_k + \gamma (fd_j) \times (fpc_k^{t,t+n}) - \delta \log \left(\frac{y_{jk}^t}{y_k^t} \right) + \varepsilon_{jk} \quad (1)$$

Following Rajan and Zingales (1998) we measure industry level external financial dependence with firm level data for the US. External financial dependence is computed as the ratio of capital expenditures minus cash flow from operations divided by capital expenditures across all firms in a given industry. Proceeding this way is valid as long as (i) differences in financing across industries are largely driven by differences in

¹⁴Although we also have access to industry level data on hours worked, we prefer to focus on productivity per worker and not productivity per hour because measurement error is more likely to affect the latter than the former.

technology, (ii) technological differences persist across countries, (iii) countries are relatively similar in terms of overall firm environment. Under these three assumptions, the US based measure of external finance is likely to be a valid measure of external financial dependence for countries other than the US.¹⁵ In reality these three conditions are likely to be verified. For instance if pharmaceuticals require proportionally more external finance than textiles in the US, this is likely to be the case in other countries. Moreover given that we focus on a subset of developed OECD countries, cross-industry differences are likely to persist across countries. Finally because the US is one of the most developed capital market in the world, US based measures of external financial dependence are likely to give the least noisy measures of industry level demand for external finance.

The last ingredient needed to estimate (1) is fiscal policy cyclicity. A simple benchmark to begin with consists in estimating fiscal policy cyclicity as the marginal change in fiscal policy following a change in the output gap. Hence country k fiscal policy cyclicity ($fpc_k^{t,t+n}$) over the period $[t; t+n]$ can be estimated with the following regression

$$def_k^\tau = \eta_k + (fpc_k^{t,t+n}) z_k^\tau + u_k^\tau \quad (2)$$

where $\tau \in [t; t+n]$, def_k^τ is a measure of fiscal policy in country k in year τ (fiscal balance, primary balance, expenditures, revenues, etc. . .), z_k^τ is a measure of the output gap of the economy in country k in year τ , η_k is a constant and u_k^τ is an error term. The output gap is measured as the difference between output and trend output. It therefore represents the position of the economy in the cycle. Equation (2) is estimated for each country. For instance if the LHS is fiscal balance to GDP, a positive (resp. negative) parameter ($fpc_k^{t,t+n}$) reflects a counter-cyclical (resp. pro-cyclical) fiscal policy as the government fiscal balance is larger (resp. smaller) when economic conditions improve.

While this benchmark equation is extremely simplistic, it must be regarded as a first step. More elaborated fiscal policy specifications can be considered. In particular, following Gali and Perrotti (2003) fiscal policy cyclicity can be measured in a regression including a debt stabilization motive and controlling for fiscal

¹⁵Note however that this measure is unlikely to be valid for the US as it likely reflects the equilibrium of supply and demand for capital in the US and is hence endogenous.

policy persistence. Noting b_k^τ the ratio of public debt to GDP in country k in year τ , a more elaborate estimation of fiscal policy cyclicity $\left(fpc_{2,k}^{t,t+n}\right)$ over the period $[t; t+n]$ can be obtained estimating the following equation:¹⁶

$$def_k^\tau = \alpha_k + \left(fpc_{2,k}^{t,t+n}\right) z_k^\tau + \beta_k b_k^{\tau-1} + \gamma_k def_k^{\tau-1} + \varepsilon_k^\tau \quad (3)$$

To estimate the basic specification (1) we can rely on a simple OLS procedure which if need be can be corrected for heteroscedasticity bias. The reason why we can proceed this way is that the right hand side variable i.e. the interaction term between industry financial dependence and fiscal policy cyclicity is in theory exogenous to the LHS variable, industry value added growth or industry labour productivity growth. On the one hand financial dependence is measured in the US while industry growth on the LHS is considered for other countries than the US. Hence reverse causality in the sense that industry growth outside the US could affect the industry financing structure in the US seems quite implausible. Moreover in some cases the LHS variable is measured on a post 1990 period while the financial dependence indicator is always measured on a pre 1990 period, hence further reducing the possibility of reverse causality. On the other hand fiscal policy cyclicity is measured at the macro level while the LHS variable is measured at the industry level which in theory precludes any case for reverse causality as long as each sector individually represents a small share of total output in the economy. Moreover as a cross-check of the validity of these arguments, we also carry out instrumental variable regressions where fiscal policy cyclicity is instrumented. We then verify that equations passing over-identification tests confirm our results.¹⁷

We focus our empirical investigation on the industrialized OECD countries, i.e. we abstract from Central and Eastern European countries (Hungary, Poland, Slovakia, and the Check Republic), and emerging markets (Mexico, Turkey and South Korea). We end up with a panel of seventeen countries which as stated above does not include the US. Data is available from 1980 to 2005. We consider six different time spans 1980-2005, 1980-2000, 1985-2005, 1985-2000, 1990-2005, 1990-2000. The latter cases are useful because Germany can

¹⁶Results presented in this paper are based on the simple fiscal policy counter-cyclicity specification (2). Using specification (3) does not modify the main conclusions of the paper.

¹⁷Next tables will show a large degree of similarity between OLS and IV estimations, thus confirming that our empirical strategy properly addresses the reverse causality issue, even in the case of OLS estimation.

then be included to our sample.¹⁸ Data used come from three different sources. Industry level real value added growth and labour productivity growth data come from EU KLEMS dataset which provides annual industry level data for a large number of indicators.¹⁹ The primary source of data on industry financial dependence is Compustat which gathers balance sheets and income statements for US listed firms. We draw on Rajan and Zingales (1998) and Raddatz (2006) to compute dataset the industry level indicators for financial dependence.²⁰ Finally macroeconomic fiscal and other control variables come from the OECD Economic Outlook dataset and from the World Bank Financial Development and Structure database.²¹

4 The basic specification

We first estimate the benchmark equation (1) in the case where the LHS variable is real value added growth and fiscal policy cyclicality is measured using equation (2). We consider two different cases; one where the LHS variable of (2) is total fiscal balance to GDP (table 1a) and another where the LHS of (2) is primary fiscal balance to GDP (table 1b).

Insert table 1a here

Insert table 1b here

As detailed above, we consider six different time spans as is shown in each table, fiscal policy cyclicality being measured in each regression on the relevant time period. Empirical results show that real value added growth is significantly and positively affected by the interaction of financial dependence and fiscal policy cyclicality: a larger sensitivity of total fiscal balance -or net primary fiscal balance- to GDP to the output gap raises industry real valued added growth, and the more so for industries with higher external financial dependence. Note that estimated coefficients are highly significant -in spite of the relatively conservative standard errors

¹⁸See appendix for country sample and other details on data.

