Economic integration, political integration or both?*

Daniel Brou†
Columbia University

Michele Ruta‡
European University Institute

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Abstract

We study the effects of economic and political integration by presenting a model in which firms compete with each other in both an economic market – where they produce a good and compete for market share – and in a political (rent seeking) market – where they compete for transfers from the government. Growth is driven by firms' cost-reducing innovation activity and economic and political integration affect firms' incentive to innovate differently. In this setting, economic and political integration can be seen as complementary. Economic integration, when not accompanied by political integration, can lead to less innovation and slower growth as firms respond to increased competition in the economic market by focusing more on rent seeking activity. When economic integration is accompanied by political integration, innovation and growth will be stronger and welfare higher.

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†Department of Economics, Columbia University, 1022 International Affairs Building, New York, NY 10027 (email: db493@columbia.edu).

‡Department of Economics, European University Institute, Via della Piazzuola 43, 50133 Firenze, Italy (e-mail: michele.ruta@eui.eu)

1 Introduction

Political borders are fluid. Since the end of World War II, we have observed an impressive incidence of political disintegration. Indeed, the number of independent countries is now almost three times greater than it was in 1945. On the other hand, there are also examples of the opposite process. International political (along with economic) integration has occurred in Europe, where nation states have imposed limits on their sovereign use of certain policies (e.g. fiscal policy), have delegated control over some relevant competencies, such as trade policy and antitrust, to the European Union and are debating further political integration.

While economists have generally devoted their attention to the growth effects of economic integration, the consequences of political integration on economic growth have received surprisingly little attention.[1] Does political integration affect economic growth? And if so, through what channels? Perhaps more importantly, is political integration beneficial for growth (and separatism harmful) as economic markets globalize?

The main result of our analysis is that political and economic integration can be complementary. This result is contrary to the previous literature which treats political integration as a way of expanding economic markets when the option of economic integration is not available. By contrast we conclude that, when firms participate in both the economic and political markets, political integration prevents economic integration from skewing firms' incentives away from productive activity and toward rent seeking.

We study integration in a framework where growth is endogenous and depends on how much firms invest in research and development (R&D). Firms choose to devote resources to both productive activities (production of final goods and R&D) and to an unproductive activity.[2] In particular, unproductive activity takes the form of a competition for the distribution of government transfers - that is, a game of rent seeking.[3] Since firms participate in both an economic market - where they compete for market share - and in a political market - where they compete for transfers from the government - changes in one market will have an impact on behavior in the other. This is the channel we isolate to study the effects of economic and political integration. We argue that, other things equal, political integration changes the level of competition within the political market and has consequences for innovation and growth. Consider political disintegration: when a country breaks up, some regions become newly independent political entities. Regional governments as-

[1] An important exception is the work by Alesina, Spolaore and Warcziarg (2000 and 2005) and Spolaore and Warcziarg (2005). We postpone a discussion of related literature to the next section.

[2] We define unproductive activity similarly to Bhagwati (1982) whose directly unproductive profit-seeking (DUP) activities are "*ways of making profits (i.e. income) by undertaking activities that are directly unproductive, in the sense that they produce pecuniary returns but do not produce goods or services that enter a conventional utility function or input into such good and services.*"

[3] Alternately, we could consider a game where firms lobby the government for changes in anti-competitive policy like patent protection or barriers to entry. This extension is considered in the final section.

sume new prerogatives and decide aspects of economic policy that were formerly the domain of a central government. Firms in a newly independent region, formerly seeking rents from the central authority, must now influence the local government. The number of firms vying for rents in the political market of the newly independent political entity can be affected. Importantly, this effect carries through to the economic market since it has an effect on firms' gross profits and the number of firms that can be supported in equilibrium.

The economic model builds on the work of Peretto (1996 and 2003) and Brou and Ruta (2007). We assume an oligopolistic goods market with an endogenous number of firms engaging in the production of a differentiated final good and undertaking two main activities other than final good production: in-house R&D (innovation) and rent seeking. Both activities can be profitable for firms, but have very different consequences for the welfare of society. Rent seeking requires a firm to devote scarce resources (in the form of labor) to obtaining transfers from the government. In this sense rent seeking is purely wasteful, while industrial R&D generates knowledge that reduces firm-specific costs and can be used in subsequent R&D activity, thus increasing the growth rate of the economy. With free entry, the number of firms in each region is determined by the zero profit condition that firms' cash flows just cover their fixed, R&D and rent seeking costs. Among other measures of competitiveness, the number of firms interacting in the economic and political markets plays a role in determining firms' incentives to engage in R&D, which drives economic growth.

Political integration makes the competition for transfers more intense. Firms must increase their rent seeking effort in order to maintain their share of government transfers. As profits from the political market fall, each firm must rely more on the economic market for profits. This makes competition in the economic market more intense and increases the incentive to innovate. At the same time, higher costs of rent seeking drive some local firms out of the market. This has the effect of reducing the number of firms competing in the economic market, which reduces the incentive to innovate. Overall, the effect of political integration on innovation, growth and welfare is ambiguous.

For a given number of regional firms, economic integration, by making the economic market more competitive, increases firms' incentive to innovate in order to lower costs and capture a greater share of the market. A resulting higher cost of innovation leads to the exit of some local firms. In the absence of political integration, this has the effect of making rent seeking more attractive because there are less firms competing for distribution from the local government. Greater profits from the political market reduce a firm's need to compete in the economic market and reduce the incentive to innovate. The overall effect of economic integration on innovation, growth and welfare is ambiguous.

Notice that political and economic integration have similar implications. Integration in one market has a positive effect on innovation and growth by making that market more competitive. Unfortunately, integration in one market alone decreases the number of firms in the other market

and has a negative effect on innovation and growth. Political integration alone cannot guarantee improvements in growth or welfare and neither can economic integration on its own. We then show that joint economic and political integration improve economic performance by ensuring that competition increases in both markets. Firms have a greater incentive to invest in R&D in order to keep their market share and the incentive to focus on rent seeking activities is muted. We conclude that political and economic integration are complementary institutions.

The paper is organized as follows. The following section discusses some classic work on rent seeking and political integration and recent related economic literature. Section 3 presents the formal model. We describe a typical firm's optimal behavior in section 4 and solve for the general equilibrium of the economy in section 5. Section 6 studies political and economic integration. We discuss conclusions and applications in section 7. Technical details are in the appendix.

2 Related literature

The issue of political integration has attracted the attention of political scientists, philosophers and historians for a long time. The idea that political integration creates competition between different rent seekers has a rich intellectual history. In *Idea of a Perfect Commonwealth*, David Hume writes,[4]

> "[w]e shall conclude this subject, with observing the falsehood of the common opinion, that no larger state, such as France or Great Britain, could ever be modeled into a commonwealth, but that such a form of government can only take place in a city or small territory. The contrary seems probable. Though it is more difficult to form a republican government in an extensive country than in a city; there is more facility, when once it is formed, of preserving it steady and uniform, without tumult and faction... In a larger government, which is modeled with masterly skill, there is compass and room enough to refine the democracy... it is very difficult, either by intrigue, prejudice, or passion, to hurry them [e.g. different parts] into any measures against the public interest."

In the *Federalist Paper 10*, James Madison suggests that an advantage of political integration over political separation exists in the larger variety of special interests confronting each other.[5] Madison writes: "*It clearly appears, that the same advantage... in controlling the effects of faction, is enjoyed by a large over a small republic,–is enjoyed by the Union over the States composing it.*" Madison returns to the same idea in the *Federalist Paper 51* discussing the possibility of Rhode Island as an independent state rather than a member of the Union. He writes: "*In the extended republic of the United States, and among the great variety of interests, parties, and sects which*

[4] We thank Frances Rosenbluth for bringing this passage to our attention.

[5] Madison refers to these groups as factions and defines them as, "*[a] number of citizens, who are united and actuated by some common impulse of passion, or of interest, adversed to the rights of other citizens, or to the permanent and aggregate interests of the community.*"

it embraces, a coalition of a majority of the whole society could seldom take place on any other principles than those of justice and the general good." Taken together, the passages from Hume and Madison suggest that the multiplicity of rent seeking groups under political integration makes each one of them less able to distort policy to their advantage (and to the disadvantage of the general interest).

To our knowledge, few economists have focused on this aspect of political integration. Relevant exceptions include Mancur Olson and James Buchanan. In *The Rise and Decline of Nations*, Olson observes that jurisdictional integration - "*the shift to a new institution of the right to take at least some important decisions in economic policy*" - reduces the power of organized interest groups. Buchanan (1990) goes even further. Analyzing the process of political integration in Europe he writes, "*[t]he 'European difference' here lies, of course, in the juxtaposition of the historically familiar exercise of rent seeking pressures within nation-states and the prospect for a constitution of federal union that will insure competition among producers and consumers of goods and resources across the territory that encompasses the several nation-states.*"[6]

The present work is related to several strands of recent economic research. Unproductive activities have been investigated in many different areas of economic theory. Several authors have studied the effect of unproductive activity on economic performance. Krueger (1974) finds that rent seeking is socially costly because it leads an economy to operate inside its transformation curve. Baumol (1990) argues that growth depends on the allocation of resources between productive activities, such as innovation, and unproductive ones, such as rent seeking and organized crime, and provides several historical examples of this mechanism dating from the Roman Empire to Mandarin China to recent times. A similar argument is developed within an endogenous growth model by Murphy, Shleifer and Vishny (1991) - who also find some empirical support in a cross country analysis. Barelli and Pessoa (2004) study the effects of rent seeking on capital accumulation, while Krusell and Rios-Rull (1996), Prescott and Parente (2000) and Bellettini and Ottaviano (2005) focus on the role of vested interests in preventing the adoption of efficient technologies.[7] In a companion paper (Brou and Ruta, 2007), we look at the effects of rent seeking on the structure of markets and growth. Differently from the previous literature, we study how political and economic integration influence firms' incentives to engage in R&D relative to rent seeking.

A recent, but growing, literature studies the economic determinants and the effects on welfare

[6] Political thinkers proposing integration in Europe after the end of World War II were also well aware of the effects of political integration on rent seeking. Altiero Spinelli, whose writing inspired the creation of the European Union, wrote in 1957 that "*the power of national states to decide economic policy only benefits national special interests*" and argued that, for precisely this reason, these groups were opposing the European integration process. The historical account of Ginsborg (1990) finds in fact that in Italy a lobby of steel producers pressured the government to stay out of the European Coal and Steel Community in the early 1950s. Moreover, the leading business association (Confindustria) opposed the project of the European Economic Community in 1957.

