Public Procurement, Market Integration, and Income Inequalities

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Abstract

Aggregate demand externalities are the source of the cumulative processes of the new economic geography. In this paper these externalities drive the endogenous emergence of the pattern of international specialization in integrating economies. A distinguishing feature of this work is that it considers two aspects of market integration simultaneously: reduction of trade costs, and liberalization of the public procurement market. The first dimension has been widely studied. Adding the second dimension, which is on the policy agenda of the WTO and the EU, yields insights concerning the pattern of international specialization, income inequalities, and welfare.

1. Introduction

This paper investigates the consequences of market integration on international specialization. A distinguishing feature of this work is that it considers two aspects of market integration simultaneously. One is the reduction of trade barriers and the other is liberalization of the public procurement market.

The reduction of trade barriers has received very wide attention and often is taken as synonymous with market integration. Integration of the public procurement markets remains almost completely unexplored. Yet, in many countries the public procurement market is large (approximately 11% of GDP) and far from being internationally integrated. Indeed, it is usually recognized that governments favor domestic producers in public tendering. This concern has received great attention from policymakers. For instance, the European Commission noted repeatedly that, although trade and public procurement liberalization are both policy objectives of the European Union, implementation of the latter remains largely unsatisfactory (CEC, 1988, 1997). The WTO shares the concern and, as part of the Uruguay Round, dedicated a special treaty (known as the Government Procurement Agreement) to liberalization of the public procurement market (Hoekman and Mavroidis, 1997).

The model utilized in this paper fits in the literature on the dynamics of specialization that highlights the tension between dispersion and agglomeration forces (new economic geography). The study finds that a reduction of trade costs is much less likely to trigger agglomeration forces if public procurement is not liberalized. A consequence of this is that factor prices are more likely to be equalized when procurement is discriminatory than when it is liberalized. Naturally, discriminatory procurement implies a welfare loss because of the inefficiency in the production of government output. However, given the second-best nature of the setup, there is a special case in which discriminatory procurement improves welfare.

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Academic research on public procurement in the context of international trade is rather scant. A notable exception is the work by Baldwin (1970, 1984). He argued that discriminatory government procurement in favor of domestic suppliers is inconsequential on international specialization and trade flows. He cast his analysis in the standard Heckscher–Ohlin model, probably the most widely utilized at the time of his writing. Subsequently, Miyagiwa (1991) has shown that Baldwin’s proposition extends to a setup characterized by an oligopoly with homogeneous goods. Brülhart and Trionfetti (2000) reconsidered the question in the context of a model with increasing returns and monopolistic competition and found that home-biased public procurement affects international specialization and trade flows. There is an important difference between this literature and the approach of this paper. While the cited literature studied the consequences of discriminatory procurement on steady states, this paper studies the effect of discriminatory procurement on agglomeration dynamics.

A different line of research has studied the nature and motivation of the political interplay between the tendering entity and domestic and foreign bidders in various types of informational settings. This literature is loosely, if at all, related to international trade and, therefore, will not be discussed here. A general treatment is in Laffont and Tirole (1993) and a lucid review is in Mattoo (1996).

Research on the dynamic effects of a reduction of trade costs on the geographical distribution of economic activity, of which an accurate review is in Ottaviano and Puga (1998), has grown very rapidly in recent years. This literature highlights the tension between agglomeration and dispersion forces. At high trade costs dispersion forces prevail and the industrial activity is evenly distributed in all countries (low international specialization). At low trade costs the agglomeration forces take over and the industrial activity concentrates in a few countries only (sharp international specialization). The policy implications are of capital importance. For instance, Krugman and Venables (1996) suggest that as the old continent moves towards a fully integrated single market (low trade costs) the agglomeration forces might take over and, eventually, the economic landscape will exhibit sharp specialization patterns. Similarly, at the global level, sharp specialization patterns may result from market integration, as suggested in Krugman and Venables (1995).

This paper challenges this view. It argues that the liberalization of the public procurement market is as important as the reduction of trade costs in influencing the economic landscape. In particular, the paper argues that if the public procurement market is not liberalized agglomeration forces are very unlikely to prevail even at low trade costs. It is important to note that this result does not depend on any sort of international or intranational transfers, subsidies, income redistribution, shifts in demand, differences in the taxation among countries, relative size of immobile factors, or differences in the provision of public goods or publicly provided private goods among countries. The results rest solely on the aggregate demand externality (market size effect) generated by discriminatory public procurement.

It is informative at this stage to present two statistics about government procurement: its size and its bias. Further details are in Trionfetti (2000). Table 1 reports the size of non-military government purchase of goods and services (excluding salaries to employees) for the period 1984–90 and for the countries for which data are available. Not all countries report these figures. Some countries (like Japan and Italy) report public expenditure including salaries, transfers, and military expenditure. The table shows that government procurement averages around 11% of GDP and is substantially constant over the time span considered.
Measuring government discrimination in favor of domestic suppliers is a bit more difficult than measuring the size of government procurement. The reason is that discriminatory behavior is usually tacit and the formal respect of the tendering procedure is no guarantee of fair treatment of foreign firms. Table 2 compares the average import share of the private sector with the average import share of governments (averages over 25 categories of traded commodities). The import share is defined as the ratio between expenditure that falls on imports and total expenditure (for any particular category of commodity).