¹⁹Data is available at the following address: http://www.euklems.net/data/08i/all_countries_08I.txt

²⁰Rajan and Zingales data is accessible at the following address: <http://faculty.chicagogsb.edu/luigi.zingales/research/financing.htm>

²¹OECD Economic Outlook dataset is accessible at the following address: <http://titania.sourceoecd.org>. The World Bank Financial Development and Structure database is accessible at the following address: <http://siteresources.worldbank.org>

estimates given clustering at the country level- and relatively stable across periods especially in the case where the fiscal policy indicator is the net primary fiscal balance to GDP. Finally estimated coefficients are usually larger when the fiscal policy indicator is the total fiscal balance to GDP. This sounds natural given that sensitivity to the output gap is likely to be lower for total than for primary fiscal balance (cf. figure 1 and figure 2 in appendix).²² These results can be extended to the case where labour productivity growth is the LHS variable.

Insert table 2a here

Insert table 2b here

As is shown in table 2a and 2b, labour productivity growth is significantly affected by the interaction of financial dependence and fiscal policy cyclicalities: a larger sensitivity of total fiscal balance -or net primary fiscal balance- to GDP to the output gap raises industry labour productivity growth, and the more so for industries with higher external financial dependence. Hence decomposing real value added growth into labour productivity growth and employment growth, this last set of regressions shows that the growth gain in real value added due to counter-cyclical fiscal policies is indeed driven both by a growth gain in employment and a growth gain in labour productivity growth. Comparing the estimated coefficients in table 1a and table 2a shows that approximately 60 to 80% of the gain in real value added growth due to a more counter-cyclical fiscal policy is attributable to a increase in labour productivity growth while 20 to 40% is due to an increase in employment. Similar -although slightly larger- figures are obtained from comparing table 1b and table 2b (70 to 80% of the gain in real value added growth due to a more counter-cyclical fiscal policy is attributable to a increase in labour productivity growth).

The natural question is then how big are the numbers estimated? To give a sense of the magnitudes involved here, we compute the growth gain for an industry moving from the 25% to the 75% percentile in external financial dependence in a country where fiscal policy counter-cyclicalities would also move from the

²²For instance, net primary fiscal balance to GDP is almost always counter-cyclical (positive output gap sensitivity) while total fiscal balance to GDP is pro-cyclical in a number of countries (negative output gap sensitivity).

25% to the 75% percentile, measuring fiscal policy with primary fiscal balance to GDP. The approximate growth gain in terms of real value added is between one and a half and two and a half percentage points per year while the growth gain in terms of productivity growth is around one percentage point per year.

Time Period	1980-2000	1980-2005	1985-2000	1985-2005	1990-2005	1990-2000
Table 1b	1,30%	1,29%	1,77%	2,00%	1,73%	2,08%
Table 2b	0,86%	0,91%	1,36%	1,40%	1,43%	1,47%

Table 3: Growth gain from a change in financial dependence and fiscal policy cyclicity

These numbers are fairly large especially if compared with the original results in Rajan and Zingales (1998). According to their results the real value added growth gain to moving from the 25% to the 75% percentile in terms of financial development and external financial dependence is roughly about 1% per year. Hence some of our estimates for labour productivity growth are larger than their estimates for real value added growth. One of the main reasons for this difference is that dispersion across countries in the cyclicity of primary fiscal balance is indeed very large. Hence moving from the 25% to the 75% percentile in terms of primary fiscal balance to GDP counter-cyclicity implies a very large change in the design of fiscal policy along the cycle. Moreover this simple computation does not take into account the possible costs associated with the transition from a steady state with low fiscal policy counter-cyclicity to a steady state with high fiscal policy counter-cyclicity. It is therefore only meant to suggest that differences in fiscal policy counter-cyclicity can be an important driver of differences in value added and productivity growth at the industry level.

Before going into further investigation, it is worth looking at two issues. The first one consists in verifying whether any particular country in the sample is indeed driving the empirical results. To examine this point we withdraw countries one by one and check whether the main results still hold.

Insert table 4a here

Table 3a indeed shows that the interaction of industry level external financial dependence and fiscal policy

counter-cyclicalities are always a significant determinant of industry real value added growth. Moreover estimated coefficients are relatively stable, which confirms that none of the countries in the sample is driving by itself the result that fiscal policy counter-cyclicalities are growth enhancing neither in terms of statistical significance nor in terms of economic magnitude. This is somewhat unsurprising given the relatively homogenous set of countries we focus on. Table 4a shows that this also applies to labour productivity: no single country in the sample is responsible for the positive effect of fiscal policy counter-cyclicalities on labour productivity.

Insert table 5a here

The second issue that deserves some attention is related to the existence of some industries with negative external financial dependence. These are industries for which capital expenditures have been lower than internally generated funds over the 1980-1990 period in the US. For such industries, a more counter-cyclical fiscal policy in the sense of a larger sensitivity of fiscal balance to the output gap translates into a lower (more negative) interaction term. A positive coefficient of the interaction term would then imply that a counter-cyclical fiscal policy is indeed growth reducing and not growth enhancing. To check the validity of this point, we separate the interaction term in two variables: an interaction between external financial dependence and fiscal policy counter-cyclicalities for industries with positive external financial dependence and an interaction term for industries with negative external financial dependence. If counter-cyclical fiscal policy is indeed growth enhancing we should obtain a positive coefficient when financial dependence is positive but a negative coefficient when financial dependence is negative.

Insert table 6a here

Insert table 6b here

Table 6a and table 6b essentially show that splitting the interaction term into two components depending on whether external financial dependence is positive or negative tends to confirm the result that fiscal policy counter-cyclicalities enhance real value added growth since the coefficient of the interaction term is positive

only when external financial dependence is positive. Hence for industries with negative external financial dependence, moving from a pro to a counter-cyclical fiscal policy moves the interaction term from a positive to a negative figure which raises growth given the negative estimated coefficient. Note however that magnitude and statistical significance of the estimated coefficient is larger for the positive component of the interaction term while the negative component is not always significant. This is not surprising given that industries with a negative external financial dependence represent a small share of the sample. Finally as is shown in table 7a and 7b, this result holds both for real value added as well as for labour productivity growth.

