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Summary

The stagnation of the Italian economy over the last two decades is widely documented. During this period, the world economy has become highly integrated, and foreign outsourcing has become a standard practice for firms. While trade theory predicts benefits from the internationalization of production, Italy seems to have gained negligibly from it, or, rather to have lost. In a simple model, we show that this may be the case when markets are overregulated and competition policies are weak. We study a small open economy with one oligopolistic and one competitive sector, which outsources part of its production process abroad. Advances in globalization entail lower tariff rates of outsourcing. Contrary to the common wisdom, we show that national welfare is an inverted U-shaped function of tariffs. There exists a tariff threshold, below which the economy loses from globalization because the competitive sector overproduces and the oligopolistic underproduces (the oligopolistic good has a higher marginal effect on welfare). Competition policies that target the competitive sector lower the threshold and allow the economy to benefit from increased openness.

Keywords: Italy's Economic Decline, General Equilibrium, Cournot Oligopoly, Outsourcing

JEL Classification: D43, D51, F12, F62, L13

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The long Italian stagnation and the welfare effects of outsourcing

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Abstract

The stagnation of the Italian economy over the last two decades is widely documented. During this period, the world economy has become highly integrated, and foreign outsourcing has become a standard practice for firms. While trade theory predicts benefits from the internationalization of production, Italy seems to have gained negligibly from it, or, rather to have lost. In a simple model, we show that this may be the case when markets are overregulated and competition policies are weak. We study a small open economy with one oligopolistic and one competitive sector, which outsources part of its production process abroad. Advances in globalization entail lower tariff rates of outsourcing. Contrary to the common wisdom, we show that national welfare is an inverted *U*-shaped function of tariffs. There exists a tariff threshold, below which the economy loses from globalization because the competitive sector overproduces and the oligopolistic underproduces (the oligopolistic good has a higher marginal effect on welfare). Competition policies that target the competitive sector lower the threshold and allow the economy to benefit from increased openness.

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1. Introduction

In the early nineties, the Italian economy was one of the world's largest per GDP. This successful performance was the outcome of a long period of sustained growth, which had started immediately after the end of WW2 and continued until the late eighties. In 1991, per-capita GDP was above EU average. Starting in that year however, the so-called "Italian «Economic Miracle»" (Nardozzi, 2003) seemed to vanish quickly, and a long period of stagnation took its place. Italy started to diverge from its major EU partners and in terms of real per-capita GDP, in 2014 it was back to the levels as of 1997 (IMF, 2015). This long period of internal stagnation almost coincides with a phase of extraordinarily intense globalization. Like all other developed countries, Italy took active part in this process, but, contrary to its partners, seemed unable to benefit from it.

The fact that a country may fail to benefit from greater openness comes quite at odds with the conventional economic wisdom that indeed predicts net benefits from increased integration. However, this perception is quite widespread among Italian scholars (e.g. Trento, 2003, Ciocca, 2004, and Accetturo et al., 2013) who believe that Italy failed to gain from globalization or even lost from it because of a number of structural weaknesses. The broad consensus around this position, however promptly clashes with the heterogeneity of ideas around which features of the economy really prevented the country from taking advantage of globalization. The debate is particularly intricate because most positions rely on qualitative empirical analysis and deductive reasoning rather than on quantitative methods. For this reason it is quite difficult to identify clear causational linkages among the different factors considered and also a hierarchy among them is not immediately clear. In an attempt to identify the most relevant weaknesses according to the ongoing debate, a main issue seems to be the generalized low propensity towards innovation. According to some authors like for example Faini and Sapir (2005) and Ciocca (2010), this might be a basic reason for the slow pace of adoption of the new information and communication technologies (ICT) by Italian firms. Vacciago (2003) and Accetturo et al. (2013) recognize ICT as a crucial factor of competitiveness for national firms during these decades of intense globalization while other authors (e.g. Pagano e Schivardi, 2003 and Rossi, 2004) believe the relatively small size of the average Italian firm to be a major impediment to the slow adoption of ICT. The scarce R&D efforts seem a valid explanation also for the structure of the Italian specialization pattern, which a large body of literature (see for example Ciocca, 2004 and D'Ippoliti and Roncaglia, 2011) retains excessively biased towards traditional and low-tech productions (typically: textile products, apparels, shoes, furniture, hydraulics and non-metal manufacturing). In this perspective, Italy might have suffered from globalization mainly because of the involvement of the emerging countries, which are characterized by similar specialization patterns, and enjoy huge cost advantages relatively to Italy.

In this chapter, we share the view that Italy might have effectively failed to gain from globalization, or rather to have suffered from it. However, we focus on another salient aspect of the economy as a possible explanation for such failure, namely the scarce

degree of competition on domestic product markets.[2] To lend support to this view, we provide a highly stylized model of a small open economy with Cournot-oligopolistic markets and foreign outsourcing. We assume two sectors, manufactures and services and we mimic the higher degree of competition in the goods' markets relatively to the service markets by assuming the former to be perfectly competitive and the latter Cournot-oligopolistic. We approximate the level of economic integration of Italy in the world economy with an exogenous tariff on intermediates.[3] The economy altogether is thus subject to two distortions, i.e. the number of oligopolists in the service market and the tariff on intermediates.

The interaction between these two distortions constitutes a typical second-best framework (Lipsey and Lancaster, 1956), which allows us to prove that a lower tariff rate, leading to a more intensive degree of outsourcing is not necessarily beneficial for the economy if internal markets are (even partly) overregulated. For a given level of competition in the oligopolistic service market, consumer welfare is an inverted *U*-shaped function in the level of tariffs and an optimal tariff does exist. When competition in the oligopolistic sector is scarce, a sufficiently low tariff on intermediates may induce a welfare loss. Relatively to the oligopolistic sector, the competitive sector overproduces, and the marginal welfare in this sector is lower than in the competitive. Similarly, when outsourcing is subject to tariffs, oligopoly and *not* perfect competition is the desirable market regime, and an optimal number of firms in the oligopolistic sector can be determined. A tight market regulation leads to a reduction of production in the oligopolistic sector and more resources become available for the production of the competitive good, and this may generate a welfare gain. More importantly, the optimal number of oligopolitsts is inversely related to the level of tariffs. When economic integration proceeds, the domestic competition policy should react and become stricter, otherwise the greater openness translates into aggregate welfare losses. From this perspective, these findings lend analytical support to the idea that Italy may have effectively lost from globalization.

The model presented in this chapter belongs to a quite recent line of research on Cournot oligopoly in general equilibrium, originally initiated by Neary (2003). An overview of this literature is contained in Zotti and Lucke (2014) who depart from the one-country-one-factor structure of Crettez and Fagart (2009) to study the welfare optimality of trade and competition policies in small open oligopolistic economies (SOOE) with trade in final goods. We extend the small open oligopolistic economy framework of Zotti and Lucke (2014) to incorporate a rudimental form of trade in intermediates, which is the prominent feature of the current wave of globalization (see

[2] On this point, a large economic literature (e.g. Barca, 1997, Faini, 2003, Faini et al. 2005, Nardozzi, 2004 and Ciocca, 2007, Forni et al., 2010) maintains that markets in Italy were and still are less competitive than in most OECD countries. Bianco et al. (2012), for example, provide evidence of a stable or an even growing Lerner index on several final product markets throughout the whole nineties. The need for more competitive markets is also a primary policy issue (OECD, 2005, CNEL 2007, Christopoulou and Vermeulen 2008) and a major objective of the National Reforms' Program by the Italian Ministry of Economy and Finance (MEF, 2011).

