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Home-market vs. vote-market effect: Location equilibrium in a probabilistic voting model

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Abstract

This paper considers the location of manufacturing activities when regional policies are endogenous. We find that once the political economy of regional policy is explicitly taken into account, regional population size has an ambiguous effect on the level of regional subsidy, even though it plays a key role in determining the equilibrium spatial allocation of industry. In particular, the final allocation of firms depends both on the relative economic strengths of the two regions, as predicted by more orthodox economic geography models, as well as by their relative political strengths.

JEL classification: D72; F12; R12

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1. Introduction

The de-location process associated with trade integration has been a major concern for European policy makers for decades. It is reflected, for instance, in the quadrupling of cohesion spending as a share of the EU budget since 1986, and in the important level of spending by member states on their disadvantaged regions such Germany's Eastern Länder and Italy's Mezzogiorno. Much of this spending is explicitly aimed at preventing, delaying or even reversing the agglomeration of economic activity in favoured regions.

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The aim of the present paper is to address the issue of agglomeration during a process of regional integration in a framework where regional policy is determined by political economy forces. More precisely, taking a laissez-faire equilibrium as a benchmark, we show how politics and economic integration interact in both directions to speed up or slow down the agglomeration process that results from integration.

The economic model we propose is in the tradition of the so-called "new economic geography" à la Fujita et al. (1999). Specifically, we use a simplified monopolistic competition model of a nation with two asymmetric-sized regions. Industrial output is produced with capital and labour, and by assumption capital is inter-regionally mobile while labour is not. The interaction of transportation costs and increasing returns gives rise to the well-known home-market effect (Krugman, 1980). In simple settings such as ours, the home-market effect implies that a gradual lowering of trade cost will induce all industry to agglomerate in a single region. We refer to the region in which industry clusters as 'the core' and to the other region as 'the periphery'.

To keep the analysis simple, capital owners are not inter-regionally mobile so that all capital earnings are "repatriated" to the owner's region. The fact that capital income is repatriated and that labour is immobile across regions breaks the "circular causality" processes typical of more general economic geography models. This has two consequences. First, the location equilibrium is unique, so to a given regional policy corresponds a unique spatial allocation of industry. Second, the model does not feature the catastrophic behaviour that is the hallmark of many economic geography models (catastrophic behaviour is said to arise when an infinitesimal change in transport costs produces a discrete shift in the location of firms). Because of these properties, we are able to obtain analytical results (as is well known, very few analytical results are available in models of economic geography displaying catastrophic behaviour, even without adding endogenous regional policy variables).

State intervention at the regional level could take any form, from infrastructure spending to tax reduction and so forth. To be concrete we focus on a location-specific subsidy that reduces the fixed cost a firm faces when setting up production in the subsidised region. In our simple model, the fixed cost consists of only capital, so the location subsidy ends up as a subsidy to capital (and, in equilibrium, to the level of production). The interaction between the two regions at the political level determines the direction and the amount of the regional subsidy. We assume lump-sum transfers are available; in this context, the policy instrument chosen is non-distortionary, which implies that the results of our analysis do not depend upon the choice of instrument.

The political economy model we work with is based on electoral competition rather than on a lobbying approach. Sectoral concerns are likely to be transmitted to the decision makers through lobbying activities (see, e.g., Becker, 1983; Grossman and Helpman, 1994; Olson, 1965). However, when we look at regional issues, we see regions as spatial entities and not as sectors. Since they are often recognized as distinct entities in the political system, regions are more likely to influence the policy outcome directly, i.e. through elections. Hence, we will not rely on a lobbying approach to characterize the political game. Instead, we use a Hotelling–Downs probabilistic-voting model (Hinich, 1977; Ledyard, 1984).

Probabilistic-voting models (also referred to as swing-voter models) feature a second, political dimension, in addition to the economic-policy dimension that characterizes median-voter models. Voters are endowed with non-policy preferences over the two parties (what we call ‘ideology’). The economic-policy dimension is, by assumption, orthogonal to ‘ideology’. Candidates know voters’ preferences when it comes to the economic issue at hand, but they know only the distribution of voters’ preferences in the ideology dimension. As we shall see, this assumption implies a dramatic departure from the median voter’s ‘dictatorship’ (Hinich, 1977); in particular, the outcome can be non-majoritarian on some (or even all) dimensions. The key is that the ‘swing voter’ (the voter whose ballot can be thought of as winning the election) need not be the voter whose preferences reflect the median in the economic dimension because voters also care about ideology. In this set up, a group of voters with particularly uniform ideology are more likely to be swing voters. Knowing this, candidates will craft their policy platforms to cater to the economic interest of this group.[1]

We assume that the population in the urban region is more widely spread out along the ideology dimension than the population in the small, rural one. We make this assumption on the grounds that economic activities and, hence, special interests are more variegated in more urbanized regions than in less urbanized ones (or, equivalently, that regional policy is a less salient issue).[2] As we shall see, this stylized fact will shift the equilibrium policy variable in favour of the economically small region (see Persson and Tabellini, 2000, Chapter 3).[3]

Indeed, there is some indirect evidence that politically powerful regions are not always the largest ones when it comes to regional policies. As an illustration, take the repartition of the EU 1994–1999 budget devoted to the ‘Structural Funds’. Almost 72% of this was allocated to ‘Objective 1’ European regions, namely to regions that are mainly peripheral and with relatively little industrial activities.[4] All the same, people living in ‘Objective 1’ European regions accounted for approximately 26% of the total European population. In total, aids used to finance objectives with a specifically regional nature (Objectives 1, 2, 5b and, the recently created, 6) accounted for 87% of the total Structural Funds.[5] The same bent can be found also at the national level. In 1999 –2000, for example, subsidies granted to firms located in the Mezzogiorno (Southern Italy), where 36% of the total Italian population lives, were twice as much as those given to firms located in the rest of the country.[6]

[1] See Coughlin (1992) for an exhaustive analysis of the probabilistic voting approach to representative democracy and Anderson et al. (1992) for the theory of discrete choice when preferences are random.

[2] This stylized fact – that larger cities tend to be more diversified – is one of many on city diversity and specialization, as surveyed by Duranton and Puga (2000).

[3] The fact that small groups sometimes possess disproportionate political power is not new in the literature. Alternative explanations exist. For instance, small groups can presumably circumvent the free-rider problem since they are more easily able to organise themselves into pressure groups (Olson, 1965), or the electoral system might incite competing candidates to appeal to narrowly defined and specific groups rather than more broad groups (Myerson, 1993; Persson and Tabellini, 2000, Chapter 8).

[4] Formally, ‘Objective 1’ regions are regions with per capita GDP below 75% of the EU’s average.

[5] Source: Eurostat.

[6] Source: Ministero del Tesoro Italiano, Terzo Rapporto sullo Sviluppo Territoriale, 1999–2000.

In addition to accounting for the commonly observed phenomenon of anti-agglomeration policy, the endogenization of policy has interesting implications for the economic geography literature. Once regional policy is considered as a political issue, economic integration does not necessarily lead to full agglomeration of industries in the larger region, as the orthodox geography model would predict. The location of economic activity will depend both on the economic home-market effect and on what we call by analogy the vote-market effect. As usual, we find that low levels of openness to trade correspond to dispersed outcomes (neither region attracts all firms), but sufficiently high levels of openness result in a core–periphery pattern. One of our novel results concerns the location of the core (orthodox economic geography models predict that it must be in the big region). However, if the economically small region is politically over-represented, the big region attracts the core if and only if its relative economic size overcomes its relative political weakness. Finally, and interestingly, although the equilibrium spatial allocation of industry is never ambiguous, the question of which region gets subsidized has an ambiguous answer; the answer being determined by both economic and political considerations. As we shall see, this is partly due to the fact that agglomeration creates quasi-rents that can be taxed in the core without leading to re-location.

1.1. Related literature review

With few exceptions, the economic geography literature has not considered policy issues since it is concerned mainly with the positive analysis of exogenously rising levels of openness. When it has, instruments of regional policy were either taken as exogenous (Baldwin and Robert-Nicoud, 2000; Martin, 1999; Martin and Rogers, 1995; Ottaviano and Thisse, 2002), or addressed the specific issue of inter-regional tax competition (Andersson and Forslid, 1999; Baldwin and Krugman, 2001; Kind et al., 2000, Ludema and Wooton, 2000). Likewise, Persson and Tabellini (1992) consider a model where two policy makers, each from a different region or country, compete for the mobile factor (capital) by setting taxes. They consider how equilibrium redistributive policies are affected by economic integration in a more classical environment (i.e. they focus on public good provision in populations with heterogeneous factor ownerships rather than on economic geography issues). By contrast, we assume that both regions belong to a single, centralized constituency and focus exclusively on the interaction between spatial redistribution politics and geography in a framework of electoral competition.