Insert table 7a here

Insert table 7b here

4.1 Opening the fiscal policy box

If fiscal policy, understood as fiscal balance, counter-cyclicality promotes growth in terms of value added and labour productivity, one is inclined to ask which component of fiscal policy is growth enhancing when counter-cyclical and which item of fiscal policy has no effect on growth through its counter-cyclicality. To provide a possible answer to this question, we examine two different decompositions. First we split fiscal policy into receipts and expenditures and ask counter-cyclicality in which component is (more) important for growth. Second, we divide fiscal expenditures between government consumption and government investment and ask a similar question.

Insert table 8a here

Insert table 8b here

Empirical evidence shows that counter-cyclicality in government receipts does not seem to play a significant role neither for real value added growth nor for labour productivity growth. This would suggest that the positive effect on growth of fiscal balance counter-cyclicalities is mainly coming from counter-cyclicalities in

expenditures. Indeed the interaction term between external financial dependence and counter-cyclical in government expenditures to GDP is a significant determinant of industry growth both for real value added and labour productivity.

Insert table 9a here

Insert table 9b here

This brings two remarks. First it seems that the the positive impact of fiscal policy counter-cyclical on growth does not stem from the simple effect of automatic stabilizers since the latter is presumably more relevant for government receipts than for government expenditures. Put differently, the positive effect of counter-cyclical fiscal policy goes beyond the simple effect of automatic stabilizers. Second the result that counter-cyclical in government expenditures is growth enhancing suggests that fiscal policy affects growth through a demand channel. If a countercyclical fiscal policy raises productivity growth by smoothing the aggregate demand, then it is natural that government expenditures are more important for stabilization than government receipts. In the model developed above, counter-cyclical government expenditures typically raise aggregate demand and hence the value of collateral in downturns which raises entrepreneurs' ability to invest in more productive, yet more risky projects. On the contrary counter-cyclical government receipts can do the same only as long as the effect of a reduction in taxes is not offset by the drop in aggregate demand. Next we focus on government expenditures and ask which type of expenditure is growth enhancing through its counter-cyclical? To do so we focus on the impact of government consumption and government investment on real value added growth.

Insert table 10a here

Insert table 10b here

In this case, empirical evidence seems to point out that counter-cyclical fiscal policy is growth enhancing mainly through government consumption not government investment since the former is significant while the

latter is not. There may be several reasons that can account for this result. First government consumption counter-cyclicalities are likely to exhibit larger variation across countries than government investment counter-cyclicalities because in most countries government investment is planned over long time horizons so that countries end up being relatively similar in terms of government investment counter-cyclicalities. On the contrary, government consumption counter-cyclicalities display much larger dispersion. As a matter of fact in our sample, dispersion across countries in government consumption counter-cyclicalities σ_c is about two times larger than dispersion in government investment counter-cyclicalities σ_i . Second, the volume of government investment is relatively small compared to the volume of government consumption. Indeed in our sample, average government consumption to GDP across countries m_c is more than six times larger than average government investment to GDP m_i .

Time Period	1980-2000	1980-2005	1985-2000	1985-2005	1990-2005	1990-2000
σ_c/σ_i	2,17	2,59	1,84	2,34	2,08	1,37
m_c/m_i	6,21	6,40	6,42	6,62	6,78	6,57

Table 11: Dispersion in government consumption relative to government investment

As a consequence the effect of government investment counter-cyclicalities is likely to be of second order importance compared to the effect of government consumption counter-cyclicalities. The empirical analysis for labour productivity growth delivers essentially a similar result. As in the case of real value added growth, counter-cyclicalities in government consumption are a significant growth predictor while counter-cyclicalities in government investment are not.

Insert table 12a here

Insert table 12b here

Hence the traditional distinction between government consumption -usually regarded as unproductive spending- and government investment -regarded as (more) productive spending- does not apply here. One reason for this result is possibly that countries where government consumption is more counter-cyclical are also coun-

tries where government consumption is more productive in the sense that it is more efficiently used as a substitute to private demand, especially in downturns.

4.2 Counter-cyclical and competing stories

Up to now we have provided evidence that countercyclical fiscal policy has a significant positive impact on industry real value added and labour productivity growth. In this section, we challenge this result by looking at how its significance changes when it competes with standard factors that are known to affect growth at the industry level. Put differently, how robust is the effect of counter-cyclical fiscal policy on growth? To what extent are we picking up other stories? While an exhaustive study to determine how the story related to stabilizing fiscal policy compares with alternative explanations would be very long, we propose to focus on a limited but insightful number of them. First if industries differ mainly in the split between internal and external funds to finance investment, then it seems natural that industries located in countries which have been borrowing from abroad, i.e. running current account deficits, should be growing faster because a current account deficit implies that the country as a whole is importing capital. On the contrary industries located in current account surplus countries should be growing slower, everything else equal. Empirical evidence shows however that this is not the case: the interaction of current account balance and external financial dependence has no significant impact neither on real value added growth nor on labour productivity growth while the impact of the interaction between external financial dependence and stabilizing fiscal policy is still significant. Moreover the magnitude of estimated coefficients is relatively unchanged while significance is enhanced. Hence the impact on growth of a stabilizing fiscal policy is robust to controlling for the current account balance.

Insert table 13a here

Insert table 13b here

Next we look at the impact of inflation. In theory one of the negative effects of inflation relates to its impact on the allocative efficiency of capital. When inflation is higher, the financial system allocates less efficiently capital. As a consequence, this negative effect is more likely to be verified for industries with high reliance on external finance because investors will face more difficulties to identify the high productivity projects which will translate into more capital allocated to low productivity projects. On the contrary, for industries with no external financial dependence, this negative effect does not apply by definition. Hence the negative impact of inflation should be dampened.

Insert table 14a here

Insert table 14b here

Empirical evidence provides two results. First inflation does exert a significant negative impact on industry growth which amplifies for industries with larger reliance on external capital. But this effect is robust only when real value added growth is on the LHS. Significance is lower or even absent when labour productivity growth is the dependent variable. What this means is that inflation is costly not necessarily because it reduces productivity growth but more likely because it reduces employment growth, firms adjusting their labour demand to cope with the misallocation of capital. This way, value added growth is hurt but productivity growth is not. Second, the effect of counter-cyclical fiscal policy is both significant and robust to the inclusion of inflation as a control variable. Put differently, the positive effect on growth of a stabilizing fiscal policy is not related to the fact that countries in which fiscal policy is more counter-cyclical would be countries with lower average inflation and hence higher allocative efficiency.

