Macroeconomic Effects of Deregulation in Goods Market with Heterogeneous Firms

Marco Arnone and Diego Scalise
Catholic University of Milan (Italy)

Abstract

This paper builds on the Blanchard and Giavazzi (2003) model of deregulation. We concentrate on product market to construct a framework explaining in a more nuanced way the redistributive effects of deregulation between sectors and within the same sector, and possible oppositions to this policy by firms and workers. In a general equilibrium framework, we introduce two sectors (regulated and unregulated), heterogeneity in firms' productivity, and a fixed cost of entry. In such a context effects of deregulation policies can be ambiguous depending on some parametric restrictions, and sometime counterproductive. As a result, deregulation policies are not always welfare improving: a deregulation action will succeed in increasing competition and reducing mark up when the economy is already partially deregulated (sufficiently high level of competition), but may achieve the opposite outcome when it is highly regulated. Additionally, we study the choice of the best policy instrument and the optimal sequencing in the use of instruments.

1 Introduction[1]

As pointed out by Blanchard and Giavazzi (2003) reduction and redistribution of rents are the heart of any deregulation policy. It seems to

[1]This project was started when Marco Arnone was an Economist at the Monetary and Financial Systems Department of the International Monetary Fund. We wish to thank Luigi Bonatti, Stefano Bosi, Luigi Campiglio, Jordi Gali, Bernard Laurens, Andreu Mas-Colell, Giuseppina Malerba, Marco Mazzoli, Alessandro Prati, Alessandro Rebucci, Xavier Sala-i-Martin, and Martin Sommer for helpful suggestions and comments. Opinions expressed reflect only those of the authors. Errors are ours alone. Appendices mentioned in the paper are available upon request (marco.arnone@yahoo.com, ferdinando.scalise@unicatt.it).

be very important to understand in depth the functioning and outcomes of such policies, first of all "to clarify political economy constraints on deregulation"[2], and to choose the best policy instruments to introduce it into markets. This point turns out to be crucial if we consider that such policies are claimed as necessary and fundamental to improve a country's economic performance[3].

Blanchard and Giavazzi (2003) build a general equilibrium model with regulation in both labor and product markets: in the first market a policy maker can act to reduce contractual strength of workers in the wage bargaining with firms, while in the second s/he can increase competition, through an increase in elasticity of demand (only in the short run), and reduce the entry cost for firms (proportional to output, only in the long run). The result is a claim for a coordination of the two policies to win the oppositions of workers, possible at least in the short run, because of the reduction of their rent; in addition, deregulation is able to reduce unemployment and should be widespread. As a result in Blanchard and Giavazzi (2003) deregulation is always welfare improving.

This paper embeds the Blanchard and Giavazzi (2003) model; we concentrate on product market deregulation to construct a framework to explain in a more nuanced way redistributive effects of such a policy between sectors and within the same sector and possible oppositions to it by firms and workers; also, we try to study the choice of the best policy instrument to use and the optimal sequencing in the use of instruments. We introduce two product sectors (one regulated and the other unregulated), heterogeneity in firms' productivity and a fixed cost of entry in a general equilibrium framework very similar to that in Blanchard and Giavazzi (2003). However, unlike Blanchard and Giavazzi (2003), in such a context effects of deregulation policies can be ambiguous depending on some parametric restrictions, and sometime counterproductive. As a result, deregulation policies are not always welfare improving; when implementing deregulation policies, policy makers should consider the choice of the appropriate policy instrument for any given set of parameters: a deregulation action will succeed in increasing competition and reducing mark up when the economy is already partially deregulated (sufficiently high level of competition), but may achieve the opposite outcome when it is highly regulated.

The paper is organized as follows: in section 1 we present the model and the equilibrium conditions; in section 2 we analyze partial equilibrium effects of deregulation in product market (i.e. an increase in elasticity and a reduction in the variable cost of regulation), assuming

[2] See Blanchard and Giavazzi (2003).

[3] See, for example, Gersbach (1999).

entry/exit decisions as given, while in section 3 we will discuss general equilibrium outcomes of the different policies (i.e. an increase in elasticity, a reduction in the variable regulation cost and a reduction in the fixed entry cost) making the number of firms in the market endogenous.

2 The Model

In the economy there are L homogeneous consumers-workers (we assume no capital and saving); they are owners of existing firms and have preferences given by a Cobb-Douglas utility function on an homogeneous good, S, and a bundle of Dixit-Stiglitz (1977) differentiated goods, Φ:

$$U = \Phi^{\alpha} S^{1-\alpha} \tag{1}$$

Φ can be thought of as produced by a manufacturing sector Φ and S as services offered by sector S.

It is simple to verify that utility is increasing and concave with respect to consumption; labor does not enter the function, so effort does not give disutility to agents: as a result they always offer on the market their entire labor endowment (that can be normalized to 1). Firms are assumed to be risk neutral and so profit maximizers.

Sector S is deregulated, perfectly competitive and uses labor as its only production factor (all firms in this sector have the same productivity); workers receive a wage given by their marginal product value, which in equilibrium is equal to the good price, P_S.

