Resisting Economic Integration when Industry Location is Uncertain

Gallo, Fredrik

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Fredrik Gallo*

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Abstract

This paper analyses the political determination of transportation costs in a new economic geography model. In a benchmark case with certainty about where agglomeration takes place, a majority of voters favour economic integration and the resulting equilibrium is an industrialised core and a de-industrialised periphery. Allowing for uncertainty, a high level of trade costs may win the election and maintain the initial distribution of industry. The reason is that a coalition of risk-averse immobile factors of production votes for the status quo due to uncertainty about which region will attract industry if economic integration is pursued. Finally, the standard view that agglomeration is unambiguously beneficial to residents in the industrial centre is challenged by introducing costs of undertaking economic integration.

Key words: footloose entrepreneur model; majority voting; new economic geography; regional policy

JEL: F12, F15, R12

1 Introduction and Previous Studies

Negotiations on trade policy have always been at the top of the political agenda of many countries. This has been manifested by the birth of numerous free trade areas, customs unions, and international organisations governing and monitoring common rules of world trade. Furthermore, many countries devote large amounts of money to improve their

*Department of Economics, Lund University, P.O. Box 7082, SE - 220 07 Lund, Sweden. I am indebted to Fredrik Andersson, Carl-Johan Belfrage, Rikard Forslid, Richard Friberg, Gianmarco I. P. Ottaviano, Frédéric Robert-Nicoud and Federica Sbergami for their thoughtful suggestions. The usual disclaimer applies. Financial support from the Crafoord Foundation, the Foundation for Advancement of Economic Research at Lund University, the Jan Wallander and Tom Hedelius Foundation, and the Royal Swedish Academy of Sciences is gratefully acknowledged.

domestic infrastructure to make it easier and cheaper to transport goods, promote trade and increase the mobility of people. For instance, in 2001, the European Commission published a White Paper stating that an inadequate common transportation system and inconsistent technical regulations, especially regarding the railway system, were still major obstacles to European economic integration and the implementation of the common transport policy established in the Rome treaty.[1] The White Paper contains some 60 specific measures, under 12 policy packages[2] to be taken at Community level, addressing these issues. Some of the proposed measures are investments aimed at improving infrastructure, like implementing the Trans-European Transport Network (TEN-T) and completing the remaining special projects selected by the Essen European Council in 1994.[3] Others deal with the harmonisation of national safety and technical standards, while some are concerned with enforcing existing Community competition rules ensuring that regulatory and technical barriers to entry in the transport sector are eliminated.

Four years later, a mid-term assessment of the progression towards the White Paper's goals was published (De Ceuster G. et al., 2005). While the overall level of progress of legislative activities at the EU level is considered to have advanced well (legislation covering about 50% of the measures has been adopted by the European Parliament and

[1] COM (2001) 370. Also, see COM (2002) 18 for the challenges facing the EU in creating an integrated European railway area.

[2] The 12 policy packages are: 1) Improving quality in the road transport sector 2) Revitalising the railways 3) Controlling growth in air transport 4) Promoting transport by sea and inland waterway 5) Turning intermodality into reality 6) Building the Trans-European transport network 7) Improving road safety 8) Effective charging for transport 9) Recognising the rights and obligations of users 10) Developing high-quality urban transport 11) Putting research and technology at the service of clean, efficient transport, and 12) Managing the effects of globalisation.

[3] A revision of the TEN-T guidelines in 2004 added new projects to the original 14. The TEN-T now includes 30 priority axes and projects, of which only three had been completed in 2005: the railway axis Cork-Dublin-Belfast-Stranraer, the Malpensa Airport and the Öresund fixed link. See the European Commission (2005) for an overview of the projects.

the Council, while another 15% are pending approval), the measures considered the most effective (like pricing measures and effective transport charging) have not yet been implemented. Furthermore, the report states that the failure to implement infrastructure charging has meant that a potential key source of finance for the TEN-T has not become available.[4] The assessment also notes that (De Ceuster G. et al., 2005, p. 15): "There is a need to reassure industry that it will not be made less competitive by the move and to buy off opposition from peripheral countries." and that focus should be on creating incentives "to overcome local political or financial barriers" to implementation (ibid.).[5]

The effects of trade and transportation policies on industrial structure have been analysed in the *new economic geography* (henceforth *NEG*)[6], in which economic integration triggers agglomeration processes that change the geographical distribution of firms. Indeed, the level of trade costs is one of the key parameters determining the location of industrial production. The trade costs are thought of as capturing all potential impediments to trade including tariffs, transportation costs (gasoline bills, insurance costs, road tolls, and delays due to congestion), differing national legislation and technical standards, language differences and red tape at borders. All of these are lumped together into a single measure of trade barriers, which is determined outside the models. An unsatisfactory feature, perhaps, given all the political effort and non-negligible sums of money that are invested in shaping the trade and transport policies of many countries.

The aim of this paper is to endogenously determine the level of trade costs within

[4] At the beginning of 2005 the Member States estimated that the completion of the 30 priority projects by 2020 would require EUR 252 billion. Including projects not on the priority list, completing the TEN-T was estimated to exceed EUR 600 billion (see the European Commission, 2005).

[5] Indeed, Annex XX of De Ceuster G. et al. (2005) is devoted to identifying how various socio-economic groups are affected by the policies, and analyses conflicts among them.

[6] Pioneered by Krugman (1991), Krugman and Venables (1995) and Venables (1996). Fujita et al. (1999) provide a synthesis of the early contributions in the field. A second generation of models can be found in Baldwin et al. (2003).

a *NEG* framework, using a simple political economy approach. In standard *NEG* models industry relocates as economic integration is undertaken, affecting various factors of production differently. The winners are firms and consumers in the region that attracts industry, whereas the losers are the inhabitants in the deindustrialised region. We empower these different groups politically and determine how far economic integration is pursued. This means that government in some form has to be introduced. This has been done by others in different *NEG* settings in order to analyse tax competition (Andersson and Forslid, 2003, Baldwin and Krugman, 2004, Kind et al., 2000, and Ludema and Wooton, 2000), and regional and industrial policy (Forslid and Midelfart, 2005, Martin and Rogers, 1995, and Robert-Nicoud and Sbergami, 2004). Baldwin et al. (2003) analyse, apart from the policies mentioned above, unilateral trade policy and preferential trade agreements, introducing a gallery of analytically solvable *NEG* models. They also categorise various welfare effects, analyse whether agglomeration is desirable or not, and investigate market outcomes from efficieny and equity perspectives.

In Behrens and Gaigne (2006) and Behrens et al. (2006), the level of transportation costs is (partly) endogenous in a *NEG* setting. The common denominator is that a part of transportation costs is made dependent on the total volume of trade between trading partners. Specifically, density diseconomies are introduced. As firms agglomerate in a location the volume of trade decreases, increasing unit shipping costs. This renders moving less attractive for remaining firms and agglomeration becomes self-defeating and gradual in nature. An equilibrium level of trade costs is hence determined by the spatial distribution of firms.

Our study takes a different route, introducing a majority voting game in the *footloose entrepreneur* model developed by Forslid and Ottaviano (2003). Industry is geographically dispersed between two regions forming a unified political jurisdiction. Pursuing economic integration is initially costless and voter groups with competing interests struggle to get as much industy as possible located in their own region. Two political candidates announce their positions on the level of transportation costs. The policy proposal gaining a majority of votes will then be implemented and, depending on the winning level of transport costs, industry will either relocate or stay put. Due to uncertainty about which region will attract industrial activity (an inherent feature of all *NEG* models with symmetric locations), a coalition of risk-averse agents may resist economic integration.

The basic idea is the same as in Fernandez and Rodrik (1991), where uncertainty about the distribution of the gains and losses of trade reform gives rise to a bias against the reforms. In our paper, immobile factors of production do not know *ex ante* (when they vote) if they will live in the industrialised centre (with its lower cost of living) or in the de-industrialised periphery. This uncertainty may prevent reforms, that promote economic integration, from being implemented, even though they would gain support *ex post*. We then extend the analysis and investigate how political support for economic integration is affected if reform is costly. Our results challenge the standard view that agglomeration is always beneficial to the residents in the region hosting the agglomeration. In the simplest case of economic integration being financed by a lump-sum tax, even the mobile factor may resist integration efforts. The reason is that the tax affects its nominal return negatively, lowering it compared to the level it earns in the absence of economic reform.