Thirdly, we look at financial development. A large part of the growth literature stresses the impact of financial constraints on growth. Indeed industries with larger financial dependence are reasonably expected to grow faster if they can access external funds more easily, at a cheaper cost. Hence, it seems natural to confront our results to the possibility that fiscal policy counter-cyclicality is simply a proxy for financial development, which could be a very natural outcome given the existence of a positive relationship between

fiscal policy counter-cyclicality and financial development (cf. Aghion and Marisnecu (2007)). In the two next tables, we test how the effect of fiscal policy counter-cyclicality on growth compares with the effect of financial development.

Insert table 15a here

Insert table 15b here

As previously, we focus on two different indicators for fiscal policy: total and primary fiscal balance counter-cyclicality. As to financial development, we also use two different indicators: private credit to GDP and stock market capitalization to GDP. For value added growth as for labour productivity growth, we do not find any case where the effect of counter-cyclical fiscal policy is not robust to introducing financial development. Hence we can conclude that the growth effect of cyclical macro policy is at least as important as can be the growth effect of structural reforms in the sense of fostering financial development or reducing barriers to access finance. While this sounds like an incredibly challenging result, it worth noting that the effect of financial development itself as highlighted by Rajan and Zingales in their paper is not robust to the sample we use here. Put differently the result that financial development raises growth at the industry level and more so for high financial dependence industry does not hold when focusing on developed OECD countries as we do here. Hence it is not surprising that we also end up with a similar result although with different data for a different period. While this general result clearly deserves more scrutiny to be taken for granted, an important policy implication is that structural reforms should go hand in hand with a reform in the design of cyclical macro policy.²³

Finally if the cyclical component of fiscal policy does significantly affect real value added and labour productivity growth, it is also likely that the structural component of fiscal policy plays a similar role. Indeed counter-cyclical fiscal policy may be growth enhancing not because counter-cyclicality is valuable on its own

²³ Although we simply present regressions with real value added growth as a dependent variable, the same result applies to labour productivity growth. Moreover the growth effect of fiscal policy counter-cyclicality is also robust when the analysis is extended to include other right hand side financial variables such as liquid liabilities to GDP, private credit by banks or stock market turnover ratio. More generally, the same result holds when a horse race is run between fiscal policy counter-cyclicality on the one hand and average inflation, average openness to trade or average current account balance to GDP on the other hand.

but because counter-cyclicality in fiscal policy reflects better designed fiscal policy. higher efficiency. For instance if differences in fiscal balance counter-cyclicality systematically vary with differences in average fiscal balance across countries, then it could be that more counter-cyclical fiscal policy reflects higher fiscal discipline in which we could mistakenly attribute to fiscal counter-cyclicality what in reality is a result of fiscal discipline. To study this question, we run a horse race regression with counter-cyclicality in total fiscal balance (resp. primary fiscal balance) to GDP on the one hand and the average fiscal balance (resp. average primary balance) to GDP on the other hand.

Insert table 16a here

Insert table 16b here

Table 16a shows that the average level of the total fiscal balance to GDP ratio does not in general embed significant explanatory power to account for real value added growth. On the contrary the effect of counter-cyclical fiscal balance is still significant which implies that the effect of counter-cyclical fiscal policy on growth does not go through the structural component of fiscal policy. There are however some estimations where the average fiscal balance to GDP does play a significant positive impact, a lower average fiscal deficit to GDP raising industry value added growth (cf. column (i) and (iii)). Now when we turn to labour productivity growth on the LHS (table 16b), the average fiscal balance to GDP has no significant effect whatsoever, while counter-cyclicality in fiscal balance is still significant. The positive effect of a stabilizing fiscal policy on labour productivity growth is hence robust to controlling for the average fiscal policy balance and therefore does not proxy for the effect of average fiscal policy. However this does not necessarily imply that fiscal discipline in the sense of a moderate average fiscal deficit has no implications for growth. In particular fiscal discipline is likely to be a prerequisite for stabilizing fiscal policies in as much as a large average fiscal deficit would preclude any government from stabilizing the economy in downturns if the government, as any other agent faces a borrowing constraint.

4.3 Dampening effects

In the theoretical model described above, the impact of counter-cyclical fiscal policy on growth is amplified when external financial dependence is larger but dampened when the share of pledgeable income is bigger. In this section we test the second prediction, namely whether a larger share of pledgeable income tends to reduce the positive effect of fiscal policy counter-cyclicality on growth. Income pledgeability is captured through the volume of private credit to GDP because when a larger share of income is pledgeable to outside investors, entrepreneurs borrow more capital and the volume of credit is larger. Two additional terms are introduced compared with to the standard specification (1). We first add the interaction of private credit to GDP and external financial dependence and secondly the interaction of private credit to GDP, fiscal policy counter-cyclicality and external financial dependence. The first term controls for the positive effect of private credit on growth while the second term is designed to capture dampening effects of private credit on the impact of fiscal policy counter-cyclicality on growth. Note however that there may be alternative ways to investigate the existence of dampening effects. For instance countries could be divided between those with above and those with below median private credit to GDP. However this last procedure has not proved very successful in identifying dampening or amplifying effects. This is why we use a triple linear interaction.

Insert table 17a here

Insert table 17b here

We present estimations for real value added and labour productivity growth when the fiscal policy indicator is total fiscal balance to GDP. In this case empirical evidence shows that a larger volume of private credit to GDP effectively tends to dampen the positive effect on growth of fiscal policy counter-cyclicality since the coefficient of the triple interaction term is almost always negative. However this dampening effect is barely statistically significant, especially for labour productivity growth. There are two possible reasons. First it is likely that identifying dampening or amplifying effects through a triple interaction is difficult because the triple interaction term is likely to be collinear with the two simple interaction terms, especially

in our case where the number of countries is relatively small. Second private credit to GDP is likely to be a relatively poor proxy for income pledgeability. As a result, these empirical evidence are at best suggestive of the existence of dampening effects. But clearly more investigation is needed with a larger cross-country dimension and/or a better proxy for income pledgeability.

4.4 Instrumental variable estimation

An important limit to the empirical investigation we carry out in this paper is the fact that counter-cyclical policy cannot be observed. It can only be inferred through a regression. This can pose a number of problems. Among these problems lies the fact that counter-cyclical policy is measured with a standard error. Hence OLS estimation is not consistent as long as we do not observe the “true” value of counter-cyclical policy but a “noisy” one. Reducing the impact of this problem on the significance of our results can be done through instrumental variable estimations. Hence we instrument fiscal policy counter-cyclical policy with variables which have two characteristics. First, these variables are directly observed, none is inferred from another model. Second they are all predetermined with respect to the counter-cyclical policy index we instrument. This means that the period the instruments are observed on is anterior to the period on which counter-cyclical policy has been inferred. We use as instruments log of GDP per worker, imports to GDP, current account balance to GDP, long term interest rate, CPI inflation and private credit to GDP.