[7] On the political economy of technological change from an historical perspective, see Mokyr (1998).

of the break up and unification of countries. One branch of this literature deals with mostly static concerns and frames the political integration decision as a trade-off faced by voters and governments. On the one hand, there are benefits arising from economies of scale in public good provision and the internalization of cross-border externalities. On the other hand, costs arise from a loss of sovereignty or a change in the political equilibrium. Contributions to this branch of the literature include Milanovic (1996), Alesina and Spolaore (1997), Bolton and Roland (1997), Casella and Feinstein (2002) and Alesina, Angeloni and Etro (2005).[8] We abstract from these considerations and focus on the effect of political integration on the behavior of firms.

A more recent approach, found in Alesina, Spolaore and Wacziarg (2000 and 2005), focuses on the relationship between political integration, the size of the economic market and economic growth. More specifically they argue that, in a world with important trade restrictions, political integration has a positive effect on economic growth, because it increases the size of the economic market. On the other hand, in a regime of free trade, political integration should not matter for economic growth, the size of the economic market being independent of political borders. Their empirical analysis confirms that the effects of country size on growth are less important as economies become more open.[9] Spolaore and Wacziarg (2005) study the endogenous determination of trade policy and political integration. Similarly to the literature on customs unions, they argue that political integration has a positive market size effect, but a negative effect on trade openness. The total effect of political integration on economic growth is in general ambiguous. The main channel through which political integration affects economic growth is through its effect on the size of the economic market. As a result, political integration and economic integration may be seen as substitutes. Our work differs from this in that we consider economic and political integration as (possibly) separate phenomena. Political integration affects economic growth by changing firms' incentive to innovate. We find that economic and political integration can work as complements.

The literature on the effects of *economic* integration on growth is extensive and we do not attempt to summarize the main findings.[10] Our work is most closely related to the literature on how economic integration affects the level of competition in a market, which in turn affects firms' incentive to innovate. However, our approach is highly indebted to the work of Peretto (2003) who builds on Grossman and Helpman (1991) and studies the effects of economic integration on market structure and economic growth. Similarly to other work in this area (e.g. Aghion and Howitt, 1998), economic integration has a positive effect on growth by increasing competition in economic

[8] For recent surveys see Alesina and Spolaore (2003) and Ruta (2005).

[9] Alesina, Spolaore and Wacziarg (2005) critically review the literature on country size and economic growth. This literature typically suggests that the size of countries has little to do with economic growth, but fails to take into account the fact that openness can substitute for a large domestic market.

[10] Path-breaking work on economic integration and endogenous growth is Rivera-Batiz and Romer (1991). For recent surveys of the literature see Licandro (2004) and Ventura (2005).

markets.[11] We contribute to this line of research by introducing a political market. This allows us to consider economic *and* political integration.

3 The model

Consider an economy composed of m regions. Each region has a population of identical individuals of size L. Consumers have symmetric preferences over differentiated goods supplied by oligopolistic producers and are endowed with one unit of labor each. We abstract from the labor-leisure decision, so that total labor supply in each region is L. In region k, there are n_k endogenously determined firms. Firms interact in two different markets. In the economic market, firms engage in the production of a good that is demanded by consumers and in R&D activities aimed at lowering the cost of production. In the political market, firms devote valuable resources, in the form of labour, to rent seeking activities. Regions can be integrated into a single political entity (a political union) and a single market (economic union) or disintegrated into different independent states and separate economies. Economic integration implies that all firms sell their product to all consumers in the region. The number of regions in an economic union is denoted m_e. Political integration means that a supranational government taxes all citizens in order to finance its expenditures. Firms seeking redistribution must deal with this level of government. The number of regions in a political union is denoted m_p.

3.1 The economic market

The economic market is modeled following Peretto (2003). In the economic market, firms compete with each other for market share. We assume an oligopolistic market in differentiated goods where consumers have love-of-variety preferences. Firms compete by setting prices and investing in cost reducing R&D. There are a total of $M_e = \sum_{k=1}^{m_e} n_k$ firms each producing a different product in the economic market. Consumers in the economic union have access to all M_e goods produced in the union.

3.1.1 Demand

Each firm's demand is derived from the optimizing behavior of consumers. Recall that in each region there are L identical individuals with symmetric preferences across all goods. Given the number of regions, m_e, in the economic union, an individual living in region k maximizes lifetime

[11] This is consistent with recent work in industrial organization (e.g. Nickell, 1996, Blundell et al., 1995, Aghion et al., 2005) which suggests a positive relationship between product market competition (measured by, among other things, the number of competitors in the same industry) and productivity growth within a firm or industry.

utility

$$U_k(t) = \int_t^{\infty} e^{-\rho(\tau - t)} \log C_k(\tau) d\tau \tag{1}$$

subject to the intertemporal budget constraint that the present discounted value of expenditure cannot be greater than the present discounted value of income plus initial wealth,

$$\int_t^{\infty} R(\tau) \left[E_k(\tau) + T_k(\tau) \right] d\tau \leq \int_t^{\infty} R(\tau) \left[W(\tau) + D(\tau) \right] d\tau + A_k(t),$$

where $\rho > 0$ is the individual discount rate, $R(\tau) \equiv e^{-\int_t^{\tau} r(s) ds}$ is the cumulative discount factor from time t to time τ, $E_k = \sum_{i=1}^{n_k} p_{ik} C_{ik} + \sum_{s \neq k}^{m_e} \sum_{i=1}^{n_s} p_{is} C_{is}$ is per capita expenditure on consumption goods and T_k is the constant lump-sum per capita tax in region k. $W \equiv 1$ is the wage rate, which we take as the numeraire. Finally, A_k is per capita asset holdings in region k and D represents dividend income.[12] The consumption index C_k is given by[13]

$$C_k = \left[\sum_{i=1}^{n_k} C_{ik}^{\frac{\epsilon - 1}{\epsilon}} + \sum_{s \neq k}^{m_e} \sum_{i=1}^{n_s} C_{is}^{\frac{\epsilon - 1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon - 1}}, \tag{2}$$

where $\epsilon > 1$ is the elasticity of product substitution, C_{ik} is consumption of good i produced in region k and C_{is} is consumption of good i produced in region s. Lastly, n_k and n_s are the number of goods produced in region k and region s, respectively.

In order to simplify notation, we introduce the following price index for region k:

$$p_k = \left[\sum_{i=1}^{n_k} p_{ik}^{1-\epsilon} + \sum_{s \neq k}^{m_e} \sum_{i=1}^{n_s} p_{is}^{1-\epsilon} \right]^{\frac{1}{1-\epsilon}},$$

where p_{ik} and p_{is} are the prices of good i in region k and s, respectively.

In this standard framework, households obtain the optimal expenditure plan by setting

$$\frac{\dot{E}_k}{E_k} = r - \rho \tag{3}$$

and, given this time path for expenditures, maximizing (2) subject to E. This yields the following demand schedules:

$$C_{ik}^k = E_k \frac{p_{ik}^{-\epsilon}}{p_k^{1-\epsilon}},$$

[12] In free entry/exit equilibrium, profits will always be zero implying that this term can be omitted without loss of generality.

[13] Unless there is possibility of confusion, in the rest of the article we omit time subscripts for ease of exposition.

$$C_{ik}^{s} = E_k \frac{p_{is}^{-\epsilon}}{p_k^{1-\epsilon}}.$$

The first equation is the demand for good i when good i is produced in the same region where it is consumed. The second equation represents the demand of good i in region k when it is produced in a region different from k. Using these individual demand curves, total demand faced by firm i from region k is

$$X_{ik} = LE_k \frac{p_{ik}^{-\epsilon}}{p_k^{1-\epsilon}} + \sum_{s \neq k}^{m_e} LE_s \frac{p_{ik}^{-\epsilon}}{p_s^{1-\epsilon}} = \frac{LE_k}{p_{ik}} \frac{p_{ik}^{1-\epsilon}}{p_k^{1-\epsilon}} + \sum_{s \neq k}^{m_e} \frac{LE_s}{p_{ik}} \frac{p_{ik}^{1-\epsilon}}{p_s^{1-\epsilon}} \equiv S_{ik}^{k} \frac{LE_k}{p_{ik}} + \sum_{s \neq k}^{m_e} S_{ik}^{s} \frac{LE_s}{p_{ik}}, \quad (4)$$

where $S_{ik}^{s} \equiv \frac{p_{ik}^{1-\epsilon}}{p_s^{1-\epsilon}}$ is the the share of country s's market captured by firm i from region k and p_s is the price index of consumption goods in region s. Notice that firm i in region k faces a price elasticity of demand given by

$$\xi_{ik} \equiv \frac{\partial X_{ik}}{\partial p_{ik}} \frac{p_{ik}}{X_{ik}} = \frac{LE_k \left[\epsilon S_{ik}^{k} - (\epsilon - 1)(S_{ik}^{k})^2\right] + \sum_{s \neq k}^{m_e} LE_s \left[\epsilon S_{ik}^{s} - (\epsilon - 1)(S_{ik}^{s})^2\right]}{LE_k S_{ik}^{k} + \sum_{s \neq k}^{m_e} LE_s S_{ik}^{s}}. \quad (5)$$

3.1.2 Production technology

Each firm produces output with technology

$$X_{ik} = Z_{ik}^{\theta}(L_{x_{ik}} - \phi), \quad (6)$$

where X_{ik} is output of firm i in region k and $L_{x_{ik}}$ is labor used in production, while $\phi > 0$ is a fixed and sunk cost of production that the firm has to pay in each period of activity. The firm's knowledge (or patent) stock is given by Z_{ik} and $\theta \in (0, 1)$ is the elasticity of cost reduction.

Firms invest in R&D in order to accumulate cost reducing innovations that are patented. Since $\theta \in (0, 1)$, labor productivity increases with the patent stock. Technological innovations evolve according to the following condition

$$\dot{Z}_{ik} = L_{z_{ik}} Z_{ik}. \quad (7)$$

Equations (6) and (7) imply that individual firms use their own, proprietary knowledge in producing output.[14] If the firm allocates $L_{z_{ik}}$ units of labor to R&D in an interval of time dt, it produces $\dot{Z}_{ik}$

[14] Innovations are specific to the firm, but the specification can be generalized to allow for spillovers so that the R&D process produces knowledge that is useful to other firms. In this case, which is presented in the Technical Appendix, firms use their own knowledge in the production of output, but all firms benefit from the R&D of other firms in the economic market.

new patents.