The rest of this paper is organised as follows. The next section lays out the basic structure of the economic model. Section 3 adds the majority voting game and contains an analysis of the political determination of trade costs when reform is free of charge. Costly reform is introduced in section 4. Some tentative conclusions are offered in section 5.

2 The Economic Model

We employ the *footloose entrepreneur* model from Forslid and Ottaviano (2003), which is also laid out in detail in Baldwin et al. (2003, ch. 4). A political jurisdiction consists of two regions (or countries), North and South, which are identical with respect to preferences, technology and factor endowments. An asterisk denotes South's variables. Each region has two sectors (A and M) and two factors of production (skilled, H, and unskilled, L, labour). Unskilled workers are assumed to be geographically immobile, whereas skilled workers move freely between the regions. Each type of worker inelastically supplies one unit of labour. The A sector is perfectly competitive and produces a homogeneous good under constant returns to scale, employing unskilled labour only. Firms in the monopolistically competitive M sector produce a horizontally differentiated good under increasing returns to scale, employing both skilled and unskilled labour. Cross-regional shipping of A-sector goods is free, whereas trade in M-sector goods is subject to iceberg transportation costs. Consumer preferences are represented by

$$\begin{aligned} U(Z) &= \frac{Z^{1-\gamma}}{1-\gamma};\ 0 \leq \gamma < 1;\ Z \equiv C_M^{\mu} C_A^{1-\mu}; \\ C_M &\equiv \left(\int_{i=0}^{n+n^*} c_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}};\ 0 < \mu < 1 < \sigma, \end{aligned} \tag{1}$$

where C_A is consumption of the homogeneous good, C_M is the manufacturing aggregate, c_i is the consumption of variety i, n (n^*) is the mass of varieties produced in North (South), μ is the share of expenditure on M varieties, and σ denotes the constant elasticity of substitution between any pair of the differentiated goods. New in (1), compared to the original model in Forslid and Ottaviano (2003), is the use of the constant relative risk aversion (*CRRA*) utility function, $U(Z)$. The consumers' attitude toward risk is measured by the coefficient of relative risk aversion, $-\frac{U''(Z)Z}{U'(Z)} = \gamma$. A higher γ implies that consumers are more risk-averse; if $\gamma = 0$, then consumers are risk-neutral.[7]

[7] In general, the parameter γ of the *CRRA* utility function need not be restricted to be less than unity. However, as will be explained in section 2.1, the model's agglomeration properties impose the restriction

The unit input requirement for A sector firms is assumed to be $a_A = 1$. Perfect competition enforces marginal cost pricing: $p_A = w_L$ and $p_A^* = w_L^*$, where p_A is the price of the homogeneous good and w_L is the wage paid to unskilled labour. Due to costless trade in the A sector, choosing the homogeneous good as the numéraire yields $p_A = p_A^* = 1$ and hence $w_L = w_L^* = 1$.[8] Production of a M sector variety requires a fixed cost of one unit of skilled labour and a_M units of unskilled labour per unit of output. The total cost function for a typical M sector firm is thus

$$TC_j = w_H + w_L a_M x_j, \tag{2}$$

where w_H is the return to skilled labour and x_j is the firm's level of output. The assumed unit input requirement of skilled labour implies that the worldwide mass of firms ($n^w = n + n^*$) equals the world's stock of skilled labour ($H^w = H + H^*$). Profit-maximisation ensures that the price of variety j produced in North is

$$p_j = (\frac{\sigma}{\sigma - 1}) w_L a_M. \tag{3}$$

Given the utility function in (1), the total demand for variety j produced in North is

$$c_j = \frac{\mu Y p_j^{-\sigma}}{P^{1-\sigma}} + \frac{\tau \mu Y^* (\tau p_j)^{-\sigma}}{P^{*1-\sigma}}, \tag{4}$$

where $\tau > 1$ is the iceberg transportation cost, $Y = w_L L + w_H H$ is regional income in North and $P = \left[n p_j^{1-\sigma} + n^* \left(\tau p_j^* \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$ is North's price index of the manufacturing aggregate M.

Pure profits in the M sector, $\Pi_j = (p_j - w_L a_m) c_j + (p_j - w_L a_m) \tau c_j^* - w_H$, are zero in equilibrium due to free entry and exit. As firms compete for the fixed stock of skilled workers they bid up their wage until it equals the operating profit. Setting $\Pi_j = 0$ and using the demand functions, the pricing condition, the price indices and the standard normalisation

in this paper.

[8] Unskilled workers' wages are only equalised across regions provided that the A sector is active in both regions after trade. The required condition is $\mu < \frac{\sigma}{2\sigma - 1}$.

$a_M \equiv \frac{\sigma-1}{\sigma}$, North's return to skilled labour can be written as $w_H = \frac{1}{\sigma}\left(\frac{\mu Y}{n+\phi n^*} + \frac{\phi\mu Y^*}{\phi n+n^*}\right)$, where $\phi \equiv \tau^{1-\sigma}$ is the usual measure of trade freeness, ranging from 0 (autarky) to 1 (free trade). For South the corresponding expression is $w_H^* = \frac{1}{\sigma}\left(\frac{\mu Y^*}{\phi n+n^*} + \frac{\phi\mu Y}{n+\phi n^*}\right)$. The share of skilled labour located in North is defined as $s_H \equiv \frac{H}{H^w}$, and the share of firms located in North as $s_n \equiv \frac{n}{n^w}$. We normalise the world stock of skilled workers to unity, $H^w = 1$, which implies that $n = s_n = s_H$ (due to the one-to-one relationship between skilled workers and M sector firms). The return to skilled labour in each region can then be written as

$$w_H = \frac{\mu}{\sigma}\left(\frac{Y}{s_H + \phi\left(1-s_H\right)} + \frac{\phi Y^*}{\phi s_H + \left(1-s_H\right)}\right) \tag{5}$$

and

$$w_H^* = \frac{\mu}{\sigma}\left(\frac{Y^*}{\phi s_H + \left(1-s_H\right)} + \frac{\phi Y}{s_H + \phi\left(1-s_H\right)}\right). \tag{6}$$

With preferences represented by the utility function in (1), the indirect utility function for a Northern resident of labour typ $j = L, H$ is

$$V_j = \frac{\left(kI_jP^{-\mu}\right)^{1-\gamma}}{1-\gamma}, \tag{7}$$

where $P = \left[s_H + \phi\left(1-s_H\right)\right]^{\frac{1}{1-\sigma}}$ is the price index of the manufacturing aggregate, $k \equiv \mu^\mu\left(1-\mu\right)^{1-\mu}$ and I_j is the individual's income according to:

$$I_j = \begin{cases} 1 & \text{for unskilled workers} \\ w_H & \text{for skilled workers} \end{cases}. \tag{8}$$

The model has two types of long-run equilibria: symmetric ones, in which the stock of skilled workers (and hence the M sector) is equally divided between the regions, and core-periphery equilibria where all the M sector firms are located in one region. In the latter case, we will refer to the location hosting the M sector as the *core*, and the other one the *periphery*. We next look at how economic integration affects the M sector's long-run equilibrium location.

2.1 Long-Run Equilibria and Stability

Initially skilled workers are equally distributed between the regions, $s_H = \frac{1}{2}$. In the long run they are mobile and maximise their indirect utilities by moving to the region with the higher utility. We follow Baldwin et al. (2003, ch. 4) and assume that skilled labour's migration is governed by $\dot{s}_H = (V_H - V_H^*)\, s_H\, (1 - s_H)$, where V_H is given by (7) and V_H^* is South's equivalent. A long-run equilibrium with *both* regions producing M goods ($0 < s_H < 1$) will only exist if $V_H = V_H^*$. Migration also ends if one of the regions becomes the core, hosting all of M industry ($s_H = 1$ or $s_H = 0$).

The standard procedure to see whether the initial symmetric distribution of firms is stable is to consider a move by an infinitely small mass of skilled workers from one region to the other. If the post-shock indirect utility is lower in the receiving region than in the sending region, then the skilled workers will want to move back and restore the initial equilibrium. If the move raises indirect utility they will want to stay and the symmetric outcome will be unstable.

