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ABSTRACT

The District and the Global Economy: Exportation *versus* Foreign Location*

This Paper studies the welfare implications of the location decisions of innovative newcomers that, though spinning off an industrial district, may choose whether to locate inside or outside its borders. Even if this choice has always been relevant, globalization has turned the issue of whether to locate inside or outside the district from an intra- to an international issue. The fear is delocation, that is, the implosion of the district due to the flight of innovative newcomers to distant locations. This negative effect could offset the benefits that the district reaps both in terms of cost reduction through foreign production in low-wage countries and in terms of access to new markets.

We address these issues by depicting the industrial district as a centre of innovation where positive local spillovers sustain the endogenous invention of new goods by profit-seeking firms. After invention, firms face a crucial choice between reaching distant markets by export or by plant delocation. By focusing on market-seeking rather than cost-reducing location choices, we argue that, by the very nature of the district, the equilibrium distribution of firms is bound to be inefficient from the point of view of the district as a whole. In particular, firms' attempts to circumvent trade barriers through delocation slow the pace of innovation and harm the welfare of the district.

JEL Classification: F43, O30 and R12
Keywords: delocation, fixed exchange rates, industrial district, regional development and stabilization

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1 Introduction

Whether an innovative newcomer should locate inside or outside an industrial district is not a question with a straightforward answer. According to Marshall (1920) location inside a district has distinctive advantages due to the availability of specialized inputs, a labor pool with the right skill composition and informal interactions that favor the generation and the diffusion of knowledge. At the same time, location inside the district carries problems on its own in terms of obstacles raised by incumbent competitors and conservative business practices. This is well documented by several case studies. For example, Pasold (1977) reports a detailed account by an innovative newcomer to the British knitwear industry about the disadvantages offered by the dominant MID around Leicester and Nottingham, and the advantages of avoiding it. Loasby (1998) shows how the interwar expansion of the British car industry started with the location of new firms in non-engineering districts: "Morris in Oxford, Austin to the south-west of Birmingham, away from the small-scale car manufacturers in the Black Country, and Ford in Dagenham, abadoning the engineering skills of its early base in Manchester" (p.82). He argues that these are examples of a repeated pattern along British industrial history and similar patterns have been identified elsewhere by Scott (1988), Porter (1990), Pyke *et al.* (1990), and Saxenian (1994).

This paper studies the location decisions of innovative newcomers that, though spinning off a *Marshallian Industrial District* (henceforth MID; see, e.g., Sabel and Zeitlin, 1985; Sabel, 1988; Best, 1990), may choose whether to locate inside or outside its borders. Even if this choice has always been relevant, globalization has changed the alternative whether to locate inside or outside the district, from an intra- to an inter-national issue (Nelson, 1993; OECD, 1996).[1] The fear is *delocation*, that is, the implosion of the MID due to the flight of innovative newcomers to distant locations (see, e.g., Conti and Menghinello, 1998, for a detailed analysis of the Italian case). On the other hand, globalization may create new opportunities for the district, both in terms of cost reduction through foreign production in low wage countries and in terms of access to new markets (Frankel and Kahler, 1993). For instance, Amin (1994) argues that in the global economy a successful industrial district could evolve into a central focus of knowledge within an internationally structured industry, as the Italian leather tanning in Santa Croce sull'Arno.

Our analysis pursues Amin's insight and studies a MID that is the centre of knowledge creation in a sector supplying an international market. By focusing on market-seeking rather than cost-reducing location choices, we argue that, by the very nature of the MID, the equilibrium distribution of firms inside and outside the district is bound to be inefficient from the point of view of the district as a whole. However, before proceeding any further, it is necessary to clarify what we mean by MID.

In principle, a MID is "an organization of the production process based on single specialized industries, carried out by concentrations made up of many small firms of similar character in particular localities achieving the advantages of large-scale production by external rather than internal economies, with social environments that feature local communities of people adhering to relatively homogeneous systems of values, and with networks of merging urban and rural settlements inside territories united by production and social links" (Sforzi, 1990). While this definition points to all the socio-economic subtleties of a MID, it would be futile to aim at presenting an integrated model capturing all its distinctive features (Soubeyran and Thisse, 1999). Therefore we adopt here a streamlined approach and, for the purposes of the present analysis, we define a MID as *a location that hosts a large number of small firms which produce similar goods for export and take advantage of the localized accumulation of skills embodied in the resident labor force* (Bellandi, 1989).

From this narrower perspective, a MID is essentially an agglomeration where several external effects are at work (Fujita and Thisse, 1996). First of all, there are *technological externalities* stemming from a collective process of learning-by-doing fed by local interactions in the form of "informal discussions among workers in each firm, interfirm mobility of skilled workers, the exchange of ideas within families and clubs, and bandwagon effects" (Souberayn and Thisse, 1999). Secondarily, there are *pecuniary externalities* due to demand ('backward') and cost ('forward') linkages between firms that arise from imperfect competition in the presence of trade costs and increasing returns to scale at plant level (Fujita, Krugman and Venables, 1999). It is precisely the presence of all such externalities that makes a priori unlikely that individually rational decisions by firms will map into collectively optimal outcomes for the district.

Because the focus of the paper is not the origin of the district but rather the decisions it faces in a global economy, we restrict our attention to a simple spatial economy in which a MID has already emerged as a center of innovation, and we model it as an *endogenously growing locale characterized by both technological and pecuniary externalities.* In so doing, we build on the insights of one-sector growth models with local learning-by-doing (Bertola, 1993; Soubeyran and Thisse, 1999) as well as multi-sector growth models with localized product innovation (Walz, 1996; Martin and Ottaviano, 1999). In particular, we depict growth as the result of research and development (R&D) efforts carried out by profit-seeking labs that are located in the district and benefit from localized learning externalities (Romer, 1990; Grossman and Helpman, 1991). Since, in principle, our model may describe any stylized endogenously growing locale, its contribution to the study of industrial districts should be evaluated as a novel application of recent insights from endogenous growth and location theory.

R&D is modeled as the perfectly competitive supply of new blueprints and it is characterized by external economies of scale that arise from *collective learning* by the workforce of the MID: "Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas" (Marshall, 1920; p. 271).

