



Center for Empirical Macroeconomics

Working Paper No. 94

What can we expect from structural reforms?

The importance of market interactions and specific investments for
the impact of policy changes on economic performance

by

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impact of policy changes on economic performance

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Winter 2004-2005

Abstract

The impact of structural reforms is considered using a double-sided matching process on financial and labor markets. Firms have to search for both financial investors and workers to produce output whose value is endogenous as all three actors can proceed on investments specific to the match. Financial investors will monitor entrepreneurs, firms will select their technology and workers will decide upon their effort level. In equilibrium, when wages and debt levels are negotiated, this may lead to multiple equilibria presenting important structural differences. In particular, they will react differently to similar changes in structural policies such as product or financial market deregulation as can be demonstrated numerically.

Keywords: Structural reforms, multiple equilibria, specific investment, market liquidity, matching on financial and labor markets, market interaction, institutional complementarity

JEL-Classification: G24, J64, O14

*The views expressed in this paper are those of the author and do not necessarily reflect those of the OECD.

1 Introduction

In its communication to the external public the ECB and other international organisations have consistently argued in favour of a swift implementation of structural reforms, such as those envisaged in the Lisbon agenda. In the meantime, parts of the structural reform agenda have been put into action and their quantitative effects assessed. This first wave of structural reforms - in particular linked to product market liberalisation and privatisation of public utilities - have led to a very active area of economic research on the macroeconomic effects of structural reforms and the transmission mechanisms of reforms onto different dimensions of macroeconomic performance extensively discussed.

What has not been resolved in this literature is to identify the conditions and structural parameters underlying the reform success that has been observed in some countries but not in others. Moreover, most of the discussion has relied on relatively straightforward partial equilibrium analysis based on uni-dimensional incentive or inefficiency arguments. However, when talking about modern knowledge-based societies, technology and its accumulation takes a prominent role in the growth process. Hence, at least some concepts of this literature needs to be imported in the analysis of the effects of structural reforms to fully grasp the effect these reforms have on both employment and productivity growth.

Recently, researches have started to acknowledge the multi-dimensional nature of the effects of structural reforms including the need to analyse the effects in a bundle. This precludes any analysis of imperfections of either labour or financial markets alone, as such studies usually produce very fragile results. Contributions in this field, therefore, turned to a more encompassing analysis of the different transmission mechanisms that various policy-induced or institutional market imperfections may have on economic performance. In particular, explicitly considering market interactions where imperfections on two different markets could simultaneously affect macroeconomic performance turned out to be a very fruitful approach (Acemoglu, 2000; Amable, Ernst, Palombarini, 2002; Wasmer and Weil, 2002). In these models, informational asymmetries, coordination problems and contracting problems are considered to generate economy-wide spillovers beyond the frictions on the market on which they are originating. Even though their own-market effect may still be ambiguous - following results of the earlier research - the spillover onto other markets (the market interaction effect) as well as the combined effect with other characteristics of the macroeconomy (the complementary effect) have the potential to explain structural differences between economies.

The existence of market interaction and complementary relations between the institutional environment and policies is likely to have an important effect on the way how structural reforms will affect to economic performance. When policies have to be packaged, gradual reforms will usual not deliver the intended effect and - consequently - may loose political support. In addition, given the microeconomic transmission mechanisms through which these policies and institutions work, economies that are characterized by different institutional and policy settings may show considerable structural differences - such as a different sectoral

composition - that make them react differently to policy changes (see Ernst, 2003).

Against this background, the following paper tries to develop a more general framework through which the impact of structural reforms can be studied and their impact on the macroeconomy be analyzed. The aim of the paper is twofold: On the one hand, the paper demonstrates the importance of market interaction for the functioning of the macroeconomy, possibly affecting the characteristics and the number of arising equilibria. On the other hand, in establishing these different equilibria, the paper analyzes quantitatively the impact of structural reforms on the macroeconomic performance of each of the arising equilibria.

In the following, market interactions arise as a consequence of contractual imperfections on one market that affect outcomes on others. Given that economic activity implies the exchange of goods and services on different markets if not at the same time then at least in a specific order, the individual decision making process will create interrelations between the contractual shortcomings on one market and the decision to engage in economic relations on others. For instance, when firms are financially constraint to seek for outside funding, the extent to which they have access to finance will affect their possibility to put vacancies on the labor market. Moreover, in general equilibrium, labor market developments will feed back into the financial markets, determining the expected returns of financial funds.

In the presence of match-specific assets that have to be built up to improve the firm's performance, quasi-rents generated through the search process allow to remunerate this specific investment. These specific assets may arise for various reasons and may interact with each other, determining the global value of the match. For instance, firms and workers may have to invest in match-related capital such as firm-specific skills, technological effort and innovation that are only valuable inside the relation. Financial investors, on the other hand, may proceed at market screening *ex-ante* in order to select good entrepreneurs or monitor the firm *ex-post* monitoring in order to control for good managerial effort. All three types of specific investment may be important to generate high returns to the match and may enter in a complementary way - directly or indirectly - into the firm's production function. For instance, high levels of innovative effort raises the returns to finance and hence increase incentives for financial investors to enter the market. On the other hand, a decrease of monitoring effort allows for more managerial slack, increasing the risk of early destruction and consequently reducing innovative and workers' effort.

For optimal investment in specific assets to occur, the necessary incentives have to be provided through sustained returns to investment. Incentives to invest in specific assets are, however, usually negatively correlated with the outside option of both the investor and the bargaining partner. Consequently, high market liquidity - i.e. low market frictions - may negatively influence the specific investment provided by either firms, workers or financial investors, as the specific match-value decreases. Given the interaction that exists between markets, the reduced incentives for one investment type will spill over to the other market, decreasing overall investment into the firm's assets, ultimately lowering its productivity. Consequently, that there may exist a trade-off between efficiency gains that can be achieved in very liquid markets - and that usually lead search models to show increasing returns to market

liquidity - and specific investment that would allow for a higher firm productivity. While more flexible, liquid markets allow for a quick reallocation of resources through increased matching, more rigid markets may provide the necessary incentives for specific investments that are related to the success of existing firms.

The paper is organized as follows. In the following section, we present a market-liquidity model in an IS-LM framework to develop the main statistical properties of the arising equilibria. In section 3 we discuss the comparative statics of the model with respect to its parameter space, indicating the structural reform process. The policy simulations are set up and discussed in section 4, where we first present the methodology used in this exercise and then present the simulation evidence, including confidence intervals for the estimates related to parameter uncertainty. A final section concludes.

2 Market liquidity and specific investment in IS-LM

In order to assess the impact of structural reforms on macroeconomic performance, we will set-up in the following a search-based formulation of the standard IS-LM model that allows to explicitly take into account more detailed microeconomic relations and incentive problems. As in the standard framework, the model is made up of three markets: financial, labour and product markets. Contrarily to the neoclassical synthesis, we assume that product markets clear instantaneously (i.e. firms can sell all their proceeds) while financial and labour markets are characterised by real rigidities due to the search and matching process on these markets.

2.1 Search and matching on labour and financial markets

The model is made up of three types of agents: entrepreneurs, workers and financiers. Entrepreneurs have ideas but do not produce and do not possess any capital. Worker transform entrepreneurs' ideas into output but have neither entrepreneurial skills nor capital; financiers (or bankers) are able to provide capital required to implement production but can be neither entrepreneurs nor workers. A productive firm is thus a relationship between an entrepreneur, a financier and a worker. In addition, firms and financiers may invest in a asset specific to the match, improving the match's productivity but lost when the relationship is dissolved.