Solving the model when trade is free ($\phi = 1$) reveals that any distribution of skilled workers yields $V_H = V_H^*$. Any allocation of skilled workers is thus an equilibrium allocation. If trade costs are infinite ($\phi = 0$), we have $\frac{V_H}{V_H^*} = \left(\frac{s_H}{1-s_H}\right)^{\frac{(\sigma-1-\mu)(1-\gamma)}{1-\sigma}}$. A *rise* in $\frac{s_H}{1-s_H}$ will then *decrease* $\frac{V_H}{V_H^*}$ provided that $(\sigma - 1 - \mu)(1 - \gamma) > 0$. This is the "no-black-hole" condition; agglomeration forces will always prevail if this regularity condition is not met. In Forslid and Ottaviano (2003) the corresponding condition is $\sigma - 1 - \mu > 0$ (as $\gamma = 0$). The usual economic interpretation is that if agglomeration forces are too strong (σ low and μ large), then agglomeration of the M sector is the only location outcome. Such behaviour is generally ruled out in *NEG* models by imposing the no-black-hole condition. Our use of the *CRRA* utility function explains the appearance of γ. We hence need $\sigma - 1 - \mu > 0$ *and* $\gamma < 1$ to ensure that the symmetric outcome is stable under autarky, and both inequalities are assumed to hold from now on.

Finally, solving the model for the case of general trade costs ($0 < \phi < 1$) gives[9]

$$\frac{V_H}{V_H^*} = \left[\frac{(\sigma+\mu)\,\phi^2 + \sigma - \mu + s_H \mu \left(1-\phi^2\right) - \sigma s_H (1-\phi)^2}{2\sigma\phi - s_H \mu \left(1-\phi^2\right) + \sigma s_H (1-\phi)^2} \left(\frac{P}{P^*}\right)^{-\mu} \right]^{(1-\gamma)}, \tag{9}$$

where $P = [s_H + \phi(1-s_H)]^{\frac{1}{1-\sigma}}$ and $P^* = [\phi s_H + 1 - s_H]^{\frac{1}{1-\sigma}}$. Depending on the level of trade freeness, $\frac{V_H}{V_H^*}$ may be increasing or decreasing in s_H. Specifically, when trade freeness is low (high), the symmetric outcome is stable (unstable). The critical level of trade freeness where the symmetric distribution of skilled workers becomes unstable is called *the break point*. It is obtained by signing the derivative of (9) with respect to s_H at $s_H = \frac{1}{2}$. Evaluating the derivative at $s_H = \frac{1}{2}$, setting the result[10] equal to zero and solving for ϕ yield

$$\phi^B = \frac{(\sigma-\mu)(\sigma-1-\mu)}{(\sigma+\mu)(\sigma-1+\mu)}. \tag{10}$$

If $\phi \leq \phi^B$, then dispersion of industry is stable. If $\phi > \phi^B$, then skilled workers move to one of the regions. Which of them is indeterminate, a feature of the model that gives rise to uncertainty and is crucial to the analysis that will follow later on.

On the other hand, a core-periphery equilibrium is only sustainable for levels of trade freeness above *the sustain point* (ϕ^S), which is obtained by setting (9), evaluated at $s_H = 0$ or $s_H = 1$, equal to unity. It is implicitly defined by

$$2\sigma \left(\phi^S\right)^{\frac{\sigma-1-\mu}{\sigma-1}} - (\sigma+\mu)\left(\phi^S\right)^2 - \sigma + \mu = 0 \tag{11}$$

It can be verified that $\phi^S < \phi^B$.[11] This completes the description of the M sector's long-run location equlibria, which can be summarised as follows. For low levels of trade freeness, skilled workers (and hence M sector firms) are symmetrically distributed between the two regions. Raising the level of trade freeness above ϕ^B induces skilled workers to move to one of the regions. Once a core-periphery equilibrium is reached, it will be sustainable for all levels of trade freeness above ϕ^S.

[9] See Appendix A.1.

[10] See Appendix A.2 for the expression.

[11] See Forslid and Ottaviano (2003) or Baldwin et al. (2003, ch. 4).

2.2 Comparing Location Equilibria

We now compare some key variables in the core-periphery equilibrium to the symmetric one. Consider first the case when the M sector is symmetrically distributed between the two regions ($s_H = \frac{1}{2}$). We then have $n = n^* = \frac{1}{2}$, $P = P^* = \left(\frac{1+\phi}{2}\right)^{\frac{1}{1-\sigma}}$, $Y = Y^* = \left(\frac{\sigma}{\sigma-\mu}\right)\frac{L^w}{2}$, $w_L = 1$ and $w_H = w_H^* = \left(\frac{\mu}{\sigma-\mu}\right)L^w$. If the M sector is located in one region, say in North ($s_H = 1$), then we have $n = 1$, $n^* = 0$, $P = 1$, $P^* = \phi^{\frac{1}{1-\sigma}}$, $Y = \left(\frac{\sigma+\mu}{\sigma-\mu}\right)\frac{L^w}{2}$, $Y^* = \frac{L^w}{2}$, $w_L = 1$ and $w_H = \left(\frac{\mu}{\sigma-\mu}\right)L^w$. North now produces more varieties so the price index in that region is lower, whereas the opposite is true for South. Regional income in North (South) is lower (higher) in the symmetric equilibrium, but the equilibrium wage paid to skilled workers is the same. Unskilled workers also earn the same wage no matter how industry is located between the regions. We can hence conclude the following:

Result 1 (Baldwin et al., 2003, ch. 11, Result 11.14). The *only* thing that matters for skilled and unskilled workers when ranking *equilibrium* location outcomes is the price indices. The immobile factor always prefers agglomeration to occur in its own region, while the mobile factor always prefers full agglomeration irrespective of where it occurs.

In other words, agglomeration is unambiguously good for you. According to Neary (2001), this feature renders NEG models unfit for analysing industrial policy issues. Two points are worth highlighting here. First, since nothing in the model *a priori* determines where industry locates as a result of economic integration, there is uncertainty about which region attracts the M sector and gets the lower price index. Second, should changing the level of trade freeness (which triggers agglomeration) be costly and financed by a lump-sum tax, then unskilled and skilled workers' preferences need no longer be based on price indices only. The rest of the present paper aims at endogenously determining the actual level of trade freeness (and hence industry location) by coupling the uncertainty over price indices with risk-averse agents (section 3), using a very simple political economy approach, and introducing costs for improving the level of trade freeness (section 4). We introduce the political game in the next section.

3 The Political Model

The political game is assumed to be the simplest possible.[12] Society faces a single policy decision: choosing a level of ϕ. The feasible alternatives are a continuum ranging from autarky to nearly free trade, corresponding to the points $\phi \in \left[0, \overline{\phi}\right]$ of the real line ($\phi^B < \overline{\phi} < 1$).[13] There are two political candidates, each of whom cares only about winning the election. In a two-stage game, the candidates simultaneously announce their policy position (which they are committed to carrying out in case of an electoral success) in the first stage, and then the voters cast their votes in the second stage. The policy proposals can be thought of as promoting economic integration (i.e. reform programs aimed at improving infrastructure, harmonising regulations, cutting red tape at borders etc), which in our model translates into a higher ϕ. If the candidates take the same position, each voter tosses a (fair) coin to decide which of them to vote for. The candidate who captures a majority of the votes assumes office and implements his policy proposal. With this set-up we know that, if a voting equilibrium exists, the candidates will announce the same policy and face a fifty-fifty chance of being elected.

At the time of the election the M sector firms are geographically dispersed between the regions. After the election, ϕ may be increased and there are two possible location

[12] The set-up of the political game is taken from Grossman and Helpman (2001, ch. 2). Some of the difficulties we avoid, such as multidimensional policy space and strategic voting, are discussed there.

[13] This exogenously imposed upper bound on ϕ ensures that there are some transport costs in the model, since the problem becomes uninteresting if trade is completely free. Location is then indeterminate and transportation costs do not matter for welfare. The actual choice of $\phi \in \left[0, \overline{\phi}\right]$ remains completely endogenous. We do this to illustrate the basic mechanism at work. In section 4, reform is costly and this upper level is also determined within the model.

equilibria. Either the M sector will remain divided between the regions (the winning level of ϕ is below or equal to ϕ^B) or it will agglomerate in one of them[14] (the winning proposal is greater than ϕ^B). The two political candidates first examine each worker's ideal level of ϕ in the current (symmetric) equilibrium and determine the level of ϕ that would gain a majority of the votes. Then they examine what the winning level would be in the agglomerated equilibrium that could *potentially* materialise after the election.[15] The location outcome will be of great importance for the immobile factor of production, who runs a risk of being stuck in a de-industrialised region with its higher cost of living.