According to Lucas (1993), while collective learning "takes place in schools, in research organizations, and in the course of producing goods and engaging in trade[, l]ittle is known about the relative importance of these different modes of accumulation" (p. 270). We choose to focus on a particular mode and assume that, at any instant in time, the productivity of each R&D lab is an increasing function of the stock of blueprints that not only have been invented but are also currently implemented inside the district. This assumption is aimed at capturing the local positive feedback from plants to labs that characterize much of localized innovation processes (Martin and Ottaviano, 1999). While such feedback might not be crucial in certain high-tech clusters (see, e.g., Irwin and Klenow, 1994, for the semiconductor industry), our choice is motivated by more general empirical evidence (Adams and Jaffe, 1994 and 1996; Love and Roper, 1999) and by the fact that the potential loss of that feedback is the top concern of those who fear delocation from more traditional MIDs (Conti and Menghinello, 1998).

By acquiring the corresponding copyrights, new firms are able to use the blueprints to produce new goods, either in the district or in a foreign location. Thus, while in the former instance foreign customers are supplied by exportation, in the latter they are served by local production. To give economic substance to national borders, firms are assumed to face barriers to both international trade and foreign location, so that foreign sales incur additional costs with respect to home sales.

All this leads to an analytical framework whose basic structure is closely related to static models of the so-called 'new economic geography' (Fujita, Krugman and Venables, 1999), and especially recent models of endogenous regional growth (Walz, 1996; Martin and Ottaviano, 1999). It departs from the former by stressing the effects that the location of production has on the pace of innovation. It also supplements the latter under three main respects by allowing for different regional sizes, barriers to foreign location, and explicit welfare analysis. The framework is shown to generate the following results. First, as it is intuitive, at the market equilibrium high trade (foreign location) barriers discourage exports (foreign location) and encourage foreign location (exports). Second, firms' choices are generally suboptimal. In particular, we show that, from the point of view of the district, delocation is always welfare reducing. This happens because, in the attempt to circumvent the obstacles to goods and foreign location, firms overlook the aggregate impact of their decisions on local innovation activities and consumer surplus. On the contrary, from the point of view of distant consumers, firms delocation may be too little when trade barriers are high.

The remainder of the paper is organized in four parts. The first presents the model. The second finds the market equilibrium. The third discusses its welfare properties. The fourth concludes.

2 The model

We consider an economy made of two regions. In one of them, an already existing district is the innovation center of a horizontally differentiated sector. Firms in this sector may supply both local and far markets. However, due to distance, the former are much easier to reach than the latter, so that the costs of accessing the former can be considered negligible relatively to the costs of accessing the latter. Thus, each firm has a local market that can be reached costlessly and a distant market which can be reached only by spending additional resources. The economy can be partitioned accordingly in two locations: the district together with its local market (henceforth labeled simply 'the MID') and its distant market (henceforth labeled 'the rest of the world').

Variables pertaining to the district bear no label, while those belonging to the rest of the world are labeled by *. There are two factors of production. The first is labor, whose total endowment $\overline{L}$ is given and distributed between locations so that, at time t, a fraction $L(t) = \lambda(t)\overline{L}$ of workers reside in the district with $\lambda(t) \in (0, 1)$. Workers are geographically immobile and are employed in the production of two final goods: a homogenous good Y and a composite good D consisting of $N(t)$ horizontally differentiated varieties, $n(t)$ of which are produced in the MID. The second factor is knowledge capital and it is accumulated by an innovation sector I. Knowledge is embodied in blueprints, which are necessary to produce the different varieties of good D and are protected by infinitely lived patents. $\overline{K}(t)$ denotes the total endowment of knowledge capital available at time t, with a fraction $K(t)$ belonging to the district.

Since the specification of the model is largely symmetric in most of its crucial features, we concentrate on the description of the MID. Corresponding expressions for the rest of the world can be derived by symmetry. Preferences are instantaneously Cobb-Douglas and intertemporally CES with unit elasticity of intertemporal substitution:

$$U = \int_0^\infty \ln \left[D(t)^\alpha Y(t)^{1-\alpha} \right] e^{-\rho t} dt \tag{1}$$

where $Y(t)$ is the consumption flow of the homogeneous good at time t, $\rho > 0$ is the rate of time preference, and $\alpha \in (0, 1)$ is the share of expenditures devoted to the consumption flow of the composite good $D(t)$. Following Dixit and Stiglitz (1977), this good consists of a number of different varieties:

$$D(t) = \left[\int_0^{N(t)} c(s,t)^{1-1/\sigma} ds \right]^{1/(1-1/\sigma)}$$

where $c(s,t)$ is the consumption of variety s at instant t, $N(t)$ is the total mass of varieties (blueprints) available in the economy at t, and, as we will see, $\sigma > 1$ is the elasticity of substitution between varieties as well as the own-price elasticity of demand for each variety. As in Romer (1990) and in Grossman and Helpman (1991) growth will come from an endogenous increase in the number of available varieties of good D as measured by $N(t)$.

As to the supply side, the homogenous good Y is produced using labor with constant returns to scale in a perfectly competitive sector and it is freely traded between locations. Without loss of generality, the unit input requirement is set to 1 for convenience. In order to focus on market-seeking rather than cost-saving foreign location, it is assumed that the demand of this good in the whole economy is large enough that it cannot be satisfied by production in one place only.[2] This hypothesis ensures that in equilibrium the homogenous good Y will be produced everywhere. Thus, because of free trade it will have the same price everywhere and it will prove convenient to choose it as numeraire: $p_Y(t) = 1$ for every t.

The differentiated varieties of good D are produced in a monopolistically competitive sector. More precisely, the supply of each variety requires the use of the corresponding blueprint for any scale of production and β units of labor for each unit of output. Should the same variety be produced by different plants, even if operated by one firm, the royalty of the corresponding blueprint would have to be paid for each single plant. Consequently, production exhibits increasing returns to scale at plant level and this ensures an one-to-one equilibrium relationship between firms, plants, blueprints and varieties and we will use the four terms (blueprint, variety, firm, and plant) interchangeably.[3] Differently from the homogeneous good Y, trade in the differentiated varieties is costly due to administrative barriers or sheer distance. Following Samuelson (1954) trade costs are modelled as *iceberg* frictions: $\tau \geq 1$ units have to be shipped for a unit delivery of any variety to the foreign market. Therefore, only a fraction of the shipped quantity is actually consumed. A value of $\tau = 1$ represents free trade, while in the limit, as $\tau \to \infty$, trade is inhibited.