In a related context, Rauch (1993) assesses the role of the developers of industrial parks in coordinating location decisions by individual firms. Firms are initially agglomerated in a location that no longer has the comparative advantage (the nature of agglomeration forces is left unspecified). Under some conditions, there is a first-mover disadvantage and as a consequence firms fail to coordinate and are stuck in the 'wrong' location (that is, history matters). In this context, Rauch shows that 'land developers' (see e.g., Henderson, 1985) can circumvent this coordination problem by subsidizing the first firms to move, while charging a positive price to the land slots allocated to firms moving at a later stage. In this way, the land developer makes non-negative profits and firms that move first are compensated for not taking advantage of the location economies that accrue to the initial location. Rauch also cites some evidence that supports his theory. In our paper, the central government plays the role of the land developer, but its role is not to coordinate firm relocation (our model features a unique locational equilibrium, so there can be no coordination failure). Rather, political candidates seek a location equilibrium that maximizes their political support. Generically, the outcome is not the utilitarian optimum.

The paper by Cadot et al. (2001) provides empirical support for the idea that candidates will craft their policy platforms to please regions that have a lot of 'swing voters'. Using French panel data, these authors show that electoral concerns (as well as lobbying activities) are significant determinants to the spatial allocation of regional transportation infrastructure investments. In particular, they instrument for the proportion of swing voters in different regions and show this explanatory variable to be statistically highly significant. Since they take the location of industries as given, however, their study is not a direct test of our model but it provides strong support to the political mechanism we are assuming.

The rest of the paper is organized as follows. The next section introduces the basic economic model and solves it taking the policy variable as given. Section 3 presents the reduced form of the welfare functions and discusses how utility is affected by the policy choice, still exogenously given. In Section 4 the economic model is integrated into a political economy model and the two are solved together. Section 5 discusses the results. The concluding section considers some casual empirics that support our model. Some proofs are relegated to the appendix.

2. The basic economic model

The model is based on the Flam and Helpman (1987) version of the Dixit and Stiglitz (1977) monopolistic competition.[7] We consider two potentially asymmetric regions, Urban (U) and Rural (R), belonging to the *same* country, endowed with two factors, labour (L) and capital (K), and each producing a homogenous good, Y, and a differentiated good, X. The production of the latter involves increasing returns to scale and its interregional trade is characterized by transportation costs. The interaction between increasing returns to scale and impediments to trade gives rise to the home-market effect. In this sense, our's is a new economic geography model.

2.1. Assumptions

Both labour and capital are used to produce the differentiated good X under increasing return to scale and monopolistic competition. Following Flam and Helpman, production of each X variety involves a one-time fixed cost consisting of one unit of K and a per-unit-of-output cost consisting of a_x units of L.

[7] To our knowledge, Martin and Rogers (1995) were the first to use this kind of model in a new economic geography framework.

The Y sector produces a homogenous good under constant return to scale and perfect competition using a_y units of labour per unit of output. Labour is the only input. This good is also chosen as the *numeraire*.

Labour is perfectly mobile across sectors, but immobile across regions. For simplicity, the mass of labour available at the country level is set equal to 1. The specific factor K is regionally mobile but capital owners are not, hence, capital income is fully repatriated to their region of residence.

Inter-regional trade of the differentiated good is subject to iceberg transportation costs. Thus, in order to sell one unit of X in the other region, $\tau > 1$ units need to be shipped. Y trade is costless.

The representative consumer in each region maximizes the following quasi-linear utility function:

$$u = \ln X + Y, \quad X \equiv \left(\int_{i=0}^{N+N_R} c(i)^{(\sigma-1)/\sigma} \, \mathrm{d}i \right)^{\sigma/(\sigma-1)}, \tag{1}$$

where $\sigma > 1$ is the constant elasticity of substitution among the X-varieties, and N and N_R stand for the number of firms in Urban and in Rural, respectively, and, given the assumption on the market structure, also for the number of varieties of the differentiated goods produced in each region. [8] Each consumer in the rural region owns one unit of labour and K_R/L_R units of capital; the typical individual in the urban region owns one unit of labour and K/L units of capital. In this static model, income equals expenditure, therefore the budget constraint can be written as follows:

$$w + \rho K/L = T + \int_{i=0}^{N+N_R} c(i)p(i) \, \mathrm{d}i + Y, \tag{2}$$

where w is the labour wage, ρ is the capital reward including (locally specific) capital subsidies, T are the per-capita taxes paid by the representative consumer in order to cover any policy intervention chosen by the government, and the remaining terms are private expenditure. Observe that these taxes are non-distortionary; other (potentially interesting) policy implications would be implied if distorting instruments were implemented. The same budget constraint holds, *mutatis mutandis*, for the rural region. Variables pertaining to the rural region are subscribed with an R, while those pertaining to the urban one are un-subscribed, unless there is risk of confusion; in that case they will be subscribed with a U. Aggregate variables, i.e. variables referring to the nation as a whole, are indicated with the subscript C, for *Country*. We impose $T_R = T$.

We assume that the intervention consists of a subsidy to firm's fixed costs. As such subsidies are independent of output and, given that the one-time fixed cost consists of one unit of K, they actually represent a subsidy to capital. [9] Let r (r_R) be the before-subsidy capital reward for entrepreneurs producing in region U (R) and define

[8] The choice of a quasi-linear specification, which is fairly standard in the literature on public goods provision (e.g., see Persson and Tabellini, 2000), is harmless: All results carry over if a Cobb–Douglas functional form is chosen instead (calculations are available from the authors). The logarithmic specification, on the other hand, is a handy assumption that helps us to get neat expressions, as we shall see later.

[9] Because of free entry, though, at equilibrium this will be equivalent to a subsidy to the value of sales (estimated at f.o.b. prices) and hence to the quantity of output.

θ as r/r_R, with $\theta \in \Re_{++}$. When rural production is subsidized, $\theta > 1$ and $\theta - 1$ is the *ad-valorem* subsidy given to capital owners who produce in that region, regardless of their origin. Under these circumstances, θr_R is the capital reward for producing in R and r is the capital reward for producing in U. When $\theta < 1$, $1/\theta - 1$ is the *ad-valorem* subsidy given to capital owners producing in region U. In this case, capital owners that set up their firms in Urban get r/θ, those setting up their firms in Rural get r_R. Clearly $\theta = 1$ means that capital is not subsidized anywhere and the lower the $|\theta - 1|$, the smaller is the subsidy. In what follows the location subsidy is determined implicitly as a result of the political game between the two regions. The fact that at most one region is subsidized at a time is a simplifying assumption. This is always an equilibrium even in the more general case in which both regions can be subsidized. [10]

2.2. Equilibrium conditions

As usual with quasi-linear utility functions, the quantity of Y consumed by the representative consumer is determined as a residual from (2). Standard utility maximization yields the following demand function for each variety of the differentiated good:

$$c(i) = \frac{p(i)^{-\sigma}}{\int_{j=0}^{N+N_R} p(j)^{(1-\sigma)}\,\mathrm{d}j}. \tag{3}$$

Competition implies marginal-cost pricing in the Y sector, and, with Y as numeraire, $w = p_Y = 1$. Free trade in Y and perfect labour mobility between sectors guarantees labour reward equalization in both regions, namely $w = w_R = 1$, as long as neither specializes. For simplicity we rule out complete specialization, so that nominal wage equality always holds. [11]

We choose units such that $a_y = 1$ and $a_x = 1 - 1/\sigma$ and solve the first-order conditions for Urban and Rural firms for equilibrium prices. Adopting the usual convention for which the first subscript indicates the region where the good is produced and the second the region where it is consumed, the standard monopolistic competition pricing equations are $p_{UU} = p_{RR} = 1$ and $p_{UR} = p_{RU} = \tau$.

Competition for K drives r up to the level where pure profits are eliminated, so K's reward in Urban is the operating profit of a typical Urban-based X-firm. A similar condition holds in Rural. [12] When production takes place in both regions, perfect capital mobility equalizes the after tax/subsidies rewards to capital across regions, i.e. $\rho = \rho_R$ in equilibrium. Due to subsidies, however, before tax/subsidies rewards – namely r and r_R – can differ. In particular, when setting a firm in region R is subsidized (and, hence, $\theta > 1$) $\rho = \rho_R = r = \theta r_R$. When $\theta < 1$, namely when firms in Urban are subsidized, $\rho = \rho_R = r_R = r/\theta$.

[10] We could also use perturbations to the game so that this would be the unique equilibrium. An example is available from the authors.

[11] In order to exclude complete specialization in production, it is enough to assume that the large region is not big enough to supply all the Y demand. In particular, a sufficient condition for that being true is that the biggest region's labour share, $s_L \equiv L/(L + L_R)$, is less than $1/\sigma$.

