Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus Devolution

Massimo Del Gatto

NOTA DI LAVORO 93.2004

MAY 2004

KTHC - Knowledge, Technology, Human Capital

Massimo Del Gatto, *Faculty of Economics, University of Bologna*

Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus Devolution

Summary

This paper emphasises the importance of the political-institutional dimension in the understanding of the spatial distribution of economic activity. We introduce the notion of Territorial Authority Scale, which refers to the degree of devolution (towards sub-national tiers of government) involved in the authority to decide on Spatial Policy, and propose a model of 'agglomeration in a system of cities' in which both intra-city trade and inter-city trade are considered. Enriching both the literature on integration/agglomeration and that on city size and formation, we show that: i) devolution results in over-agglomeration (fewer cities, which tend to be over-sized) and low welfare; ii) the higher the level of spatial (i.e. transport costs) and economic (i.e. intensity of trade) integration, the higher is the magnitude of the inefficiency. From a theoretical point of view, the paper represents an attempt to import, into geographical economics, a 'scale approach', which is an established approach to the notion of space in sociology.

Keywords: Agglomeration, Integration, Cities, Devolution, Economic geography, Transport costs, Spatial policy, Trade, Product variety, Linkages

JEL Classification: F12, F15, L11, L13, R12, R13, R59

I would like to thank Gilles Duranton and Gianmarco Ottaviano for decisive comments. I'm also grateful to Giorgia Giovannetti, Francesco Pigliaru, Beniamino Quintieri, and Robert Waldmann for helpful discussions. Financial support by the University of Bologna is gratefully acknowledged.

Address for correspondence:

Massimo Del Gatto
University of Bologna
Faculty of Economics
Italy
Fax: +390623311171
E-mail: M.Del-Gatto@lse.ac.uk

1 Introduction

An interesting debate on the relationship between socio-economic integration and territorial structure of institutions (commonly addressed by the s.c. political geography) is currently animated in sociology. A proliferation of studies, emergent during the 1990s, refers to a greater or lesser extent to Lefebvre's conception that the tension between global integration and territorial redifferentiation results in a 'generalised explosion of spaces' (Lefebvre [48]). As highlighted by Brenner [17], the way of approaching the so called 'urban question' is increasingly assuming the form of what Lefebvre [47] terms 'the scale question', an issue strictly linked to the consideration of supraurban spaces, such as the political-institutional tiers of government. This corresponds to a change in the way in which the urban dimension is confronted in the literature: 'scale' rather than 'functions'. Evidence of this process is the use of a series of expressions aimed at summing up the idea: 'global-local interplay' (Dunford and Kafkalas [25]), 'local-global nexus' (Peck and Tickell [54]), 'glocalization' (Swyngedouw [69, 70]), 'glurbanization' (Jessop [42]).

Economic theory seems not to be interested by this tendency and the 'scale question' appears to be almost totally neglected. What we would like to stress in this paper is that the inclusion of a political-institutional dimension (supraurban space) could offer a further contribution to the comprehension of the spatial distribution of economic activities. In particular, we show how the relationship between agglomeration and integration can be better understood taking into consideration the presence, or the absence, of a spatial planning system, together with the tier at which the spatial policy is decided.

An initial reason for this thinking derives from the empirical literature produced to date. The attempts to test for the now famous, and widely accepted, positive relationship between integration and agglomeration of activities do not reach unequivocal conclusions, and a result commonly regarded as theoretically robust have not yet been translated into a stylised fact. Instead, what seems to be empirically robust is that an increase in concentration, related to a conspicuous reduction in transport costs, is much more difficult to find in Europe than in the US[1] (where it is evident in the correspondence of the large development of the railway network which occurred between 1860 and 1930). Is it pure chance that the relationship seems to be verified precisely where an authority explicitly involved in spatial policies has never existed?

To cope with this theoretical lacuna, we focus on the degree of decentralisation, towards subnational tiers of government and/or local authorities (i.e. 'devolution')[2], of the authority to decide (and co-ordinate) all those actions in-

[1] See, among others, Kim [43] for the US, compared with Knarvik et al. [44], Brülhart [15], Hallet [33], Brülhart and Traeger [16] for the EU.

[2] The terminology we adopt is somewhat standard (see, for example, Davey [23]). We intend *decentralisation*, latu sensu, as a transfer of decision making power; the concept of *devolution* is instead restricted to the transfer of decision making power to representative bodies with independent political accountability. This distinguishes the notion of devolution from two other forms of decentralisation, in which we are not interested in this paper: the transfer to lower echelons within the same organisational hierarchy (i.e. deconcentration), and

tended to impact on the spatial distribution of economic activities: borrowing the notion of 'scale' from sociology, we name it 'Territorial Authority Scale' (TAS)[3]. Thus, Territorial Authority (TA) will be the authority to control the size, and eventually the number, of cities. In economic literature, the issue has been only occasionally addressed by those studies dealing with the formation of cities as a problem related to that of optimality in city size.

From this point of view, two main paradigms can be highlighted: cities can be thought of to form by *self-organisation* or through the action of large scale *city developers*, driving the formation of cities and/or managing them after their birth. The problem can be posed in the following terms. Optimality in city size is strictly linked to the assumptions about the type of forces fostering agglomeration and, once accepted that "*cities form in the economy because there are scale economies in production*" (Mills [50]), the mechanism through which cities form becomes decisive with respect to the achievement of an optimal distribution of economic activities across cities. Moreover, the solution strictly depends on the assumptions made concerning the origin of such scale economies. In this regard, the literature divides again into two principal categories: IRS driven by positive technological externalities; IRS driven by positive pecuniary externalities. In the first case, externalities act at city level and not at individual level, and this makes the hypothesis compatible with the existence of a competitive equilibrium (Chipman [20]). In the latter, imperfect competition is introduced using a Spence-Dixit-Stiglitz (Spence [64]; Dixit and Stiglitz [24]) specification of the production (or utility) function. The practical consequence of using one or other approach lies in the fact that, under perfect competition, a welfare analysis is always possible and, thanks to the usual assumption of purely external negative congestion effects (Henderson [34]), optimal size is an intrinsic result.

Thanks to these properties, the results available, in terms of the relationship between optimal size and the mechanisms of city formation, are, in the case of technological externalities, far richer than those available under pecuniary externalities. Since Henderson [34], we know that cities are always oversized when they form through self-organisation under perfect competition. We also know, remaining with Henderson [34], that the presence of city developers[4] corrects this form of market failure. Vickrey [73] shows that, in the absence of city developers, a socially optimal equilibrium is still always possible if a

the transfer to separate legal persons under the same political direction (i.e. delegation).

[3]Though our attention is mainly focused on the territorial scale, rather than on the distribution of functions among different tiers of government, our idea of TAS is very similar to what Giordano and Roller [32], recognising the same lack of information (but providing only a descriptive analysis of the evolution in Italy and Spain in order to draw some lessons for the ongoing situation in England), call "relations between the city and the regional scale of governance".

[4]Henderson adopted the notion of 'city corporations' but since Stiglitz [67, 68], the literature has used slightly different terminology: 'city developers' or 'land developers' (Henderson and Becker [36], Helsley and Strange [41]), 'large agents' (Henderson and Becker [35]). We treat these definitions as synonymous, since they all refer to perfectly informed organisms, operating under perfect competition, and able to control the movement of people at local level. For further considerations, see Wildasin [74]and Fujita and Thisse [31].

perfectly competitive land market is included in the analysis. From this point of view, the literature on city size intersects that which examines cities as providers of local public goods. The Henry George Theorem is a point of reference in this field: given the level of expenditure on a pure public good (in a certain city), city size is optimal when it maximises the utility level of all residents. The condition of efficiency is that the aggregate differential land rent (i.e. the sum of the land rent in each location across the city, less the opportunity cost of land) equals the public expenditure for the provision of the public good[5]: this is the size that would be chosen by a CP. With local authorities, as highlighted by Fujita and Thisse [31][6], an urban system is efficient if, and only if, it constitutes a free-entry equilibrium at city level, thanks to the fact that we can assume that the local authorities capitalise all the losses resulting form the provision of public goods: the presence of city developers operating in a perfectly competitive 'market of cities' assures optimal size (see Henderson and Becker [35, 36]).[7]

On the other hand, the assumption of pecuniary externalities, though allowing a better explanation of city formation in the presence of trade, has so far prevented researchers from coping with welfare analysis. Thus, the agglomeration models following the New Economic Geography approach (Krugman [45], Krugman and Venables [46], Venables [72]), move in the self-organisation framework, neglecting both the presence of a regulatory authority and the problem of optimality[8].

Collating these points, what we know at the state of the art is that city size is surely optimum, without trade, in presence of a perfectly competitive land market. In the absence of such a market, and still without trade, a sufficient condition for optimality is that cities are formed by city developers acting in a perfectly competitive 'market of cities'. Three considerations, representing the main reasons for the present study, are in order.

First, what is the role of *trade* in this context? The above mentioned literature moves essentially in a homogeneous space, in which trade does not occur neither within nor between cities. After Starret [65], in this case, and assuming CRS at firm level, an autarchic equilibrium is always possible, even when transportation is costly. However, there is no trade in autarchy, and the consideration of transport cost is completely useless (s.c. *Folk Theorem of Spatial Economy*). If we assume some form of indivisibility in economic activity, the inclusion of trade becomes unavoidable but in this case, with locally non-satiated preferences, there is no competitive equilibrium involving transportation, so that the

[5]For this definition of the Henry George Theorem see Fujita and Thisse [31], Ch. 5. For further details: Flatters et al. [27], Stiglitz [66], Arnott and Stiglitz [13].

[6]See their Proposition 5.2.

[7]To facilitate the comparison with our findings, a feasible lecture of the model we use is to think at the intermediate goods X_i as local public goods. Every unit benefits, in the production of Y, of the variety of goods both in the city and in other cities, while transport costs tell us the extent to which the goods are excludible. Owing to the fact each unit produces one and only one public good, the decision about their optimal provision coincides with the choice of the optimal city size. In this regard, the fact that the availability of land is assumed unlimited corresponds to the assumption that sites do not capitalise its value.

[8]See, however, Ottaviano et al. [52] and related works.

hypothesis of perfectly competitive markets must be abandoned (i.e. *Spatial Impossibility Theorem*). This is the main reason still keeping the literature divided between theories dealing with city size with only technological externalities, with a purely internal (to cities) dimension and a strong flavour of urban economics (call them 'theory of cities'), and theories of agglomeration under pecuniary externalities (widely named 'trade and location theory'), in which locations are admitted to have commercial relationships but, since a competitive equilibrium is never possible, the problem of optimality in respect of the mechanism of city formation is not regarded at all.

The issue of trade is directly linked to another problem: though the notion of 'system of cities' has been adopted (at least since Henderson [34]) by the theory of cities, the extension to a more general context of more than one city/region has not been fully realised, and very little work has been done in terms of *number and size of cities*. The two issues are strictly correlated because we currently need a better comprehension of the role of inter-city trade as a centripetal or centrifugal force. Abdel-Rahman and Fujita [3], providing a unified framework for using either the former or the latter, show that, when trade occurs within cities, technological and pecuniary externalities lead to different policy recommendations and to different optimal city sizes, although the aggregate production function they generate is the same. Therefore, that sort of 'externality hunting' that characterised the literature in the past years should now leave place to the study of what happens when we admit inter-city commercial relationships, and the way to do that is to move the analysis into a system of cities. The problem is currently addressed in two different theoretical contexts. On the one hand, there are models of a system of cities allowing for inter-city trade. Anas and Xiong [11], in a model in which both manufactures and services are admitted to be traded, focus on the effects on specialisation and diversification of decreasing transport costs (showing that a lower cost of trading manufactures favours a system of specialised cities, while a lower cost of trading services favours a system of diversified cities), but do not analyse the level of agglomeration neither in terms of number of cities (two city-industries are considered) nor in terms of city size. Tabuchi et al. [71], studying both number and size of cities, obtain that in the early stages of an integration process we should assist to increasing concentration in larger cities (with the smaller ones tending to disappear), while, in correspondence of sufficiently low transport costs, further integration should determine deglomeration and creation of new cities. On the other hand, a series of related contributes[9] addresses the problem of the number and size of countries, which can be viewed as an extensive version of our problem. In particular, Alesina et al. [8] study the relationship between economic integration and political disintegration, showing that a reduction in transport costs and/or political trade barriers can be associated to an increase in the number of nations.

The third consideration is the following: to what extent is the hypothesis of

[9]Cfr. Alesina and Spolaore [6]; Alesina and Wacziarg [9]; Alesina et al. [8]; Alesina [4]; Alesina and Spolaore [7]; Alesina et al. [5].

perfect competition in the *market of cities*, in which city developers act, feasible? The assumption is probably dictated by the theoretical need to reproduce the behaviour of a central authority or the presence of a perfectly competitive market for land. If this is not the case, however, the hypothesis of perfect competition in the market of cities seems to be not the best one: it implies that the number of cities approaches infinity and that their size is irrelevant with respect to the market. This reduces the cases we are able to deal with and prevents the possibility of studying the phenomenon of agglomeration at a local/regional level. To stress this point, it is useful, following Herrschel and Newman [39], to distinguish between 'monocentric city regions' and 'policentric city regions'. The former indicating a geography characterised by the presence of a dominant metropolitan core, that reduces the role of the region to little more than its own hinterland; the latter referring to the presence of more than one urban centre, that assures a certain degree of competition among cities themselves. From this perspective, a model of perfect competition in the market of cities could be thought of as an appropriate representation of the relationship between state and cities, if the number of these latter is sufficiently high, but a more suitable hypothesis is needed in order to analyse both monocentric city regions and policentric city regions, or even the state-cities relationship, when the number of cities is not sufficiently large to justify perfect competition. Therefore, the debate concerning the realism of the assumption that cities could form through the action of city developers notwithstanding[10], what seems relevant is the context in which cities come to light: does a perfect competition market of cities exist? In all the cases in which the answer is negative, we do require an alternative.