R&D is carried out by perfectly competitive labs that benefit from local technological spillovers. In modeling such spillovers, we follow Adams and Jaffe (1996), whose empirical investigation supports the idea that new knowledge derives not only from formal research by labs, but also from learning by doing as well as informal 'research' activities performed at the production plant level. In particular, local knowledge creation in a certain sector tend to benefit disproportionately both from the existing local stock of knowledge and from the number of local production plants (Adams and Jaffe, 1994), which is also consistent with the networking effects found by Love and Roper (1999). We capture this idea by assuming that at any time t labor productivity in sector I is an increasing function of $K(t)$, $K^*(t)$, $n(t)$, and $n^*(t)$, that, while increasing in all arguments, gives more weight to $K(t)$ and $n(t)$. Specifically, to sharpen the analysis we prefer to adopt an extreme formulation and assume that the productivity of researchers in a certain location is an increasing function of local knowledge and local plants only, i.e. technological spillovers are purely local in scope. The specific functional form for the unit input coefficient at time t is chosen to be $\eta/\min[K(t), n(t)]$ and $\eta/\min[K^*(t), n^*(t)]$ depending on whether R&D is performed inside or outside the MID respectively. This functional form is chosen for analytical convenience because, as we will see, it ensures that in steady state the economy achieves a costant rate of endogenous balanced growth (Grossman and Helpman, 1991). Finally, since we are not interested in the origin of the MID but rather in its behavior as an already established innovation center, it is natural to assume that all knowledge that exists initially has been created in the district, $\overline{K}(0) = K(0)$. Together with the chosen functional form, this implies that R&D is infinitely costly, and thus will never be undertaken, outside the MID, which remains the only source of innovation: $\overline{K}(t) = K(t)$ for every t.

After invention, knowledge capital can be employed for production in sector D either in the district or abroad. The latter option, however, is more costly in that foreign production requires additional knowledge capital with respect to domestic production (Teece, 1977). Such an additional requirement may be due to the costs of transfering tacit knowledge or alien business practices to foreign workers; costs that are often exacerbated by cultural and linguistic differences. It may also be due to more artificial costs, such as those needed to comply with local quality and safety standards as well as idiosyncratic laws and bureaucratic procedures. Specifically, we choose units of knowledge capital so that the knowledge content of a blueprint equals 1 if it is designed for production in the MID, and $1/\phi$, with $\phi \in [0, 1]$, if it is designed for production abroad. Then, ϕ becomes an inverse index of *foreign location costs*, which equals zero when such costs are prohibitive and one when they are immaterial. Thus, in general, the total number of blueprints

$N(t)$ and the total endowment of knowledge capital $K(t)$ do not coincide. To see this, call $\gamma(t) \in [0,1]$ the share of $K(t)$ embodied in the blueprints used in the MID. Since $n(t) = \gamma(t)K(t)$ but $n^*(t) = \phi(1-\gamma(t))K(t)$, we have $N(t) = [\gamma(t) + \phi(1-\gamma(t))]K(t)$.

Finally, to close the model we have to specify the institution that governs the intertemporal allocation of resources. We assume that there is a *financial market* where a safe bond is traded and bears an interest rate $r(t)$ in units of the numeraire. This market is where investment in R&D is financed and it is global in the sense that it is freely accessible by all consumers no matter where they reside. Consequently $r(t)$ is the economy-wide interest rate.

3 The market equilibrium

In this section we study how the spatial distributions of innovation and production are jointly determined by the market mechanism. The aim is to investigate the implications of plant delocation on the role of the MID as an innovation center in an increasingly integrated economy with falling costs of trade (lower τ) and of foreign location (larger ϕ). Section 4 will discuss the welfare properties of the market outcome.

A. Consumption

A typical MID resident maximizes (1) with respect to $c(s,t)$ and $Y(t)$ under the intertemporal budget constraint:

$$\dot{A}(t) = r(t)A(t) + w(t) - E(t) \tag{2}$$

where $A(t)$ is individual holdings of the safe bond at time t, $\dot{A}(t) \equiv dA(t)/dt$ is their variation, $w(t)$ is the wage rate, and $E(t)$ is individual expenditures:

$$E(t) = \int_0^{N(t)} p(s,t)c(s,t)ds + p_Y(t)Y(t) \tag{3}$$

with $p_Y(t)$ representing the price of good Y and $p(s,t)$ the price of variety s at instant t.[4]

The solution of the maximization problem yields a time path of expenditures that obeys the Euler equation of a standard Ramsey problem. Given unit intertemporal elasticity of substitution, we have:

$$\widehat{E}(t) = \widehat{E}^*(t) = r - \rho \tag{4}$$

where $\widehat{E}(t) \equiv \dot{E}(t)/E(t)$ and $\dot{E}(t) \equiv dE(t)/dt$. Condition (4) establishes that, along a utility-maximizing path, the rate of change of individual expenditures is equal to the difference between the economy-wide interest rate and the rate of time preference. This implies that the presence of a global financial market makes expenditures change at the same rate in both locations.

Utility maximization also yields demand functions for each variety with constant elasticity σ of both demand and substitution. In particular, given that $\lambda\overline{L}$ consumers reside in the district, the MID demands for home- and foreign-produced varieties are respectively:

$$c(i,t) = \frac{p(i,t)^{-\sigma}}{P(t)^{1-\sigma}}\alpha E(t)\lambda\overline{L}, \quad i \in [0, n(t)] \tag{5}$$

$$c(j,t) = \frac{q(j,t)^{-\sigma}}{P(t)^{1-\sigma}}\alpha E(t)\lambda\overline{L}, \quad j \in (n(t), N(t)] \tag{6}$$

where $P(t)$ is the price index of the composite good $D(t)$:

$$P(t) \equiv \left[\int_0^{N(t)} p(s,t)^{1-\sigma} ds\right]^{1/(1-\sigma)} = \left[\int_0^{n(t)} p(i,t)di + \int_{n(t)}^{N(t)} q(j,t)dj\right]^{1/(1-\sigma)} \tag{7}$$

with $p(i,t)$ representing the price of the i-th out of $n(t)$ varieties produced in the district and $q(j,t)$ the price of the j-th out of $n^*(t)$ varieties produced abroad. Symmetric expressions hold for the rest of the world. Having solved the intertemporal consumption problem, to simplify notation, from now on we will drop the explicit time dependence of variables when this does not generate confusion.

B. Production

Given perfect competition, profit maximization by firms in sector Y requires the price to be set at marginal cost, $p_Y = w$. Due to free trade in Y and our choice of numeraire, that leads wages to be equalized at unity in the two locations, $w = w^* = p_Y = 1$.