The import share of governments is substantially lower than the import share of the private economy. The proportions range from 3/4 (Germany), to 2/3 (UK), and 1/3 (France, Ireland, and Italy), down to slightly more than 1/4 (Spain). It is plausible that this is a reflection of the presence of some form of government bias in favor of domestically produced goods.

While it is informative to present these statistics it is important to point out that the present paper does not investigate the causes of the home bias. Rather, it investigates the consequences of it.

2. The Model

The model in this paper is identical to that in Krugman and Venables (1995) except for the demand side, which here includes government procurement. Other models

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Data source: EUROSTAT (1992), Input–Output Tables, tables 6, 12, and 15.
of the new economic geography could be chosen and the results would be qualitatively the same.

The world is composed of two countries, 1 and 2. Labor is the only primary factor of production. There exist three sectors: the manufacturing sector “M”; the government sector “G”; and the service sector “S”. Employment in each sector and country is denoted by \(L_{Hi}\), where \(H = M, G, S;\) and \(i = 1, 2\). The service sector is utilized to fix the wage rate. Thus, it is assumed that the conditions of perfect competition apply to the services sector, whose technology is \(S = L_S\). Taking the price of output in this sector \(P_S\) as the numéraire, we get the standard normalization, \(w_{Si} = P_S\) \(i \geq 1\), with equality as long as \(S \neq 0\) in \(i\). The manufacturing sector produces a differentiated commodity used for consumption by households and as an intermediate input by the governments and by the manufacturing sector itself. Governments produce a generic service (such as the police or mail service) under a constant-returns-to-scale technology that employs labor and the differentiated commodity. Countries have equal endowments of labor, \(L_1 = L_2 = 1\). Labor is assumed to have skills which are country-specific (such as knowledge of the country’s laws, language, and business regulations) and therefore is immobile between countries but mobile among sectors. Labor mobility is assumed to be perfect between the service sector and the government sector but imperfect between the manufacturing sector and the other sectors. These assumptions about labor mobility are not crucial. The results in this paper would obtain for models of economic geography where labor is immobile between sectors but mobile internationally. Similarly, the same results would obtain if labor were imperfectly mobile between the government and the service sector. As is customary in these kinds of models, it is assumed that trade in the item produced by the constant-returns-to-scale sector is free while trade in the items produced by the increasing-returns-to-scale sector is costly. Following a consolidated tradition, iceberg trade costs are assumed. For each unit sent, only a fraction \(\tau \in (0, 1]\) arrives at its destination.

The supply side follows strictly Krugman and Venables (1995). Each variety of the differentiated commodity produced by the manufacturing sector is subject to economies of scale represented by a fixed cost and constant marginal costs, both in terms of a composite input \(Z\). The input requirement per \(x\) units of output is \(Z = \alpha + \beta x\). Each firm produces \(Z\) according to \(Z = [L_M/(1 - \mu)]^{(1/\mu)(M/\mu)}\), where \(\mu \in (0, 1)\) represents the importance of the industry’s output as its own intermediate inputs and \(M\) is a CES aggregate with constant elasticity \(\sigma > 1\). Given this structure, the firm’s total cost is \(TC_i = w_{Mi}^{1-\mu}P_i^\mu(\alpha + \beta x)\). Aggregate demand from firms in country \(i\) for each domestic and each foreign variety of manufactures to be used as inputs are \(m_{ii} = p_{ii}^{-\sigma}P_i^{1-\sigma}mu_iTC_i\), and \(m_{ij} = p_{ij}^{1-\sigma}P_i^{\sigma}\mu_iTC_i\), respectively. The term \(P_i = (n_iP_i^{1-\sigma} + n_jP_j^{1-\sigma})^{1/(1-\sigma)}\) is the usual price index and \(p_{ij}\) is the price in \(i\) of the variety produced in \(j\). Profit maximization yields the well-known pricing rules: \(p_{ii} = w_{Mi}^{1-\mu}P_i^\mu\beta\) and \(p_{ij} = (1/\tau)p_{ij}\). Free entry into the manufacturing sector assures zero profits. The zero-profit condition gives firm’s output which is independent of firm’s location and equal to the constant \(\chi = (\alpha/\beta)(\sigma - 1)\). A distinctive feature of this setup is that the manufacturing sector uses its own output as input. This feature is the source of the agglomeration forces. Using the input demand functions, the price index, the pricing rules, and the total cost function, it is easy to have a grasp of the agglomeration mechanism. Suppose that the initial equilibrium is disturbed by a random shock that causes an increase of \(n_i\) (and a decrease of \(n_j\)). It follows that total costs in \(i\) decrease while they increase in \(j\). This, in turn, increases profitability in \(i\) and reduces it in \(j\), thus favoring a further increase of \(n_i\) (and a decrease of \(n_j\)), and so on in a cumulative way.
Household preferences are standard. The utility function is a nested CES–Cobb–Douglas with constant elasticity of substitution among varieties $\sigma$ and expenditure share $\gamma \in (0, 1)$ for the differentiated commodity and $(1 - \gamma)$ for services. Governments adopt a poll tax. Aggregate demand of households in $i$ for each variety produced in $i$ and $j$ are $c_{ii} = p_{ii}^{\sigma}P_{i}^{\sigma-1}T_{i}$ and $c_{ij} = p_{ij}^{\sigma}P_{i}^{\sigma-1}P_{j}^{\sigma-1}$, respectively, where $T_{i} = \sum_{i'} \nu_{i'i}L_{i'i'} - T_{i}$ is disposable income of the private sector in $i$.