Our model heavily draws from Alesina et al. [8], but, for the reason explained, it is conceived to apply to a system of cities, and to stress the role of trade in a local context, in presence of both technological and pecuniary externalities. More in details, inter-city trade constitutes the vehicle through which pecuniary externalities are carried across the system, while technological externalities assure the presence of cities also if trade does not occur at all. The concept of TAS is then used to investigate how the inclusion of a political-institutional dimension (supraurban space) can enrich the understanding of agglomeration. This is done contrasting two situations: the case in which a central planner set both number and size of cities, and the case in which a certain number of potential local planners decide the size of their own city, after having unilaterally decided to form it. Finally, we investigate how a different TAS can influence optimality in equilibrium, affecting the relationship between agglomeration and integration.

In this context, we find that TA devolution produces a sort of market failure in terms of agglomeration: too few cities, and oversized, respect to the optimum (proposition 3). We also show (proposition 4) that trade is chiefly responsible for this result, and this is due to the fact it represents the vehicle used by pecuniary externalities to spread over the system.

The rest of the paper is organised as follows. In sections 2 and 3 we present

[10] On this debate see Henderson and Mitra [37].

the model and give a general solution. Then, we separately analyse the solution under fully centralised TA (section 4) and devolution to local planners (section 5). Finally, we compare the two different outcomes and expose our findings concerning: i) the relationship between optimality of the agglomeration level and TAS (section 6); ii) the way in which an integration process (through trade) affects the relationship (section 7). Some conclusions and purposes for further research are drawn in section 8.

2 The Model

2.1 Assumptions

Let our economy consist of a urban system whose economic basic units, called *sites*, are grouped in *cities*. Sites can be thought of as homogeneous areas, themselves made up of one or more individuals. The economy as a whole is composed of an infinite number of potential sites, but only a certain number W of them is currently developed.

Hence, city k consists of S_k sites, with $0 < S_k \leq W$, and site i occupies an area equal to L_i units of land.

Both individuals and sites are equidistant and spatially immobile; as a consequence, the system of cities, and cities themselves, do not shape according to an explicit form: we simply assume that our geography coincides with a space whose dimension is $W - 1$.[11] In such a world, spatial autocorrelation is constant, while spatial concentration varies in accordance with the size of cities and inversely to their number. Thus, in the symmetric case, the ratio of city size to the number of cities (S/N) is an exhaustive measure of both concentration and polarisation, even when size and number move in the same direction.[12]

[11] This spatial structure should be equivalent (Abdel-Rahman [2]) to a system of circular cities in a space assumed large enough to avoid overlapping.

[12] This may seem reductive in a model aimed at focusing on different agglomeration outcomes; nevertheless, this hypothesis is intended to enrich the analysis by allowing a definition of agglomeration in a multi-city case. In fact, at least two problems, concerning agglomeration, arise in a multi-regional framework. In such a case: i) it is usually impossible to say if agglomeration is rising or falling when the number of cities moves according to their size; ii) from a spatial point of view, one should discern between "concentration" meant in the sense of Gini, that is essentially an a-spatial concept (owing to the fact Gini and similar indices are able to catch differences in terms of distribution of units among cities, but they are not thought to catch changes in terms of physical distance among units), and "polarisation", usually measured through spatial auto-correlation, a concept that grasps very well the idea of spatial proximity, but is totally insensitive to different city sizes, once the distance among units has been set (see Arbia [12] for an overview). Both the problems are solved when sites are immobile and equidistant. In this case the ratio of the size to the number of cities is a sufficient statistic for all types of contextual changes in number and size, and the spatial dimension of the model is reduced to the mere consideration of transport costs. This is of some relevant importance, since it creates a common ground between two-regional models (e.g. New Economic Geography) and multi-regional models (e.g. Tabuchi et al. [71]) in matters of concentration and dispersion, so allowing a comparison of results in terms of agglomeration obtained in different contexts.

With regard to production, two goods, both obtained under perfect competition, are considered: a homogeneous final good Y, and an intermediate, horizontally differentiated good X. The former is produced by each site but is traded neither between sites nor between cities. The latter is used by all sites as input in the production of Y and is provided by each site to all the others in the following way: each site i produces one and only one intermediate input using a specific stock of an inexhaustible natural resource that permits to obtain R_i units of intermediate goods. Each type of good X is therefore identified by one and only one place of production; according to that, W represents both the number of sites and the number (of types) of intermediate goods in our system (*overall variety*), while S_k represents both the number of sites and the number (of types) of intermediate goods in city k (*within city variety*).

In this setting, maximizing utility is the same as maximizing production (i.e. consumption).

Site i production function for final good Y assumes the general form:

$$Y_i = A_{k(i)} X_{\cdot i}^{\alpha} L_i^{1-\alpha} \qquad \textit{with} \quad i \in S_{k(i)} \tag{1}$$

where: subscript $k(i)$ refers to the city in which site i is located; $X_{\cdot i}$ is the total amount of intermediate goods used by site i to produce Y; L_i is the amount of land available for site i; $A_{k(i)}$ incorporates differences in fundamentals at city level (it will be broken up into two factors in section 2.2.1).

Intermediate goods enter the production of final good according to a standard CES:

$$X_{\cdot i} = \left(\sum_{j=1}^{W} x_{ji}^{1-\frac{1}{\sigma_i}} \right)^{\frac{1}{1-\frac{1}{\sigma_i}}} \tag{2}$$

$\textit{with} \quad i \in S_{k(i)}; \quad j \in S_k; \quad k = 1, \ldots, k(i), \ldots, N$

where: x_{ji} is the amount of intermediate good produced in site j and used in site i; $\sigma_i > 1$ is the elasticity of substitution among inputs.

In order to obtain a more tractable production function for final good Y, we simply set $\sigma_i = \sigma = 1/(1-\alpha)$, and call $0 < \alpha < 1$ "degree of substitutability" among inputs:[13]

$$Y_i = A_{k(i)} \sum_{j=1}^{W} x_{ji}^{\alpha} L_i^{(1-\alpha)} \tag{3}$$

[13] Concavity requires $0 < \alpha < 1$; when $\alpha \to 1$, the elasticity of substitution tends to be infinite ($\sigma \to \infty$) and the number of inputs is not relevant for the production of Y; conversely, when $\alpha < 1$, inputs are not perfect substitutes and the number of inputs can strongly influence the production of Y. Note also that (3) is homogeneous of degree one; this means that the amount of Y produced by each site in a competitive equilibrium is indeterminate. Owing to the fact the model is here solved in the presence of planners, this is not influential: the problem can be solved assuming that Y is produced by a single city/site, behaving competitively.

with $i \in S_{k(i)}; \quad j \in S_k; \quad k = 1, \ldots, k(i), \ldots, N$

2.2 Agglomeration forces

Concerning agglomeration forces, we assume the presence of technological effects and pecuniary externalities.[14] The literature clearly shows that the existence of some form of IRS in production is a necessary condition for agglomeration to occur. Either the assumption of only technological externalities (Henderson [34]) or the assumption of only pecuniary externalities (Rivera-Batiz [58], Abdel-Rahman [1], Fujita [28]) has been used to explain spatial concentration, however, as noted by Ottaviano and Thisse [53], their relative importance depends on the scale of the analysis: while at the level of cities (Anas et al. [10]) or industrial districts (Pyke et al. [56]) it appears correct to use technological externalities, on a larger geographical scale it seems opportune to include pecuniary externalities (which also presents us with the intellectual advantage of opening the so called "black-box" of technological externalities). In this respect, it has also to be kept in mind that Abdel-Rahman and Fujita [3] have clarified that agglomeration can be obtained both under technological and pecuniary externalities, the unique difference being in terms of

In a context such as that of a system of cities, it follows that each may play a role in fostering agglomeration or deglomeration. This idea is imported in our model using inter-city trade as the vehicle through which pecuniary externalities spread over the system, and technological externalities in order to assure the existence of cities also when inter-city trade does not occur at all. The reason for this lies in our preference for a system of autarchic cities, in respect to a totally dispersed economy, when the level of transport costs does not allow trade.[15]

2.2.1 Technological effects

Concentration at the local level is appealing thanks to "communication effects" which are used, here as elsewhere, in the sense of Marshall[16]. However, our technological effects are not regarded as external to sites and internal to cities[17]: they directly enter the production function of final goods Y.

[14] According to Scitovsky [61], we adopt the notion of "technological externalities" to indicate that the production in site i not only depends on the inputs it uses but also depends on the inputs that other firms use. On the other hand, we use the concept of "pecuniary externalities" referring to the fact that the profit (not the production) of site i is itself a function of production and inputs used by other firms. The difference is crucial because the former acts through non-market interactions, while the latter is expressed through market interactions, such as prices and trade.

[15] In fact, as shown in section 7, we find that, with very low spatial integration, agglomeration is first of all led by technological spillovers, and the role of the degree of substitutability among inputs is much less determinant in fostering agglomeration.

[16] Cfr. "*The mysteries of the trade become no mysteries* [...]" (Marshall [49], Book IV, Ch. X, 3. Note, however, that Marshall's idea concerning externalities goes well beyond simple communication effects.

[17] As it would be adopting a functional specification of the type introduced by Chipman [20], that precisely corresponds to the marshallian concept of communication externalities.

More in details, similarly to Ciccone and Hall [22] and Ciccone [21], we assume that production in site i, in city k, is also a function of the density of economic activity in that city, where density is defined as the ratio of total production of Y to the total area of the city (in terms of units of land).[18]

Going back to equation (3), the term $A_{k(i)}$ can be used to incorporate this idea simply setting:

$$A_{k(i)} = \Lambda_{k(i)} \left(\frac{\sum_{i=1}^{S_{k(i)}} Y_i}{\sum_{i=1}^{S_{k(i)}} L_i} \right)^{\frac{\lambda-1}{\lambda}} \tag{4}$$

where positive effects operate if, and only if, $\lambda > 1$.

Equation (4) says us that the term $A_{k(i)}$ consists of two ingredients. The first - $\Lambda_{k(i)}$ - is the standard (Hicks - neutral) *total factor productivity*, incorporating the so called "fundamentals" at city level. The second expresses technological effects due to agglomeration in cities, which depends on the density of economic activity (i.e. production) and λ (the parameter measuring technological effects at site level).[19] The two terms taken together tell us that cities whose productivity is higher ($\Lambda_{k(i)}$ is bigger) are those who take the greater advantages from concentration.[20]

2.2.2 Input-output linkages and trade

The other agglomeration force that we adopt are input-output linkages in production.

The idea that an increase in the number of intermediate goods has a positive effect on production (i.e. *Love of Variety*) has been widely used in agglomeration theory under monopolistic competition, although in slightly different ways. Looking at equation (3), similarly to Rivera-Batiz [58], Abdel-Rahman [1], Fujita [28] and other standard models, the number of inputs positively effects the production of Y.[21] However, differently from them and some others (e.g. Venables [72]), we assume perfect competition in the final good market, and this implies that, apart from the degree of substitutability, centripetal forces directly rely on the ratio of external on internal transport costs.

To introduce trade, we consider an open economy in which the transport of Y is free (neither physical nor commercial barriers), while trade in inputs incurs

[18]Pioneer works about the effects of city size on productivity are Segal [64] and Moomaw [51].

[19]Looking at A_k as a measure of productivity, the idea expressed in equation (4) is very close to be a static and spatial version of Verdoon's low, in which productivity is a direct function of a constant plus the total production.

[20]Note that with different values of Λ_k we would have a system of heterogeneous cities. Though this could be of some interest, we will assume that Λ_k is the same across cities; besides making the solution easier, this permits the isolation of the effects of TAS, that is our goal.

[21]This can be shown assuming that intermediate goods are priced symmetrically, so that $P_{ij} = P \ \forall j$ and $\forall i$. In this case, the demand of each input is $R/(WP)$, that, once substituted in equation (3), gives $Y_i = A_{k(i)} L_i^{(1-\alpha)} W^{1-\alpha} (R/P)^{\alpha}$ with $i = 1, \ldots, S_k$. It is evident that productivity increases with overall variety (W), and the strength of this link relates negatively to the degree of substitutability (α).

iceberg transport costs à la Samuelson [60]. The distinction between internal and external transport costs matters as we assume that inputs are traded both within and between cities: of one unit of good transported, only a fraction $(1-\tau)$ gets destination if trade takes place within a city (*home trade*)[22], while only a fraction $(1-\beta)$ reaches destination if trade involves sites located in different cities (*external trade*). Hence, the amount of intermediate goods that site i receives, for Z units he bought, is $(1-\tau)Z_{ii}$, in the first case, and $(1-\beta)Z_{ji}$, in the latter.[23]

Considering that each site uses all the types of inputs available in the economy, and that all sites in a particular city receive the same amount of intermediate goods produced locally $[(1-\tau)Z_{ii}]$ and the same amount of intermediate goods produced in other cities $[(1-\beta)Z_{ji}]$, equations (3) can be rewritten as:

$$Y_i = A_{k(i)} L_i^{(1-\alpha)} \left\{ S_{k(i)} \left[(1-\tau)\, Z_{ii}\right]^\alpha + \sum_{k'} S_{k'} \left[(1-\beta)\, Z_{ji}\right]^\alpha \right\} \tag{5}$$

with $\quad i \in S_{k(i)}; \quad j \in S_{k'}; \quad k = 1, \ldots, k(i), \ldots, N; \quad k' = \{k \mid k \neq k(i)\}$

Thus, owing to the assumption of openness, production in city i also benefits from an increase in the number of sites in other cities. What makes concentration attractive is that, when $\tau < \beta$, an increase in the number of sites internal to the city where site i is located $(S_{k(i)})$ renders a larger number of inputs available at lower transport costs. As it will be more clear in equation (17), the two terms in curly brackets can be thought of as indexes of the relative importance of home trade and export trade among sites, where transport costs constitute the system of weights. An increase in $S_{k(i)}$ means, in relative terms, an increase in the use of locally produced inputs respect to the imported ones. Imagine that a certain number of sites moves from city j to city i: this does not effect overall variety, but renders more inputs subject to internal, rather than external, transport costs. If the former are lower than the latter $(\tau < \beta)$, the production in city $k(i)$ benefits of this increase in within city variety.[24] *Coeteris paribus*, however, both an increase in $S_{k(i)}$, the size of other cities being the same, and an increase in the size of these latter (S_k), $S_{k(i)}$ being the same, are good news for city $k(i)$, independently of the level of transport costs. Obviously, localisation is irrelevant if $\tau = \beta = 0$.