[12] Seeing K as the specific factor to sector X, capital receives the agglomeration (quasi-) rents.

Since X-firms need one unit of capital per variety, and capital is interregionally mobile (even though its reward is repatriated), capital's full-employment condition requires $N + N_{\mathrm{R}} = K + K_{\mathrm{R}}$.

As usual, monopolistic competition implies that operating profit (namely revenue less payment to labour) is $p_{\mathrm{UU}}x/\sigma$ for a typical Urban firm and $p_{\mathrm{RR}}x_{\mathrm{R}}/\sigma$ for a typical Rural firm (making use of the fact that f.o.b. prices are the same for the units that are exported and those that are sold locally). The equilibrium size of a typical firm is therefore proportional to capital's reward, namely $x = r\sigma$ and $x_{\mathrm{R}} = r_{\mathrm{R}}\sigma$ (Flam and Helpman, 1987). The equalization of after tax/subsidy rental rates enforced by capital mobility implies that $\theta = x/x_{\mathrm{R}}$ as well. (Therefore, the equalization of equilibrium firm size holds if, and only if, $\theta = 1$.) Moreover, the value of global X-sector output at producer prices must equal the value of global X-sector private expenditure. The market-clearing condition in U requires that $p_{\mathrm{UU}}Nx = LNp_{\mathrm{UU}}c_{\mathrm{UU}} + L_{\mathrm{R}}Np_{\mathrm{UR}}c_{\mathrm{UR}}$, where c_{UU} and c_{UR} are defined by Eq. (3). By the same token, the market-clearing condition in R is $p_{\mathrm{RR}}N_{\mathrm{R}}x_{\mathrm{R}} = L_{\mathrm{R}}N_{\mathrm{R}}p_{\mathrm{RR}}c_{\mathrm{RR}} + LN_{\mathrm{R}}p_{\mathrm{RU}}c_{\mathrm{RU}}$. Making use of Eq. (3) and substituting the appropriate optimal price, we obtain the following production scales for the Urban and the Rural representative firms:

$$x = \frac{L}{N + N_{\mathrm{R}}\phi} + \frac{L_{\mathrm{R}}\phi}{N\phi + N_{\mathrm{R}}}, \quad x_{\mathrm{R}} = \frac{L_{\mathrm{R}}}{N\phi + N_{\mathrm{R}}} + \frac{L\phi}{N + N_{\mathrm{R}}\phi}, \tag{4}$$

where $0 \leqslant \phi \equiv \tau^{1-\sigma} \leqslant 1$ is a measure of *freeness* of inter-regional trade. ϕ ranges from zero, with infinite barriers, to unity, with zero barriers. As (4) also holds in autarchy (with $\phi = 0$ and $N = K$), the autarchy r is lower in the capital-abundant region.

With capital mobility, the number of varieties produced in a region may differ from the region's capital stock, so we also have to determine the equilibrium location of X-firms. The zero profit and the market clearing conditions can be used to find the equilibrium levels for N and N_{R} and, simultaneously, the equilibrium scales x and x_{R}. However, since the total number of X-firms is fixed at $K + K_{\mathrm{R}}$, it is more convenient for our purposes to focus on the ratio $N/N_{\mathrm{R}} \equiv v$ (rather than on levels). Similarly, define λ as L/L_{R}. The no-arbitrage condition $\theta = x/x_{\mathrm{R}}$ and (4) together imply the location equilibrium:

$$v = \frac{(1-\theta\phi)\lambda - \phi(\theta - \phi)}{(\theta - \phi) - \lambda\phi(1 - \theta\phi)}. \tag{5}$$

Expression (5) holds for admissible values of v, namely when parameters are such that $0 < v < +\infty$. Outside this parameter space, v equals zero or $+\infty$ in an obvious manner. By inspection, U's share of firms (defined as $s_N = v/(1+v)$) is increasing in U's size (defined as $s_L = \lambda/(1+\lambda) = L/(L + L_{\mathrm{R}})$) and decreasing in its relative cost of capital, θ. Moreover, v is larger than λ if $\lambda > 1 > \theta$ (not immediate, but true); these inequalities illustrate effects that will be recurrent in the sequel. Under the following working assumption, which will hold from now on, v is also increasing with ϕ.

Assumption 1. U is the largest region, i.e. $s_L > 1/2$ (or $\lambda > 1$). We will sometimes refer to λ as the relative *economic strength* of region U (or, equivalently, as the relative *economic weakness* of region R).

Expression (5) is the fulcrum of our analysis, so it is worth studying it in the absence of subsidies, i.e. when $\theta = 1$. In this case the equilibrium ratio of U's to R's firm share becomes

$$v|_{\theta=1} = \frac{\lambda - \phi}{1 - \lambda\phi}. \tag{6}$$

When U is larger, making trade freer ($d\phi > 0$) results in a de-location of firms to the big region. This is consistent with other models in the same spirit. Note that $v \to \infty$ for $\phi = 1/\lambda < 1$ (*core–periphery* outcome for sufficiently low, though still positive, trade barriers) and that

$$\left.\frac{\partial v}{\partial \lambda}\right|_{\theta=1} = \frac{1 - \phi^2}{(1 - \lambda\phi)^2} > 1 \tag{7}$$

for values of ϕ such that (5) yields an interior solution, i.e. for $\phi < 1/\lambda \equiv \phi^{\mathrm{CP}}$ (*home-market effect*, Krugman, 1980).

In order to isolate the effect of a subsidy on the firm allocation share, we calculate the ratio v at $\lambda = 1$ (equal sized regions) and take the first derivative with respect to $1/\theta$. Using (5), it is easy to show that $(\partial v/\partial(1/\theta))|_{\lambda=1} > 1$. This says that one additional unit of subsidy given to U leads to a more than proportional change in de-location towards U. We call this property the *home-subsidy effect*. Both the home-market and the home-subsidy effect will be used in the following sections to help boost intuition.

Equilibrium Y-sector output is determined as a residual from (2).

In order to close the model we need to specify a functional form for T, the per-capita tax level. We will deal with this issue at the end of the following section. We now turn to a brief discussion about the regional policy instrument we consider.

3. The economic effects of regional policy

In this section we analyse the economic effect of the regional subsidization taking its level as given. In the next section the regional policy will be endogenously determined.

The regional policy instrument implemented by the central government in order to affect inter-regional industrial location consists in giving a subsidy on the firms' fixed cost in *one* of the two regions.

To focus on the real-income, cross-regional distribution problem, we make the following additional assumption:

Assumption 2. Per-capita endowments of capital and labour are the same for each individual across regions, that is, $K_R/L_R = K/L$.[13] As a consequence, $K/(K + K_R) = s_L$ (or $K/K_R = \lambda$).

Under this assumption, s_L is also region U's share of the country's nominal income and expenditure. Hence, *economic* agents differ only with respect to the region they live in, and have only one conflict of interest: *ceteris paribus*, they all prefer the firms to

[13] By factor prices equalization, their nominal incomes are also equal.

locate where they live since the retail price is lower for goods produced at home than for goods imported from the other region (recall that the inter-regional transportation cost is fully passed on to the consumers).

Cross-factor distribution issues, which are at stake in the literature on tax competition (see, e.g., Ludema and Wooton, 2000), are left aside here: Taxation of the mobile factor does not influence income distribution across agents. Nevertheless, like in the tax competition literature, taxes on the mobile factor are set so as to affect location, and hence cross-region income distribution (through the cost-of-living, or price-index). In Ludema and Wooton (2000), industry location is an issue that looses salience when trade costs are low. Hence, while raising taxes may induce the mobile factor owners to migrate, this is less costly to the region that loses tax competition as ‘imports’ are now cheaper. The same effect is present in our model as well and translates into the fact that a core-periphery structure will necessarily emerge for some positive ϕ at the political-economy equilibrium, even though voters from the two regions still disagree on the preferred outcome.

3.1. Location effects

We first look at the effect of the policy parameter θ on the equilibrium location, s_N.

Let $\overline{\theta}$ and $\underline{\theta}$ be the values of θ such that s_N equals zero (all firms are located in Rural) or one (all firms are located in Urban), respectively.[14] From (5):

$$\overline{\theta} \equiv \frac{s_L + \phi^2(1-s_L)}{\phi} < \frac{1}{\phi}, \qquad \underline{\theta} \equiv \frac{\phi}{(1-s_L)+s_L\phi^2} > \phi. \tag{8}$$

Under Assumption 1, $\overline{\theta} > \underline{\theta}$ and $\overline{\theta} > 1$.