Labor market frictions are present under the form of a search and matching process à la Pissarides (2000), with a constant returns matching function $h(\mathcal{U}, \mathcal{V})$, where $h_x > 0$, $h_{xx} < 0$, $x \in \{\mathcal{U}, \mathcal{V}\}$. Matches between workers and firms depend on job vacancies \mathcal{V} and unemployed workers \mathcal{U} . From the point of view of the firms, labor market tightness is measured by $\theta \equiv \mathcal{V}/\mathcal{U}$. Labor market liquidity will be $1/\theta$. The instantaneous probability of finding a worker is thus $h(\mathcal{U}, \mathcal{V})/\mathcal{V} = h(1/\theta, 1) \equiv q(\theta)$, $q'(\theta) < 0$. Firms have the possibility to affect the productivity of the match by undertaking match-related specific investments: they may select an appropriate technology, $T \in R^+$.

An entrepreneur incurs capital and search costs before production starts. These costs must be financed by external funding. Following Wasmer and Weil (2002), we consider credit market frictions similar to labour market frictions: a matching function formalises at the aggregate level the relationship between a banker and a firm¹. In addition to search costs, financial investors can decide to monitor projects closely to increase the realised outcome and hence increase the productivity of the match; in order to do so, they have to invest in a monitoring technology, spending $\eta \in R^+$.

If \mathcal{B} is the number of bankers looking for borrowers and \mathcal{F} the number of entrepreneurs looking for financing, the flow of loan contracts successfully signed is given by $m(\mathcal{B}, \mathcal{F})$, with m a constant returns functions with positive and decreasing marginal returns to each input. From the point of view of firms, credit market tightness is measured by $\phi \equiv \mathcal{F}/\mathcal{B}$ and $1/\phi$ is an index of credit market liquidity, i.e. the ease with which entrepreneurs can find financing. The instantaneous probability than an entrepreneur will find a banker is $m(\mathcal{B}, \mathcal{F})/\mathcal{F} = m(1/\phi, 1) \equiv p(\phi)$. This probability is increasing in credit market liquidity, i.e. decreasing in credit market tightness. The probability that a banker will find a borrower is $m(\mathcal{B}, \mathcal{F})/\mathcal{B} = m(1, \phi) = \phi \cdot p(\phi)$. This probability is increasing in credit market tightness, thus decreasing in credit market liquidity.

2.2 Life cycles of entrepreneurs, workers and financial investors

The interaction between financial and labour markets arises through the presence of the firm on these two markets at different stages of its life. In particular, the firm passes through four stages: fund raising, recruitment, production and market exit. In each stage a particular interaction between different market participants takes place, while the market interaction process runs through the intertemporal linkages that exists between the different stages given the presence of the entrepreneur on different markets over the firm's life cycle.

1. **Fund raising:** In stage 0, entrepreneurs enter the market at cost c , looking for a financial investor willing to finance the posting of a job vacancy, while financiers are searching for clients having entered the market at cost k . Financial investors will decide on the corporate governance mechanism, η , that allows to monitor the firm during its production stage.
2. **Recruitment:** In stage 1, entrepreneurs invest in productive technology T in form of dedicated capital which is not contractible and start looking for the worker that will enable them to take up production. The probability that an entrepreneur will meet a worker, and that the recruitment stage will end, is $q(\theta)$.
3. **Production:** In stage 2, the firm starts production and is generating flow profits $y(T, \eta)$, depending on the installed technology and the bank's monitoring commitment. It uses

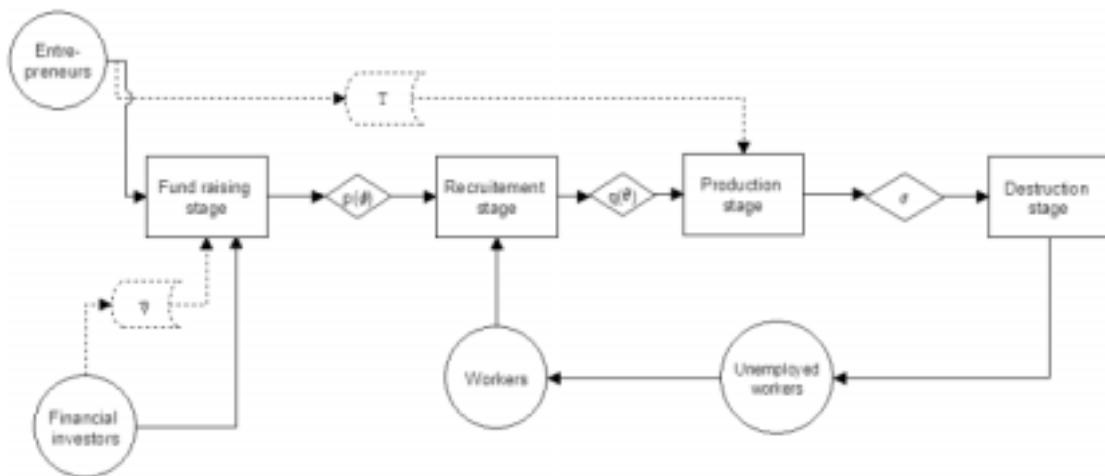
¹Already Den Haan, Ramey and Watson (1999) modelled credit market imperfections with the help of a matching function between borrowers and lenders.

these profits to pay its workers a wage w and by paying back to its financiers a flow amount d for the entire duration of the match. Both factor payments are negotiated before production starts and contingent on the production technology and the specific investments.

4. **Destruction:** In the final stage 3, the match between firm and worker is destroyed. We assume that destruction depends on exogenous factors such as the degree of product market competition and productivity shocks; transition from stage 2 to 3 occurs with probability σ .

Over the life cycle, the firm faces therefore several costs: market entry barriers (c), capital costs (k), technological investment (T), wages (w) and debt repayments (d). Workers provide unit labour effort in exchange of wages, while financiers provide spend on the monitoring technology (η), provide capital, on which they receive interest and principal. The following flow diagram describes the different stages of the matching and production process. The switch from one stage to another is governed by a stochastic process, where the arrival rate of the next stage depends on the market liquidity of the financial and the entrepreneur: the more firms are struggling for finance, the easier it will be for banks to match and *vice versa*; the same applies for the labour market.

Figure 1: Market interactions



Recalling the two definitions for labour and financial market liquidity $\theta = \frac{\mathcal{V}}{\mathcal{U}}$: labour market liquidity and $\phi = \frac{\mathcal{F}}{\mathcal{B}}$: financial market liquidity, where \mathcal{V} , \mathcal{F} : a firm's demand on labour and financial markets, \mathcal{U} , \mathcal{B} : supply curves on the labour and the financial market, the model can be written in terms of a standard IS-LM model by relating ϕ to the interest rate and θ to the activity level, i.e. $\phi \sim r$ and $\theta \sim Y$. This feature will be exploited in the following to derive the IS- and the LM-schedules².

²Details on the search model and the formulation of the IS-LM schedule can be found in the annex 7.1.

2.3 The goods market equilibrium: the IS-schedule

The IS-schedule can be derived from the arbitrage between (expected) entry costs in the market - proportional to market entry barriers c - and the expected gain for the entrepreneur discounted by the interest rate and the matching probabilities θ and ϕ . Investment will be higher, the more unemployed workers are looking for a job and the more banks are available to finance new projects, hence $\frac{\partial I}{\partial \theta} < 0$ and $\frac{\partial I}{\partial \phi} < 0$. On the other hand, savings will be unaffected by labour market conditions and will be increasing with the number of firms per bank (or alternatively the interest rate).