[22]Referring to the circular structure we mentioned in note (11), this choice for the internal structure of cities should be equivalent to the assumption of circular cities in which τ represents the cost of commuting with the CBD.

[23]Note that β could also be intended as a generalised measure of "political distance" (e.g. protectionism, bureaucracy, etc.). To keep distinct the two aspects, Alesina et al. [8] propose a multiplicative form: $(1-\beta)(1-\delta)$, where δ is meant as a measure of non-physical costs of trade.

[24]Obviously, we assume that city $k(i)$ is (enough) small respect to the system.

3 Solution of the model

In order to obtain the demands for inputs, we use marginal cost pricing, according to which it has to be:

$$A_{k(i)} L_i^{(1-\alpha)} \alpha (1-\tau)^{\alpha} Z_{ii}^{\alpha-1} = P_{ii} \tag{6}$$

$$A_{k(j)} L_j^{(1-\alpha)} \alpha (1-\beta)^{\alpha} Z_{ij}^{\alpha-1} = P_{ij} \tag{7}$$

with $i \in S_{k(i)}; \quad j \in S_{k(j)}$

where P_{ii} and P_{ij} are the prices per unit of input i traded, respectively, within the city and between different cities. All sites belonging to the same city as site i demand the same amount of intermediate good i, say Z_{ii}, and all sites (j) belonging to other cities $k \neq k(i)$ demand an amount equal to Z_{ij}. With no price discrimination and tariffs of any kind, the price of input i has to be the same wherever it is sold, so that $P_{ii} = P_{ij}\ \forall j$.[25] Therefore, from equations (6) and (7), we have:

$$\frac{Z_{ij}}{Z_{ii}} = \left(\frac{A_{k(j)}}{A_{k(i)}}\right)^{\frac{1}{1-\alpha}} \left(\frac{1-\beta}{1-\tau}\right)^{\frac{\alpha}{1-\alpha}} \left(\frac{L_j}{L_i}\right) \tag{8}$$

Input i is also subject to the following resource constraint:

$$S_{k(i)} Z_{ii} + \sum_{k \neq k(i)} S_k Z_{ij} = R_i \tag{9}$$

with $i \in S_{k(i)}; \quad j \in S_{k \neq k(i)}; \quad k = 1, \ldots, k(i), \ldots, N$

From (8) and (9), and setting the price of Y as the numeraire ($P_Y = 1$) we can write the amount of each domestic input demanded by site i:

$$Z_{ii} = \frac{A_{k(i)}^{\frac{1}{1-\alpha}} (1-\tau)^{\frac{\alpha}{1-\alpha}} L_i R_i}{S_{k(i)} A_{k(i)}^{\frac{1}{1-\alpha}} L_i (1-\tau)^{\frac{\alpha}{1-\alpha}} + \sum_{k'} S_{k'} A_{k'}^{\frac{1}{1-\alpha}} L_j \,(1-\beta)^{\frac{\alpha}{1-\alpha}}} \tag{10}$$

with $i \in S_{k(i)}; \quad j \in S_{k'}; \quad k = 1, \ldots, k(i), \ldots, N; \quad k' = \{k \mid k \neq k(i)\}$

[25] That, under perfect competition, the price of goods in each location has to cover marginal production costs plus transport costs is clear after Samuelson [60]. Since, in this way, transport costs are supported by the customers, this is an assumption of mill pricing. Ottaviano and Thisse [53] note that it is moreover a necessary condition for the absence of missing markets in perfect competition.

In the same way[26], the amount of each input demanded by site i, but produced in other cities than city $k(i)$ is:

$$Z_{ji} = \frac{A_{k'}^{\frac{1}{1-\alpha}}(1-\beta)^{\frac{\alpha}{1-\alpha}} L_j R_j}{S_{k'} A_{k'}^{\frac{1}{1-\alpha}} L_j (1-\tau)^{\frac{\alpha}{1-\alpha}} + \sum_{k''} S_{k''} A_{k''}^{\frac{1}{1-\alpha}} L_q (1-\beta)^{\frac{\alpha}{1-\alpha}} + S_{k(i)} A_{k(i)}^{\frac{1}{1-\alpha}} L_i (1-\beta)^{\frac{\alpha}{1-\alpha}}} \tag{14}$$

with $\quad i \in S_{k(i)}; \quad j \in S_{k'}; \quad q \in S_{k''};$
$k = 1, \dots, k(i), \dots, N; \quad k' = \{k \mid k \neq k(i)\}; \quad k'' = \{k \mid k \neq k(i), k(j)\}$

Equations (10) and (14) provide the demand function for each input by our generic site i; these demand functions can be used in equation (5) in order to obtain the production of Y as a function of the size of cities in the system. Before proceeding, however, we would like to make things simpler assuming symmetry at level of sites and technology.

Concerning sites, let us assume *symmetry within cities*, and normalise values:

$$L_i = L = 1; \quad R_i = R = 1 \qquad \forall \quad i = 1, \dots, W \tag{15}$$

In this way, sites differ only for being located in different cities; this means that subscripts refer now to every site located in a particular city.[27]

Concerning technology, let us impose *symmetry in technology between cities*:

$$\Lambda_k = \Lambda \qquad \forall \quad k = 1, \dots, N \tag{16}$$

[26] Analitically, for every input j we have:

$$A_{k(j)} L_j^{(1-\alpha)} \alpha (1-\tau)^{\alpha} Z_{jj}^{\alpha-1} = P_{jj} \tag{11}$$

$$A_{k(q)} L_q^{(1-\alpha)} \alpha (1-\beta)^{\alpha} Z_{jq}^{\alpha-1} = P_{jq} \tag{12}$$

with $\quad j \in S_{k(j)}; \quad q \in S_{k(q)}$

and the following resource constraint for input j:

$$S_{k(j)} Z_{jj} + \sum_{k \neq k(j)} S_k Z_{jq} = R_j \tag{13}$$

with $\quad j \in S_{k(j)}; \quad q \in S_{k \neq k(j)}; \quad k = 1, \dots, k(j), \dots, N$

Referring to site i, we have equation (14).

[27] Two considerations are in order. First, when sites are equal even in terms of land that they occupy, the production density in a city is constant and equal to $y_i/L_i = Y/L$ (i.e. the effect of density on output is the same both at site and city level). Second, assumption (15) is not innocuous from the point of view of returns to scale. In fact, substituting (4) in (1) and aggregating over all sites in city $k(i)$, we have the following city production function for Y: $Y_k = \Lambda_k X_{k,\cdot i}^{\alpha\lambda} L_{k,\cdot i}^{1-\alpha\lambda}$, where subscript $k, \cdot i$ refers to the sum over all sites in city k. Under the hypothesis that $L_i = L = 1$ the number of sites affects (through λ) productivity more than proportionally, both in sites and cities.

With this assumption, our cities have the same characteristics from a technological point of view, and they obtain exactly the same benefits from concentration.

Using (15) and (16), and substituting (4) in (5), equation (5) (i.e. the production function of our generic site i) becomes:

$$Y_i = \Lambda^\lambda \{\theta_I \frac{S_{k(i)}}{[\theta_I S_{k(i)} + \theta_E \sum_{k'} S_{k'}]^\alpha} + \\ + \theta_E \sum_{k'} \frac{S_{k'}}{[\theta_I S_{k'} + \theta_E \sum_{k''} S_{k''} + \theta_E S_{k(i)}]^\alpha}\}^\lambda \quad (17)$$

with $\quad i \in S_{k(i)}; \quad j \in S_{k'}; \quad q \in S_{k''};$
$k = 1, \ldots, k(i), \ldots, N; \quad k' = \{k \mid k \neq k(i)\}; \quad k'' = \{k \mid k \neq k(i), k(j)\}$

where, to save notation and to deal with a measure of "spatial proximity", rather than "spatial separation", we set:

$$\theta_I \equiv (1-\tau)^{\frac{\alpha}{1-\alpha}}; \quad \theta_E \equiv (1-\beta)^{\frac{\alpha}{1-\alpha}}; \quad (18)$$

Equation (17) is the fundamental equation in the model and it will be used, with the opportune specifications, to determine the agglomeration outcome in two different cases: i) centralised territorial authority (section 4); ii) decentralised territorial authority (section 5). This will permit the study of how a different hypothesis on TAS can determine divergences in terms of agglomeration around our system of cities. Through computation, we obtain couples of values (S,N) which (are not of interest per se but since they) indicate what type of inefficiency the devolution of the TA can cause on the spatial distribution of economic activity, in particular when an integration processes is in act.

4 Optimal size and number of cities with Centralised Territorial Authority

In this section, we deal with the first-best solution under the hypothesis that both size and number of cities are chosen by a central authority, that we call *Central Planner* (CP). We assume the maximisation of a Benthamian social welfare function:

$$V^{CP} = y^{CP} - h^{CP} \quad (19)$$

where $y^{CP} = \sum_{i=1}^{W} Y_i$, and h^{CP} is the CP's cost function, specified as follows.

Variety is costly: in addition to the cost that has to be sustained to create a site, our economy is subject to costs related both to the number of sites in cities and to the total number of sites in the system. More in details, we assume:

1. *Site Cost* - The creation of sites involves a fixed cost, in terms of units of the final good, equal to ψ.

2. *Within city Variety Costs* (WVC^{CP}) - Within city variety (i.e. the number of sites in single cities) implies costs that, in terms of units of the final good, are more than proportional respect to the number of sites in the city[28]:

$$WVC^{CP}(S_k) = \sum_{k=1}^{N} MS_k^{\frac{\mu}{1-\mu}} \tag{20}$$

where N is the number of cities and $\mu > 0.5$, which we assume to be the same across cites, is the parameter measuring the congestion due to variety in cities. Hence, WVC^{CP} are increasing and convex in S.

3. *Overall Variety Costs* (OVC^{CP}) - The system of cities as a whole is subject to costs, in terms of units of the final good, that we assume more than proportional respect to the total number of sites:

$$OVC^{CP}(W) = RW^{\frac{\rho}{1-\rho}}. \tag{21}$$

where $\rho > 0.5$ is the parameter measuring congestion due to variety in the system. Thus, OVC^{CP} are increasing and convex in W.

Therefore, the CP's cost function takes the form:

$$h^{CP}(N, W, S_k) = PW^{\frac{\rho}{1-\rho}} + \left(\sum_{k=1}^{N} MS_k^{\frac{\mu}{1-\mu}}\right) N + \psi W \tag{22}$$

Accordingly, the CP's problem would be a system of N equations, as many as cities, and N unknowns, i.e. the optimum dimension S_k^* of each city. However, N is itself unknown, thus we should fix the number of cities to solve the model, so vanishing all our efforts to determine size and number of cities endogenously. To solve the puzzle, we use the following property of the model:

Proposition 1 *Let it be $S \in (1, W]$ the set of possible city sizes; if the production function for the final good Y satisfies conditions (15) and (16), and if the resource constraint (9) is satisfied $\forall i$ (the available resources are fully used), a CP chooses the size of cities symmetrically, i.e. $S_k = S$, $\forall k$.*

(Proof: see Appendix 1)

Proposition 1 allows us to rewrite (5) (the production function of site i) as:

$$Y = \Lambda^{\lambda} \left[(\theta_I - \theta_E)S + \theta_E W\right]^{\lambda(1-\alpha)} \tag{23}$$

About 23, it is useful to highlight what follows:

Proposition 2 *The production of Y is: i) increasing in W, ii) increasing or decreasing in S, depending on whether it is $\theta_I > \theta_E$ or $\theta_I < \theta_E$, iii) increasing in θ_I, iv) increasing in θ_E[29], v) decreasing in α), vi) increasing in λ.*

[28] As recognised by Sheshinski [63], congestion should be related to the density of population, not to the population tout court. However, since each site occupies a fixed area $L_i = L$, the density is here constant and equal to $\frac{1}{L}$.

[29] Provided that is $W > S$. This condition is always assumed verified in what follows.

Finally, the CP's problem becomes:

$$\max_{S,W} V^{CP} = W\Lambda^{\lambda}\left[(\theta_I - \theta_E)S + \theta_E W\right]^{\lambda(1-\alpha)} - RW^{\frac{\rho}{1-\rho}} - \left(MS^{\frac{\mu}{1-\mu}}\right)\frac{W}{S} - \psi W \tag{24}$$

in which we used the fact that $N = W/S$. The problem is graphically shown in figure 1.

5 Size and number of cities with Decentralised Territorial Authority

In order to study the consequences of a different TAS on the degree of agglomeration, we here consider the extreme case in which TA is completely devoluted to *local planners* (LP); this means that LP in city $k(i)$ has the authority to fully and freely decide the size of that city.[30]

The first step to determine the equilibrium is to define an objective function for each LP. As for the previous case, we use a Benthamian specification of social welfare, but we now assume that each LP cares only about his own city, so that the function he maximizes takes the form:

$$V_{k(i)}^{LP} = y_{k(i)}^{LP} - h_{k(i)}^{LP} \tag{25}$$

where $y_{k(i)}^{LP} = \sum_{i=1}^{S_{k(i)}} Y_i$ and h_i^{LP} is the cost function specified as follows

1. *Site Cost* - The creation of sites involves a fixed cost, in terms of units of the final good, equal to ψ.

2. *Within city Variety Costs* (WVC^{LP}) - The level of variety internal to the city implies costs, in terms of units of the final good, more than proportional respect to the number of sites in the city:

$$WVC^{LP}(S_{k(i)}) = MS_{k(i)}^{\frac{\mu}{1-\mu}} \tag{26}$$

   where μ, that we assume constant across cites, is the parameter measuring congestion due to variety in cities. Setting $\mu > 0.5$ WVC^{LP} are increasing and convex in city size.

3. *City-specific Overall Variety Costs* (OVC^{LP}) - The system of cities as a whole is subject to costs, in terms of units of the final good, that we assumed in section 4 more than proportional to the total number of sites

[30] As noted by Helsley and Strange [40], the notion of city developers (defined as in note 4), is not equivalent to that of local governments, owing to the fact the former have not the authority to impose a reduction in city size (they cannot induce people to leave the city they live in). Our LPs do not identify themselves with local governments, since they do not have any fiscal authority, and cannot be merely thought of as city planners, since they are assumed to have the authority to set city size. *Latu sensu*, however, they are both local governments and city developers.

