Trade and migration: a U-shaped transition in Eastern Europe

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Abstract

This paper proposes a 2-country 3-region economic geography model that can account for the most salient stylized facts experienced by Eastern European transition economies during the 1990s. In contrast to the existing literature, which has favored technological explanations, trade liberalization and factor mobility are the only driving forces. The model correctly predicts that in the first half of the decade trade liberalization led to divergence in GDP per capita, both between the West and the East and within the East. Consistent with the data, in the second half of the decade, internal labor mobility in the East reversed this process, and convergence became the dominant force. The model furthermore shows that the same U-shaped pattern applies to relative industrialization of West and East, although within the East the hinterland continued to lose industry throughout the decade.

1 Introduction

The decade of the 1990s in Eastern European transition economies has been characterized by a U-shaped pattern of relative development. Initially, relative income per capita between Western and Eastern Europe diverged, and from the middle of the decade onward, this pattern reversed, and Eastern Europe started to catch up with its Western counterpart. When analyzing the relative performance of different Eastern European countries, a similar pattern emerges. The countries closest to the West initially experienced faster growth than the Hinterland, but in the second half of the decade that pattern also reversed.

The literature has typically explained these U-shaped patterns by relying on technological arguments or on the misallocation of factors of production. Boldrin and Canova (2003), for example, suggest that technological obsolescence led to an initial period of intense unemployment and reallocations after trade was liberalized. Blanchard (1996) and Blanchard and Kremer (1997) link the initial slump to microeconomic "disorganization". The collapse of the state sector was precipitated by traditional input suppliers, who found attractive opportunities outside the state sector and broke the established productive chains.[1] Cociuba (2006) and Keller (1997) also stress the role played by technology adoption to account for the GDP trajectories of Eastern European countries. The existing literature thus puts the emphasis on the intensity of reallocations that were needed to adapt to a superior Western technology, followed by a remarkable catch-up process that was conditioned (and sometimes threatened) by redistributive public policies.

While we do not claim these explanations are erroneous in any way, in this paper we deliberately disregard issues of technological backwardness or sectoral misallocations. Instead, we propose an economic geography model, where trade liberalization and factor mobility are the only driving forces. The model consists of 2 countries (West and East) and three regions (one region in West, and a Border and Hinterland in the East). To make the results as sharp as possible, West and East have identical technologies and endowments. Agriculture is perfectly competitive, and industry is monopolistically competitive. Although workers are perfectly mobile between sectors,

[1] According to Blanchard and Kremer (1997), international trade was - if at all - beneficial to stabilize those economies, since it provided them with abundant new input suppliers, capable of replacing the previously destroyed economic relationships. Here our paper suggests that an immediate exposure to international trade might have been damaging to CEE countries in the short run.

there is no labor mobility between East and West. As for labor mobility within the East, part of the policy experiment consists in understanding how the introduction of labor mobility between Border and Hinterland affects relative economic performance. Trade in industrial goods is subject to transport costs, which are higher between Hinterland and West than between Border and West. As in Krugman and Venables (1995), industrial firms use intermediate goods, which gives rise to forward and backward linkages.

This simple setup, which abstracts from technology and endowment differences, is sufficient to account for the main stylized facts. Before describing the results in some more detail, we need to be more specific about the timing and the extent of the two driving forces, trade liberalization and factor mobility. The focus of our analysis is the decade of the 1990s. The European Union had already liberalized much of trade with Eastern Europe in the very early 90s. Later in the decade, labor mobility within Eastern Europe, which traditionally had been virtually illegal, was liberalized. We can therefore conclude that trade liberalization predated migration within the East. One could of course wonder why we do not analyze labor mobility between East and West as well. However, with the exception of ethnic Germans, migration between East and West only took off in earnest at the turn of the century, so it cannot account for the reversal in the U-shaped pattern around the middle of the decade.

The first result is that trade liberalization between West and East leads to divergence in GDP per capita, both between West and East and between Border and Hinterland. The positive performance of West can be explained by a Home market effect. As trade costs drop, firms shift towards the larger market. This same phenomenon gives rise to the relative deindustrialization of East in favor of West. Proximity to the larger market has benefits though, given the crucial access to the bulk of consumption goods and intermediate output. This explains the divergence between Border and Hinterland, in favor of the region closest to the West.

The second result is that the introduction of labor mobility within East leads to convergence in GDP per capita, not just between Border and Hinterland (which is obvious), but also between West and East. As soon as migrations are allowed, population moves from Hinterland to Border. This allows for a stronger Home market effect in East. As a result, Border attracts new firms, and income per capita in East starts to catch up with that of West. Within East, income differences between Border and Hinterland go down, but in terms of industrialization, Border continues to gain relative to Hinterland.

It is important to realize that - at least under our parameterization - trade liberalization alone would not be able to account for the upward part of the U-shaped pattern between West and East and between Border and Hinterland[2]. Allowing for labor mobility is therefore what drives the revival of East. However, it is sufficient for labor mobility to be introduced within East for income per capita to converge between East and West. Of course, permitting labor mobility between East and West would only reinforce our results.