The product market equilibrium arises then as the intersection of investment and savings. With the above liquidity variables used to formulate the standard functions:

$$I = I(\theta, \phi); S = S(\phi)$$

the IS-schedule and its slope can be derived as follows:

$$\begin{aligned} I &= S \Leftrightarrow I(\theta, \phi) = S(\phi) \\ \left. \frac{d\phi}{d\theta} \right|_{I=S} &= -\frac{\partial I / \partial \theta}{\partial I / \partial \phi - \partial S / \partial \phi} < 0 \text{ as } \frac{\partial I}{\partial \theta} < 0, \frac{\partial I}{\partial \phi} < 0, \frac{\partial S}{\partial \phi} > 0. \end{aligned}$$

In the process of finding a suitable financier, setting up a vacancy and producing output, the firm encounters several costs that have been summarised above in the description of its life cycle. Barriers to entry, replacement rates and the wage share will make the posting a vacancy more expensive, moving the IS-schedule upwards as more firms will compete for loans. The same holds for an increase of the exit ratio, as it will reduce the expected profits that the firm can earn from a filled vacancy. Finally, the effect of λ is ambiguous: on the one hand, it represents a cost for the entrepreneur as financial investors will demand higher returns, on the other hand it will make finding a financier easier; which of the effects dominates depends on the parameter setting. This can be summarised in the following investment function:

$$IS = IS \left(\theta, \phi \mid \begin{matrix} c, & \sigma, & b, & \chi, & \lambda \\ (-) & (-) & (-) & (-) & (+/-) \end{matrix} \right)$$

2.4 Supply of loans: the LM-schedule

The credit market of the standard IS-LM approach is here augmented by financial intermediation and a market for loans that is determining the interest rates at which firms can finance their investment. Contrarily to the line taken by Bernanke and Blinder (1988) we assume here that this banking channel endogenously determines the corporate governance mechanism in order to avoid free-riding of the firm managers. The set-up of any control

mechanism is costly for banks but depends on the tightness of the grip a bank has having on its debtors. As the costs have to be financed out of the debt contract, which is all the more favorable, the more oligopolistic the banking sector is (i.e. the lower ϕ), the bank control of the firm is stronger, the less liquid financial markets are: $\eta = \eta(\phi)$, $\eta' > 0$.

As before for the demand schedule, the LM-schedule can then be derived from the arbitrage between the (expected) endogenous costs of market entry for financial intermediaries - proportional to $k + \eta$, where η describes the endogenously determined corporate governance mechanism - and the expected gains for intermediaries discounted by the interest rate and the matching probabilities θ and ϕ . Hence demand (L) and supply (B) for loans can be written as:

$$L = L(\theta, \phi); B = B(\phi)$$

which allows to derive the LM schedule as follows:

$$L = M \Leftrightarrow L(\theta, \phi) = B(\phi)$$

$$\left. \frac{d\phi}{d\theta} \right|_{L=B} = -\frac{\partial L/\partial\theta}{\partial L/\partial\phi - \partial B/\partial\phi} \begin{cases} < 0 & \text{for } \frac{\partial L}{\partial\theta} < 0 \\ > 0 & \text{for } \frac{\partial L}{\partial\theta} > 0 \end{cases} \text{ as } \frac{\partial L}{\partial\phi} < 0, \frac{\partial B}{\partial\phi} > 0.$$

Note that following the endogenously determined corporate governance mechanism, the sign of $\frac{\partial L}{\partial\theta}$ is undetermined, which can be easily understood looking at a more standard formulation of loan demand $\mathcal{L}(Y, r) \sim L(\theta, \phi)$. Loan demand is determined by aggregate income which can be decomposed as: $Y = LP \cdot E$ where LP stands for labour productivity and E : for total employment. From the standard matching literature we know that $E \sim \theta$ and from Amable and Ernst (2003) we know that $LP \sim \frac{1}{\theta}$ and $LP \sim \phi$. The classical case corresponds to the standard case with an upward-sloping LM-curve and $Y \sim \theta$. However, in the case with very sclerotic activity and high interest rates (high ϕ) changes in activity will have a stronger impact on labour productivity than on employment, letting the overall sign of L being determined by the negative consequences of a raising θ for LP . This is related to the fact that in the presence of a strict corporate governance framework, the resources will be most efficiently used for improvements in the match-specific labour productivity, whereas for low interest rates and a weak corporate governance framework, labour productivity will be less affected by changes in market liquidity.

Similar to the discussion above, loan supply - i.e. financial investors - faces different costs at the different stages of the financing process. The costs are broadly similar to those for firms, with the exception of market entry barriers, c , uniquely born by firms and, conversely, banking costs, k , uniquely born by financial investors. Loan supply therefore reacts in the following way to changes in these cost parameters:

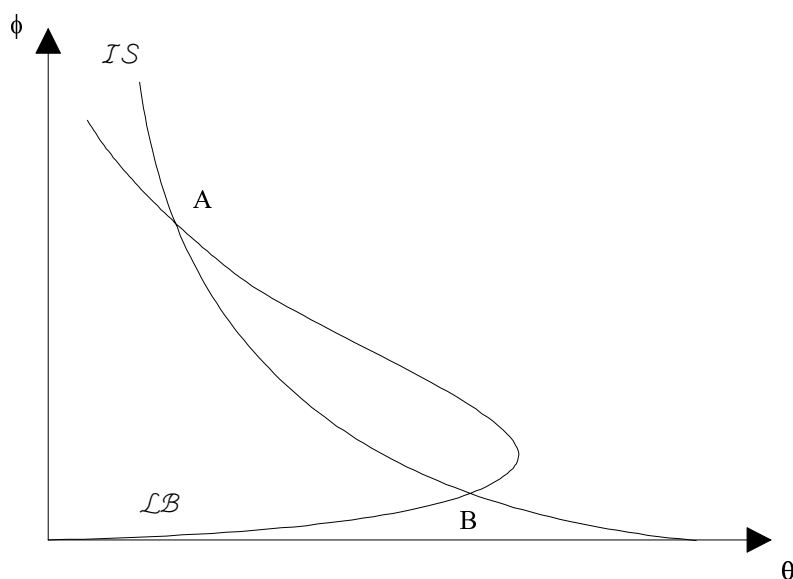
$$LB = LB \left(\theta, \phi \mid \begin{matrix} k, \sigma, b, \chi, \lambda \\ (-) (-) (-) (-) (+/-) \end{matrix} \right).$$

3 Structural reforms and economic performance

3.1 The IS-LM equilibrium

The above formulation of the IS and LM schedules very much resembles the standard set-up, with the exception that the LM-curve is now non-linear due to the inclusion of the corporate governance mechanism.

Figure 2: Non-linear IS-LM and multiple equilibria



Whenever the negative effect of labour market liquidity on labour productivity is strong enough, the slope of the LM-curve will be negative in a way to cut the IS-curve a second time: in this case, we are in the presence of multiple equilibria. This raises the possibility that the two equilibria will react differently with respect to changes in the parameter space, which will be analysed in the following.

3.2 Comparative statics in the simplified model

In this stripped-down version of the model, such comparative static results can be established in a straightforward manner. First, however, we will look at how the liquidity on financial and labour markets will affect unemployment, labour productivity and GDP before looking in more detail into the relationship between structural parameters and equilibrium liquidity rates.