(W). Here we hypothesise that a single planner does not take into consideration the cost for the system as a whole, but instead considers only his own quote of this cost:

$$OVC^{LP}(S_{k(i)}) = R\left(S_{k(i)} + \sum_{k'} S_{k'}\right)^{\frac{\rho}{1-\rho}} \tag{27}$$

where $k' = \{k \mid k \neq k(i)\}$, and $\rho > 0.5$ is the parameter measuring congestion due to variety in the system. Thus, also OVC^{LP} are increasing and convex in city size.

Thus, LP's cost function in city i is:

$$h^{LP} = R\left(S_{k(i)} + \sum_{k \neq k(i)} S_k\right)^{\frac{\rho}{1-\rho}} + MS_{k(i)}^{\frac{\mu}{1-\mu}} + \psi S_{k(i)} \tag{28}$$

and his problem, i.e. the maximisation of (25) respect to $S_{k(i)}$, can be written, using (17) and (28), as:

$$\begin{aligned} \max_{S_{k(i)},\overline{S}_{k'}} V_{k(i)}^{LP}\left(S_{k(i)}, S_{k'}\right) = S_{k(i)}\Lambda^{\lambda}\{\theta_I \frac{S_{k(i)}}{[S_{k(i)}\theta_I + \sum_{k'} S_{k'}\theta_E]^{\alpha}} + \\ + \sum_{k'} \theta_E \frac{S_{k'}}{[S_{k'}\theta_I + S_{k(i)}\theta_E + \sum_{k''} S_{k''}\theta_E]^{\alpha}}\}^{\lambda} - \\ - R\left(S_{k(i)} + \sum_{k'} S_{k'}\right)^{\frac{\rho}{1-\rho}} - MS_i^{\frac{\mu}{1-\mu}} - \psi S_i \end{aligned} \tag{29}$$

with $\quad i \in S_{k(i)}; \quad j \in S_{k'}; \quad q \in S_{k''};$
$k = 1, \dots, k(i), \dots, N; \quad k' = \{k \mid k \neq k(i)\}; \quad k'' = \{k \mid k \neq k(i), k(j)\}$

The endogenous determination of size and number of cities requires the simultaneous solution of the problem (29) by all potential LPs. This process with perfect information can be thought of as a two-stage game in which: in the first stage, all potential LPs decide whether or not to form a city; in the second stage, those LPs who formed cities simultaneously choose the size of their own city, given number and size of all the others.[31] Therefore, the solution we are looking for has the characteristics of a SPNE[32] and can be found in the following way, that corresponds to the determination of the equilibrium by backward induction:

[31] Formally, the equilibrium is the solution of the game $\Gamma = [N, \{S_k\}, \{V_k(\cdot)\}]$ with N players (the planners), in which $k = 1, \dots, N$ and $S_k \in (1, W]$. Pure strategies consist in choosing S_k and the equilibrium in pure strategies is the set $\{S_k^*\}$, formed by the N values of S_k satisfying the following conditions $V_j(S_j^*, S_{k-j}) \geq V_j(S_j^{'}, S_{k-j})\ \forall j = 1, \dots, N$ and $\forall S_j^{'} \neq S_j^*$. With perfect information, it is intended here that city j has a perfect knowledge of its payoff for each combination (S_j, S_{k-j}).

[32] The solution should also be *trembling hand perfect*, since the objective function we calibrated is strictly concave.

1. Impose zero profit in all cities:

$$\left| V_{k(i)}^{LP}(\cdot) \right| = 0 \qquad \forall k = 1, \ldots, N \tag{30}$$

2. Derive the first order condition for LP $k(i)$:

$$\left| \frac{dV_{k(i)}^{LP}}{dS_{k(i)}} \right|_{\overline{S}_{k'}} = 0 \qquad with \quad k' = \{k \mid k \neq k(i)\} \tag{31}$$

3. Impose symmetry at level of cities in (30) and (31):

$$S_k = S \qquad \forall k = 1, \ldots, N \tag{32}$$

4. Solve the system (30) - (31) under symmetry.

The zero profit condition (30) means *free-entry* at city level. Namely, this is the condition for sub-game perfection: if N is given, since it is not profitable to create new cities, and if each planner is already maximising his own social welfare function, there are no cities interested in changing their size. Condition (31) guarantees maximisation[33] and represents the reaction function of the planner in city $k(i)$ to each $S_{k \neq k(i)}$, once N has been determined. Condition (32) directly follows from the symmetry in all the reaction functions, due to (15) and (16).

The system we calibrated is reported in figure 2; and the solution can be read in part (b).[34]

6 Agglomeration and TAS

The determination of the consequences of TA devolution in our system forms the basis of the following examination. Within this, we compare the size and number of cities obtained computing the CP's problem (24), that represent the first-best outcome, with the number and size that solve the system (30) - (31). As we shall see, in the latter case the system is characterised by a lower level of welfare. What we are interested in is whether this situation is associated with higher agglomeration levels, compared to the optimum; if yes, we also would like to know what is the relative change in terms of size and number of cities.

Table 1 reports the ratio of the decentralised to the centralised solution for the following variables: size of cities - i.e. within city variety - (S), total number of sites - i.e. overall variety - (W), number of cities (N), agglomeration index ($Aggl.$), per capita welfare (V_{pc}). The agglomeration index is calculated as S/N and V_{pc} is, in both cases, the ratio of the value function to the total number of sites.

[33] SOCs are fully satisfied, thanks to the concavity in S of (29).

[34] With regard to note (31), the calibration is intended to satisfy the existence of a subset $\{\overline{S}_k\} \in \{S_k\}$, nonempty, convex and compact (in $\Re^1$), such that: i) $V_k(\overline{S}_k)$ is continuous and quasiconcave; ii) $V_k = 0$ $\forall k$ (free-entry condition).

Beginning with the last column, the level of V_{pc} that the system is able to reach with a decentralised TA is, as expected, lower in respect to the optimum. The other columns help us in understanding the nature of this form of inefficiency. The economic activity is much more agglomerated than with a centralised authority (the agglomeration index is more than thirteen times those of first-best) and the over-agglomeration is characterised by a lower number of cities, whose size is too large respect to the optimum. Moreover, the economy as a whole is less developed under devolution, as can be argued looking at the total number of sites. In other terms, the overall variety tends to lower if it is managed by local authorities. This is due to the fact that they tend to augment the variety level in their own city, where it becomes excessive; this form of competition also provokes a welfare-reducing decrease in the number of cities. It has thus been shown that:

Proposition 3 Coeteris paribus*, and respect to the (first-best) centralised outcome, TA devolution results in: i) lower social welfare; ii) excessive agglomeration, characterised by a smaller number of cities, which also result to be over-sized (excessive within cities variety); iii) smaller number of sites in the economy (insufficient overall variety).*

To understand completely why the former result occurs, and, in particular, to grasp the causes of over-sizing, consider[35] an already developed system of cities, in which city $k(i)$ decides to increase the number of sites. The consequences of this unilateral decision can be analysed by observing equation (29). Initially, examine the effects of an increase in $S_{k(i)}$ on internal sites (sites located in $k(i)$). A first positive effect comes from the so called love of variety: a larger number of inputs is now available for the production of Y. The increase in the first term in curly brackets indicates an increase of the relative importance of home trade respect to external trade; this effect is amplified by the presence of technological externalities (λ). Conversely, a negative effect arises owing to the higher congestion costs the increase in $S_{k(i)}$ produces. If positive effects must more than compensate for negative ones, a city planner manifests the will to increase the number of sites. Let us go now to the effects of this choice on each other city, that can be read as the effect of a change in $S_{k'}$ on $V_{k(i)}^{LP}$. As before, a larger number of inputs is now available to produce Y; this is a good news for all sites and it causes an increase in external trade respect to internal trade. As before, technological externalities intervene in amplifying this positive effect and congestion costs (for the part of variety costs that does not depend on the choices of city planner $k(i)$) intervene in contrasting it. Pecuniary externalities arise due to the fact that city planner $k(i)$ does not take into consideration these latter effects on all the other localities, when it decides to form the city. However, if benefits dominate costs, the presence of positive externalities should lead to a system of under-sized cities. The reason of the over-agglomeration is that both the number and size of cities are free to change and endogenously determined:

[35]Though the following is not a rigorous explanation of Nash equilibrium, it can successfully accommodate the idea of over-sizing.

when city planner $k(i)$ realises that other cities are so small that its existence is no longer profitable, it is faced with two choices: to leave the system or to increase unilaterally the number of sites. Both these possibilities lead to an increase in the agglomeration around the system and, under symmetry, this process stops only when S is large enough to assure that no cities want to leave the system.

As a remark, note that the final outcome in terms of agglomeration directly mirrors the assumption concerning the structure of the market in which cities form. Our findings, derived under the hypothesis of an oligopolistic market for cities, diverge substantially from those obtained by other studies assuming perfect competition.[36] In particular, in contrast with Henderson and Becker [35, 36], our city size is not optimal when cities form through the action of LPs. This is due mainly to the fact that the oligopolistic structure of the market allows the presence of pecuniary externalities, so that each planner does not take into account the effect of his choices (about city formation and city size) on the others. This given, in the next section we show that the magnitude of over-agglomeration results to be positive correlated to the intensity of trade.

7 Trade, agglomeration and TAS

The following section deals with the study of how trade can affect the relationship on which we focused in the previous section. First of all, however, we have to spend some lines on the channel through which it manifests its influence on the agglomeration process.

As said in section 1, the literature on the spatial distribution of economic activities can collected in two main categories: theory of cities, and trade and location theory. It is generally agreed that the former focuses on purely internal (to cities) agglomeration forces, while the latter mainly addresses the role of the external dimension, which directly relies on trade. It would be our wish to stress the fact that this is a very delicate issue in a system of cities, where there are commercial relationships both within and between cities. In this case, neither the theory of cities nor the trade and location theory provides a satisfying theoretical basis for dealing with agglomeration. In particular, the very problem with the trade and localisation approach is that, without introducing some restrictions on parameters (such as the 'no black holes condition' in Fujita et al. [30]), there are no endogenous limits to concentration. Moreover, one need to assume (Puga [55]) a certain degree of spatial immobility, in order to obtain dispersion in correspondence of high levels of economic integration. Thus, though the relevance of trade in fostering agglomeration is evident, its role in determining dispersion relies only on the effect that an increasing concentration has on profits, through competition (the so called market crowding effect). In our model, we assume that each locality either derives some advan-

[36] Another attempt to provide "an alternative" to the perfect competitive market for cities is in Henderson and Thisse [38]. They demonstrate that, without perfect competition, a system of cities can still be obtained if developers behave strategically.

tage, or disadvantage, from the characteristics of others: if the number of goods available in a city increases, all the other cities with which it has commercial relationships can benefit from this. This is exactly what a reduction in external transport costs determines: it renders imported goods less expensive, a thing that no doubt represents an incentive against the attraction of new firms (provided that within city trade is not interested by the same tendency). This is the reason for which we place some emphasis on specifying whether transport costs are the cost to provide goods to other cities, or simply to other units located in the same city.[37]

These arguments are of some relevant importance for the relationship between trade and agglomeration in our model. To understand why, recall from section 2.2.2 that pecuniary externalities depends on the relative importance of internal and external trade, and note that, owing to the fact that commercial relationships can now play both the role of fostering agglomeration and that of fostering deglomeration (depending on variations of the ratio of external on internal transport costs), pecuniary externalities themselves can now be thought of to contain both elements working in favour of concentration and elements working against it, even in correspondence of very low external transport costs.

From this perspective, the model provides a probably interesting extension of Abdel-Rahman and Fujita [3]. Limiting the analysis to the commuting costs, they show that, both under the hypothesis of technological externalities and love of product variety (monopolistic competition model), the city size determined by the market is excessive in respect to the optimum (i.e. the size that would be chosen by a central authority). Their idea is here extended in the following direction: though we do not deal with the market solution, we show that, in the presence of trade among cities, the city size set by autonomous local planners is surely excessive in respect to the optimum.

In this context, an integration process is described by a decrease in external transport costs. To isolate its effect on the agglomeration process, we assume zero internal transport costs ($\tau = 0$) and solve the model, in correspondence of the whole range of external transport costs ($0 < \beta < 1$), both with fully centralised TA and with decentralised TA. Then, we contrast the two outcomes calculating the ratio of the latter on former solution. Our results are shown in figure 3, and the ratios for the three key cases of low, intermediate and high values of β are also reported in table 4. The following statement constitutes the main finding:

Proposition 4 Coeteris paribus*, a positive relationship between (spatial and economic) integration and inefficiency of TA devolution arises.*

Proposition 4, where the term 'inefficiency' refers to Proposition 3, says us that the lower the external transport costs (spatial integration), and the more intense the external trade (economic integration)[38], the higher is the level of

[37]Relevant 'food for thought', related to such a way of looking at trade, is provided by Ethier [26].

[38]Note that, owing to the fact that each site provides a certain type of intermediate good to

over-agglomeration (i.e. over-sized cities + too few cities) and the smaller is the total number of sites in the system, thus less social welfare is provided. The reason for Proposition 4 is clear: we are considering a system of 'open' cities. Mindful that in section 6 the principal reason for the over-agglomeration has been identified in the presence of pecuniary externalities, and mindful that these latter are positively related to commercial relationships among sites in different cities, it follows that the more integrated the economy, the higher are the external effects caused by city $k(i)$, on each other city, by increasing its size. At the limit, when the level of trade costs does not allow trade inter-city trade, this form of external effects vanishes and the solution tends to be optimal. This is evident looking (table 4) at the case in which $\tau = 0$ and $\beta = .986$, that is a system of autarchic cities. In this case the decentralised solution coincides with the centralised one and agglomeration is uniquely driven by technological externalities. This latter issue can be argued from the sensitivity analysis relative to λ: for $(\tau = 0, \beta = .986)$, the agglomeration level in the decentralised case rises from 4.7 up to 11 when λ goes from 1.5 to 1.8, and from 4.7 to 7.6 in the centralised case.