Fig. 1 plots $\overline{\theta}$ (dashed curve) and $\underline{\theta}$ (solid curve) as a function of trade freeness for a given value of s_L. $\overline{\theta}$ shows the minimum level of Rural subsidization necessary to attract all firms to R. For values less than one, $\underline{\theta}$ shows the minimum subsidy to Urban which is necessary to make U the core; for values above one, $\underline{\theta}$ shows the maximum tax to U which is consistent with no firms leaving Urban.

As is possible to see from the dashed curve, the freer the trade, the smaller the subsidy required to attract all the firms to R (liberalization amplifies the effect of a subsidy). Note that, since $\overline{\theta} > 1 \forall \phi$, the minimum level of subsidy to industries in R that makes the rural region the core is always positive: A positive regional policy is necessary to offset the tendency of the small region to lose firms as ϕ rises, because of the home-market effect.

The converse is not necessarily true, as a look at $\underline{\theta}$ (the solid curve) shows: The relationship between the level of subsidies to firms located in U which is necessary to keep all the firms in the same region and the level of trade integration is bell-shaped (by inspection of Eq. (8)). The reason is that the home-market effect works in favour of the large region, so that a small tax on firms locating there (or, equivalently, a

[14] Note that, when θ is smaller than $\underline{\theta}$ or bigger than $\overline{\theta}$, the usual relations $\rho = r = \theta r_{\mathrm{R}}$ and $\rho = r_{\mathrm{R}} = r/\theta$ do not hold anymore. In particular, for $\theta < \underline{\theta}$, all the firms are located in U and capital owners get $\rho = r/\theta$, independently on where they live. If $\theta > \overline{\theta}$, they get $\rho = \theta r_{\mathrm{R}}$.

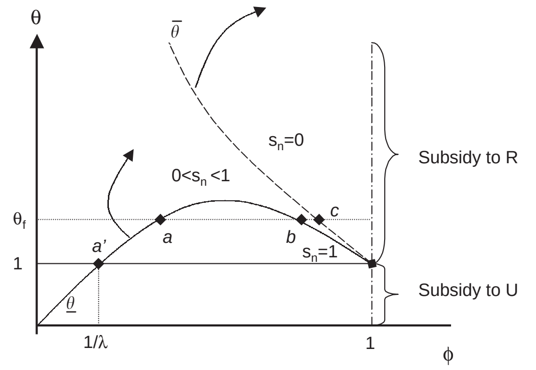

Fig. 1. Upper and lower bounds for θ. When $\theta > 1$ production in R is subsidized; When $\theta < 1$ subsidy goes to production in U. Arrows indicate how curves move for an increase in s_L.

small subsidy on potential firms in R) is ineffective in making any firm move to R for $\phi > 1/\lambda$.[15]

It is also instructive to consider the effectiveness of a given level of Rural subsidy along the integration path. In particular, consider how the location equilibrium is affected when ϕ rises while the level of θ is fixed at some $\theta_f > 1$ in the diagram. When ϕ is relatively close to zero, there is some economic activity in both regions, since $\theta \in (\underline{\theta}, \overline{\theta})$. As the two regions become more integrated, the home-market effect starts dominating the subsidy effect. From point a on, the relative strength of the home-market effect is so reinforced by the ongoing integration process that this level of subsidy to industrial activity in R is completely ineffective and Rural becomes a 'Periphery' $(1 - s_N = 0)$ in spite of the subsidy on offer. As ϕ continues to increase, the relative strength of the home-market effect decreases and eventually, when point b is reached, some of the firms start leaving the 'Core' U (which is hence no longer a core). Things get even worse for U as transportation costs fall further: To the right of point c the core is in R. Again, if we take the model literally, this shows how effective regional policy is when $\phi \to 1$: Without any subsidy $(\theta = 1)$, the core would be (and remain) in Urban from point a' onwards.

Lastly note that an increase in s_L makes the home-market effect become stronger. As it is possible to see from Eq. (8), a higher value of s_L makes both $\underline{\theta}$ and $\overline{\theta}$ shift upward (see arrows in Fig. 1). The upward movement of $\overline{\theta}$ indicates that, given ϕ, in order to compensate the fact that firms are attracted by the big market, the minimum subsidy to R production needed to keep the core in Rural has now to be higher. Likewise, the upward shift of $\underline{\theta}$ implies that the minimum subsidy level needed to assure the core to U is now lower, and also that the range of trade freeness for which a small subsidy offered to location in R is still compatible with the core remaining in U is now wider.

[15] The fact that taxing capital in the Core does not necessarily lead it to relocate comes in sharp contrast to the classical results on tax competition and is in line with the results in Andersson and Forslid (1999), Baldwin and Krugman (2001), Kind et al. (2000) and Ludema and Wooton (2000).

To sum up, the following three conclusions arise from this analysis:

Result 1: At a given subsidy level θ_f, the relationship between trade integration and equilibrium location is generically non-monotonic.

Result 2: When trade is highly integrated, location is very sensitive to policy.

Result 3: As s_L increases, the home-market effect becomes stronger; the same level of subsidies ensures $s_N = 1$ for smaller ϕ's and higher subsidies are needed in order to empty the big region.

3.2. Taxation and welfare effects

In the present model the central government's regional policy is financed exclusively by taxes. In order to understand how the direction and the level of the subsidy translates into individuals' welfare, we first need to define the per-capita level of taxes as a function of θ. When the subsidy is given to production plants located in region U, i.e., when $\theta < 1$, and remembering that $L + L_R \equiv 1$, each individual in the country pays

$$T = (1/\theta - 1)Nr. \tag{9}$$

On the other hand, if the plants in R get the subsidy, $\theta > 1$ and

$$T = (\theta - 1)N_R r_R. \tag{10}$$

N and N_R are given by (5) or by 0 and $K + K_R$ when relevant.

Plugging (2)–(4) and (9) or, alternatively, (10) into (1), making use of the definition of ρ, of the relationship between the equilibrium sizes (x and x_R) and the operating profits (r and r_R), and of the pricing equations, we obtain the materialistic indirect utility functions of the two regions (see Appendix A for details). In particular, for $\theta \in \Theta \equiv [\underline{\theta}, \overline{\theta}]$: [16]

$$V_U(s_N(\theta); s_L, \phi) = \frac{\ln(s_N + (1 - s_N)\phi)}{\sigma - 1} + \frac{\ln(K + K_R)}{\sigma - 1} + \frac{1}{\sigma} \tag{11}$$

and

$$V_R(s_N(\theta); s_L, \phi) = \frac{\ln(s_N\phi + (1 - s_N))}{\sigma - 1} + \frac{\ln(K + K_R)}{\sigma - 1} + \frac{1}{\sigma}, \tag{12}$$

where $s_N = \upsilon/(1 + \upsilon)$ is given by (5) and $\partial V_U/\partial s_N > 0$, $\partial V_R/\partial s_N < 0$ and $\partial s_N/\partial \theta < 0$, so that, in the interval of interest, V_U (V_R) is always decreasing (increasing) in θ.

Fig. 2 shows the materialistic indirect utility functions in the two regions as a function of θ and for a given value of ϕ. Citizens get as capital owners what they pay as tax payers. Hence, an increase in θ has two opposite revenue effects that perfectly compensate each other. At the same time, citizens are also better off by a reduction of the price index (the logarithmic terms in (11) and (12) above), the determination of which, given the presence of trade costs, depends on firms' location. When subsidies

[16] Incidentally, note that Θ is a function of ϕ.

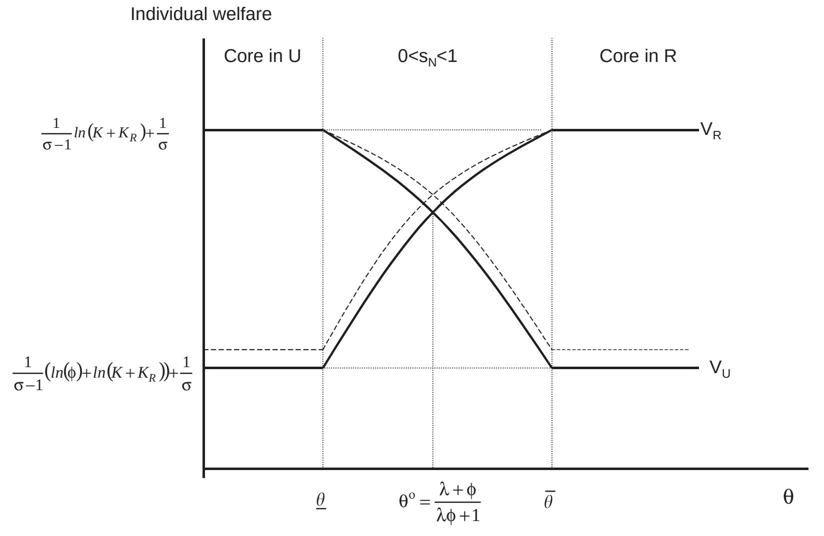

Fig. 2. Materialistic indirect utility function. Dashed: Welfare effects of an increase in ϕ.

belong to Θ and firms are still located in both regions, both the degree of trade integration ϕ and the equilibrium location s_N or v influence welfare. Outside $\Theta \equiv [\underline{\theta}, \overline{\theta}]$, instead, θ has no influence on location anymore and the only thing that can lower the price index of the region that has become the periphery is an increase in freeness. The dashed curves show how welfare is affected by an increase in the degree of integration. When production happens in both regions, a deepening in freeness of trade positively affects both regions' welfare. When production is concentrated in one of the two regions, only the periphery benefits from a deepening in trade integration.