Sector Φ is regulated and firms are heterogeneous with respect to productivity (φ): heterogeneity is represented by a probability distribution $\mu(\varphi)$, defined on a subset of the positive semi-axis. Prices of each variety (indexed by the productivity of the firm φ), wages and employment for the firm are determined after a privately efficient bargaining process: workers' contractual strength is β and reflects any aspect of labor market regulation which increases the bargaining power of workers, ranging, for example, from the existence and the nature of "extensions agreements", to closed-shop arrangements, to the rules on the right of strike. Workers can freely move between and within sectors.

As in Blanchard and Giavazzi (2003) we assume this type of bargaining because we want to capture the possibility that firms may not be operating on their demand for labor; we want also to allow for the fact that, when there are rents, stronger workers (higher β) may be able to obtain a higher wage without suffering a decrease in employment, at least in the short run. Efficient bargaining delivers that implication but any assumption which relaxes the link between the wage and the marginal product of labor could yield qualitatively similar results.

We introduce two types of regulation costs: a proportional cost b, that can be interpreted as deriving from bureaucracy (for example, a reduction in b may come from relaxing accounting requirements for firms) and a fixed cost of entry, f; the latter is formalized as an opportunity cost, and is relevant only in the general equilibrium[4]. In general it can be thought of as any barrier that can take the form of legal or administrative restriction on entry, e. g. a state monopoly. The introduction of a fixed cost of entry, together with heterogeneity in firms' productivity, delivers non trivial results in the general equilibrium and substantially changes effects of deregulation policies.

Standard consumer optimization implies that aggregate demand for a single variety is given by:

$$q(\varphi) = \frac{\alpha I}{P_\Phi}\left[\frac{p(\varphi)}{P_\Phi}\right]^{-\sigma} \tag{2}$$

where I is total nominal income in the economy, σ is the elasticity of substitution between goods, $p(\varphi)$ is the price of the good, and P_Φ is the price index associated with differentiated goods, defined as:

$$P_\Phi = \left[\int_{\varphi_*}^{+\infty} p(\varphi)^{1-\sigma}\mu(\varphi)d\varphi\right]^{\frac{1}{1-\sigma}} \tag{3}$$

Given that in equilibrium not all firms will find production profitable, the price index consider only varieties from the cutoff producer φ_* onwards. This implies that φ_* can be used as an inverse measure of the mass of producers existing in equilibrium[5], and as a consequence, σ can be viewed as a function of the productivity cutoff:

$$\sigma = \bar{\sigma} g(\varphi_*) \tag{4}$$

where $g'(\varphi_*) < 0$, even when for ease of notation this dependence will not be made explicit. $\bar{\sigma}$ reflects another dimension of product market regulation (and another policy instrument). For example, in the context of European integration, decreases in $\bar{\sigma}$ may reflect the elimination of tariff barriers, or standardization measures making it easier to sell domestic products in other European Union countries.

[4] For additional discussions on the reasons for this choice see section 4.

[5] This is a consequence of the static nature of the framework. More complex analysis could embody a dynamic version along the lines of Hopenhayn (1992) or Melitz (2003).

Surplus for a firm with productivity φ is given by[6]:

$$\pi(\varphi) = r(\varphi) - c(\varphi) = \alpha I \left[\frac{p(\varphi)}{P_\Phi}\right]^{1-\sigma} - \frac{b}{\varphi}\frac{\alpha I}{P_\Phi}\left[\frac{p(\varphi)}{P_\Phi}\right]^{-\sigma} w(\varphi) =$$
$$= \frac{\alpha I}{P_\Phi^{1-\sigma}} p(\varphi)^{-\sigma}\left[p(\varphi) - \frac{b}{\varphi} w(\varphi)\right] \tag{5}$$

while surplus for workers of this firm is the total excess of their salary $(w(\varphi))$ on the reservation wage (w_S), i.e. the wage they could obtain in the deregulated sector S:

$$V(\varphi) = [w(\varphi) - w_S]\frac{b}{\varphi} q(\varphi) = [w(\varphi) - w_S]\frac{b}{\varphi}\frac{\alpha I}{P_\Phi}\left[\frac{p(\varphi)}{P_\Phi}\right]^{-\sigma} \tag{6}$$

Maximizing the total surplus function $\beta \log V(\varphi) + (1-\beta)\log \pi(\varphi)$ it is shown in Appendix A.1 that wages and prices will be set at:

$$w(\varphi) = w_\Phi = \left(1 + \frac{\beta}{\sigma - 1}\right) w_S \tag{7}$$

$$p(\varphi) = \frac{\sigma}{\sigma - 1}\frac{b}{\varphi} w_S \tag{8}$$

As usual it is assumed that $\sigma > 1$ to rule out trivial results.

Privately efficient bargaining together with workers' surplus as specified in equation (8) leads to wages equal for all workers independently of the productivity of the firm they work in: as expected wages are a constant mark-up over the reservation wage[7].

Productivity, however, affects pricing: the greater φ, the lesser the price charged by the firm; it is also clear that proportional regulation costs add a burden that directly translates into higher price for each

[6] Cost function is defined as:

$$c(\phi) = \frac{b}{\varphi} q(\varphi) w(\varphi) = \frac{b}{\varphi}\frac{\alpha I}{P_\Phi}\left[\frac{p(\varphi)}{P_\Phi}\right]^{-\sigma} w(\varphi)$$

In words, one unit of output can be produced using $\frac{1}{\varphi}$ unit of labor and so cost $\frac{w(\varphi)}{\varphi}$; however, firms must also bear regulation cost b, and so one unit of output actually requires $\frac{b}{\varphi}$ unit of labor to be produced.