[3] The average tariff for Italy was decreasing in the period 1990-2010 (Accetturo et al., 2013).

for Italy the study by Breda and Cappariello, 2010). At the same time we maintain the original static structure of the model in consideration of the substantial lack of growth over the last two decades in Italy. Moreover, we approximate the relative closedness of the Italian service sector[4] in comparison to the good sector with the assumption that Italy does not trade services[5]. Under the assumption of balanced trade, the economy imports intermediates and exports manufactures.

The second section of this chapter seeks to provide an overview of the main features of the Italian economy over the last two decades. Preliminarily, it includes some basic empirical evidence of the stagnation. The third section describes the structure of the model of a small open oligopolistic economy (SOOE) with outsourcing, and the fourth section derives results about globalization and welfare-optimal competition policy. The fifth section draws some conclusions.

2. Economic stagnation and inability of gaining from globalization

The features of the Italian economy in the last two decades are the object of two contiguous strands of literature. These are the debate on the reasons for the economic stagnation and the historical discussion on the structural weaknesses of the economy, which dates back to the times of the national unification. Most of the literature on the stagnation considers various aspects of the economy, and uses deductive reasoning (Rossi, 2004, p. 640) supported by qualitative data observation to provide intuitions concerning their role in the crisis. Globally, this literature indicates many reasons for the observed stagnation, and from this perspective, it complements and updates the older debate on the structural weaknesses of the economy.[6] Altogether, these two strands of literature are relevant for the debate on Italy's inability to gain from globalization because of the comprehensive overview they provide on the alleged weaknesses of the economy. From a methodological point of view, in fact, this debate is very similar to the literature on the economic stagnation, as it tries to infer causational linkages between a given feature of the economy and the missed benefits from globalization.

Based on these nonetheless distinct strains of literature, this section seeks to provide a broad overview of the main features of the Italian economy, and to highlight which of them seem to have impeded Italy from gaining from globalization. An overview of these features is given in Table 1. The table records the main contributions of the literature on the economic stagnation, and reveals the deep heterogeneity of the debate. In this overview, we focus on the major weaknesses of the economy and we seek to deal with them along a unified line of reasoning, which starts from the central role of the

[4] Italian trade in manufactures varies around 80%-90% of the trade balance (see Amighini and Chiarlone, 2004 and Accetturo et al., 2013).

[5] From the technical point of view of the modeling structure, this assumption does not impinge on the results.

[6] An example of this complementarity is Faini, (2003) who includes the historical north-south divide as an explanation for the Italian stagnation of the last two decades.

stagnant TFP and proceeds by searching for its possible determinants. Table 1 complements the overview, as it includes those aspects excluded from this discussion.

We document the Italian economic stagnation by comparing the evolution of the real per-capita GDP between Italy and other major developed economies. Figure 1 shows the Italian GDP as a fraction of the GDP of the EU-14 (i.e. the EU prior to the Fifth Enlargement, excluding Italy) for the period 1951-2008. The process of economic convergence prescribed by neoclassical growth theory is clearly observable from the end of WW2 to the beginning of the nineties. Since then, fully completed convergence turned into lengthy divergence. In order to illustrate the severity of the Italian stagnation, we present (Figure 2) the overall performance of the economy in terms of real per-capita GDP growth rates for the period 1951-2008. Note that it is sensible to analyse the Italian growth performance after studying the international comparison, since this allows excluding any neoclassical-type convergence process as a major source of the slowdown.

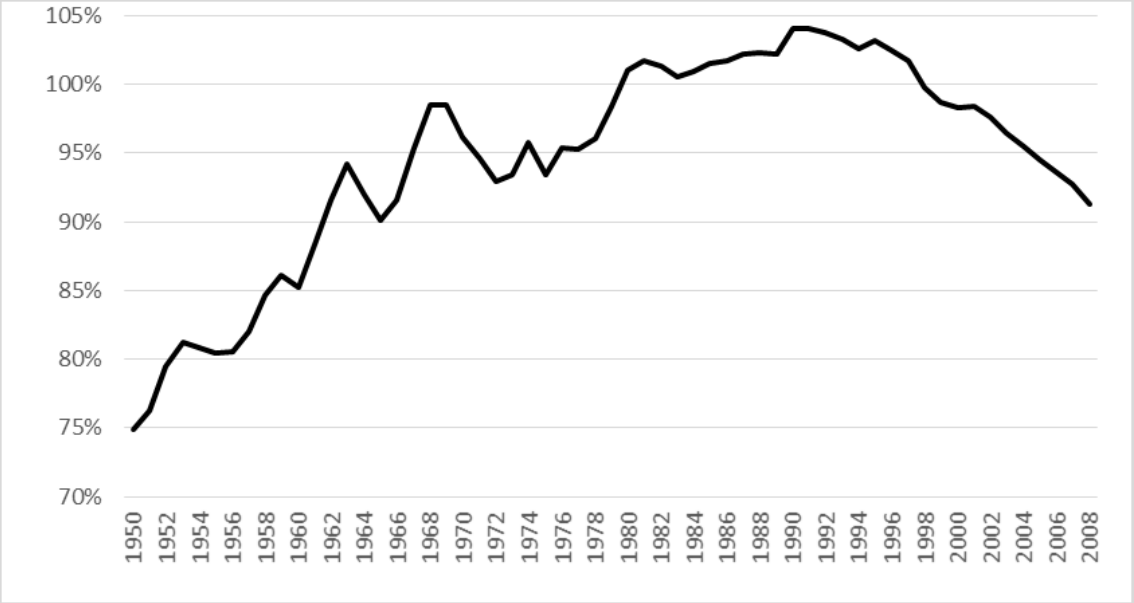

Figure 1 – Italy's real per-capita GDP as a fraction of EU-14 average (Source: Own calculations from Groningen Growth and Development Centre data, www.ggdc.net)

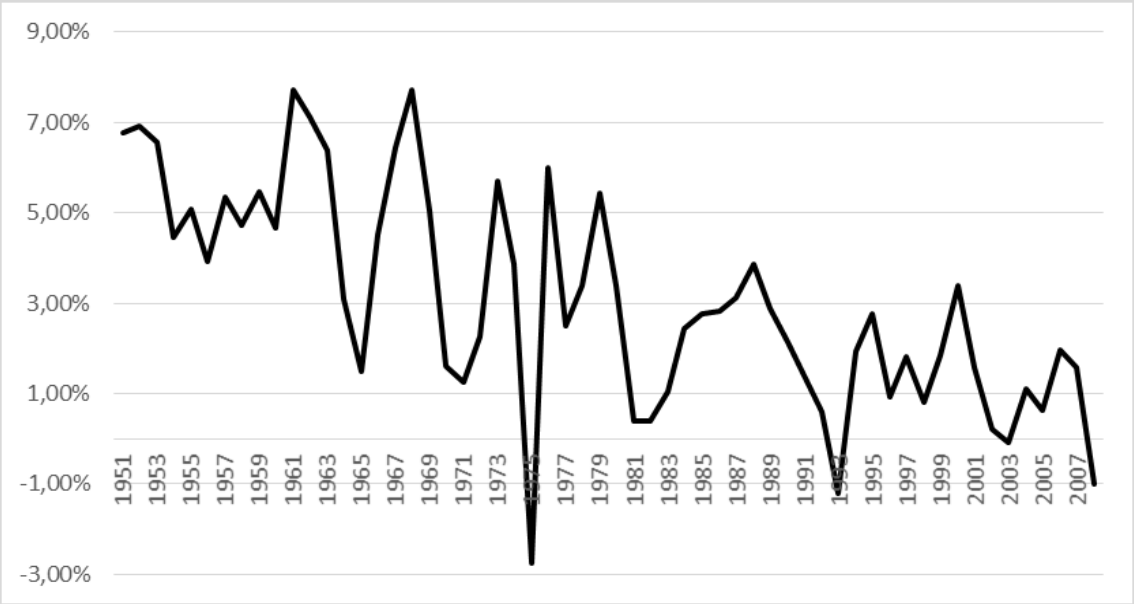

Figure 2 – Italy's real per-capita GDP growth rates (Source: Own calculations from Groningen Growth and Development Centre data, www.ggdc.net)