Moreover, note that the negative relation between concentration and transport costs that is usually found in location theory, is no longer true in this model; that is, it is found to apply when referring to the cost of within-city trade, but not when referring to external trade. In fact, arguing from the comparative static reported in tables 2 and 3[39], a fall in τ leads to higher levels of agglomeration, together with higher values of S, W, while the number of cities shrinks. A fall in external transport costs, instead, results in lower levels of agglomeration. In detail, it provokes an increase in both the number of cities and the total number of sites in the system, while city size follows a different path depending on the assumption on TAS: in the centralised case, a decrease in β results in a decrease in city size, while the reverse occurs under decentralisation. Note that this is the main reason for the divergence between the two agglomeration outcomes underlined in Proposition 4. Why this happens, can be understood by focusing on the way in which the two different types of planners regard the cost to carry goods around the system. The centralised planner perceives transport costs as a weight for the economy as a whole and reacts to a decrease in external transport costs, attempting to minimise their impact on each site. The best way to do this is to favour external trade, reducing city size and increasing the number of cities, so lowering the agglomeration level. LPs perceive only their own part of transport costs and react to a fall in trade costs trying to maximise welfare in their own city; the number of sites rises owing to the fact the reduction in transport costs also increases profits in each city. For the same reason, the number of cities increases as well, but in such a manner (more than city size) that the level of agglomeration decreases.

all the others, economic integration (i.e. the intensity of commercial relationships) is strictly reflected in the level of transport costs.

[39]For completeness, table 2 and 3 report the comparative static for all the other parameters, but a detailed analysis of them is beyond the scope of our investigation. Any detail, together with the sensitivity analysis, will be provided on request.

8 Conclusions

We have focused on the territorial structure of institutions in order to point out its relevance to a better understanding of the relationship between the process of socio-economic integration and the phenomenon of agglomeration. From a theoretical point of view, this paper represents an attempt to confront the spatial distribution of economic activities following a "scale approach". This way of thinking the local dimension is directly borrowed from sociology, where it represents an established approach to the notion of space. The core concept lies in a question posed by Lefebvre [48], wherein the 'tension between global integration and territorial redifferentiation results in a "generalised explosion of spaces" in which the relations among all geographical scales are continuously rearranged and reterritorialised' (Brenner [17]). Among the numerous inputs that such an interpretation of the s.c. globalisation offers to economic theory, we have focused on the fact *economic change impacts on space, creating new institutional challenges* (Herrschel and Newman [39]). According to this thesis, a process of 'rescaling' the arrangement of the state would be associated to globalisation; including changing boundaries of governing institutions, shifting territoriality in governance, and changing responsibility between established and newly emerging government levels. There is no unanimous consensus as to the desirability of such a process. The s.c. 'New Regionalism', for example, stating 'that the "national economy" is spatially differentiated and that local economic regions are the crucial units for focusing analysis and policy' (Barnes and Ledebur [14]), asserts that having the 'right institutions' creates economic advantages. On the other hand, Brenner [18] notes that 'responses to changing economic geographies and sociospatial characteristics appear to favour a shift away from centralised structures towards multicentric power structures'; furthermore, Herrschel and Newman [39] note that such a rescaling process risks to determine 'a loss in coherence and efficacy of policies and governance, with a growing danger of competition between a multitude of institutions'.

The model proposed here provides an analytical basis for dealing with the various spheres involved in such a process, using the notion of 'scale' to merge this theoretical background with that typical of economic analysis.

As already noted, the sociological notion of space refers to an intricate set of physical and social spheres and to the complexity in which they intertwine. According to this definition, an integration process no doubt *impacts on space*. The evaluation of the economic aspects of this impact requires, however, a definition of space that is suitable for modelling. This poses a problem of scale from at least two points of view: the territorial dimension (urban space), and the political-institutional dimension (supraurban space).

To cope with this problem, we moved in a multidimensional space whose dimension is determined by the number of individuals; in this context, transport costs fully approximate physical distance and an integration process is defined as a progressive fall in transport costs. We then circumscribed the analysis to a system of cities, in which trade occurs both within cities (internal trade) and between cities (external trade), and the volume of trade is a direct function of transport costs, hence an integration process is always also a process of economic integration. Finally, in order to take the supraurban space into consideration, we introduced the notion of TAS, which in general refers to the tier at which the spatial policy is set.

Thus, the economic debates to which this paper may contribute are those concerning: i) the relationship between integration and agglomeration; ii) optimal city size.

Concerning the former, one of the main messages provided by the literature is the identification of the now famous negative relationship between transport costs and agglomeration, which relies broadly on external centripetal forces related to trade. However, this literature largely neglects the second debate, that on the optimal agglomeration level, an issue which, on the contrary, is widely addressed by the literature on city size, which, conversely, may be said to neglect the role of commercial exchanges in determining the convenience in shaping the geography of activities.

In this paper, we merged these aspects, looking at the optimality of the agglomeration level, in a system of trading cities, associated to two extreme cases of TAS, and investigating the effects, on the agglomeration, of (spatial and economic) integration.

We found that the risks highlighted, among others, by Brenner [18] and Herrschel and Newman [39] seem to be not groundless. In particular, we show that a TAS characterised by a high level of devolution (i.e. a rescaling of the arrangement of the state towards subnational tiers of government) leads to sub-optimal agglomeration levels: fewer cities, which also results in them being over-sized and having a lower level of economic development together with a lower level of individual welfare (Proposition 3).

With respect to the integration process, we obtained that, if the level of commercial exchanges can be thought of as directly mirroring the degree of transport costs (spatial integration), the integration level (thus, the amount of trade) can be shown to be principally responsible for the above result (Proposition 4). This suggests that the role played by the territorial structure of the institutions in shaping the spatial distribution of economic activities grows alongside the process of socio-economic integration.

A further result is that the negative relationship between agglomeration and transport costs is no longer of consequence when we assume the presence of an authority involved in spatial policy. In our model, a fall in transport costs is associated, in equilibrium, and in both the cases analysed, to a decrease in agglomeration.

A way to reconcile our findings with existing theory on agglomeration and integration is to consider that, if we accept the idea that more integration is associated with more concentration in certain localities, we also have to accept the idea that giving more power to those localities may lead to further agglomeration, promoting the position of the already developed centres and determining a progressive loss of importance of the smaller or less developed areas (i.e. the periphery).

According to this, a row test for our results probably lies in the empirical findings on the relationship between transport costs and concentration in the EU and the USA[40]. A further and more interesting investigation, suggested by this work could examine the concentration of cities in countries characterised by different histories of devolution (i.e. by a different TAS). We have already tried to do this for Germany and the United Kingdom, which represent two extreme examples of countries with a long tradition of, respectively, federalist and centralised arrangements of state. On the basis of the administrative boundaries, Germany seems to demonstrate a higher degree of agglomeration, with people concentrated in fewer and larger centres, and a regional structure that broadly approaches, unlike England, the idea of the monocentric city region. Further insights into this point are presented in a recent paper by Rodríiguez-Pose and Bwire [59], which analyse the "historical trajectory of devolution" in six countries, in order to study its role in explaining cross-regional differences in growth patterns within each country.

From a theoretical point of view, at least three problems remain to be addressed.

First, our model describes devolution as an oligopolistic market of cities. However, this can be the case if, and only if, in the relationship between a certain tier of government and the tiers that follow in the hierarchy (e.g. state/regions, or region/cities), the number of these latter does not justify the assumption of a perfect competitive market. While providing an alternative to the theoretical apparatus of Henderson and Becker [35, 36], this is an aspect that has to be kept in mind when considering the policy implications of the model: under perfect competition, Henderson and Becker [35, 36] show that city size is still optimal if cities are formed by developers (i.e. local planners).

Second, the idea that a more decentralised spatial policy is associated with less efficient outcomes in terms of agglomeration represents a clash with other inefficiencies brought about by centralisation. However, this critique does not intrude here, since our model does not offer any general rule, aiming instead to consider only one of the aspects, of one of the types, of decentralisation.

Finally, the assumption of symmetry is surely the most relevant weakness of the model. Though it could be thought not to influence our main findings, it would be worthwhile extending the message about integration and agglomeration in a system of differently sized (or simply different) cities. We are aware of the arguments against the assumption of a representative city (Richardson [57]), and we agree, for example, with Capello and Camagni [19] that the notion of "efficiency" in city size should first of all refer to its relationships with the rest of the system - notably the core of the sociological notion of space, from which we started here. However, it is difficult to deal simultaneously with so many

[40]The idea relies on the fact that the EU's authority is faced with two goals: on the one hand, it is called to favour economic integration, on the other hand, it has to fight poverty and to promote economic development. If the positive relationship between integration and agglomeration and is valid, one of the main effects of the European Spatial Policy, which aims at foster the process of spatial and economic integration, is to advance the concentration of activities in certain areas, and its principal negative effect is therefore a progressive impoverishment of peripheral regions. Thus, the authority is called on to implement actions to counteract the main effect of its policy, thus preventing agglomeration and/or over-agglomeration to occur.

disparate elements if you want to recognise the effect of each element in the eventual outcome. Perhaps consideration of the insights of Tabuchi et al. [71], or of a hierarchical structure (Fujita et al. [29]) may offer a desirable extension to this thinking.

Appendix A. Derivation of proposition 1

Let v_s^{CP} and v_{ns}^{CP} be the CP value function in the two cases of symmetric and non-symmetric city size, with S^* and S_k^* the respective optimal city size $(k = 1, \ldots, N)$. Indicating by V_k^{CP} the CP value function concerning city k, we have:

$$v_s^{CP} = NV^{CP}(S^*) \qquad v_{ns}^{CP} = \sum_{k=1}^{N} V_k^{CP}(S_k^*) \tag{33}$$

The condition under which the former solution always dominates the latter is $v_s^{CP} > v_{ns}^{CP}$ $\forall k = 1, \ldots, N$. Dividing both sides by N, this condition can be written as:

$$\frac{v_s^{CP}}{N} \quad > \quad \frac{\sum_{k=1}^{N} V_k^{CP}(S_k^*)}{N} \tag{34}$$

Thanks to the concavity of $V^{CP}(\cdot)$, equation (34) is always true within the interval $S^* \in (1, W]$, while it is not satisfied when $S_k = W$, i.e. complete agglomeration, and $S_k = 0$ $(N = W)$, i.e. complete dispersion; hence proposition 1 and the assumption that $S^* \in (1, W]$ throughout the analysis.

References

[1] H.M. Abdel-Rahman, Product differentiation, monopolistic competition and city size, Regional Science and Urban Economics 18 (1988) 69-86.

[2] H.M. Abdel-Rahman, When do cities specialize in production?, Regional Science and Urban Economics 26 (1996) 1-22.

[3] H.M. Abdel-Rahman, M. Fujita, Product variety, Marshallian externalities, and city sizes, Journal of Regional Science 30 (1990) 165-83.

[4] A. Alesina, The Size of Countries: does it matter?, Journal of the European Economic Association, Schumpeter Lecture (2003) 301-316.

[5] A. Alesina, R. Baqir, C. Hoxby, Political Jurisdictions in Heterogeneous Communities, Journal of Political Economy forthcoming (2004).

[6] A. Alesina, E. Spolaore, On the Number and Size of Nations, Quarterly Journal of Economics 112(4) (1997) 1027-56.

[7] A. Alesina, E. Spolaore, The Size of Nations, MIT Press, Cambridge MA, 2003.

[8] A. Alesina, E. Spolaore, R. Wacziarg, Economic Integration and Political Disintegration, American Economic Review 90 (2000) 1276-1296. Also published in: R. Pornfret, Economic Analysis of Regional Trading Agreements, Edward Elgar, UK, 2003.

[9] A: Alesina, R. Wacziarg, Openness, Country Size and the Government, Journal of Public Economics 69 (1998) 305-322.

[10] A. Anas, R. Arnott, K.A. Small, Urban spatial structure, Journal of Economic Literature 36(3) (1998) 1426-1464.

[11] A. Anas, K. Xiong, Intercity trade and the industrial diversification of cities, Journal of Urban Economics 54 (2003) 258-276.

[12] G. Arbia, The Empirical Analysis of Spatial Concentration, G. D'Annunzio University of Pescara DMQTE Quaderni di statistica 1 (1998).

[13] R. Arnott, J. Stiglitz, Aggregate land rent, expenditure on public goods, and optimal city size, Quarterly Journal of Economics 93 (1979) 471-500.

[14] W.R. Barnes, L.C. Ledebur, The New Regional Economics, Sage, London 1997.

[15] M. Brülhart, Evolving Geographical Concentration of European Manufacturing Industries, Weltwirtschaftliches Archiv 137 (2001).

[16] M. Brülhart, R. Traeger An Account of Geographic Concentration Patterns in Europe, *mimeo* (2002).

[17] N. Brenner, The urban question as a scale question: reflections on Henri Lefebvre, urban theory and the politics of scale, International Journal of Urban and Regional Research, 24(2) (2000) 361-378.

[18] N. Brenner, Decoding the newest "metropolitan regionalism" in the USA: a critical overview, Cities 19(1) (2002) 3-21.

[19] R. Capello, R. Camagni, Beyond Optimal City Size: An Evaluation of Alternative Urban Growth Patterns, Urban Studies 37(9) (2000) 1479-1496.

[20] J.S. Chipman, External Economies of Scale and Competitive Equilibrium, Quarterly Journal of Economics LXXXIV 3 (1970).

[21] A. Ciccone, Agglomeration Effects in Europe, European Economic Review 46 (2002) 213-227.

[22] A. Ciccone, R. Hall, Productivity and the Density of Economic Activity, The American Economic Review 86(1) (1996) 54-70.

[23] K. Davey, Urban Management. The Challenge of Growth, Avebury (1996).

[24] A.K. Dixit, J.E. Stiglitz, Monopolistic competition and optimum product diversity, American Economic Review 67 (1977) 297-308.

[25] M. Dunford, G. Kafkalas (Eds.), Cities and regions in the New Europe, Belhaven Press, London, 1992.

[26] W.J. Ethier, National and International Returns to Scale in the Modern Theory of International Trade, The American Economic Review 72(3) (1982) 389-405.

[27] F. Flatters, V. Henderson, Mieszkowsi P., Public goods, efficiency, and regional fiscal equalization, Journal of Public Economics 3 (1974) 99-112.

[28] M. Fujita, A monopolistic competition model of spatial agglomeration, Regional Science and Urban Economics 18 (1988) 87-124.