[7] This is a consequence of the risk neutrality of firms and risk aversion of consumers, assumed above. It would be interesting to study the implications of assuming risk aversion for firms, as a more realistic assumptions in developing countries.

variety. It is interesting to note that for $\beta \to 0$ (i.e. very small contractual strength of workers) or for $\sigma \to \infty$ (i.e. very competitive product market) the wage converges to its reservation (competitive) level.

Moreover, higher productivity does have an effect on labor, reflected in the employment level for each firm: if $n(\varphi)$ is the labor requirement for firm φ, then:

$$n(\varphi) = \frac{b}{\varphi} q(\varphi) = \frac{\alpha I}{P_{\Phi}^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} w_S \right)^{-\sigma} \left(\frac{\varphi}{b} \right)^{\sigma - 1} \tag{9}$$

So higher productivity firms will hire more labor; they will also have larger revenues and profits (see Appendix A.1).

3 Partial equilibrium

In the partial equilibrium we take the number of firms as given and so the mass of producers in sector Φ is fixed by definition at $1 - G(\varphi_*)$; apart from exogenous variations in $\bar{\sigma}$, the elasticity σ is fixed as well. In this framework, it is possible to show that in sector Φ consumer expenditure is always equal to total payments to all factors[8]. The only market for which an equilibrium must be imposed in the partial equilibrium is the labor market.

If the production function in sector S is simply $S = L_S$, (where L_S is the labor requirement in sector S), from homogeneous market equilibrium it follows that:

$$P_S = \frac{(1-\alpha)I}{L_S} \tag{10}$$

Normalizing the sector S price to 1, wage w_S will also be equal to 1, all variables can be expressed in terms of units of homogeneous good (or units of salary in sector S), and the labor input requirement is

$$L_S = (1-\alpha)I \tag{11}$$

In order to compute labor requirements for sector Φ, it is necessary to give an explicit form to the productivity distribution $\mu(\varphi)$. So in what follows[9] it is assumed that:

[8] The main reason for this result is the absence of fixed costs of production. To check it, it is necessary to integrate profits and total wages per firm along all firms producing in the short run, for a given productivity distribution $\mu(\varphi)$ (or simply integrating revenues for each firm): the resulting expression is always αI, which is total nominal expenditure by consumers, given Cobb-Douglas preferences.

[9] In Axtell (2001) it is shown that the distribution of firms' size as measured by revenues can be approximated with a Pareto; given that in the class of models to which this paper belongs there is a direct relation between size and productivity, a

$$\mu(\varphi) = \lambda\varphi^{-(\lambda+1)} \tag{12}$$

Under this hypothesis[10], P_Φ can be restated as (see Appendix A.2):

$$P_\Phi = \left(\frac{\sigma}{\sigma-1}b\right)\left[\frac{\lambda}{\lambda-(\sigma-1)}\varphi_*^{-\lambda+(\sigma-1)}\right]^{\frac{1}{1-\sigma}} \tag{13}$$

where it has been assumed that $\lambda > (\sigma-1)$[11]. We also show (see Appendix A.2) that the labor requirement in sector Φ is given by:

$$L - L_S = L_\Phi = \frac{(\sigma-1)}{\sigma}\alpha I \tag{14}$$

where L represents the labor force.

Equations (11) and (14) constitute a simple system of two equations in two unknowns, L_Φ which implies L_S, and nominal income I; the solution is (see Appendix A.2)

$$L_\Phi = \left[1 - \frac{\sigma(1-\alpha)}{\sigma-\alpha}\right]L, \qquad L_S = \frac{\sigma(1-\alpha)}{\sigma-\alpha}L, \qquad I = \frac{\sigma}{\sigma-\alpha}L \tag{15}$$

A fraction of total labor force is hired by the regulated sector's firms, while the other is absorbed by perfectly competitive producers[12]; in the model there is no unemployment, but only different allocations of rents. It is interesting to note that for $\sigma \to 1$ (minimum level of competition in sector Φ) $L_S \to L$: this means that all the labor force is hired by the competitive sector. On the other hand when $\sigma \to \infty$, $L_\Phi \to \alpha L$ that is the perfect competition employment level in sector Φ, given the Cobb-Douglas utility function.

3.1 Effects of deregulation in the goods market in partial equilibrium

3.1.1 An increase in the elasticity of substitution ($\bar{\sigma}$)

Because firms' mass is fixed variations in $\bar{\sigma}$ do not lead to entry or exit, and so an increase unambiguously leads to higher σ: prices of all varieties decrease (because of the increase in competition), as well as relative

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Pareto distribution (with parameter λ and initial point in 1) is a good approximation. The same reasoning is found in Helpman (2003).

[10] In order to give the distribution a finite variance, λ must be an integer greater than 2, which will be assumed.

[11] This assumption implies that $(\sigma-1)-th$ uncentered moment of the distribution is finite, and this is common in this class of models. See for example Melitz (2003).