Profits from the economic market can be expressed as

$$\Pi^e_{ik} = p_{ik}X_{ik} - L_{x_{ik}} - L_{z_{ik}}. \tag{8}$$

Some of the parameters defined above play an important role in determining how tightly contested the economic market will be. Since much of the following analysis will focus on how competitive each market is, a discussion of these parameters will be useful. The elasticity of product substitution, ϵ, measures how easily consumers substitute between product varieties. When ϵ is high, consumer demand will react strongly to differences in firms' pricing behavior. The elasticity of cost reduction, θ, measures how sensitive a firm's costs are to new cost reducing innovations. When θ is high, differences in firms' investment in cost reducing R&D will result in large differences in costs. Economies characterized by higher levels of ϵ and θ are economies with more highly contested economic markets. Following the terminology of Bliss and Di Tella (1997), we can refer to these as *deep* parameters of competition. Another parameter that can be used to describe the level of competition in the economic market is the number of regions in the economic union, m_e. We can refer to this as the level of foreign competition. A final determinant of the competitiveness of the economic market is the market structure. In our symmetric set up, market structure can be summarized by the (endogenous) number of firms that operate in each region, n_k, which measures both concentration and average firm size. The total number of firms competing for market share - and the total number of goods available to consumers - is M_e.

3.2 The political market

The political market is modeled as a simple contest for redistribution in the spirit of Tullock (1980). Firms must expend real resources in order to obtain a share of the fiscal pie. The share that each firm receives is an increasing function of that firm's share in total rent seeking activity. Firms compete by choosing the amount of labor to dedicate toward rent seeking activity. There are a total of $M_p = \sum_{k=1}^{m_p} n_k$ firms each vying for redistribution from the government. The government finances these transfers by imposing a lump-sum tax on consumers.

3.2.1 Rent seeking technology

We use a general version of the rent seeking contest described by Tullock. In this set up, given the number of regions in the political union (m_p), the government has a fixed budget, $B(m_p)$, which is to be distributed among the contestants. Each contestant receives a fraction of the budget proportional to his share in total rent seeking activity. We allow only firms that are active in the economic market to compete for government transfers. In each period, the government responds

to firms' rent seeking activity according to the following technology,

$$Q_{ik} = \left[\frac{L_{Q_{ik}}^{\upsilon}}{\sum_{k=1}^{m_p} \sum_{i=1}^{n_s} L_{Q_{ik}}^{\upsilon}} \right] B\left(m_p\right) \tag{9}$$

where Q_{ik} denotes the rents transferred to firm i in region k, $L_{Q_{ik}}$ is labor used in rent seeking by firm i in region k, and $\upsilon \in [0,1]$ measures the responsiveness of government to rent seeking effort.[15] Notice that an increase in the government's responsiveness increases the effectiveness of a firm's own effort in obtaining transfers. But it also increases the effectiveness of the effort of other firms which, since this is a game of distribution, has a negative impact on each firm's ability to obtain transfers. This simple technology is consistent with two aspects of rent seeking that are widely described in the literature. First, rent seeking is a directly unproductive activity in that firms dedicate real resources to obtain a profit without producing any good or service (along the lines of Baghwati, 1982). Secondly, competition between different special interests reduces the returns to rent seeking (along the lines of Becker, 1983).

Profits from the political market can be expressed as

$$\Pi_{ik}^{p} = Q_{ik} - L_{Q_{ik}}. \tag{10}$$

The government must balance its budget in each period by collecting lump-sum taxes, T_k, in order to finance transfers to firms. The budget constraint is given by

$$B = m_p L T_k = \sum_{k=1}^{m_p} \sum_{i=1}^{n_s} Q_{ik}, \tag{11}$$

where the tax rate is assumed to be fixed. Notice that political integration (i.e. an exogenous increase in m_p) implies an increase in the number of firms vying for rents and in the size of tax base (and, therefore, in the available budget).

As for the economic market, it is useful to discuss the measures of competition in the political market. The responsiveness of government to rent seeking effort, υ, measures how sensitive transfers are to differences in rent seeking effort. When υ is high, small differences in rent seeking effort can lead to large differences in transfers received by firms.[16] Thus υ is a *deep* parameter

[15] In Tullock (1980), the parameter υ is equal to unity. Assuming υ to be between 0 and 1 requires a brief explanation. Whenever $\upsilon > \frac{M_p}{M_p - 1}$, two problems arise. First, in the symmetric Tullock game there will be a continuum of (payoff equivalent) asymmetric mixed strategy equilibria along with the unique symmetric equilibrium. Second, there will be full rent dissipation - firms will not profit from rent seeking activity. The restriction on υ allows us to avoid these issues altogether. Since the asymmetric equilibria guarantee contestants the same payoff this is not a costly assumption. Furthermore, we focus on the more interesting case where rent seeking can be profitable for firms. See Baye, Kovenock and DeVries (1999) for a more detailed discussion of these issues.

[16] In fact, if we relax the restriction on υ and allow it to become very large, the Tullock game converges to an

of competition in the political market. The level of foreign competition in the political market is given by m_p, the number of regions in the political union. Again, market structure is summarized by the (endogenous) number of firms that operate in each region, n_k. The total number of firms competing for redistribution is M_p.

4 Firm behavior

Following Peretto (2003) we give an informal description of the Nash equilibrium in the manufacturing sector.[17] Firms choose time paths of price, R&D spending and rent seeking expenditure in order to maximize the present discounted value of net cash flow. For firm i in region k, the present discounted value of net cash flows is

$$V_{ik}(t) = \int_t^\infty R(\tau)\Pi_{ik}(\tau)d\tau,$$

where instantaneous profits are given by

$$\Pi_{ik} = \Pi^e_{ik} + \Pi^p_{ik} = p_{ik}X_{ik} + Q_{ik} - L_{x_{ik}} - L_{z_{ik}} - L_{Q_{ik}}. \tag{12}$$

The firm will maximize V subject to technological and political constraints (6) and (9), total demand (4), while taking as given the number of active firms and its competitors' pricing, innovation and rent seeking strategies. We assume that the initial knowledge is given and equal for all firms in all regions. The remainder of this section provides a discussion of the Nash Equilibrium. A full derivation of the firm's optimal behavior is provided in the Technical Appendix.

4.1 The economic market

Each firm sets its price according to the optimal Bertrand-Nash price strategy

$$p_{ik} = \frac{\xi_{ik}}{\xi_{ik} - 1} Z_{ik}^{-\theta}, \tag{13}$$

where ξ_{ik}, as defined in equation (5), is the price elasticity of demand faced by the firm.

The rate of return on innovation is given by

$$r = \frac{\theta(\xi_{ik} - 1)}{\xi_{ik}} \left[S^k_{ik} LE_k + \sum_{s \neq k}^{m_e} S^s_{ik} LE_s \right] - \frac{\dot{Z}_{ik}}{Z_{ik}}. \tag{14}$$

all-pay auction. The highest bidder (i.e. the firm with the greatest rent seeking effort) will receive the entire budget.

[17] A formal definition can be found in Peretto (1996).

In the symmetric equilibrium, the pricing strategy is given by (removing all subscripts to denote the symmetric equilibrium values)

$$p_{ik} \equiv p = \frac{\xi}{\xi - 1} Z^{-\theta}, \forall i, k \tag{15}$$

where $\xi = \epsilon - (\epsilon - 1)\frac{1}{m_e n}$. The rate of return on innovation allows us to solve for the optimal R&D strategy:

$$L_{z_{ik}} \equiv L_z = \frac{LE\theta(\xi - 1)}{n\xi} - r, \forall i, k. \tag{16}$$

Equation (16) defines each firm's R&D effort in partial equilibrium. It is useful to consider the determinants of this R&D strategy. The term $\frac{LE}{n\xi}$ represents the *gross-profit effect* that depends on total sales per firm $\frac{LE}{n}$ and the mark-up $\frac{1}{\xi}$. The term $\theta(\xi - 1)$ is the *business-stealing effect* - by investing in cost reducing innovations, firms lower prices and expand their market share. Both of the deep parameters of economic competition, ϵ and θ, have a positive relationship with R&D effort. As the economic market becomes more competitive, firms have more to gain by cutting costs. At the same time, equation (15) shows that the firm must charge a lower price when ϵ and θ are high. An increase in foreign competition (m_e), all else equal, has the same effect. Using these two conditions, we can rewrite profits from the economic market as

$$\Pi^e = pX - L_x - L_z = \frac{LE\left[1 - \theta(\xi(M_e) - 1)\right]}{n\xi(M_e)} + r - \phi, \tag{17}$$

where the notation makes explicit that the elasticity of demand depends on the total number of firms in the economic market (M_e). Notice that an increase in the deep parameters of competition (ϵ and θ) and/or in the level of foreign competition (m_e) reduces profits from the economic market.

4.2 The political market

At each point in time, firms set their rent seeking strategy in response to their competitors' behavior according to

$$L_{Q_{ik}} = \upsilon B \mathcal{S}^p_{ik}(1 - \mathcal{S}^p_{ik}) \tag{18}$$

where $\mathcal{S}^p_{ik} \equiv \frac{L^{\upsilon}_{Q_{ik}}}{\sum_{k=1}^{m_p}\sum_{i=1}^{n_s} L^{\upsilon}_{Q_{ik}}}$ is the share of effective rent seeking effort by firm i in region k.

In symmetric equilibrium, $\mathcal{S}^p_{ik} \equiv \mathcal{S}^p = \frac{1}{m_p n}$ and we can rewrite profits from the political market as

$$\Pi^p = Q - L_Q = \frac{B\left[1 - \upsilon(1 - \mathcal{S}^p)\right]}{m_p n} = \frac{LT\left[1 - \upsilon(1 - \mathcal{S}^p(M_p))\right]}{n} \tag{19}$$

where the last equality uses the government budget constraint (11) and the notation makes explicit that the share of effective rent seeking ($\mathcal{S}^p$) depends on the total number of firms in the political

market (M_p). Notice that an increase in the deep competition parameter (υ) or an increase in foreign competition (m_p) results in greater rent seeking effort and lower profits from the political market.

5 Market structure and growth

Market structure plays an important role in the general equilibrium of this economy. Given the firm behavior described in the previous section, entry/exit decisions will determine the number of active firms. Market clearing conditions are then imposed in order to determine the general equilibrium of the economy.

5.1 Equilibrium market structure

Consider the entry/exit decisions of firms. We assume that the cost of entry is zero. In an equilibrium with free entry, total profits, Π_{ik}, must equal zero at all time. Imposing symmetry, we have $\Pi_{ik} = \Pi$ for all i and k. Using equations (12), (17), and (19), the zero-profit condition can be written as

$$\frac{LE\left[1-\theta(\xi-1)\right]}{n\xi} + r + \frac{LT\left[1-\upsilon(1-\mathcal{S}^p)\right]}{n} = \phi. \tag{20}$$

The zero profit condition demonstrates the interaction between the level of competition in the two markets. Consider a change in one of the deep parameters of economic competition. An increase in ϵ, for example, results in an increase in competition in the economic market as consumers find it more palatable to substitute between different varieties. Each firm has less market power, is forced to charge a lower markup and needs to invest more in cost reducing R&D. Profits from the economic market decrease, but the zero profit condition ensures that this decrease in profitability leads to the exit of some firms. As n decreases, there is less competition between firms also in the political market leading to an increase in rent seeking activity and political profits.