Our model can be viewed of a generalization of Krugman and Venables (1995). They showed how in a 2-region model the early stages of trade liberalization could bring about lower real wages and deindustrialization in smaller markets. The difference with our 3-region model is that we can analyze both the relative performance of East and West and Border and Hinterland. In other words, we can say something about the internal geography of East.. This approach has other potential applications. For example, one may be interested in understanding how trade liberalization affects the internal geography of China. To address this issue, clearly a 3-region model, such as the one we propose, is needed. [3]

[2] It is true that, in a setting with two symmetric countries, Puga (1999) predicts that trade alone would generate a final East-West convergence stage. Nevertheless, the existence of an internal trade barrier within the East gives rise to an asymmetry in the size of the markets, which prevents convergence unless migration is introduced. In any case, we can understand the introduction of free migration as a way to accelerate the upcoming of convergence (both East-West and Border-Hinterland) as trade barriers melt away.

[3] Another interesting point is exploring the normative implications of free internal labor mobility.

Our work is also related to Puga and Venables (1997), with the qualification that we explore asymmetric country sizes. That practice is also undertaken by Forslid (2004), although his model does not permit the study of labor mobility, and the absence of vertical linkages prevents a detailed welfare analysis. Finally, Venables (2000) presents a similar three-location framework as we do, but he focuses on the internal geography of a developing country that is hardly industrialized for intermediate levels of trade costs. Our starting point is different: for all levels of trade costs, both West and East are industrialized.[4]

To the best of our knowledge, there are very few papers dealing explicitly with trade liberalization and the internal geography and welfare of Eastern European countries. One of them is Crozet and Koenig-Soubeyran (2002). They extend Krugman (1991) by including a third location (the EU) and allowing for a differential regional access to the EU market within the CEECs. They analyze in depth the different forces shaping the prevalence of the Border over the Hinterland, although their model cannot study deindustrialization at the national level, and does not reproduce the external and internal patterns of convergence.

Another paper of interest is Damijan and Kostevc (2002), who study the role played by FDI to accelerate the arrival of an interregional-convergence stage within Eastern Europe. The role played by FDI in their model resembles the one played here by internal migration. Nevertheless, in their setting the Hinterland - understood as the region where the state capital locates - is larger than the Border and benefits

Unfortunately, our conclusions - though interesting - are very dependent on our parameterization and difficult to generalize.

[4]Brakman and Garretsen (1993) and Ross (2001) are two interesting applications of economic-geography models to the understanding of internal disparities in the unified Germany. Nevertheless, they do not introduce a third location (the larger EU) as a significant element to explain those evolutions. They just portray a lowering of internal trade barriers between both German regions. Their models - as Krugman (1991) and Forslid and Ottaviano (1999) - , link the mass of manufacturing varieties to the stock of mobile labor, which prevents a study of global industrialization / deindustrialization.

from the absorption of manufacturing activity in the early stages of trade openness. That is just the opposite to what Crozet and Koenig (2002) and our model predict.

The rest of the paper is organized as follows. Section 2 describes the stylized facts we aim to explain, and justifies the main assumptions underlying our policy experiment. Section 3 presents the analytical framework. Section 4 uses numerical experiments to study the effect of trade liberalization and migration. Section 5 concludes.

2 Policy changes and stylized facts

2.1 Policy changes

We start by discussing the two main policy changes we focus on: increased trade openness between West and East, and internal labor mobility within East. Justifying their relative timing, with trade liberalization predating labor mobility, is important for our policy experiments.

East-West trade liberalization

The route towards East-West trade liberalization started quite early in countries like Yugoslavia or Romania. In particular, the European Community signed an initial Generalized System of Preferences with Romania in 1974, and an agreement on manufacturing trade was reached in 1980. However, The most comprehensive Generalized Systems of Preferences (GSP) were approved by the EU and individual CEE countries at the beginning of the 1990s, from 1990 to 1992. The EU granted GSP status first to Hungary and Poland (1990), then to Bulgaria and former Czechoslovakia (1991), and subsequently to Estonia, Latvia and Lithuania (1992). In short, *"the features found in the trading pattern of CEECs suggest that the export share towards EU-15 was, in the first half of the 1990s, relatively high partly because reduction in trade barriers* *had already taken place."* (De Benedictis, De Santis and Vicarelli (2005)).

Since the beginning of the integration process there has been a huge increase in trade flows between the EU-15 and Eastern Europe. Between 1989 and 1999 trade between the EU-15 and Eastern Europe experienced a six-fold increase. As argued by Petrakos, Fotopoulos and Kallioras (2005), trade is predominantly of the intra-industry type.

Migratory liberalization within East, but not between East and West

According to Kaczmarczyk and Okolski (2005), during the communist era migration in Eastern Europe was negligible. This does not only apply to migration between countries, but also within countries. Rural-to-urban mobility was also greatly delayed and generally low. In contrast to Western European nations, in many Eastern countries the process of industrialization took place in the absence of massive urbanization.

It was during the 1990s when substantial policy reforms were enacted to liberalize labor flows across Eastern European countries. For example, in 1993 the Czech Republic established a liberal migration policy which turned the country into the home to tens of thousands of migrants from Europe and Asia during the decade (Drbohlav, 2005). In 1993 Russia abolished the internal passport and allowed for freedom of movement (Heleniak, 2002).