Governments provide a service $G$ by use of a nested CES–Cobb–Douglas technology with constant elasticity of substitution among varieties $\sigma$ and expenditure share $\gamma \in (0, 1)$ for the differentiated commodity and $(1 - \gamma)$ for labor. The assumption that households and governments have the same Cobb–Douglas and CES parameters saves notation and bears no consequence on the dynamics of the model. Government budgets balance at all times. Total taxation $T_{i}$ is a constant fraction $\delta \in [0, 1)$ of national income $I_{i}$; i.e., $T_{i} = \delta I_{i}$. Since profits are zero, national income equals the wage bill; i.e., $I_{i} = \sum_{i'} \nu_{i'i}L_{i'i'}$.

Under liberalized procurement, maximization of $G_{i}$ subject to $T_{i}$ yields the usual demand functions $g_{ii} = p_{ii}^{\sigma}P_{i}^{\sigma-1}T_{i}$ and $g_{ij} = p_{ij}^{\sigma}P_{i}^{\sigma-1}T_{i}$. Government $i$'s import share is $p_{ij}^{\sigma}P_{j}^{\sigma-1}$. Under discriminatory procurement each government maximizes $G_{i}$ given $T_{i}$ and a domestic content requirement $f_{i}$. The resulting behavior is that governments allocate efficiently the expenditure between labor and the differentiated commodity. This means that they spend $\gamma T_{i}$ on manufactures and $(1 - \gamma)T_{i}$ on labor. Yet, given the requirement $f_{i}$, they spend $f_{i}\gamma T_{i}$ on domestic manufactures and $(1 - f_{i})\gamma T_{i}$ on foreign manufactures. This simple assumption represents two widely used discriminatory practices: (1) the outright exclusion of foreign bidders from domestic public tenders, and (2) the domestic content requirement imposed on foreign firms. Indeed, this is the same assumption adopted in Baldwin (1970, 1984). On the practice of this discriminatory behavior, see Hoekman and Mavroidis (1997).

The fundamental difference between liberalized and discriminatory procurement is that under liberalized procurement governments' import share is endogenous and it depends on the location of industries; while under discriminatory procurement the import share is constant, exogenous, and independent from the location of industries. Under liberalized procurement the import share is $p_{ij}^{\sigma}P_{j}^{\sigma-1}$, while under discriminatory procurement it is $(1 - f_{i})$. The constant import share is the source of the dispersion force generated by discriminatory procurement. This dispersion force may be illustrated by considering government $i$'s expenditure on each domestic and foreign variety under discriminatory procurement; these are $g_{ii} = p_{ii}^{\sigma}P_{i}^{\sigma-1}f_{i}\gamma T_{i}$ and $g_{ij} = p_{ij}^{\sigma}P_{i}^{\sigma-1}f_{i}\gamma T_{i}$, respectively. Notice that there are now two price indexes applicable to government $i$: $P_{ii} = n_{i}^{\sigma(1-\sigma)}p_{ii}$ is the price index associated with the CES aggregate of domestic varieties, while $P_{ij} = n_{i}^{\sigma(1-\sigma)}p_{ij}$ is the price index associated with the CES aggregate of foreign varieties. Using these price indexes, the expenditure on each domestic and foreign variety are, respectively

$$p_{ii}g_{ii} = \frac{\phi_{i}\gamma T_{i}}{n_{i}}, \quad p_{ij}g_{ij} = \frac{(1 - \phi_{i})\gamma T_{i}}{n_{j}}. \quad (1)$$

Now consider a shock that increases $n_{1}$ (and decreases $n_{2}$). Expressions (1) show that the increase of $n_{1}$ (and the decrease of $n_{2}$) reduces government expenditure on each variety produced in 1 and increases expenditure on each variety produced in 2. Consequently, potential profitability declines in 1 and increases in 2, thereby countering a further increase of $n_{1}$ (and decrease of $n_{2}$). This demand externality, which may be called the discriminatory procurement linkage, counters agglomeration, thereby
contributing to the stability of the initial equilibrium. Conversely, if procurement is liberalized, the expenditure on each domestic variety increases after an increase of \( n_1 \) (and decrease of \( n_2 \)), thereby contributing to the agglomeration forces in the same manner as private expenditure. It is worth noticing that the discriminatory procurement linkage neither rests on the particular assumption on labor mobility, nor does it depend on the specific supply-side structure adopted in this paper. The discriminatory procurement linkage solely depends on the demand externality intrinsic in any monopolistic-competitive type of market structure.