[12] In fact $\frac{\sigma(1-\alpha)}{\sigma-\alpha} < 1$ follows directly by the assumption that $\sigma > 1$ and $\alpha > 0$.

nominal wages in sector Φ; it is interesting to note that the greater the bargaining power of workers, the heavier the drop in nominal wages[13]. Moreover, P_Φ becomes smaller and real wages increase (see Appendix A.2.1). This policy measure also affects the allocation of labor between sectors and within the same sector. As can be seen from equation (15),

$$\frac{\partial}{\partial\sigma}L_\Phi = \frac{\partial}{\partial\sigma}\left[-\left(1+\frac{\alpha}{\sigma-\alpha}\right)(1-\alpha)\,L\right] > 0 \tag{16}$$

hence an increase in σ raises total employment in sector Φ, reallocating workers from S to Φ (given that L remains unchanged). However, effects on employment at firm level are not the same for all firms and for all values of σ. Substituting P_Φ and I in equation (9) it can be shown that employment for firm φ_* is given by:

$$n(\varphi_*) = \varphi_*^{\lambda}\alpha L\left[1-\frac{1-\alpha}{\sigma-\alpha}\right]\frac{\lambda-(\sigma-1)}{\lambda} \tag{17}$$

Differentiating (17) with respect to σ, it is shown (see Appendix A.2.1) that $\frac{\partial}{\partial\sigma}n(\varphi_*)$ is positive only if σ is sufficiently low, i.e. for:

$$1 < \sigma < \alpha + \sqrt[2]{1-\alpha}\sqrt[2]{\lambda+1-\alpha} \tag{18}$$

When the starting value of σ is greater than this threshold, more competition driven by an increase in $\bar{\sigma}$ leads to a reduction in employment for the marginal firm; considering that $n(\varphi) = n(\varphi_*)\left(\frac{\varphi}{\varphi_*}\right)^{\sigma-1}$, this means that employment drops also for firms sufficiently near the marginal one in terms of productivity. However, given that total employment in the sector grows there is a reallocation of employment from less productive firms to more productive ones, in addition to labor shift across sectors.

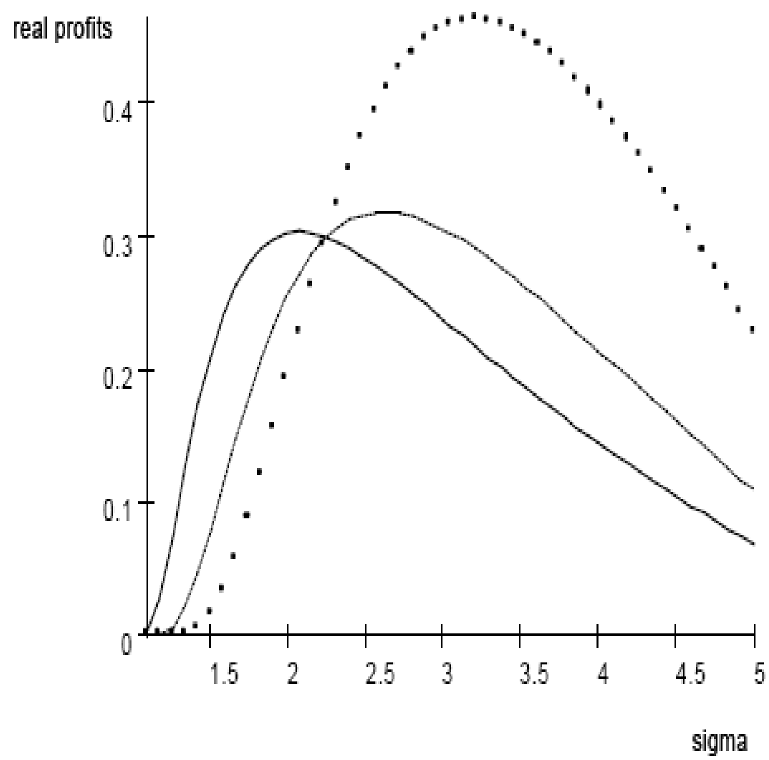
Total wages to workers in sector Φ increase or decrease depending on values of α and β: in Appendix A.2.1 it is shown that

$$\frac{\partial}{\partial\sigma}w_\Phi L_\Phi = -\left(\frac{\alpha(\alpha+\beta-1)}{(\sigma-\alpha)^2}\right)L \tag{19}$$

In particular, sufficiently high bargaining power for workers leads to a decrease in total wages paid in the sector following an increase in σ.

Turning our attention to real profits, a rather peculiar effect of changes in $\bar{\sigma}$ is identified: namely, an increase in σ raises real profits of the cut-off firm only if the starting value of σ is sufficiently low, i.e., if there is

[13] The higher the bargaining power of workers, the further the wage from its competitive level, the heavier the drop following an increase in competition.



enough monopoly power; otherwise, an increase in competition lowers revenues and profits more than the price index; as a consequence the marginal firm looses in real terms (see Appendix A.2.1 for proof and the graph) [14].

This fact could explain opposition to (and lobbying against) deregulation from less productive firms: they try to protect their rents from competition. Moreover, if we assume some form of "transition cost" for workers to move across sectors and firms, the comparison between this cost and the gain in terms of real wage will determine their attitude with respect to deregulation: in particular, if the reallocation cost is sufficiently high, it is possible that they agree with their employers in contrasting the process, making possible the creation a sort of "stopping

[14] Additionaly, given that $\pi_r(\varphi) = \pi_r(\varphi_*)(\frac{\varphi}{\varphi_*})^{\sigma-1}$ (where $\pi_r(\varphi) = \frac{\pi(\varphi)}{P_\Phi}$), if existing monopoly power is high, all firms gain from the deregulation process; on the contrary, if σ is higher than the threshold, only firms with greater productivity obtain an increase in real profits (those for which $\frac{\varphi}{\varphi_*}$ increases more than the reduction in $\pi_r(\varphi)$).

block" made of entrepreneurs and labor unions. It is crucial to take into account these possible redistributive effects when choosing the policy instrument to introduce deregulation in a product market.