3.2.1 Unemployment, productivity and GDP

Using the standard formulation for labour market search, in equilibrium inflows (proportional to matching $\theta \cdot q(\theta)$) and outflows (proportional to the destruction rate σ) of unemployment are equal, hence steady state unemployment can be written as:

$$(1 - u) \sigma = u \cdot \theta q(\theta) \Leftrightarrow u = \frac{\sigma}{\sigma + \theta q(\theta)}.$$

Moreover, given that a match involves only one entrepreneur and one worker, labour productivity equals firm production and can be defined as:

$$LP = y(T(\theta), \eta(\theta, \phi)).$$

Finally, GDP can be derived from the number of workers that are currently employed in a match. Hence, provided that there is no firm heterogeneity this writes as:

$$GDP = (1 - u) \cdot LP = \frac{\theta q(\theta)}{\sigma + \theta q(\theta)} y(T(\theta), \eta(\theta, \phi)).$$

Following these relationships between the model's parameters and macroeconomic variables, the following table can be set up, giving an overview of the reaction of u , LP and GDP with respect to labour and financial market liquidity:

	u	LP	GDP
θ	-	-	+/-
ϕ	0	+	+

Interestingly, while labour market liquidity unambiguously decrease unemployment (as expected), it has a negative impact on labour productivity (due to the incentive effect) and hence an ambiguous effect on GDP (depending on the strength of the relative effects). Financial market liquidity (i.e. $1/\phi$), on the other hand, does not affect unemployment (at least not in a partial equilibrium sense) and decreases labour productivity and GDP.

3.2.2 Structural reforms and market liquidity

The impact of labour and financial market liquidity on macroeconomic variables constitutes, however, just one side of the effects of structural reforms on the macroeconomy. Hence, in order to establish the comparative statics results of the impact of the parameter space $\{c, k, \sigma, b, \chi, \lambda\}$, we fully differentiate the system $IS = LB$ with respect to the different parameters, taking into account the differential behaviour of LB depending on the equilibrium

the economy is. Here, the first two parameters (c, σ) describe product market policies, the second two (b, χ) labour market policies and the last two (k, λ) financial market policies. The following table gives an overview of the reaction of ϕ and θ with respect to these different policy variables³; a graphical presentation of the change of the equilibrium schedules can be found in annex 7.2 (figure 3, p. 28). In the following table, equilibrium **A** refers to the “sclerotic” equilibrium with high unemployment and high interest rates, while equilibrium **B** refers to the “flexible” economy with low unemployment and low interest rates. Note that the table reports the effects of structural reforms as they are usually implemented, i.e. a reduction in c, k, b, χ, λ and an increase in σ :

Table 1: Comparative statics results of the IS-LM model

		c	σ	b	χ	k	λ
A	θ	+	-	+	+/-	-	-
	ϕ	-	+	+	+	+	+
B	θ	+	-	+	+	+	-
	ϕ	+	-	-	+/-	-	+

Note: The table reports the effects of policy changes in the sense of structural reforms on the basis of the above IS-LM model; in particular the following policy changes have been accounted for: $c \downarrow, \sigma \uparrow, b \downarrow, \chi \downarrow, k \downarrow, \lambda \downarrow$.

As can be seen from the table, the two equilibria do not show the same behaviour with respect to all structural policies. In some cases, labour market liquidity moves in opposite directions (following a change in k) for others financial market liquidity moves in opposite directions (for changes in c, b, σ and k). Consequently, very different outcomes can be expected for these structural reforms. Only in the case of a change in market power of financial intermediaries behave both equilibria in the same way. In light of these substantial differences between the two equilibria, it seems to be important to quantify the impact of structural reforms on these two equilibria.

4 Policy simulations

Despite the relative complex parameter structure of the model, the fact that it can be described by two equilibrium schedules - the labour market and the financial market equilibrium schedule - allows for a straightforward estimation of the model by determining the (at most)

³Note that the reported comparative statics results are based on the simplified IS-LM model and not on the underlying search framework.

two crossing points of the IS and LM curves. This will allow a more complete picture of the expected effects of structural reforms, complementing our comparative statics results in the preceding section.

4.1 The simulations set-up

In order to set up such policy simulations, we will firstly specify the underlying functional relations that describe the production process. In a second step, we describe the methodology used for the simulations before turning to a discussion of the parameter choice. In the last part of this section we will present the outcome of various simulations including robustness tests with respect to underlying functional parameters.

4.1.1 The specification of the model

Labour productivity is determined by a firm's technology choice and a bank's choice of the appropriate corporate governance mechanism in the following additive separable way:

$$LP \equiv y = A \cdot ((1 - \beta) \cdot T^a + \beta \cdot \eta^n) \quad (1)$$

where $a, n \in (0, 1)$, A : proxy for Total Factor Productivity (TFP) and $\beta \in (0, 1)$: a weighting parameter indicating the relative importance of corporate governance mechanisms in the determination of final output. We suspect β being relatively low but strictly positive.

The technology choice is determined by the difference between a firm's inside and outside option, which will be higher the tighter the labour market is. Moreover, in order to characterise the cost efficiency of technological investments by an technology adjustment cost function: $\Psi(T) = T^\tau$, $\tau \geq 1$, stating that the less cost efficient T is, i.e the higher τ , the less important will T be in the determination of labour productivity. Hence, writing $\frac{r+\sigma}{q(\theta)}$ for the capitalised costs of technological investment and using the above production function, the optimal technological choice can be derived from (14) as:

$$T^* = \left[A(1 - \beta) \frac{aq(\theta)}{\tau(r + \sigma)} \right]^{\frac{1}{\tau - a}}$$

Moreover, as can be easily calculated, the less cost efficient the specific investment is, the less reactive will labour productivity with respect to labour market liquidity in partial equilibrium.

Similarly the investment in the corporate governance mechanism can be derived by considering the financial investors are selecting the corporate governance mechanism before matching with an entrepreneur. Using (1) and (15), their optimal investment in corporate

governance can be calculated as:

$$\eta^* = \left[A \cdot \beta \cdot \frac{1 - \chi}{1 - \lambda \chi} \frac{n \phi p(\phi) q(\theta)}{(r + \sigma)(r + q(\theta))} \right]^{\frac{1}{1-n}}$$

Finally, the two equilibrium schedules represent the arbitrage between costs and profits for financial investors and firms at the investment stage. Assuming that λ represents the bargaining power of financial intermediaries these two conditions can be written as⁴:

$$IS : \frac{c}{p(\phi)} - (1 - \lambda) \pi(\theta, \chi, b, T^*, \eta^*, \sigma) = 0 \quad (2)$$

$$LM : \frac{k + \eta(\phi)}{\phi \cdot p(\phi)} - \lambda \pi(\theta, \chi, b, T^*, \eta^*, \sigma) = 0 \quad (3)$$

where χ : bargaining power of workers (share of wages), b : replacement ratio and σ : exit ratio and $\pi(\theta, \chi, b, T^*, \eta^*, \sigma) = \frac{\frac{1-\chi}{r+\sigma} q(\theta)(LP-b) - (\Psi(T) + \gamma(1-\chi))}{(1-\lambda\chi)(r+q(\theta))}$. The wage share and the replacement ratio enter the profit function via their impact on the total wage costs, while the exit rate determines the expected value of the profit stream.

