Economic integration and political fragmentation

Grégoire Rota-Graziosi

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Abstract

The purpose of this article is to provide an economic analysis of the relationship between economic integration and political fragmentation. This follows previous contributions from Alesina, Spolaore, and Wacziarg (2000), Casella (2001), Casella and Feinstein (2002) or Leite-Monteiro and Sato (2003). We go a step further than these authors by assuming that economic integration and political fragmentation are both decided by a majority vote. As them, we observe that economic integration involves political fragmentation. But, we establish also that economic integration might be sometimes deterred by the majority to prevent political fragmentation from happening.

Key words : economic integration, public good, secession, vote.
JEL : D2, H2, H7.

Grégoire Rota Graziosi
CERDI-CNRS, Université d'Auvergne
65 boulevard François Mitterrand
63000 Clermont Ferrand, France
Email: gregoire.rota_graziosi@u-clermont1.fr

1 Introduction

In recent times independantist movements have appeared in some countries such as in Spain, Belgium or Canada and further regional autonomy has been demanded for example in Scotland or Catalogna. Nation-State seems today to be threatened. At the same time markets became worldwide. These two trends have brought some authors to study the relationship between economic integration and political fragmentation. Theoretical literature appears divided on this issue. On one hand, some authors in particular in political science as Young (1995) consider that different degrees of economic integration are compatible with different institutional rules as voluntary harmonization, consultative organisms, international negociations, legislative or executive instances... This author concludes then that there is no relation between economic and political integration. On the other hand, economic literature has recognized early the link between these two processes. For instance, List conceived two centuries ago customs union as a first step towards the building of the German State.[1]

More recently, a literature has been built on the original analysis by Buchanan and Faith (1987) of the possibility of 'internal exit' through secession. Unfortunately, the effects of economic integration on the cost of secession are not studied in this seminal article, since the authors consider incorrectly individual incomes as exogenous.[2] Following the works of Alesina and Spolaore (1997) or Bolton and Roland (1997) on political fragmentation,[3] Alesina, Spolaore, and Wacziarg (2000), Casella (2001) and Leite-Monteiro and Sato (2003) focus explicitly on the relationship between economic integration and political integration. On one hand, Alesina, Spolaore, and Wacziarg (2000) assume a production economy where every agent owns a specific input to produce the final good. The cost of heterogeneity increases with the size of the country. For these authors, inter-

[1] *Zollverein* was established in 1834, monetary union came in 1857, and the German empire was instituted in 1871.

[2] See Rota Graziosi (2006) for a corrected version of their framework.

[3] Alesina and Spolaore (1997) extend their initial model in order to take into account the effects of economic integration. They assume a productivity factor, human capital, which is increasing in the size of the country and in the openess of its frontiers. When economic integration is achieved, individual incomes depend exclusively on a worldwide level of human capital, reducing then economic advantage of large nations (see also the chapter in Alesina and Spolaore (2003) on this issue).

national trade liberalization improves individual income but reduces optimal country size. Casella (2001) obtains a similar result by developing a model of coalition formation. The author establishes that the optimal number of coalitions rises with the size of the market. These two first articles conclude unambiguously that trade openness favors secessions or at least political decentralization. On the other hand, Casella and Feinstein (2002) and Leite-Monteiro and Sato (2003) establish a non monotone relationship between economic integration and political one. Casella and Feinstein (2002) show that individuals prefer political separation into different jurisdictions for smaller or larger size of market. Focusing on incomes redistribution, Leite-Monteiro and Sato (2003) use a model of fiscal competition and find that the incentives of political separation are decreasing and then increasing in the capital mobility costs.

In the line of these preceding articles, we examine the interactions between economic integration and political fragmentation. However, all the above quoted authors consider as exogenous the change of economic integration, which might resut from a decrease in the capital mobility costs or from an increase in the market size.[4] The main originality of our work is to consider that economic integration and politic disintegration are both collectively determined through a simple majority vote. If we admit as Alesina, Spolaore, and Wacziarg (2000) or Casella (2001) that economic integration involves political disintegration, we wonder here if an opposition to economic openness would emerge motivated by the fear of secession. In other words, the political consequences of economic integration might be such that autarky, or in a more moderate way some protectionist barriers, would be choosen even if it means a lower private income for a majority of agents in order to maintain the political unity of the country and to insure a more advantageous provision of national public goods.

Following Casella (2001) or Casella and Feinstein (2002), we use the model of Salop (1979), which conforms to the more realistic formulation of differentiation from Hotelling

[4] In their working paper version, Alesina, Spolaore, and Wacziarg (1997) study the endogeneity of economic integration, by assuming that trade barriers are a function of country size in a world of symmetric countries. In Casella and Feinstein (2002), the size of markets which captures the degree of economic integration results from individual decisions. Neither in Alesina, Spolaore, and Wacziarg (1997) nor in Casella and Feinstein (2002), economic integration is decided by vote.

or Lancaster.[5] The heterogenity of the population is characterised by a circle and we consider every national government as a local public good. Following Casella (1994), Casella (2001) or Casella and Feinstein (2002), individual incomes result from exchanges between traders. There are two types of market: one national and one international. For the purpose of this paper, we examine only two polar cases: autarky, as set againts complete economic integration. In autarky the market is only national and individual revenue results from the unique domestic market. Economic integration allows agents to participate within the international market. We conclude that autarky might be prefered when the productivity on the international market is insufficiently low with respect to the productivity on the domestic one.

The paper is organized as follows: the next section describes the framework and the useful assumptions; in section 3 we define critical value of parameters for political fragmentation; section 4 examines the consequences of economic integration; section 5 concludes.

2 The framework

We present initially the setup of the studied game. Then, we describe our world representation, the individual incomes formalization and we deduce the individual preferences.

2.1 The Setup of the game

We consider a three-stage game. We adopt the following timing for decision making:

- stage 1: inhabitants vote for the degree of trade openness;
- stage 2: a vote in the studied peripheral region determines or not if secession occurs;

[5] Krugman (1989) writes :

> "The Hotelling-Lancaster formulation has the advantage of greater realism, and leads to somewhat more plausible formulation of the nature of the gains from trade. However, it is quite difficult to work with. The Spence-Dixit-Stiglitz approach, by contrast, while less convincing, lends itself quite easily to modelling."

- stage 3: inhabitants of the relevant jurisdiction choose the location of the unique public good.