To understand the magnitude of the phenomenon, in 1989 fewer than 3 million visitors entered Poland from the Soviet Union, but their number more than doubled the next year and continued to grow to more than 14 million in the peak year 1997. Although these numbers talk about visitors, a survey conducted in Ukraine and Poland in 1995 suggests that many of the so-called visitors worked illegally during their stays in Poland, mostly as petty traders. They were encouraged by the economic crisis in the former Soviet Union, and by the easy access to Eastern Europe.

This last point is important. The results of a survey on the borders of Poland with Belarus, Ukraine and Russia reveal that Poland was not perceived by respondents to be the destination country, but rather as a good place to "learn about migration", before infiltrating the grey economic zones of Western Europe. According to Iglicka (2001a), migration from Russia stopped in Poland, because of the much more difficult access to Western European countries. Iglicka (2001b) argued that

"Migration pressure from the East induced by the collapse of the system, combined with the restrictive migration policy of Western Europe towards former USSR countries, were conducive to the formation of the Central European buffer zone. Poland is probably the best example of a buffer zone country."[5]

The only exception to restricted migration between East and West concerns ethnic Germans. Between 1989 and 1999 an estimated 678,000 ethnic Germans moved to the homeland. Although there were non-ethnic German foreign nationals moving, their net migration experienced a sharp decline around 1992, to the extent that net migration in the mid nineties was close to zero.

Of course by the turn of the century this situation changed, and migratory flows between East and West increased significantly. However, our paper's focus is limited to the 1990s. For that particular decade, assuming labor mobility within the East, but no labor mobility between East and West seems adequate.

2.2 Main stylized facts

We now give an overview of the main stylized facts we aim to account for in our theoretical model.

U-shaped pattern of relative income per capita between East and West

[5]Poland, the Czech Republic or Hungary will be an example of a Border country in the model we will present later.

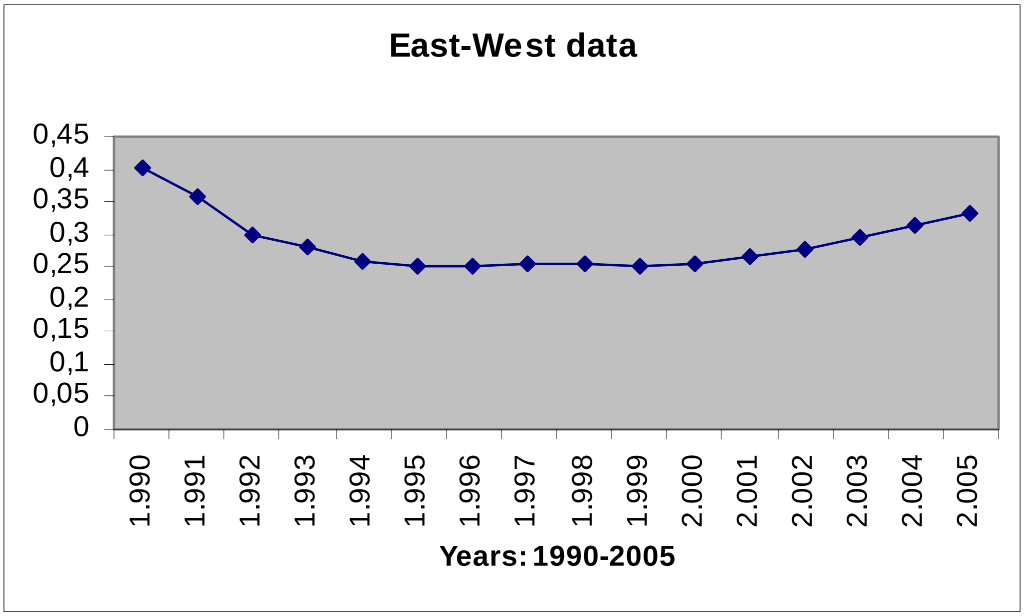

Figure 1: U-shaped pattern of East-West relative income per capita

Figure 1 shows income per capita of East relative to West.[6] As can be seen divergence in the first half of the decade was followed by convergence in the second half of the decade.

U-shaped pattern of relative income per capita within East

A similar U-shaped pattern shows up when analyzing the income per capita of Hinterland relative to Border. This can be seen in Figure 2, where we consider the Czech Republic, Hungary and Poland as the Border, and the rest of Eastern countries included in our previous footnote as the Hinterland.

[6]Data come from the Penn World Tables. West has been defined as EU-15, and East as Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Macedonia, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia and Uzbekistan.