We now turn our attention to obtaining an expression for equilibrium expenditures. From condition (12), the zero profit condition can be rewritten as

$$p_{ik}X_{ik} + Q_{ik} = L_{xik} + L_{zik} + L_{Qik}.$$

Then, summing across firms and imposing the labor market clearing condition in region k, $L = \sum_{i=1}^{n_k}(L_{xik} + L_{zik} + L_{Qik})$, the zero profit condition can be written as

$$L = \sum_{i=1}^{n_k}(p_{ik}X_{ik} + Q_{ik}).$$

Imposing symmetry and using condition (4), we have per capita expenditures

$$E = 1 - \frac{nQ}{L} = 1 - T, \tag{21}$$

where the last equality relies on the fact that in symmetric equilibrium, the government's budget constraint is $m_p LT = m_p nQ$. Notice that taxes (which are used to redistribute rents to firms) reduce per capita equilibrium expenditures. This provides a further link between the economic and political market.[18] Moreover, note that E is constant over time. Jointly with condition (3), this implies that $r = \rho$ in equilibrium.

We can now write the zero profit condition as

$$\frac{L\left[1-T\right]\left[1-\theta(\xi(m_e n)-1)\right]}{n\xi(m_e n)} + \rho + \frac{LT\left[1-\upsilon(1-\mathcal{S}^p(m_p n))\right]}{n} = \phi. \tag{22}$$

The market structure of this economy depends on the interaction of firms in the economic and political markets. The price elasticity of demand $\xi(m_e n)$ and the share of effective rent seeking $\mathcal{S}^p(m_p n)$ are expressed as functions of the number of firms in order to highlight the role of economic and political integration in determining firm profits (recall that the number of firms competing in the economic and political markets are $M_e = m_e n$ and $M_p = m_p n$, respectively). This condition implicitly determines the equilibrium number of firms in each region, n. The left-hand side of equation (22) is everywhere decreasing in n, thus implying that the equilibrium exists and is unique. This relationship is depicted in Figure 1, with the curve representing the left-hand side labeled $\Pi - \phi$. Changes in market structure will occur whenever something alters the relationship between $\Pi - \phi$ and n, causing a shift in the curve.

5.2 Equilibrium growth and welfare

Along the balanced growth path, both consumers' expenditures and the number of firms are constant. The rate of cost reduction then determines the growth of output and consumption. We can define it as

$$g \equiv \frac{\dot{C}}{C} = \theta \frac{\dot{Z}}{Z} = \theta L_z. \tag{23}$$

From condition (16), we have the firm's R&D strategy as a function of total expenditures. Firms take the number of competitors in the economic and political market as given and choose the optimal level of R&D using

[18] None of the results to follow would be altered if it were firms rather than consumers who paid the tax. The only difference would be that, in symmetric equilibrium, the amount of taxes paid by each firm would exactly equal the transfers received and $\Pi^p = -L_Q$. All other results and comparative statics would be the same. We prefer the assumption that taxes are paid by consumers because firms extract some benefit from rent seeking.

$$L_z = \frac{LE\theta(\xi - 1)}{n\xi} - \rho.$$

The equilibrium number of firms, in turn, is endogenous and determined by the zero profit condition. Substituting the zero profit condition (22) into the last equation and using the definition of growth yields the equilibrium growth rate of the economy

$$g(n) = \theta \frac{\theta \left[\xi(m_e n) - 1\right] \left[\phi - \Pi^p(m_p n)\right] - \rho}{1 - \theta \left[\xi(m_e n) - 1\right]}. \tag{24}$$

This condition is a modified version of the firm's R&D decision which takes into account that firms have perfect foresight and correctly perceive the effect of parameter changes on their profits and, based on this, choose whether to be active or not. Rent seeking has an important impact on the incentive for firms to invest in R&D and therefore on growth. The higher are profits from the political market, the less important is the economic market for each firm's survival. Profits from rent seeking provide firms with a certain amount of "slack" in economic competition. The equilibrium number of active firms determines competition in the economic and political markets, R&D, pricing and rent seeking strategies and, ultimately, long run growth. This relationship is depicted in Figure 2. Equilibrium growth is determined by the growth schedule (24) together with the equilibrium number of firms as determined by the zero profit condition (22). Changes in the equilibrium growth rate will come about as a result of shifts in the growth schedule and/or changes in regional market structure.

Welfare for the typical consumer is given by substituting equilibrium values into the consumption index (2) and integrating (1) to yield

$$U = \frac{1}{\rho} \left[\frac{1}{\epsilon - 1} \log(m_e n) + \log \frac{\xi(m_e n) - 1}{\xi(m_e n)} + \frac{g}{\rho} + \log(1 - T) \right].$$

The first two terms capture the fact that consumers benefit from increases in the number of consumption goods and the quantity of each good that they consume. The third term captures the fact that utility is also increasing in the growth rate of the economy, which is also the growth rate of consumption. The final term recognizes that, in general equilibrium, redistributive taxation leads to a deterioration in expenditures. Economic and political integration will play a role in determining both the number of varieties available to consumers as well as the growth rate of the economy by altering the incentives of firms to devote resources to cost reducing R&D.

6 The effects of integration

In this section we start by studying the results of political and economic integration separately, focusing on the effects that each type of integration has on market structure, innovation, rent seeking, growth and welfare. This will allow us to gain a greater understanding of the interaction between all of the components of this model and the different types of integration. Finally, we will study the consequences of economic *and* political integration.

We start by giving definitions of what we mean by economic and political integration.

- *Economic integration* is captured by an increase in m_e. This exogenous increase in the size of the economic market allows firms to sell their products to more consumers in more regions with no limits (quotas, tariffs, etc.) At the same time, firms will have to compete for market share with firms in more regions.

- *Political integration* is captured by an increase in m_p. This exogenous increase in the size of the political market allows firms to seek rents from a larger pool of resources (the tax revenue of the larger political union). At the same time, firms will have to compete for rents with firms in more regions.

Our definitions require some discussion. Economic integration is interpreted as an exogenous move from autarky to free trade. However, our results would not change if we were to introduce in the model trade restrictions between regions (e.g. tariffs) and define economic integration as an exogenous decrease in such restrictions.

Our definition of political integration is admittedly restrictive along several dimensions (see also the discussion of this point in section 7), however it allows us to focus on the implications that a larger political market has for rent seeking and its effect -through this channel- on economic growth and welfare. Underlying this definition there are two simplifying assumptions that require further discussion. First, in the absence of political integration, a firm in region s cannot obtain transfers from the government of region s'. The assumption here is that only members of the polity are eligible for transfers from the government.[19] Second, one could argue that political integration may

[19] In a model of lobbying, rather than rent seeking, this may be a concern because in practice foreign lobbies can influence the home government (evidence by Gawande et al (2004) shows that this is in fact the case for trade policy in the US). However the logic of our results would not change if we allow foreign rent seekers to be active in the home political market provided that they face higher costs of influencing the home government (for instance, due to worse connections with home bureaucrats and politicians or because of taboos about governments accepting support from foreign firms). In particular, we can have firms participating in a rent seeking game in each region with the rent seeking function taking the form

$$Q_{ik}^{D}=\left[\frac{L_{Q_{ik}}^{\upsilon}}{\sum_{j=1}^{n_k}L_{Q_{jk}}^{\upsilon}+\sum_{s\neq k}^{m_p}\sum_{j=1}^{n_s}\left[(1-\beta)L_{Q_{js}}\right]^{\upsilon}}\right],$$

lead to a change in the size of the "political pie" that rent seekers can distort to their advantage (i.e. a variation in the tax T) or in the rent seeking technology (i.e. a variation in the responsiveness of the government υ). The direction of change, however, is not *a priori* clear and in the ensuing discussion we abstract from it.

6.1 Political integration

We consider an increase in the size of the political union. In order to determine the effect of political integration on economic growth, we must recognize that there are two separate effects on growth. First consider the growth schedule,

$$g(n) = \theta \frac{\theta\left[\xi(m_e n) - 1\right]\left[\phi - \Pi^p(m_p n)\right] - \rho}{1 - \theta\left[\xi(m_e n) - 1\right]}.$$

An increase in m_p has the direct effect of increasing growth for any given number of regional firms, n. The intuition is as follows. An increase in foreign competition in the political market makes rent seeking less profitable for a given number of regional firms as in the symmetric equilibrium rents are unaltered, but the amount of labour devoted to rent seeking is increased. In general equilibrium this reduces the slack provided by rent seeking and makes R&D relatively more attractive than rent seeking, resulting in an increase in innovative activity and growth.

A second effect on growth takes place through the endogenously determined market structure. Consider the zero profit condition,

$$\frac{L\left[1 - T\right]\left[1 - \theta(\xi(m_e n) - 1)\right]}{n\xi(m_e n)} + \rho + \frac{LT\left[1 - \upsilon(1 - \mathcal{S}^p(m_p n))\right]}{n} = \phi.$$

The increase in foreign competition in the political market makes rent seeking more competitive and reduces profits from the political market. With no direct effect on the economic market, some firms must exit because they are not making enough to cover the fixed and sunk cost of operating. Increased foreign political competition drives out some regional firms. To see what happens to the

when a firm vies for rents in its own region, and

$$Q_{ik}^F = \left[\frac{\left[(1-\beta)L_{Q_{ik}}\right]^{\upsilon}}{\sum_{j=1}^{n_k} L_{Q_{jk}}^{\upsilon} + \sum_{s\neq k}^{m_p}\sum_{j=1}^{n_s}\left[(1-\beta)L_{Q_{js}}\right]^{\upsilon}}\right],$$

when a firm vies for rents in another region.

Under this specification, political integration can be seen as a decrease in the cost of rent seeking in other regions (i.e. a decrease in β). It can be shown that a decrease in β has quantitatively the same effects as an increase in m_p. It makes the political market more competitive, raises rent seeking effort and decreases profits from the political market.

number of firms in the political market, rewrite the zero profit condition as a function of M_p,

$$\frac{m_p L\left[1-T\right]\left[1-\theta(\xi(\frac{m_e M_p}{m_p})-1)\right]}{M_p \xi(\frac{m_e M_p}{m_p})}+\rho+\frac{m_p LT\left[1-\upsilon(1-\mathcal{S}^p(M_p))\right]}{M_p}=\phi.$$

Political integration (an increase in m_p) increases the left-hand side directly and by decreasing the elasticity of demand. In order for the condition to continue to hold, M_p must increase. In other words, the number of firms vying for rents under political integration is larger than the number of firms in the political market before integration. This is true even though an increase in m_p drives some domestic firms out of business.