This sequence of decision allows us to go a step further than the analysis of Alesina, Spolaore, and Wacziarg (2000). By applying backward induction, we are then able to consider the political consequences of trade openness on the country unity. Following Buchanan and Faith (1987) or Bolton and Roland (1997), we admit in the second step regional autodetermination principle: a region can become unilaterally independant. The game ends by the vote of the location of the unique public good in the relevant jurisdiction. Democracy is here direct. There is neither information asymmetry between those who govern and those who are governed nor lobbying groups which would influence rulers.

2.2 World representation

We represent population heterogeneity by a circle with a unitary radius. For every agent there is a corresponding angle, denoted by x ($x \in [0, 2\pi]$). By assumption, individuals are uniformly distributed along the circle, their total population is 2π. The world is shared in n countries (indexed by i). Each country (i) is composed of m_i regions. Following Bolton and Roland (1997), we assume a fixed partition of the world, borders are historically determined. In others words, national borders (b_{i-1} and b_i for the country i, $i = 1, ..., n$) and regional borders (a_{ij-1} and a_{ij} for region j of country i, $j = 1, ..., m_i$) are exogeneous. These assumptions constrast with Alesina, Spolaore, and Wacziarg (2000) in which secession is choosen by unanimity. We suppose: $b_0 = a_{10} = b_n = a_{nm_n} = 0$.

Insert Figure 1

For tractability, we limit countries size to π. There exist at least two countries in the world, moreover we restrict our analysis to peripheric regions. This kind of regions is defined here by an international border, shared with the "host" country. Besides their size are supposed relatively small. More accurately, we study the behaviour of country 1 and its region 1. Their respective sizes are denoted by: $s_1 = b$ for country 1 and $s_{11} = a$

for region 1, with by assumption $a < \frac{b}{2}$. In the rest of the paper, we will focus only on individuals located between 0 and b.

By assumption, agents are immobile. There exist no fiscal competition between the countries. In an European context, this hypothesis might be justified by the high level of mobility costs induced by imperfections on the job market or on the real-estate market (see Faini, Galli, Gennari, and Rossi (1997) for an empirical study on this issue). Another justification is cultural particularisms which reduce interregional mobility. The assumption of individual immobility corresponds to the exogeneity of individual preferences too, which is essential for the spatial model of voting (see Hinich and Merrill (1984)).

2.3 Individual incomes

Every agent is initialy endowed with two units of a specific good. As Casella (2001) or Casella and Feinstein (2002), this dotation is not productive in itself. Income results from a commercial matching between agents. There are two matches for each agent. The income of the individual x is given by:

$$w(b, \beta; x) = (1 + \beta) w^d(b; x) + (1 - \beta) w^e(b; x),$$

where $w^d(b; x)$ and $w^e(b; x)$ are respectively the individual incomes on national and international market. The parameter β measures the level of country economic integration: $\beta = 1$ involves autarky; $\beta = 0$ means complete economic integration. The degree of openness or of protectionism (β) results from a majority vote at the first step of the game. We do not consider international negociations on β. Moreover, there is no trade retaliations among the new created countries in case of secession. Thus, in autarky individuals trade only on the domestic (or national) market. With complete economic integration one match is held in the national market, the other in the international market.

We assume a transaction cost increasing in the distance between two commmercial partners. An agent (x) knows exaclty her location on the circle but she ignores the place of her commercial partner, denoted by v. Thus, the net gain of their transactions is uncertain. Each agent is only aware on which market they trade. So, she knows if her commercial partner, denoted by v, leaves her country ($v \in [0, b]$) or if she is a foreigner ($v \notin [0, b]$). The individual income on the domestic market is given by:

$$w^d(b; x) = \omega^d b \left(1 - E\left[d(x, v) \,|v \in [0, b]\right]\right), \tag{1}$$

where ω^d evaluates the productivity of the domestic market. A similar argument defines individual income on the international market, denoted by $w^e(b; x)$. The size of this market is $2\pi - b$ and ω^e is its productivity. We have:

$$w^e(b; x) = \omega^e (2\pi - b) \left(1 - E\left[d(x, v) \,|v \notin [0, b]\right]\right), \tag{2}$$

Moreover, we assume that:

$$\omega^e > \omega^d > 0. \tag{3}$$

For a given distance between two trading partners, international exchanges are more productive that domestic ones. This hypothesis creates an individual incitation to economic integration. We consider a quadratic normalized distance ($d(x, v) = \left(\frac{x-v}{\pi}\right)^2$). Since we assume a uniform distribution along the circle, the expected value of distance on the two markets (domestic and interntional) yields to:[6]

$$\begin{aligned}
E\left[d(x, v) \,|v \in [0, b]\right] &= \int_0^b \frac{1}{b} \left(\frac{x - v}{\pi}\right)^2 dv, \\
E\left[d(x, v) \,|v \notin [0, b]\right] &= p\left(v \in [-\pi + x, 0]\right) E\left[d(x, v) \,|v \in [-\pi + x, 0]\right] \\
&\quad + p\left(v \in [b, x + \pi]\right) E\left[d(x, v) \,|v \in [b, x + \pi]\right],
\end{aligned}$$

where $p\left(v \in [-\pi + x, 0]\right) = \frac{\pi - x}{2\pi - b}$ and $p\left(v \in [b, x + \pi]\right) = \frac{\pi + x - b}{2\pi - b}$. In Appendix A.1, we

[6] Given the assumptions of our model, we notice that the individual income is symmetric with respect to $\frac{b}{2}$:

$$\forall \varepsilon \in \left[0, \frac{b}{2}\right], \quad w\left(b, \beta; \frac{b}{2} - \varepsilon\right) = w\left(b, \beta; \frac{b}{2} + \varepsilon\right) \tag{4}$$

establish that domestic individual revenues are increasing with the size of the country (see relation (17)), while international ones are decreasing (see expression (18)). We highlight an advantage to large countries when tariff barriers are high and a greater incentive to openness when the country is small. Our assumptions yield to the same result as Alesina, Spolaore, and Wacziarg (2000).

However, in contrast to Casella (1994), Casella (2001) or Casella and Feinstein (2002), our incomes formulation is such that optimal distance between two traders is nil. For an identical productivity of domestic and international exchanges, people prefers to trade with their immediate neighbours than with more distant agents. Inhabitants leaving close to the center of the country ($b/2$) have then the highest domestic market incomes, whilst their international market incomes are lowest. Our assumption induces an incitative for inhabitants in peripheral regions to support economic integration.