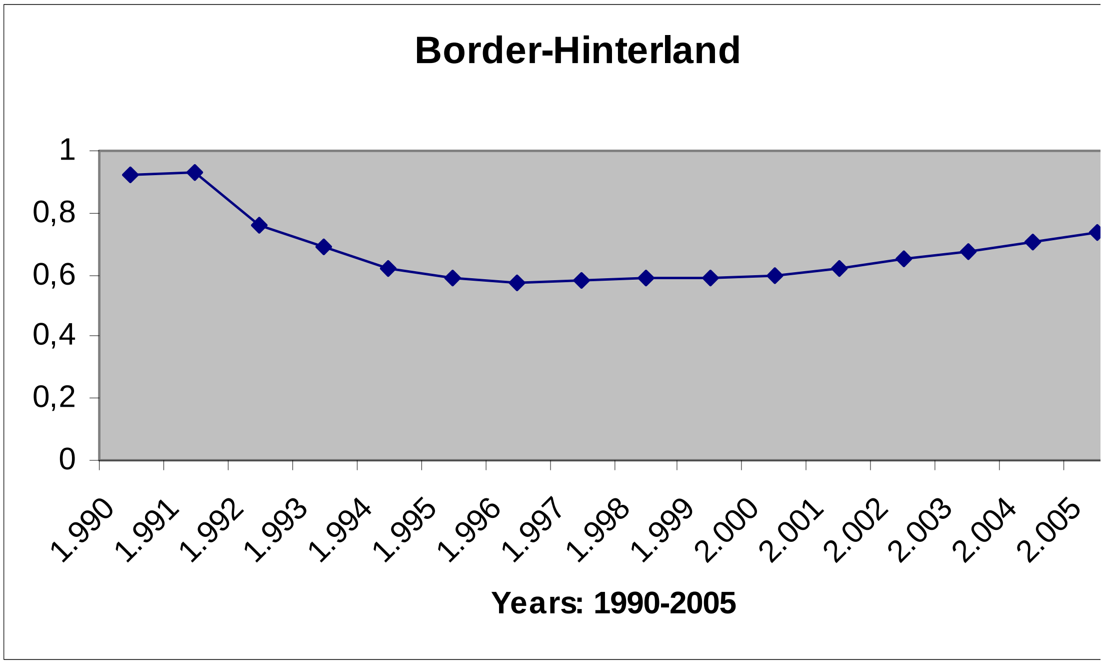

Figure 2: U-shaped pattern of relative income per capita within East.

U-shaped pattern of industrialization between East and West

In Figure 3 we plot total East-West relative manufacturing production during the period 1993-2000. Unfortunately, we do not have data for the first three years of the decade, which probably prevents us from observing the magnitude of the initial slump. Data are expressed in values of the 1999 local currencies, i.e. they are not expressed in a common currency, although we can probably capture the main trends.[7]

Continued deindustrialization of Hinterland

This stylized fact is sensitive to the inclusion / exclusion of Russia within the Hinterland, since that country reindustrialized significantly in the second half of the

[7] Data are collected from the wiiw Industrial Database for Eastern Europe (Wien) and the Groningen Growth and Development Center. We include the Czech Republic, Hungary and Poland as the Border, whereas we only have access to Romania and the Slovak Republic as the Hinterland.

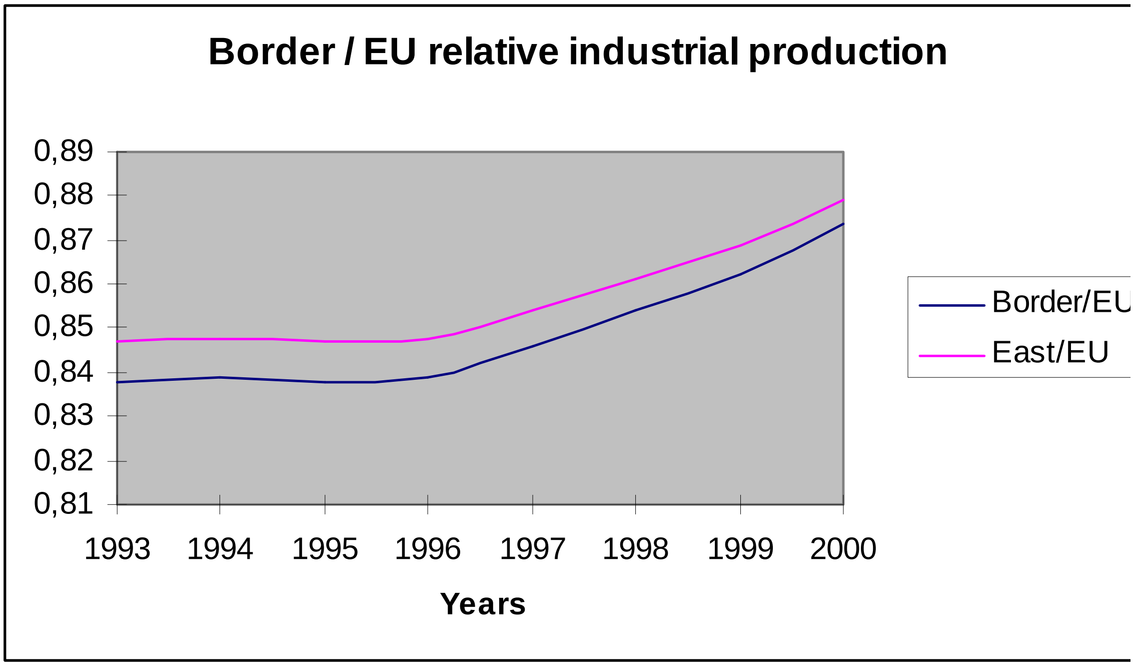

Figure 3: U-shaped pattern of industrialization between East and West.

decade, for reasons probably disconnected from our chain of causality.