A basic feature of the Italian stagnation is undoubtedly a poor TFP dynamics. This is widely recognized by numerous studies which use different methods to show the unambiguous role of the stagnant TFP in the slowdown of the labor productivity. Faini (2003) and Ciocca (2004) study the data on capital accumulation and conclude that this remained substantially constant in the nineties. Daveri and Jona-Lassinio (2005) perform a decomposition of labor productivity growth and show that falling labor productivity and not labor input is the reason for the observed decline in real per-capita income growth. Noticeably, these results are fully confirmed almost a decade later by Orsi and Turino (2014) who apply the business cycle accounting procedure by Chari et al. (2007) and show that the labor input actually improved considerably starting in the mid-nineties.[7]

Table 1 – Features and weaknesses of the Italian economy according to the relevant literature on the stagnation

Is this feature a major weakness of the Italian economy?	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Labor productivity slowdown	0	Y	Y	0	Y	Y	Y	Y	Y	Y
TFP slowdown	0	Y	Y	0	Y	Y	Y	Y	0	Y
Decline in the labor input	0	N	0	Y	N	0	0	0	0	0

[7] Further studies with similar results are Daveri (2002), Brandolini and Cipollone (2003) and Daveri (2004), Jorgenson (2005) and Fachin and Gavosto (2010).

Insufficient R&D activity	N	0	Y	Y	Y	Y	Y	Y	0	Y
Slowdown in capital accumulation	0	N	0	0	N	N	0	0	Y	0
Delay in ICT incorporation	Y	0	Y	0	Y	Y	0	0	0	Y
Tax evasion	0	0	Y	0	0	0	0	Y	0	0
Corruption	0	0	0	0	0	0	0	0	0	Y
Inadequate specialization pattern	0	N	Y	0	Y	Y	Y	0	Y	0
Low endowment of human capital	0	Y	Y	Y	N	0	Y	0	0	0
Lack of competition on markets	0	Y	0	0	Y	Y	0	Y	0	Y
Labor market rigidities	0	0	0	0	0	0	0	0	0	N
Labor costs	0	0	0	0	0	N	0	N	0	N
Labor market reforms	0	0	0	0	0	0	0	Y	Y	0
Poorly functioning financial markets	0	0	0	0	N	0	0	0	0	Y
Public debt burden	0	0	0	Y	Y	0	0	Y	0	0
Stock and quality of physical infrastructure	0	0	0	Y	Y	0	0	Y	0	Y
Stock and quality material infrastructure	0	0	0	Y	Y	0	0	Y	0	0
Insufficient firms' size	N	0	Y	Y	Y	Y	0	Y	0	Y
Biased income redistribution	0	0	0	0	Y	0	0	0	Y	0
Aggregate demand weakness	0	0	0	0	0	N	0	0	Y	0
Italy's North-South divide	0	Y	0	N	Y	0	0	0	0	0
Inflation	0	0	0	0	N	0	0	0	Y	0

Authors: [1]: Vaciago (2003); [2]: Faini, R. (2003); [3]: Trento, S. (2003); [4]: Toniolo (2004); [5]: Ciocca (2004); [6]: Rossi (2004); [7]: Faini and Sapir. (2005); [8]: Ciocca (2010); [9]: D'Ippoliti and Roncaglia (2011); [10]: Accetturo et al. (2013).
Abbreviations: Y = yes; N = no; 0 = irrelevant

There are two main explanations for the poor TFP dynamics, which are both taken from the literature on the sources of the EU-US productivity divide since the mid-nineties. These are the labor market reforms of the nineties (e.g. Blanchard and Landier, 2002 and Dew-Becker and Gordon 2012) and the insufficiency of investments in R&D and ICT (e.g. van Ark et al. 2008). In the case of Italy, there is in fact robust evidence both

for the trade-off between employment and productivity[8] and for the direct effect of the insufficient level of R&D on the TFP (e.g. Parisi et al., 2006 and Fachin and Gavosto, 2010). The level of R&D expenditures as a share of GDP has been constantly below the EU-average (OECD, 2006 and OECD, 2012) with R&D intensity in the private sector far lower than in the other EU countries. During the nineties, in particular, the business R&D efforts in the nineties showed a net drop in comparison to the previous decade. According to Venturini (2004), also the pace of investment in ICT followed a similar path in Italy[9]. Bassanetti et al. (2004) perform a growth accounting exercise aimed at measuring ICT contribution to growth, and their results show a negligible impact of ICT on the TFP dynamics. The slow adoption of ICT by Italian firms is one of the factors hampering Italy's exploitation of the opportunities offered by globalization according to a conspicuous body of literature (e.g. Vacciago, 2003, Rossi, 2004, Ciocca, 2004 and more recently, Accetturo et al., 2013).

The inadequate intensity of business R&D and the delayed adoption of ICT have motivated an extensive literature aiming at exploring their main determinants. Two explanations for this generalized inertia towards innovation are worth mentioning here. One position that enjoys a broad consensus in the debate (e.g. Trento, 2003, Toniolo, 2004, Rossi, 2004), points to the average size of the Italian firm, which international comparison reveals to be smaller than in other major partners. According to these authors, there exists a dimensional threshold, below which a single firm faces serious constraints in engaging successful research activities, or even in adopting (relatively) costly modern technologies[10]. Regarding the latter measure, several authors (e.g. Faini and Sapir, 2005) consider the simple scarcity of human capital in a company as a major obstacle for the adoption of the modern ICT. A second explanation focuses on the pattern of specialization of the economy, which is the object of a huge body of literature starting in the sixties[11] and provides empirical evidence that Italy has a comparative advantage in traditional (low-tech) sectors. According to this view, these sectors have an intrinsically low propensity to innovate.

From the perspective of the literature on the effects of globalization on Italy, the biased structure of the economy provides a sensible explanation for the negative consequences from increased integration. Italy in fact may have suffered from globalization because its competitiveness has been challenged by the emergence of the developing countries in the international arena[12]. Among the first to believe that the specialization pattern has

[8] Papers that, with different approaches, confirm the employment-productivity trade-off for Italy are Boeri and Garibaldi (2007), Lucidi and Kleinkrecht (2010), Lucidi (2012), Jona-Lasinio and Vallanti (2011) and, more recently, Orsi and Turino (2014).

[9] Pilat et al. (2002) however distinguish between "fast-adopters" (UK, Netherlands, Sweden and Finland) and "laggards" (Italy and Spain and, to some extent, Germany and France).

[10] The debate on the reasons for the inadequately small size of Italian firms is very wide. Some insights can be found foremost in Onida (2004) and in Trento (2003) as well as in Ciocca (2004) and Accetturo et al. (2013).

[11] For a review of this literature, see for example, Amighini and Chiarlone, (2004) and Federico and Wolf (2012) for a more historical perspective.

[12] Against this view, Fortis and Curzio (2003) believe that the main threat for the Italian manufacturing is due to the "asymmetric" (i.e. unfair and illegal) competition by China.

become "inadequate" are Onida (1999) and Trento (2003). Faini and Sapir (2005) support this view by calculating the Balassa index of Revealed Comparative Advantage (Balassa, 1965) for Italy and by studying its evolution through time. The size of the literature studying the Italian specialization pattern contrasts however with the tiny number of papers searching for the reasons behind it. The explanations provided are a general scarcity of human capital (e.g. Faini, 2003, Faini and Sapir, 2005, Boeri et al. 2005), and, again the insufficient average size of Italian firms. Several authors (e.g. Trento, 2003, Onida, 2004 and Ciocca, 2004) argue in fact that a change in the specialization pattern is generally less probable for smaller firms. An even greater shortcoming of this literature however, seems to be the inability to demonstrate any causation between the proven biases in the specialization pattern and Italy's difficulties on world markets during this wave of globalization. We are not aware in fact of any paper proving this causation through quantitative methods.