Insert table 18a here

Insert table 18b here

The instrumental variable estimations are hence an attempt to determine whether the interaction between financial dependence and fiscal policy counter-cyclical policy could be a significant determinant of industry level growth solely because the standard errors around the estimates of fiscal policy counter-cyclical policy have not been properly taken into account in the estimations. Table 18a and table 18b provide estimations when total fiscal balance to GDP -the fiscal policy indicator used- is instrumented with variables detailed above.

Two main conclusions emerge from these estimations. First the positive effect of counter-cyclical fiscal policy on growth is robust to the instrumental variable estimation. For both value added growth and labour productivity growth, the results show that higher counter-cyclicality in fiscal policy significantly improves industry growth and the more so for industries with larger external financial dependence. The second conclusion that bears attention is that the magnitudes estimated in the IV estimations are either roughly similar to those we first estimated especially in tables 1 and table 2 or larger. Using instruments to estimate the effect of fiscal policy counter-cyclicality does not appear to modify at the first order the estimated differential in real value added and labour productivity growth rates stemming from different cyclicality in fiscal policies. Moreover what these estimations show is that in any case we would be willing to consider differences between IV and OLS estimations, that would imply larger rather smaller growth differentials given that the magnitude of coefficients is at least equal and in general larger with IV estimations. Finally as is shown in tables 19a and 19b, considering the case different interactions for positive and negative external financial dependence does not modify the above results: the effect on growth of fiscal policy counter-cyclicality interacted by external financial dependence is robust and in general larger with IV estimations.

Insert table 19a here

Insert table 19b here

5 Conclusions

In this paper we have tried to evaluate whether and how the cyclical pattern of macro policy can affect growth, focusing on fiscal policy. Following the Rajan-Zingales (1998) methodology, we have drawn a relationship between fiscal policy counter-cyclicality –measured at the macro level– and growth (both value added and productivity) at the industry level. This simple methodology has the advantage to properly handle the reverse causality issue: namely that within our setup, fiscal policy can affect growth while the opposite is not possible because the former is measured at the macro level while the latter is measured at the industry level. Based

on this framework, we have provided evidence that (i) industries have grown faster in economies where fiscal policy has been more counter-cyclical, both in terms of output and productivity (ii) that the positive growth effects of fiscal policy counter-cyclicality have been larger for industries which rely proportionally more on external finance. These two conclusions have been shown to be robust to the inclusion of a large number of structural macroeconomic variables, including financial development, openness to trade or net current account position. Hence, the cyclical pattern of fiscal policy is probably at least as important as can be structural features in their impact on growth.

The results have three different consequences for future research. First they call for a wide renewal of theoretical research on the business cycle and growth to build a proper assessment of the interactions that exist between them especially through the financial channel. Second, a natural question that emerges from this paper is whether and how the results on fiscal policy counter-cyclicality extend to monetary policy counter-cyclicality. This is an important question as monetary policy can move more easily than fiscal policy, although transmission lags can be larger for the former than the latter. Finally if the conclusion that counter-cyclicality in macro policy contributes to raise growth proves to be relevant, then comes the question of the determinants of counter-cyclicality and especially the institutional arrangements that can foster or prevent counter-cyclicality. This final theme could be of great importance to revisit the debate on growth and institutions.

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6 Appendix A: Proofs

6.1 Proof of Proposition1

First suppose that $\frac{\mu\beta P_j(w+s_j^x)}{\bar{c}} > 1$, then two subcases may occur. Either $\frac{\mu\beta P_j k}{\bar{c}} \geq 1$, in which case, the program is linear in z , as we assumed $P_j \leq \lambda E_{h|j}(P_h + g_j^x)$, the firm's owner will try to increase z as much as possible, so that the optimum will in fact involve $\frac{\mu\beta P_j k}{\bar{c}} \leq 1$, so the solution will either be the interior solution with $\frac{\mu\beta P_j k}{\bar{c}} < 1$ or, if the interior solution is not in the set, the corner solution where $\frac{\mu\beta P_j k}{\bar{c}} = 1$

Assume now that $\frac{\mu\beta P_j(w+s_j^x)}{\bar{c}} \leq 1$, then the optimal solution will necessarily involve $\frac{\mu\beta P_j k}{\bar{c}} \leq 1$.

The first order condition for this maximization, assuming an interior solution ($k > 0, z > 0$), yields:

$$-\beta P_j + \lambda \left(\frac{\mu\beta P_j (w + s_j^x) - 2\mu\beta P_j z}{\bar{c}} \right) \beta E_{h|j}(P_h + g_j^x) = 0$$

and

$$\begin{aligned} z_j &= \frac{1}{2} \left(w + s_j^x - \frac{\bar{c}}{\mu\lambda\beta (E_{h|j}(P_h) + g_j^x)} \right) \\ k_j &= \frac{1}{2} \left(w + s_j^x + \frac{\bar{c}}{\mu\lambda\beta (E_{h|j}(P_h) + g_j^x)} \right) \end{aligned}$$

Note that (i) we always have $z_j < k_j$; (ii) the condition $k_j \geq 0$ can never binds: (iii) the condition $z_j \geq 0$ will bind if $w + s_j^x \leq \frac{\bar{c}}{\mu\lambda\beta (E_{h|j}(P_h) + g_j^x)}$ (which is impossible if $\frac{\mu\beta P_j(w+s_j^x)}{\bar{c}} > 1$ and $P_j \leq \lambda E_{h|j}(P_h + g_j^x)$).