The product market and the labor market clear at any time. Labor market-clearing conditions in the constant-returns-to-scale sector are trivial. Labor market-clearing conditions in the manufacturing sector are \( w_{Mi}L_{Mi} = (1 - \mu)n_i p_{vi} \lambda \), (for \( i = 1, 2 \)), where use has been made of the fact that firms’ expenditure on labor is a fraction \( (1 - \mu) \) of total cost and that profits are zero. The product market-clearing conditions differ according to whether government procurement is liberalized or discriminatory. For clarity of exposition it is convenient to write the market-clearing equations separately. Let us denote by \( E_i \) country \( i \)'s total private expenditure on manufactures; this is \( E_i = \gamma T_i + \mu n_i p_{vi} \lambda \). Further, let us denote by \( N \) the total number of varieties produced in the world (\( N = n_1 + n_2 \)); and by \( L_M \) the total employment in the manufacturing sector in the world (\( L_M = L_{M1} + L_{M2} \)). Finally let us define \( \lambda = L_{M1}/L_M \). In each pair of the following equations, the left-hand side of the first equation reports the total aggregate expenditure on any of the varieties produced in 1, while the left-hand side of the second equation refers to any variety produced in 2.

Under liberalized procurement the market-clearing conditions for goods are

\[
\begin{align*}
\frac{p_{1i} \lambda^{1-\sigma} (E_1 + \gamma T_1)}{\lambda^{1-\sigma} + \tau^{1-\sigma} (1-\lambda)p_{22}^{1-\sigma}} &+ \frac{\tau^{\sigma-1} p_{1i}^{\sigma} (E_2 + \gamma T_2)}{\lambda^{1-\sigma} \tau^{\sigma-1} + (1-\lambda)p_{22}^{1-\sigma}} = N p_{11}, \\
\frac{\lambda^{\sigma-1} p_{22}^{\sigma} (E_1 + \gamma T_1)}{\lambda^{1-\sigma} + \tau^{1-\sigma} (1-\lambda)p_{22}^{1-\sigma}} &+ \frac{p_{22}^{\sigma} (E_2 + \gamma T_2)}{\lambda^{1-\sigma} \tau^{\sigma-1} + (1-\lambda)p_{22}^{1-\sigma}} = N p_{22}.
\end{align*}
\] (2a)

Under discriminatory procurement the market-clearing conditions for goods are

\[
\begin{align*}
\frac{p_{1i}^{1-\sigma} E_1}{\lambda^{1-\sigma} + \tau^{1-\sigma} (1-\lambda)p_{22}^{1-\sigma}} &+ \frac{\tau^{\sigma-1} p_{1i}^{\sigma} E_2}{\lambda^{1-\sigma} \tau^{\sigma-1} + (1-\lambda)p_{22}^{1-\sigma}} + \frac{\phi_1 \gamma T_1 + (1-\phi_2) \gamma T_2}{\lambda} = N p_{11}, \\
\frac{\tau^{\sigma-1} p_{22}^{\sigma} E_1}{\lambda^{1-\sigma} + \tau^{1-\sigma} (1-\lambda)p_{22}^{1-\sigma}} &+ \frac{p_{22}^{\sigma} E_2}{\lambda^{1-\sigma} \tau^{\sigma-1} + (1-\lambda)p_{22}^{1-\sigma}} + \frac{(1-\phi_1) \gamma T_1 + \phi_2 \gamma T_2}{(1-\lambda)} = N p_{22}.
\end{align*}
\] (2b)

Using \( E_i = \gamma T_i + \mu n_i p_{vi} \lambda \) in (2a) and (2b) shows that government procurement cancels out of (2a) while the same simplification does not apply to (2b). This fact anticipates the result that liberalized procurement is inconsequential on the pattern of specialization and its stability while discriminatory procurement affects both. Systems (2a) and (2b) yield identical solutions for some of the endogenous variables. It is convenient to place these solutions here. The total number of varieties is \( N = 2 \gamma/(1 - \mu) \), and total employment in the manufacturing sector is \( L_M = 2 \gamma \). Clearly, \( N \) and \( L_M \) are constant over time for they depend only on parameters that are constant over time.
Coming to the dynamics, it is assumed that labor is perfectly mobile between the service and government sectors so that we have $w_{Si} = w_{Gi}$ ($i = 1, 2$) at any time. Labor is instead only imperfectly mobile between the manufacturing sector and the other two sectors and moves slowly into (out of) the manufacturing sector as the manufacturing wage exceeds (is smaller than) the wage in the service and government sectors.\footnote{This assumption can be formalized with the two differential equations $\dot{L}_{M1} = \xi (w_{M1} - w_{Si})$ and $\dot{L}_{M2} = \xi (w_{M2} - w_{Si})$, where $\xi$ is an arbitrary constant.} Defining $\omega \equiv w_{M1} - w_{M2}$ and using the fact that that $L_M$ is constant allows us to rewrite the differential equations as

$$\dot{\lambda} = \omega(\lambda; \mu, \sigma, \tau, \gamma, \phi, \delta).$$

Equation (3) highlights the fact that $\omega$ depends on the state variable $\lambda$ and on the parameters through system (2a) or (2b). Steady states occur when $w_{Si} = w_{Gi} = w_{Mi} = 1$, ($i = 1$ and 2). The system is trivially at rest when complete specialization occurs; that is when $w_{M1} > 1$ and $\lambda = 1$, or when $w_{M2} > 1$ and $\lambda = 0$. Whether dispersion forces or agglomeration forces will prevail depends on trade costs and on the parameters of government procurement. It is to this analysis that we turn next.