The two explanations for the low propensity to innovate are seriously challenged by Sterlacchini and Venturini (2014) and, from a quite different perspective, by Ciocca (2010). The former authors estimate the long-term elasticity of TFP with respect to the level of R&D (measured as the share of R&D expenditures on value added) for a set of five OECD countries including Italy. In the case of Spain, which shares a similar industrial structure with Italy both for firms' size and specialization pattern, the estimated elasticity is 0.19 while for Italy it amounts to 0.08 - 0.12 (with France at 0.19 - 0.21). Noticeably, the authors observe that "in the typical research-intensive industries, Italian firms devote to R&D half of the share of value added invested in the most industrialized countries" (Sterlacchini and Venturini, 2014, p. 193). The authors propose indeed a different explanation for the insufficient R&D investments, which points to the general tightness of financial constraints at firm level. In their view, these are a direct consequence of the structure of the Italian banking system (in this vein see also Accetturo et al. 2013).

Ciocca (2010) suggests that firms quickly lost their propensity to innovate following a series of policies, which deeply changed the domestic business environment. On foreign markets, the competitiveness of Italian firms was inflated by the undervaluation of the lira, which started with the strong depreciation in the early nineties (Italy abandoned the European Exchange Rate Mechanism as of September 1992) and persisted until 2002. Internally, generous public spending, wage moderation (which started with the July-1993 Tripartite agreement among government, business organizations and trade unions) and a deliberately weak competition policy gave a major contribution to soaring company profits. Widespread and rapidly rising tax evasion further explains the weakened propensity of firms to engage in innovation.

3. The model

We denote the two sectors of the economy by X and Y, where the former is competitive and the latter oligopolistic. Production of X requires value added, which is produced

using labor L and capital K, and a foreign intermediate O. The use of input O reflects the delocalization choice of domestic firms. The tariff rate on imported intermediates is equal to a percentage τ of their price. For simplicity, tariffs take the form of a monetary transfer to consumers. Production of Y requires only labor and capital, which are available in fixed supply at $\bar{L}$ and $\bar{K}$. Primary production factors are fully mobile between sectors, but immobile internationally. The model is static, so that investment is zero. Hence, domestic demand includes solely final consumption. In the case of X, it is necessary to distinguish between domestic supply X^S and demand X^D, where the surplus is exported and export proceeds are used to finance imports O, i.e. foreign trade is always balanced.

Households

The economy is populated by $\bar{L}$ homogeneous private agents. Their preferences are described by a standard Cobb-Douglas utility function:

$$U(X,Y) = X^{\varphi} \cdot Y^{1-\varphi}, \qquad 0 < \varphi < 1 \tag{1}$$

Agents are endowed with one unit of labor each, which they supply inelastically at the nominal wage W. In addition, they lend private nominal wealth $P_K\bar{K}$ at the rental rate r to firms, which use the physical capital stock $\bar{K}$ for production. Private agents are price takers in both factor markets. Monetary private income, I, consists of primary factor income, tariffs and profits in the oligopolistic sector:

$$I = W \cdot \bar{L} + rP_K \cdot \bar{K} + E \cdot \tau \bar{P}_O \cdot O + \Pi^Y \tag{2}$$

Here E is the nominal exchange rate, $\bar{P}_O$ is the world price of the imported intermediate O and Π^Y are the monetary profits of the oligopolistic sector Y. Utility (1) is maximized under the following budget constraint:

$$\bar{P}_X \cdot X + P_Y \cdot Y = I \tag{3}$$

where $\bar{P}_X$ is the world market price of commodity X and P_Y the price of commodity Y. Both prices are expressed in home currency. Utility maximizing quantities are

$$X = \varphi \cdot \frac{I}{\bar{P}_X} \tag{4}$$

$$Y = (1-\varphi) \cdot \frac{I}{P_Y} \tag{5}$$

Note that demand (5) excludes monopoly in sector Y, i.e. $N \neq 1$, because price elasticity is one.

Firms

Firms in sector X employ value added V and intermediate O according to a Cobb-Douglas technology with constant returns to scale:

$$X^S = A^X \cdot V^{\eta} O^{1-\eta} \tag{6}$$

where $V = A^V \left(K^V\right)^{\alpha} \left(L^V\right)^{1-\alpha}$. The optimal quantity of value added is

$$V = \frac{X^S}{A^X}\left[\frac{\eta}{1-\eta}\frac{\left(1+\tau\right)\bar{P}_O}{P_{V,x}}\right]^{1-\eta} \tag{7}$$

with $P_{V,x} = \frac{1}{A^V}\left(\frac{rP_K}{\alpha}\right)^{\alpha}\left(\frac{W}{1-\alpha}\right)^{1-\alpha}$, while the optimal intermediate demand is

$$O = \frac{X^S}{A^X}\left[\frac{1-\eta}{\eta}\frac{P_{V,x}}{\left(1+\tau\right)\bar{P}_O}\right]^{\eta} \tag{8}$$

where the assumption $\tau \geq 0$ is sufficient for a positive demand.

In sector *Y*, output is produced using only value added with a Cobb-Douglas technology where total factor productivity is A^Y and the capital production elasticity is β. Within each sector, firms are completely homogeneous. Sector *X* is perfectly competitive and many atomistic firms produce and sell their output at world prices. In sector *Y* only few and relatively large business units are active, which operate only on domestic markets and behave strategically as Cournot oligopolists. Despite their non-atomistic dimension, they remain relatively small with respect to the whole economy, i.e. they do not enjoy monopsony power. As argued by Neary (2003), this is crucial, as only through this assumption are single actors prevented from influencing macroeconomic variables so that Cournot oligopoly can be modeled rigorously in general equilibrium.

The total number *N* of oligopolistic firms is exogenous. Since firms are fully identical, sectoral inputs and output are

$$K^Y = N \cdot K_i^Y, \qquad i = 1,2,\ldots \tag{9}$$

$$L^Y = N \cdot L_i^Y, \qquad i = 1,2,\ldots \tag{10}$$

$$Y = N \cdot Y_i, \qquad i = 1,2,\ldots \tag{11}$$

Due to constant returns to scale, cost minimization yields linear cost functions in both

sectors:

$$C^X\left(X^S\right)=m_x\cdot X^S \tag{12}$$

$$C^Y\left(Y\right)=m_y\cdot Y \tag{13}$$

where $m_x=\frac{1}{A^X}\left(\frac{P_{V,x}}{\eta}\right)^{\eta}\left[\frac{\left(1+\tau\right)\bar{P}_O}{1-\eta}\right]^{1-\eta}$, and $m_y=P_{V,y}=\frac{1}{A^Y}\left(\frac{rP^K}{\beta}\right)^{\beta}\left(\frac{W}{1-\beta}\right)^{1-\beta}$ are the unit costs in each sector.