7 Appendix B

Countries in the sample	Abbreviations
Australia	AUS
Austria	AUT
Belgium	BEL
Germany	DEU
Denmark	DNK
Spain	ESP
Finland	FIN
France	FRA
Great-Britain	GBR
Greece	GRC
Ireland	IRE
Italy	ITA
Japan	JPN
Luxembourg	LUX
Netherlands	NLD
Portugal	PRT
Sweden	SWE

Industries in the sample

Description	ISIC rev.3 code
FOOD , BEVERAGES AND TOBACCO	15t16
Food and beverages	15
Tobacco	16
TEXTILES, TEXTILE , LEATHER AND FOOTWEAR	17t19
Textiles and textile	17t18
Textiles	17
Wearing apparel, dressing and dying of fur	18
Leather, leather and footwear	19
WOOD AND OF WOOD AND CORK	20
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	21t22
Pulp, paper and paper	21
Printing, publishing and reproduction	22
Publishing	221
Printing and reproduction	22x
CHEMICAL, RUBBER, PLASTICS AND FUEL	23t25
Coke, refined petroleum and nuclear fuel	23
Chemicals and chemical	24
Pharmaceuticals	244
Chemicals excluding pharmaceuticals	24x
Rubber and plastics	25
OTHER NON-METALLIC MINERAL	26
BASIC METALS AND FABRICATED METAL	27t28
Basic metals	27
Fabricated metal	28
MACHINERY, NEC	29
ELECTRICAL AND OPTICAL EQUIPMENT	30t33
Office, accounting and computing machinery	30
Electrical engineering	31t32
Electrical machinery and apparatus, nec	31
Insulated wire	313
Other electrical machinery and apparatus nec	31x
Radio, television and communication equipment	32
Electronic valves and tubes	321
Telecommunication equipment	322
Radio and television receivers	323
Medical, precision and optical instruments	33
Scientific instruments	331t3
Other instruments	334t5
TRANSPORT EQUIPMENT	34t35
Motor vehicles, trailers and semi-trailers	34
Other transport equipment	35
Building and repairing of ships and boats	351
Aircraft and spacecraft	353
Railroad equipment and transport equipment nec	35x
MANUFACTURING NEC; RECYCLING	36t37
Manufacturing nec	36
Recycling	37

Variable	Data Sources	
	Source	
Industry Real Value Added	EU KLEMS	
Industry Labour Productivity	EU KLEMS	
External Financial Dependence	Compustat	
Output Gap	OECD Economic Outlook	
Total Fiscal Balance	OECD Economic Outlook	
Primary Fiscal Balance	OECD Economic Outlook	
Government Consumption	OECD Economic Outlook	
Government Investment	OECD Economic Outlook	
Government Expenditures	OECD Economic Outlook	
Government Receipts	OECD Economic Outlook	
CPI Inflation	OECD Economic Outlook	
Current Account Balance	OECD Economic Outlook	
Private Credit	World Bank Financial Structure and Development	

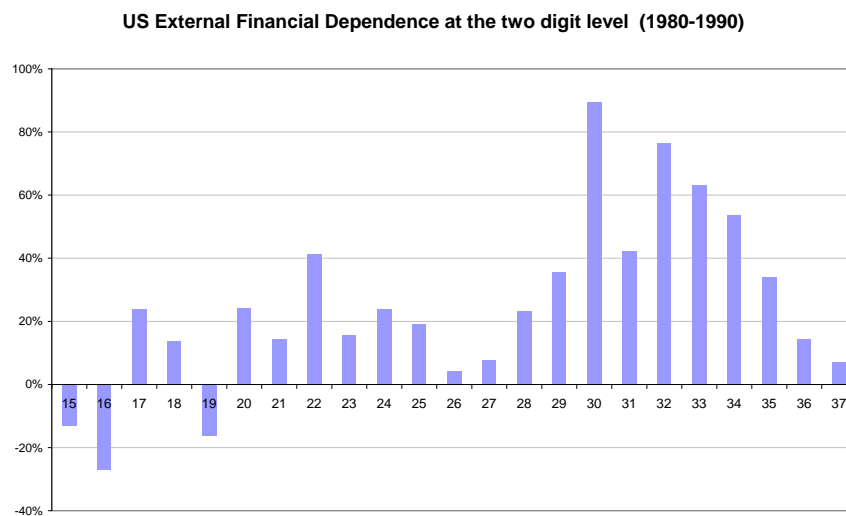


Figure 2

Source: Compustat and ISIC Rev. 3.

Average Government Total Deficit (%GDP, 1980-2005)

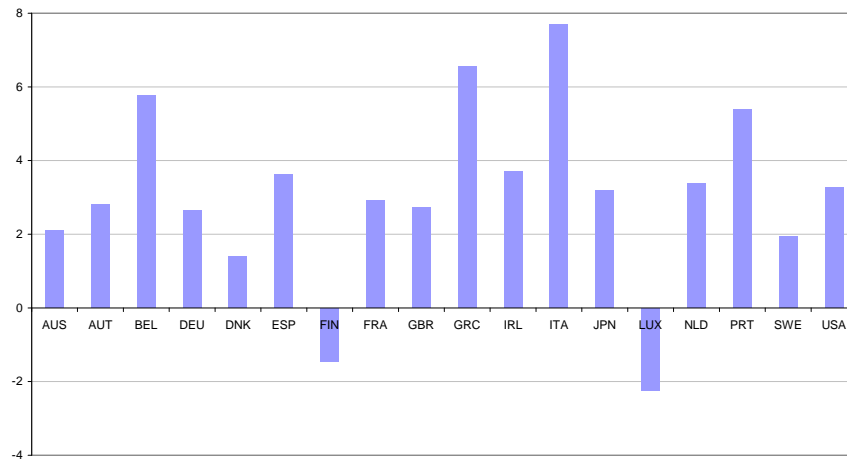


Figure 3

Average Government Primary Surplus (%GDP, 1980-2005)

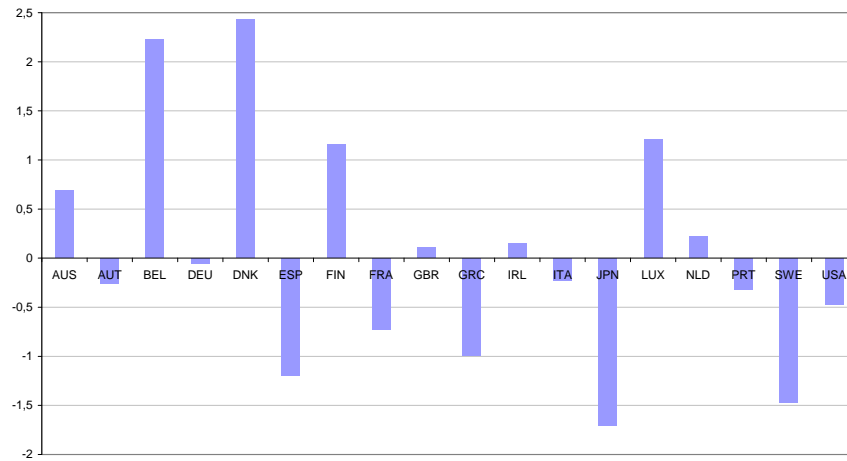


Figure 4

Source: OECD economic outlook and authors' computations.