As to good D, the supply of each variety requires the use of the corresponding blueprint for any scale of production and β units of labor for each unit of output. A firm that implements a blueprint inside the MID maximizes profits:

$$\Pi = pc + q^*c^* - \beta[c + \tau c^*] - R \tag{8}$$

where R is the rental rate of knowledge capital, p and c are the delivered price and quantity in the district, while q^* and c^* are the delivered price and quantity in the rest of the world. Notice that, in order to gain revenues q^*c^* on foreign sales, the firm has to produce $\tau c^* > c^*$, because the fraction $(\tau - 1)c^*$ is lost in transit due to iceberg trade costs. Analogously, a firm that implements a blueprint outside the MID maximizes profits:

$$\Pi^* = p^*\widetilde{c}^* + q\widetilde{c} - \beta[\widetilde{c}^* + \tau\widetilde{c}] - R^*/\phi \tag{9}$$

where R^* is the rental rate of knowledge capital abroad, p^* and $\widetilde{c}^*$ are the delivered price and quantity outside the district, while q and $\widetilde{c}$ are the delivered price and quantity in the MID. The term $1/\phi$ is the amount of knowledge capital that is needed to design a blueprint for the foreign market.

Given isoelastic demands and wage equalization across locations, maximization of (8) and (9) by monopolistically competitive firms leads to producer prices (*mill prices*) that are the same for all varieties independently from the places of production and sale: $p = p^* = \beta\sigma/(\sigma - 1)$. This entails that consumers pay different prices (*delivered prices*) on varieties supplied by firms in different places. In particular, they pay a lower price $p = p^* = \beta\sigma/(\sigma - 1)$ for locally produced varieties and, due to trade costs, a higher price $q = q^* = \tau\beta\sigma/(\sigma - 1)$ for imported varieties. Accordingly, all varieties produced in the MID generate the same operating profits equal to:

$$\pi = px - \beta x = \frac{\beta x}{\sigma - 1} \tag{10}$$

where $x = c + \tau c^*$ is the scale of output. Analogously, all firms located outside the district generate identical operating profits equal to:

$$\pi^* = px^* - \beta x^* = \frac{\beta x^*}{\sigma - 1} \tag{11}$$

where $x^* = \widetilde{c}^* + \tau\widetilde{c}$ is the scale of output.

Finally, due to free entry and exit in sector D, all operating profits are absorbed by the rental rates of knowledge capital: $R = \pi$ and $R^*/\phi = \pi^*$.

This is explained by the fact that a firm can enter the market only if it acquires the exclusive right of exploiting a blueprint. With free entry a large number of potential entrants bid competitively for the existing blueprints so that, in equilibrium, knowledge capital owners end up extracting all operating profits from successful entrants.

C. Innovation

Research labs finance their activity in the bond market where r represents their borrowing rate of interest. They are willing to engage in R&D in so far as the value of a unit of new knowledge capital covers the wage bill of the researchers that are needed to create it.

Specifically, let v be the value ('price') of a unit of K embodied in a blueprint used in the MID, i.e. the present value of its rental rates R discounted at the interest rate r:

$$v(t) = \int_t^{\infty} R(s) e^{-[r(s)-r(t)]} ds \tag{12}$$

Then, differentiating (12) with respect to t and leaving the time dependence of variables implicit, we obtain the condition of no-arbitrage-opportunity between investing in R&D and borrowing at the safe rate r:

$$r = \frac{\dot{v}}{v} + \frac{R}{v} \tag{13}$$

which requires an investment to yield the same instantaneous return in terms of bonds (rv) and blueprints (the 'capital gain/loss' $\dot{v}$ plus the 'dividend' R). A similar condition must hold for the value v^* of a unit of K embodied in a blueprint used abroad:

$$r = \frac{\dot{v}^*}{v^*} + \frac{R^*}{v^*} \tag{14}$$

Because of perfect competition in sector I, each unit of knowledge capital is priced at marginal cost, that is, the marginal cost of a unit of knowledge capital is just covered by the discounted flow of its rental rates. Since $w = 1$ and $K \geq \gamma K = n$, this implies that the value of a unit of K must be equal to $\eta / \min[K, n] = \eta/(\gamma K)$. Consequently, if some blueprints are designed for production in the MID while others for production in the rest of the world, it must be $v = v^* = \eta / \min[K, n] = \eta/(\gamma K)$. Differently, if production takes place only in the district or abroad, it must be $v = \eta/(\gamma K)$ or $v^* = \eta/(\gamma K)$ respectively.

D. Market Clearing

To close the model we need to impose clearing conditions on the markets for labor and good D. As to the former, the economy-wide endowment $\overline{L}$ is demanded by sectors I, Y, and D. In the MID innovation demands an amount of labor equal to its unit input coefficient $\eta/(\gamma K)$ times output $\dot{K}$, i.e. $\eta\dot{K}/K$. Sector Y demands one unit of labor for each unit of output, whose value matches a share $1-\alpha$ of economy-wide expenditures so that overall Y-sector demand is $\overline{L}_Y = (1-\alpha)[\lambda E + (1-\lambda)E^*]\overline{L}$. Finally, sector D demands $n\beta x$ units of labor in the MID and $n^*\beta x^*$ units abroad. The value of the combined output at mill prices matches a share α of economy-wide expenditures, $p(nx + n^*x^*) = \alpha[\lambda E + (1-\lambda)E^*]\overline{L}$. Given $p = \beta\sigma/(\sigma-1)$, this implies that in the D-sector labor demand is $\overline{L}_D = n\beta x + n^*\beta x^* = [(\sigma-1)/\sigma]\alpha[\lambda E + (1-\lambda)E^*]\overline{L}$ so that economy-wide labor market clearing, $\overline{L} = \overline{L}_I + \overline{L}_Y + \overline{L}_D$, can be written as:

$$\overline{L} = \frac{\eta}{\gamma}\frac{\dot{K}}{K} + \frac{\sigma-\alpha}{\sigma}[\lambda E + (1-\lambda)E^*]\overline{L} \tag{15}$$

As to good D, for its market to clear, the supply of each variety has to be equal to its demand (inclusive of trade costs) from consumers in both regions. Plugging equilibrium prices, $n = \gamma K$ as well as $n^* = \phi(1-\gamma)K$ into (5) and (6), we get:

$$x = \frac{\alpha(\sigma-1)}{\beta\sigma}\frac{\overline{L}}{K}\left[\frac{\lambda E}{\gamma + \delta\phi(1-\gamma)} + \frac{\delta(1-\lambda)E^*}{\delta\gamma + \phi(1-\gamma)}\right] \tag{16}$$

$$x^* = \frac{\alpha(\sigma-1)}{\beta\sigma}\frac{\overline{L}}{K}\left[\frac{\delta\lambda E}{\gamma + \delta\phi(1-\gamma)} + \frac{(1-\lambda)E^*}{\delta\gamma + \phi(1-\gamma)}\right] \tag{17}$$

where $\delta \equiv \tau^{1-\sigma}$ is a measure of the freeness of trade ranging between 0 in autarky and 1 with free trade.