With the reduced form of the economic model at hand, we turn to the political model.

4. The political economy model

Until now we have taken the policy variable, θ, as given. We now let it be endogenously determined by a specific political process. Recall that the regional policy instrument under analysis is a subsidy to setting up a firm in one of the regions. Both regions belong to the same country. All voters, whether living in region U or in region R, chose a candidate from the *same* set of candidates. This set is exogenously given for simplicity.

4.1. Assumptions

To model the political game we make use of a variant of the Hotelling–Ledyard model (see Ledyard, 1984) and assume that the policy space, $\Theta \equiv [\underline{\theta}, \overline{\theta}]$, is one dimensional;[17] the set of candidates $\{A, B\}$ is fixed and finite; each candidate cares only about winning and is assumed to maximize her expected number of votes; the number of citizens, whose preferences are monotonic over Θ, is finite and equal to $L + L_R$; candidates simultaneously choose a position in Θ; having observed the candidates' platform, voters decide for which candidate to vote; voting is costless.

More precisely, our formulation of the probabilistic voting model follows Lindbeck and Weibull (1987).[18] Each of the two candidates competing for office belongs to a distinct, well-established political party. Each party has a well-known (by history, say) position on several different issues (think of issues like EU membership, the role of trade unions, gun control, commitment to free-trade, etc.). This is supposed to remain unchanged in the future. By hypothesis, candidates cannot deviate from their respective party's position on these issues, possibly because the internal party structure makes it impossible for her to do so. Nevertheless, they have some leeway on other dimensions and any promise they make on these during the electoral campaign is credible either because parties are divided on them or because these issues are not too salient to them. (Remember that winning is the only concern of the two candidates.) In our framework we assume that the only dimension on which candidates can make a credible promise is the regional policy.

Each individual i is assumed to have an idiosyncratic preference of intensity ε_i for either candidate, with $\varepsilon_i > 0$ if i prefers B and $\varepsilon_i < 0$ if i prefers A. This is private information to i. However, in the two regions all ε_i are drawn from a symmetric, with mean zero cumulative distribution function, $F_U(\varepsilon)$ in region U and $F_R(\varepsilon)$ in R.[19] F_U and F_R are known to anybody (in other terms there is no aggregate uncertainty). Presumably social and economic activities are more variegated and heterogeneous in the big region, implying that distinct socio-economic groups, each having distinct interests, are more numerous in Urban. This translates in a higher dispersion of the cumulative distribution around the mean in U. Hence, if μ^2 is the variance of $F_U(\varepsilon)$ and η^2 the variance of $F_R(\varepsilon)$, $\mu > \eta$.[20] We loosely refer to μ and η as the 'socio-economic' heterogeneity of the populations in U and R , respectively. Finally, we assume that $\mathrm{F_U}$ and $\mathrm{F_R}$ fulfill the sufficient conditions for a Nash equilibrium to exist (see Proposition 3 in the appendix).

Voters derive their utility both from consumption of good X – whose price is influenced by geography and hence by regional policy – and by the winning candidate's

[17] The policy space could actually be any interval that encompass Θ, but, since any θ smaller than $\underline{\theta}$ or bigger than $\overline{\theta}$ yields the same location and the same materialistic utility levels of $\underline{\theta}$ and $\overline{\theta}$, respectively, we can restrict the policy space to Θ without loss of generality.

[18] See Persson and Tabellini (2000, Chapter 3) for a simplified version.

[19] To be exact, double-sided uncertainty is needed for the existence result. That is, we should be assuming that the mean of both F_U and F_R is itself a random variable. We take its distribution to be symmetric and centred on zero. In order not to add yet other notations, we do not make it explicit. Note that all the expressions in the sequel hold under that assumption.

[20] Exactly the same results are obtained assuming that $\mathrm{F_U}(\varepsilon)$ and $\mathrm{F_R}(\varepsilon)$ are identical (or equivalently that the ε_i's are drawn from a common symmetric, with mean zero cumulative distribution), but that agglomeration of industry is a more salient issue to those voters left behind in the periphery than to those living in the core, as it presumably is. In aggregate terms, these interpretations are equivalent, as pointed out by a referee.

party traditional policies, assumed to be unrelated to consumption of good X for simplicity.[21] Hence, individual i's welfare is $V_j[s_N(\theta_B)] + \varepsilon_{ji}$ if candidate B wins and $V_j[s_N(\theta_A)]$ otherwise, with $j = \mathrm{U}, \mathrm{R}$.

4.2. The game

The two candidates announce their platforms, θ_A and θ_B simultaneously and non-cooperatively, taking the platform of the opponent as given. The probability of winning for each of them is equal to 0, 1/2 or 1 whenever the expected vote share is smaller than, equal to, or larger than 1/2, respectively. In particular, given that an individual i in region j is indifferent between the two candidates if, and only if, $V_j[s_N(\theta_A)] - V_j[s_N(\theta_B)] = \varepsilon_{ji}$, candidate A's problem is

$$\max_{\theta_A \in \Theta} \Omega(\theta_A, \theta_B^*) \equiv s_L F_{\mathrm{U}}[V_{\mathrm{U}}[s_N(\theta_A)] - V_{\mathrm{U}}[s_N(\theta_B^*)]] + (1 - s_L) F_{\mathrm{R}}[V_{\mathrm{R}}[s_N(\theta_A)] - V_{\mathrm{R}}[s_N(\theta_B^*)]], \tag{13}$$

the problem being symmetric for candidate B. Notice that, because the mapping in (5) is one-to-one, maximizing with respect to θ is equivalent to maximizing with respect to s_N.

By symmetry of the maximization problem, the two candidates will converge to the same platform at equilibrium . Therefore, the first-order condition for the maximization problem in (13) is

$$\left[s_L f_{\mathrm{U}}(0) \frac{\partial V_{\mathrm{U}}}{\partial s_N} + (1 - s_L) f_{\mathrm{R}}(0) \frac{\partial V_{\mathrm{R}}}{\partial s_N} \right] \frac{\partial s_N}{\partial \theta} = 0 \tag{14}$$

and the second-order condition is satisfied by assumption.[22] Notice that, due to standard statistical properties of probability distribution functions belonging to the same family, $f_{\mathrm{R}}(0)/f_{\mathrm{U}}(0) = \mu/\eta \equiv m$. The ratio m measures the relative political strength of the two regions.

In (14), $s_L f_{\mathrm{U}}(0)$ and $(1 - s_L) f_{\mathrm{R}}(0)$ represent the mass of *swing voters* in U and in R, respectively, namely the mass of those voters that are marginally indifferent between the two candidates at equilibrium. This mass is increasing with the size of the electorate (s_L and $1 - s_L$) and inversely related to the spread of the population along the political dimension (μ and η).

We now have all the elements to discuss the equilibrium of the model as a whole.

[21] In other terms, the long-term party political dimension and regional policy are orthogonal to each other. The presence of this other dimension leads to qualitative results that are quite different from the predictions of a uni-dimesional median voter model. See e.g., Persson and Tabellini (2000) or Coughlin (1992) for details.

[22] See Appendix A.2 for details. Proposition 3 establishes the existence of this Nash equilibrium.

5. The equilibrium

Having plugged Eqs. (11) and (12) and (5) in (14), and using the definition $m \equiv \mu/\eta$, the optimal value of θ satisfying the first-order condition is

$$\theta^* = 1 + \frac{(m-1)(1-\phi)}{1+m\phi} \tag{15}$$

for $\theta \in \Theta$. θ^* equals $\underline{\theta}$ or $\overline{\theta}$ in the obvious way otherwise.

Plugging θ^* back into (5) we find the corresponding equilibrium ratio of industry shares:

$$v^* = \frac{\lambda - m\phi}{m - \lambda\phi}. \tag{16}$$

Simple derivations give the expected signs for the following partial derivatives: $\partial v^*/\partial\lambda > 0$ and $\partial v^*/\partial m < 0$ (a region's share of industry increases with its sizes and political weight).