The variations of the whole individual revenue ($w(b,\beta;x)$) with respect to the size of the country (b) and its openness are then given by:

$$\frac{\partial w(b,\beta;x)}{\partial b} = \left(1 - \frac{(b-x)^2}{\pi^2}\right)\left[(1+\beta)\,\omega^d - (1-\beta)\,\omega^e\right]. \tag{5}$$

We deduce that:

$$\frac{\partial w(b,\beta;x)}{\partial b} > 0 \Leftrightarrow \beta > \frac{\omega^e - \omega^d}{\omega^e + \omega^d} \text{ or equivalently } \frac{\omega^d}{\omega^e} > \frac{1-\beta}{1+\beta} = \omega_1^c(\beta). \tag{6}$$

Under condition (3), the size of the country increases individual income if and only if openness is sufficiently low (or β sufficiently high). Moreover, we note that under autarky, the income is obviously increasing in the size of the country $\left(\frac{\partial w(b,1;x)}{\partial b} > 0\right)$. If we consider the variation of individual income with respect to openness (β), we have: $\frac{\partial w(b,\beta;x)}{\partial \beta} = w^d(b;x) - w^e(b;x)$. Given the assumptions of our framework, it appears that each individual would be in favor of free trade ($\beta = 0$) as soon as international incomes exceed domestic ones. However, this result does not take into account the consequences of economic integration over political unity, and then over the national policies. Moreover, we notice that: $\frac{\partial^2 w(b,\beta;x)}{\partial b \partial \beta} = \left(1 - \frac{(b-x)^2}{\pi^2}\right)\left(\omega^d + \omega^e\right) > 0$. More protectionnist is the country, more important will be the effect of its size on individual incomes. In other words, openness and country size appear here as strategic complements. Finally, under our assumptions, we observe that economic integration reduces individual incomes inequalities.[7] Incomes are even equal when economic integration is complete ($\beta = 0$) and the productivity parameters identical ($\omega^d = \omega^e$).

2.4 Preferences

As Alesina and Spolaore (1997) and Bolton and Roland (1997), we suppose that private and public goods are substitute. All individuals have the same preferences summarized in the utility function of agent (x): $\upsilon\left(c_p, c_b; x\right) = c_p\left(x\right) + c_b\left(x\right)$, where $c_p\left(x\right)$ is private consumption and $c_b\left(x\right)$ public consumption. Individuals consume all their revenues. Private consumption is then equal to available income:

$$c_p(x) = C_p\left(t, b, w; x\right) = (1-t)w\left(b, \beta; x\right), \tag{7}$$

where t is the uniform tax rate.

Every country is represented by an unique public good called government, a term which we identify a group of administrative, judicial and economic services. Following Tiebout (1956), we suppose the public good locally produced in a single place, the capital ($y \in [0, b]$). As Alesina and Spolaore (1997), we assume the individual utility of the public good as decreasing with the distance from their ideal point, their place on the circle. Thus, public consumption is given by:

$$c_b(x) = C_b\left(y, g, b; x\right) = g\left(1 - d\left(x, y\right)\right),$$

where g is the maximum individual utility of the public good, when $d\left(x, y\right) = 0$. As Buchanan and Faith (1987) or Alesina and Spolaore (1997), public good quantity is fixed.

[7] This result can be related to the empirical works of Lindert and Williamson (2001).

Its cost is constant, equal to K. This assumption involves some scale economies in the furniture of public good, which yields to a centripetal force in opposition to the centrifugal force, due to the population heterogenity. Moreover, to keep the model workable we assume: $K = bg$. Balanced budget constraint yields to: $K = bt\overline{w}(b, \beta)$, where $\overline{w}(b, \beta)$ is the average income, equal to:[8]

$$\overline{w}(b, \beta) \equiv \frac{1}{b} \int_0^b \left[(1 + \beta) w^d (b; x) + (1 - \beta) w^e (b; x) \right] dx. \tag{8}$$

We deduce that the tax rate is equal to:

$$t(b, \beta) = \frac{g}{\overline{w}(b, \beta)}. \tag{9}$$

Differentiating the tax rate with respect to the country size (b) yields to:

$$\frac{\partial t(b, \beta)}{\partial b} = -\frac{g}{\overline{w}(b, \beta)^2} \left(\frac{\partial \overline{w}(b, \beta)}{\partial b} \right).$$

We establish that the tax rate decreases with the size of the country if the relative productivity of international exchanges is sufficiently high (see expression (24) in Appendix A.1):

$$\frac{\partial t(b, \beta)}{\partial b} < 0 \Leftrightarrow \frac{\partial \overline{w}(b, \beta)}{\partial b} > 0 \Leftrightarrow \frac{\omega^d}{\omega^e} > \frac{1 - \beta}{1 + \beta} \equiv \omega_1^c(\beta), \tag{10}$$

and

$$\frac{\partial t(b, \beta)}{\partial \beta} > 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} > \frac{8\pi^3}{6b\pi^2 - b^3} - 1 = \omega_2^c(b). \tag{11}$$

The tax burden increases in the degree of trade barriers (β) if and only if the relative productivity of international exchanges is insufficiently low.[9]

[8] We notice that the mean income is always increasing in the trade openness (decreasing in β).

[9] Owing to the tax rate (t) belongs to the intervall $[0, 1]$, we have an additional condition on the level of g, which we will assume respected in the rest of the paper: $g < \underline{g}(b, \beta) = b\overline{w}(b, \beta)$.

3 Equilibrium determination

We turn now to the resolution of our game. Applying backward inducion, we first determine the location of the public good, then we establish if secession occurs or not and we end by determining the voted degree of trade openness.