3 The model

Consider a model with two countries (West and East) and three regions (one region in West, and Border and Hinterland in East). The three regions are denoted by W (West), B (Border) and H (Hinterland). There are two sectors, agriculture and industry, and two factors of production, labor and land. Both countries have identical technologies and endowments, though West is better integrated due to the absence of internal trade costs. In practice, this turn West into a larger market. The regions of East are equally large in terms of land. Whereas labor is immobile between East and West, it may or may not be mobile within East. Part of our policy experiment consists in understanding how the introduction of migratory flows between Border and Hinterland affects relative economic performance. Trade in industrial goods is

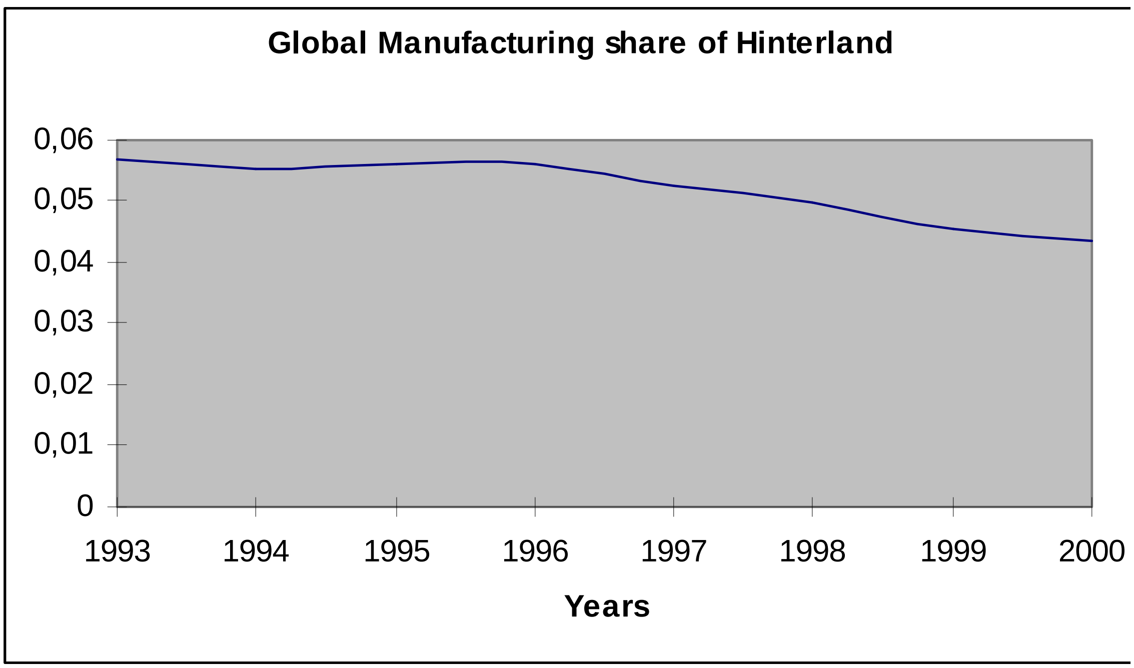

Figure 4: Continuous deindustrialization of Hinterland, which consists here of Romania and Slovakia.

subject to transport costs, which are higher between Hinterland and West, than between Border and West. The agricultural sector is perfectly competitive, and uses land and labor as its input. Since land is only used in agriculture, its supply is fixed, so that the agricultural sector faces decreasing returns to labor. This entails agriculture endogenously takes place in all locations. The industrial sector is monopolistically competitive. As in Krugman and Venables (1995), industrial firms use labor and intermediate goods, which gives rise to forward and backward linkages. The detailed description of the model in the following subsections is similar to Puga (1999).

3.1 Endowments

We have tried to avoid any interference of comparative-advantage forces to make our point. That is, countries and regions do not differ in their access to technology or relative endowments of labor and land, but just in their locational advantage. That advantage is itself endogenous, and linked to the interplay of international and interregional trade costs, as the former decrease over time.

In particular, let us denote by K_i and m_i the stocks of labor and land in location i, respectively. The former is an invariable parameter of the model, whereas the latter will end up being endogenous, once we allow for labor mobility between Border and Hinterland within the East. In particular, we will set $K_H = K_B = 1/2$, $K_W = m_W = 1$, $m_H + m_B = 1$.

3.2 Industry

Trade in manufactures is subject to iceberg transport costs. Between West and Border, for one unit to arrive, τ_B units should be shipped, where $\tau_B>1$. The internal trade cost between Border and Hinterland is T, where $T>1$. Between West and Hinterland, Border plays the role of a 'port' through which all goods nees to be shipped. This implies that trade cost between West and Hinterland, τ_H, must be equal to $\tau_B T$.

The industrial sector is monopolistically competitive. There is a continuum of manufacturing varieties whose available mass in each location is an endogenous variable. Following Dixit and Stiglitz (1977), production of a quantity $x(k)$ of any variety k requires the same fixed (α) and variable ($\beta x(k)$) quantities of the production input in any location. This combined with symmetry and increasing returns ensures that in equilibrium no variety is produced by more than one firm in more than one country.

The production input in manufacturing is a Cobb-Douglas composite of labor and an aggregate of intermediates. Following Ethier (1982), all industrial goods enter symmetrically into the intermediate aggregate, with a constant elasticity of substitution across varieties (σ>1). The price index of the aggregate industrial composite used by firms is region specific, and in the case of location B it is defined by

$$q_B = \left[\int_{h \epsilon n_B} p_B^{1-\sigma}(h)dh + \int_{h' \epsilon n_W} p_w^{1-\sigma}(h')\ \tau_B^{1-\sigma}dh' + \int_{h'' \epsilon n_H} p_H^{1-\sigma}(h'')\ T^{1-\sigma}dh''\right]^{\frac{1}{1-\sigma}} \quad (1)$$

where p_i represents the price of a locally-produced manufacturing variety in region i. We have also denoted by n_i the available mass of manufacturing varieties produced in region i. (The price indices of the other regions can be defined by analogy). Now that we have determined the price of the intermediate composite, we can write down the cost function of a manufacturing firm h located in region i that produces output x$_i$ (h):

$$C_{ih} = (\alpha + \beta x_i(h))q_i^{\mu} w_i^{1-\mu} \quad (2)$$

where w_i stands for the local wage in region i, and μ $(0 \leq \mu \leq 1)$ is the share of intermediates in firms' costs (an indicator of the strength of vertical linkages).