The rest of section 3 is concerned with the political candidates' examination of the various voter groups' preferred level of ϕ, i.e. their search for the winning proposal. The next subsection analyses a benchmark case of certainty and risk-neutrality, while section 3.2 allows for uncertainty and risk-averse agents.

3.1 Certainty and Risk-Neutral Agents

Risk-neutrality means that we can set $\gamma = 0$. There is no uncertainty; all factors of production know which region the M sector will agglomerate in. Specifically, we assume that North will become the industrial centre. Although not explicitly modelled, we can think of North as having some small advantage (like a port) that will induce skilled workers to move there. We will focus on the two types of long-run equilibria described in section 2.2. The first is a symmetric distribution of the M sector ($s_H = \frac{1}{2}$); the other is an agglomeration of the M sector in North ($s_H = 1$). We split the analysis into these two cases for expositional clarity. We also note that all the voter groups' preferences over ϕ are discontinuous at ϕ^B (since we compare long-run location *equilibria*) and need not be single-peaked.

[14] We assume that industry relocates instantaneously.

[15] This implies that the two political candidates are forward-looking regarding the location outcomes of economic integration.

3.1.1 Symmetric Industrial Structure

The equilibrium is only symmetric if $\phi \in \left[0,\ \phi^B\right]$, so here we restrict the analysis to this interval. There are two types of voter groups in each region, skilled and unskilled workers. However, each group in one region votes like the corresponding group in the other region due to symmetry, effectively reducing the number of voting groups to two. The indirect utility of unskilled workers in North is $V_L^S = k\left(\frac{1+\phi}{2}\right)^{-\frac{\mu}{1-\sigma}}$; for skilled workers it is $V_H^S = k\left(\frac{\mu}{\sigma-\mu}\right)L^w\left(\frac{1+\phi}{2}\right)^{-\frac{\mu}{1-\sigma}}$ (the superscript S refers to the symmetric equilibrium). It is straightforward to show that $\frac{\partial V_L^S}{\partial \phi} > 0$ and $\frac{\partial V_H^S}{\partial \phi} > 0$. Skilled and unskilled workers' indirect utilities are strictly increasing in ϕ and both groups have a most preferred policy from which deviations monotonically decrease welfare. Specifically, their indirect utility is highest at ϕ^B. The reason is simple. As noted in section 2.2, the equilibrium nominal returns to skilled and unskilled labour are unaffected by falling transport costs. Imports become cheaper, however, reducing the price index and increasing individual welfare. The implication is that all four groups of voters prefer ϕ^B in the symmetric equilibrium. Any other policy proposal $\phi \in \left[0,\ \phi^B\right]$ would lose in a pairwise vote against it. This candidate (ϕ^B) should hence be compared to the winning proposal of the core-periphery equilibrium.

3.1.2 Core-Periphery Equilibrium

The core-periphery equilibrium will only materialise if $\phi > \phi^B$. Since we have ruled out the possibility of completely free trade, the analysis is focused on the interval $\phi \in \left(\phi^B,\ \overline{\phi}\right]$, $\overline{\phi} < 1$. There are three types of voter groups: skilled workers in the core, unskilled workers in the core, and unskilled workers in the periphery. When all the M firms are located in North there are no imports of differentiated goods from South: the indirect utilities of all residents in North are unaffected by economic integration. We have $V_L^{CP} = k$ and $V_H^{CP} = k\left(\frac{\mu}{\sigma-\mu}\right)L^w$, which clearly do not depend on ϕ (the superscript CP refers to the core-periphery equilibrium). The voter groups in the industrial core are hence indifferent between all $\phi \in \left(\phi^B,\ \overline{\phi}\right]$. However, from Result 1 we know that their welfare is higher in the core-periphery equilibrium (the proviso is that transportation is costly, $\phi < 1$). They would thus vote for any $\phi \in \left(\phi^B,\ \overline{\phi}\right]$ that is pitted against ϕ^B.

For unskilled labour left in the periphery we have $V_L^{*CP} = k\phi^{-\frac{\mu}{1-\sigma}}$, $\frac{\partial V_L^{*CP}}{\partial \phi} > 0$. They prefer the highest possible level of ϕ, i.e. $\phi = \overline{\phi}$, since they have to import all M varieties from North. It is straightforward to show that unskilled workers in the periphery are indifferent between the symmetric and the agglomerated equilibria's proposals (ϕ^B and $\overline{\phi}$) if $\overline{\phi} = \frac{1+\phi^B}{2} (\equiv \phi^I)$. Since V_L^{*CP} is strictly increasing in ϕ it follows that $V_L^{*S}\left(\phi^B\right) > V_L^{*CP}\left(\overline{\phi}\right)$ if $\overline{\phi} < \phi^I$ (and $V_L^{*S}\left(\phi^B\right) < V_L^{*CP}\left(\overline{\phi}\right)$ if $\overline{\phi} > \phi^I$). As all residents in the core always prefer $\overline{\phi}$ to ϕ^B, the only conflict of interest that can arise is if $\overline{\phi} \in \left(\phi^B,\ \phi^I\right)$, in which case unskilled workers stuck in the periphery prefer ϕ^B to $\overline{\phi}$. Then the only potential vote for ϕ^B will come from the immobile factor in the periphery, which numbers $\frac{L^w}{2}$. However, there are $\frac{L^w}{2} + H^w (= \frac{L^w}{2} + 1)$ people in North prefering $\overline{\phi}$, so ϕ^B can never win a majority vote. Summarising our findings, we have:

Result 2. A majority favouring economic integration will always be attained when there is certainty about where the industrial centre will be established. The winning porposal will be high trade freeness and industry will agglomerate in one of the regions.

A corollary observation is the following. Suppose the economy is in the core-periphery equilibrium when the election takes place. Then a majority vote *against* that equilibrium will never occur, since only one of the factors (unskilled workers in the periphery) will potentially gain from lower trade freeness and a reindustrialisation of South. This implies that, despite the absence of single-peakedness in preferences over ϕ (due to the discontinuity at ϕ^B), there can be no cycles in the voting outcomes. We next introduce uncertainty and risk-aversion into the model.

3.2 Uncertainty and Risk-Averse Agents

The major difference when we allow for uncertainty is that unskilled workers do not know *ex ante* (when they vote) in which region industry will agglomerate should economic integration be pursued. Since *all* unskilled workers beforehand run a risk of being stuck in the periphery with lower welfare, they may all actively resist economic integration. As before we analyse the symmetric and the core-periphery equilibria separately.

3.2.1 Symmetric Industrial Structure

Now we have $V_L^S = \frac{k^{1-\gamma}}{1-\gamma}\left(\frac{1+\phi}{2}\right)^{-\frac{\mu(1-\gamma)}{1-\sigma}}$ and $V_H^S = \frac{k^{1-\gamma}}{1-\gamma}\left(\frac{\mu L^w}{\sigma-\mu}\left[\frac{1+\phi}{2}\right]^{-\frac{\mu}{1-\sigma}}\right)^{1-\gamma}$. These are a positive, monotonic transformation of the indirect utilities in section 3.1.1, leaving preferences over ϕ unaffected. For the same reasons as in section 3.1.1, all the four voter groups prefer ϕ^B to any other policy proposal $\phi \in \left[0,\ \phi^B\right]$. The question is whether it will win a pairwise comparison with the core-periphery equilibrium's candidate?

3.2.2 Core-Periphery Equilibrium

Things are the same for skilled workers as in section 3.1.2. They always end up in the core and their indirect utility in the core-periphery equilibrium is unaffected by changes in transport costs. They are hence indifferent between all the proposals $\phi \in \left(\phi^B,\ \overline{\phi}\right]$. However, whenever transportation is costly their welfare is higher in absolute terms in the core-periphery equilibrium and they will vote for any $\phi \in \left(\phi^B,\ \overline{\phi}\right]$ pitted against ϕ^B.