3.1 Public good location

Applying backward induction, we consider now the third stage of the game: the location of the public good, in other terms the capital place, denoted by y. Under condition (9), the indirect utility function is given by:

$$V(y, b, g, \beta; x) = (1 - t(b, \beta))\, w(b, \beta; x) + g(1 - d(x, y))$$

The choice of the capital for individual x is then given by the following maximization program: $y^*(x) \equiv \underset{y \in [0,b]}{\arg\max} V(y, b, g, \beta; x)$. The First Order Condition (FOC) involves: $y^*(x) = x$. The concavity of $V(.)$ with respect to y allows us to determine the Condorcet winner (y^M) by applying the Median Voter Theorem.[10] We deduce that: $y^M = \frac{b}{2}$. After substituting y by its equilibrium value, the indirect utility function, denoted by $U(b, g, \beta; x)$, is then given by:

$$U(b, g, \beta; x) = (1 - t(b, \beta))\, w(b, \beta; x) + g\left(1 - d\left(x, \frac{b}{2}\right)\right) \tag{12}$$

The population heterogeneity is double. Indeed, agents differentiate not only by their private incomes (as in Bolton and Roland (1997)), but also by their appreciation of the public good (as in Alesina and Spolaore (1997)). However, following Bolton, Roland, and Spolaore (1996), our formulation reduces population heterogeneity to one dimension: the individual place on the circle.

[10] The conditions of unidimensionality and unimodality are respected.

3.2 Political fragmentation or not

We now describe the second stage of the game, in which voters choose regional independance or not. We apply the same argument as in the preceding section when region 1 ($[0, a]$) becomes independant.[11] With independance the capital moves from $b/2$ to $a/2$ in the center of the region 1, so $y^* = \frac{a}{2}$. The indirect utility of an inhabitant (x) of the region 1 turns into:

$$U(a, g, \beta; x) = (1 - t(a, \beta)) w(a, \beta; x) + g\left(1 - d\left(x, \frac{a}{2}\right)\right).$$

For tractability, we assume that the rest of country 1 remains close after the secession of region 1. So the new capital locates in $\frac{a+b}{2}$ and the size of this new country is $b - a$. The utility function of individual x located between a and b is then given by:

$$U(b - a, g, \beta; x) = (1 - t(b - a, \beta)) w(b - a, \beta; x) + g\left(1 - d\left(x, \frac{a+b}{2}\right)\right).$$

In order to determine when the secession occurs, we define a function, denoted by $D(a, b, g, \beta; x)$, which is the difference in utility terms between the two political status (separation and union) for individual x. We have:

$$D(a, b, g, \beta; x) = U(a, g, \beta; x) - U(b, g, \beta; x).$$

An appropriate decomposition of $D(a, b, g, \beta; x)$ allows us to capture three distinct effects of secession:

$$\begin{aligned} D(a, b, g, \beta; x) &= \underbrace{(1 - t(b, \beta))(w(a, \beta; x) - w(b, \beta; x))}_{E^I(a,b,\beta;x)} + \underbrace{w(a, \beta; x)(t(b, \beta) - t(a, \beta))}_{E^F(a,b,\beta;x)} \\ &\quad + \underbrace{g\left(d\left(x, \frac{b}{2}\right) - d\left(x, \frac{a}{2}\right)\right)}_{E^P(a,b;x)} \end{aligned}$$

[11] The condition of non-negativity of the tax rate changes into: $g < \underline{g}(a, \beta) = a\overline{w}(a, \beta)$.

Indeed, we distinguish:

- An income effect, denoted by $E^I(a,b,\beta;x)$: individual domestic incomes increase with the size of the country, whilst individual international incomes decrease. The result remains ambiguous and depends on $\frac{\omega^e}{\omega^d}$ $(\gtrless \omega_1^c(\beta))$. More formally, we know from (6) that:

$$\text{if} \quad \beta > \frac{\omega^e - \omega^d}{\omega^e + \omega^d} \text{ or equivalently if } \frac{\omega^d}{\omega^e} > \omega_1^c(\beta), \quad \text{then} \quad E^I(a,b,\beta;x) < 0. \quad (13)$$

- A fiscal effect $(E^F(a,b,\beta;x))$: the assumption of a fixed quantity of public good involves a rising of the taxes when the fiscal base contracts with secession. Expression (10) yields to:

$$\text{if} \quad \beta > \frac{\omega^e - \omega^d}{\omega^e + \omega^d} \text{ or equivalently if } \frac{\omega^d}{\omega^e} > \omega_1^c(\beta), \quad \text{then} \quad E^F(a,b,\beta;x) < 0. \quad (14)$$

- A political effect $(E^P(a,b;x))$: this outcome results from the move of the capital and depends on the location of the individual (x). We remark that this effect is not affected by the openness of the country (β). We have:

$$\begin{array}{ll} x \in \left[0, \min\left\{\frac{a+b}{4}, a\right\}\right], & E^P(a,b;x) \geqslant 0, \\ x \in \left[\min\left\{\frac{a+b}{4}, a\right\}, \max\left\{\frac{a+b}{4}, a\right\}\right], & E^P(a,b;x) \leqslant 0. \end{array} \quad (15)$$

  If $a < b/3$,[12] secession provide to all inhabitants of region 1 a policy more satisfactory $\left(E^P(a,b;x) \geqslant 0\right)$.

By the first effect, we emphasize that political fragmentation has an impact on private individual incomes. This link was ignored by Buchanan and Faith (1987). However, while in the corrected version of Buchanan and Faith (1987)[13] secession always involves a decrease in private income as in Bolton and Roland (1997), we have here an ambiguous

[12] For $a < b/3$, we have: $a < \frac{a+b}{4}$ or equivalently $d\left(a, \frac{a}{2}\right) < d\left(a, \frac{b}{2}\right)$.
[13] See Rota Graziosi (2006).

relation between political fragmentation and individual incomes due to the effects of international trade. The second and third effects yield to a similar trade-off as developped by Alesina and Spolaore (1997). The heterogenity of the population in the consumption of public good acts as a centrifugal force, while the scale economies in the provision of this public good involves a centripetal force. The sum of these three effects induces then the regional majority to choose the independance or not.

In order to highlight the combinaison of the three effects, we focus on the two polar cases: autarky ($\beta = 1$) and complete integration ($\beta = 0$). In autarky, agents based near the border are not only the poorest, but they benefit the least from the public good. We remark that the assumption of an uniform tax involves a positive relationship between individual income and fiscal obligations, thus a negative link between taxes and the distance from the capital. This effect mitigates the centrifugal force due to the heterogeneity of the population. We deduce a first result

Lemma 1 *No secession occurs in autarky* ($D(a, b, g, 1; x) < 0$).

Proof: see Appendix A.2.

In autarky ($\beta = 1$) political fragmentation always involves a reduction of the individual income ($E^I(a, b, \beta; x) < 0$). Combined with the rise of the taxation ($E^F(a, b, \beta; x) < 0$) this outcome exceeds the possible advantage of separation, *i.e.* a closer government ($E^P(a, b; x) > 0$). Thus autarky insures here political stability.