4.1.2 Simulations methodology

The system set up by the equations (2) and (3) can be calculated and its equilibria analytically and numerically determined, once the matching process on labour and financial markets is defined. As we have described at the beginning, we will rely here on a constant-returns-to-scale matching technology and assume a Cobb-Douglas functional form, as it is usually retained in this literature. However, given the important unsecurity regarding the parameter choices and the fact that there are no commonly acceptable parameters for matching functions, the simulation results have been stress-tested by using random samples of parameters, based on the sample variation that can be found in current empirical studies on matching functions (see Petrongolo and Pissarides, 2001). However, given that the ensuing distribution of simulation results does not follow any standard distribution function, only first and third quartiles of the results have been reported (instead of full-blown confidence intervals).

4.1.3 Parameter choices

Having described the economic interactions taking place in our model economy, we are now in position to evaluate the impact of changes in structural policies on the equilibrium outcomes in the two equilibria using numerical simulations. Starting from a baseline simulation three different policy changes are analysed: the deregulation of product markets through a lowering of entry barriers, c ; the deregulation of labour markets by reducing the wage bargaining

⁴See section 7.1.2.

power of trade unions, χ , and the reduction of replacement ratios, b ; and the deregulation of financial markets through reducing entry barriers for banks, k , and their bargaining power, λ . As will be shown in the following, these simulations show important differences depending on whether the policy impact on equilibrium **A** - in the following referred to as the "rigid" economy - or **B** - the "flexible" economy - is considered.

Relating parameters to observed variables. In order to set-up the numerical estimates, we need to define some of the macroeconomic parameters that appear in our equations. Some of these structural parameters can be related straightforwardly to standard macroeconomic series and fixed accordingly. In this respect, the following relations have been retained:

	Parameter	Reference value
Investment share	γ	0.2
Wage share (baseline scenario)	χ	0.62
Interest rate	r	0.05
Replacement ratio	b	0.1
Barriers to entry (average economy)	c	0.2
Barriers to entry (banking sector)	k	0.05
Share of specific investments	a	0.1 – 0.2
Exit ratio	σ	0.11
Bargaining power of banks	λ	0.3

Note that the parameters c , k , b , and χ serve as policy variables that will be subject to structural policy changes. The parameter a describes the importance of specific investments in total production; following Hall (1999) we select values between 10% and 20%. Moreover, in order to specify the production function, it is necessary to determine TFP levels, which are usually unavailable in macroeconomic databases. In this respect, it is reassuring to note that the results do not depend in any systematic way on the TFP level, but only on the importance of technology relative to the corporate governance mechanism. As noted above, we suspect the latter to be low, in particular on the level of the macroeconomy. Here, we used the short-cut: $A' = A \cdot (1 - \beta)$ and $N = A \cdot \beta$ with $A' = 4$ and $N = 0.1$, implying $\beta \approx 0.02$.

The matching functions. A final specification of the model requires the matching functions to be determined. Based on the assumption of constant-returns-to-scale matching functions, we adopt the following specifications

$$\begin{aligned}
 q(\theta) &= q_0 \cdot \theta^{-q_1} \\
 p(\phi) &= p_0 \cdot \phi^{-p_1}
 \end{aligned}$$

Table 2: Matching function parameter

	Mean	Std. Dev.	Actual mean	Std. Dev.
q_0	0.6	0.42	0.5	0.34
q_1	0.5	0.17	0.5	0.17
p_0			0.8	0.54
p_1	0.2	0.07	0.2	0.07

with $q_0, p_0 > 0$, q_1 and $p_1 \in (0, 1)$. Here, we will retain $q_0 = 0.6$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$. These choices of the initial values of the matching function parameters are taken from Gregg and Petrongolo (2004), Petrongolo and Pissarides (2001) for the labour market matching and Hendry and Moran (2003) for the financial market matching.

In order to assess the significance of the outcome of the different policy simulations, confidence intervals have been constructed around these four parameters, based on variance calculations from the different papers. For the financial market, no similar empirical literature exists, however, up to this date. The best prior we could use, therefore, is to apply variances that are similar in magnitude to the corresponding values for the labour market parameters.

Note that the standard deviation for p_0 and p_1 are based on the assumption that their distribution resembles that for labour markets. The values of p_0 and p_1 are taken from Hendry and Moran (2003) and Dell'Araccia and Garibaldi (2000). The value for q_0 is taken from Gregg and Petrongolo (2004).

4.1.4 Specific investment and adjustment costs

The technological investment is characterised by an efficiency parameter $\tau \geq 1$ such that actual costs of the investment are determined as (see discussion above): $\Psi(T) = T^\tau$, impacting on the importance of T on the determination of labour productivity. As can be easily calculated, the less cost efficient the specific investment is, the less reactive will labour productivity with respect to labour market liquidity in partial equilibrium⁵.

As can be expected, the degree of cost effectiveness of the specific investment plays a key role in our simulations. The higher the adjustment cost, the less reactive will the firm's investment in specific asset be when labour market conditions change. Hence, part of our results may be driven by the particular assumptions we are making about the degree of adjustment costs for specific investment. Given the multiplicity of equilibria and the

⁵Taking logs, the cross derivate of T^* with respect to θ and τ evaluates to: $\frac{-q'(\theta)}{(\tau-a)^2 q(\theta)}$, which is positive, i.e. the negative influence of θ on T^* decreases with rising τ .

differences in reactions with respect to structural policies, this is obviously an important empirical handle to determine in which direction a particular economy is likely to move.

4.2 What can we expect from structural reforms: simulation results

Starting from a baseline simulation three different policy changes are analysed: the deregulation of product markets through a lowering of entry barriers, c ; the deregulation of labour markets by reducing the wage bargaining power of trade unions, χ , and the reduction of replacement ratios, b ; and the deregulation of financial markets through reducing entry barriers for banks, k , and their bargaining power, λ . As will be shown in the following, these simulations show important differences depending on whether the policy impact on equilibrium A - in the following referred to as the "rigid" economy - or B - the "flexible" economy - is considered.

4.2.1 Product market deregulation

First, an increase in product market competition is considered (panels A and B in figure 3), simulating a reduction of barriers to firm entry as measured by the parameter c ; concretely, in the simulation, c is lowered from 0.2 to 0.154, i.e. by 23%. As can be seen in the following table, the reaction is somewhat different across the two equilibria.

Table 3: The impact of product market deregulation

A reduction of barriers to entry by 23% changes	for equilibrium	
	A	B
Unemployment	-4,2pp.	-0,3pp.
Output	-8,2%	1,7%
Labour productivity	-12,7%	1,3%
Memorandum item		
Initial unemployment	7,7%	4,1%

Note: All values are reported in % except for changes in unemployment (percentage points). The simulation is based on a 23% reduction of barriers to entry. The parameters used are: $T = 2.6$; $q_0 = 0.5$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$; $b = 0.1$; $c = 0.2$; $\sigma = 0.11$; $k = 0.05$; $\gamma = 0.2$; $\lambda = 0.3$; $\chi = 0.62$; $n = 0.24$; $a = 0.1$; $r = 0.05$; $N = 0.2$.

In both cases, a more dynamic firm entry reduces the unemployment rate, as standard theory would suggest. However, the unemployment rate is somewhat more elastic in the "rigid" economy A, than in the "flexible" economy B. More interestingly, however, are the

results on the financial market. As a more dynamic firm entry yields more opportunity for banks to finance, a reduction in the barriers to entry on the product market produces a more dynamic banking sector ... but only for the "rigid" economy! In the "flexible" economy, the banking sector does not follow the product market dynamics, yielding a higher firm to bank ratio and hence lower liquidity.