In the economic market, with no change in m_e, it must be the case that M_e falls. As firms drop out of the market, R&D effort is reduced because competition for market share is reduced. This results in a movement down along the growth schedule.

Political integration has an ambiguous effect on economic growth. On the one hand, it makes rent seeking less attractive relative to R&D and boosts growth. On the other hand, greater foreign competition drives out some regional producers and dissuades growth generating R&D. This can be seen in Figure 3, where political integration implies an outward shift of the growth schedule (from g to g') and a reduction in the regional number of firms (from n to n'). The overall effect on growth is ambiguous.

A similar intuition holds for welfare. Holding constant the number of regional firms, political integration raises welfare by increasing growth. However, because tougher political competition drives out some domestic producers, the variety of consumption goods falls. This has a direct negative effect on welfare and a further negative effect through reduced growth.

Proposition 1. *Political integration reduces the number of regional firms (n) and the number of firms competing in the economic market (M_e); increases the number of firms competing in the political market (M_p); and has an ambiguous effect on innovation, economic growth and welfare.*

Although the current specification does not allow us to be precise about the conditions under which political integration will be good for growth and welfare, some further discussion is warranted. Political integration will be positive when the direct effect (the upward shift in the growth schedule) is large and the indirect effect (the movement down along the growth schedule from a fall in n) is small. Inspection of equations (24) and (22) reveals that this will occur when υ is small relative to ϵ and θ.[20] Political integration will be beneficial when economic markets are inherently more

[20] The shift in the growth schedule is determined by $\frac{\partial g}{\partial m_p}=\frac{\theta^2(\xi-1)}{1-\theta(\xi-1)}\frac{\upsilon LT}{(m_p n)^2}$. The decrease in n is a response to the decrease in the left-hand side of equation (22), $\frac{\partial LHS}{\partial m_p}=-\frac{\upsilon LT}{(m_p n)^2}$.

competitive than political markets because the gain from increased competition in the political market (by making rent seeking less attractive relative to R&D) will more than offset the loss of some firms.

6.2 Economic integration

We now turn our attention to the effects of economic integration. As with political integration, there is a direct effect on growth and an indirect effect through the market structure. Inspection of equation (24) reveals that an increase in m_e has the direct effect of increasing growth for any given number of regional firms, n. The increase in foreign economic competition means that firms face tougher price competition, inducing them to raise R&D effort and, consequently, growth.

At the same time, lower prices and greater R&D expenditures mean that some existing firms will have to exit the market in order to satisfy the zero profit condition (22). We can show that the number of firms competing in the economic market increases by rewriting the zero profit condition in terms of M_e:

$$\frac{m_e L\left[1-T\right]\left[1-\theta(\xi(M_e)-1)\right]}{M_e\xi(M_e)}+\rho+\frac{m_e LT\left[1-\upsilon(1-\mathcal{S}^p(\frac{m_p M_e}{m_e}))\right]}{M_e}=\phi.$$

Economic integration (an increase in m_e) increases the left-hand side directly and by increasing S^p. In order for the condition to continue to hold, M_e must increase. The number of firms in an enlarged economic union is greater even though some domestic producers close down. In the political market, the departure of regional firms with no change in m_p diminishes competition for rents and makes rent seeking more profitable.

The effect of economic integration on growth is ambiguous in this model. For a given number of domestic firms, the growth rate is always higher under increased economic integration, because the price elasticity of demand, ξ, is larger. Foreign competition decreases the economic market power of each firm making R&D more attractive and causing growth to rise. However, the change in market structure and the increase in rent seeking activities negatively affect the economic performance of countries in the long run. The interaction of these political and economic effects determines the rate of growth of the economy. In terms of Figure 4, the growth schedule shifts up and the vertical line representing the equilibrium number of firms shifts to the left.

In terms of welfare, consumers benefit from the increase in variety of consumption goods. The ambiguous changes in innovation and growth, however, preclude a clear effect of economic integration on welfare.

Proposition 2. *Economic integration reduces the number of regional firms (n) and the number of firms competing in the political market (M_p); increases the number of firms competing in the*

economic market (M_e); and has an ambiguous effect on innovation, economic growth and welfare.

A move toward economic integration will cause the number of firms operating in each region to fall even as the global number of goods available to consumers increase. This has been called the homogenization effect of trade liberalization. A number of theoretical arguments have been proposed in the literature to suggest that the losses from the closing of domestic firms are more than offset by new varieties and efficiency gains (e.g. production is taken over by lower cost firms). Here we argue that, when firms also participate in the political market, the elimination of domestic firms can be particularly damaging because it makes rent seeking a much more appealing proposition for the remaining domestic firms. Opening the market to trade increases economic competition and results in greater price competition which requires greater R&D expenditures. But as domestic firms drop out of the market, political power is concentrated and rent seeking becomes more attractive.[21] Firms that were once protected by trade restrictions turn their efforts to influence their government to obtain different forms of favors once these restrictions are no longer in place (public transfers are likely to be good substitutes for trade barriers from the firm's perspective). This draws resources away from R&D. The overall effect of economic integration on R&D (and therefore growth) is ambiguous.

6.3 Economic *and* political integration

We now turn our attention to the interaction between economic and political integration. Consider economic integration (however the same argument can be made using political integration as the starting point). On impact, economic integration shifts the growth schedule by

$$\frac{\partial g}{\partial m_e} = \theta \frac{\theta(\phi - \Pi^p) - \rho}{1 - \theta(\xi - 1)} \frac{\partial \xi}{\partial m_e} > 0.$$

As discussed above, this is a result of increased competition over market share for any given level of n. The level of political integration plays an important role in the size of this effect because it determines the slack afforded to firms by political profits. More formally, we can see that the shift in the growth schedule is greater when there is more political integration by taking the derivative with respect to m_p:

$$\frac{\partial g^2}{\partial m_e \partial m_p} = -\frac{\theta^2}{[1 - \theta(\xi - 1)]^2} \frac{\partial \xi}{\partial m_e} \frac{\partial \Pi^p}{\partial m_p} > 0.$$

It is important to also note that the level of political integration does not affect the decrease in n. Recall that the change in n is determined by the size of the shift in the left-hand side (LHS)

[21] Notice that the fall in competition in the political market increases rent seeking no matter the level of υ in the political market. The extent of this increase, however, is clearly related to the characteristics of the political market (i.e. larger increases in rent seeking for higher values of υ).

of the zero-profit condition (22):

$$\frac{\partial LHS}{\partial m_e} = -\frac{L(1-T)(1+\theta)}{(n\xi)^2} < 0.$$

This effect is independent of m_p (i.e. $\frac{\partial LHS^2}{\partial m_e \partial m_p} = 0$). Since the shift in the growth schedule caused by economic integration is greater under higher levels of political integration and the change in n the same, it must be the case that the growth effect of economic integration will be better when there is greater political integration.

In order to consider the effects of joint economic and political integration on the total number of firms, we will focus on an economy with $m_e = m_p = m$.[22] Joint economic and political integration can then be analyzed as an increase in m. The zero profit condition becomes

$$\frac{L\left[1-T\right]\left[1-\theta(\xi(mn)-1)\right]}{n\xi(mn)} + \rho + \frac{LT\left[1-\upsilon(1-\mathcal{S}^p(mn))\right]}{n} = \phi.$$

An increase in m reduces the left-hand side for any given value of n by increasing competition in both the economic and political markets. Both activities become less profitable and some regional firms must exit the market. Expressing the zero profit condition as a function of the global number of firms $M \equiv mn$ yields

$$\frac{mL\left[1-T\right]\left[1-\theta(\xi(M)-1)\right]}{M\xi(M)} + \rho + \frac{mLT\left[1-\upsilon(1-\mathcal{S}^p(M))\right]}{M} = \phi.$$

An increase in m increases the left-hand side for any given value of M so the global number of firms increases even though some firms in each region exit the market.

Lastly, consider the effect of full integration on welfare. As an increase in the size of an economic *and* political union increases the number of firms in both the economic and political markets and has a stronger effect on growth than economic or political integration alone, it must be that welfare improves under a full integration strategy compared to partial integration.

Proposition 3. *Full integration reduces the number of regional firms (n); increases the number of firms competing in the economic and political markets (M_e* and *M_p); and results in better outcomes for innovation, growth and welfare than either economic or political integration alone.*

As mentioned in the previous section, economic integration alone does not guarantee improvements in growth and welfare because it increases the attractiveness of rent seeking relative to R&D.

[22] This approach is for expositional convenience only.

Political integration, by increasing competition in the political market, offsets this mechanism. In this sense, political and economic integration can be seen as complementary.

Let us stress that the problem with economic integration on its own is that it increases competition in the economic market and not in the political market. This skews firms' incentives toward rent seeking. Political integration is one way to solve this problem because it introduces an equiproportional increase in political competition. This ensures that the benefits of increased economic competition are fully realized. In practice, it should be noted that other effects of free trade might also be in place, even if not explicitly modeled in this paper. Economic integration is generally perceived as beneficial to the quality of institutions.[23] If this is the case, trade could be associated with creating inherently more competitive political markets as well (an increase in υ). As long as economic integration is carried out in a way that does not make firms want to focus on rent seeking, the benefits of open trade will be realized. However, due to the complementarity of economic and political integration, these benefits will be larger under a full integration strategy.

7 Conclusions

This paper presents an endogenous growth model with rent seeking and studies the economic effects of political and economic integration. Contrary to the previous literature which treats political integration as an alternate way of increasing the size of the economic market, we find that economic and political integration can function as complementary institutions. When firms engage in both innovation and unproductive rent seeking, changes in the economic and political markets alter the benefits of each type of activity. By considering political integration as an increase in the size of the political market - and independent of the size of the economic market - we see that it has an ambiguous effect on innovation, growth and welfare. The results for economic integration on its own are similar. It increases competition for market share, which tends to increase a firm's incentive to innovate. But it also eliminates some of the regional firms, reducing competition and making rent seeking more attractive for the remaining firms. The overall effect on innovation, growth and welfare is ambiguous. Whether political or economic integration alone increase growth and welfare will depend on the relative level of competition in each market.

When countries undertake economic and political integration jointly, the effects on innovation, growth and welfare improve. The basic intuition is that joint integration makes both the political and economic markets more competitive without altering the incentives across these markets. Consider economic integration on its own. The increased competition makes innovation more appealing. But by reducing the regional number of firms it decreases competition in the political

[23] Empirical evidence suggests that more open economies tend to be associated with better institutions (see Rodrik, Subramanian and Trebbi, 2004). However, the causal relationship is not obvious.

market, making rent seeking more attractive and reducing the return to innovation. When political integration accompanies economic integration, the latter effect is nullified. Innovation becomes more attractive and growth and welfare increase.