3. Results

The first result concerns complete specialization. Complete specialization is characterized by the production of $M$ being concentrated in one country only. In terms of the notation of the present model, complete specialization means that $\lambda = 0$ (if country 2 is completely specialized in $M$) or that $\lambda = 1$ (if country 1 is completely specialized in $M$).

\textbf{Proposition 1.} If procurement is discriminatory, complete specialization cannot occur. Further, if procurement is discriminatory, complete specialization cannot be approached asymptotically. These two statements hold for any $\tau \in (0, 1]$.

The first statement in Proposition 1 is trivially proven; it suffices to observe that system (2b) is not defined for values of $\lambda = 1$ or $\lambda = 0$ (division by zero in the third term on the left-hand side) and, therefore, it does not have equilibria for $\lambda = 1$ or $\lambda = 0$. To prove the second statement it suffices to observe that, using the pricing rule in system (2b), we have $\lim_{\lambda \to 0} (w_{M1} - w_{M2}) = \infty$ which, by virtue of (3), implies that $\dot{\lambda} > 0$. In words: when country 2 is near full specialization in $M$, the dynamic mechanism works against further specialization of country 2 in $M$. Analogously, $\dot{\lambda} < 0$ as $\lambda \to 1$. Thus, complete specialization cannot be approached asymptotically over time.

The second result pertains to the number of steady-state equilibria. Replacing $w_{Si} = w_{Gi} = w_{Mi} = 1$, ($i = 1, 2$) in system (2b) gives an equation of the third degree in $\lambda$. The real solutions to this equation give steady-state values of $\lambda$. Since the equation is of the third degree it admits at most three distinct real solutions which may all be coincident or may all be distinct. From this the next proposition follows quite trivially.

\textbf{Proposition 2.} If procurement is discriminatory there exist one or three steady states.

Setting parameters such that countries are identical (in particular, setting $\delta_1 = \delta_2 = \delta$, and $\phi_1 = \phi_2 = \phi$) allows us to find one of the real solutions of (2b). Simple inspection
of (2b) shows that $\lambda = \frac{1}{2}$ is a solution. Incidentally, note that $\lambda = \frac{1}{2}$ is a solution also for equations (2a). For clarity of exposition let us refer to this particular steady state as the “symmetric” equilibrium.

The third result concerns the stability of the symmetric equilibrium. The symmetric equilibrium is locally stable if in its neighborhood the slope of the phase curve is negative and it is locally unstable if the slope of the phase curve is positive. The slope of the phase curve is given by the sign of $d\omega/d\lambda$ which obtains from (2a) or (2b). The mathematical analysis is relegated to the Appendix. The text lists the results and summarizes the findings by use of Figure 1. The symmetric equilibrium is perturbed by $dL_{M1} = -dL_{M2} > 0$.

**Liberalized Procurement**

Let us denote by $(\tau^L, \bar{\tau}^L)$ the domain of trade costs within which the symmetric equilibrium is unstable when procurement is liberalized. This domain is

$$0 < \left\{ \frac{(1-\mu)[1-\sigma(1-\mu)]}{(1+\mu)[1-\sigma(1+\mu)]} \right\}^{1/(\sigma-1)} = \tau^A < \tau < \bar{\tau}^A = 1.$$  (4)

Inequalities (4) are identical to expression (11) in Krugman and Venables (1995, p. 869). This is not surprising; it simply means that liberalized procurement is inconsequential on the stability of the symmetric equilibrium. Note that the set $(\tau^L, \bar{\tau}^L)$ is never empty. This means that, for any value of $\mu$ and $\sigma$, there exists a level of trade costs that destabilizes the symmetric equilibrium.

**Discriminatory Procurement**

Let us denote by $(\tau^D, \bar{\tau}^D)$ the domain of trade costs within which the symmetric equilibrium is unstable when procurement is discriminatory.

**PROPOSITION 3.** The set $(\tau^D, \bar{\tau}^D)$ is a proper subset of $(\tau^L, \bar{\tau}^L)$.

Proposition 3 (proved in the Appendix) is the first important result. It says that discriminatory procurement, however small, contrasts the emergence of sharp patterns of specialization because it reduces the domain of trade costs for which the symmetric equilibrium is unstable.

