Is there a connection between outsourcing and economic decline in Italy?
A general equilibrium analysis with oligopolistic markets

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Abstract

The decline of the Italian economy over the last two decades is widely documented. During this period, the global economy has become highly integrated and foreign outsourcing has turned into 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 competition policies are weak and productivity growth is poor. We study a small open economy with one oligopolistic and one competitive sector, which outsources part of its production process abroad. Deeper globalization entails lower trade costs of outsourcing. We show that welfare is an inverted *U*-shaped function of these costs. Hence, there is a level of trade costs, which maximizes utility. Below this threshold, the economy loses from globalization because the competitive sector overproduces, and the oligopolistic good has a higher marginal effect on welfare. Policies, which enhance competition and improve productivity in the competitive sector lower the threshold, and thus contribute to offset possible negative effects from deeper globalization.

Keywords: Cournot oligopoly, Italy's economic decline, outsourcing, general equilibrium

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

Introduction

The Italian economy is facing the worst recession since the Second World War. In the first quarter 2013, quarterly GDP growth has been negative for the seventh time in a row and preliminary estimates by ISTAT (ISTAT, 2013) confirm the adverse trend for the second quarter 2013. Clearly, the global financial crisis of 2007-2009 and the recent fiscal austerity measures contributed decisively to the severity of the situation. However, the performance of the Italian economy over the last two decades suggests that the current depression is also due to other factors, which characterise the national economic and institutional framework. For this reason, it seems appropriate to see the current crisis as a stage of a more persistent tendency of general decline (Daveri and Jona-Lasinio, 2005).

Despite the crucial importance of the issue, the literature on the reasons for the Italian economic decline appears quite tiny. Daveri and Jona-Lasinio (2005) focus on the role of labour productivity and conclude that Italy's poor economic performance is mostly due to a decline in the total factor productivity, while capital deepening has only a marginal role[1]. More recently, Accetturo et al. (2013) agree on the fall of the total factor productivity as the main cause for the weak growth of the labour productivity, but they also claim that this stagnation impedes firms to cope with the increased world market integration (globalization). In particular, they find that the progressive internationalisation of production (outsourcing) seems to have hurt the Italian economy. Since this seems to contrast with the established wisdom on the benefits of freer trade and higher specialisation, Accetturo et al. (2013) investigate the role of a number of factors in shaping the level of total factor productivity. In accordance with Daveri and Jona-Lasinio (2005) they find that a number of markets are overregulated, and thus lack of competition. This is confirmed by other studies (see for example OECD, 2005 and CNEL, 2007), and, from a slightly different perspective, by Tridico (2013), who tries to elicit a set of more institutional reasons for the productivity decline. Comprehensive as it is, this literature is extremely illuminating. However, due to the heterogeneity of the factors considered, it lacks the support of an appropriate modelling framework, which formally illustrates the causality between the single variable and the performance of the economy.

In this paper, we take another approach. We propose a simple model of international outsourcing and oligopolistic markets as a new explanation for the Italian economic decline. We select two variables, the total factor productivity and the degree of market competition, and show that, in general, the internationalisation of production (outsourcing) may fail to be beneficial to a country if markets are too regulated or innovation is scarce. Since we think that the reallocation of production is the central aspect of the recent integration process, we imagine that international trade in final goods occurs freely. By contrast, we argue that outsourcing operations require specific activities, which imply positive trade costs. The institutional advancement in economic integration and the introduction of new, cost-saving technologies mean lower trade

[1] Other studies with similar results are Daveri (2002), Daveri (2004), Bassanetti et al. (2004).

costs. For simplicity, we assume that these costs are exogenous to the economy and proportional to the traded volume of intermediates. We model the persistency of scarce competition in product markets (documented for example by Faini et al., 2005) through the introduction of Cournot oligopolies in parts of the economy. Specifically, we assume that one sector of the economy, e.g. industry, operates under perfect competition, while a second sector, e.g. services, is oligopolistic. Assuming balanced trade, we postulate that the economy imports intermediates and exports manufactures.

In this setting, we first study the general equilibrium effects of falling trade costs. For a given level of competition in the oligopolistic market, we find that consumer welfare is an inverted *U*-shaped function of the level of trade costs. Second, we show that there exists an optimal competition policy when firms outsource part of their production abroad, and trade costs are positive. Third, we find that the optimal competition policy is inversely related to the level of total factor productivity in the competitive sector. Thus, an improvement in productivity may be a substitute for a stricter competition policy. Hence, exogenous advances in globalisation may require a mix of policies aimed at more competition in the oligopolistic sector and higher productivity in the competitive sector.