[29] M. Fujita, P. Krugman, T. Mori, On the evolution of hierarchical urban systems, European Economic Review 43(2) (1999) 209-251.

[30] M. Fujita, P. Krugman, A.J. Venables, The Spatial Economy, MIT Press, Cambridge, MA, 1999.

[31] M. Fujita, J.F. Thisse, Economics of Agglomeration, Cambridge University Press, 2002.

[32] B. Giordano, E. Roller, A Comparison of City Region Dynamics in the UK, Spain and Italy: More Similarities than Differences?, Regional Studies 37(9) (2003) 911-927.

[33] M. Hallet, Regional Specialisation and Concentration in the EU, European Commission Directorate-General for Economic and Financial Affairs Economic Papers 141 (2000).

[34] V. Henderson, The Size and Type of Cities, The American Economic Review LXIV 4 (1974) 640-656.

[35] V. Henderson, R. Becker, Intra-industry specialization and Urban Development, in: J.M. Huriot, J.F. Thisse (Eds.), Economics of Cities, Cambridge University Press, 2000, pp. 138-166.

[36] V. Henderson, R. Becker, Political Economy of City Sizes and Formation, Journal of Urban Economics 48 (2000) 453-484.

[37] V. Henderson, A. Mitra, The new urban landscape: Developers and edge cities, Regional Science and Urban Economics 26 (1996) 613-643.

[38] V. Henderson, J.F. Thisse, On Strategic Community Development, Journal of Political Economy 109(3) (2001) 546-569.

[39] T. Herrshel, P. Newman, Governance of Europe's city regions. Planning, policy and politics, Routledge, London, 2002.

[40] R.W. Hesley, W.C. Strange, Matching and agglomeration economies in a system of cities, Regional Science and Urban Economics 20 (1990) 189-212.

[41] R.W. Hesley, W.C. Strange, Limited developers, Canadian Journal of Economics 30 (1997) 329-348.

[42] B. Jassop, Globalization and its (il)logic(s), in: K. Olds (Ed.), Globalization and the Asia-Pacific, Routledge, London, 1998.

[43] S. Kim, Expansion of markets and the geographic distribution of economic activities: the trends in US regional manufacturing structure, 1860-1987, The Quarterly Journal of Economics 110 (1995) 881-908.

[44] K.H.M. Knarvik, H.G. Overman, S.J. Redding, A.J. Venables, The Location of European Industry, Economic Papers 142, European Commission, Directorate-General for Economic and Financial Affairs (2000).

[45] P. Krugman, Increasing Returns and Economic Geography, Journal of Political Economy, 99 (1991) 483-499.

[46] P. Krugman, A.J. Venables, Globalisation and the inequality of nations, The Quarterly Journal of Economics CX 4 (1995).

[47] H. Lefebvre, De l'État: de Hegel à Marx par Stalin, Vol. 2, Union Générale d'Éditions, Paris, 1976.

[48] H. Lefebvre, Space: social product and use value, in: J.W. Frieberg (Ed.), Critical Sociology: European Perspectives, Irvington Publishers, New York, 1979.

[49] A. Marshall, Principles of economics, London, Macmillan, 1890.

[50] E.S. Mills, An Aggregative Model of Resources Allocation in a Metropolitan Area, The American Economic Review Proc. 57 (1967) 197-210.

[51] R. Moomaw, Productivity and City Size: A Critique of the Evidence, Quarterly Journal of Economics 96(4) (1981) 675-688.

[52] G. Ottaviano, T. Tabuchi, J.F. Thisse, Agglomeration and Trade Revisited, International Economic Review 43(2) (2002) 409-435.

[53] G. Ottaviano, J.F. Thisse, On Economic Geography in economic Theory: increasing returns and pecuniary externalities, Journal of Economic Geography 1(2) (2001) 153-179.

[54] J. Peck, A. Tickell, Searching for a new institutional fix: the after-fordist crisis and the global-local disorder, in: A. Amin (Ed.), Post-Fordism: a reader, Blackwell, Cambridge, 1994.

[55] D. Puga, The rise and fall of regional inequalities, European Economic Review 43 (1999) 303-334.

[56] F. Pyke, B. Becattini, W. Sengenberger (Eds.), Industrial Districts and Inter-firm Cooperation in Italy, International Institute for Labour Studies, Geneva, 1990.

[57] H.W. Richardson, Optimality in city size, systems of cities, and urban policy: a sceptic's view, Urban Studies 9 (1972) 29-48.

[58] F.L. Rivera-Batiz, Increasing returns, monopolistic competition, and agglomeration economies in consumption and production, Regional Science and Urban Economics 18 (1988) 125-153.

[59] A. Rodríguez-Pose, A. Bwire, The economic (in)efficiency of devolution, Research Papers in Environmental and Spatial Analysis, LSE Department of Geography and Environment 86 (2003).

[60] P.A. Samuelson, The transfer problem and transport costs: The terms of trade when the impediment are absent, Economic Journal 62 (1952) 278-304.

[61] T. Scitovsky, Two concepts of external economies, Journal of Political Economy 62 (1954) 143-151.

[62] D. Segal, Are there returns to scale in City Size?, Review of Economics and Statistics 58(3) (1976) 339-350.

[63] E. Sheshinski, Congestion and the Optimum City Size, The American Economic Review 63(2) (1973) 61-66.

[64] M. Spence, Product selection, fixed costs, and monopolistic competition, Review of Economic Studies 43 (1976) 217-35.

[65] D. Starrett, Market allocations of location choice in a model with free mobility, Journal of Economic Theory 17 (1978) 21-37.

[66] J.E. Stiglitz, The theory of local public goods, in: M.S. Feldstein, R.P. Inman (Eds.), The economics of Public Services, Macmillan, London, 1977, pp. 273-334.

[67] J.E. Stiglitz, Public goods in open economies with heterogeneous individuals, in: J.F. Thisse, H.G. Zoller (Eds.), Locational analysis of public facilities, Amsterdam, North-Holland, 1983, pp. 55-78.

[68] J.E. Stiglitz, The theory of local public goods twenty-five years after Tiebout: a perspective, in: G.R. Zodrov (Ed.), Local provision of public services: the Tiebout model after twenty-five years, New York, Academic Press, 1983, pp. 17-54.

[69] E. Swyngedouw, The Mammon quest: "glocalisation", interspatial competition and the monetary order: the construction of new scales, in: M. Dunford, G. Kafkalas (Eds.), Cities and regions in the New Europe, Belhaven Press, London, 1992.

[70] E. Swyngedouw, Neither global nor local: "glocalization" and the politics of scale, in: K. Cox (Ed.), Space of globalization, Guilford Press, New York, 1997.

[71] T. Tabuchi, J.F. Thisse, D. Zeng, On the Number and Size of Cities, CEPR Discussion Papers 3386 (2002).

[72] A. Venables, Equilibrium Locations of Vertically Linked Industries, International Economic Review 37(2) (1996) 341-359.

[73] W. Vickrey, The city as a firm, in: M.S. Feldstein, R.P. Inman (Eds.), The Economics of Public Services, Macmillian, London, 1977.

[74] D.E. Wildasin, Theoretical analysis of local public economics, Handbook of Regional and Urban Economics, E.S. Mills (Ed.), Elsevier Science Publishers B.V. II, 1987.

FIGURE 1: CENTRAL PLANNER'S PROBLEM: (*EQUATION 24*).

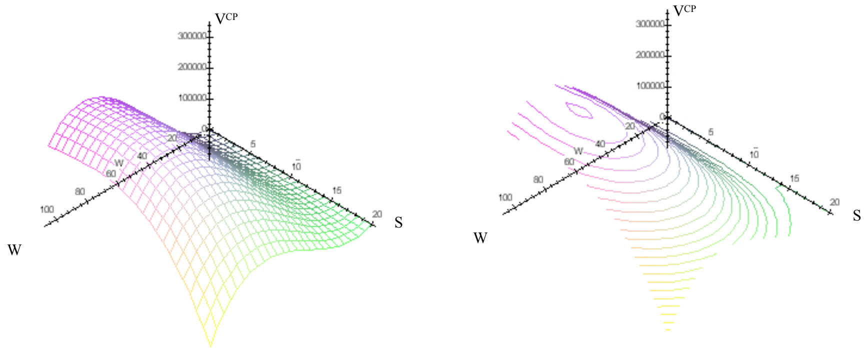

FIGURE 2: LOCAL PLANNER'S PROBLEM.
FIG. 2.A. SYSTEM (30-32): FREE-ENTRY CONDITION (CLOSE-MESH) AND FIRST ORDER CONDITION (WIDE-MESH).
FIG. 2.B. SYSTEM SOLUTION: FREE-ENTRY CONDITION (THIN LINE) AND FIRST ORDER CONDITION (THICK LINE).

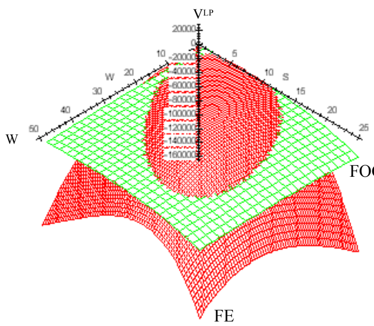

FIG. 2.A

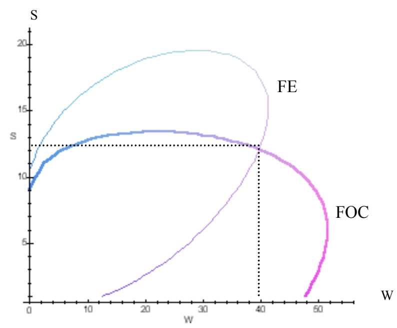

FIG. 2.B

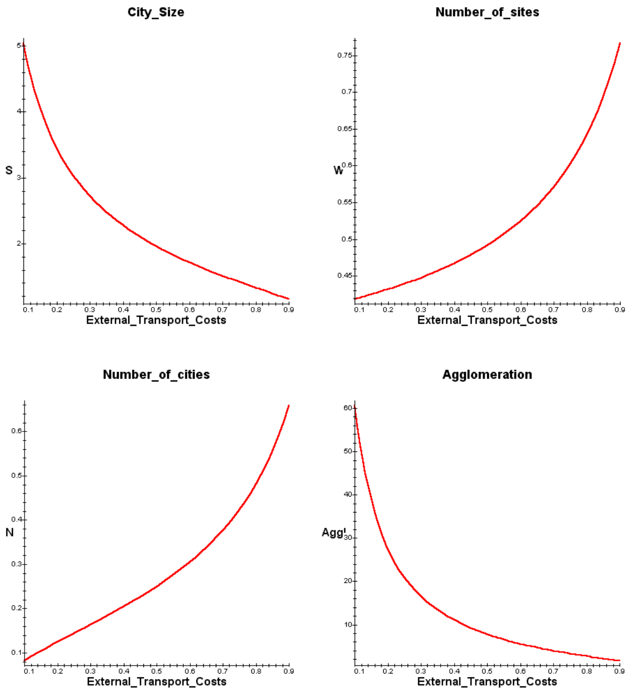

FIGURE 3: *PROPOSITION 4*: RELATIONSHIP BETWEEN INTEGRATION AND (IN)EFFICIENCY OF TA DEVOLUTION.

Table 1. Centralisation versus TA devolution.

S	***W***	***N***	***Aggl.***	***V*** (per capite)
2.5	0.47	0.19	13.16	0.88

Ratio of the decentralised to the centralised solution
for: τ=.4; β=.6; α=.4; λ=1.5; ψ= .5; μ=.8; ρ=.75.

Table 2. Integration and TA devolution.

	S	***W***	***N***	***Aggl.***
τ=0, β=.1	5.04	0.42	0.08	60.58
τ=0, β=.5	1.97	0.49	0.25	7.85
τ=0, β=.986	0.99	0.99	1.00	1.00

Ratio of the decentralised to the centralised solution.

Table 3. Central Planner's solution. Comparative statics.

	S	***W***	***N***	***Aggl.***
τ	-	-	+	-
β	**+**	-	-	+
α	-	-	-	**+**
λ	+	+	+	+
ψ	**+**	-	-	**+**
μ	-	-	+	-
ρ	**+**	-	-	**+**

Starting points (centralised equilibrium): W=83; S=4; N=16;
Y= 927.491.

Table 4. Local Planners' solution. Comparative statics.