Cyclicality in Government Total Balance to GDP (1980-2005)

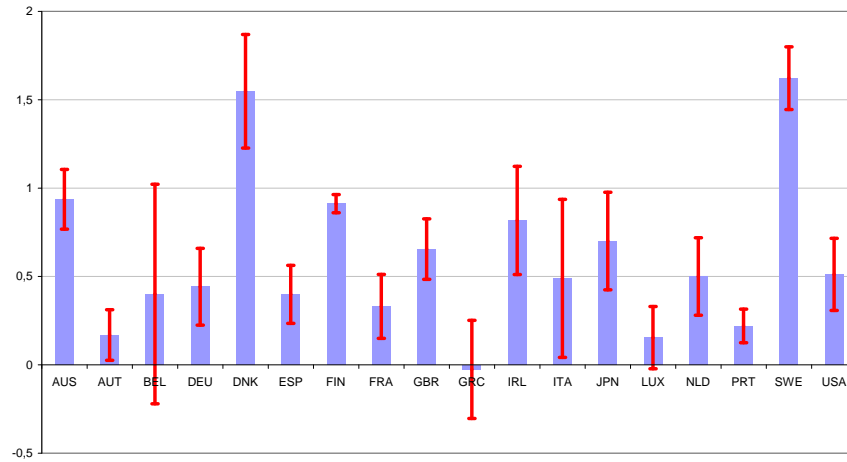


Figure 5

Cyclicality in Government Primary Balance to GDP (1980-2005)

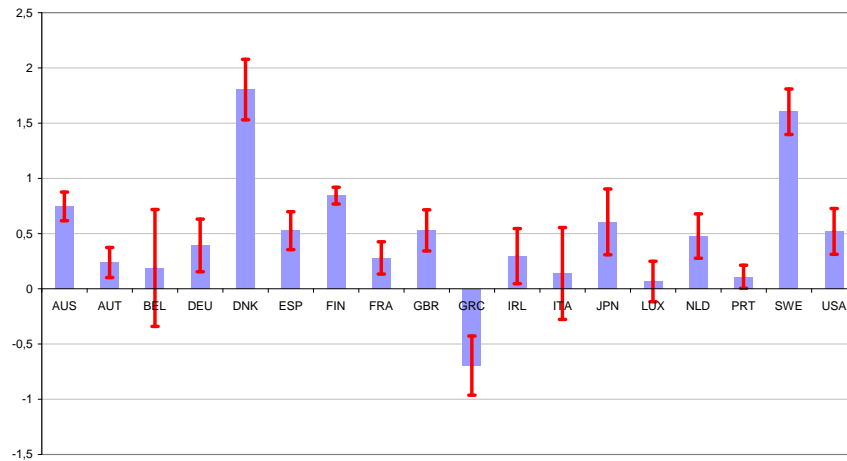


Figure 6

Note: Each bar represents the estimated coefficient α_i in the regression: $fb_{it} = \alpha_i (gap_{it}) + \beta_i + \varepsilon_{it}$ where fb_{it} is alternatively government total fiscal balance to GDP (figure 5) or government primary fiscal balance to GDP (figure 6) in country i at time t , gap_{it} is the output gap in country i at time t . Each line represents two standard deviations of the estimated coefficient α_i . See below for the list of abbreviations of country names. Source: OECD economic outlook and authors' computations.

Cyclicality of Government Receipts to GDP (1980-2005)

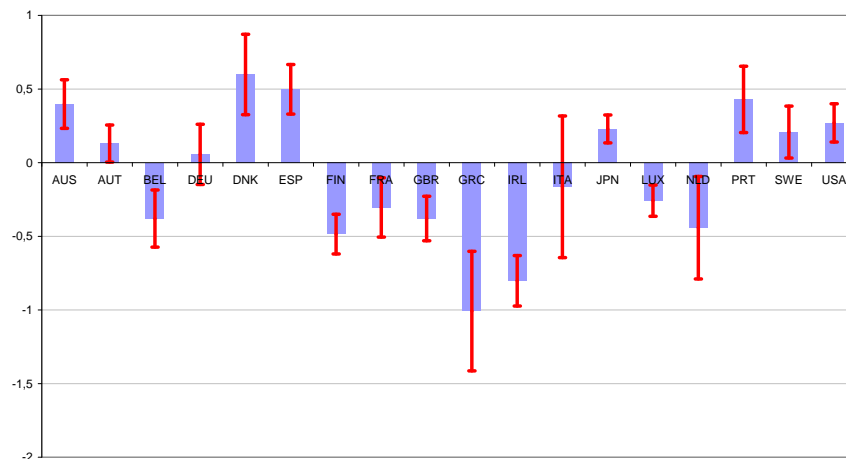


Figure 7

Cyclicality of Government Spending to GDP (1980-2005)

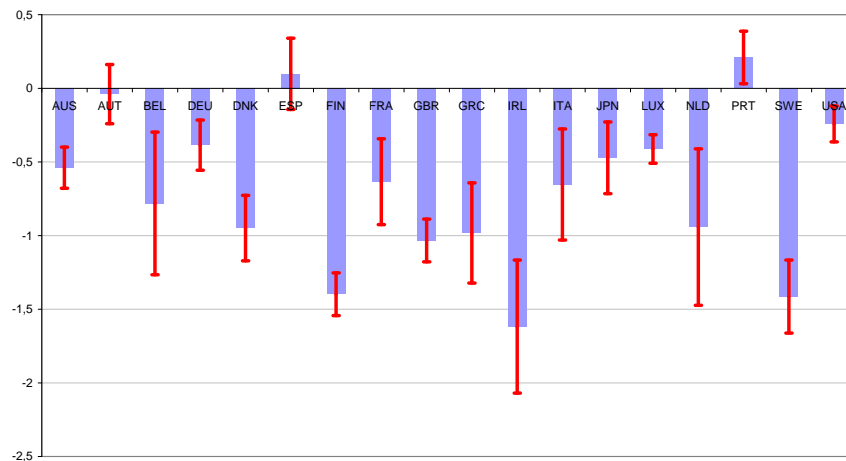


Figure 8

Note: Each bar represents the coefficient α_i in the OLS regression: $gy_{it} = \alpha_i(gap_{it}) + \beta_i + \varepsilon_{it}$ where gy_{it} is alternatively government receipts to GDP (figure 7) or government spending to GDP (figure 8) in country i at time t and gap_{it} is the output gap in country i at time t . Each line represents two standard deviations of the estimated coefficient α_i . See below for the list of abbreviations of country names. Source: OECD economic outlook and authors' computations.