It is straightforward to derive the demand functions for primary production factors:

$$K^V=\alpha\frac{P_{V,x}}{rP^K}\cdot V \tag{14}$$

$$K^Y=\beta\frac{P_{V,y}}{rP^K}\cdot Y \tag{15}$$

$$L^V=\left(1-\alpha\right)\frac{P_{V,x}}{W}\cdot V \tag{16}$$

$$L^Y=\left(1-\beta\right)\frac{P_{V,y}}{W}\cdot Y \tag{17}$$

In sector *X*, profit maximization requires:

$$m_x=\bar{P}_X \tag{18}$$

In sector *Y*, each oligopolistic firm *i* maximizes profits taking the behavior of all other competitors as given:

$$\max_{Y_i}\quad \Pi_i^Y\left(Y_i\right)=P_Y\left(Y\right)\cdot Y_i-m_y\cdot Y_i \tag{19}$$

The condition for optimality is:

$$\frac{dP_Y}{dY}\frac{dY}{dY_i}\cdot Y_i+P_Y\left(Y\right)=m_y \tag{20}$$

Since all oligopolists are equal, condition (20) together with (5) gives the optimal output quantity at the sectoral level:

$$Y=\left(1-\varphi\right)\frac{N-1}{N}\cdot\frac{I}{m_y} \tag{21}$$

where $N > 1$ must hold for a positive supply.

Foreign Trade

Foreign trade includes exports of the homogenous commodity X and imports of intermediate O. Since technology (6) in sector X is Cobb Douglas, imports of O are essential and could not be zero[13]. The economy uses exports of sector X to finance the import of intermediates in the same sector. Tariffs on imports of O are the only form of foreign trade distortion.

Market clearing conditions and Walras Law

There are two factor markets, and two commodity markets in this economy. Equilibrium on factor markets requires

$$K^V + K^Y = \bar{K} \tag{22}$$

and

$$L^V + L^Y = \bar{L} \tag{23}$$

Walras' Law implies balanced trade

$$\bar{P}_X \cdot \left(X^S - X^D \right) = E\bar{P}_O \cdot O \tag{24}$$

where the difference $\left(X^S - X^D \right)$ denotes positive exports by sector X. Moreover, we keep things simple by assuming that the entire production of Y is sold to domestic consumers.

Since (24) is redundant, the SOOE is represented by a system of seven independent equations in eight variables. These are three good quantities, X^S, X^D, Y, the foreign intermediate O, the price of the oligopolistic good P_Y, the factor prices W and rP^K, and the nominal exchange rate E. Two equations describe consumer demand for each good, two equations represent domestic firms' supply, two equations are primary inputs' market clearing conditions, and one equation is the optimal demand for intermediate O. A unique solution is obtained by choosing the nominal exchange rate to be the numéraire, i.e. $E = 1$.

[13] Note that the economy may become autarkic if the technology in sector X is generalised to one with constant elasticity of substitution (CES).

4. Results

Private utility U can be expressed as a function of the tariff rate τ and of the number of oligopolistic firms N. To see this, insert model solutions for consumption demand (A1) and (A2) in equation (1), and obtain the indirect utility function as:

$$U(\tau,N)=\Upsilon\cdot\frac{\left(\frac{N-1}{N}\right)^{1-\varphi}\left[P_{V,x}(\tau)\right]^{\varphi}\cdot \mathrm{T}(\tau)}{\left[\alpha+\beta\frac{N-1}{N}\cdot \mathrm{T}(\tau)\right]^{\varepsilon}\left[(1-\alpha)+(1-\beta)\frac{N-1}{N}\cdot \mathrm{T}(\tau)\right]^{1-\varepsilon}} \tag{25}$$

where

$$\Upsilon:=\left(\bar{K}\right)^{\varepsilon}\left(\bar{L}\right)^{1-\varepsilon}\left[\alpha^{\alpha}(1-\alpha)^{1-\alpha}\frac{\varphi}{1-\varphi}\frac{A^{H}}{\bar{P}_{X}}\right]^{\varphi}\left[\beta^{\beta}(1-\beta)^{1-\beta}A^{Y}\right]^{1-\varphi}$$

and $\varepsilon:=\varphi(\alpha-\beta)+\beta$, and

$$\mathrm{T}(\tau):=\frac{1-\varphi}{\varphi}\left(1+\frac{1-\eta}{\eta}\frac{\tau}{1+\tau}\right). \tag{26}$$

Here, the price of value added in sector X is

$$P_{V,x}(\tau)=\eta\left[A^{X}\cdot\bar{P}_{X}\left(\frac{1-\eta}{\bar{P}_{O}}\right)^{1-\eta}\right]^{\frac{1}{\eta}}(1+\tau)^{-\frac{1-\eta}{\eta}} \tag{27}$$

Note that the condition $\tau>-\eta$, which ensures a positive utility, follows directly from the assumption of positive tariffs.

We will now use (25) to show that deeper globalization may fail to improve national welfare, if the economy is oligopolistic. We will show that there exists an optimal level τ^{*} of tariffs, below which the economy loses from globalization while the opposite applies if tariffs are higher than that level.

Proposition 1: Optimal level of economic integration in oligopoly
If $N>1$ is finite, the optimal level of tariffs τ^{*} is unique and strictly positive.

Proof: See appendix.

According to *Proposition 1*, globalization benefits a country only above a certain threshold of tariffs if the economy is oligopolistic. In stark contrast to standard trade theory, welfare (measured by private utility) is not a monotonously decreasing function

of tariffs. Figure 3 reports utility as a function of the tariff rate for the cases $N = 2$ (bold), $N = 4$ (broken), and $N = 8$ dotted[14].

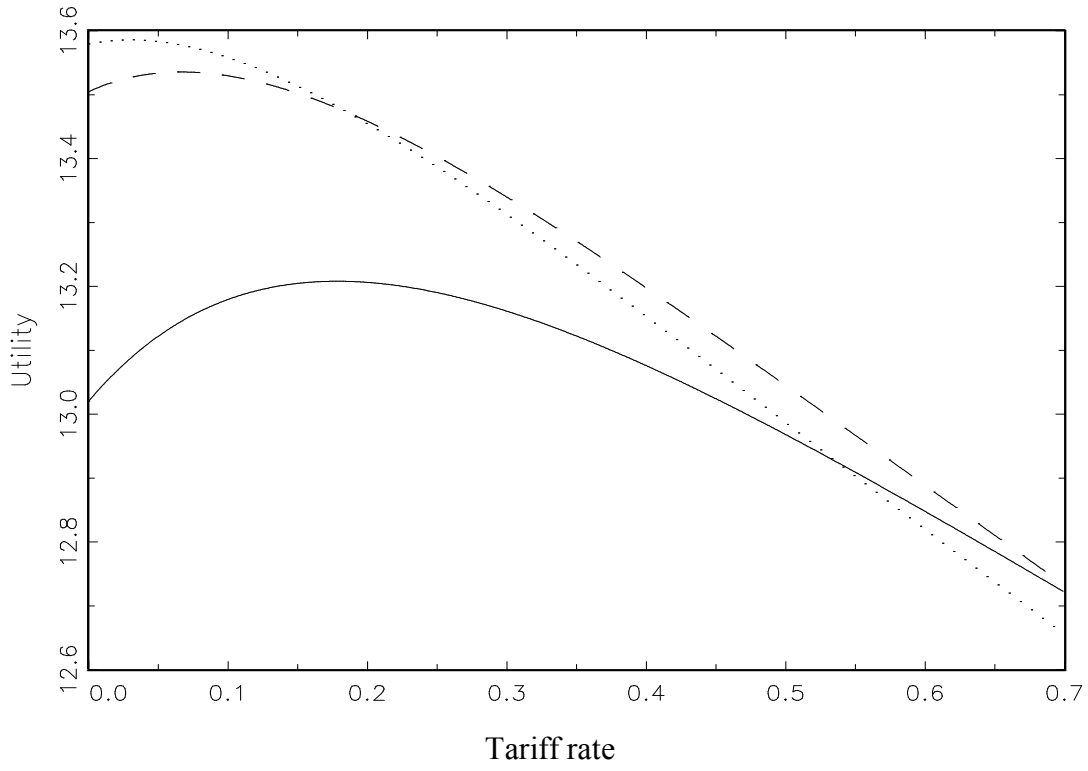

Figure 3 – Private utility as a function of the tariff rate

The intuition for the inverted *U*-shaped dependence of welfare on the tariff level in the SOOE model is as follows: Resources are limited and production in one sector has opportunity costs in terms of output in the other sector. Due to imperfect competition in the *Y*-sector, sector *Y* underproduces and sector *X* overproduces relative to the efficient (first best) allocation under perfect competition. Since marginal utility is too low for the *X* good and too high for the *Y* good a reallocation of resources from the overproducing to the underproducing sector will - other things equal - lead to higher utility.