3.1.2 A decrease in the proportional cost of regulation (b)

As shown, proportional costs of regulation add a burden for unit produced, transforming a firm with productivity φ in one with productivity $\frac{\varphi}{b}$.

A deregulation policy implemented through a reduction in b will have no counterintuitive effects. First of all, it will lead to lower prices, considering that firms can apply a mark up on lower marginal costs; as a consequence, the price index in sector Φ (eq. (13)) unambiguously declines.

This reduction in b has two opposite effects on nominal profits: they raise because of the increase in the actual productivity, but decrease because a reduction in the price index is equivalent to a worsening in the relative competitive position; however, the final effect on nominal profits is zero (nominal profits[15] do not depend on b), but real profits increase for all firms. The bargaining rule will allow nominal wages to reap no benefits, but nonetheless workers also gain because of a reduction in the price index, which raises real wages. It is possible to conclude that, at least in the short term, a reduction in the variable cost of regulation seems a better policy instrument to foster deregulation.

4 Effects of deregulation in general equilibrium

Decision to enter or exit the market is taken by firms comparing real profit with real costs; in this context the latter are modelled as fixed opportunity costs borne at the time of entry[16]. With heterogeneous firms, real profits are different for each firm; this means that a proportional cost is not able to identify a minimum cutoff productivity below which production is not convenient: this is the reason for modelling this (opportunity) regulation cost as independent from output (therefore, from productivity). The choice of an opportunity cost is made as usual in order to keep the accounting for labor requirement between sectors simple.

In general equilibrium, the condition that determines a cutoff productivity φ_* [17] (by equating real profits to the fixed entry cost f) must

[15] As shown in Appendix XX, equation (50).

[16] This could be done comparing costs of entry to the present value of future profits, or by thinking of f as a fixed opportunity cost. These two formulations seem to be equivalent because differences would follow from an exogenous (and here neglected) discount factor that would have to be included in the model.

[17] As a consequence it will fix a mass of producers and an elasticity of substitution.

be such that:

$$\frac{\alpha\,(1-\beta)\,(\sigma-1)L}{b\sigma(\sigma-\alpha)}\left[\frac{\lambda-(\sigma-1)}{\lambda}\right]^{\frac{\sigma-2}{\sigma-1}}\varphi_*^{\lambda-\frac{\lambda}{\sigma-1}-1}-f=0 \qquad (20)$$

This function $p(\varphi_*, \sigma(\bar{\sigma}, \varphi_*), f, b) = 0$ implicitly relates productivity cutoff, regulation costs and elasticity of substitution in such a way that real profits for the cutoff firm are zero. To analyze changes in productivity cutoff and elasticity following different policy measures, it would be necessary to take a number of derivatives of this equation. But this rapidly reveals a hard task. In order to extract some causal relations, an unusual approach will be adopted: with regard to the function $\sigma = \bar{\sigma} g\,(\varphi_*)$, the study will be conducted only in two cases: when σ is insensitive to variations in φ_* (i.e., $g'\,(\varphi_*) \to 0^-$) and when σ is very sensitive to variations in φ_* (i.e., $g'\,(\varphi_*) \to -\infty$); nonetheless this will give a number of relevant hints, from which it is possible to deduce policy effects in intermediate cases, given monotonicity and continuity.

All the implicit function analysis that follows will rely on a fundamental derivative:

$$\frac{\partial}{\partial \varphi_*} p(\varphi_*, \sigma(\bar{\sigma}, \varphi_*), f, b) = p'_{\varphi_*} + \bar{\sigma} p'_{\sigma} g'\,(\varphi_*) \qquad (21)$$

Real profits of the cutoff firm change following a variation in φ_* through two channels: because of the shift in cutoff productivity φ_*, and because this shift will in general change the elasticity of substitution for all firms, and so also for the cutoff producer.

As shown in the graph, the partial derivative of real profits with respect to σ is positive till σ^+, and is negative thereafter: therefore effects of deregulation polices in general equilibrium will depend on the starting value of σ (as seen before for the partial equilibrium). Also, we need to consider the effect of the non-linear term $g(\varphi_*)$ on σ: for low values of σ (precisely for $\sigma < \lambda^+ = \frac{(2\lambda-1)}{(\lambda-1)}$) an increase in φ_* will lead to lower real profits, i.e. $p'_{\varphi_*} < 0$; while for $\sigma > \lambda^+$ this derivative is positive. It can be the case that either $\sigma^+ < \lambda^+$ or $\sigma^+ > \lambda^+$ [18]. This taxonomy presented in table 1 is relevant because, for intermediate level of σ, the derivatives take different signs, and so deregulation policies lead to different outcomes[19] (while in the other cases signs are the same).