Turning to unskilled workers, there is a very important difference. When the election takes place they do not know where the industrial centre will be established should they vote for high trade freeness (this is true for *all* unskilled workers). Furthermore, they are now risk-averse and as location outcomes are risky they base their voting decision on expected indirect utility. Due to symmetry we can focus on unskilled workers in North. Their expected indirect utility is $EU = pV_L^C + (1-p)\,V_L^P$, where V_L^C (V_L^P) is indirect utility if North becomes the core (periphery) and p is the probability that it will. Because the two regions are identical at the symmetric equilibrium, there is a fifty-fifty chance that either of them will attract the whole M sector, hence $p = \frac{1}{2}$. Also, $V_L^C = V_L|_{s_H=1} = \frac{k^{1-\gamma}}{1-\gamma}$ and $V_L^P = V_L|_{s_H=0} = \frac{k^{1-\gamma}}{(1-\gamma)}\phi^{\frac{-\mu(1-\gamma)}{1-\sigma}}$. We then have $\frac{\partial EU}{\partial \phi} > 0$; expected indirect utility is strictly increasing in ϕ and attains its maximum at $\overline{\phi}$. Note that this is valid for all unskilled workers; they *all* prefer $\overline{\phi}$ in the interval $\left(\phi^B,\ \overline{\phi}\right]$. Again, the two emerging policy proposals are ϕ^B and $\overline{\phi}$.

The level of ϕ where $V_L^S\left(\phi^B\right) = EU\left(\overline{\phi}\right)$ is now $\overline{\phi} = \left[2\left(\frac{1+\phi^B}{2}\right)^{\frac{\mu(1-\gamma)}{\sigma-1}} - 1\right]^{\frac{\sigma-1}{\mu(1-\gamma)}}$ $(\equiv \phi^I)$. As EU is strictly increasing in ϕ, it must be that $V_L^S\left(\phi^B\right) > EU\left(\overline{\phi}\right)$ if $\overline{\phi} < \phi^I$ and $V_L^S\left(\phi^B\right) < EU\left(\overline{\phi}\right)$ if $\overline{\phi} > \phi^I$. So, unskilled workers would prefer any $\overline{\phi} > \phi^I$ to ϕ^B, in which case we would get a core-periphery outcome. The major difference compared to section 3.1.2 is that should $\overline{\phi} \in \left(\phi^B,\ \phi^I\right)$, then *all* unskilled workers would prefer ϕ^B to $\overline{\phi}$ and they would resist reform. Whether or not ϕ^B wins against $\overline{\phi}$ in this case depends on the number of unskilled workers. If $L^w > H^w$, then a majority of unskilled workers will vote for ϕ^B; if $L^w < H^w$ a majority of skilled workers will vote for $\overline{\phi}$. Finally, at the point of indifference (i.e. if $\overline{\phi} = \phi^I$), each unskilled worker tosses a coin to decide which alternative to vote for. Since there is a continuum of unskilled workers, half of them will vote for ϕ^B and the other half for $\overline{\phi}$. Because skilled workers will vote for $\overline{\phi}$ in this case, it will win against ϕ^B. We also note that if agents become more risk-averse (γ increases), then the possibility increases that ϕ^B is preferred to $\overline{\phi}$. The reason is that ϕ^I increases with γ, widening the interval $\left(\phi^B,\ \phi^I\right)$[16]. Our findings in this section can be summarised as:

Result 3. When the distribution among immobile production factors of the gains and losses of economic integration is uncertain, a majority of the factor at risk of being hurt by reform may resist it. This is more likely to happen the higher the risk-aversion

[16] See Appendix A.3.

among agents. As a result economic integration may be resisted and industry will be geographically dispersed.

The result of the political game becomes qualitatively different when we incorporate uncertainty. From Result 2 we know that policy proposals in favour of economic integration will always prevail under certainty, giving rise to agglomeration. However, if identifying the winners and losers of economic integration is uncertain *ex ante*, then measures to promote it may be resisted. We note that this is so even if the reform package is free of charge. We next analyse how voting behaviour is affected if undertaking economic integration is costly.

4 Introducing Costly Reform

The previously exogeneously given level $\overline{\phi}$ will now be determined within the model. The economy is at some given starting level of trade freeness, ϕ^{SL}, and we assume that the symmetric equilibrium is stable at that level (hence $\phi^{SL} < \phi^{B}$). Improving infrastructure to some new level $\phi \in \left(\phi^{SL}, 1\right]$ is costly. Specifically, we assume that the total reform cost function is

$$RC(\phi) = \beta\left(\phi - \phi^{SL}\right), \tag{12}$$

where $\beta > 0$ is the constant marginal cost of reform. The total cost of improving infrastructure is shared equally by *all* residents and is financed by a lump-sum tax, denoted Γ.[17] A skilled worker's disposable income becomes $w_H - \Gamma$; for unskilled labour it is $1-\Gamma$. However, skilled workers' nominal wage, w_H, will be affected by the introduction of the tax. To see this, we note that the lump-sum tax reduces regional incomes:

$$Y = L + w_H H - \rho;\ Y^* = L^* + w_H^* H^* - \rho^*, \tag{13}$$

[17] As explained in Appendix A.4, the lump-sum tax does not affect the stability of the symmetric equilibrium. The break point is hence the same as in (10).

where $\rho \equiv \Gamma(L+H)$ and $\rho^* \equiv \Gamma(L^*+H^*)$ are the total tax revenues collected from each region. The regional incomes in (13), in turn, enter into the right-hand sides of equations (5) and (6), lowering skilled workers' wages (the general expressions for the new wages are given in Appendix A.4). We start by analysing the initial symmetric distribution of firms.

4.1 Symmetric Industrial Structure

Here $L = L^*$ and $H = H^*$, so $\rho = \rho^* \equiv \overline{\rho}$ (i.e. regional tax revenues are equal). Using (A.5) and (A.6) in Appendix A.4 with $\rho = \rho^* \equiv \overline{\rho}$ and $s_H = \frac{1}{2}$, the new wages paid to skilled labour can be shown to be

$$w_H = w_H^* = \frac{\mu\left(L^w - 2\overline{\rho}\right)}{\sigma - \mu}, \tag{14}$$

where $2\overline{\rho} = \beta\left(\phi - \phi^{SL}\right)$ is total tax revenue. The lump-sum tax thus affects unskilled and skilled labour differently. Unskilled workers' wage is always unity and the tax simply reduces their disposable income to $1 - \Gamma$. For skilled workers there is an additional negative effect. The tax reduces income spent on M sector goods, reducing demand per variety. A lower demand means that firms' operating profits are reduced and since operating profits are used to cover the wage paid to skilled workers (i.e. the fix cost), their wage has to be bid down to restore zero pure profits. To analyse how these new negative effects of reform affect voting behaviour, we first look at unskilled labour.

A balanced budget requires $\Gamma = \frac{\beta\left(\phi - \phi^{SL}\right)}{L^w + H^w}$, so unskilled workers' indirect utility is now $V_L = \frac{k^{1-\gamma}}{1-\gamma}\left[1 - \frac{\beta\left(\phi - \phi^{SL}\right)}{L^w + H^w}\right]^{1-\gamma}\left(\frac{1+\phi}{2}\right)^{-\frac{\mu(1-\gamma)}{1-\sigma}}$. It can be shown that V_L is strictly concave in ϕ (see Appendix A.5.1). The maximiser of unskilled workers' welfare when $\phi \in \left[\phi^{SL}, \phi^B\right]$ is

$$\phi_L = \frac{\mu\left(L^w + H^w + \beta\phi^{SL}\right) + \beta(1-\sigma)}{\beta(\sigma - 1 + \mu)}. \tag{15}$$

Clearly, ϕ_L is increasing in the world mass of taxpayers $(L^w + H^w)$ and in the starting level of trade freeness (ϕ^{SL}). It is easily demonstrated that it is decreasing in the marginal cost of reform (β). The common economic intuition is that the less costly reform is for the individual (either because there are more people sharing the tax burden or that the actual cost itself diminishes), the more reform an unskilled worker wants. However, we can *not* be sure that $\phi_L \in \left[\phi^{SL}, \phi^B\right]$, which is the interval we are concerned with in the symmetric equilibrium. In fact, changing the marginal cost of reform can give rise to three relevant outcomes for unskilled workers. If β is low enough, then $\phi_L > \phi^B$ and we are back in section 3.2.1. Unskilled workers' welfare is strictly increasing in ϕ: reform is not very costly and they prefer ϕ^B. When β is at an intermediate level, however, the preferred level of trade freeness is $\phi_L \in \left(\phi^{SL}, \phi^B\right)$. For a high β, reform is too costly and unskilled workers do not want any reform at all; they prefer ϕ^{SL}.