This has, on the other hand, important consequences for gross output, as the higher firm-to-bank ratio in the "flexible" economy allows to make up for some of the lost incentives to build up specific investment. Hence, both, the higher matching ratio on the labour market and the higher specific investment by financial investors boost gross output in the "flexible" economy. Conversely, in the "rigid" economy, the higher financial market liquidity and the lower incentives by firms to invest in specific assets lowers gross output.

This is but a very striking example of how the impact of structural reforms may depend upon the initial conditions (here the initial liquidity of the labour market). It should be noted, however, that this result depends on the importance of specific investments for the firm's productivity relative to the liquidity effect of markets. For a wide range of parameters, the (negative) incentive effect of reforms may be strong enough as to reduce labour productivity so much that the impact on GDP for both equilibria is negative (see the following table based on a larger τ but otherwise with the same parameters as before):

Table 4: The impact of product market deregulation

A reduction of barriers to entry by 2.2% changes	for equilibrium	
	A	B
Unemployment	-1,2%	-0,2%
Output	-4,5%	1,0%
Financial market liquidity	13,5%	-7,7%
Memorandum item		
Initial unemployment	9,8%	9,1%

Note: All values are reported in % except for changes in unemployment (percentage points). The simulation is based on a 23% reduction of barriers to entry. The parameters used are: $T = 2.6$; $q_0 = 0.5$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$; $b = 0.1$; $c = 0.2$; $\sigma = 0.11$; $k = 0.05$; $\gamma = 0.2$; $\lambda = 0.3$; $\chi = 0.62$; $n = 0.24$; $a = 0.1$; $r = 0.05$; $N = 0.2$.

Robustness check. In order to assess the robustness of the above simulation results for changes in the size of market entry barriers, we will report in the following estimations based on perturbed parameters for the matching functions on labour and financial markets. In doing so, we will following the simulation methodology described above. One of the difficulties in proceeding with these perturbation excersises is that there are no immediately accessible measures of the variance of the structural parameters. At best, they can be taken from reported variation in individual papers or they have to be deducted from a meta-analysis

of existing research. Moreover, the perturbation may affect the results differently, depending on whether the parameter uncertainty concerns the labour or the financial market matching function.

Based on the reported variances in table 2, we will therefore proceed at two perturbation exercises, one for each matching function. Another difficulty of this task concerns the fact that the resulting estimates for unemployment, labour productivity and GDP do not follow any more the properties of a Gaussian distribution, which puts some restrictions on the measures of the robustness of the simulations. The following table reports the median and the first and third quartiles of the policy outcomes for perturbed parameters of the labour market matching process.

Table 5: Monte Carlo simulation: Perturbing the labour market matching function

Equilibrium		Median	Quartiles	
			1st	3rd
A	u_0	7.14	2.91	16.41
	Δu	-2.73	-5.80	-1.49
	ΔLP	-11.02	-12.71	-11.02
	ΔGDP	-8.25	-10.84	-3.73
B	u_0	4.08	1.23	10.24
	Δu	-0.33	-0.96	-0.12
	ΔLP	-0.34	-0.34	1.35
	ΔGDP	1.38	0.29	1.55

Note: The statistical properties are derived on the basis of 10000 simulated observations. All values are reported in % except for changes in unemployment (percentage points). The simulation is based on a 23% reduction of barriers to entry. The parameters used are: $T = 2.6$; $q_0 = 0.5$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$; $b = 0.1$; $c = 0.2$; $\sigma = 0.11$; $k = 0.05$; $\gamma = 0.2$; $\lambda = 0.3$; $\chi = 0.62$; $n = 0.24$; $a = 0.1$; $r = 0.05$; $N = 0.2$.

Due to the extreme skedness of the distribution of simulated effects, only very rough statistical details can be given. In particular, the median (instead of the mean) and the first and third quartiles are presented in the above table. Although these indicate a relatively wide margin in terms of the absolute numbers, no sign change is observed, conforing our initial simulation result.

Second, we will proceed at the perturbation of the parameters of the financial market matching function. One additional difficulty with this process is, that not all parameter tuples (p_0, p_1) will actually yield an equilibrium as the financial market matching has a different impact on the IS and the LM curve. Hence, equilibria only exist for a relatively limited (and non-convex) parameter space. Moreover, given that no empirical study regarding the financial market matching function exists to our knowledge, the statistical inference had to be based on the assumption that the parameters of the financial market matching process

follow a similar distribution as those for the labour market. The following table reports the median and the first and third quartiles of the policy outcomes for perturbed parameters of the financial market matching process.

Table 6: Monte Carlo simulation: Perturbing the financial market matching function

		Median	Quartiles	
			1st	3rd
Equilibrium A	u_0	14.86	9.09	30.81
	Δu	-6.70	-17.46	-3.15
	ΔLP	-11.09	-16.37	-7.54
	ΔGDP	-1.37	-4.55	8.28
Equilibrium B	u_0	5.96	4.78	9.42
	Δu	-1.58	-2.98	-1.03
	ΔLP	-2.89	-4.12	-1.96
	ΔGDP	-0.86	-1.14	0.00

Note: The statistical properties are derived on the basis of 9115 simulated observations. All values are reported in % except for changes in unemployment (percentage points). The simulation is based on a 23% reduction of barriers to entry. The parameters used are: $T = 2.6$; $q_0 = 0.5$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$; $b = 0.1$; $c = 0.2$; $\sigma = 0.11$; $k = 0.05$; $\gamma = 0.2$; $\lambda = 0.3$; $\chi = 0.62$; $n = 0.24$; $a = 0.1$; $r = 0.05$; $N = 0.2$.

As can be seen in comparing table 5 and table 6, the margins are much wider in perturbing financial market parameters, confirming the original discussion in Wasmer and Weil (2002). Sign changes occur, in particular for the GDP estimates when the confidence intervals are based on the first and third quartile, hence even when using these very rough statistical properties for robustness inference, the results show signs of strong instability.

4.2.2 Labour market deregulation

Change in capital-labor income distribution. Another often discussed structural policy concerns the deregulation of the labor market that could affect both replacement ratios, b , and unions' bargaining power, χ , impacting directly on the wage to be paid to workers. In the following table, we first consider a reduction of the trade unions' bargaining power from 0.62 to 0.58, i.e. by 4.0pp. The results together with the perturbed samples are presented in table 7 and show - again - differences across equilibria regarding their reaction to such a reduction in bargained wages.

Table 7: The impact of a wage decrease: Actual and perturbed simulation

Equilibrium		Actual	PERTURBED LM MATCHING			PERTURBED FM MATCHING		
			Median	Quartiles		Median	Quartiles	
				1st	3rd		1st	3rd
A	u_0	7.1	3.88	1.92	5.86	6.62	5.85	7.74
	Δu	-2.2	-1.18	-1.88	-0.81	-1.90	-2.48	-1.48
	ΔLP	-3.4	-3.43	-3.43	-3.43	-2.82	-3.27	-2.47
	ΔGDP	-1.1	-2.19	-2.59	-1.44	-0.74	-1.21	-0.16
B	u_0	4.9	2.40	0.95	4.08	5.20	4.92	5.76
	Δu	-1.0	-0.49	-0.75	-0.31	-1.07	-1.24	-0.97
	ΔLP	-0.5	-0.52	-0.52	-0.52	-0.69	-0.84	-0.46
	ΔGDP	0.5	-0.02	-0.22	0.26	0.51	0.44	0.69

Note: The statistical properties are derived on the basis of 20000 simulated observations. All values are reported in % except for changes in unemployment (percentage points). The simulation is based on a 4pp decrease of the wage share. For the perturbation of labour market matching, only 8795 observations displayed effectively two equilibria before and after the policy change. The parameters used are: $T = 2.6$; $q_0 = 0.5$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$; $b = 0.1$; $c = 0.2$; $\sigma = 0.11$; $k = 0.05$; $\gamma = 0.2$; $\lambda = 0.3$; $\chi = 0.62$; $n = 0.24$; $a = 0.1$; $r = 0.05$; $N = 0.2$.