![Figure 1. Phase Diagram](image-url)
It is interesting to investigate whether there is a $\delta$ sufficiently large such that the set $(\tau^D, \tau^D)$ is empty. As stated by Proposition 4 (proved in the Appendix), the answer is a qualified “yes.”

**Proposition 4.** There exist a critical $\delta^*$ such that, if $\delta > \delta^*$, the set $(\tau^D, \tau^D)$ is empty.

If $\delta > \delta^*$, there is no level of trade costs that destabilizes the equilibrium (i.e., the slope of the phase curve is negative for any $\tau$). Accordingly, there seem to be solid grounds on which to argue that a fall in trade costs, without a fully liberalized procurement market, is very unlikely to reshape the pattern of international specialization.

It is convenient to summarize the results of this section by use of a figure. When trade costs are sufficiently high ($\tau < \tau^L$), only the symmetric equilibrium is stable regardless of whether procurement is liberalized or discriminatory (situation not depicted in Figure 1). Figure 1 depicts the more interesting situation in which trade costs are in $(\tau^L < \tau < 1)$. In this situation three possibilities emerge.

1. If government procurement is liberalized, then the symmetric equilibrium (denoted by $\lambda_\infty$) is unstable (solid line). This is the benchmark case.
2. If government procurement is discriminatory, and $\delta > \delta^*$, then the symmetric equilibrium is stable (dotted line). This is the result of Proposition 4.
3. If government procurement is discriminatory, but $\delta < \delta^*$, than the symmetric equilibrium may be unstable. This means that the phase curve may be upward-sloping around the symmetric equilibrium (dashed line). However, given that there are at most three steady states (Proposition 2), that the phase line is continuous, and that the phase line goes to infinity (minus infinity) as $\lambda \to 0$ ($\lambda \to 1$) (Proposition 1), it follows that the phase curve must be downward-sloping around the other two steady states. This means that the other two steady-state equilibria ($\lambda_W$ and $\lambda_E$) must be stable.

### 4. Real Wage Differentials and Welfare

Real wage differentials and welfare of both countries depend on the degree of international specialization, that is on $n_i/N$. It is useful to use the definition $\eta \equiv n_i/N$.

**Proposition 5.** Real wage differentials under discriminatory procurement are smaller than or equal to what they are under liberalized procurement. Equality occurs only at $\tau = 1$.

**Proof by direct inspection.** Real wage differential, denoted by $\Omega$, is

$$\Omega(\eta, \tau) = \frac{w_i}{P_i^\gamma} - \frac{w_j}{P_j^\gamma} = N_i^{\gamma/(\sigma-1)} \left[ \frac{\eta}{w_i} - \frac{(1-\eta)}{w_j} \right]^{\gamma/(\sigma-1)} - \left[ \frac{\eta}{\tau^{\sigma-1}} - \frac{(1-\eta)}{w_j} \right]^{\gamma/(\sigma-1)} \cdot$$

where $w_i$ is the steady-state wage in $i$. Note that $\Omega(\eta, \tau)$ is a strictly convex function of $\eta$ for any $\tau < 1$. This means that real wage differential decreases as countries become...
less specialized. Since discriminatory procurement prevents complete specialization from occurring (Proposition 2) it results in smaller income inequalities for any $\tau < 1$. If $\tau = 1$, income inequalities are trivially zero ($\Omega = 0$ for any $\eta$) regardless of whether procurement is liberalized or discriminatory.\footnote{Federico Trionfetti © Blackwell Publishers Ltd 2001}

Let us now look at world welfare. World welfare, denoted by $V$, obtains from households’ indirect utilities. That is, from the sum of real disposable income $Y^d(\eta, \tau) \equiv I^1_0/P^1_0 + I^2_0/P^2_0$, and from government output $G_i(\phi_i)$. Keeping the assumption of identical parameters between countries so that $G_1(\phi_1) = G_2(\phi_2) \equiv G(\phi)$, world welfare is

$$V(\eta, \phi, \tau) = Y^d(\eta, \tau) + 2G(\phi). \quad (6)$$

One may think that discriminatory procurement results in lower world welfare than if procurement were liberalized. The reason is that discriminatory procurement causes inefficient production of $G$ and this is a welfare loss. But this is not all. Discriminatory procurement guarantees incomplete specialization and this is a welfare gain. To see this, observe that $Y^d(\eta, \tau)$ is a strictly concave parabola in $\eta$ for any $\tau < 1$ and it is a constant if $\tau = 1$. This means that real disposable income increases as countries become less specialized. The reason is that as the manufacturing sector becomes more evenly distributed between countries a smaller quantity of output is lost in transport. The balance between the welfare gain resulting from lower specialization and the welfare loss resulting from inefficient production of government output depends on $\tau$ and $\eta$ and is, in general, ambiguous except in the following case. To illustrate the case, let us define the set $\Theta \equiv (\bar{\tau}^L, \bar{\tau}^D) \cup (\bar{\tau}^D, \bar{\tau}^L)$ and note that, if $\tau \in \Theta$, then the symmetric equilibrium is unstable under liberalized procurement but stable under discriminatory procurement.