There are, of course, some important caveats to our results. The issue of political integration is clearly a complex one and requires more theoretical and empirical work. To address it in a formal and tractable model, we focus on a highly stylized representation of the political market. It would be quite optimistic to argue that this fully captures the implications of political integration. The goal of this paper is to isolate the competition effects from the point of view of the firms whose R&D investments drive economic growth. We abstract away from clearly important considerations such as changes in the quality and structure of institutions, government incentives and the loss of sovereignty.

Another possible concern is that firms' unproductive activity can take other forms. If firms lobby for anti-competitive policies such as extensions of patents rights or barriers to entry, there may be a positive effect on innovation and growth since these policies increase the return to innovation. While this is a possibility, the industrial organization literature on competition and growth is not conclusive on the effects of decreased competition on innovation. Empirically, the relationship between competition and innovation is positive or inverted U-shaped.[24] There is no guarantee that successfully lobbying for this type of policy change will result in an increase in R&D effort. Furthermore, if firms have to allocate resources to obtaining these policies, this will still draw resources away from innovative activity. In our model in particular, any labor dedicated to lobbying cannot be used for R&D.[25]

To draw policy implications from a stylized model such as this one is difficult, but tempting. We briefly discuss some possible applications. First, most of the recent political break ups, from the USSR to Montenegro, took place in countries where the quality of institutions were low. Political disintegration in the former Soviet Union in particular has been accompanied by an astonishing increase in rent seeking activities and a large fall in growth rates. The two are obviously related to the collapse of the socialist system of production and the transition to a market economy. However, it is tempting to argue that the political break up *per se* had effects on both rent seeking and growth as predicted by this model. Local oligarchs found much less competition in their local polities and focused their efforts on unproductive methods of obtaining income.

Second, pressures for the political independence of Quebec from the rest of Canada have resurfaced in the last few years. An argument often mentioned in favor of independence is that,

[24] Aghion and Griffith (2005) provide an excellent review of the theoretical and empirical literature.

[25] Consider a pharmaceutical company with several new drugs in the pipeline. It has a choice between devoting resources toward further R&D or lobbying the government for an extension of the patent. While it is true that successful lobbying increases the return to R&D, it may still be more attractive to continue to lobby for other policy favors instead of actually investing in R&D.

with the implementation of the North American Free Trade Agreement (NAFTA), the economic costs of political independence are low (possibly zero in a perfectly integrated market). Our results suggest that this argument fails to realize that a political break up itself might have effects on economic growth and that these effects might be magnified (not lowered) by economic integration.

Finally, economic integration in Europe has been accompanied by some degree of political integration. Notice that after the creation of the European Communities (later called the European Union) in the 1950s, countries that preferred economic integration with no political integration formed three other free trade areas, the most important being the European Free Trade Association (EFTA). Most members of EFTA, such as the UK, Austria, Sweden, Portugal, Denmark, Finland, later opted to join the EU and ceased to be EFTA members.[26] The recent integration of Eastern and Central European countries in the European Union represents another example of countries preferring joint economic *and* political integration over a purely economic integration strategy. Currently the EU has exclusive competence in several policy areas, namely those concerning the regulation of the internal market. Of particular interest is the discipline of state aid to firms (that closely resemble the kind of transfers in our model). National governments have been limited by the Treaties in their ability to decide such policy and the European Commission has been empowered with enforcement. In both cases (regulation of the internal market and state aid), we argue that an underlying reason is to prevent firms from avoiding economic competition by focusing their efforts on local (i.e. national) rent seeking activities that would undermine the benefits of establishing a single market in Europe.

We shall conclude with a final word on the globalization of markets and political (dis)integration. Overall this model reaches conclusions on the relationship between economic integration and political separatism that are analogous to other recent arguments that have emerged in the literature. First, the view that integrated economic markets need political as well as legal and social institutions for their effective functioning (see Rodrik, 2000, and Wolf, 2004). Second, the view that the proliferation of borders reduces trade (and, therefore, growth) even when countries share culture, language and institutions (McCallum, 1995). Third, the view that globalization is creating new policy externalities and this leads national governments to choose worse economic policies (Broner and Ventura, 2006, and Epifani and Ganica, 2006, among others).

Although, as discussed in section 2, the work of Alesina, Spolaore and Wacziarg (2000) has markedly different results from our model (namely that economic integration should be accompanied by political disintegration), the two works should be seen as complementary. Governments engage in a multiplicity of activities. In some of these activities (e.g. education, cultural policy) heterogeneity of policy preferences may be extremely relevant. In other policy areas (e.g. subsidies, market regulation) rent seeking might be pervasive. The focus of Alesina, Spolaore and Wacziarg (2000) is

[26] Currently, EFTA has four members: Iceland, Norway, Switzerland, and Liechtenstein.

on the first type of activities, while this paper emphasizes the latter. Taken together, the two articles suggest that globalization should be associated with a change in the global political structure, and provide some insights on the direction such a change should take.

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A Technical appendix

In this technical appendix, we provide a full derivation of the equilibrium of the model presented in section 3.

A.1 Consumer behavior

An individual living in region k solves the problem:

$$\max_{\{C_k(\tau)\}} u_k(t) = \int_t^{\infty} e^{-\rho(\tau-t)} \log C_k(\tau) d\tau \tag{A1}$$

subject to the intertemporal budget constraint (in differential equation form)

$$\dot{A}_k(\tau) = W_k(\tau) + D_k(\tau) + rA_k(\tau) - E_k(\tau) - T_k(\tau) \tag{A2}$$

where

$$\begin{aligned} C_k &= \left[\sum_{s=1}^{m_e} \sum_{j=1}^{n_s} C_{js}^{\frac{\epsilon-1}{\epsilon}} \right]^{\frac{\epsilon}{\epsilon-1}}, \\ E_k(\tau) &= \sum_{s=1}^{m_e} \sum_{j=1}^{n_s} p_{js} C_{js}. \end{aligned}$$

The Hamiltonian is given by[27]

$$\mathcal{H} = e^{-\rho(\tau-t)} \log C_k + \mu_k \left[W + rA_k - E_k + T_k \right]$$

and yields the following conditions:

$$\frac{\partial \mathcal{H}}{\partial C_{js}} = e^{-\rho(\tau-t)} \frac{C_k}{C_{js}} \left[\frac{C_{js}^{\frac{\epsilon-1}{\epsilon}}}{\sum_{l=1}^{m_e} \sum_{i=1}^{n_s} C_{il}^{\frac{\epsilon-1}{\epsilon}}} \right] - \mu_k p_{js} = 0, \forall j, s \tag{A3a}$$

$$\frac{\partial \mathcal{H}}{\partial A_k} = \mu_k r = -\dot{\mu}_k, \tag{A3b}$$

$$\lim_{\tau \to \infty} \mu(\tau) A_k(\tau) = 0. \tag{A3c}$$

Summing (A3a) over j and s and re-organizing yields $e^{-\rho(\tau-t)} = \mu_k E_k$. Taking logarithms and

[27] Recall that in free entry equilibrium, profits will always be zero so the term $D(\tau)$ can be omitted without loss of generality. Also, we drop the time subscripts where there is no confusion.

derivatives gives

$$-\rho = \frac{\dot{\mu_k}}{\mu_k} + \frac{\dot{E_k}}{E_k} \Longrightarrow \frac{\dot{E_k}}{E_k} = r - \rho,$$

where the final expression uses (A3b). We can use the first condition for $j \neq i$ and $s \neq k$ to obtain

$$C_{js} = \left(\frac{p_{ik}}{p_{js}}\right)^{\epsilon} C_{ik}, \forall j, s.$$

Substituting this into the definition of expenditure yields,

$$E_k = \sum_{s=1}^{m_e}\sum_{j=1}^{n_s} p_{js}\left(\frac{p_{ik}}{p_{js}}\right)^{\epsilon} C_{ik} \Longrightarrow C_{ik} = E_k \frac{p_{is}^{-\epsilon}}{p_k^{1-\epsilon}}, \forall i, k, s$$

where $p_k = \left[\sum_{s=1}^{m_e}\sum_{j=1}^{n_s} p_{js}^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}}$ is the price index of consumption in region k. It is straight forward to calculate the instantaneous demand faced by firm i from region k as

$$X_{ik} = LC_{ik} + \sum_{s\neq k}^{m_e} LC_{is} = \frac{LE_k}{p_{ik}}\frac{p_{ik}^{1-\epsilon}}{p_k^{1-\epsilon}} + \sum_{s\neq k}^{m_e}\frac{LE_s}{p_{ik}}\frac{p_{ik}^{1-\epsilon}}{p_s^{1-\epsilon}} \equiv S_{ik}^k\frac{LE_k}{p_{ik}} + \sum_{s\neq k}^{m_e} S_{ik}^s\frac{LE_s}{p_{ik}}, \tag{A4}$$

where $S_{ik}^s \equiv \frac{p_{ik}^{1-\epsilon}}{p_s^{1-\epsilon}}$ is the the share of country s's market captured by firm i from region k. It is useful to calculate the price elasticity of demand faced by firm i in region k,

$$\xi_{ik} \equiv \frac{\partial X_{ik}}{\partial p_{ik}}\frac{p_{ik}}{X_{ik}} = \frac{LE_k\left[\epsilon S_{ik}^k - (\epsilon-1)(S_{ik}^k)^2\right] + \sum_{s\neq k}^{m_e} LE_s\left[\epsilon S_{ik}^s - (\epsilon-1)(S_{ik}^s)^2\right]}{LE_k S_{ik}^k + \sum_{s\neq k}^{m_e} LE_s S_{ik}^s}. \tag{A5}$$

A.2 Firm behavior

Firm i in region k solves the problem:

$$\max_{\{p_{ik}(\tau), L_{z_{ik}}(\tau), L_{Q_{ik}}(\tau)\}} V_{ik}(t) = \int_t^{\infty} R(\tau)\Pi_{ik}(\tau)d\tau, \tag{A6}$$

subject to

$$\begin{aligned}
\Pi_{ik} &= \Pi^e_{ik} + \Pi^p_{ik} = p_{ik}X_{ik} + Q_{ik} - L_{x_{ik}} - L_{z_{ik}} - L_{Q_{ik}}, \qquad \text{(A7)}\\
L_{x_{ik}} &= Z_{ik}^{-\theta}X_{ik} + \phi,\\
Q_{ik} &= \left[\frac{L^{\upsilon}_{Q_{ik}}}{\sum_{k=1}^{m_p}\sum_{i=1}^{n_s} L^{\upsilon}_{Q_{ik}}}\right] B,\\
\dot{Z}_{ik} &= L_{z_{ik}}\left[Z_{ik} + \sum_{j\neq i}^{n_k}\frac{\gamma}{1+\delta(n_k-1)}Z_{jk} + \gamma\sum_{s\neq k}^{m_e}\sum_{j=1}^{n_s}\frac{\gamma}{1+\delta(n_s-1)}Z_{js}\right] \equiv L_{z_{ik}}K_{ik},
\end{aligned}$$

and X_{ik} is given by (A4). This specification is different than the one in the main text in that K_{ik} is the total stock of knowledge available to a firm when innovating. This innovation technology implies that individual firms use their own, proprietary knowledge in producing output, but all firms benefit from the R&D of other firms in the economic market. We assume that technological spillovers are transmitted through trade so that the relevant knowledge base depends on the level of economic integration. The parameter $\gamma \in [0,1]$ determines the share of privately developed R&D that becomes publicly available. The parameter δ determines how quickly congestion sets in. If the firm allocates $L_{z_{ik}}$ units of labor to R&D in an interval of time dt, it produces $\dot{Z}_{ik}$ new patents. The main text assumes that $\gamma = 0$, such that $\dot{Z}_{ik} = L_{z_{ik}}Z_{ik}$.