[18] Given that σ^+ is increasing in φ_* and that a greater φ_* implies a stricter selection among producers and then a higher observed productivity in the sector, the case in which $\sigma^+ < \lambda^+$ can be labelled "lower productivity" case, while $\sigma^+ > \lambda^+$ "higher

	Lower productivity $(\sigma^+ < \lambda^+)$	Higher productivity $(\sigma^+ > \lambda^+)$
Low σ	$(1, \sigma^+)$ $p_{\varphi_*} < 0, p_\sigma > 0$	$(1, \lambda^+)$ $p_{\varphi_*} < 0, p_\sigma > 0$
Medium σ	(σ^+, λ^+) $p_{\varphi_*} < 0, p_\sigma < 0$	(λ^+, σ^+) $p_{\varphi_*} > 0, p_\sigma > 0$
High σ	$(\lambda^+, +\infty)$ $p_{\varphi_*} > 0, p_\sigma < 0$	$(\sigma^+, +\infty)$ $p_{\varphi_*} > 0, p_\sigma < 0$

In such a context in order to deduce the effects of any deregulation policy one has to locate the economic system in the matrix of 4 rows (low, intermediate, and high σ; lower and higher productivity) by 2 columns (insensitive elasticity, very sensitive elasticity) presented in table 2.

As it will be shown in the next two sub-sections, effects of the same deregulation policy can be quite different depending on the values of the policy coefficients, and this richness is believed to be the main contribution that heterogeneity can add to an understanding of the topic.

4.1 A reduction in fixed regulation cost

By differentiating (20) with respect to φ_* and f, the total effect on the cutoff productivity of a reduction in f is given by:

$$\frac{\partial \varphi_*}{\partial f} = -\frac{\frac{\partial p}{\partial f}}{\frac{\partial p}{\partial \varphi_*}} = -\frac{1}{p'_{\varphi_*} + \bar{\sigma} p'_\sigma g'(\varphi_*)} \tag{22}$$

while the total effect on σ is given by:

$$\frac{\partial \sigma}{\partial f} = \bar{\sigma} g'(\varphi_*) \frac{\partial \varphi_*}{\partial f} \tag{23}$$

Substituting signs of relevant derivatives in the 8 cases in which the

productivity"one.

[19] Even if the actual intervals that identify "intermediate" values of σ differ in the two cases, this can be overlooked in a first approximation, given that the aim is to stress only different directions in total effects.

Long run effects of a reduction in f		Insensitive $g(\varphi_*)$		Very Sensitive $g(\varphi_*)$	
		$d\varphi_*/df$	$d\sigma/df$	$d\varphi_*/df$	$d\sigma/df$
Low σ		>0	0^-	0^+	<0
Medium σ	Lower Prod.	>0	0^-	0^-	>0
	Higher Prod.	<0	0^+	0^+	<0
High σ		<0	0^+	0^-	>0

economic system can be located, we obtain the matrix presented in table 2.

This table is a summary of two detailed ones that can be found in Appendix A.3 (to which reference can be made for all results here stated), in which magnitudes are also reported. When an effect is marked as "> 0", it means that it is significantly (mathematically) bounded away from zero, in comparison to a label like "0^+", in which the effect is positive but not significantly different from zero. Results of this analysis are qualitatively equivalent to those for a reduction in b[20], given that in any case the signs of the derivatives are the same.

The first point to make is that in all cases there is a trade-off between effects on average productivity and elasticity. Given that the economy is always moving along the same curve $\sigma = \bar{\sigma} g(\varphi_*)$, policies that increase aggregate productivity through a selection effect on φ_* reduce firms' mass and lower elasticity of substitution, i.e. increase monopoly power of surviving producers; on the other hand, policies that succeed in raising σ allow new entrants in the sector. However, new firms are less productive than incumbents[21], therefore average measured productivity is lower in the new equilibrium.

The degree of sensitiveness of σ is a measure of this trade-off: when the elasticity of substitution is insensitive with respect to variations in the mass of firms, there is room for adjustments in the number of producers (but, of course, there is not for σ); on the other side, when σ is

[20] Reported in Appendix XX. In this set up there is not an explicit fixed cost of production, therefore no economies of scale emerge; this is why the equivalence holds. In a broader set up, results may be different in the two cases.

[21] Because those who were able to produce at a profit were already doing so.

highly sensitive, adjustments take place through it, and almost without effect on φ_*. Also, a reduction in f can have quite different outcomes depending on where the system is located with respect to the relevant dimensions: for instance, a reduction can raise aggregate productivity (and this will also imply lower price index, given that σ does not change) if the economy is in the insensitive, low σ region, but can cause aggregate productivity to fall if σ is already high.

In order to discuss a deregulation process through this policy, it is crucial to make an assumption about the shape of $g(\varphi_*)$, namely, if it is convex or concave at the origin. If $g(\varphi_*)$ is a convex function, then low values of σ are likely to be found in the insensitive region. In this case, deregulation forces a number of firms out of the market and implies a (negligible) decrease in σ. In the opposite case, if $g(\varphi_*)$ is a concave function, a heavily regulated sector may be found in a region with very sensitive elasticity to the mass of producers: deregulation will lead to a slight exit of firms from the market, immediately compensated by an increase in monopoly power of surviving producers, i.e., a further reduction in σ. For intermediate cases, these two effects have different relative magnitudes, but nonetheless their direction is preserved: the main result is that if deregulation wants to pursue a reduction in monopoly power of firms, the low σ area is a sort of “trap”, a "no-improvement" region for this kind of policy. Its effect is to worsen the situation; as a consequence, a reduction in f is not a good starting point. This region extends also to intermediate values of σ (it extends to the insensitive region, if aggregate productivity is low; it extends to the very sensitive region, if aggregate productivity is high), making the implementation of this policy particularly difficult. If one is not sure about the location of the economy, implementing this policy may reveal counterproductive. Only for high values of σ (and sensitive elasticity function, i.e. a convex $g(\varphi_*)$) this policy leads to a reduction in the monopoly power of firms, but at the expense of lower average productivity.