For skilled workers indirect utility is $V_H = \frac{k^{1-\gamma}}{1-\gamma}\left[w_H - \frac{\beta\left(\phi-\phi^{SL}\right)}{L^w+H^w}\right]^{1-\gamma}\left(\frac{1+\phi}{2}\right)^{-\frac{\mu(1-\gamma)}{1-\sigma}}$, where $w_H = \frac{\mu\left[L^w-\beta\left(\phi-\phi^{SL}\right)\right]}{\sigma-\mu}$. Their indirect utility is strictly concave in ϕ (see Appendix A.5.2) and the maximiser in the interval $\left[\phi^{SL}, \phi^B\right]$ is

$$\phi_H = \frac{\mu^2 L^w \left(L^w + H^w\right) + \beta\left[\mu\left(L^w + H^w\right) + \sigma - \mu\right]\left[\mu\phi^{SL} + 1 - \sigma\right]}{\beta\left[\sigma - 1 + \mu\right]\left[\sigma - \mu + \mu\left(L^w + H^w\right)\right]}. \tag{16}$$

It is straightforward to show that $\phi_H < \phi_L$ (the required condition is that $\sigma-\mu+\mu H^w > 0$, which always holds as $H^W = 1$). The maximiser of skilled workers' indirect utility is smaller than unskilled workers'. The reason is the aforementioned effect of the lump-sum tax. Not only do skilled workers have to pay the same tax as unskilled labour, their nominal wage is also negatively affected. As they are penalised twice by costly reform, their optimal level of trade freeness is *ceteris paribus* lower. However, skilled workers' preferences over ϕ are qualitatively the same as unskilled workers' preferences above. Whether skilled or unskilled labour's preferred level of ϕ will be proposed by the political candidates depends on their relative numbers. If $L^W > H^W$ ($L^W < H^W$), then unskilled (skilled) workers' preferred level will be the candidates' proposal. We next turn to the core-periphery equilibrium.

4.2 Core-Periphery Equilibrium

The expression for skilled workers' wage is[18] $w_H = \frac{\mu\left[L^w - \beta\left(\phi - \phi^{SL}\right)\right]}{\sigma - \mu}$. Their indirect utility becomes $V_H = \frac{k^{1-\gamma}}{1-\gamma}\left(\frac{\mu\left[L^w - \beta\left(\phi - \phi^{SL}\right)\right]}{\sigma-\mu} - \frac{\beta\left(\phi - \phi^{SL}\right)}{L^w + H^w}\right)^{1-\gamma}$, which is strictly decreasing in ϕ. They want as low ϕ as possible when $\phi \in \left(\phi^B,\ 1\right]$, as increases in ϕ will only lower their wage while leaving the price index unaffected (all of industry is already located in the core).

Turning to immobile workers, their expected indirect utility is $EU = pV_L^C + (1-p)\,V_L^P$, where $V_L^C = \frac{k^{1-\gamma}}{1-\gamma}\left(1 - \frac{\beta\left(\phi-\phi^{SL}\right)}{L^w+H^w}\right)^{1-\gamma}$, $V_L^P = \frac{k^{1-\gamma}}{1-\gamma}\left(1 - \frac{\beta\left(\phi-\phi^{SL}\right)}{L^w+H^w}\right)^{1-\gamma}\phi^{\frac{-\mu(1-\gamma)}{1-\sigma}}$, and $p = \frac{1}{2}$. In Appendix A.5.3 we show that EU is strictly concave in ϕ. Unfortunately, it is not possible to find a closed-form solution for the maximiser. It is implicitly defined by the first-order condition

$$-\frac{\beta\left(1+\phi^a\right)}{L^w+H^w} - \frac{\mu\phi^{a-1}}{(1-\sigma)}\left(1 - \frac{\beta\left(\phi-\phi^{SL}\right)}{L^w+H^w}\right) = 0;\ a \equiv \frac{-\mu\left(1-\gamma\right)}{1-\sigma}. \tag{17}$$

We denote the solution to (17) ϕ^{EU}. Due to the strict concavity of EU we have the qualitatively same three outcomes as in the symmetric equilibrium above. Either expected indirect utility is strictly increasing or strictly decreasing in the relevant interval (corresponding to low and high levels of marginal costs of reform, respectively), or the maximum will be attainable. As ϕ^{EU} is only given implicitly in (17), we explore it with numerical methods to illustrate labour's preferences over how far economic integration should be pursued.

4.3 Economic Integration or Status Quo?

In the figures below we illustrate some preferences of unskilled and skilled workers over ϕ. We follow Baldwin et al. (2003, ch. 4) in choosing units so that $L^W = 1 - \frac{\mu}{\sigma}$.[19] The

[18] To see this, we set $s_H = 1$ in (A.5) in Appendix A.4 (or $s_H = 0$ in (A.6)).

[19] We only use this normalisation to be able to draw the figures. The implication is that skilled workers are more numerous (as $H^W = 1$) and their preferred policy will win any election. However, there is

discontinuity in all figures appears at the break point (ϕ^B). To the left of the discontinuity we are in the symmetric outcome; to the right of it the levels of ϕ yield a core-periphery equilibrium. Each pair of the figures is drawn for the same parameter values (reported in Appendix A.6), and the left (right) figure displays unskilled (skilled) workers' indirect utility. The vertical line in each figure marks the starting level of trade freeness (ϕ^{SL}).

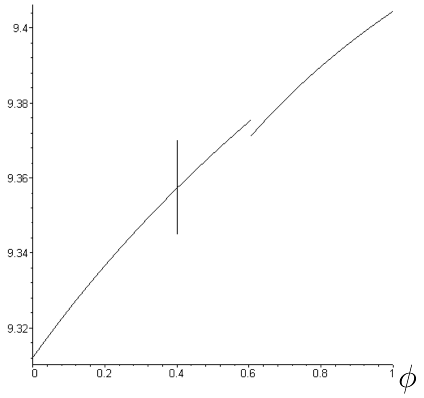

Fig. 4.3.A Unskilled

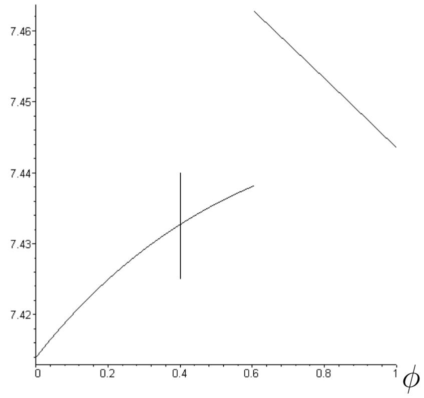

Fig. 4.3.B Skilled

In Figures 4.3.A and 4.3.B reform is not very costly and completely free trade ($\phi = 1$) is unskilled workers' preferred level of ϕ. Skilled workers prefer $\phi^B + \varepsilon$, where $\varepsilon > 0$ is infinitely small, which also yields agglomeration. However, as their indirect utility is strictly decreasing in ϕ in the interval $\left[\phi^B,\ 1\right]$, they would oppose unskilled workers' preferred level. As the figures are drawn under the assumption that $L^W < H^W$, the political candidates will announce a level of ϕ slightly greater than ϕ^B and industry will agglomerate in one of the regions. For an intermediate level of marginal cost of reform,

no loss in generality. Qualitatively similar figures can be drawn under the opposite assumption that unskilled workers are more numerous.

we have the following figures.