Many interesting results steam from Eqs. (15) and (16). Since the ultimate concern of voters is to attract economic activities in the region where they live, let us focus first on v^*. As is clear from (16), once we introduce the political dimension as a determinant of the policy decision, the equilibrium industry share does not depend anymore only on the economic forces at work. Indeed,

> *Result 4*: The equilibrium share of industry of any region is increasing with its size (essentially an economic parameter) *and* its homogeneity (a socio-economic, or political, parameter), which reflects the relative salience of the regional policy for those living in that region.

The first of these two effects is well known and is an alternative formulation of the standard home-market effect. The second one is new and is dubbed here as *vote-market effect* by analogy. Recall that in the standard model (i.e. with $m=1$), the home-market effect is defined as $\partial v^*/\partial\lambda > 1$ if, and only if, $\lambda > 1$. Likewise, when the two regions have the same size ($\lambda = 1$), the vote-market effect is: $\partial v^*/\partial(1/m) = (1-\phi^2)/(1-\phi(1/m))^2 > 1$ if, and only if, $m < 1$.

Define the *swing-market effect* as the outcome when both the home-market and the vote-market effects interact, and introduce yet a new variable, $\lambda_{\text{SWING}} \equiv \lambda/m$, representing the overall relative force of the two regions. Particularly, λ_{SWING} is the ratio of the mass of swing voters in U relative to the mass of swing voters in R, namely $\lambda_{\text{SWING}} \equiv s_L f_{\text{U}}(0)/(1-s_L)f_{\text{R}}(0) = s_L\eta/(1-s_L)\mu$. It is easy to check that $\partial v^*/\partial\lambda_{\text{SWING}} = (1-\phi^2)/(1-\phi\lambda_{\text{SWING}})^2 > 1$ if, and only if, $\lambda_{\text{SWING}} > 1$. In other terms,

> *Result 5*: The swing-market effect works in favour of the region that has the largest mass of swing voters.

To put it differently, in equilibrium, the big region U will end up attracting a more than proportional mass of firms only if its economic strength ($\lambda > 1$) more than compensate its political weakness due to the higher dispersion of its population over the political dimension ($m > 1$). Conversely the economically small region can attract a more than proportional number of firms if it has enough political power, i.e. if it has a sufficiently large number of swing voters. Thus, when the vote-market effect is added to the basic model, predictions may differ from those induced by the standard *economic* home-market effect and the political game may qualitatively reverse the *laissez-faire* outcome.

A final point deserves attention here. When trade barriers are sufficiently low, but still positive, our model too features a core–periphery outcome unless $\lambda_{\text{SWING}} = 1$, a degenerate case. In particular, the whole industry concentrates in Urban whenever $\phi > \lambda_{\text{SWING}}$, while $s_N = 0$ (Rural becomes the core) whenever $\phi > \lambda_{\text{SWING}}^{-1}$. The novelty of our analysis is that, when the political game is given the deserved attention, the definite prediction of the traditional models on the big region becoming the core does not necessarily hold anymore: It is not necessarily the large region that attracts all economic activities in the end. The political environment does matter in shaping the equilibrium geography.

Having analysed the equilibrium location of economic activities, we can now turn to the analysis of the equilibrium subsidy level which delivers v^*.

5.1. The equilibrium subsidy level: Does size matter?

As expected, interior solutions for θ^* are increasing in m (see (15)). Candidates want to attract swing voters and the less dispersed group has a larger mass of such voters (ceteris paribus). Hence, the wider is the difference in the homogeneity degree of the two regions, the higher is the subsidy level the relatively more homogeneous region receives. Besides, θ^* is larger than unity and, hence, Rural is subsidized, if $m > 1$. This departure from a majoritarian result, which is due to the fact that regional policy is more salient to a minority of citizens, is one of the sources of non-majoritarian outcomes discussed in Besley and Coate (2000).

The attentive reader might have noticed that apparently regional size does not matter in determining the equilibrium subsidy θ^*. Observe that, indeed, the economic weight λ does not appear in (15) and the region that gets the subsidy is the more homogeneous one, independently from its size. This is clearly a knife-edge result which can be explained by the dual nature of s_L. On the one hand, s_L is a political variable: In (14), it represents the size of the electorate and has a direct positive effect on s_N^* due to a straightforward electoral competition effect. On the other hand, s_L is an economic variable: In (5), λ represents the size of the labour force and pushes s_N up via the home-market effect; a higher θ is thus required to keep s_N at its equilibrium level s_N^*. (see the appendix for algebraic details). These two forces have opposite effects on θ^* in (15). In the present case they exactly cancel out. The logarithmic transformation of the CES aggregate in the utility function (1) is responsible for this knife-edge result. In the working paper version it is shown (Robert-Nicoud and Sbergami, 2001) that a more general functional form for (1) translates into a net effect of λ on θ^*.

5.2. Core–periphery outcomes

It is also very instructive to look closer at the corner solutions of θ^*. Corner solutions for θ occur when $\underline{\theta} = \text{argmax}_{\theta\in\Theta}\, \Omega(\theta)$ or $\overline{\theta} = \text{argmax}_{\theta\in\Theta}\, \Omega(\theta)$. It is possible to show (calculations are available from the authors) that

$$\theta^* - \underline{\theta} \geqslant 0 \quad\Leftrightarrow\quad \phi \leqslant \frac{m}{\lambda} \equiv \frac{1}{\lambda_{\text{SWING}}} \tag{17}$$

and that

$$\overline{\theta} - \theta^* \geqslant 0 \quad\Leftrightarrow\quad \phi \leqslant \frac{\lambda}{m} \equiv \lambda_{\text{SWING}}. \tag{18}$$

Consider first the case in which the *political strength* of voters in region R is not as strong as the economic strength of the voters in U, namely $m < \lambda$ (or, equivalently, the case in which the vote-market effect is weaker than the home-market effect). As the two regions become highly integrated and ϕ approaches unity, (17) tells us that the core is in U. In this case, the common wisdom according to which regional policy can only ‘postpone the unavoidable’, that is, the emptyness of the small region, receives strong support. For $m > 1$, the *laissez-faire* solution would only precipitate the core–periphery outcome, viz. $\phi^{\text{CP}} < 1/\lambda_{\text{SWING}}$.

Consider now the opposite case, in which the voters in R are so homogeneous that their *political strength* completely offsets their *economic weakness* (that is R has more swing voters than U). In such a case, $m > \lambda$, so that $\theta^* = \overline{\theta}$ for high degrees of freeness. In other words, as inter-regional trade is highly integrated, the core will end up being in the small region, R.

In conclusion we can say that

> *Result 6*: Whatever the relative strength of the two regions, whether economic or political, if ϕ increases over time and gets closer to unity, eventually, a core-periphery outcome does come out; where the core will end up being depends on the overall strength of the two regions, and it will not necessarily be in the big region as the orthodox theory would predict.

5.3. Further results

As is possible to see from (15), the equilibrium level of regional aid is decreasing with the degree of freeness ϕ. Even if it might seem counter-intuitive, this prediction is consistent with the observation that regional policy is more and more effective when transportation costs decrease (see Section 3). In our model, even a small subsidy can have a big impact on industry location when trade is sufficiently integrated. Moreover, the fact that θ^* decreases with ϕ does not say anything about the *effectiveness* of these aids. Indeed, location becomes more and more sensible to policy as ϕ increases; as a consequence of this, the fact that θ^* is decreasing with ϕ does not necessarily mean that R gets less *effective* aid. The correct way to address this issue is to compare the *political economy* location equilibrium, v^*, to the *laissez-faire* outcome, $v|_{\theta=1}$ (see

Eqs. (16) and (6)). From the rural region's point of view, the regional aid policy is meant to be *favourable* if the following holds:

$$\Delta_{\mathrm{R}} \equiv v|_{\theta=1} - v^* = \frac{\lambda(1-\phi^2)(m-1)}{(\lambda\phi-1)(\lambda\phi-m)} > 0, \tag{19}$$

which is the case if, and only if, $m > 1$ (recall that for interior solutions $\phi < 1/\lambda < m/\lambda$). Besides,

$$\frac{\partial \Delta_{\mathrm{R}}}{\partial \phi} = \frac{s_L}{(1-\phi)^2}\frac{m-1}{m+\lambda} > 0 \tag{20}$$

provided that $m > 1$. Hence,

> *Result 7*: taking the *laissez-faire* economic equilibrium as a benchmark, the introduction of an endogenous policy variable increases the number of firms in the politically strong region. This effect is even stronger with the deepening of the economic integration.

To conclude let us look briefly at the normative side of the model. As shown in the appendix, U's typical agent's welfare is maximized at $\underline{\theta}$, corresponding to the smallest, possibly negative, amount of subsidy to the plants located in the urban region such that U is the core. Conversely, in R welfare is maximized at $\theta = \overline{\theta}$, corresponding to the smallest amount of subsidy to plants in the rural region compatible with R being the core. Clearly, the interests of the two categories of the population are opposed. In particular, when $m > 1$, the larger region U is worse-off in comparison to the *laissez-faire* outcome, and the small one, R, is better-off.