The current value Hamiltonian is

$$\mathcal{J} = \left[p_{ik} - Z_{ik}^{-\theta}\right]X_{ik} - \phi - L_{z_{ik}} + \left[\frac{L^{\upsilon}_{Q_{ik}}}{\sum_{k=1}^{m_p}\sum_{i=1}^{n_s} L^{\upsilon}_{Q_{ik}}}\right]B - L_{Q_{ik}} + \lambda_{ik}L_{z_{ik}}K_{ik},$$

and yield the following conditions:

$$\begin{aligned}
\frac{\partial\mathcal{J}}{\partial p_{ik}} &= X_{ik} + \left[p_{ik} - Z_{ik}^{-\theta}\right]\frac{\partial X_{ik}}{\partial p_{ik}} = 0, \qquad \text{(A8a)}\\
\frac{\partial\mathcal{J}}{\partial L_{z_{ik}}} &= -1 + \lambda_{ik}K_{ik} = 0, \qquad \text{(A8b)}\\
\frac{\partial\mathcal{J}}{\partial L_{Q_{ik}}} &= \frac{\upsilon B}{L_{Q_{ik}}}\left[\frac{L^{\upsilon}_{Q_{ik}}\left(\sum_{k=1}^{m_p}\sum_{i=1}^{n_s} L^{\upsilon}_{Q_{ik}} - L^{\upsilon}_{Q_{ik}}\right)}{\sum_{k=1}^{m_p}\sum_{i=1}^{n_s} L^{\upsilon}_{Q_{ik}}}\right] - 1 = 0, \qquad \text{(A8c)}\\
\frac{\partial\mathcal{J}}{\partial Z_{ik}} &= \theta Z_{ik}^{-\theta-1}X_{ik} = r\lambda_{ik} - \dot{\lambda}_{ik}, \qquad \text{(A8d)}\\
\lim_{\tau\to\infty} R(\tau)\lambda_{ik}(\tau)Z_{ik}(\tau) &= 0. \qquad \text{(A8d)}
\end{aligned}$$

From (A8a), we obtain the standard optimal Bertrand-Nash price strategy,

$$p_{ik} = \frac{\xi_{ik}}{\xi_{ik}-1} Z_{ik}^{-\theta}. \tag{A9}$$

Using (A8a) and (A4), condition (A8d) can be expressed as

$$\frac{\theta(\xi_{ik}-1)}{\xi_{ik} Z_{ik}} \left[LE_k S_{ik}^k + \sum_{s \neq k}^{m_e} LE_s S_{ik}^s \right] = r\lambda_{ik} - \dot{\lambda}_{ik}.$$

Taking logs and time derivatives of (A8b) and substituting into the above equation yields the rate of return on innovation,

$$r = \frac{\theta(\xi_{ik}-1)}{\xi_{ik}} \left[S_{ik}^k LE_k + \sum_{s \neq k}^{m_e} S_{ik}^s LE_s \right] \frac{K_{ik}}{Z_{ik}} - \frac{\dot{K}_{ik}}{K_{ik}}. \tag{A10}$$

Condition (A8c) defines the optimal rent seeking strategy,

$$L_{Q_{ik}} = \upsilon B \mathcal{S}_{ik}^p (1 - \mathcal{S}_{ik}^p) \tag{A11}$$

where $\mathcal{S}_{ik}^p \equiv \frac{L_{Q_{ik}}^{\upsilon}}{\sum_{k=1}^{m_p} \sum_{i=1}^{n_s} L_{Q_{ik}}^{\upsilon}}$.

A.3 Free entry

Assuming the cost of entry is zero, free entry will drive the present discounted value of a firm to $V_{ik} = 0$. Moreover, stock prices must satisfy the arbitrage condition derived by taking the time derivative of a firm's value as defined in (A6):

$$\dot{V}_{ik} = rV_{ik} - \Pi_{ik}.$$

Together, these conditions imply that profits, Π_{ik}, must equal zero at all time. Using the conditions derived above, the zero profit condition can written as

$$\frac{1}{\xi_{ik}} \left[S_{ik}^k LE_k + \sum_{s \neq k}^{m_e} S_{ik}^s LE_s \right] + \left[1 - \upsilon \mathcal{S}_{ik}^p (1 - \mathcal{S}_{ik}^p) \right] B = \phi + L_{z_{ik}}, \tag{A12}$$

which states that a firm's net cash flows from operations just cover their fixed and R&D costs.

A.4 The symmetric equilibrium

In symmetric equilibrium, the following hold for all i and k:

$$\xi_{ik} = \epsilon - (\epsilon - 1)\frac{1}{m_e n} \equiv \xi(m_e n),$$

$$S_{ik}^k = S_{ik}^s = \frac{1}{m_e n} \equiv S^e(m_e n),$$

$$\mathcal{S}_{ik}^p = \frac{1}{m_p n} \equiv \mathcal{S}^p(m_p n),$$

$$\frac{K_{ik}}{Z_{ik}} = 1 + \frac{\gamma(m_e n - 1)}{1 + \delta(m_e n - 1)} \equiv \alpha(m_e n),$$

where the term α represents the productivity of labor in R&D.[28] This last equation leads to two important observations. First, firms accumulate knowledge at a rate that depends on α and L_z:

$$\dot{Z} = L_z K \Longrightarrow \frac{\dot{Z}}{Z} = \alpha(m_e n) L_z.$$

Second, the total stock of knowledge available to each firm, K, grows according to $\frac{\dot{K}}{K} = \frac{\dot{Z}}{Z} + \frac{\dot{\alpha}}{\alpha}$. Note that, with entry costs equal to zero, the number of firms is a jumping variable and is constant along the balanced growth path. This implies that $\frac{\dot{\alpha}}{\alpha} = 0$ and $\frac{\dot{K}}{K} = \frac{\dot{Z}}{Z} = \alpha L_z$. We can now rewrite the rate of return on innovation (A10) as

$$r = \frac{LE\alpha\theta(\xi - 1)}{n\xi} - \alpha L_z. \tag{A13}$$

Using the symmetric values, the zero profit condition simplifies to

$$\frac{LE}{n\xi} + \frac{LT\left[1 - \upsilon(1 - \mathcal{S}^p)\right]}{n} = \phi + L_z. \tag{A14}$$

Together, equations (A13) and (A14) give the optimal R&D strategy

$$L_z = \frac{\left[\phi - \Pi^p\right]\theta(\xi - 1) - \frac{r}{\alpha}}{1 - \theta(\xi - 1)}.$$

A.5 General equilibrium

In order to solve for the general equilibrium of this model, we impose the market clearing condition for each region k, $L = \sum_{i=1}^{n_k}\left(L_{xik} + L_{zik} + L_{Qik}\right)$. Together with the zero profit condition, $p_{ik}x_{ik} +$

[28] As discussed above, in the main text of this paper we assume that $\gamma = 0$. This means that $\alpha = 1$.

$Q_{ik} = L_{xik} + L_{zik} + L_{Qik}$, we obtain

$$\begin{aligned} L &= \sum_{i=1}^{n_k} (L_{xik} + L_{zik} + L_{Qik}) \\ &= \sum_{i=1}^{n_k} (p_{ik} X_{ik} + Q_{ik}) \\ &= nLEm_e S^e + nQ, \end{aligned}$$

where the last equality uses (A4) and symmetry. Rearranging terms and using the government budget constraint, $m_p LT = m_p nQ$, we have per capita expenditures,

$$E = 1 - T.$$

Notice that E is constant over time, which implies that $r = \rho$ in equilibrium.

The two most important expressions can now be expressed as their general equilibrium values. The rate of return on innovation equation allows us to express the equilibrium R&D strategy:

$$L_z = \frac{[\phi - \Pi^p]\,\theta(\xi - 1) - \frac{\rho}{\alpha}}{1 - \theta(\xi - 1)}.$$

Furthermore, the zero profit condition is

$$\frac{L\,[1 - T]\,[1 - \theta(\xi - 1)]}{n\xi} + \frac{\rho}{\alpha} + \frac{LT\,[1 - \upsilon(1 - \mathcal{S}^p]}{n} = \phi.$$

Along the balanced growth path, both consumers' expenditures and the number of firms are constant. The rate of cost reduction then determines the growth of output and consumption. In symmetric equilibrium, the consumption index simplifies to

$$C = (m_e n)^{\frac{\epsilon}{\epsilon - 1}} \frac{E}{m_e n} \frac{\xi - 1}{\xi} Z^{\theta}. \tag{A15}$$

Since, along the balanced growth path, n is constant, the growth rate of consumption (and output and the knowledge stock) is

$$\begin{aligned} g &\equiv \frac{\dot{C}}{C} = \theta \frac{\dot{Z}}{Z} = \theta \alpha L_z \\ &= \theta \frac{\theta\alpha\,[\xi - 1]\,[\phi - \Pi^p] - \rho}{1 - \theta\,[\xi - 1]}. \end{aligned}$$

This condition is a modified version of the firm's R&D decision which takes into account that firms have perfect foresight and correctly perceive the effect of parameter changes on their profits and, based on this, choose whether to be active or not. The equilibrium number of active firms determines competition in the economic and political markets, R&D, pricing and rent seeking strategies and, ultimately, long run growth.