We consider now the situation in complete economic integration ($\beta = 0$). From (13), (14) and (15), we have the following lemma:

Lemma 2 *Free trade involves secession.*

Proof: since we have assumed $\omega^e > \omega^d$, conditions (13) and (14) yield to $E^I(a, b, 0; x) > 0$ and $E^F(a, b, 0; x) > 0$. For a majority at least of inhabitants in region 1 ($\left[0, \frac{a}{2}\right]$), we observe that the political effect is positive: $E^P(a, b, 0; x) > 0$. Since the two others effects are favorable too, independance is unilaterally wished by a majority of region 1.

A sufficient condition under which economic integration favors policital fragmentation is that the productivity of international exchanges are greater than this of domestic ones ($\omega^e > \omega^d$). As Alesina and Spolaore (1997), Alesina, Spolaore, and Wacziarg (2000) and Casella (2001) we show that economic integration reduces the cost of the regional independance and allows secession.

3.3 Which degree of trade openness

We now turn to the last stage of the game by considering the choice of trade openness. The maximization program of each individual utility level with respect to trade openness is given by:

$$\begin{aligned} \forall x \in [0,a], \quad \beta^*(x) &\equiv \underset{\beta\in[0,1]}{\arg\max}\left(\max\left\{U(b,g,\beta;x), U(a,g,\beta;x)\right\}\right) \\ \forall x \in [a,b], \quad \beta^*(x) &\equiv \underset{\beta\in[0,1]}{\arg\max}\left(\max\left\{U(b,g,\beta;x), U(b-a,g,\beta;x)\right\}\right) \end{aligned} \tag{16}$$

The discontinuity of the objective functions does not allow us to establish an explicit solution of this program. We restrict ourselves to determine sufficient conditions that yield to unambiguous conclusions. We focus then on corner solutions of $\beta\,(=0,1)$, which corresponds to free trade or autarky. If the FOC of (16) is strictly negative (positive), then individual located at x will be in favor of free trade (autarky), even if free trade involves political fragmentation. We obtain the following proposition :

Proposition 1 *Under our assumptions, we observe that:*
(i) a majority in country 1 *will choose economic integration, which involves political fragmentation, if the following sufficient condition holds:*

$$\frac{\omega^d}{\omega^e} < \omega_3^c(b),$$

(ii) a majority in country 1 *will choose autarky, and then political union remains, if the following sufficient condition holds:*

$$\frac{\omega^d}{\omega^e} > \omega_2^c(a).$$

Proof: see APPENDIX A.3.

Economic integration is not systematically choosen. Indeed, the relative productivity of the international trade must be sufficiently high ($\omega^e > \omega^d/\omega_3^c(b)$). We do not examine individual preferences when the ratio ω^d/ω^e varies between $\omega_3^c(b)$ and $\omega_2^c(a)$. However, we illustrate our results in the following Figure.

Insert Figure 2

In this Figure, we represent the utility levels of four critical inhabitants, respectively located at $x = 0$, a, $\frac{a+b}{2}$ and b, when trade openness (β) varies from 0 to 0.4. Since the individual utility level depends on the occurence of secession, the curves are kinked in β. Indeed, there exists a critical value of $\beta^c(x)$, for which individual x prefers secession to political unity. If the country is sufficiently large $(b = 4\pi/5)$ as in the first graphic of Figure 2, we notice that all curves are decreasing in β. This illustrates the situation where inhabitants vote for free trade and secession occurs. In the second graphic of Figure 2, we highlight a possible conflict among country inhabitants. Indeed, while individuals located close to the borders ($x = 0$ or b) wish free trade in order to reduce the cost of secession, others inhabitants located close to country center ($x = b/2$ or $(a+b)/2$) support autarky. It appears then that the initial conditions concerning trade openness matter.

The second set of graphics represents the utility levels of inhabitants for different value of trade openness.

Insert Figure 3

The gray curve is the utility level when the country remains united, while the black one represents the utility level in case of regional secession. We consider four critical values of β (respectively 0, 0.32, 0.335 and 1). The top-left graphic is an illustration of Lemma 1 and corresponds to the autarky case $(\beta = 1)$. We observe that the black curve is always below the gray one: all country inhabitants prefer political union to secession under autarky. Similarly, the top-right graphic provides an example of Lemma 2. Under complete economic integration $(\beta = 0)$, the black curves are always above the gray one, which means that all inhabitants prefer secession under free trade. The two last graphics $(\beta = 0.32$ or $0.335)$ show a potential conflict among country inhabitants. Two distinct groups emerge: one in favor of political unity is composed by individuals leaving close to the center; the other which supports secession leaves in the peripheral areas. If this last group has the majority in the region, then political separation occurs.

4 Conclusion

The objective of this paper was to examine the interaction between economic integration and political fragmentation. As Alesina and Spolaore (1997), Alesina, Spolaore, and Wacziarg (2000) or Casella and Feinstein (2002), we have established that the openness of trade barriers allows secession. But owing to this relation, autarky is sometimes preferred to economic integration by a majority of voters, in order to keep the political unity of the country.

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A Appendix

A.1 Differentiations and analytical expressions

Expression (1) is equal to:

$$w^d(b;x) = \frac{\omega^d b}{3\pi^2}\left(3\pi^2 - b^2 + 3bx - 3x^2\right).$$

From (1), we deduce that:

$$\frac{\partial w^d(b;x)}{\partial b} = \omega^d\left(1 - \frac{b^2}{2\pi^2}\right) > 0. \tag{17}$$

Expression (2) is equivalent to:

$$w^e(b;x) = \frac{\omega^e b\left(4\pi^3 - 3\pi^2 b + b^3 - 3b^2 x + 3bx^2\right)}{6\pi^2(2\pi - b)}.$$

It yields to:

$$\frac{\partial w^e(b;x)}{\partial b} = -\omega^e\left(1 - \frac{b^2}{2\pi^2}\right) < 0. \tag{18}$$

Individual income is then given by:

$$w(b,\beta;x) = \frac{b\left(3\pi^2 - b^2 + 3x(b-x)\right)(1+\beta)\omega^d + \left(4\pi^3 + b^3 - 3b\left(\pi^2 - x^2 + bx\right)\right)(1-\beta)\omega^e}{3\pi^2}.$$