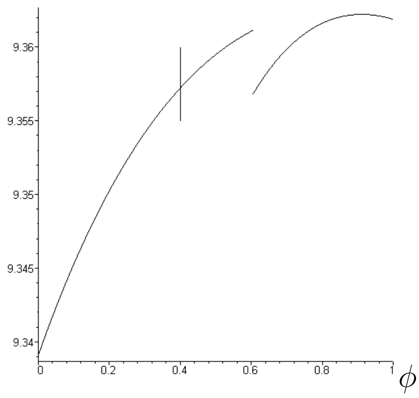

Fig. 4.3.C Unskilled

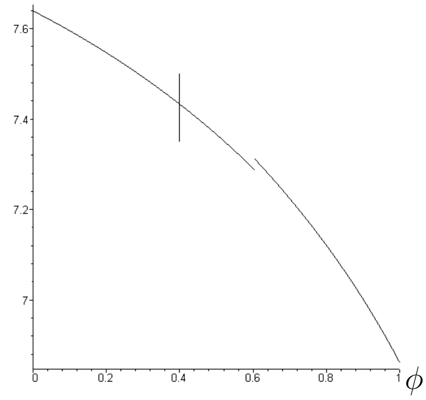

Fig. 4.3.D Skilled

Unskilled workers prefer ϕ^{EU} to ϕ^{B} (as $EU(\phi^{EU}) > V_L(\phi^{B})$), while skilled workers do not want any reform at all (their preferred level is ϕ^{SL}). The *immobile* factor is hence in favour of economic integration (which would lead to agglomeration), while the *mobile* factor is not and wants *status quo*. In stark contrast to section 3 (where reform is costless), the mobile factor is not always better off should it agglomerate in one of the regions. The reasons are the aforementioned effects of having to pay the lump-sum tax *and* the lower nominal wage resulting from decreased expenditure on M-sector goods. The latter effect is absent for unskilled workers, whose nominal wage is always unity, so they might favour economic integration even when the mobile factor does not. For an even higher marginal cost of reform we have

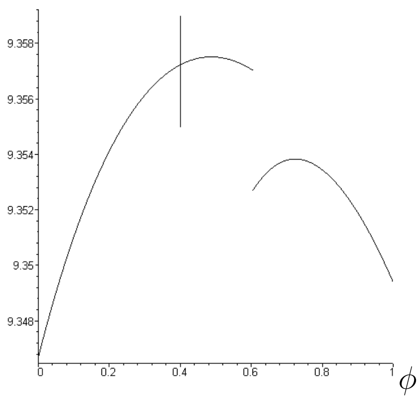

Fig. 4.3.E Unskilled

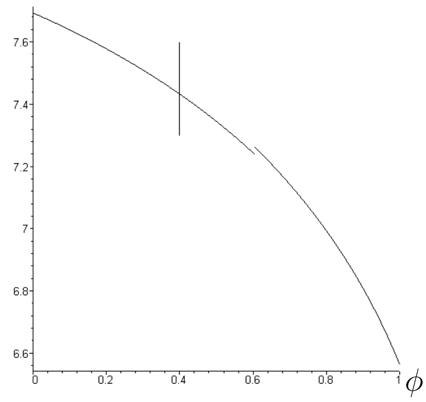

Fig. 4.3.F Skilled

Here both types of labour want a level of ϕ that maintains the initial symmetric distribution of M sector firms. Unskilled workers' optimal level is ϕ_L from (15) as $V_L(\phi_L) > EU(\phi^{EU})$, while skilled workers want ϕ^{SL}. Again, as the figures have been drawn under the assumption that $L^W < H^W$, skilled workers will win the election and no reform at all will be undertaken. Clearly, unskilled and skilled workers' preferences over location equilibria need not be so seemingly straightforward as stated in Result 1, once costs of undertaking economic integration are introduced.

Result 4. If reform packages promoting economic integration are costly and financed by a lump-sum tax, then the mobile factor need not be better off under agglomeration. The reason is that its nominal wage is affected negatively by the tax. As a result the mobile factor may actively resist any integration efforts. Resistance is more likely the more costly reform is.

In this section, we have shown that agglomeration is *not* necessarily a good thing for the mobile factor (which always ends up in the industrial centre) if reforms that promote economic integration are costly, and those costs are financed by lump-sum taxation. The reason is that the ranking of equilibrium location outcomes is no longer dependent on the price indices only. Although the mobile factor still gets a lower price index in the industrial centre, it will also receive a lower nominal return. Costly economic integration introduces a trade-off between the two. It is also clear that less costly reforms are less likely to be resisted as the negative effect on the nominal wage then diminishes.

5 Conclusions

Much political attention is directed towards shaping and influencing trade and transport policy in most countries. For instance, in 2001, the European Union stepped up its effort to implement the common transport policy. A White Paper laid out an ambitious program aimed at eliminating the remaining obstacles to a more integrated European transport sector. The effects of such policies on the location of economic activity have been thoroughly analysed in the *new economic geography*, a literature in which the level of transportation costs is pivotal in determining industrial location. Yet, with few exceptions, most standard models treat these costs as an exogenous parameter.

This paper extends the *footloose entrepreneur* model with a simple majority voting rule to endogenously determine how far economic integration is pursued. We show that, due to uncertainty about which region will become the industrialised centre, resistance against economic integration may come from risk-averse immobile factors of production who run a risk of being stuck in a deindustrialised region.

Another common feature of *new economic geography* models is that agglomeration unambiguously benefits the factors in the location receiving the agglomeration. Introducing costs of undertaking economic integration, we show that this need no longer be the case. In a simple benchmark case, where reform packages are financed by a lump-sum tax, the nominal return to the mobile factor is affected negatively by policy reform. Economic integration then involves a trade-off between getting a lower price index and a lower nominal wage. While the actual voting outcomes will depend on details like the relative magnitude of unskilled and skilled workers and on how costly undertaking reform is at the margin, the more general picture that emerges is that the policy implications of standard new economic geography models need not be so simple as previously thought.

Appendix

A.1 Finding the relative real wage for a general level of trade costs

Inserting $Y = L + w_H H$ and $Y^* = L^* + w_H^* H^*$ (where $L = L^* = \frac{L^w}{2}$) into the equations (5) and (6) yields a system of two equations and two unknowns. Solving for w_H and w_H^* yields

$$w_H = \frac{\mu L^w}{2} \frac{\left[\sigma\left(\Delta^* + \phi\Delta\right) - \mu\left(1 - s_H\right)\left(1 - \phi^2\right)\right]}{D} \tag{A.1}$$

and

$$w_H^* = \frac{\mu L^w}{2} \frac{\left[\sigma\left(\Delta + \phi\Delta^*\right) - \mu s_H\left(1 - \phi^2\right)\right]}{D}, \tag{A.2}$$

where $\Delta \equiv s_H + \phi\left(1 - s_H\right)$, $\Delta^* \equiv \phi s_H + 1 - s_H$ and $D \equiv \left(\sigma\Delta - \mu s_H\right)\left(\sigma\Delta^* - \mu\left(1 - s_H\right)\right) - \mu^2\phi^2 s_H\left(1 - s_H\right)$. We have that $\frac{V_H}{V_H^*} = \left(\frac{w_H P^{-\mu}}{w_H^* P^{*-\mu}}\right)^{1-\gamma}$. Inserting (A.1), (A.2), the price indices and simplifying yield (9) in the text.

A.2 Finding the break point

Using (9) we have

$$\left.\frac{d\left(\frac{V_H}{V_H^*}\right)}{ds_H}\right|_{s_H=\frac{1}{2}} = \frac{-4\left(1-\gamma\right)f\left(\phi\right)}{\left(1+\phi\right)\left(\sigma-1\right)\left(\sigma\phi+\mu\phi+\sigma-\mu\right)}, \tag{A.3}$$

where $f\left(\phi\right) \equiv \phi^2\left(\sigma+\mu\right)\left(\sigma+\mu-1\right) + 2\phi\left(\sigma\left(1-\sigma\right)-\mu^2\right) + \left(\sigma-\mu\right)\left(\sigma-\mu-1\right)$. The denominator in (A.3) is positive. From the no-black-hole condition we know that $\gamma < 1$. The derivative is hence zero if $f\left(\phi\right) = 0$. Solving the quadratic equation yields two real roots, $\phi^B = \frac{(\sigma-\mu)(\sigma-1-\mu)}{(\sigma+\mu)(\sigma-1+\mu)}$ and $\phi = 1$. The derivative is negative for $\phi < \phi^B$ and positive for $\phi > \phi^B$.