The model presented here 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 (2013) who study the optimality of trade and competition policies when one sector of the economy is oligopolistic. As also in Crettez and Fagart (2009), their result is a direct application of Lipsey and Lancaster's (1956) second-best theory. We modify Zotti and Lucke (2013) in order to incorporate foreign outsourcing. We assume that production in the competitive sector requires value added and a foreign intermediate. In this setting, trade costs never reach prohibitive levels, so that outsourcing is a viable option in any case. With other things being equal, the level of firms' vertical integration depends on trade costs. If competition in the oligopolistic sector is scarce, particularly low trade costs may induce a welfare loss. Relatively to the oligopolistic sector, the competitive sector overproduces, and the marginal welfare is higher in the oligopolistic sector than in the competitive. In the opposite case of sufficiently high trade costs, stricter market regulation allows a reduction of production in the oligopolistic sector so that more resources are available for the production of the competitive good, and this may generate a welfare gain. We also extend the existing literature on oligopoly in general equilibrium to the more general case of a production technology with constant elasticity of substitution (CES). In contrast to this literature, we show that the optimal competition policy in one sector depends also on the productivity level in the other. An improvement in the production techniques leads to a shift of resources towards the oligopolistic sector, which indeed may reach the same production level with a milder competition policy.

The next section describes the main features of the model while section 3 derives results about globalization and competition policy in a small open oligopolistic economy (SOOE). Section 4 concludes.

The model

There are two sectors in the economy, denoted by X and Y, where the former is competitive and the latter oligopolistic. Production of X requires value added, which is produced using labour L and capital K, and a foreign intermediate O. The use of input O reflects the delocalisation choice of domestic firms. The trade costs per unit of imported intermediate are equal to a percentage τ of its price. For simplicity, they take the form of a monetary transfer to consumers. Production of Y requires only labour and capital, which are available in fixed supply at $\overline{L}$ and $\overline{K}$. 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 $\overline{L}$ 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 supply inelastically one unit of labour each at the nominal wage W. In addition, they lend private nominal wealth $P_K \overline{K}$ at the rental rate r to firms, which use the physical capital stock $\overline{K}$ for production. Private agents are price takers in both factor markets. Monetary private income, I, consists of primary factor income, trade costs and profits in the oligopolistic sector:

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

Here E is the nominal exchange rate, $\overline{P}_O$ 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:

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

where $\overline{P}_X$ 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

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

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

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

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

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

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

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 single actors are prevented from influencing macroeconomic variables so that Cournot oligopoly can be modelled rigorously in general equilibrium.

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

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

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

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

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

$$C^X\left(X^S\right) = P_{P,x} \cdot X^S \tag{12}$$

$$C^Y\left(Y\right) = P_{P,y} \cdot Y \tag{13}$$

where $P_{P,x} = \frac{1}{A^X}\left(\frac{P_{V,x}}{\eta}\right)^{\eta}\left[\frac{\left(1+\tau\right)\overline{P}_O}{1-\eta}\right]^{1-\eta}$, and $P_{P,y} = P_{V,y} = \frac{1}{A^Y}\left(\frac{rP^K}{\beta}\right)^{\beta}\left(\frac{W}{1-\beta}\right)^{1-\beta}$ are the producer prices 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:

$$P_{P,x} = \overline{P}_X \tag{18}$$

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

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

The condition for optimality is:

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

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

$$Y = (1-\varphi)\frac{N-1}{N}\cdot\frac{I}{P_{P,y}} \tag{21}$$

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[2]. The economy uses exports of sector *X* to finance the import of intermediates in the same sector. Trade costs 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

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

and

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

Walras' Law implies balanced trade

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

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. $E = 1$.

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

Results

Solving the model is messy, but straightforward. Private utility U can be expressed as a function of the trade costs 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:

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

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

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

Here, the price of value added in sector X is

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

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

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

Proposition 1: Sub-optimality of outsourcing in oligopoly
If $N > 1$ is finite, the threshold τ^{*} of trade costs is unique and strictly positive.

Proof: See appendix.

According to *Proposition 1*, globalization benefits a country only above a certain threshold of trade costs if the economy is oligopolistic. In stark contrast to standard trade theory, welfare (measured by private utility) is not a monotonously decreasing function of the costs of outsourcing. Figure 1 reports utility as a function of the trade costs for the cases $N = 2$ (bold), $N = 4$ (broken), and $N = 8$ dotted[3].