We have:

$$\frac{\partial w(b,\beta;x)}{\partial \beta} = \frac{b\left(3\pi^2 - b^2 + 3x(b-x)\right)\omega^d - \left(4\pi^3 + b^3 - 3b\left(\pi^2 - x^2 + bx\right)\right)\omega^e}{3\pi^2}, \tag{19}$$

and

$$\frac{\partial^2 w(b,\beta;x)}{\partial\beta\partial x} = \frac{b(b-2x)\left(\omega^d + \omega^e\right)}{\pi^2} \gtrless 0 \Leftrightarrow x \lessgtr \frac{b}{2}. \tag{20}$$

which allows us to establish that:

$$\frac{\partial w\left(b,\beta;\frac{b}{2}\right)}{\partial\beta} \geqslant \frac{\partial w(b,\beta;x)}{\partial\beta} \geqslant \frac{\partial w(b,\beta;b)}{\partial\beta} = \frac{\partial w(b,\beta;0)}{\partial\beta}. \tag{21}$$

The differentiations of the mean individual income with respect to the size and the trade openness are given by:

$$\frac{\partial\overline{w}(b,\beta)}{\partial b} = \left[1 - \frac{b^2}{2\pi^2}\right]\left[(1+\beta)\omega^d - (1-\beta)\omega^e\right], \tag{22}$$

and

$$\frac{\partial\overline{w}(b,\beta)}{\partial\beta} = -\frac{8\pi^3\omega^e + \left(b^3 - 6b\pi^2\right)\left(\omega^d + \omega^e\right)}{6\pi^2}. \tag{23}$$

The tax rate given by (9) is also equivalent to:

$$t(b,\beta)=\frac{6\pi^2 g}{\omega^d(1+\beta)\,b\,(6\pi^2-b^2)+\omega^e(1-\beta)\,(8\pi^3-6\pi^2 b+b^3)}$$

We have:

$$\frac{\partial t(b,\beta)}{\partial b}=-\frac{18g\pi^2\left(2\pi^2-b\right)^2\left[(1+\beta)\,\omega^d-(1-\beta)\,\omega^e\right]}{b^2\left[-b\,(6\pi^2-b^2)\,(1+\beta)\,\omega^d-(b^3-6b\pi^2+8\pi^3)\,(1-\beta)\,\omega^e\right]^2}, \tag{24}$$

and

$$\frac{\partial t(b,\beta)}{\partial \beta}=\frac{6\pi^2 g\left[8\pi^3\omega^e-b\left(6\pi^2-b^2\right)\left(\omega^d+\omega^e\right)\right]}{\left[-b\,(6\pi^2-b^2)\,(1+\beta)\,\omega^d-(b^3-6b\pi^2+8\pi^3)\,(1-\beta)\,\omega^e\right]^2}, \tag{25}$$

from which we deduce relations (11) and (11).

We note that

$$\frac{\partial E^I(a,b,\beta;x)}{\partial x}=-\frac{(b-a)\,(a+b-2x)}{\pi^2}\,(1-t(b,\beta))\left[(1+\beta)\,\omega^d-(1-\beta)\,\omega^e\right], \tag{26}$$

$$\frac{\partial E^F(a,b,\beta;x)}{\partial x}=-\frac{a\,(a-2x)}{\pi^2}\,(t(a,\beta)-t(b,\beta))\left[(1+\beta)\,\omega^d-(1-\beta)\,\omega^e\right], \tag{27}$$

$$\frac{\partial E^P(a,b;x)}{\partial x}=\frac{g\,(a-b)}{\pi^2}<0. \tag{28}$$

A.2 Secession in autarky

We have:

$$E^F(a,b,1;x)<0 \quad \text{and} \quad E^I(a,b,1;x)<0.$$

Since we focus on a small peripheral region of country 1, we have assumed $a<b/2$. Thus we have: $a+b-2x>0$, $\forall x\in[0,a]$. From (26), (27) and (28) we deduce that

$$\begin{aligned}
\frac{\partial E^I(a,b,1;x)}{\partial x} &= -\frac{2\,(b-a)\,(a+b-2x)}{\pi^2}\,(1-t(b,1))\,\omega^d<0,\\
\frac{\partial E^F(a,b,1;x)}{\partial x} &= -\frac{2a\,(a-2x)}{\pi^2}\,(t(a,1)-t(b,1))\,\omega^d>0,\\
\frac{\partial E^P(a,b;x)}{\partial x} &= \frac{g\,(a-b)}{\pi^2}<0.
\end{aligned}$$

Thus, $\forall x\in[0,a]$

$$\begin{aligned}
D(a,b,g,1;x) &= E^I(a,b,1;x)+E^F(a,b,1;x)+E^P(a,b;x)\\
&< E^I(a,b,1;0)+E^F(a,b,1;a)+E^P(a,b;0)\\
&< E^F(a,b,1;a)+E^P(a,b;0)
\end{aligned}$$

where

$$\begin{aligned}
E^F(a,b,1;a) &= 2a\left(3\pi^2-a^2\right)g\left(\frac{1}{b\,(6\pi^2-b^2)}-\frac{1}{a\,(6\pi^2-a^2)}\right)\\
E^P(a,b;0) &= \frac{g}{4\pi^2}\left(b^2-a^2\right).
\end{aligned}$$

Since by defintion $0 \leqslant a \leqslant \frac{b}{2}$, we have:

$$\begin{aligned} E^F(a,b,1;a) &\leqslant g\frac{b}{2}\left(3\pi^2-\frac{b^2}{4}\right)\left(\frac{1}{b\left(6\pi^2-b^2\right)}-\frac{1}{\frac{b}{2}\left(6\pi^2-\frac{b^2}{4}\right)}\right) \\ &= -\frac{g}{2}\frac{\left(3\pi^2-\frac{b^2}{4}\right)\left(6\pi^2-\frac{3}{4}b^2\right)}{\left(6\pi^2-\frac{b^2}{4}\right)\left(6\pi^2-b^2\right)} \leqslant -\frac{g}{4}\frac{6\pi^2-\frac{3}{4}b^2}{6\pi^2-b^2} \end{aligned}$$

$$E^P\left(\frac{b}{2},b;0\right) \leqslant E^P(a,b;0) \leqslant E^P(0,b;0) = \frac{g}{4\pi^2}b^2 \leqslant \frac{g}{4}$$