A.3 Risk-aversion and resistance

We have

$$\frac{\partial \phi^I}{\partial \gamma} = \frac{\phi^I g(f)}{1-\gamma}, \tag{A.4}$$

where $g(f) = \frac{\ln(2f^a-1)}{a} - \frac{2f^a \ln f}{2f^a-1}$, $f \equiv \frac{1+\phi^B}{2}$, $f \in \left(\frac{1}{2}, 1\right)$ and $a \equiv \frac{\mu(1-\gamma)}{(\sigma-1)} > 0$. Since $\phi^I > 0$ and $0 \leq \gamma < 1$, the derivative in (A.4) will be positive if $g(f) > 0$. It is easy to show that $\frac{dg}{df} = \frac{2af^{a-1}\ln f}{(2f^a-1)^2} < 0$. As $g(1) = 0$ and g is a strictly decreasing function of f, it must be that $g(f) > 0$ for all $f \in \left(\frac{1}{2}, 1\right)$.

A.4 The new wages paid to skilled workers when reform is costly

Inserting the new regional incomes in (5) and (6) and solving for w_H and w_H^* yield

$$w_H = \frac{\mu\left[\sigma\left[(L-\rho)\Delta^* + (L^*-\rho^*)\phi\Delta\right] - (L-\rho)\mu(1-s_H)\left(1-\phi^2\right)\right]}{D} \tag{A.5}$$

and

$$w_H^* = \frac{\mu\left[\sigma\left[(L^*-\rho^*)\Delta + (L-\rho)\phi\Delta^*\right] - (L^*-\rho^*)\mu s_H\left(1-\phi^2\right)\right]}{D}, \tag{A.6}$$

where Δ, Δ^* and D are defined as in Appendix A.1. Note that the stability of the symmetric outcome is not affected by the introduction of the lump-sum tax. To see this, we set $\rho = \rho^* \equiv \overline{\rho}$ (since regional tax revenues are equal in the symmetric outcome) and use $L = L^* = \frac{L^w}{2}$ in (A.5) and (A.6). We see that $\frac{L^w}{2} - \overline{\rho}$ then is a common factor for the numerators of (A.5) and (A.6), which cancels out in $\frac{V_H}{V_H^*} = \left(\frac{w_H P^{-\mu}}{w_H^* P^{*-\mu}}\right)^{1-\gamma}$.

A.5 Strict concavity of various indirect utilities (costly reform)

In what follows we will make extensive use of the no-black-hole condition ($\sigma-1-\mu > 0$ *and* $\gamma < 1$). We also introduce the following notation: $P \equiv L^w + H^w > 0$, $b \equiv 1 - \frac{\beta\left(\phi-\phi^{SL}\right)}{(L^w+H^w)} > 0$ (unskilled workers' disposable income), $s \equiv \frac{\mu\left[L^w-\beta\left(\phi-\phi^{SL}\right)\right]}{(\sigma-\mu)} - \frac{\beta\left(\phi-\phi^{SL}\right)}{(L^w+H^w)} > 0$ (skilled workers' disposable income) and $a \equiv -\frac{\mu(1-\gamma)}{(1-\sigma)} > 0$ (since $0 < \mu < 1 < \sigma$ and $0 \leq \gamma < 1$).

A.5.1 Unskilled workers, symmetric equilibrium

The indirect utility is $V_L = \frac{k^{1-\gamma}}{(1-\gamma)} \left[1 - \frac{\beta\left(\phi-\phi^{SL}\right)}{(L^w+H^w)}\right]^{1-\gamma} \left[\frac{1+\phi}{2}\right]^{-\frac{\mu(1-\gamma)}{(1-\sigma)}}$. We then have

$$\frac{d^2V_L}{d\phi^2} = C\left[-\frac{\gamma\beta^2}{bP^2} - \frac{2a\beta}{P(1+\phi)} + \frac{\mu b(1-\sigma+\mu(1-\gamma))}{(1-\sigma)^2(1+\phi)^2}\right],$$

where $C \equiv k^{1-\gamma}b^{-\gamma}\left[\frac{1+\phi}{2}\right]^a > 0$. Since $C > 0$ it suffices if the expression within square brackets is negative for V_L to be strictly concave in ϕ. Given our parameter restrictions, the sum of the two first terms within square brackets is clearly negative. The third is negative if $1-\sigma+\mu(1-\gamma) < 0 \leftrightarrow \gamma > \frac{1-\sigma+\mu}{\mu}$, where the right-hand side is negative due to the no-black-hole condition. Any $0 \le \gamma < 1$ then ensures that the third term within square brackets is negative and hence that $\frac{d^2V_L}{d\phi^2} < 0$.

A.5.2 Skilled workers, symmetric equilibrium

We have $V_H = \frac{k^{1-\gamma}}{(1-\gamma)} \left[\frac{\mu\left[L^w-\beta\left(\phi-\phi^{SL}\right)\right]}{\sigma-\mu} - \frac{\beta\left(\phi-\phi^{SL}\right)}{(L^w+H^w)}\right]^{1-\gamma} \left[\frac{1+\phi}{2}\right]^{-\frac{\mu(1-\gamma)}{1-\sigma}}$, so

$$\frac{d^2V_H}{d\phi^2} = C\left[-\frac{\gamma\beta^2c^2}{s} + \frac{2(1-\gamma)\beta\mu c}{(1-\sigma)(1+\phi)} + \frac{\mu s(1-\sigma+\mu(1-\gamma))}{(1-\sigma)^2(1+\phi)^2}\right],$$

where $C \equiv k^{1-\gamma}s^{-\gamma}\left[\frac{1+\phi}{2}\right]^a > 0$, and $c \equiv \frac{\mu}{(\sigma-\mu)} + \frac{1}{L^w+H^w} > 0$. Again, the sum of the three terms within square brackets is negative due to the no-black-hole condition; V_H is strictly concave in ϕ.

A.5.3 Expected indirect utility of unskilled workers

We have

$$\begin{aligned}\frac{d^2EU}{d\phi^2} \quad &= \quad C\left[-\frac{\gamma\beta^2}{P^2b} - \frac{\gamma\beta^2\phi^a c}{P^2b} - \frac{\gamma\beta\mu\phi^{a-1}d}{Pb(1-\sigma)} + \right.\\ &\left. \frac{\mu(1-\gamma)\beta\phi^{a-1}c}{P(1-\sigma)} + \frac{(1-\sigma+\mu(1-\gamma))\mu\phi^{a-2}d}{(1-\sigma)^2}\right],\end{aligned}$$

where $C \equiv \frac{k^{1-\gamma}}{2}b^{-\gamma} > 0$, $c \equiv 1 - \frac{\mu}{(1-\sigma)} > 0$, $d \equiv 1 + \frac{\beta\phi^{SL}}{(L^w+H^w)} > 0$. Again, since $C > 0$ it suffices if the expression within square brackets is negative for EU to be strictly concave in ϕ. The only term within square brackets that is positive is the third one. However, it can be shown that the sum of the four last terms within square brackets is negative if

$$\gamma > \frac{\left[P - \beta\left(\phi - \phi^{SL}\right)\right]\left[\beta\phi\mu\left(1-\sigma-\mu\right) + \left(1-\sigma+\mu\right)\mu\left(P+\beta\phi^{SL}\right)\right]}{\left[\beta\phi\mu\left(1-\sigma-\mu\right) + \mu\left(P+\beta\phi^{SL}\right)\right]^{2}}. \tag{A.7}$$

The denominator in (A.7) is positive as is the first factor in the numerator. Due to the parameter restrictions $0 < \mu < 1 < \sigma$ and the no-black-hole condition, the second factor in the numerator is negative. The right-hand side in (A.7) is hence negative, and any $\gamma > 0$ ensures that $\frac{d^2EU}{d\phi^2} < 0$.

A.6 Parameter values used for the figures

All the figures 4.3.A - 4.3.F share the following parameter values: $\mu = 0.3$, $\sigma = 3$, $\gamma = 0.9$, and $\phi^{SL} = 0.4$. The only parameter value that changes is β: we use $\beta = 0.01$ (figures 4.3.A and 4.3.B), $\beta = 0.15$ (4.3.C and 4.3.D), and $\beta = 0.19$ (4.3.E and 4.3.F).

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