**Proposition 6.** If $\tau \in \Theta$, and if $\phi_1 = \phi_2 = \phi^* = 1/(1 + \tau^{\sigma-1})$, then discriminatory procurement yields higher world welfare than liberalized procurement.

**Proof.** See Appendix. \hfill $\square$

This proposition is proved in the Appendix, but the intuition is simple. Government intervention may be welfare-improving because of its macroeconomic nature. Its nature is not to intervene into the market (for instance by use of incentives): rather, it is to create a market and let it operate freely. In this way there is no interference with the efficiency of private production or consumption decisions. Its negative welfare effect is limited to production of $G$ and it is minimized if $\phi_i = \phi_j = \phi^* = 1/(1 + \tau^{\sigma-1})$. A final comment is in order to explain why $\phi^*$ minimizes the welfare loss. Consider, for instance, country 1 (the choice of the country is irrelevant). The government import share under discriminatory procurement is the arbitrary constant $(1 - \phi)$ while the import share under liberalized procurement at the symmetric equilibrium would be $\tau^{\sigma-1}/(1 + \tau^{\sigma-1})$. Inefficiency in the production of $G$ stems from the fact that, in general, $(1 - \phi) \neq \tau^{\sigma-1}/(1 + \tau^{\sigma-1})$. Yet, if governments set $\phi_1 = \phi_2 = \phi^* = 1/(1 + \tau^{\sigma-1})$, then the (constant) import share is at its efficient value. It follows that if $\tau \in \Theta$, and if $\phi_1 = \phi_2 = \phi^* = 1/(1 + \tau^{\sigma-1})$, discriminatory procurement stabilizes the symmetric equilibrium without generating inefficiency.

**5. Conclusion**

This paper has studied the effect of market integration on international specialization and welfare. Two aspects of market integration were investigated simultaneously: a reduction of trade costs, and liberalization of the public procurement market.
The positive analysis has shown the possibility that a reduction in trade costs has no consequences whatsoever on international specialization if the public procurement market is not liberalized (Proposition 4). In general, the effects of a reduction of trade costs are attenuated by discriminatory public procurement (Propositions 1 and 3). These results are counter to the conclusion of studies that focused on trade costs as the sole dimension of market integration. Also, they challenge the conventional wisdom (based on the Heckscher–Ohlin model) that discriminatory government procurement is inconsequential on international specialization. The positive analysis has also shown that a reduction of trade costs is inconsequential on regional income inequalities if there is no liberalization of the public procurement market (Proposition 5). Again, this is a result that goes counter to conventional wisdom based on models where trade costs are the sole source of market segmentation.

The results of the welfare analysis are not conclusive. In a special case, however, discriminatory procurement improves welfare (Proposition 6). This is an interesting case of “second-best” theory. Markets are subject to two distortions (monopolistic competition and trade costs). Adding a third distortion (i.e., discriminatory procurement) is not necessarily welfare-reducing.

These results may be relevant for the current process of integration in the WTO context as well as in the European context. In both, a reduction of trade costs is being accompanied by liberalization of the public procurement market. This paper has explored the positive and welfare effects of these parallel policies. The results may have further implications in the context of European market integration. Liberalization of the public procurement market is welcome because it increases the efficiency in the production of government output, but it has its drawbacks. Indeed, keeping the public procurement market segmented contributes to counter agglomeration forces and to reduce income inequalities across countries (and regions). This, in turn, reduces the need for increasing and increasingly unsustainable transfer programs across countries. This tradeoff, that this paper does not attempt to resolve, would remain completely overlooked if the analysis had focused on the reduction of trade costs only.

Appendix

Proof of Proposition 3

Let us define \( \theta \equiv (1 - \tau^{-1})/(1 + \tau^{-1}) \). Differentiation of system (2a) gives the following expression for the slope of the phase curve:

\[
\frac{d\omega}{d\lambda} = \frac{[1 - \sigma + \mu \sigma \theta] \theta - [(\sigma - 1) \theta - \mu \sigma \theta]}{[1 - \mu \sigma - \theta][1 - \sigma + \mu \sigma \theta] - [(\sigma - 1) \theta - \mu \sigma \theta][1 - (1 - \mu) \sigma \theta]}. \tag{A1}
\]

Differentiation of system (2b) gives the following expression for the slope of the phase curve:

\[
\frac{d\omega}{d\lambda} = \frac{1}{1 - \delta(1 - \mu)} \frac{[\mu \theta - \delta(1 - \mu)][1 - \sigma + \mu \sigma \theta] \theta + [(\sigma - 1) \theta - \mu \sigma \theta][1 - (1 - \mu) \sigma \theta]}{[(1 - \mu) \sigma - \theta][1 - \sigma + \mu \sigma \theta] - [(\sigma - 1) \theta - \mu \sigma \theta][1 - (1 - \mu) \sigma \theta]}. \tag{A2}
\]

Each of the following steps can be proven by use of simple calculus.
1. Observe that $d\omega/d\lambda$ in (A2) is a continuous and concave function of $\tau$ for any $\mu$, $\sigma$, $\tau$ and $\delta$.