Thus, we deduce:

$$E^F(a,b,1;a) + E^P(a,b;0) \leqslant -\frac{g}{16}\left(\frac{b^2}{6\pi^2-b^2}\right) < 0 \Leftrightarrow D(a,b,g,1;x) < 0.$$

A.3 Trade openness

Since the utility function is discontinuous due to the possible secession, we are not able to solve explicitly the maximization progam (16). We restrict our analysis to define only sufficient conditions for free trade or for autarky. We consider first the case where economic integration does not involve secession. Differentiating $U(b,g,\beta;x)$ with respect to β yields to:

$$\frac{\partial U(b,g,\beta;x)}{\partial\beta} = -\frac{\partial t(b,\beta)}{\partial\beta}w(b,\beta;x) + (1-t(b,\beta))\frac{\partial w(b,\beta;x)}{\partial\beta},$$

The symmetry of $w(b,\beta;x)$ with respect to $\frac{b}{2}$ involves that: for $x \in [0,b]$,

$$\partial U\left(b,g,\beta;\frac{b}{2}\right)/\partial\beta \geqslant \partial U(b,g,\beta;x)/\partial\beta \geqslant \partial U(b,g,\beta;0)/\partial\beta.$$

First, we focus on the sign of $\partial t(b,\beta)/\partial\beta$, $\partial t(a,\beta)/\partial\beta$ and $\partial t(b-a,\beta)/\partial\beta$. From (25), we have:

$$\begin{aligned} \frac{\partial t(b,\beta)}{\partial\beta} &> 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} > \frac{8\pi^3}{b\left(6\pi^2-b^2\right)} - 1 = \omega_2^c(b), \\ \frac{\partial t(a,\beta)}{\partial\beta} &> 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} > \frac{8\pi^3}{a\left(6\pi^2-a^2\right)} - 1 = \omega_2^c(a), \\ \frac{\partial t(b-a,\beta)}{\partial\beta} &> 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} > \frac{8\pi^3}{(b-a)\left[6\pi^2-(b-a)^2\right]} - 1 = \omega_2^c(b-a). \end{aligned}$$

Since the peripheral region is by assumption small ($a < b/2$), we deduce that:

$$\omega_2^c(b) < \omega_2^c(b-a) < \omega_2^c(a).$$

We consider now the sign of $\partial w(.)/\partial\beta$ in the different political situations. Since trade openness has to be approved by a simple majority and not by all inabitants of the country, we consider the critical individual located in $b/4$ (or equivalently in $3b/4$). Moreover, we define only sufficient conditions. A majority of country inhabitants will be then in favor of free trade (respectively of autarky) if: $\partial t(b,\beta)/\partial\beta > 0$ and $\partial w(b,\beta;b/4)/\partial\beta < 0$ (respectively $\partial t(b,\beta)/\partial\beta < 0$ and $\partial w(b,\beta;b/4)/\partial\beta > 0$). If the political unity remains, whatever is the trade openness, expression (19) yields to:

$$\frac{\partial w\left(b,g,\beta;\frac{b}{4}\right)}{\partial\beta} < 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} > \frac{64\pi^3}{b\left(48\pi^2-7b^2\right)} - 1 \equiv \omega_3^c(b).$$

We note that: $\omega_2^c(b) > \omega_3^c(b)$. We deduce that:

$$\begin{aligned}
\frac{\omega^d}{\omega^e} &> \omega_2^c(b) > \omega_3^c(b) \Rightarrow \forall x \in \left[0, \frac{b}{4}\right] \cup \left[\frac{3b}{4}, b\right], \quad \frac{\partial U(b, g, \beta; x)}{\partial \beta} < 0, \\
\frac{\omega^d}{\omega^e} &< \omega_3^c(b) < \omega_2^c(b) \Rightarrow \forall x \in \left[0, \frac{b}{4}\right] \cup \left[\frac{3b}{4}, b\right], \quad \frac{\partial U(b, g, \beta; x)}{\partial \beta} > 0.
\end{aligned}$$

The symmetry of the utility funtion vanishes in case of secession. However, since we are only looking for sufficient conditions, we consider separately the same two individuals located at $b/4$ and at $3b/4$. We focus first on the individual in $b/4$. We have two cases depending whether she leaves in the peripheral region or not ($b/4 \lesseqgtr a$). From (19), we deduce that:
If $b/4 < a$,

$$\frac{\partial w\left(a, \beta; \frac{b}{4}\right)}{\partial \beta} < 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} < \frac{64\pi^3}{a(48\pi^2 - 16a^2 + 12ab - 3b^2)} - 1 \equiv \omega_{31}^c(a, b).$$

If $b/4 > a$, (19) translates into:

$$\frac{\partial w\left(b-a, \beta; \frac{b}{4}\right)}{\partial \beta} < 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} < \frac{64\pi^3}{(b-a)(48\pi^2 - 16a^2 - 4ab - 7b^2)} - 1 \equiv \omega_{32}^c(a, b)$$

Considering the individual located at $3b/4$, we know that she does not leave in the secessionist region. So, we have:

$$\frac{\partial w\left(b-a, \beta; \frac{3b}{4}\right)}{\partial \beta} < 0 \Longleftrightarrow \frac{\omega^d}{\omega^e} < \frac{64\pi^3}{(b-a)(48\pi^2 - 16a^2 + 20ab - 7b^2)} - 1 \equiv \omega_{33}^c(a, b)$$

Simple comparisons yield to establish that:

$$\begin{aligned}
\omega_2^c(a) &= \max\left\{\begin{array}{c} \omega_2^c(b), \omega_2^c(b-a), \omega_2^c(a), \\ \omega_3^c(b), \omega_{31}^c(a, b), \omega_{32}^c(a, b), \omega_{33}^c(a, b) \end{array}\right\} \\
\omega_3^c(b) &= \min\left\{\begin{array}{c} \omega_2^c(b), \omega_2^c(b-a), \omega_2^c(a), \\ \omega_3^c(b), \omega_{31}^c(a, b), \omega_{32}^c(a, b), \omega_{33}^c(a, b) \end{array}\right\}
\end{aligned}$$

Thus, we deduce Proposition 1:

$$\begin{aligned}
\frac{\omega^d}{\omega^e} &> \omega_2^c(a), \quad \max\left\{\frac{\partial U(a, g, \beta; x)}{\partial \beta}, \frac{\partial U(b, g, \beta; x)}{\partial \beta}\right\} > 0, \\
\frac{\omega^d}{\omega^e} &< \omega_3^c(b), \quad \max\left\{\frac{\partial U(a, g, \beta; x)}{\partial \beta}, \frac{\partial U(b, g, \beta; x)}{\partial \beta}\right\} < 0.
\end{aligned}$$