Put differently, for any pair of payoffs $\{V_{\mathrm{U}}(\theta), V_{\mathrm{R}}(\theta)\}$, it is impossible to make everybody better-off without harming anyone. This is quite obvious since, in this setting, any variation in θ^* has opposite effects on the welfare of the two type of agents.[23] The instrument considered here, θ, is non-distortionary in that the political-economy outcome lies on the (second-best) Pareto frontier, defined as $\{(V_{\mathrm{U}}(s_N)), (V_{\mathrm{R}}(s_N)) : s_N \in [0,1]\}$.

6. Summary and conclusion

In the late 1950s, the per-capita income gap between Belgium's main regions, Flanders and Wallony, was particularly wide.[24] Flanders was behind and it was widely expected that it would take it more than 20 years to close the gap. In fact, it took only 6 years for Flanders' per capita income to reach the level of Wallony. What happened? Early in the 1960s, the 'Loi d'expansion régionale' (literally, the 'law of regional expansion') entered into force. This law was designed to attract investment, mainly to Flanders. Some of this investment was clearly diverted from Wallony, and the law had the effect of accelerating the catch-up process. But why did this law get passed in the first place?

[23] This is always true, of course, because $\theta^* \in \Theta$.

[24] We are grateful to Jacques Thisse for providing us with this powerful example taken from Bismans (1998).

The explanation put forth by our model focuses on the difference in the political environments prevailing in the two regions. Wallony was deeply divided politically with a very conservative right, a strong left-wing party, and a tense class struggle. By contrast, the political parties and the unions in Flanders were more moderate. Moreover, Wallony experienced an influx of immigrants and, consequently, its society was more heterogeneous and variegated than the Flemish society. These differences still remain today, and now it is Wallony that is behind.

This historical example illustrates how political groups that focus only on a few issues are particularly attractive for politicians. In particular, we have argued that a more homogenous electoral base is better able to capture political gains through a voting process and we have applied this property to an economic geography issue showing that political forces can dramatically change the market outcome.

Using a very simple model of economic geography enriched to allow for endogenously determined regional policy, this paper analyses the impact of regional policy on the spatial allocation of industry. In spite of the framework's simplicity, interesting results emerge. The relative size of the regions has an ambiguous effect on the equilibrium subsidy. On the one hand, if a larger fraction of the population – hence, of voters – lives in a given region, the equilibrium subsidy to the other region tends to be reduced as more voters favour a lower value of subsidies. On the other hand, due to the home-market effect, an increase in a region's size increases its equilibrium share of industry – and hence, its real income – for any given subsidy level. This aspect of the home-market effect allows all political candidates to rise the subsidy to the other region without altering individuals' welfare. In essence, the very fact that the economically big region is big means that its people are willing to accept larger "real taxes" (in the form of a loss in their economic welfare). The net effect of the relative population size is thus ambiguous.

The effectiveness with which regional policy slows down the agglomeration process depends on the relative size of the two populations. For a given amount of regional aid, the regional policy is less effective in attracting industrial activity to the small region if the size disparity of the two regions is larger, again due to the home-market effect. Thus, the political factor determines the amount of aid and the economic factor establishes its effectiveness. Indeed, if the small region is much more homogenous than the large region, politically determined regional policy may even reverse the spatial outcome predicted by orthodox economic geography theory. That is, the core can end up in the small region when transport costs are sufficiently low since the agglomeration forces that favour the big region become very weak as trade gets freer, allowing the small region's political advantage to overcomes its economic weakness.

Even if it is difficult to find cases in where regional policy reversed the expected regional specialization patterns, our theoretical findings help exposit the internal logic of the complex interplay of openness, regional policy and the observed spatial allocation of industry. Poor and depressed regions may not attract all the economic activities and become the core in spite of the help they get in the form of regional aids as happened in the case of Flanders. Nevertheless, ceteris paribus, we should expect countries (or constituencies) marked by prominent 'rural-vs.-urban' divides to have lower levels of agglomeration at any point on the integration path. We note, however, that adding labour mobility – in the form of, say, a rural exodus – might increase the heterogeneity of urban areas (assuming it takes one generation for the newcomers to adapt fully to the new life-style). To the extent that this favours a more aggressive anti-agglomeration regional policy, such a mechanism would tend to favour a more spatially dispersed outcome for industry.

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Appendix A.

A.1. Derivation of the indirect utility functions

As can be seen from (11) and (12), θ affects both V_{U} and V_{R} through s_N only. In particular, both the representative individual's net earnings $w + \rho(K + K_{\mathrm{R}}) - T$ and expenditure on X are constant, as we now show.

Claim 1. *The expenditure on the differentiated good X is constant.*

Proof. Plugging the price equations into $p(i)c(i)$, where $c(i)$ is given by (3), and integrating over all varieties, which gives the (individual) expenditure on the X-good, we get

$$\frac{N + N_{\mathrm{R}}\tau\tau^{-\sigma}}{N + N_{\mathrm{R}}\phi} = 1 \tag{A.1}$$

by definition of ϕ. □

Claim 2. *The net earnings of the typical individual are constant with respect to θ in both regions.*

Proof. Take the case $\theta > 1$ (a symmetric reasoning would apply in the other case). Observe that $w + \rho(K + K_{\mathrm{R}}) - T = 1 + (Nx/\sigma + N_{\mathrm{R}}\theta x_{\mathrm{R}}/\sigma) - (\theta - 1)N_{\mathrm{R}}x_{\mathrm{R}}/\sigma$. Using (4), this can be rewritten as

$$w + \rho(K + K_{\mathrm{R}}) - T = 1 + \frac{1}{\sigma}\left(\frac{N + \phi N_{\mathrm{R}}}{N + \phi N_{\mathrm{R}}} s_L + \frac{\phi N + N_{\mathrm{R}}}{\phi N + N_{\mathrm{R}}}(1 - s_L)\right) \tag{A.2}$$

which is identical to $1 + 1/\sigma$.

To get (11) and (12) in the text, note that $\ln(N + \phi N_{\mathrm{R}}) \equiv \ln(s_N + (1 - s_N)\phi) + \ln(K + K_{\mathrm{R}})$ and that utility derived from the consumption of good Y is identical to the net earnings minus expenditure of X by definition of (1). □

A.2. Existence and uniqueness of the Nash equilibrium in the platform-setting game

A.2.1. Uniqueness

We first recall the basic trade-off that any candidate faces: When increasing the value of θ, a candidate (say candidate A) expects to loose (to gain) the votes of the most indifferent voters in U (in R). Swing voters are more numerous the higher their density, the larger the population size, and the larger the change proposed. At equilibrium, the number of lost and gained votes must be equal:

$$L\frac{\partial V_{\mathrm{U}}}{\partial \theta_A} f_{\mathrm{U}}(\Delta_{\mathrm{U}}(\theta_A, \theta_B)) + L_{\mathrm{R}}\frac{\partial V_{\mathrm{R}}}{\partial \theta_A} f_{\mathrm{R}}(\Delta_{\mathrm{R}}(\theta_A, \theta_B)) = 0, \tag{A.3}$$

where $\Delta_{\mathrm{U}}(\theta_A, \theta_B) \equiv V_{\mathrm{U}}(\theta_A) - V_{\mathrm{U}}(\theta_B)$ and f_{U} and f_{R} are the densities of the distributions of $\varepsilon_{\mathrm{U}i}$ and $\varepsilon_{\mathrm{R}i}$, respectively.

Since the problem is symmetric for candidate B, the two candidates converge on the same platform θ^*, and from (A.3) we can generalize (14) to

$$\frac{f_{\mathrm{U}}(0)}{f_{\mathrm{R}}(0)}\lambda = -\frac{\partial V_{\mathrm{R}}/\partial\theta}{\partial V_{\mathrm{U}}/\partial\theta}(\theta^*). \tag{A.4}$$

Proposition 1. *Restrict both candidates' strategy space to Θ. If θ^* identified in (A.4) – of which (14) in the text is a special case – is the equilibrium strategy, then the Nash equilibrium (θ^*, θ^*) is unique.*

Proof. Note first that the slope of the Pareto-frontier – the right-hand side of (A.4) is equal to $-\lambda(1-\theta\phi)/(\theta-\phi)$. This term is negative on Θ. Monotonicity of the RHS of (A.4) implies the uniqueness of θ^*. □

A.2.2. Existence

Candidates A and B are assumed to maximize their expected plurality κ_A and $1-\kappa_A$ (respectively), where

$$\kappa_A = s_L F_{\mathrm{U}}(\Delta_{\mathrm{U}}(\theta_A, \theta_B)) + (1 - s_L) F_{\mathrm{R}}(\Delta_{\mathrm{R}}(\theta_A, \theta_B)) \tag{A.5}$$

is derived from (13). In this section we will look for sufficient conditions such that the Debreu–Glicksberg–Fan theorem for the existence of a Nash equilibrium in pure strategies holds (e.g., Theorem 1.2 in Fudenberg and Tirole, 1991). Conditions required by this theorem are (i) a non-empty, convex and compact strategy set Θ, (ii) payoff functions κ_i: $i = A, B$ continuous in (θ_A, θ_B), and (iii) quasi-concave in θ_i. The first two conditions are obviously met by definition of Θ and by inspection of (A.5). For (iii) to hold, it is sufficient that $F_j(\Delta_j(\theta_A, \theta_B)) : j = \mathrm{U}, \mathrm{R}$ are concave. The following lemma shows that this requirement is met.