4.2 An increase in the elasticity of substitution ($\bar{\sigma}$)

By implicit differentiation of (20), it is straightforward to see that:

$$\frac{\partial \varphi_*}{\partial \bar{\sigma}} = -\frac{\frac{\partial p}{\partial \bar{\sigma}}}{\frac{\partial p}{\partial \varphi_*}} = -\frac{g(\varphi_*)}{p_{\varphi_*} + \bar{\sigma} p_\sigma g'(\varphi_*)} p_\sigma \tag{24}$$

It is shown in Appendix XX that:

$$\frac{\partial \sigma}{\partial \bar{\sigma}} = \frac{g(\varphi_*)}{p_{\varphi_*} + \bar{\sigma} p_\sigma g'(\varphi_*)} p_{\varphi_*} \tag{25}$$

Long run effects of an increase in $\bar{\sigma}$		Insensitive $g(\varphi_*)$ $d\varphi_*/d\bar{\sigma}$	Insensitive $g(\varphi_*)$ $d\sigma/d\bar{\sigma}$	Very Sensitive $g(\varphi_*)$ $d\varphi_*/d\bar{\sigma}$	Very Sensitive $g(\varphi_*)$ $d\sigma/d\bar{\sigma}$
Low σ		>0	$g(\varphi_*)^+ > 0$	0^+	0^+
Medium σ	Lower Prod.	<0	$g(\varphi_*)^- > 0$	0^+	0^-
	Higher Prod.	<0	$g(\varphi_*)^+ > 0$	0^+	0^-
High σ		>0	$g(\varphi_*)^- > 0$	0^+	0^+

Working out signs in the 8 cases in which the economic system can be located, the relevant matrix is presented in table 3.

For intermediate values of σ, it turns out that the degree of selection already existing in the sector[22] does not have an effect on directions of change (contrary to what happens for f): for insensitive elasticities, an increase in $\bar{\sigma}$ leads to lower average productivity and lower monopoly power; otherwise, the net effect will be near zero (making the policy action completely irrelevant).

More than before, the shape of $g(\varphi_*)$ is crucial when considering deregulation policies. If $g(\varphi_*)$ is a convex function, then low values of σ are likely to be found in the insensitive region. An increase in $\bar{\sigma}$ leads to higher average productivity and higher elasticity, i.e., lower monopoly power for surviving firms; for sufficiently high σ, the economy is in the very sensitive region, and efforts to cut down monopoly power of producers are ineffective; moreover, for intermediate values of σ, if the system[23] is still located in the insensitive region, a policy maker may be able to increase σ only by allowing less efficient producers to enter the market (and so to reduce aggregate productivity).

If $g(\varphi_*)$ is concave, a heavily regulated sector is initially located towards the upper right of the matrix, in which the extreme sensitiveness of elasticity to the mass of producers tends to make efforts to deregulate the sector through changes in $\bar{\sigma}$ pointless. In this case, a large change in $\bar{\sigma}$ may prove necessary in order to exit that region. Even so, the economy could be placed in the traditional trade-off between less monopoly power

[22] Or average measured productivity, which is the same in this context.

[23] This depends on the degree of convexity of $g(\varphi_*)$.

and lower average productivity. Only when policy makers have managed to place the economy on a high σ, less sensitive region, deregulation yields higher productivity together with less monopoly power.

This point makes it clear that periods of rapid technological change may be an ideal context in which these kind of reforms (even a reduction in f if we are confident about position of the economy) can be implemented: if the mean productivity of existing producers exogenously increases, σ could be increased, while reduction in average measured productivity is avoided or reduced by improvements in technology.

In all cases, it has to be stressed that one fundamental advantage of this policy is that it allows the economy to run along a new elasticity curve, for which σ is higher than before for every given value of φ_*: for this reason, the economy is able to escape the trade-off among aggregate productivity and monopoly power.

5 Policy discussion and conclusions

The two-sector model with heterogenous firms and fixed cost of entry presented above delivers some non-trivial results: first of all, deregulation policies through an increase in $\bar{\sigma}$ (a component of the elasticity of substitution σ) are not always a Pareto improvement.

In partial equilibrium, for given values of σ out of a defined range, changes in $\bar{\sigma}$ imply redistribution of profits and workers between (and within) sectors and firms. In this case, if workers face a reallocation cost, they could agree with their employers in contrasting deregulation; policies aiming at requalifying workers could minimize the negative impact of this transition; in this context a reduction in proportional regulation cost (b) is preferable as it generates a Pareto improvement.