The same mechanism holds in this case. If tariffs are sufficiently low, imperfect competition in the oligopolistic sector will result in relatively lower production of *Y* and higher production of *X* than under a hypothetical scenario with zero tariffs and perfect competition. Hence, if tariffs decrease slightly, imports of the foreign intermediate increase. Due to balanced trade, exports increase as well. This requires more production in sector *X* with higher demand for domestic resources. The price of primary factors

[14] The calibration used for Figure 3 and Figure 4 is $\bar{K} = 60$, $\bar{L} = 25$, $A^X = 0.8$, $A^Y = A^Y = 1$, $\varphi = 0.2$, $\alpha = 0.33$, $\beta = 0.4$, $\eta = 0.4$, $\bar{P}_X = \bar{P}_O = 1$.

increases. Since the price of good X is exogenously fixed, there is a substitution effect from good Y to good X. This means a welfare decrease. In this setting, the marginal benefit of lower tariffs is more than offset by the marginal damage of a decrease in production of Y.

If however tariffs are high, i.e. higher than the threshold, the balance is distorted in the opposite way, i.e. the ratio of X^D to Y is lower than in the efficient allocation. Thus, the marginal damage of imperfect competition is lower than the marginal damage of high tariffs. In this case, the economy would gain from lower tariffs.

This effect is also visible in Figure 3. For low levels of the tariff rate, the more firms are active in sector Y, the higher is welfare. However, if tariffs are high, a higher number of firms in this sector may lead to an excessive use of resources in this sector and a decrease in competition would actually increase welfare. Note, for example, that if the tariff rate amount to 60%, four firms would be welfare-better than eight.

Let us now consider competition policy under the assumption of a given level of tariffs. For simplicity, we will allow N to be any real number greater than one, i.e. we do not require N to be an integer[15]:

Proposition 2: Optimal competition policy under imperfect economic integration
If $\tau > 0$ and finite, $(\tau = 0)$ the optimal number of firms is unique and finite (infinite).

Proof: See appendix.

According to *Proposition 2*, perfect competition is not desirable if economic integration is imperfect and tariffs are positive. Welfare as a function of the number of oligopolists does not monotonically increase in the number of firms, as standard theory would suggest. Rather, welfare is inverted U-shaped and there exists an optimal number of oligopolistic firms $0 < N^* < \infty$. Figure 4 reports welfare as a function of the number of firms for the cases $\tau = 0.3$ (bold), $\tau = 0.4$ (broken), and $\tau = 0.5$ (dotted).

The optimal number of oligopolistic firms is

$$N^* = \frac{1}{1-\eta} \cdot \left(1 + \frac{\eta}{\tau}\right) \tag{28}$$

Clearly, the optimal number of oligopolists is infinite only in the case of perfect economic integration (zero tariffs).

The non-monotonicity of welfare with respect to N is based on the same intuition as in the case of Proposition 1. An increase in the number of firms in the oligopoly means a resource shift towards sector Y. Above the optimal value of N, employed resources and

[15] See Beverelli and Mahlstein (2011) for the same assumption.

produced output become excessive and an inefficiency arises. However, if globalization improves, the number of firms, which can operate in the oligopolistic sector without efficiency loss becomes higher. Equation (28) provides evidence for the need of a stricter competition policy when firms outsource a greater part of their production because of lower tariffs.

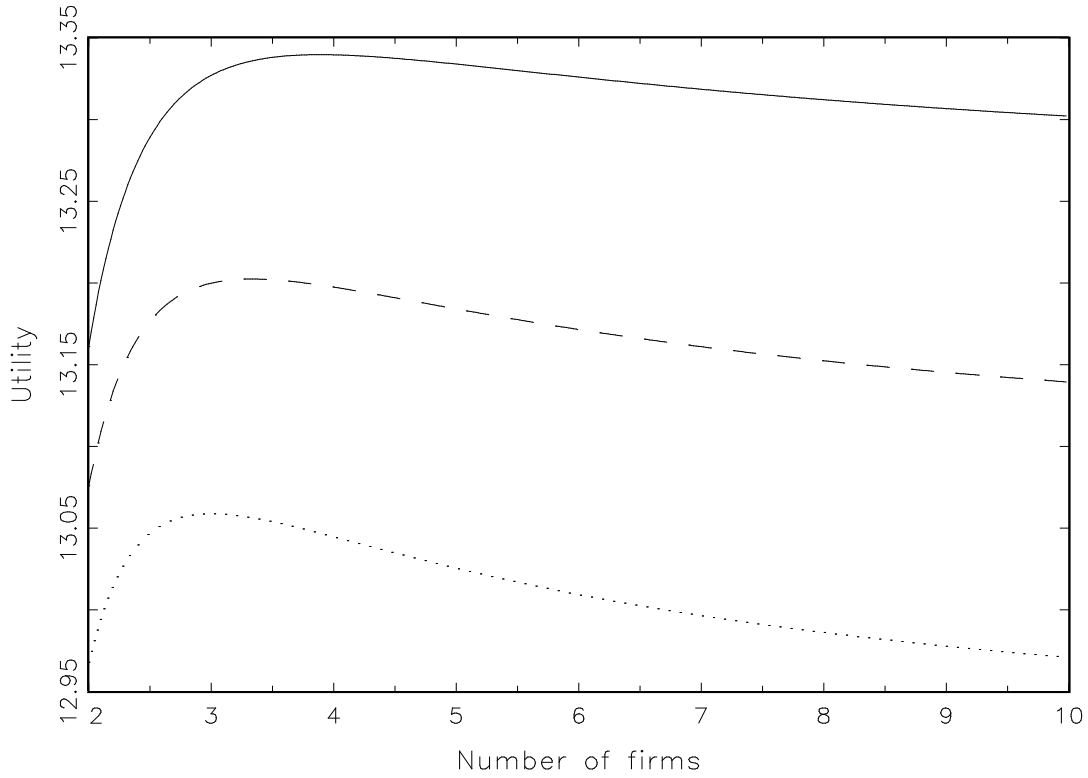

Figure 4 - Private utility as a function of the number of firms

5. Conclusions

This chapter deals with the apparent inability of Italy to gain from globalization. The debate has identified two major determinants for this failure, namely the generalized scarce propensity to innovate and the inadequate specialization pattern of the economy. There is widespread agreement concerning the former that the delayed adoption of ICT by Italian firms prevented them from exploiting the full spectrum of opportunities deriving from globalization. At the same time, the historical competitiveness of the most successful Italian sectors (typically, the low-tech ones) was challenged by the emergence of the large developing countries. Their similar production structure and huge cost advantage progressively pushed the formerly successful Italian sectors onto a declining path, and the whole specialization pattern of the Italian economy became rapidly inadequate.