There can be three alternative scenarios. In the first, there are both local and foreign plants, i.e. $\gamma \in (0,1)$. In this case, as discussed above, we have $v = v^*$, which by (13) and (14) implies $R = R^*$ and thus $\pi = \phi\pi^*$ or, using (10) and (11), $x = \phi x^*$, which states that in equilibrium foreign plants need to operate on a larger scale to generate enough operating profits to cover their higher fixed costs. This equilibrium condition allows us to solve (16) and (17) for γ and x:

$$\gamma = \phi \frac{(1-\delta\phi)\lambda E - \delta(\phi-\delta)(1-\lambda)E^*}{(1-\delta\phi)(\phi-\delta)[\lambda E + (1-\lambda)E^*]} \tag{18}$$

$$x = \frac{\alpha(\sigma-1)}{\beta\sigma}\frac{\overline{L}}{K}[\lambda E + (1-\lambda)E^*] \tag{19}$$

where γ is bounded between 0 and 1 if and only if:

$$\delta\frac{\phi-\delta}{1-\delta\phi} < \frac{\lambda E}{(1-\lambda)E^*} < \frac{1}{\delta}\frac{\phi-\delta}{1-\delta\phi} \tag{20}$$

In the second scenario, all plants are concentrated in the district, i.e. $\gamma = 1$. For this outcome to be sustainable as an equilibrium, we need to have $R > R^*$ i.e. $\pi > \phi\pi^*$, which is the case if $\lambda E/(1-\lambda)E^* > (\phi-\delta)/[\delta(1-\delta\phi)]$. This inequality is likely to be satisfied whenever the cost of foreign location is large with respect to trade costs (ϕ is small when compared with δ) and the district has a relatively large local market (λE is large when compared with $(1-\lambda)E^*$). Notice, however, that $\phi < \delta$ implies $\gamma = 1$ independently of the spatial distribution of expenditures: the costs of foreign location are so high relative to the costs of trade that it is always better to supply foreign customers through exports. To avoid this extreme result, from now on we assume $\phi > \delta$.

Finally, in the third scenario, all plants are located abroad, i.e. $\gamma = 0$. In this case no innovation can take place due to prohibitive costs, so that the district specializes in the production of the homogeneous good. For this to be the case, $\lambda E/(1-\lambda)E^* < \delta(\phi - \delta)/(1 - \delta\phi)$ has to hold, which depicts this scenario as the mirror image of the previous one. Indeed, the foregoing inequality is likely to hold if the cost of foreign location is small with respect to trade costs (ϕ is large when compared with δ) and if the district has a relatively negligible local market (λE is small when compared with $(1-\lambda)E^*$).

Condition (18) illustrates the 'forward linkage' at work in our model, implying that, ceteris paribus, the geographic concentration of production plants in the MID is increasing in the relative size of the local market. It also shows that, as it is intuitive, ceteris paribus an increase in foreign location barriers reduces the relative number of foreign plants ($\partial\gamma/\partial\phi < 0$). Less intuitive a priori is the impact of trade costs changes. Lower trade barriers increase the share of foreign plants ($\partial\gamma/\partial\delta < 0$) as far as $\lambda E/(1-\lambda)E^* < (\phi-$

$\delta)^2/(1-\delta\phi)^2$, which belongs to the acceptable interval (20). Therefore, freer trade incentivates foreign location against exportation, if foreign location costs are small relatively to trade costs (ϕ is large with respect to δ) as well as if the MID has a relatively negligible local market (λE is small with respect to $(1-\lambda)E^*$). The reason why is the so-called *home-market effect* (Helpman and Krugman, 1985) by which plants are (more than proportionately) attracted by the larger market and the more so the lower the trade costs. Therefore, absent foreign location costs, when the home market is the smaller one, lower trade costs make it more convenient for firms to locate in the larger foreign market and supply home consumers via reimports (since $(\phi-\delta)^2/(1-\delta\phi)^2 = 1$ for $\phi = 1$). On the contrary, when the home market is the larger one, lower trade costs incentivate firms to place their plants in the MID and to supply foreigners by exports. On top of that, the presence of foreign location costs biases the result against the foreign plants option (since $(\phi-\delta)^2/(1-\delta\phi)^2 < 1$ for $\phi < 1$). Lastly, condition (19) shows that the profitability of firms is unaffected by the geographical distribution of their plants.

E. Steady state

The steady state of the model is characterized by constant expenditures, E and E^*, a constant geographic distribution of plants γ, and a constant growth rate of the total number of blueprints $g = \dot{K}/K$.

Because γ is constant in steady state, differencing $v = \eta/(\gamma N)$ yields $\dot{v}/v = -\dot{N}/N = -g$. Because also consumers' expenditures are constant in steady state, the interest rate r is equal to the rate of time preference ρ. Using all these results as well as (19) in (13) and (15), we find respectively:

$$g = \frac{\gamma}{\eta}\frac{\alpha}{\sigma}\overline{L}[\lambda E + (1-\lambda)E^*] - \rho \tag{21}$$

and:

$$\overline{L} = \frac{\eta}{\gamma}g + \frac{\sigma - \alpha}{\sigma}\overline{L}[\lambda E + (1-\lambda)E^*] \tag{22}$$

Equations (21) and (22) can be solved together to express the steady state values of expenditures and the corresponding growth rate as functions of γ only:

$$[\lambda E + (1-\lambda)E^*] = 1 + \frac{\rho\eta}{\overline{L}\gamma} \tag{23}$$

and

$$g = \frac{\alpha\overline{L}}{\sigma}\frac{\gamma}{\eta} - \frac{\sigma - \alpha}{\sigma}\rho \tag{24}$$

where γ has to be no less than $\gamma_L \equiv \rho\eta(\sigma - \alpha)/(\alpha\overline{L})$ for growth to be non-negative. Thus, we need to impose $1 \geq \rho\eta(\sigma - \alpha)/(\alpha\overline{L})$ for growth to take place at all in steady state. Equation (24) illustrates the positive externality at work in the model between production and innovation. An increase in the concentration of plants in the district decreases the cost of innovation (because of local spillovers) pushing new labs to enter the innovation sector until profits in that sector are back to zero. This in turn increases the rate of innovation.