3.3 Agriculture

Agriculture is perfectly competitive. It produces a homogeneous good - which plays the role of numeraire ($p_i^A = 1 \forall i$) -, using labor and land with a constant returns to scale technology described by the production function $y_i = g(L_i^A, K_i)$. K_i is the stock of arable land available in location i and L_i^A denotes agricultural employment.

In our particular case - as in Puga (1999) - , function g will be a Cobb-Douglas production function: $g(L_i^A, K_i) = L_i^{A\ \theta}\ K_i^{1-\theta}$. Therefore, from the landowners' profit maximization we can obtain the following demand for agricultural labor:

$$L_i^A = K_i \left(\frac{\theta}{w_i}\right)^{\frac{1}{1-\theta}} \tag{3}$$

We incorporate a system of public landownership: once agricultural rents have been collected - they are perfectly taxed away and rebated to the local workers in a lump sum fashion.

Let us denote by m_i the total population living in location i, and by R_i the per-capita agricultural rents rebated to the local workers living in i. In particular, using (3) and the agricultural production function, it is easy to show that

$$R_i = \frac{\left((1-\theta)K_i \left(\frac{\theta}{w_i}\right)^{\frac{\theta}{1-\theta}}\right)}{m_i} \tag{4}$$

3.4 Preferences

Turning to the demand side, consumers have Cobb-Douglas preferences over the agricultural good and a CES composite of industrial goods, with industrial expenditure share γ $(0 \leq \gamma \leq 1)$. For simplicity, all industrial varieties produced are assumed to enter consumers' utility function with the same constant elasticity of substitution with which they enter firms' technology. This generates the following indirect utility function for workers living in location i:

$$V_i = q_i^{-\gamma} Y_i \tag{5}$$

where Y_i stands for the income of a representative worker in location i, which consists of labor earnings and the rural and urban rents rebated proportionally to the local population.

3.5 Residential Sector

We follow Krugman and Livas Elizondo (1996) and introduce commuting costs internal to each region. This provides a source of congestion, which prevents the full agglomeration of all Eastern manufactures in the Border region. In each of the three locations, we assume the existence of a Central Business District (CBD) to which the local population must commute in order to supply their amount of effective labor. That population is distributed along a segment centered at the CBD, and every worker must allocate inelastically a unit of time between effective labor and commuting[8]. As can be expected, those commuting costs will be higher the further away every commuter is from the CBD. In particular, a commuter living at a distance x from the CBD will supply $1 - 2\delta x$ units of time to the labor market, where δ is the parameter that measures the strength of commuting costs.

Consequently, the local stock of effective labor in i will be

$$L_i = 2 \int_0^{\frac{m_i}{2}} (1 - 2\delta x)\; dx = m_i\; (1 - \delta(m_i/2)) \tag{6}$$

where m_i denotes the size of the population living in location i. Since the distribution of population across CEE regions turns out to be endogenous, we will consider that $m_B + m_H = 1$ in the case of perfect labor-mobility within the East. In the case of perfect labor-mobility restrictions, we will exogenously set $m_B = m_H = 1/2$.

Moreover, the extra income that a worker can gain by living closer to the CBD will be exactly compensated by higher rent costs paid to the landowners, in such a way that all local workers enjoy the same utility level. This implies that the real urban rent $R(x)$ to be paid by a worker living in location i can be derived as follows:

$$R_i^U(x) = w_i(1 - 2\delta x) - w_i(1 - \delta m_i) = \delta w_i(m_i - 2x) \tag{7}$$

[8] For simplicity, we assume that both farmers and manufacturing workers need to commute to the CBD. That is believed to be innocuous for our main qualitative conclusions.

Since all urban rents are collected and proportionally rebated to the local population, we need to compute the magnitude of the urban rebate, which - from (7), will be equal to

$$\text{Urban Rebate} = \frac{2\int_0^{\frac{m_i}{2}} R_i^U(x)\ dx}{m_i} = \delta w_i \left(\frac{m_i}{2}\right)$$