2. Observe that in (A2), $d(d\omega/d\lambda)/d\delta < 0$ for any $\mu$, $\sigma$, $\delta$ and $\tau$.

From the second observation it follows that (A2) lies strictly below (A1) for any $\delta > 0$, however small. Since (A1) has two real roots (which are $\tau^L$ and $\bar{\tau}^L$), and since (A2) is continuous, concave, and lies strictly below (A1), it follows that the roots of (A2) must lie strictly within those of (A1). That is $\tau^L < \tau^D < \tau < \bar{\tau}^D < \bar{\tau}^L = 1$. \hfill $\square$

Proof of Proposition 4

Observe from (A2) that $d\omega/d\lambda < 0$ if and only if

$$\delta > \frac{1}{4} (1 - \tau^{\sigma-1}) \frac{\tau^{\sigma-1} (1 + \mu) [\sigma (1 + \mu) - 1] - (1 - \mu) [\sigma (1 - \mu) - 1]}{\tau^{\sigma-1} (1 - \mu) (\sigma - 1)}. \tag{A3}$$

The value of $\tau$ that maximizes the right-hand side of (A3) is

$$\tau^* (\mu, \sigma) = \left( \frac{\sqrt{\sigma (1 + \mu) - 1} [1 + \mu] [\sigma (1 - \mu) - 1]}{[\sigma (1 + \mu) - 1] (1 + \mu)} \right)^{1/(\sigma - 1)}. \tag{A4}$$

Replacing this value into the right-hand side of (A3) gives $\delta^* (\sigma, \mu)$. Finally, direct computation shows there are values of $\sigma$ and $\mu$ such that there exists a $\delta \in (0, 1)$ larger than $\delta^* (\delta, \mu)$. \hfill $\square$

Proof of Proposition 6

Let $V^L$ denote world welfare under liberalized procurement and let $V^D$ denote world welfare under discriminatory procurement. If $\tau \in \Theta$, and if $\phi = \phi_i = \phi^* = 1/(1 + \tau^{\sigma-1})$, then, using (6), we have the following inequality:

$$V^D - V^L = N^{\gamma (\sigma - 1)} \left[ 2^{1 - \gamma (\sigma - 1)} (1 + \tau^{\sigma - 1})^{\gamma (\sigma - 1)} - \left( \frac{w_i}{\beta} + \tau^* \right) \right] > 0. \tag{A5}$$

Proof of inequality (A5) is in three steps. The proof assumes $\sigma > 1 + \gamma$. First, at $\tau = 0$ we have $V^D > V^L$. At $\tau = 1$ we have $V^D \geq V^L$, with equality only if $w_i = 1$. Next, the signs of the following derivatives hold for any $\mu$, $\delta$, $\tau \in (0, 1)$ and for any $\sigma > 1 + \gamma$:

$$dV^D/d\tau > 0, \quad d^2V^D/d\tau^2 > 0; \quad dV^L/d\tau > 0, \quad d^2V^L/d\tau^2 < 0.$$

Finally, at $\tau = 1$ we have that $dV^D/d\tau = dV^L/d\tau$, which means that $V^D$ and $V^L$ have the same slope; moreover they are tangential to each other if $w_i = 1$.

In words: since $V^D$ is convex and $V^L$ is concave, and both are increasing in $\tau$, and since they have the same slope at $\tau = 1$ (where $V^D \geq V^L$), it must be that $V^D > V^L$ for any $\tau \in \Theta$. \hfill $\square$

References


Notes

1. This assumption can be justified on the grounds that the service and government sector use labor with similar skills while firms use labor with other skills. The micro-foundation of this assumption is not at the heart of the matter. Alternatively, it could be assumed that labor is perfectly mobile across all sectors and that firms move to the country that yields highest profits. The dynamics resulting from this alternative assumption is identical to the one in the text. A further comment is in order. It could be assumed that labor moves slowly between the service and government sector. This assumption would make the dynamics more complex but would not change the end results. The reason for this is that the agglomeration and dispersion forces, which solely drive the end result, arise only in the increasing-returns monopolistic-competitive sector and not in the homogeneous good sector because only the former, and not the latter, is subject to demand externalities.

2. This simple adjustment mechanism neglects expectations. This may find various justifications but it is mainly a simplification practice widely utilized in the literature.

3. The same inequality is found in Krugman and Venables (1996) and Puga (1999) even though the supply side in those models is slightly different from the one used here. Throughout this paper, as in Krugman and Venables (1995, p. 870), it is assumed that $\sigma > 1/(1 - \mu)$. The economic meaning of the inequality is that neither economies of scale nor intermediate linkages should be too strong.

4. Expression (5) takes account of the fact that the steady-state value of wages equals 1 in both countries under discriminatory procurement, but it may be different from 1 in one country when complete specialization occurs under liberalized procurement.

5. For most values of $\mu$ and $\sigma$, the resulting value of $\delta^* (\mu, \sigma)$ is less than 0.1. This is not an unreasonable number in view of the fact that public procurement averages to 11% of GDP.

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