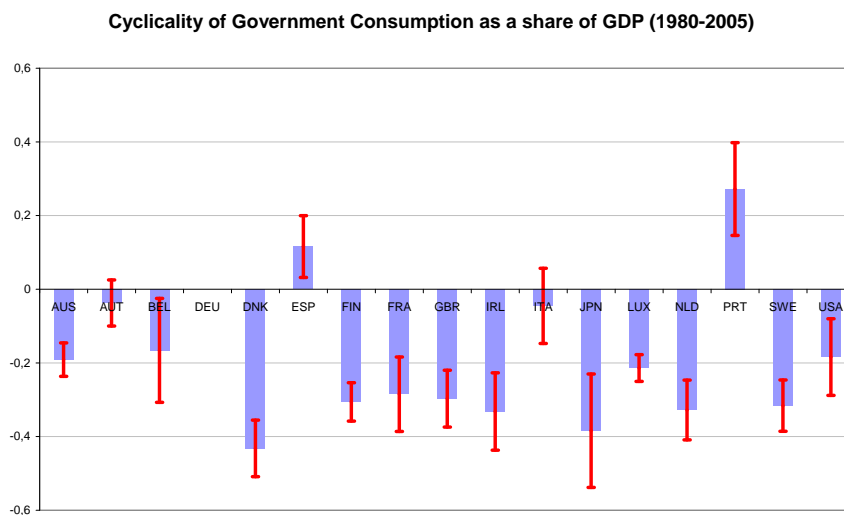


Figure 9

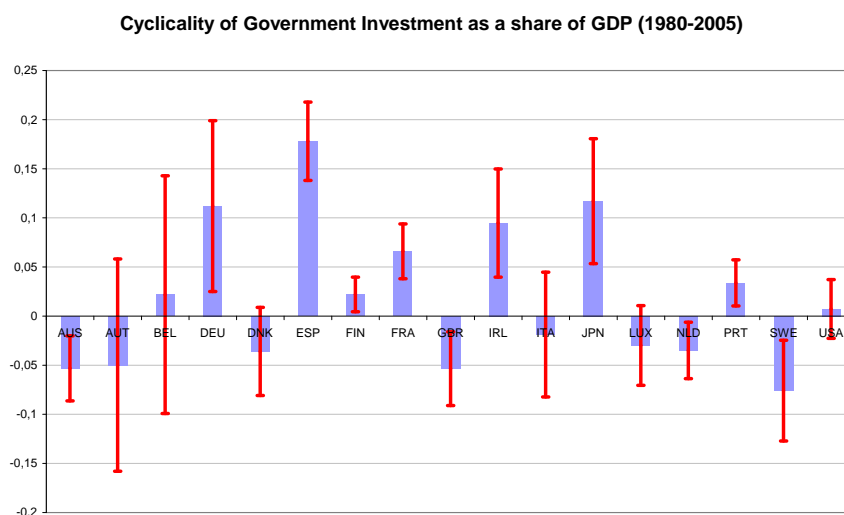


Figure 10

Note: Each bar represents the coefficient α_i in the OLS regression: $gd_{it} = \alpha_i(gap_{it}) + \beta_i + \varepsilon_{it}$ where gc_{it} is alternatively government consumption to GDP (figure 9) or government investment to GDP (figure 10) in country i at time t and gap_{it} is the output gap in country i at time t . Each line represents two standard deviations of the estimated coefficient α_i . See below for the list of abbreviations of country names. Source: OECD economic outlook and authors' computations.

Cyclicality of the share of Government Consumption in total Government Spending (1980-2005)

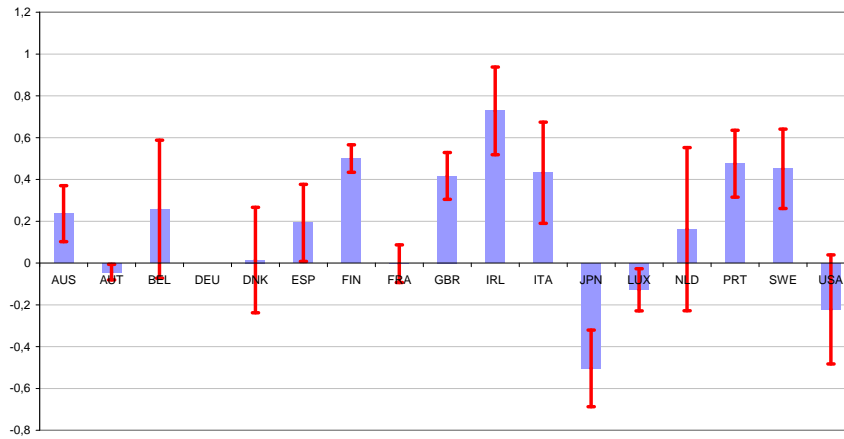


Figure 11

Cyclicality of the share of Government Investment in total Government Spending (1980-2005)

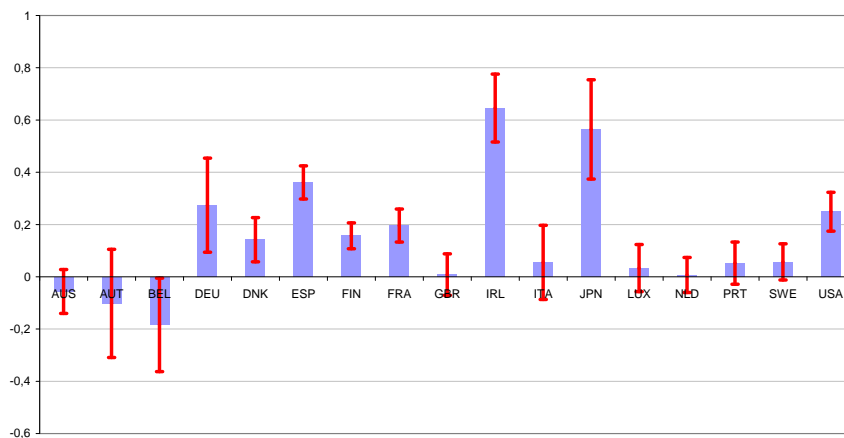


Figure 12

Note: Each bar represents the coefficient α_i in the OLS regression: $gds_{it} = \alpha_i (gap_{it}) + \beta_i + \varepsilon_{it}$ where gds_{it} is alternatively the share of government consumption in total government spending (figure 11) or the share of government investment in total government spending (figure 12) in country i at time t and gap_{it} is the output gap in country i at time t . Each line represents two standard deviations of the estimated coefficient α_i . See below for the list of abbreviations of country names. Source: OECD economic outlook and authors' computations.