Therefore, adding up labor income and rural and urban rebates, nominal income

$$Y_i = w_i(1 - \delta \left(\frac{m_i}{2}\right)) + R_i \tag{8}$$

3.6 Labor Mobility

There is no labor mobility between West and East, but there may be labor mobility between Border and Hinterland. As is standard in the literature, migration is assumed to be myopic, acting only in response to *current* real-wage differentials. Labor mobility has the effect of eliminating real-income differences, net of commuting costs, between Border and Hinterland:

$$Y_B q_B^{-\gamma} = Y_H\ q_H^{-\gamma} \tag{9}$$

3.7 General Equilibrium

Individual demands coming from workers, all of which share the same elasticity of substitution σ, are calculated by using Roy's identity on expression (5) and summed in each region. Demands coming from individual firms, which also share the same elasticity of substitution, are calculated by using Shephard´s lemma and summed in each region. As a result, total demand for a firm in region i producing variety h, $x_i(h)$,is

$$x_i(h) = \sum_{j\epsilon\{B,H,W\}} (p_j(h))^{-\sigma} e_j\ q_j^{\sigma-1} T_{ij}^{1-\sigma} \tag{10}$$

where T_{ij} is the indicator of transport costs from i to j, and e_i is the total expenditure on manufactures in region i:

$$e_i = \gamma \left(w_i m_i (1 - \delta \left(\frac{m_i}{2} \right)) + m_i R_i \right) + \mu \int_{h \in n_i} C(h) \; dh \tag{11}$$

The first term in expression (11) is the value of consumer expenditure, since consumers spend a fraction γ of their income on manufactures, where consumer income is the sum of labor income and the rebate of urban and agricultural rents. The final term is intermediate demand, generated as firms spend fraction μ of their costs on manufactures.

Differentiating demand with respect to a firm's own price - after substituting expressions (1), (2) and (11) into (10) - shows that every firm faces a constant price elasticity σ in every region. All firms producing in any particular region then have the same profit - maximizing producer price, which is a constant relative mark-up over marginal cost:

$$p_i = \frac{\sigma \beta}{\sigma - 1} q_i^{\mu} w_i^{1-\mu} = q_i^{\mu} w_i^{1-\mu} \tag{12}$$

where we have applied the normalization $\frac{\sigma\beta}{\sigma-1} = 1$.

Even though firms set a unique price for their output regardless of whether it is sold domestically or exported, the consumer price paid per unit received is either T, τ_B or $T\tau_B$ times higher in the region where the good has to be imported. The profits of each manufacturing firm in region B are, from expressions (2) and (12),

$$\pi_B = \frac{1}{\sigma} \left[q_B^{\mu(1-\sigma)} w_B^{(1-\mu)(1-\sigma)} \left(q_B^{\sigma-1} e_B + q_H^{\sigma-1} e_H \Phi + q_W^{\sigma-1} e_W \Phi_I \right) - q_B^{\mu} w_B^{1-\mu} \right]$$

or, equivalently,

$$\pi_i = \frac{p_i}{\sigma}(x_i - 1) \tag{13}$$

where $\Phi = T^{1-\sigma}, \Phi_I = \tau_B^{1-\sigma}$ and we have applied the normalization $\alpha = \frac{1}{\sigma}$.This means that

$$x_i = 1 \tag{14}$$

is the unique level of output giving firms zero profits.

On the other hand, given (1) and (12), the price-index equation for region B can be written implicitly as follows:

$$q_B^{1-\sigma} = \left(q_B^{\mu} w_B^{1-\mu}\right)^{1-\sigma} n_B + \left(q_H^{\mu} w_H^{1-\mu}\right)^{1-\sigma} n_H \Phi + \left(q_W^{\mu} w_W^{1-\mu}\right)^{1-\sigma} n_w \Phi_I \qquad (15)$$

and the same can be done with q_H and q_W.

Turning to the labor market, from (2) and (3), the labor-market clearing condition can be written as

$$(1-\mu)\frac{C(h)_i}{w_i} n_i + K_i \left(\frac{\theta}{w_i}\right)^{\frac{1}{1-\theta}} = L_i = m_i \left(1 - \delta(m_i/2)\right) \qquad (16)$$

The first term in the left-hand side of (16) is labor demand in manufacturing, obtained by application of Shephard´s lemma to (2). The second term stands for the agricultural demand for labor, which is given by expression (3). If we add up both terms, the sum must be equal to the available supply of effective labor, given by (6).

Now we are ready to give a formal definition of a Steady State associated with a given level of τ_B:

Definition 1 *A Steady State associated with a given τ_B is a vector of prices and allocations $\{p_{i,}, w_i, q_i, x_i, R_i, Y_i, C_i, m_B, \ e_i, n_i; \ i \in \{B, H, W\}\}$ that satisfies*

1. *Equation (1):* $q_B = \left[\int_{h \epsilon n_B} p_B^{1-\sigma}(h) dh + \int_{h' \epsilon n_W} p_w^{1-\sigma}(h') \ \tau_B^{1-\sigma} dh' + \int_{h'' \epsilon n_H} p_H^{1-\sigma}(h') \ T^{1-\sigma} dh'\right]^{\frac{1}{1-\sigma}}$ *(Definition of price-index of local intermediate composite)*

2. *Equation (12):* $p_i = q_i^{\mu} w_i^{1-\mu}$ *(Profit Maximization by manufacturing firms)*

3. *Equation (10):* $x_i(h) = \sum_{j \epsilon \{B,H,W\}} (p_j(h))^{-\sigma} e_j \ q_j^{\sigma-1} T_{ij}^{1-\sigma}$ *(Utility maximization by consumers and cost minimization by firms; the market of every manufacturing variety clears).*

4. *Equation (11):* $e_i = \gamma \left(w_i m_i (1 - \delta\left(\frac{m_i}{2}\right)) + m_i R_i\right) + \mu \int_{h \in n_i} C(h) \ dh$ *(Aggregation of consumer and firm expenditure on manufactures).*