The delayed adoption of ICT and the rapid obsolescence of the specialization pattern are considered two prominent features of the Italian economy, and indeed the literature on the stagnation of the last two decades includes them among the plausible determinants of the crisis. Since the debate on Italy's inability to gain from globalization focuses on these features to find possible explanations for the crisis, we briefly review the most significant explanations in the second section of this chapter. The analysis reveals that an important weakness of the Italian economy is the scarce degree of competition on the internal markets and especially on service markets. Consequently, we focus on this aspect of the economy to propose an alternative explanation for Italy's failure in gaining from globalization. We specify a very stylized model of a small open oligopolistic economy (SOOE) with outsourcing and show that Italy might effectively have suffered from increased economic integration. The model assumes one oligopolistic and one competitive sector, which outsources part of its production abroad. We use this setting to study the welfare effects of globalization in the form of falling tariffs on intermediates. We show that for a given oligopolistic structure of the economy, globalization may fail to improve welfare, if tariffs are sufficiently low and competition is scarce. We also find that perfect competition is not desirable under positive tariffs, and that an optimal competition policy is necessary. In particular, exogenous advances in economic integration might require more competition in order to be beneficial for the economy.

These results are an application of the well-known Lipsey-Lancaster theory of second best. In general, imperfect competition and tariffs generate underproduction, and a change in either of the two types of distortion induces a resource shift between sectors with direct effects on welfare. If the degree of economic integration is extremely low, there may be underproduction in the protected sector independently of the level of competition. Thus, lower tariffs can reduce underproduction and improve welfare. Conversely, if integration reaches high levels, oligopoly is responsible for underproduction in the non-competitive sector, and advances in integration exacerbate it.

The model proposed in this chapter rests on several standard but crucial assumptions. One of them regards the perfectly functioning labor market, which is assumed to clear autonomously. Clearly, this assumption is in net contrast with the reality of the Italian economy, and needs to be taken into account when drawing conclusions based on model results. Under these limitations, this chapter proposes an alternative explanation for Italy's failure to gain from globalization over the last two decades, which pivots on the level of market competition on internal markets, and claims that the costs due to excessive regulation in some markets may have more than offset the benefits of higher economic integration.

References

Accetturo, A., A. Bassanetti, M. Bugamelli, I. Faiella, P. Finaldi Russo, D. Franco, S. Giacomelli and M. Omiccioli (2013). *Il sistema industriale italiano tra globalizzazione e crisi.* Questioni di Economia e Finanza 193. Banca d'Italia, Rome.

Balassone, F., D. Franco, S. Momigliano and D. Monacelli (2002). *Italy: fiscal consolidation and its legacy*. Banca d'Italia, The Impact of Fiscal Policy, Roma, Banca d'Italia, 2002

Barca, F. (1997). *Compromesso senza riforme nel capitalismo italiano*. In F. Barca (ed.), Storia del capitalismo italiano dal dopoguerra ad oggi. Donzelli, Roma.

Brandolini, A. e Cipollone, P. (2001). *Multifactor Productivity and Labour Quality in Italy, 1981-2000*. Banca d'Italia, Temi di discussione, n. 422.

Brandolini A., Cipollone P. (2003). *Una nuova economia in Italia*. In S. Rossi (ed.), La Nuova Economia: i fatti dietro il mito, il Mulino, Bologna.

Bassanetti, A., M. Iommi, C. Jona-Lasinio and F. Zollino (2004). *La crescita dell'economia italiana tra ritardo tecnologico e rallentamento della produttività.* Temi di Discussione 539. Banca d'Italia, Rome.

Beverelli, C. and K. Mahlstein (2011). *Outsourcing and Competition Policy.* Journal of Industry, Competition and Trade 11: 131 – 147.

Boeri T, Faini R, Ichino A, Pisauro G, Scarpa C (2005). *Oltre il declino.* Il Mulino, Bologna.

Bugamelli, M. (2001). *Il modello di specializzazione internazionale dell'area dell'euro e dei principali paesi europei: omogeneità e convergenza*. Temi di discussione, n. 402, Banca d'Italia.

Christopoulou, R. and P. Vermeulen (2008). *Markups in the Euro Area and the US over the Period 1981-2004 - a Comparison of 50 Sectors.* Working Paper Series, n. 856. European Central Bank

Ciocca, P. (2007). *Ricchi per sempre? Una storia economica d'Italia (1796-2005)*. Bollati Boringhieri.

CNEL (2007). *Liberalizzazioni e Privatizzazioni.* CNEL, Rome.

Crettez, B., and M.C. Fagart (2009). *Does entry improve welfare? A general equilibrium approach to competition policy.* Journal of Economics 98: 97 – 118.

Daveri, F. (2002). *The New Economy in Europe (1992-2001).* Oxford Review of Economic Policy, Fall, 345 – 362.

Daveri, F. (2004). *Why is there a European productivity slowdown?* CEPS Working Document 205, Brussels.

Daveri, F. and C. Jona-Lasinio (2006). *Italy's decline: getting the facts right.* Paper presented at the Conference "Nuovi Temi per la Politica Economica", Giornale degli Economisti and Ente Einaudi in Rome (November 14, 2005).

Dew-Becker, I. and R. Gordon (2008). *The role of labour market changes in the slowdown of European productivity growth*. CEPR Discussion Paper Series, 6722.

European Commission (1999). *Italy's slow growth in the 1990's: facts, explanations, and prospects*, in "European Economy", n. 5. (http://ec.europa.eu/archives/economy_finance/publications/archives/publication_summary8103_en.htm)

Faini, R. (2003). *Fu vero declino? L'Italia degli anni Novanta*. Il Mulino, 6 p. 1072-1083.

Faini, R., J. Haskell, G. Barba Navaretti, C. Scarpa and J. Wey (2005). *Contrasting Europe's decline: do product market reforms help?* Paper presented at the Conference "Oltre il declino", Fondazione Rodolfo De Benedetti, (February 2005).

Forni, L., A. Gerali and M. Pisani (2010). *Macroeconomic Effects of Greater Competition in the Service Sector: The Case of Italy*. Macroeconomic Dynamics, 14(05): 677-708.

Lipsey, R.G., and K. Lancaster. 1956. *The general theory of second best.* Review of Economic Studies 24: 11 – 32.

Mc Morrow K., W. Roger and A. Turrini A. (2009). *The EU-US total factor productivity gap: an industry level perspective*". CEPR Discussion Papers, DP7237

MEF (2011), *Documento di Economia e Finanza 2011*, III, Programma Nazionale di Riforma.

G. Nardozzi (2004). *Miracolo e declino. Italia tra concorrenza e protezione*. Roma - Bari, Laterza.

G. Nardozzi (2003). The Italian «Economic Miracle». Rivista di Storia Economica, 2: 139-180

Onida, F. (1999). *Quali prospettive per il modello di specializzazione internazionale dell'Italia?* Economia Italiana, 3: 573-629.

F. Onida (2004). *Se il piccolo non cresce. Piccole e medie imprese italiane in affanno*. Bologna, Il Mulino.

Neary, J.P. (2003). *The road less travelled: oligopoly and competition policy in general equilibrium*. In *Imperfect economics: Essays in honor of Joseph Stiglitz*, ed. R. Arnott, B. Greenwald, R. Kanbur, 485–500. Cambridge: MIT Press.

OECD (2005). *Going for growth.* OECD, Paris.

OECD (2006). *Science and Technology Database*, 2006

Pilat, D., Lee, F. e Van Ark, B. (2002). *Production and Use of TIC: a Sectoral Perspective on Productivity Growth in the OECD Area*. OECD Economic Studies, n. 35

Rossi, S. (2004). *Economia italiana: perché la deriva non si muti in declino*. Il Mulino, 4: 639-650

Simoni, M. (2012). *Senza Alibi. Perché il capitalismo italiano non cresce più*. Marsilio.

Tridico, P. (2013). *Italy: From Economic Decline to the Current Crisis.* Working Paper nr. 173. Dipartimento di Economia Università degli studi Roma Tre, Rome.