Similarly to a product market deregulation, in both cases, the deregulation of the labor market reduces the unemployment rate, as standard theory would suggest. Again, the unemployment rate is somewhat more elastic in the "rigid" economy A, than in the "flexible" economy B. On the other hand, the increased liquidity on the labor market leads to increased output only in the case of the "flexible" economy B. In the "rigid" economy A, the increased labor market flexibility produces a negative incentive effect on specific investments by both workers and financial investors - as witnessed by the increased financial market flexibility - that yields a strong negative impact on the firm productivity. At least as regards economy A, the negative impact is not being compensated by the higher liquidity on the labor market, contrarily to what is happening in equilibrium B.

Perturbing either labour market or financial market matching functions gives a slightly different picture to what we have seen before. Here, principally due to the wide variance of estimates of q_0 , the labour market perturbation does not preserve the sign or the magnitude of the simulated policy changes. However, for the much more difficult to measure financial market matching function, both the signs and the magnitudes are preserved, which is encouraging as to the relevance of the policy simulations that are presented.

A reduction of the replacement ratio. In a second step, we keep the unions' bargaining power constant at $\chi = 0.62$, but lower the replacement ratios from $b = 0.1$ to $b = 0.05$, i.e. by 50%. In light of recent policy changes, this may not look completely unrealistic. Based on the sample of OECD countries at the end of the 1990s, a 50% decrease would have corresponded to one standard deviation of replacement ratios in the sample.

The resulting changes in macroeconomic outcomes are presented in table 8 . Contrarily

to the former exercises, here the equilibria present similar reactions to such a policy change.

Table 8: Reducting replacement ratios: Actual and perturbed simulation

Equilibrium		Actual	PERTURBED LM MATCHING			PERTURBED FM MATCHING		
			Median	Quartiles		Median	Quartiles	
				1st	3rd		1st	3rd
A	u_0	8.0	4.69	2.48	6.99	7.69	6.53	9.58
	Δu	-2.8	-1.58	-2.63	-1.08	-2.55	-3.55	-1.89
	ΔLP	-2.5	-2.52	-2.52	-2.52	-2.20	-2.61	-1.85
	ΔGDP	0.5	-0.87	-1.41	0.26	0.72	0.17	1.93
B	u_0	5.4	2.84	1.17	4.71	5.71	5.43	6.38
	Δu	-1.3	-0.70	-1.11	-0.45	-1.47	-1.74	-1.40
	ΔLP	-0.9	-0.93	-0.93	-0.93	-1.06	-1.16	-0.95
	ΔGDP	0.5	-0.21	-0.48	0.22	0.55	0.49	0.72

Note: The statistical properties are derived on the basis of 9344 simulated observations for the perturbation of the LM matching function and 3220 simulated observations for the perturbation of the FM matching function. All values are reported in % except for changes in unemployment (percentage points). The simulation is based on a 50% reduction of replacement ratios. The parameters used are: $T = 2.6$; $q_0 = 0.6$; $q_1 = 0.5$; $p_0 = 0.8$; $p_1 = 0.2$; $b = 0.1$; $c = 0.2$; $\sigma = 0.11$; $k = 0.05$; $\gamma = 0.2$; $\lambda = 0.15$; $\chi = 0.62$; $n = 0.24$; $a = 0.1$; $r = 0.05$; $N = 0.2$.

Similarly to the preceding change in bargaining power, the reduction of replacement ratios on the labor market reduces the unemployment rate, as standard theory would suggest, although the reduction would be quite small overall (unemployment in equilibrium A would still stands at 15.5% after the policy change). Contrarily to the preceding cases, the "rigid" economy A reacts somewhat stronger to the policy change than the flexible economy B. Moreover, changes in output are now going in the same direction, albeit at a very slow rate. For the "flexible" economy B an increase in output of around 0.01% can be expected which is very low compared with the extent of the initial policy change.

Regarding the perturbation of these policy simulations, similar conclusions can be drawn in the case of a reduction of the replacement ratio. While labour market matching perturbation does not preserve neither sign nor magnitude, financial market matching perturbation does. This can be taken as an encouraging sign as to the relevance of the policy simulations, given the inherent difficulty of measuring financial market matching processes.

4.2.3 Financial market deregulation

Finally, we want to consider the impact of the deregulation of the financial market. In particular, we want to consider a reduction of entry barriers, k , for financial investors from 0.3 to 0.272, i.e. by a considerable 10.3%. Results are presented in table 9.

Table 9: The impact of a financial market deregulation

A increase of financial market deregulation by 10.3% changes	for equilibrium	
	A	B
Unemployment	0.1%	-0.6%
Output	2.4%	-4.0%
Financial market liquidity	-7.9%	19.8%
Memorandum item		
Initial unemployment	8.4%	8.2%

Parameter values for simulation:

$\kappa=0$, $T=1$, $n=0.5$, $a=0.34$, $c=0.7$, $b=0$, $\lambda =0.45$, $\chi=0.66$

Similar to the first two examples but even more striking are the differences across the two equilibria regarding the impact such a policy change may have. The increased financial market liquidity as would have been predicted by standard economic theory only settles in for the "flexible" economy B, while for the "rigid" economy A financial market liquidity falls even further. This has to do with the fact that - for high values of ϕ , i.e. for low financial market liquidity - the equilibrium curve \mathcal{BB} is backward bent, the incentive effect being stronger than the liquidity effect on the market. In this case, a reduction in the costs of entry for banks can only be matched by an increased investment for firm surveillance which is to say that financial market liquidity has to decrease.

Consequently, to different scenarios arise depending on whether the economy is "flexible" or "rigid". In the latter case, the strong incentive effect raises specific investments by financiers which leads to an increased firm productivity and hence an increase gross production. This will, however, be matched partly by an increase of the unemployment rate that follows from the reduced financial market liquidity which will also affect the dynamics of firm entry. For the "flexible" economy B, however, an ENRON-like phenomena is arising: while unemployment is falling following stronger financial market liquidity, the decrease in specific investments for firm surveillance by financial investors decreases the firm productivity substantially, reducing gross production by 4%.

5 Conclusion

When markets are characterized by transactional imperfections, market interaction may arise where imperfections on one market spill over to another, mutually influencing the macroeconomic outcome. However, has been shown by way of numerical examples in this paper, no unambiguous, monotonic relationship may exist once specific investment as another form of transaction problem is taken into account. In particular, we have shown that in this case, markets may interact in a way such that the economy with higher friction react

differently to the institutional environment and the liquidity of markets than the equilibrium with low frictions.

As has been shown in the beginning of the paper, such an analysis can help to account for a different industrial specialization a country may follow. Indeed, different industries are identified by different technological characteristics that may determine the extent to which specific investment are necessary for its successful evolution. When only low levels of specific investments are required - or similarly when the marginal productivity of these kinds of investment is high - then lower market frictions may in fact lead to both higher employment and higher industrial growth. Conversely, where industries are characterized by high levels of specific investments, stronger frictions provide the necessary incentives for strong industrial performance. As in this situation, one size does not fit all, one might expect different industrial portfolios to be selected by countries characterized by different degrees of frictions on their credit and labor markets.