A.4 Graphics

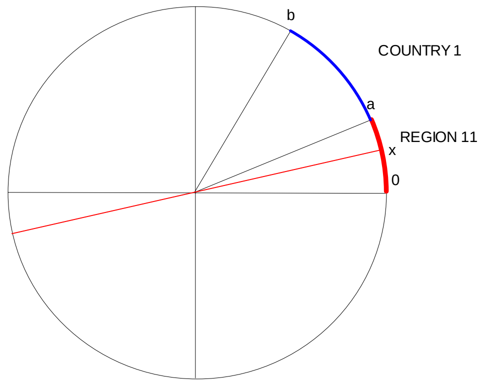
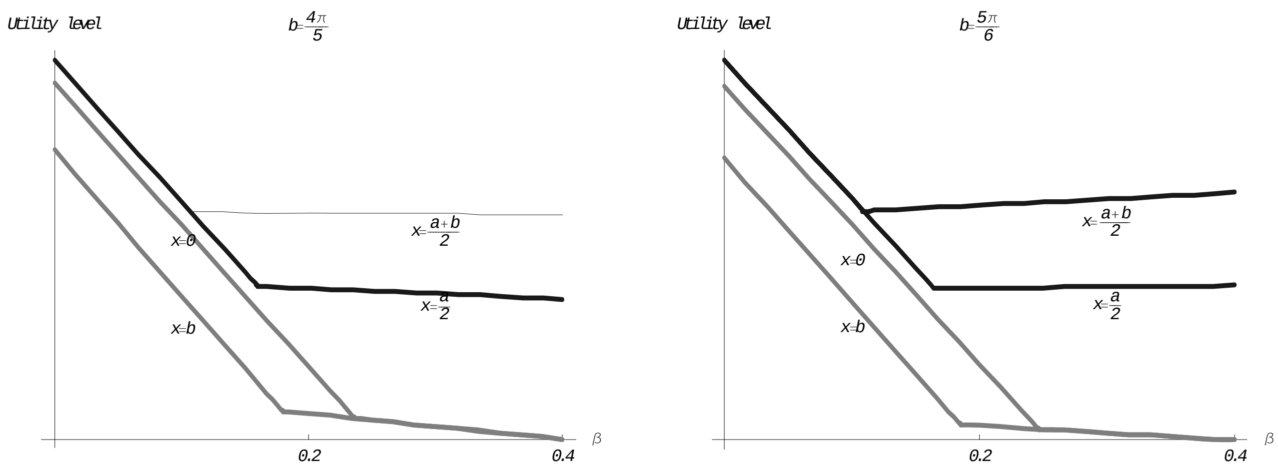
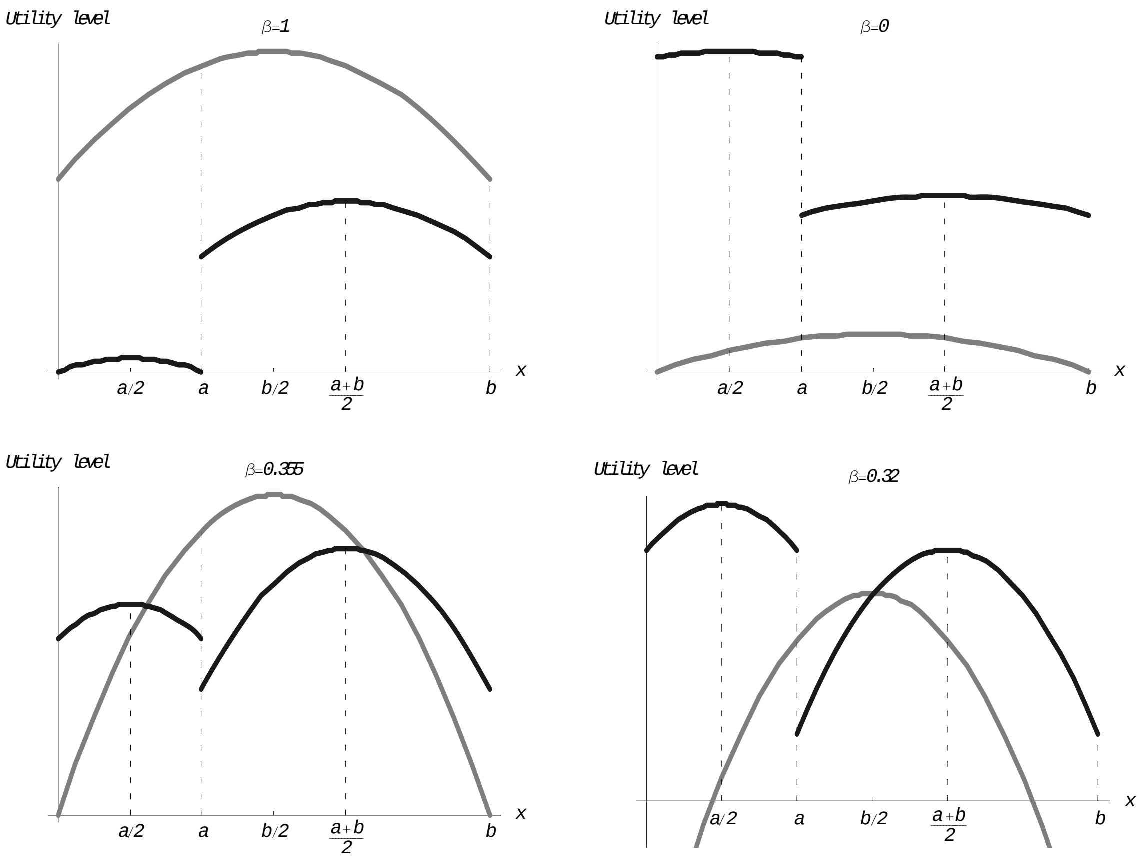


Figure 1. World representation



Utility levels for four specific individuals ($a = b/3$, $\omega^d = 1$, $\omega^e = 1.2$, $g = 3$).



Utility levels at four specific degree of openness ($b = \pi/2$, $a = \pi/6$, $\omega^d = 1$, $\omega^e = 2$, $g = 3$).