In (23) the first term on the right hand side is wage income, while the second is the value of the initial per capita stock of blueprints, which appears there since the operating profits accruing to the initial stock of blueprints are pure rents. Because this stock is exclusively owned by people in the district, we have that MID expenditures are:

$$\lambda E = \lambda + \rho\eta/(\overline{L}\gamma) \tag{25}$$

while those in the rest of the world are:

$$(1-\lambda)E^* = (1-\lambda) \tag{26}$$

We are now ready to determine the steady state location of plants. It is enough to substitute the equilibrium values of expenditures (25) and (26) into (18). This gives rise to a second order equation in γ which admits only one positive solution:

$$\gamma_M \equiv \frac{-b + \sqrt{b^2 + 4a(1-\delta\phi)\rho\eta}}{2a} \tag{27}$$

where $a \equiv (1-\delta\phi)(\phi-\delta)\overline{L}$ and $b \equiv \{(1-\delta\phi)(\phi-\delta)\rho\eta - [(1-\delta\phi)\lambda - \delta(\phi-\delta)(1-\lambda)]\phi\overline{L}\}$. Expression (27) identifies an interior steady state $\gamma_M \in (\gamma_{\overline{L}}, 1)$ if the share of people living in the district is neither too small nor too large. That is, by plugging equilibrium expenditures into (20), if:

$$\delta\frac{\phi-\delta}{1-\delta^2} - \frac{\rho\eta}{\overline{L}}\frac{1-\delta\phi}{1-\delta^2} < \lambda < \frac{1}{\phi}\frac{\phi-\delta}{1-\delta^2} - \frac{\alpha}{\sigma-\alpha}\frac{\delta(1-\delta\phi)}{\phi(1-\delta^2)} \tag{28}$$

so that, when λ is too small to satisfy (28), no innovation takes place in steady state. This implies that a district with a small local market runs the risk of dying as a center of innovation when its firms can choose to locate close to its large distant market. In this case, *the pursuit of higher profits by existing firms through foreign location destroys the spillover than sustains the development of new products.*

When discussing equation (18), we have seen that for given E and E^* changes in ϕ generate changes of opposite sign in γ_M. The same holds true for changes in δ in so far as expenditures are not too large in the MID relative to the rest of the world. These insights can be used to assess the comparative statics properties of steady state location (27). Consider for example what happens when foreign location costs falls (larger ϕ). For given expenditures, equation (18) reveals that the impact is a decrease in the number of firms located in the district (lower γ_M). By (25) this has no effect on foreign expenditures E^*, while it triggers an increase in MID expenditures E. The reason is that lower γ reduces the strength of the spillover and thus the productivity of investment in R&D. As a result, MID residents prefer to consume more than before. By (18) this effect would attract additional firms to the MID but it is not strong enough to offset the adverse effect of falling ϕ.[5]

Thus, since changes in ϕ induce changes of opposite sign in γ_M, falling costs of foreign location always cause a reduction in the number of firms located in the district. This increases expenditures and therefore by (24) triggers a slowdown of the speed of innovation. The same happens for lower trade costs (larger δ), as far as the MID domestic market is not large enough ($\lambda E/(1-\lambda)E^* < (\phi-\delta)^2/(1-\delta\phi)^2$). A sufficient condition is:

$$\lambda < \frac{(\phi-\delta)^2}{(1-\delta^2)(1-\phi^2)} - \frac{\alpha}{\sigma-\alpha}\frac{(1-\delta\phi)^2}{(1-\delta^2)(1-\phi^2)}$$

Finally, we need to comment on the effects of changes in the rate of time preference ρ and the cost parameter of innovation η. They are both directly related to the equilibrium value of the initial stock of knowledge, whose value is lower the smaller the sacrifice perceived in postponing consumption (smaller ρ) and the lower the cost of creating new knowledge (smaller η). Then, since the initial stock of knowledge belongs to the MID, a fall in either parameter reduces the difference in expenditures between the two locations and therefore by (18) decreases the share of plants that the district hosts.

4 Welfare analysis

There are a number of reasons why we should expect the market outcome to be inefficient for the MID as a whole. They stem from the many distortions at work in the model. Following Grossman and Helpman (1991) such distortions can be classified in two main groups depending on whether they are essentially static or dynamic in nature. Static distortions affect the intersectoral allocation of a given amount of labor available for production at a particular instant in time when the number of varieties is also given. Dynamic distortions affect the allocation of all labor between production and innovation.

Static distortions originate from the fact that in sector D monopolistically competitive firms set prices above marginal cost so that there is too much consumption of Y relative to D. As to dynamic distorsions, three other market failures exist in this economy. First, revenues from introducing an additional variety do not capture the corresponding positive effect on consumer surplus in terms of enhanced product diversity (*consumer-surplus effect*). Second, the profit of an additional variety does not correspond to the net change in total profits for the economy as a whole in that the decision of a firm to produce a new variety disregards the adverse effect on the profits of other firms (*profit-destruction effect*). It is a special property of CES preferences that these two pecuniary externalities exactly offset one another (Dixit and Stiglitz, 1977). This leaves the entire scene to the third market failure, which arises from the fact that past innovation as a whole has a positive spillover on the productivity of current and future R&D while any single innovator is too small to have an effect (*intertemporal-spillover effect*). Grossman and Helpman (1991) show that, in the presence of such a positive technological externality, the market allocates an inefficiently small amount of labor to innovation and an inefficiently large amount to production.

While the results in Dixit and Stiglitz (1977) as well as those in Grossman and Helpman (1991) are relevant to our analysis, our model exhibits additional complexity that derives from its spatial dimension. Indeed, in our framework the location of firms affects all three effects discussed above, and thus the associated deadweight losses. It is this new dimension that we want to explore. Specifically, holding those three distortions in place, we ask whether the market outcome γ_M entails too many or too few foreign plants from the point of view of both the MID and the rest of the world.

As to the MID, our welfare measure is the indirect utility of a representative resident. Since the model exhibits no transitionary dynamics, utility is evaluated at steady state. This can be achieved by substituting the equilibrium prices as well as the steady-state expenditures and growth rate in the utility function (1). The resulting integral can be calculated as:

$$V(\gamma) = \frac{1}{\rho} \ln \left\{ \alpha^{\alpha} (1-\alpha)^{1-\alpha} \frac{E}{P_0^{\alpha}} \right\} + \frac{\alpha g}{\rho^2 (\sigma - 1)} \tag{29}$$

where, on the right hand side, the first term is the present value of a constant stream of utility, which, due to consumption smoothing, is equal to the initial instantaneous utility level and is discounted at rate ρ. The second term is the utility gain stemming from the increasing number of varieties of good D, which grow at the constant rate g determined in (24). In particular, E is per capita expenditures (25), P_0 is the value at time 0 of the price index (7), which is equal to:

$$P_0 = \frac{\beta\sigma}{\sigma - 1} N_0^{\frac{1}{1-\sigma}} \left[\gamma + \delta\phi(1-\gamma)\right]^{\frac{1}{1-\sigma}}$$

after substituting for equilibrium prices.