Lemma 2. *Let $g: S \to Z$ be a concave function and $h: \Theta \to S$ a bijection, where both Θ and Z are compact subsets of $\Re$. Without loss of generality, assume that $h' \leqslant 0$ everywhere on Θ. Then $\omega = g \circ h$ is quasi-concave.*

Proof. Choose $\theta', \theta, \theta'' \in \Theta$ such that $h(\theta') < h(\theta) < h(\theta'')$.
Then

$$\begin{aligned}\omega(\theta) &= g[h(\theta)] = g[\alpha h(\theta') + (1-\alpha)h(\theta'')], \quad \text{some } \alpha \in (0,1)\\ &\geqslant \alpha g[h(\theta')] + (1-\alpha)g[h(\theta'')], \quad \text{by concavity of } g(\cdot)\\ &\geqslant \min\{g[h(\theta')], g[h(\theta'')]\} = \min\{\omega(\theta'), \omega(\theta'')\}.\end{aligned}$$

Also, $\theta' > \theta > \theta''$ by the monotonicity of $h(\cdot)$; so $\omega(\cdot)$ is quasi-concave. □

Next, we show that $F_{\mathrm{U}}(\cdot)$ and $F_{\mathrm{R}}(\cdot)$ in the text trivially satisfy the second-order conditions for the existence of a Nash equilibrium – conditions (A.6) and (A.7) below. (Indeed, any smooth, symmetric with mean zero pdf does.)

Proposition 3 (Sufficient conditions). *The Nash equilibrium $(\theta_A, \theta_B) = (\theta^*, \theta^*)$, with θ^* as given by (A.4), exists if both of the following hold (using a slight abuse of notation):*

$$\lambda\left[f'_{\mathrm{U}}(0)\left(\frac{\partial V^*_{\mathrm{U}}}{\partial s_N}\right)^2 + f_{\mathrm{U}}(0)\frac{\partial^2 V^*_{\mathrm{U}}}{\partial s_N^2}\right] + \left[f'_{\mathrm{R}}(0)\left(\frac{\partial V^*_{\mathrm{R}}}{\partial s_N}\right)^2 + f_{\mathrm{R}}(0)\frac{\partial^2 V^*_{\mathrm{R}}}{\partial s_N^2}\right] \leqslant 0 \quad \text{(A.6)}$$

and

$$\lambda\left[f'_{\mathrm{U}}(0)\left(\frac{\partial V^*_{\mathrm{U}}}{\partial s_N}\right)^2 - f_{\mathrm{U}}(0)\frac{\partial^2 V^*_{\mathrm{U}}}{\partial s_N^2}\right] + \left[f'_{\mathrm{R}}(0)\left(\frac{\partial V^*_{\mathrm{R}}}{\partial s_N}\right)^2 - f_{\mathrm{R}}(0)\frac{\partial^2 V^*_{\mathrm{R}}}{\partial s_N^2}\right] \geqslant 0. \quad \text{(A.7)}$$

(This proposition is a restatement of Theorem 2 in Lindbeck and Weibull (1987, pp. 280–281).)

Proof. By Lemma 2, it is sufficient to check that the RHS of (A.5) is concave in s_N, since s_N is decreasing in θ. The value of s_N at equilibrium is simply (s_N^*, s_N^*), with $s_N^* \equiv s_N(\theta^*)$. Fix $s^0 \in [0,1]$ and define $s_N(\varepsilon) = s_N^* + \varepsilon(s^0 - s_N^*)$, $\varepsilon \in (0,1)$. By convexity of $[0,1]$, $s_N(\varepsilon) \in \mathrm{int}[0,1]$. Also, define $h(\varepsilon, s^0) = \kappa_A(s_N(\varepsilon), s_N^*)$ as A's expected vote share when she plays $s_N(\varepsilon)$ and B plays her equilibrium strategy s_N^*. That is,

$$\begin{aligned}h(\varepsilon, s^0) = {} & s_L F_{\mathrm{U}}(V_{\mathrm{U}}(s_N(\varepsilon)) - V_{\mathrm{U}}(s_N^*))\\ & + (1 - s_L)F_{\mathrm{R}}(V_{\mathrm{R}}(s_N(\varepsilon)) - V_{\mathrm{R}}(s_N^*)).\end{aligned} \quad \text{(A.8)}$$

First, we have that $\forall s^0 \in [0,1]$: $h'(0,s^0)=0$ by Proposition 3 above. Next, for s_N^* to be an optimal strategy for A, it must be that $\forall s^0 \in [0,1]$: $h''(0,s^0) \leqslant 0$:

$$\begin{aligned} h''(\varepsilon,s^0) = {} & s_L f'_{\mathrm{U}}(\cdot)\left(\frac{\partial V_{\mathrm{U}}}{\partial s_N}(s_N(\varepsilon))\right)^2 (s^0 - s_N^*)^2 \\ & + s_L f_{\mathrm{U}}(\cdot)\left(\frac{\partial^2 V_{\mathrm{U}}}{\partial s_N^2}(s_N(\varepsilon))\right)^2 (s^0 - s_N^*)^2 \\ & + (1-s_L) f'_{\mathrm{R}}(\cdot)\left(\frac{\partial V_{\mathrm{R}}}{\partial s_N}(s_N(\varepsilon))\right)^2 (s^0 - s_N^*)^2 \\ & + (1-s_L) f_{\mathrm{R}}(\cdot)\left(\frac{\partial^2 V_{\mathrm{R}}}{\partial s_N^2}(s_N(\varepsilon))\right)^2 (s^0 - s_N^*)^2 \leqslant 0. \end{aligned} \tag{A.9}$$

Consequently, $h''(0,s^0) \leqslant 0$ if, and only if, (A.9) holds. A symmetric argument for candidate B shows that s_N^* is her strategy at equilibrium if (A.7) holds. □

A.3. When size does matter

Here we show that the fact that λ does not enter (15) is an artifact due to the dual nature of s_L. Define s_{E} the share of expenditure on X that accrues from region U and s_{V} the share of voters located in U. In the same spirit, we also introduce the notation λ_{E} and λ_{V} with an obvious meaning. In the core of the paper, $s_{\mathrm{V}} = s_{\mathrm{E}} = s_L$ and $\lambda_{\mathrm{V}} = \lambda_{\mathrm{E}} = \lambda$. Using this new notation we first rewrite the 'political equilibrium' (16) as

$$v^* = \frac{\lambda_{\mathrm{V}} - m\phi}{m - \lambda_{\mathrm{V}}\phi}. \tag{A.10}$$

Conversely, (5) is an economic equilibrium condition, hence we write it as

$$v = \frac{(1-\theta\phi)\lambda_{\mathrm{E}} - \phi(\theta-\phi)}{(\theta-\phi) - \lambda_{\mathrm{E}}\phi(1-\theta\phi)}. \tag{A.11}$$

Finally, (15) is the result of the tension between political and economic forces. Indeed, from (A.10) and (A.11), we obtain

$$\theta^* = 1 + (1-\phi)\frac{(m-1)\lambda_{\mathrm{E}} + m(\lambda_{\mathrm{E}} - \lambda_{\mathrm{V}})}{(1+\phi m)\lambda_{\mathrm{E}} - (\lambda_{\mathrm{E}} - \lambda_{\mathrm{V}})}. \tag{A.12}$$

Obviously, $\lambda_{\mathrm{V}} = \lambda_{\mathrm{E}} = \lambda$ implies the expressions in the text. In particular, the fact that all the λ's cancel out in (A.12) shows that λ not entering (15) is an artifact. In the text, we also claim that $\partial\theta^*/\partial\lambda_{\mathrm{V}} < 0$ and $\partial\theta^*/\partial\lambda_{\mathrm{E}} > 0$. These conditions can easily be seen by inspection of (A.12). □

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