Moreover, it has been shown that in the case that market interactions lead to multiple equilibria with differences in structural characteristics, structural policy changes do not systematically produce the results expected from standard economic theory. It has been shown that due to their underlying structural characteristics, the two equilibria show distinct patterns of changes in macroeconomic performance regarding structural policy shocks. In particular, increasing competition on one of the three markets may not yield the expected increase in output for the equilibrium with strong specific investments by stakeholders. This points to the fact that more 'liquidity' or 'flexibility' may act as a disincentive to specific investment, be it work effort, entrepreneurial monitoring or innovative outlays. Hence both partial and general equilibrium effects of market frictions have to be considered simultaneously in order to determine the likely impact of any change in structural policies.

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7 Appendix

7.1 The simulated search model

Let F_i , $i \in \{0, 1, 2, 3\}$ denote the different stages of the firm's life cycle and r the given risk-less interest rate. Then the Bellman equations for the firm values can be written as follows:

$$r \cdot F_0 = -c + p(\phi) \cdot (F_1 - F_0) + \dot{F}_0 \quad (4)$$

$$r \cdot F_1 = -\Psi(T) + q(\theta) \cdot (F_2 - F_1) + \dot{F}_1 \quad (5)$$

$$r \cdot F_2 = y(T, \eta) - w - \rho + \sigma \cdot (F_3 - F_2) + \dot{F}_2 \quad (6)$$

$$F_3 = 0 \quad (7)$$

where $y_T > 0$, $y_\eta > 0$, $y_{TT} < 0$, $y_{\eta\eta} < 0$. Moreover, we assume that there are convex technological adjustment costs $\Psi(T) = T^\tau, \tau \geq 1$. Finally, as the value of a firm is destroyed with the end of the match, we have $F_3 = 0$.

In the fund raising stage, firms spend c to match with an appropriate financial investor which will happen with probability $p(\phi)$. After installing the productive technology, T , the firm finds a suitable worker and will switch to the production stage with probability $q(\theta)$. There, it receives a stream of gross profits of $y(T, \eta)$ -depending on the monitoring commitment by financial investors - that have to be used to pay wages, w , and make debt reimbursements, ρ .

Similarly, let B_i , $i \in \{0, 1, 2, 3\}$ denote the values of the financial investor over the four different stages of the its life cycle. Then the Bellman equations for the financial investor values can be written as follows:

$$r \cdot B_0 = -k - \eta + \phi \cdot p(\phi) \cdot (B_1 - B_0) + \dot{B}_0 \quad (8)$$

$$r \cdot B_1 = -\gamma + q(\theta) \cdot (B_2 - B_1) + \dot{B}_1 \quad (9)$$

$$r \cdot B_2 = \rho + \sigma \cdot (B_3 - B_2) + \dot{B}_2 \quad (10)$$

$$B_3 = 0 \quad (11)$$

During the fund raising stage, the financial investor spends k as general search costs and commits η to monitor the firm's realisation of the investment. Having match with probability $\phi \cdot p(\phi)$, the financial investor finance the recruitment period before the firm finds its labor force, spending γ . After this period, he expects to recover his negotiated debt ρ before the firm quits the market with exit probability σ .

7.1.1 Wages and interest rates

Wages and interest rates are negotiated. Assuming χ to be the bargaining power of workers and λ that of financial investors, their respective remuneration can be determined as a linear combination of their fallback position (which equals the incentive compatibility constraint) and the match value where the weights are constituted by their bargaining power. The incentive compatibility constraint for workers is set-up by unemployment benefits, b , while financial investors must expect to recover at least their capital investment γ in order to lend money to firms. Moreover, financial investors - negotiating the terms of the contract before the technological investment is taking place - will have to take this investment into account during their bargaining process. Hence, wages and interest rates write as:

$$w = \chi(y - \rho) + (1 - \chi)b \quad (12)$$

$$\rho = \lambda \left(y - w - \Psi(T) \frac{r + \sigma}{q(\theta)} \right) + (1 - \lambda) \gamma \frac{r + \sigma}{q(\theta)}. \quad (13)$$

Recursively solving this model in order to calculate total firm's profits yields:

$$\tilde{\pi} = y - w - \rho = \frac{(1-\chi)(1-\lambda)}{1-\lambda\chi} (y-b) + \frac{1-\chi}{1-\lambda\chi} \frac{(\lambda\Psi(T) - (1-\lambda)\gamma)(r+\sigma)}{q(\theta)}$$

7.1.2 IS-LM

In order to derive the IS-LM equilibrium, we have to recover the equilibrium schedules from the system constituted by equations (4)-(7), (8)-(11) and (12)-(13). The IS-equilibrium is reached when the ex-post cost of a firm's entry equals its expected return:

$$\begin{aligned} F^{entry} &= \frac{c}{p(\phi)}, F^{RoI} = \frac{\tilde{\pi}}{r+\sigma} \frac{q(\theta)}{r+q(\theta)} - \Psi(T) \\ IS &: F^{entry} \stackrel{!}{=} F^{RoI} \end{aligned}$$

Similarly the LM-equilibrium is reached when the ex-post cost of a financier's entry equals its expected return:

$$\begin{aligned} B^{entry} &= \frac{k+\eta}{\phi \cdot p(\phi)}, B^{RoI} = \frac{\rho}{r+\sigma} \frac{q(\theta)}{r+q(\theta)} - \gamma \\ LM &: B^{entry} \stackrel{!}{=} B^{RoI} \end{aligned}$$

Both equilibrium conditions can be conveniently reduced to:

$$\begin{aligned} IS &: \frac{c}{p(\phi)} - (1-\lambda)\pi(\theta, \chi, b, \eta(\phi), \sigma) = 0 \\ LM &: \frac{k+\eta(\phi)}{\phi \cdot p(\phi)} - \lambda\pi(\theta, \chi, b, \eta(\phi), \sigma) = 0 \end{aligned}$$

where $\pi(\theta, \chi, b, \eta(\phi), \sigma) = \frac{\frac{1-\chi}{r+\sigma}q(\theta)(y-b) - (\Psi(T) + \gamma(1-\chi))}{(1-\lambda\chi)(r+q(\theta))}$.

7.1.3 Technology and corporate governance

In order to determine the equilibrium profit stream $\pi(\cdot)$, the optimal technological choice as well as the optimal selection of the corporate governance mechanism has to be determined.

Technology. Firms select the appropriate technology before matching with a worker such as to maximize the firm's value:

$$T^* = \arg \max (F_1 - F_0)$$

which - taking into account (12) - results in the following FOC:

$$ET = -r - \sigma + q(\theta)(1-\chi) \cdot \frac{\partial y}{\partial T} \stackrel{!}{=} 0 \Leftrightarrow \frac{\partial y(T, \eta^*)}{\partial T} = \frac{r+\sigma}{(1-\chi)q(\theta)}. \quad (14)$$

Corporate governance. Financial investors will select the appropriate corporate governance mechanism η before matching with the firm such as to maximise its return, ρ . Hence in equilibrium, financial investors determine η^* by maximising their entry value B_0 :

$$\eta^* = \arg \max B_0(\eta)$$

which results in the following FOC:

$$E\eta = \lambda \phi p(\phi) (1 - \chi) \psi(e^*) q(\theta) \cdot \frac{\partial y(T^*, \eta)}{\partial \eta} - (1 - \lambda \chi) (r + q(\theta)) (r + \sigma) \stackrel{!}{=} 0. \quad (15)$$

7.2 Graphical representation of policy simulations

Figure 3: Policy simulations