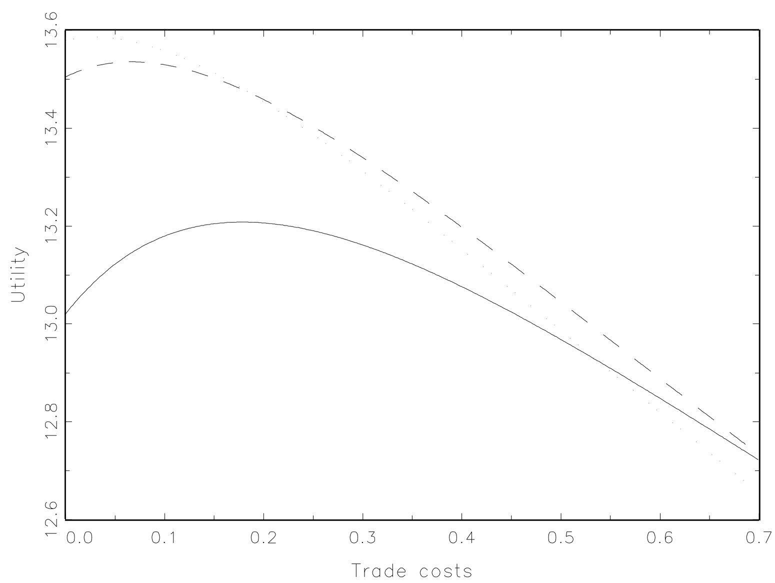


Figure 1

The intuition for the inverted *U*-shaped dependence of welfare on the trade costs 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 trade costs 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 outsourcing costs and perfect competition. Hence, if the trade costs 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 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

[3] The calibration used for Figure 1 and Figure 2 is $\bar{K} = 60$, $\bar{L} = 25$, $A^X = 0.8$, $A^V = A^Y = 1$, $\varphi = 0.2$, $\alpha = 0.33$, $\beta = 0.4$, $\eta = 0.4$, $\bar{P}_X = \bar{P}_O = 1$.

setting, the marginal benefit of lower trade costs is more than offset by the marginal damage of a decrease in production of *Y*.

If however the trade costs 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 trade costs. In this case, the economy would gain from lower trade costs.

This effect is also visible in Figure 1. For low levels of trade costs, the more firms are active in sector *Y*, the higher is welfare. However, if trade costs 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 trade costs amount to 60% four firms would be welfare-better than eighth.

Let us now consider competition policy under the assumption of a given level of trade costs. 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[4]:

Proposition 2: Optimal competition policy under outsourcing
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 the economy pays positive trade costs. 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 2 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 zero trade costs.

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 produced output become excessive and an inefficiency arises. However, if globalisation

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

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 following to lower trade costs.

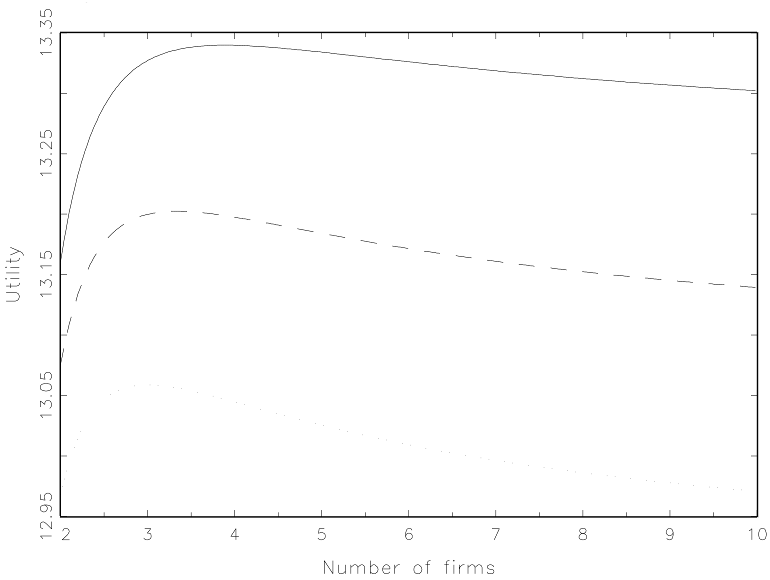


Figure 2

We generalize now our model to the case of a CES technology in sector *X*:

$$X^S = A^X \left[a \cdot V^\eta + (1-a) O^\eta \right]^{\frac{1}{\eta}} \qquad (29)$$

where $0 < a < 1$ and the elasticity of substitution between value added and intermediate is $\sigma := 1/(1-\eta)$, with $\eta < 1$. Under this assumption, utility maintains the form (25) whereby $\mathrm{T}(\tau)$ becomes:

$$\mathrm{T}(\tau) := \frac{1-\varphi}{\varphi} \cdot \left[1 + \left(\frac{1}{\overline{P}_O} \right)^\eta \left(\frac{1-a}{a} \cdot \frac{\tau^{1-\eta}}{1+\tau} \right)^{\frac{1}{1-\eta}} \left(P_{V,x} \right)^{\frac{\eta}{1-\eta}} \right] \qquad (30)$$

with

$$P_{V,x} = a^{\frac{1}{\eta}} \left\{ \left(\frac{1}{A^X \cdot \overline{P}_X} \right)^{\frac{\eta}{1-\eta}} - (1-a)^{\frac{1}{1-\eta}} \left[\frac{1}{(1+\tau)\overline{P}_O} \right]^{\frac{\eta}{1-\eta}} \right\}^{-\frac{1-\eta}{\eta}} \qquad (31)$$

Here, $\tau > -1 + A^X (1-a)^{1/\eta} \left(\bar{P}_X / \bar{P}_O\right)$ is necessary for a positive price of value added in sector *X*. Note that this condition may be stricter than our assumption of positive trade costs if $\bar{P}_O / \bar{P}_X < A^X (1-a)^{1/\eta}$. We use now utility (25) with (30) and (31) to prove that an innovation policy, which improves productivity in the competitive sector, may be a substitute for a stricter competition policy.

Proposition 3: Innovation policy as a substitute for competition policy
If $\tau > 0$ and finite, the optimal number of firms in the oligopolistic sector is inversely related to the level of productivity in the competitive.

Proof: See appendix.

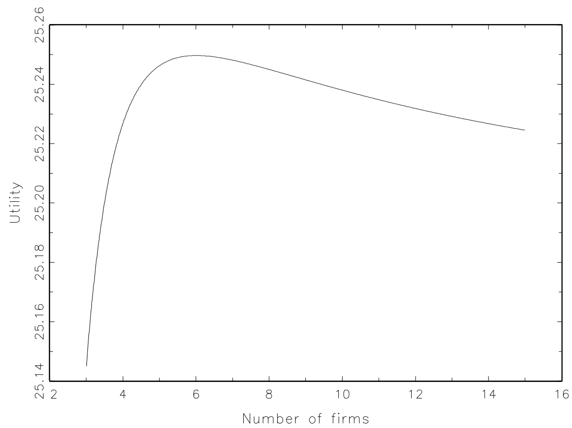
According to proposition 3, innovation policy may be used as a substitute for competition policy. Figure 3[5] shows this point. The three utility curves are obtained for $\tau = 0.4$ and $A^X = 0.9$ (first chart), $A^X = 1$ (second chart) and $A^X = 1.1$ (third chart). For a given level of trade costs, the optimal number of oligopolistic firms is lower if productivity in the competitive sector increases:

$$N^* = \left[1 - \frac{1-\varphi}{\varphi} \frac{1}{\mathrm{T}\left(A^X\right)}\right]^{-1} . \tag{32}$$

The intuition for this result is the same as in proposition 2. If productivity in the competitive sector rises, more resources are available for the production of the oligopolistic good. The innovation policy has thus the same effect of the competition policy. When globalisation improves and resources are inefficiently drained to the competitive sector, more competition in the oligopolistic market or higher productivity in the competitive sector help to counteract this shift.

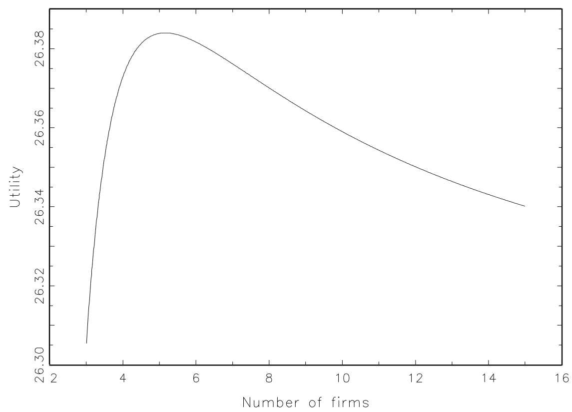
[5] The calibration used for Figure 3 is $\bar{K} = 60$, $\bar{L} = 25$, $A^V = A^Y = 2$, $a = 0.2$, $\alpha = 0.33$, $\beta = 0.4$, $\eta = 0.5$, $\varphi = 0.2$, $\bar{P}_X = \bar{P}_O = 3$.