	S	***W***	***N***	***Aggl.***
τ	-	-	+	-
β	**-**	-	-	+
α	-	-	-	**-**
λ	+	+	+	+
ψ	**-**	-	-	**-**
μ	-	-	+	-
ρ	**-**	-	-	**-**

Starting points (decentralised equilibrium): W=39; S=12;
N=3; Y= 242.280.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

http://www.feem.it/Feem/Pub/Publications/WPapers/default.html

http://www.ssrn.com/link/feem.html

NOTE DI LAVORO PUBLISHED IN 2003

PRIV	1.2003	*Gabriella CHIESA and Giovanna NICODANO*: Privatization and Financial Market Development: Theoretical Issues
PRIV	2.2003	*Ibolya SCHINDELE*: Theory of Privatization in Eastern Europe: Literature Review
PRIV	3.2003	*Wietze LISE, Claudia KEMFERT and Richard S.J. TOL*: Strategic Action in the Liberalised German Electricity Market
CLIM	4.2003	*Laura MARSILIANI and Thomas I. RENSTRÖM*: Environmental Policy and Capital Movements: The Role of Government Commitment
KNOW	5.2003	*Reyer GERLAGH*: Induced Technological Change under Technological Competition
ETA	6.2003	*Efrem CASTELNUOVO*: Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model
SIEV	7.2003	*Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI:* The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers
NRM	8.2003	*Elissaios PAPYRAKIS and Reyer GERLAGH*: Natural Resources: A Blessing or a Curse?
CLIM	9.2003	*A. CAPARRÓS, J.-C. PEREAU and T. TAZDAÏT*: North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information
KNOW	10.2003	*Giorgio BRUNELLO and Daniele CHECCHI*: School Quality and Family Background in Italy
CLIM	11.2003	*Efrem CASTELNUOVO and Marzio GALEOTTI*: Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis
KNOW	12.2003	*Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.)*: Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art
KNOW	13.2003	*Carole MAIGNAN, Gianmarco OTTAVIANO, Dino PINELLI and Francesco RULLANI* (lix): Bio-Ecological Diversity vs. Socio-Economic Diversity. A Comparison of Existing Measures
KNOW	14.2003	*Maddy JANSSENS and Chris STEYAERT* (lix): Theories of Diversity within Organisation Studies: Debates and Future Trajectories
KNOW	15.2003	*Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP* (lix): Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Economic Life
KNOW	16.2003	*Alexandra BITUSIKOVA* (lix): Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia
KNOW	17.2003	*Billy E. VAUGHN and Katarina MLEKOV* (lix): A Stage Model of Developing an Inclusive Community
KNOW	18.2003	*Selma van LONDEN and Arie de RUIJTER* (lix): Managing Diversity in a Glocalizing World
Coalition Theory Network	19.2003	*Sergio CURRARINI:* On the Stability of Hierarchies in Games with Externalities
PRIV	20.2003	*Giacomo CALZOLARI and Alessandro PAVAN* (lx): Monopoly with Resale
PRIV	21.2003	*Claudio MEZZETTI* (lx): Auction Design with Interdependent Valuations: The Generalized Revelation Principle, Efficiency, Full Surplus Extraction and Information Acquisition
PRIV	22.2003	*Marco LiCalzi and Alessandro PAVAN* (lx): Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions
PRIV	23.2003	*David ETTINGER* (lx): Bidding among Friends and Enemies
PRIV	24.2003	*Hannu VARTIAINEN* (lx): Auction Design without Commitment
PRIV	25.2003	*Matti KELOHARJU, Kjell G. NYBORG and Kristian RYDQVIST* (lx): Strategic Behavior and Underpricing in Uniform Price Auctions: Evidence from Finnish Treasury Auctions
PRIV	26.2003	*Christine A. PARLOUR and Uday RAJAN* (lx): Rationing in IPOs
PRIV	27.2003	*Kjell G. NYBORG and Ilya A. STREBULAEV* (lx): Multiple Unit Auctions and Short Squeezes
PRIV	28.2003	*Anders LUNANDER and Jan-Eric NILSSON* (lx): Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts
PRIV	29.2003	*TangaMcDANIEL and Karsten NEUHOFF* (lx): Use of Long-term Auctions for Network Investment
PRIV	30.2003	*Emiel MAASLAND and Sander ONDERSTAL* (lx): Auctions with Financial Externalities
ETA	31.2003	*Michael FINUS and Bianca RUNDSHAGEN:* A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games
KNOW	32.2003	*Michele MORETTO*: Competition and Irreversible Investments under Uncertainty
PRIV	33.2003	*Philippe QUIRION:* Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?
KNOW	34.2003	*Giuseppe MEDA, Claudio PIGA and Donald SIEGEL*: On the Relationship between R&D and Productivity: A Treatment Effect Analysis
ETA	35.2003	*Alessandra DEL BOCA, Marzio GALEOTTI and Paola ROTA:* Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation

GG	36.2003	*Matthieu GLACHANT*: Voluntary Agreements under Endogenous Legislative Threats
PRIV	37.2003	*Narjess BOUBAKRI, Jean-Claude COSSET and Omrane GUEDHAMI*: Postprivatization Corporate Governance: the Role of Ownership Structure and Investor Protection
CLIM	38.2003	*Rolf GOLOMBEK and Michael HOEL*: Climate Policy under Technology Spillovers
KNOW	39.2003	*Slim BEN YOUSSEF*: Transboundary Pollution, R&D Spillovers and International Trade
CTN	40.2003	*Carlo CARRARO and Carmen MARCHIORI*: Endogenous Strategic Issue Linkage in International Negotiations
KNOW	41.2003	*Sonia OREFFICE*: Abortion and Female Power in the Household: Evidence from Labor Supply
KNOW	42.2003	*Timo GOESCHL and Timothy SWANSON*: On Biology and Technology: The Economics of Managing Biotechnologies
ETA	43.2003	*Giorgio BUSETTI and Matteo MANERA*: STAR-GARCH Models for Stock Market Interactions in the Pacific Basin Region, Japan and US
CLIM	44.2003	*Katrin MILLOCK and Céline NAUGES*: The French Tax on Air Pollution: Some Preliminary Results on its Effectiveness
PRIV	45.2003	*Bernardo BORTOLOTTI and Paolo PINOTTI*: The Political Economy of Privatization
SIEV	46.2003	*Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH*: Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods
ETA	47.2003	*Jens HORBACH*: Employment and Innovations in the Environmental Sector: Determinants and Econometrical Results for Germany
CLIM	48.2003	*Lori SNYDER, Nolan MILLER and Robert STAVINS:* The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing
CLIM	49.2003	*Lori SNYDER, Robert STAVINS and Alexander F. WAGNER*: Private Options to Use Public Goods. Exploiting Revealed Preferences to Estimate Environmental Benefits
CTN	50.2003	*László Á. KÓCZY and Luc LAUWERS* (lxi): The Minimal Dominant Set is a Non-Empty Core-Extension
CTN	51.2003	*Matthew O. JACKSON* (lxi)*:*Allocation Rules for Network Games
CTN	52.2003	*Ana MAULEON and Vincent VANNETELBOSCH* (lxi): Farsightedness and Cautiousness in Coalition Formation
CTN	53.2003	*Fernando VEGA-REDONDO* (lxi): Building Up Social Capital in a Changing World: a network approach
CTN	54.2003	*Matthew HAAG and Roger LAGUNOFF* (lxi): On the Size and Structure of Group Cooperation
CTN	55.2003	*Taiji FURUSAWA and Hideo KONISHI* (lxi): Free Trade Networks
CTN	56.2003	*Halis Murat YILDIZ* (lxi): National Versus International Mergers and Trade Liberalization
CTN	57.2003	*Santiago RUBIO and Alistair ULPH* (lxi): An Infinite-Horizon Model of Dynamic Membership of International Environmental Agreements
KNOW	58.2003	*Carole MAIGNAN, Dino PINELLI and Gianmarco I.P. OTTAVIANO*: ICT, Clusters and Regional Cohesion: A Summary of Theoretical and Empirical Research
KNOW	59.2003	*Giorgio BELLETTINI and Gianmarco I.P. OTTAVIANO:* Special Interests and Technological Change
ETA	60.2003	*Ronnie SCHÖB:* The Double Dividend Hypothesis of Environmental Taxes: A Survey
CLIM	61.2003	*Michael FINUS, Ekko van IERLAND and Robert DELLINK*: Stability of Climate Coalitions in a Cartel Formation Game
GG	62.2003	*Michael FINUS and Bianca RUNDSHAGEN*: How the Rules of Coalition Formation Affect Stability of International Environmental Agreements
SIEV	63.2003	*Alberto PETRUCCI:* Taxing Land Rent in an Open Economy
CLIM	64.2003	*Joseph E. ALDY, Scott BARRETT and Robert N. STAVINS*: Thirteen Plus One: A Comparison of Global Climate Policy Architectures
SIEV	65.2003	*Edi DEFRANCESCO*: The Beginning of Organic Fish Farming in Italy
SIEV	66.2003	*Klaus CONRAD*: Price Competition and Product Differentiation when Consumers Care for the Environment
SIEV	67.2003	*Paulo A.L.D. NUNES, Luca ROSSETTO, Arianne DE BLAEIJ*: Monetary Value Assessment of Clam Fishing Management Practices in the Venice Lagoon: Results from a Stated Choice Exercise
CLIM	68.2003	*ZhongXiang ZHANG:* Open Trade with the U.S. Without Compromising Canada's Ability to Comply with its Kyoto Target
KNOW	69.2003	*David FRANTZ* (lix): Lorenzo Market between Diversity and Mutation
KNOW	70.2003	*Ercole SORI* (lix): Mapping Diversity in Social History
KNOW	71.2003	*Ljiljana DERU SIMIC* (lxii): What is Specific about Art/Cultural Projects?
KNOW	72.2003	*Natalya V. TARANOVA* (lxii):The Role of the City in Fostering Intergroup Communication in a Multicultural Environment: Saint-Petersburg's Case
KNOW	73.2003	*Kristine CRANE* (lxii)*:* The City as an Arena for the Expression of Multiple Identities in the Age of Globalisation and Migration
KNOW	74.2003	*Kazuma MATOBA* (lxii): Glocal Dialogue- Transformation through Transcultural Communication
KNOW	75.2003	*Catarina REIS OLIVEIRA* (lxii): Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal
KNOW	76.2003	*Sandra WALLMAN* (lxii): The Diversity of Diversity - towards a typology of urban systems
KNOW	77.2003	*Richard PEARCE* (lxii): A Biologist's View of Individual Cultural Identity for the Study of Cities
KNOW	78.2003	*Vincent MERK* (lxii): Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas
KNOW	79.2003	*Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P.OTTAVIANO*: Child Labor and Resistance to Change
ETA	80.2003	*Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA*: Investment Size and Firm's Value under Profit Sharing Regulation

IEM	81.2003	*Alessandro LANZA, Matteo MANERA and Massimo GIOVANNINI:* Oil and Product Dynamics in International Petroleum Markets
CLIM	82.2003	*Y. Hossein FARZIN and Jinhua ZHAO*: Pollution Abatement Investment When Firms Lobby Against Environmental Regulation
CLIM	83.2003	*Giuseppe DI VITA*: Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?
CLIM	84.2003	*Reyer GERLAGH and Wietze LISE*: Induced Technological Change Under Carbon Taxes
NRM	85.2003	*Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU*: How Fast are the Tourism Countries Growing? The cross-country evidence
KNOW	86.2003	*Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI:* The ICT Revolution: opportunities and risks for the Mezzogiorno
SIEV	87.2003	*Lucas BRETSCGHER and Sjak SMULDERS:* Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments
CLIM	88.2003	*Johan EYCKMANS and Michael FINUS:* New Roads to International Environmental Agreements: The Case of Global Warming
CLIM	89.2003	*Marzio GALEOTTI:* Economic Development and Environmental Protection
CLIM	90.2003	*Marzio GALEOTTI*: Environment and Economic Growth: Is Technical Change the Key to Decoupling?
CLIM	91.2003	*Marzio GALEOTTI and Barbara BUCHNER*: Climate Policy and Economic Growth in Developing Countries
IEM	92.2003	*A. MARKANDYA, A. GOLUB and E. STRUKOVA*: The Influence of Climate Change Considerations on Energy Policy: The Case of Russia
ETA	93.2003	*Andrea BELTRATTI*: Socially Responsible Investment in General Equilibrium
CTN	94.2003	*Parkash CHANDER*: The γ-Core and Coalition Formation
IEM	95.2003	*Matteo MANERA and Angelo MARZULLO*: Modelling the Load Curve of Aggregate Electricity Consumption Using Principal Components
IEM	96.2003	*Alessandro LANZA, Matteo MANERA, Margherita GRASSO and Massimo GIOVANNINI:* Long-run Models of Oil Stock Prices
CTN	97.2003	*Steven J. BRAMS, Michael A. JONES, and D. Marc KILGOUR:* Forming Stable Coalitions: The Process Matters
KNOW	98.2003	*John CROWLEY, Marie-Cecile NAVES* (lxiii): Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities
KNOW	99.2003	*Richard THOMPSON FORD* (lxiii*)*: Cultural Rights and Civic Virtue
KNOW	100.2003	*Alaknanda PATEL* (lxiii): Cultural Diversity and Conflict in Multicultural Cities
KNOW	101.2003	*David MAY* (lxiii): The Struggle of Becoming Established in a Deprived Inner-City Neighbourhood
KNOW	102.2003	*Sébastien ARCAND, Danielle JUTEAU, Sirma BILGE, and Francine LEMIRE* (lxiii) : Municipal Reform on the Island of Montreal: Tensions Between Two Majority Groups in a Multicultural City
CLIM	103.2003	*Barbara BUCHNER and Carlo CARRARO:* China and the Evolution of the Present Climate Regime
CLIM	104.2003	*Barbara BUCHNER and Carlo CARRARO*: Emissions Trading Regimes and Incentives to Participate in International Climate Agreements
CLIM	105.2003	*Anil MARKANDYA and Dirk T.G. RÜBBELKE:* Ancillary Benefits of Climate Policy
NRM	106.2003	*Anne Sophie CRÉPIN (*lxiv)*:* Management Challenges for Multiple-Species Boreal Forests
NRM	107.2003	*Anne Sophie CRÉPIN* (lxiv)*:* Threshold Effects in Coral Reef Fisheries
SIEV	108.2003	*Sara ANIYAR (* lxiv): Estimating the Value of Oil Capital in a Small Open Economy: The Venezuela's Example
SIEV	109.2003	*Kenneth ARROW, Partha DASGUPTA and Karl-Göran MÄLER(*lxiv)*:* Evaluating Projects and Assessing Sustainable Development in Imperfect Economies
NRM	110.2003	*Anastasios XEPAPADEAS and Catarina ROSETA-PALMA(*lxiv)*:* Instabilities and Robust Control in Fisheries
NRM	111.2003	*Charles PERRINGS and Brian WALKER* (lxiv): Conservation and Optimal Use of Rangelands
ETA	112.2003	*Jack GOODY* (lxiv): Globalisation, Population and Ecology
CTN	113.2003	*Carlo CARRARO, Carmen MARCHIORI and Sonia OREFFICE*: Endogenous Minimum Participation in International Environmental Treaties
CTN	114.2003	*Guillaume HAERINGER and Myrna WOODERS*: Decentralized Job Matching
CTN	115.2003	*Hideo KONISHI and M. Utku UNVER*: Credible Group Stability in Multi-Partner Matching Problems
CTN	116.2003	*Somdeb LAHIRI*: Stable Matchings for the Room-Mates Problem
CTN	117.2003	*Somdeb LAHIRI*: Stable Matchings for a Generalized Marriage Problem
CTN	118.2003	*Marita LAUKKANEN*: Transboundary Fisheries Management under Implementation Uncertainty
CTN	119.2003	*Edward CARTWRIGHT and Myrna WOODERS*: Social Conformity and Bounded Rationality in Arbitrary Games with Incomplete Information: Some First Results
CTN	120.2003	*Gianluigi VERNASCA*: Dynamic Price Competition with Price Adjustment Costs and Product Differentiation
CTN	121.2003	*Myrna WOODERS, Edward CARTWRIGHT and Reinhard SELTEN*: Social Conformity in Games with Many Players
CTN	122.2003	*Edward CARTWRIGHT and Myrna WOODERS*: On Equilibrium in Pure Strategies in Games with Many Players
CTN	123.2003	*Edward CARTWRIGHT and Myrna WOODERS*: Conformity and Bounded Rationality in Games with Many Players
	1000	**Carlo CARRARO, Alessandro LANZA and Valeria PAPPONETTI: One Thousand Working Papers**