Vaciago, G. (2003). *Il declino dell'economia italiana*. Il Mulino, 6: 1084-1092.

Visco, I. (2004). *La crescita economica in Europa: ritardi e opportunità*. L'Industria, 2.

Zotti, J. and B. Lucke (2014): *Welfare-optimal trade and competition policies in small open oligopolistic economies.* The Journal of International Trade & Economic Development (http://dx.doi.org/10.1080/09638199.2012.742555).

Appendix. Proof of propositions

The proof of both propositions is based on utility function (25) and on the model solutions:

$$X^D = \frac{\varphi}{1-\varphi} A^V \left(\frac{\alpha}{\Omega}\bar{K}\right)^{\alpha} \left(\frac{1-\alpha}{\Psi}\bar{L}\right)^{1-\alpha} \frac{1}{\bar{P}_X} \cdot P_{V,x}(\tau) \cdot \mathrm{T}(\tau) \qquad \text{(A1)}$$

$$Y = \frac{N-1}{N} A^Y \left(\frac{\beta}{\Omega}\bar{K}\right)^{\beta} \left(\frac{1-\beta}{\Psi}\bar{L}\right)^{1-\beta} \cdot \mathrm{T}(\tau) \qquad \text{(A2)}$$

where $\Omega(\tau,N) \coloneqq \alpha + \beta \cdot \mathrm{T}(\tau) \cdot (N - 1/N)$, and $\Psi(\tau,N) \coloneqq (1-\alpha) + (1-\beta) \cdot \mathrm{T}(\tau) \cdot$ $\cdot (N - 1/N)$. The conditions $N > 1$ and $\tau \geq 0 > -\eta$ $(\tau > -1 + A^X (1-a)^{1/\eta} (\bar{P}_X / \bar{P}_O))$ guarantee positive solutions in the Cobb-Douglas (CES) case.

Proposition 1

We first show that utility (1) is continuous in τ for $\tau \geq 0$. This is immediately seen from the fact that $\Omega(\tau,N)$ and $\Psi(\tau,N)$ are continuous in τ and strictly positive since $\mathrm{T}(\tau) > 0$ for any $\tau \geq 0$. Hence, X^D and Y are also continuous in τ. Differentiating equation (1) with respect to the tariff rate yields

$$\frac{\partial U}{\partial \tau} = \left[\varphi \frac{1}{X^D} \frac{\partial X^D}{\partial \tau} + (1-\varphi) \frac{1}{Y} \frac{\partial Y}{\partial \tau} \right] \cdot U \quad . \tag{A3}$$

If τ goes to infinity, utility is zero since $\Omega(\tau,N)$ and $\Psi(\tau,N)$ are finite and X^D collapses to zero (see equation (27)). For $\tau \geq 0$ $0 < U(\tau,N) < \infty, \forall N > 1$. Thus, $U'_\tau = 0$ if and only if the term in square brackets in equation (A3) is zero. Its opposite is equivalent to the following cubic equation in the level of tariffs:

$$\tau^3 + a \cdot \tau^2 + b \cdot \tau + c = 0 \tag{A4}$$

where

$$a \coloneqq \frac{1}{d} \left\{ \frac{1}{\eta^2} \frac{N-1}{N} \left[\frac{\beta(1-\beta)(1-\varphi)}{\varphi} \left(3\frac{N-1}{N} - \eta \right) + \left[\alpha(1-\beta) + (1-\alpha)\beta \right](1+\eta) \right] + \right.$$
$$\left. + \alpha(1-\alpha) \left(\frac{1}{\eta} \frac{N-1}{N} + 2\frac{\varphi}{(1-\varphi)\eta} - 1 \right) \right\}$$

$$b \coloneqq \frac{1}{d} \left\{ \left[(1-\alpha)(\alpha(1+\eta) + \beta) - \frac{\beta(1-\beta)(1-\varphi)}{\varphi} \left(1 + \eta - 3\frac{N-1}{N} \right) + \alpha(1-\beta) \right] \right.$$
$$\left. \frac{N-1}{N} \frac{1}{\eta} - \alpha(1-\alpha) \left[2 - \frac{\varphi}{(1-\varphi)\eta} \right] \right\}$$

$$c \coloneqq -\frac{1}{d} \left\{ \frac{1}{N} \left[\alpha(1-\alpha) + \beta(1-\beta) \frac{1-\varphi}{\varphi} \frac{N-1}{N} \right] \right\}$$

where

$$d := \frac{1}{\eta}\left\{\frac{1}{\eta}\frac{N-1}{N}\left[\alpha(1-\beta)+(1-\alpha)\beta\right]+\frac{\alpha(1-\alpha)\varphi}{1-\varphi}+\frac{\beta(1-\beta)(1-\varphi)}{\varphi}\left(\frac{1}{\eta}\frac{N-1}{N}\right)^2\right\}$$

Note first that $a>0$, $d>0$, and $c<0$, which ensure two negative and one positive solution. (The sign of b is irrelevant.) Let τ^* be the positive solution. In order to prove that the positive solution is a maximum observe that $U'_\tau(0,N)>0$ because $c<0$ and equation (A4) is the opposite of the term in square brackets in (A3). Since $U(\tau,N)$ is continuous, and the other roots of equation (A4) are negative, it follows that $U'_\tau(0,N)>0$ in $\left[0,\tau^*\right)$. The fact that τ^* is a root of a cubic equation with at least two distinct solutions ensures that $U'_\tau(0,N)<0$ if $\tau>\tau^*$. Thus, τ^* is a utility maximum. This proves Proposition 1.

Proposition 2

We show first that utility function (1) is continuous in N for $N>1$. This is immediately from the fact that $\Omega(\tau,N)$ and $\Psi(\tau,N)$ are continuous in N and strictly positive for any $N>1$ and so are X^D and Y. Differentiating the utility equation (25) and setting $U'_N(\tau,N)$ equal to zero yields the following quadratic equation in $M := (N-1)/N$:

$$A\cdot M^2+B\cdot M+C=0 \qquad \text{(A5)}$$

with

$$\begin{aligned} A &:= -\beta(1-\beta)\varphi\cdot\left[\mathrm{T}(\tau)\right]^2 \\ B &:= -\left[\alpha\varphi(1-\alpha)-\beta(1-\varphi)(1-\beta)\right]\cdot\mathrm{T}(\tau) \\ C &:= \alpha(1-\alpha)(1-\varphi) \end{aligned} \qquad \text{(A6)}$$

Since $A<0$ and $C>0$ for all feasible model parameters, $\left(B^2-4AC\right)$ is strictly positive. This ensures the existence of two real and distinct solutions, which are discordant in sign. Since $N_{1,2}=1/(1-M_{1,2})$, the negative solution $M_2=\left(-B-\sqrt{B^2-4AC}\right)/2A$ is unfeasible because $N>1$ must hold. The positive solution is feasible only if $M_1=\left(-B+\sqrt{B^2-4AC}\right)/2A<1$, which is equivalent to $(A+B+C)>0$. Replace A,B,C by their definitions and verify that this is a product of positive terms. Since $A<0$ and $\left(B^2-4AC\right)>0$, $\left(A\cdot M^2+B\cdot M+C\right)$ is positive

(negative) for $M < M_1$ $\left(M > M_1\right)$ which proves that $N_1 = 1/\left(1 - M_1\right)$ is a utility maximum. Use definitions (A6) and (26) to verify that the optimal N is

$$N^* = \frac{1}{1-\eta} \cdot \left(1 + \frac{\eta}{\tau}\right) \qquad \text{(A7)}$$

Observe that if τ becomes zero, N^* is infinite. This proves Proposition 2.

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