A.6 Welfare

Recall that typical consumer's welfare is given by

$$U(t) = \int_t^{\infty} e^{-\rho(\tau - t)} \log C(\tau) d\tau.$$

Using (A15), we see that

$$\log C = \frac{1}{\epsilon - 1} \log m_e n + \log \frac{\xi - 1}{\xi} + \theta \log Z + \log E.$$

Resorting to integration by parts, lifetime utility is given by

$$U = \frac{1}{\rho} \left[\frac{1}{\epsilon - 1} \log m_e n + \log \frac{\xi - 1}{\xi} + \frac{g}{\rho} + \log E \right].$$

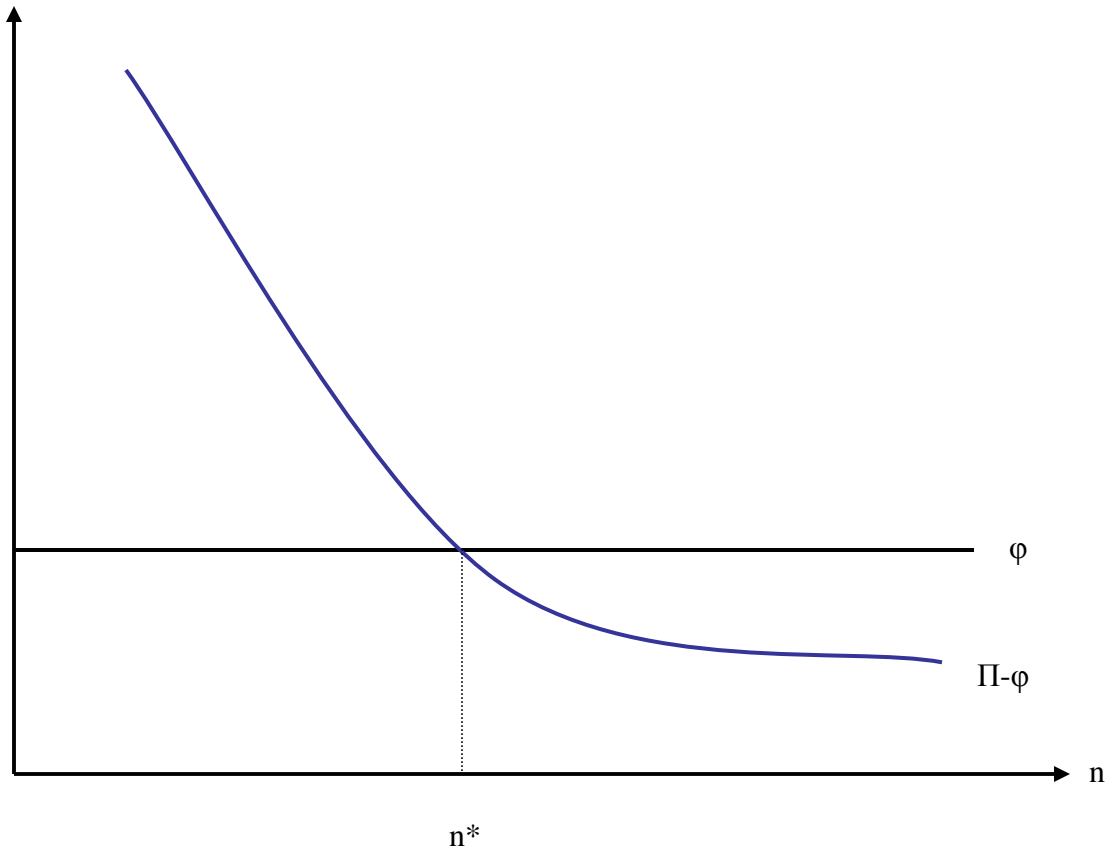

Figure 1: Equilibrium market structure

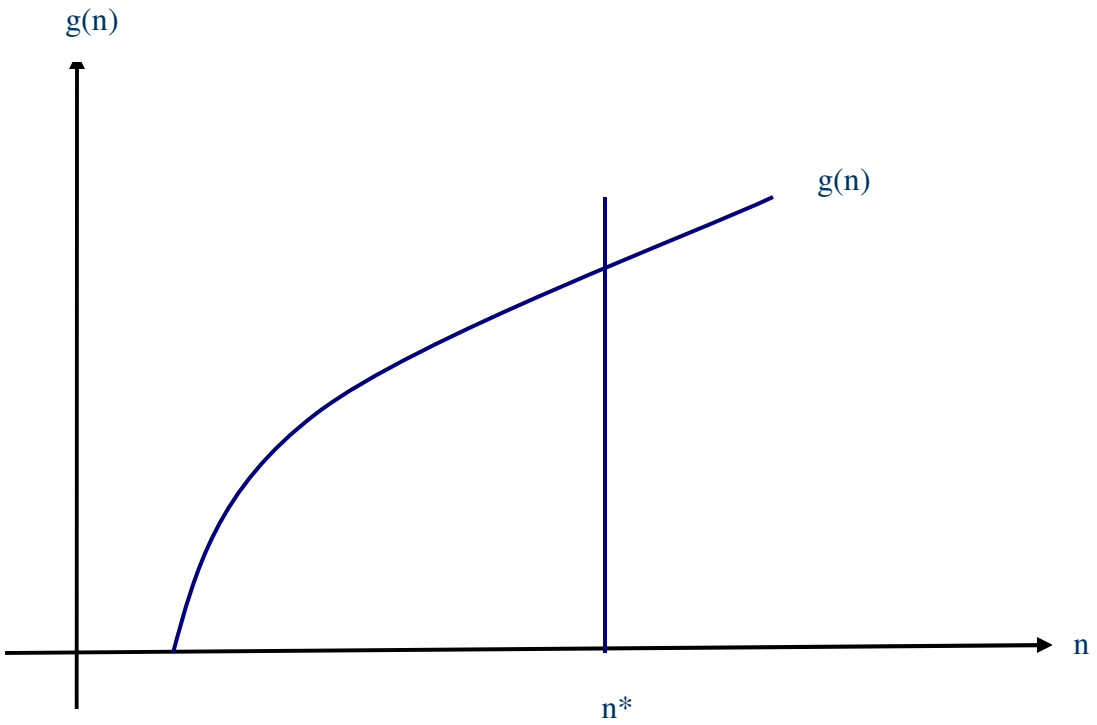

Figure 2: Equilibrium growth

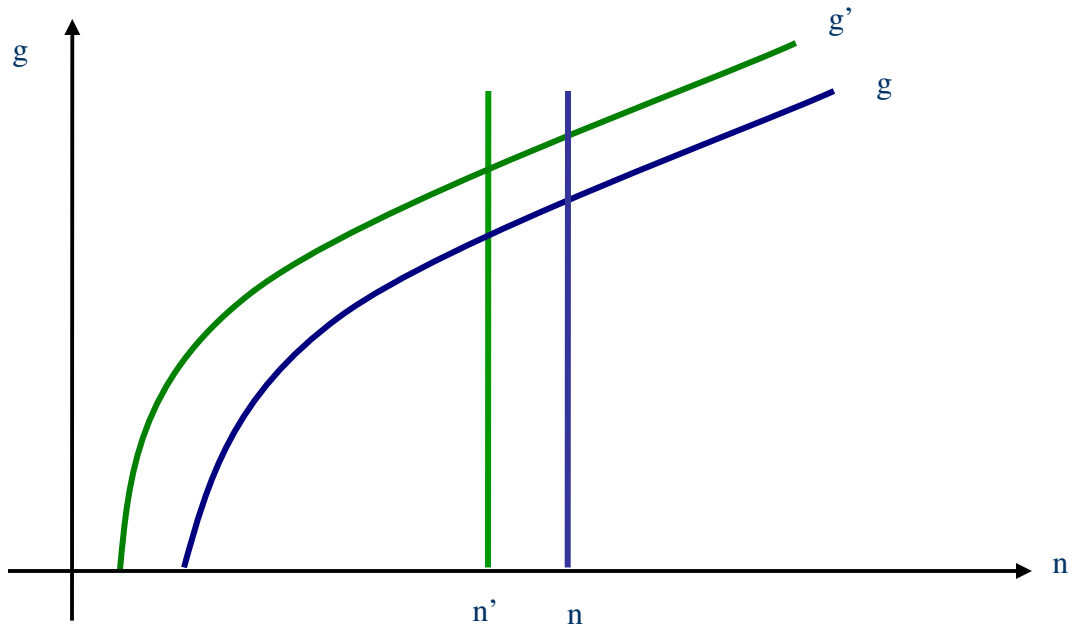

Figure 3: The effects of political integration

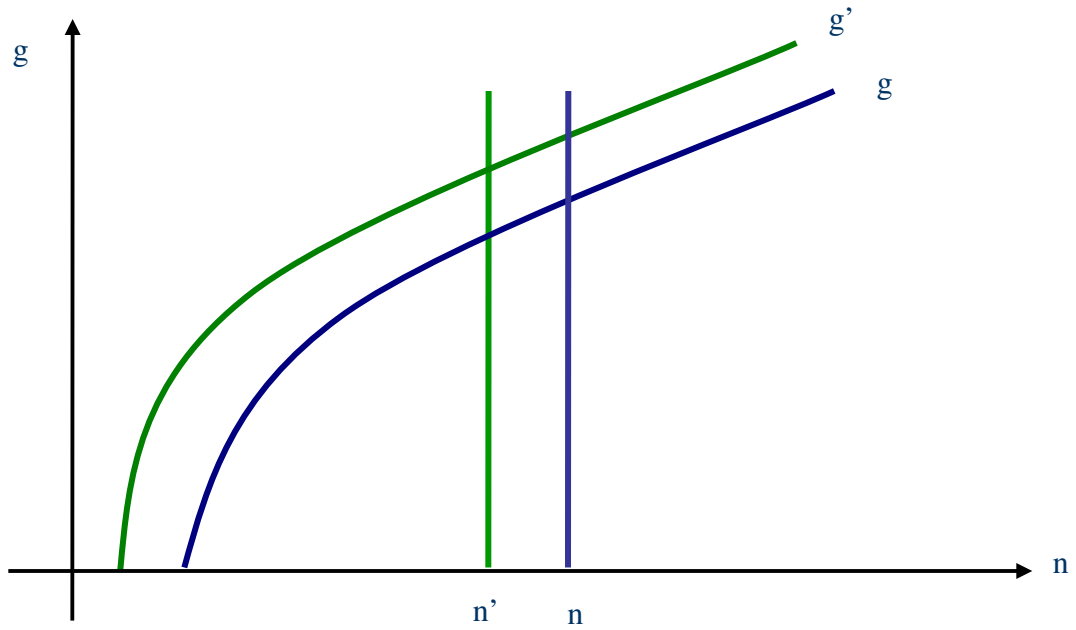

Figure 4: The effects of economic integration