Figure 3(a)



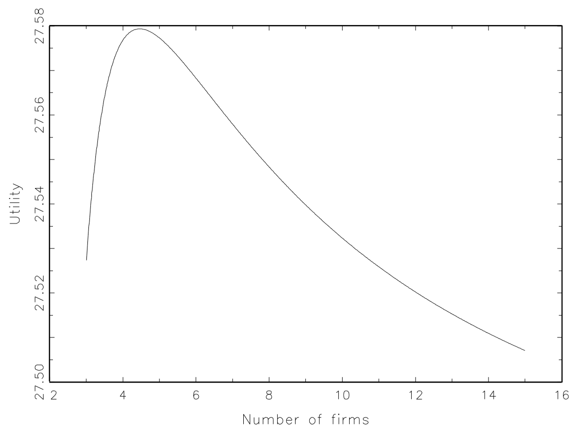
$A^X = 0.9$

Figure 3(b)



$A^X = 1$

Figure 3(c)



$A^X = 1.1$

Conclusions

This paper presents a simple model of a SOOE, with one oligopolistic and one competitive sector, which outsources part of its production abroad. We use this setting to study the welfare effects of globalisation in the form of decreasing outsourcing costs. We show that for a given oligopolistic structure of the economy, globalisation may fail to improve welfare, if the trade costs of outsourcing are sufficiently low and competition is scarce. We find also that perfect competition is not desirable, if outsourcing is costly, and an optimal competition policy is necessary. In particular, exogenous advances in globalisation might require more competition in order to be beneficial for the economy. Alternatively, an active innovation policy may be employed as a substitute for competition policy.

These results are an application of the well-known Lipsey-Lancaster theory of second best. In general, imperfect competition and trade costs 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 independently on the level of competition. Thus, lower trade costs can reduce underproduction. Conversely, if integration is high, oligopoly is responsible for underproduction, and advances in integration exacerbate it.

In the case of Italy, the degree of competition and the level of productivity are relatively low if compared to other countries with similar intensities of outsourcing. On this basis, these results offer a possible explanation for the poor performance of the Italian economy over the last fifteen years. The costs due to the excessive regulation in some markets and the general stagnation of productivity have more than offset the benefits of lower costs of outsourcing.

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Appendix. Proof of propositions

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

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

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

where $\Omega(\tau,N) := \alpha + \beta \cdot \mathrm{T}(\tau) \cdot (N - 1/N)$, and $\Psi(\tau,N) := (1-\alpha) + (1-\beta) \cdot \mathrm{T}(\tau) \cdot$ $\cdot (N - 1/N)$. 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 level of trade costs 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 trade costs:

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

where

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

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

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

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 $[0,\tau^*)$. 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 $N_{1,2}=1/\left(1-M_{1,2}\right)$, 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

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

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

Proposition 3

From Proposition 2 we know that the optimal N with a Cobb-Douglas technology in sector *X* is $N_1 = 1/\left(1-M_1\right)$. Verify that this holds also in the case of a CES production technology. Observe in fact from equations (30) and (31) that $d\mathrm{T}(\tau)/dN = dP_H(\tau)/dN = 0$. Use definitions (A6) and prove that the optimal N in the CES case is:

$$N^* = \left(1-\frac{1-\varphi}{\varphi}\frac{1}{\mathrm{T}(\tau)}\right)^{-1} \tag{A8}$$

In order to show that N^* is negatively related to the level of total factor productivity in sector *X*, observe that for a given level of trade costs, $\mathrm{T} = \mathrm{T}\left(A^X\right)$. Calculate

$$\frac{dN^*}{dA^X} = -\frac{1-\varphi}{\varphi}\frac{1}{\left(N^*\right)^2\left[\mathrm{T}\left(A^X\right)\right]^2}\cdot\frac{d\mathrm{T}}{dA^X}$$

with

$$\frac{d\mathrm{T}}{dA^X} := \frac{(1-\varphi)\eta}{\varphi(1-\eta)}\left(\frac{1}{\bar{P}_O}\right)^{\eta}\left[\frac{1-a}{A^X\left(\bar{P}_X\right)^{\eta}}\frac{\tau^{1-\eta}}{1+\tau}\right]^{\frac{1}{1-\eta}}\left\{\left(A^X\bar{P}_X\right)^{-\frac{\eta}{1-\eta}} - \left[(1-a)\left(\frac{1}{(1+\tau)\bar{P}_O}\right)^{\eta}\right]^{\frac{1}{1-\eta}}\right\}^{-2}$$

and observe that $\frac{d\mathrm{T}}{dA^X} > 0$. This proves proposition 3.