Expression (29) thus evaluates to:

$$V(\gamma) = \frac{1}{\rho}\ln\left(1+\frac{\rho\eta}{\gamma\lambda\overline{L}}\right)+\frac{\alpha}{\rho(\sigma-1)}\ln\left[\gamma+\delta\phi(1-\gamma)\right]+\frac{\alpha^2\overline{L}}{\rho^2\eta\sigma(\sigma-1)}\gamma+\text{constant} \tag{30}$$

and, by differentiating (29) with respect to γ, we obtain:

$$\frac{\partial V(\gamma)}{\partial\gamma} = \frac{\alpha^2\overline{L}}{\rho^2\eta\sigma(\sigma-1)} - \frac{1}{\gamma}\frac{\eta}{\gamma\lambda\overline{L}+\rho\eta} + \frac{\alpha}{\rho(\sigma-1)}\frac{1-\delta\phi}{\gamma+\delta\phi(1-\gamma)} \tag{31}$$

The first term on the right hand side of (31) measures the positive impact of a larger γ on MID welfare through an increase in the growth rate due to the R&D spillover (*intertemporal-spillover effect*). The second term measures the negative impact through a reduction in permanent income due to cheaper R&D that cuts into the value of the initial stock of blueprints owned by MID residents (*profit-destruction effect*). Lastly, the third term measures the positive impact through a reduction of the exact price index due to a lower trade cost bill as more varieties are produced locally (*consumer-surplus effect*).

It can be readily verified that the expression made of the first two terms in (31) together is positive at $\gamma = \gamma_{\overline{L}}$ and always increasing from there up to $\gamma = 1$. Since the third term is also always positive, $V(\gamma)$ is then maximized at $\gamma = 1$. Thus, we have reached a first welfare conclusion: *from the point of* *view of the district, foreign location is always welfare reducing.* Such a stark results is driven by the dominating role of the intertemporal-spillover effect over the profit-destruction effect.

As to the rest of the world, the expressions corresponding to (30) and (31) are:

$$V^*(\gamma) = \frac{\alpha}{\rho(\sigma-1)} \ln\left[\delta\gamma + \phi(1-\gamma)\right] + \frac{\alpha^2\overline{L}}{\rho^2\eta\sigma(\sigma-1)}\gamma + \text{constant} \tag{32}$$

and

$$\frac{\partial V^*}{\partial \gamma} = \frac{\alpha^2\overline{L}}{\rho^2\eta\sigma(\sigma-1)} - \frac{\alpha}{\rho(\sigma-1)}\frac{\phi-\delta}{\delta\gamma+\phi(1-\gamma)} \tag{33}$$

where the profit-destruction effect term is absent because foreign residents have no property rights on the initial stock of blueprints. Notice that in (33) the consumer-surplus effect has a negative sign since the price index in the rest of the world increases as more firms locate in the district.

From (33) it is readily seen that the negative consumer-surplus effect makes welfare in the rest of the world a concave function of γ. In particular, (32) reaches a maximum at $\gamma = \gamma_{ROW}$ with:

$$\gamma_{ROW} \equiv \frac{\alpha\phi\overline{L} - \rho\eta\sigma(\phi-\delta)}{\alpha\overline{L}(\phi-\delta)} = \frac{\phi}{\phi-\delta} - \frac{\rho\eta\sigma}{\alpha\overline{L}}$$

which falls in the relevant range $[\gamma_L, 1]$ as far as trade costs are not extreme, namely as long as

$$\delta \in \left[\phi\{1-\alpha\overline{L}/[\rho\eta(2\sigma-\alpha)]\}, \phi\rho\eta\sigma/(\alpha\overline{L}+\rho\eta\sigma)\right]$$

Thus, we have reached a second welfare conclusion: *also from the point of view of the rest of the world, delocation from the district is welfare reducing, when the costs of foreign location are large with respect to trade costs.* In this case, the welfare gain from faster growth dominates the loss due to costly imports.

5 Conclusion

Many external effects are inherent to the very nature of a MID and, thus, individually rational decisions by its firms are unlikely to map into collectively efficient outcomes for the district as a whole.

We have analyzed one particular choice that becomes crucial as firms created in the MID face an economic environment where goods and factors are increasingly mobile. It is the choice between exports and foreign location as a means to penetrate distant markets. We have pointed out that individually rational profit-seeking behavior by firms neglects relevant external effects that influence the collective well-being of the district. In particular, due to local technological spillovers from plants to R&D labs, their choice to locate production facilities abroad slows down the pace of innovation. As a result, from the point of view of the MID, the market outcome overprovides foreign plants and underprovides exports. This is true also from the point of view of the rest of the world as long as the costs of foreign location are large relative to the costs of trade. This market failure is particularly relevant for MIDs with small local markets, which is consistent with the concerns about the future of traditional Italian districts in a globalized economy that we discussed in the introduction.

While these results show how recent developments in endogenous growth and location theory can be fruitfully applied to the study of industrial districts, they call nonetheless for additional research. First, the result according to which any degree of delocation is always welfare reducing for the district as a whole stems from the assumption of purely localized spillovers and may not hold when labs are able to receive sufficient feedback also from distant plants. Second, since we have modeled an economy where there is only one MID that supplies the world markets, a natural extension would be to investigate the case of competing districts. Third, since our locations are just points, another natural extension would be to add a richer geographic dimension to distinguish between regional and truly international operations. Finally, the introduction of an intermediate sector could be useful to address the implications of the raising trend towards outsourcing.

Endnotes

1. By globalization we mean, in this context, the ongoing reduction of barriers to trade and factor mobility, supposedly leading towards the creation of a unique world market place where the actual locations of demand and supply will be immaterial.

2. This will turn out to be the case in equilibrium if the expenditures share of good Y is large enough, namely if $\alpha < \rho\eta/(1+\rho\eta)$, where η is the cost parameter of innovation that will be introduced below. In what follows this restriction is assumed to hold.

3. To sharpen the analysis, we disregard the case of multiplant scale economies that could give rise to firms that produce both inside and outside the district.

4. From now on we follow the common convention according to which a dot or a hat over a variable label respectively its absolute or percentage rates of change.