In general equilibrium the result of any deregulation policy can lead to some counterintuitive results, in addition to the usual ones, depending on specific parameter values: if the other component of the elasticity of substitution σ, namely function $g(\varphi_*)$, is concave and the sector is highly regulated, an increase in $\bar{\sigma}$ could be ineffective or very expensive in terms of reduced productivity (and profits and real wages). This is especially relevant in developing countries where markets are highly protected; therefore, when designing "liberalization packages" governments and international financial institutions should clearly highlight the overall *process* and phase in social safety nets to absorb the initial negative impacts on workers of the first steps towards goods market liberalization; this will help reduce social resistance and avoid political backlash in the pursuit of better economic conditions. This means that deregulation should be thought of as a strategy where successive steps will lead to a successful outcome only after a period of possibly negative economic impact. Also, periods of technological improvements should be considered an opportunity to implement deregulation policies as new technologies dampen the negative effects of deregulation on productivity.

Still in general equilibrium, also changes in f (or b) can lead to counterintuitive results: for highly and sometimes moderately regulated sectors a reduction in f (or b) does not reduce monopoly power; this policy works only for already quasi-competitive sectors and always implies a trade-off between competition and productivity. Therefore, in the choice of policy instruments, changes in f (or b) would not be good candidates on their own, but require a careful and balanced policy mix, as their usage is positive only in very advanced stages of deregulation and they always imply a trade-off.

Several extensions could be considered. This framework could be applied to a two-country approach (where one is deregulated and the other is not): introducing the exchange rate and different preferences for agents of different countries, the impact of a country's deregulation on the other could be analyzed. With the introduction of a "transition cost" for workers, the present set up could also be extended to consider a political economy game about the choice whether to deregulate or not. In addition, a further discussion of the fixed regulatory cost could be considered: we could think of a regulatory cost function in both levels and variance. For instance, in a multi-country set up, different regulatory frameworks imply different cost functions and therefore translate in different geographical costs for multinational firms; a harmonization process could lead to a reduction in the geographical variance of f (and in the cost burden for firms). Can the policy maker act on the variance to gain better results? How can international coordination reduce uncertainty about f ? This type of issues are increasingly relevant in view of discussions on the regulatory harmonization process in the European Union regarding information and communication technology, and in general in economies where agents operate across borders.

6 References

Acemoglu, Daron, "*Directed Technical Change*" Review of Economic Studies, LXIX (2003).

Axtell, Robert (2001), "*Zipf distribution of U.S firrm sizes*", Science, Vol. 293, 1818-20.

Blanchard, Olivier, "*The Medium Run*" Brookings Papers on Economic Activity, 2 (1997), 89–158.

Blanchard, Olivier, and Thomas Philippon, "*The Decline of Rents, and the Rise and Fall of European Unemployment*," mimeo, Massachusetts Institute of Technology, January 2003.

Blanchard, Olivier and Francesco Giavazzi (2003), "*Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets*", Quarterly Journal of Economics, 879-907, August.

Boeri, Tito, Giuseppe Nicoletti, and Stefano Scarpetta, "*Regulation and Labour Market Performance*" CEPR Discussion Paper, April 2000.

Coe, David, and Dennis Snower, "*Policy Complementarities: The Case for Fundamental Labor Market Reform*," IMF Staff Papers, XLIV (1997), 1–35.

Dixit, Avinash, and Joseph Stiglitz (1977), "*Monopolistic Competition and Optimum Product Diversity*", American Economic Review.

Fernandez, Raquel, and Dani Rodrik, (1991), "*Resistance to Reform: Status Quo Bias in the Presence of Individual Specific Uncertainty*," American Economic Review, LXXXI, 1146–1155.

Gersbach, Hans, (1999), "*Promoting Product Market Competition to Reduce Unemployment in Europe*," mimeo, University of Heidelberg.

——, (2003), "*Structural Reforms and the Macroeconomy: The Role of General Equilibrium Effects*" Invited Lecture, IEA meetings, Lisbon, September.

Helpman, E., Melitz, M.J., Yeaple, S.R., (2003), "*Export Versus FDI*", NBER, January.

Hopenhayn, H., (1992). "*Entry, Exit, and Firm Dynamics in Long Run Equilibrium*", Econometrica.

Joskow, Paul, and Nancy Rose, (1989), "*The Effects of Economic Regulation*" Handbook of Industrial Organization II, Richard Schmalensee and Robert D. Willig, eds. (Amsterdam: Elsevier Science Publishers), pp. 1450–1506.

Melitz, M., (2003), "*The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity*", NBER.

Nicoletti, Giuseppe, Stefano Scarpetta, and Olivier Boylaud, (1999). "*Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation*," OECD Economics Department Working Paper No. 226.

Nicoletti, Giuseppe, Robert Haffner, Stephen Nickell, Stefano Scarpetta, and Gyl. Zoega, (2001), "*European Integration, Liberalization, and Labour Market Performance*," Welfare and Employment in a United Europe, Giuseppe Bertola, Tito Boeri, and Giuseppe Nicoletti, eds. (Cambridge, MA: MIT Press).

Nicoletti, Giuseppe, and Stefano Scarpetta, (2003), "*Regulation, Productivity, and Growth*", Economic Policy.

Persson, Torsten, and Guido Tabellini, (2000), Political Economics, (Cambridge, MA: MIT Press).

Spector, David, (2002), "Competition and the Capital-Labor Conflict," CEPREMAP working paper No. 2002-07.