NOTE DI LAVORO PUBLISHED IN 2004

IEM	1.2004	*Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB*: Empirical Analysis of National Income and So2 Emissions in Selected European Countries
ETA	2.2004	*Masahisa FUJITA and Shlomo WEBER:* Strategic Immigration Policies and Welfare in Heterogeneous Countries
PRA	3.2004	*Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI:* Do Privatizations Boost Household Shareholding? Evidence from Italy
ETA	4.2004	*Victor GINSBURGH and Shlomo WEBER:* Languages Disenfranchisement in the European Union
ETA	5.2004	*Romano PIRAS:* Growth, Congestion of Public Goods, and Second-Best Optimal Policy
CCMP	6.2004	*Herman R.J. VOLLEBERGH:* Lessons from the Polder: Is Dutch CO2-Taxation Optimal
PRA	7.2004	*Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN* (lxv): Merger Mechanisms
PRA	8.2004	*Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER* (lxv): IPO Pricing with Bookbuilding, and a When-Issued Market
PRA	9.2004	*Pegaret PICHLER and Alex STOMPER* (lxv): Primary Market Design: Direct Mechanisms and Markets
PRA	10.2004	*Florian ENGLMAIER, Pablo GUILLEN, Loreto LLORENTE, Sander ONDERSTAL and Rupert SAUSGRUBER* (lxv): The Chopstick Auction: A Study of the Exposure Problem in Multi-Unit Auctions
PRA	11.2004	*Bjarne BRENDSTRUP and Harry J. PAARSCH* (lxv): Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders
PRA	12.2004	*Ohad KADAN* (lxv): Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values
PRA	13.2004	*Maarten C.W. JANSSEN* (lxv): Auctions as Coordination Devices
PRA	14.2004	*Gadi FIBICH, Arieh GAVIOUS and Aner SELA* (lxv): All-Pay Auctions with Weakly Risk-Averse Buyers
PRA	15.2004	*Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER* (lxv): Competition and Cooperation in Divisible Good Auctions: An Experimental Examination
PRA	16.2004	*Marta STRYSZOWSKA* (lxv): Late and Multiple Bidding in Competing Second Price Internet Auctions
CCMP	17.2004	*Slim Ben YOUSSEF:* R&D in Cleaner Technology and International Trade
NRM	18.2004	*Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU* (lxvi): Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics
SIEV	19.2004	*Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA:* Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice
NRM	20.2004	*Guido CANDELA and Roberto CELLINI* (lxvii): Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly
NRM	21.2004	*Jacqueline M. HAMILTON* (lxvii): Climate and the Destination Choice of German Tourists
NRM	22.2004	*Javier Rey-MAQUIEIRA PALMER, Javier LOZANO IBÁÑEZ and Carlos Mario GÓMEZ GÓMEZ* (lxvii): Land, Environmental Externalities and Tourism Development
NRM	23.2004	*Pius ODUNGA and Henk FOLMER* (lxvii): Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya
NRM	24.2004	*Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO* (lxvii):Tourism, Trade and Domestic Welfare
NRM	25.2004	*Riaz SHAREEF* (lxvii): Country Risk Ratings of Small Island Tourism Economies
NRM	26.2004	*Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA* (lxvii): Tourism and Economic Growth in Latin American Countries: A Panel Data Approach
NRM	27.2004	*Raúl Hernández MARTÍN* (lxvii): Impact of Tourism Consumption on GDP. The Role of Imports
CSRM	28.2004	*Nicoletta FERRO:* Cross-Country Ethical Dilemmas in Business: A Descriptive Framework
NRM	29.2004	*Marian WEBER* (lxvi): Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest
NRM	30.2004	*Trond BJORNDAL, Phoebe KOUNDOURI and Sean PASCOE* (lxvi): Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting
CCMP	31.2004	*Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI:* Weather Impacts on Natural, Social and Economic Systems (WISE) Part I: Sectoral Analysis of Climate Impacts in Italy
CCMP	32.2004	*Marzio GALEOTTI, Alessandra GORIA ,Paolo MOMBRINI and Evi SPANTIDAKI:* Weather Impacts on Natural, Social and Economic Systems (WISE) Part II: Individual Perception of Climate Extremes in Italy
CTN	33.2004	*Wilson PEREZ:* Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution
KTHC	34.2004	*Gianmarco I.P. OTTAVIANO and Giovanni PERI* (lxviii): The Economic Value of Cultural Diversity: Evidence from US Cities
KTHC	35.2004	*Linda CHAIB* (lxviii): Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison
KTHC	36.2004	*Franca ECKERT COEN and Claudio ROSSI* (lxviii): Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context
KTHC	37.2004	*Kristine CRANE* (lxviii): Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari
KTHC	38.2004	*Kiflemariam HAMDE* (lxviii): Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm
ETA	39.2004	*Alberto CAVALIERE:* Price Competition with Information Disparities in a Vertically Differentiated Duopoly
PRA	40.2004	*Andrea BIGANO and Stef PROOST:* The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?
CCMP	41.2004	*Micheal FINUS* (lxix): International Cooperation to Resolve International Pollution Problems

KTHC	42.2004	*Francesco CRESPI:* Notes on the Determinants of Innovation: A Multi-Perspective Analysis
CTN	43.2004	*Sergio CURRARINI and Marco MARINI:* Coalition Formation in Games without Synergies
CTN	44.2004	*Marc ESCRIHUELA-VILLAR:* Cartel Sustainability and Cartel Stability
NRM	45.2004	*Sebastian BERVOETS and Nicolas GRAVEL* (lxvi): Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach
NRM	46.2004	*Signe ANTHON and Bo JELLESMARK THORSEN* (lxvi): Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits
NRM	47.2004	*John MBURU* (lxvi)*:* Wildlife Conservation and Management in Kenya: Towards a Co-management Approach
NRM	48.2004	*Ekin BIROL, Ágnes GYOVAI and Melinda SMALE* (lxvi)*:* Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transition al Economy
CCMP	49.2004	*Gernot KLEPPER and Sonja PETERSON:* The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects
GG	50.2004	*Scott BARRETT and Michael HOEL:* Optimal Disease Eradication
CTN	51.2004	*Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG:* Simple Priorities and Core Stability in Hedonic Games
SIEV	52.2004	*Francesco RICCI*: Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory
SIEV	53.2004	*Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON:* Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?
NRM	54.2004	*Ingo BRÄUER and Rainer MARGGRAF* (lxvi): Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams
NRM	55.2004	*Timo GOESCHL and Tun LIN* (lxvi): Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices
NRM	56.2004	*Tom DEDEURWAERDERE* (lxvi): Bioprospection: From the Economics of Contracts to Reflexive Governance
CCMP	57.2004	*Katrin REHDANZ and David MADDISON:* The Amenity Value of Climate to German Households
CCMP	58.2004	*Koen SMEKENS and Bob VAN DER ZWAAN:* Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios
NRM	59.2004	*Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA* (lxvii): Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management
NRM	60.2004	*Timo GOESCHL and Danilo CAMARGO IGLIORI* (lxvi):Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon
CCMP	61.2004	*Barbara BUCHNER and Carlo CARRARO*: Economic and Environmental Effectiveness of a Technology-based Climate Protocol
NRM	62.2004	*Elissaios PAPYRAKIS and Reyer GERLAGH*: Resource-Abundance and Economic Growth in the U.S.
NRM	63.2004	*Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ* (lxvi): Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis
NRM	64.2004	*E.C.M. RUIJGROK and E.E.M. NILLESEN* (lxvi): The Socio-Economic Value of Natural Riverbanks in the Netherlands
NRM	65.2004	*E.C.M. RUIJGROK* (lxvi): Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method
ETA	66.2004	*Giannis VARDAS and Anastasios XEPAPADEAS*: Uncertainty Aversion, Robust Control and Asset Holdings
GG	67.2004	*Anastasios XEPAPADEAS and Constadina PASSA*: Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach
GG	68.2004	*Michael FINUS*: Modesty Pays: Sometimes!
NRM	69.2004	*Trond BJØRNDAL and Ana BRASÃO*: The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications
CTN	70.2004	*Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT*: On Coalition Formation with Heterogeneous Agents
IEM	71.2004	*Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA*: Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants
IEM	72.2004	*Alessandro LANZA, Matteo MANERA and Michael MCALEER*: Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns
SIEV	73.2004	*Margarita GENIUS and Elisabetta STRAZZERA*: The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests
CCMP	74.2004	*Rob DELLINK and Ekko van IERLAND*: Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment
ETA	75.2004	*Rosella LEVAGGI and Michele MORETTO*: Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach
CTN	76.2004	*Salvador BARBERÀ and Matthew O. JACKSON* (lxx): On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union
CTN	77.2004	*Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERÀ and Fernando VEGA-REDONDO* (lxx): Optimal Information Transmission in Organizations: Search and Congestion
CTN	78.2004	*Francis BLOCH and Armando GOMES* (lxx): Contracting with Externalities and Outside Options

CTN	79.2004	*Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE* (lxx): Merger Performance under Uncertain Efficiency Gains
CTN	80.2004	*Francis BLOCH and Matthew O. JACKSON* (lxx): The Formation of Networks with Transfers among Players
CTN	81.2004	*Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO* (lxx): Bicameralism and Government Formation
CTN	82.2004	*Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT* (lxx): Potential Maximization and Coalition Government Formation
CTN	83.2004	*Kfir ELIAZ, Debraj RAY and Ronny RAZIN* (lxx): Group Decision-Making in the Shadow of Disagreement
CTN	84.2004	*Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ* (lxx): Economics: An Emerging Small World?
CTN	85.2004	*Edward CARTWRIGHT* (lxx): Learning to Play Approximate Nash Equilibria in Games with Many Players
IEM	86.2004	*Finn R. FØRSUND and Michael HOEL*: Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power
KTHC	87.2004	*Elissaios PAPYRAKIS and Reyer GERLAGH*: Natural Resources, Investment and Long-Term Income
CCMP	88.2004	*Marzio GALEOTTI and Claudia KEMFERT*: Interactions between Climate and Trade Policies: A Survey
IEM	89.2004	*A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE*: Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?
GG	90.2004	*Rolf GOLOMBEK and Michael HOEL* : Climate Agreements and Technology Policy
PRA	91.2004	*Sergei IZMALKOV* (lxv): Multi-Unit Open Ascending Price Efficient Auction
KTHC	92.2004	*Gianmarco I.P. OTTAVIANO and Giovanni PERI*: Cities and Cultures
KTHC	93.2004	*Massimo DEL GATTO*: Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution

(lix) This paper was presented at the ENGIME Workshop on "Mapping Diversity", Leuven, May 16-17, 2002
(lx) This paper was presented at the EuroConference on "Auctions and Market Design: Theory, Evidence and Applications", organised by the Fondazione Eni Enrico Mattei, Milan, September 26-28, 2002
(lxi) This paper was presented at the Eighth Meeting of the Coalition Theory Network organised by the GREQAM, Aix-en-Provence, France, January 24-25, 2003
(lxii) This paper was presented at the ENGIME Workshop on "Communication across Cultures in Multicultural Cities", The Hague, November 7-8, 2002
(lxiii) This paper was presented at the ENGIME Workshop on "Social dynamics and conflicts in multicultural cities", Milan, March 20-21, 2003
(lxiv) This paper was presented at the International Conference on "Theoretical Topics in Ecological Economics", organised by the Abdus Salam International Centre for Theoretical Physics - ICTP, the Beijer International Institute of Ecological Economics, and Fondazione Eni Enrico Mattei – FEEM Trieste, February 10-21, 2003
(lxv) This paper was presented at the EuroConference on "Auctions and Market Design: Theory, Evidence and Applications" organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
(lxvi) This paper has been presented at the 4th BioEcon Workshop on "Economic Analysis of Policies for Biodiversity Conservation" organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL) , Venice, August 28-29, 2003
(lxvii) This paper has been presented at the international conference on "Tourism and Sustainable Economic Development – Macro and Micro Economic Issues" jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
(lxviii) This paper was presented at the ENGIME Workshop on "Governance and Policies in Multicultural Cities", Rome, June 5-6, 2003
(lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference "The Future of Climate Policy", Cagliari, Italy, 27-28 March 2003
(lxx) This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

2003 SERIES	
CLIM	*Climate Change Modelling and Policy* (Editor: Marzio Galeotti)
GG	*Global Governance* (Editor: Carlo Carraro)
SIEV	*Sustainability Indicators and Environmental Valuation* (Editor: Anna Alberini)
NRM	*Natural Resources Management* (Editor: Carlo Giupponi)
KNOW	*Knowledge, Technology, Human Capital* (Editor: Gianmarco Ottaviano)
IEM	*International Energy Markets* (Editor: Anil Markandya)
CSRM	*Corporate Social Responsibility and Management* (Editor: Sabina Ratti)
PRIV	*Privatisation, Regulation, Antitrust* (Editor: Bernardo Bortolotti)
ETA	*Economic Theory and Applications* (Editor: Carlo Carraro)
CTN	*Coalition Theory Network*

2004 SERIES	
CCMP	*Climate Change Modelling and Policy* (Editor: Marzio Galeotti)
GG	*Global Governance* (Editor: Carlo Carraro)
SIEV	*Sustainability Indicators and Environmental Valuation* (Editor: Anna Alberini)
NRM	*Natural Resources Management* (Editor: Carlo Giupponi)
KTHC	*Knowledge, Technology, Human Capital* (Editor: Gianmarco Ottaviano)
IEM	*International Energy Markets* (Editor: Anil Markandya)
CSRM	*Corporate Social Responsibility and Management* (Editor: Sabina Ratti)
PRA	*Privatisation, Regulation, Antitrust* (Editor: Bernardo Bortolotti)
ETA	*Economic Theory and Applications* (Editor: Carlo Carraro)
CTN	*Coalition Theory Network*