5. The proof of this last statement is simply sketched. On the one hand, equations (25) and (26) together can be used to establish a negative relation between $\lambda E/(1-\lambda)E^*$ and γ. On the other, equation (18) defines a positive relation between the same variables. The values of $\lambda E/(1-\lambda)E^*$ and γ that

satisfy both relations are the steady state values. Turning to comparative statics, when ϕ changes only the positive relation (18) is affected so that the steady state is still situated along the same negative relation as before. For concreteness, consider the impact of an increase in ϕ. When ϕ grows, (18) implies a smaller γ for any given $\lambda E/(1-\lambda)E^*$. Therefore, the final result of an increase in ϕ is a new steady state with smaller γ and larger $\lambda E/(1-\lambda)E^*$.

References

[1] Adams, James D. and Adam B. Jaffe. 1994. "The Span of the Effects of R&D in the Firm and Industry," Discussion Paper No. 94-7, Bureau of the Census Center for Economic Studies.

[2] Adams, James D. and Adam B. Jaffe. 1996. "Bounding the Effects of R&D: An Investigation Using Matched Establishment-Firm Data," *Rand Journal of Economics*, 27, 700-721.

[3] Amin, Ash. 1994. "Case study III: Santa Croce in Context or How Industrial Districts Respond to the Restructuring of World Markets," in R. Leonardi and R.Y. Nanetti (eds.), *Regional Development in a Modern European Economy,* London: Pinter.

[4] Bellandi, Marco. 1989. "The Industrial District in Marshall," in E. Goodman and J. Bamford (eds.), *Small Firms and Industrial Districts in Italy*, London: Rootledge, pp. 31-68.

[5] Bertola, Giuseppe. 1993. "Models of Economic Integration and Localised Growth," in F. Torres and F. Giavazzi (eds.), *Adjustment and Growth*

in the European Union, Cambridge: CEPR and Cambridge University Press, pp. 159-179.

[6] Best, Michael H. 1990. *The New Competition: Institutions of Industrial Restructuring*. Cambridge: Cambridge University Press.

[7] Conti, Giuliano and Stefano Menghinello. 1998. "Modelli di Impresa e di Industria nei Contesti di Competizione Globale: l'Internazionalizzazione Produttiva dei Sistemi Locali del Made in Italy," *L'Industria*, 19, 315-348.

[8] Dixit, Avinash J. and Joseph E. Stiglitz. 1977. "Monopolistic Competition and Optimum Product Diversity," *American Economic Review*, 67, 297-308.

[9] Frankel, Jeffrey and Miles Kahler, eds., 1993. *Regionalism and Rivalry.* Chicago: Chicago University Press.

[10] Fujita, Masahisa, Paul Krugman and Anthony J. Venables. 1999. *The Spatial Economy*. Cambridge MA: MIT Press.

[11] Fujita, Masahisa and Jacques-François Thisse. 1996. "Economics of agglomeration," *Journal of the Japanese and International Economies*, 10, 339-378.

[12] Helpman, Elhanan and Paul Krugman. 1985. *Market Structure and Foreign Trade*. Cambridge MA: MIT Press.

[13] Grossman, Gene and Elhanan Helpman. 1991. *Innovation and Growth in the Global Economy*. Cambridge MA: MIT Press.

[14] Irwin, Douglas and Peter Klenow. 1994. "Learning by Doing in the Semiconductor Industry," *Journal of Political Economy*, 102, 1200-1227.

[15] Loasby, Brian J. 1998. "Industrial Districts as Knowledge Communities," in M. Bellet and C. L'Harmet (eds.), *Industry, Space and Competition - The contribution of economists of the past*, Cheltenham: Edward Elgar.

[16] Love, James H. and Stephen Roper. 1999. "The Determinants of Innovation: R&D, Technology Transfer and Networking Effects," *Review of Industrial Organization*, 15, 43-64.

[17] Lucas, Robert E. 1993. "Making a miracle," *Econometrica*, 61, 251-272.

[18] Marshall, Alfred. 1920. *Principles of Economics*, 8th edition. London: Macmillan.

[19] Martin, Philippe and Gianmarco I.P. Ottaviano. 1999. "Growing Locations: Industry Location in a Model of Endogenous Growth," *European Economic Review*, 43, 281-302.

[20] Nelson, Richard R., ed., 1993. *National Innovation Systems: A Comparative Analysis.* New York: Oxford University Press.

[21] OECD. 1996. *Networks of Enterprises and Local Development.* Paris: OECD.

[22] Pasold, Edward W. 1977. *Ladybird, Ladybird.* Manchester: Manchester University Press.

[23] Porter, Michael. 1990. *The Competitive Advantage of Nations.* New York: Free Press.

[24] Pyke, Frank, Giacomo Becattini and Werner Sengenberger. 1990. *Industrial Districts and Inter-firm Cooperation in Italy.* Geneva: International Institute for Labour Studies.

[25] Romer, Paul. 1990. "Endogenous Technological Change," *Journal of Political Economy*, 98, S71-S102.

[26] Sabel, Charles F. 1988. "Flexible Specialization and the Reemergence of Regional Economies," in P. Hirst and J. Zeitlin (eds.), *Reversing Industrial Decline? Industrial Structure and Policy in Britain and Her Competitors*, Oxford: Berg.

[27] Sabel, Charles F. and Jonathan Zeitlin. 1985. "Historical Alternatives to Mass Production: Politics Markets and Technology in Nineteenth Century Industrialization," *Past and Present*, 108, 133-176.

[28] Samuelson, Paul. 1954. "The Transfer Problem and Transport Costs, II: Analysis of Effects of Trade Impediments," *Economic Journal*, 64, 264-289.

[29] Saxenian, AnnaLee. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128.* Cambridge MA: Harvard University Press.

[30] Scott, Allen J. 1988. *New Industrial Spaces.* London: Pion.

[31] Sforzi, Fabio. 1990. "The Quantitative Importance of Marshallian Districts in the Italian Economy," in F. Pyke, B. Becattini and W. Sengenberger (eds.), *Industrial Districts and Inter-firm Cooperation in Italy*, Geneva: International Institute for Labour Studies.

[32] Soubeyran, Antoine and Jacques-François Thisse. 1999. "Learning-by-Doing and the Development of Industrial Districts, *Journal of Urban Economics*, 45, 156-176.

[33] Teece, David J. 1977. "Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Know-How, *Economic Journal*, 87, 242-261.

[34] Walz, Uwe. 1996. "Transport Costs, Intermediate Goods, and Localized Growth, *Regional Science and Urban Economics*, 26, 671-695.