5. *Equation (4):* $R_i = \frac{\left((1-\theta)K_i\left(\frac{\theta}{w_i}\right)^{\frac{\theta}{1-\theta}}\right)}{m_i}$ *(Profit maximization in agriculture).*

6. *Equation (2):* $C_{ih} = (\alpha + \beta x_i(h))q_i^{\mu} w_i^{1-\mu}$ *(Definition of the cost function for every variety).*

7. *Equation (16):* $(1-\mu)\frac{C(h)_i}{w_i}n_i + K_i\left(\frac{\theta}{w_i}\right)^{\frac{1}{1-\theta}} = m_i\ (1-\delta(m_i/2))$ *(Local labor market clearing).*

8. $(x_i - 1)n_i = 0,\ x_i \leq 1,\ n_i \geq 0$.*(Free entry / zero-profit condition for local manufacturing firms).*

9. *Equation (8):* $Y_i = w_i(1-\delta\left(\frac{m_i}{2}\right)) + R_i$ *(Definition of nominal income).*

10. *Equation (9):* $Y_B q_B^{-\gamma} = Y_H\ q_H^{-\gamma}$*(Determination of relative labor supply in Border and Hinterland when labor mobility is allowed; otherwise, the relevant equation is* $m_B = 1/2$*).*

The first nine conditions above are linked to three equations, one for each location; whereas condition 10 is only expressed by equation (9). Therefore, computing a steady state for every value of τ_B is a static problem with 28 equations and 28 unknowns.

It is useful to think of short-run profits as being related to the number of firms in each region by four forces: product and labor-market competition, and cost and demand linkages. A larger number of firms producing in the same region increases demand for labor, leading to higher wage costs - expression (16). Product market competition is also tougher in regions where more varieties are produced locally; if more varieties are available locally instead of being imported subject to trade costs then the price index of industrial goods is lower - expression (1) -so, for a given price and level of expenditure, local demand for each industrial good is smaller - expression (10). Product and labor market competition tend to make firms located in markets with relatively many firms less profitable, encouraging exit and leading to the geographical dispersion of industry. Therefore, these two forces are sometimes called "neoclassical".

Pulling in the opposite direction there are cost and demand linkages. Cost linkages come from the lower prices that firms and consumers have to pay for manufactures in regions where there are relatively many firms - expressions (1), (2) and (5). Demand linkages arise as an increase in the number of demand firms and / or workers raises local expenditure on manufactures - expression (11). Cost and demand linkages tend to increase the short-run profitability of firms in regions with a large number of firms, and they lead to entry. When they are strong enough they can overturn product and labor-market competition, thereby making dispersed outcomes unstable and triggering industrial agglomeration.

In the long run, profits must be zero wherever there is a positive measure of firms, and there must be no firms wherever profits are negative. That adjustment takes place increasing the number of firms if profits are positive and decreasing it (for potential, if not for actual, firms) whenever they are negative.

4 Numerical Simulations

The goal of this section is to analyze the effect of trade liberalization and labor mobility on development, industrialization and population density. We conduct two different experiments. In both of them we look at the effects of a gradual decrease in international trade costs (τ_B), while keeping a fixed value of internal trade costs (T) between Border and Hinterland. In the first experiment there is no labor mobility of any kind, neither between East and West nor between Border and Hinterland. In the second experiment, trade liberalization is followed by the introduction of labor mobility within the East, between Border and Hinterland.

Our choice of parameter values will be identical to Puga and Venables (1997)'s with respect to $\mu = 0,55; \gamma = 0.5$; and $\theta = 0.8$. However, we selected $\sigma = 3$ instead of $\sigma = 4$ in order to fit better with the observables. On the other hand, we had to assign some values to the new parameters in our model: $\Phi = 0.85$, $\delta = 0.05$, $K_H = K_B = 1/2$, $K_W = m_W = 1$, $m_H + m_B = 1$. The degree of internal trade openness between Border and Hinterland (Φ) is, by assumption, always bigger or equal than the degree of international trade freeness (Φ_I).

4.1 Trade Liberalization without Labor Mobility

We can observe our results for the fully-restricted-labor-mobility case in figures 5 and 6, where the horizontal axis in each panel shows the level of international trade openness (τ_B), assumed to be bigger or equal to $T = 1,08$. Our simulations do not intend to capture the whole set of stable steady-states at any level of international trade costs: we just obtain a stable steady-state for the initial value of trade openness, and make the economy follow a sequence of subsequent steady states as those costs decrease.

In a separate experiment, we have also tried to introduce the whole trade reform all at once, followed by a transition. Finally, once the steady state was reached, we incorporated the migratory reform. The results were not qualitatively different from those we will present next.

Moreover, another comment is due about our chances to capture multiple steady states. For a given τ_B, we tried to study systematically the number of steady states and their evolution as trade costs decreased, by means of the unit simplex developed in Puga and Venables (1997). The main technical difference between our framework and theirs is the existence of asymmetric locations in our model. Under symmetric locations - as in Puga and Venables (1997) - the number of steady states can be safely studied in the unit simplex.

However, in our model, we first found - in the unit simplex - a number of steady states where profits were equalized across locations. Later we varied the global mass of varieties to make profits equal to zero everywhere, and found that the number of steady states was different: some of the previously obtained in the unit-simplex

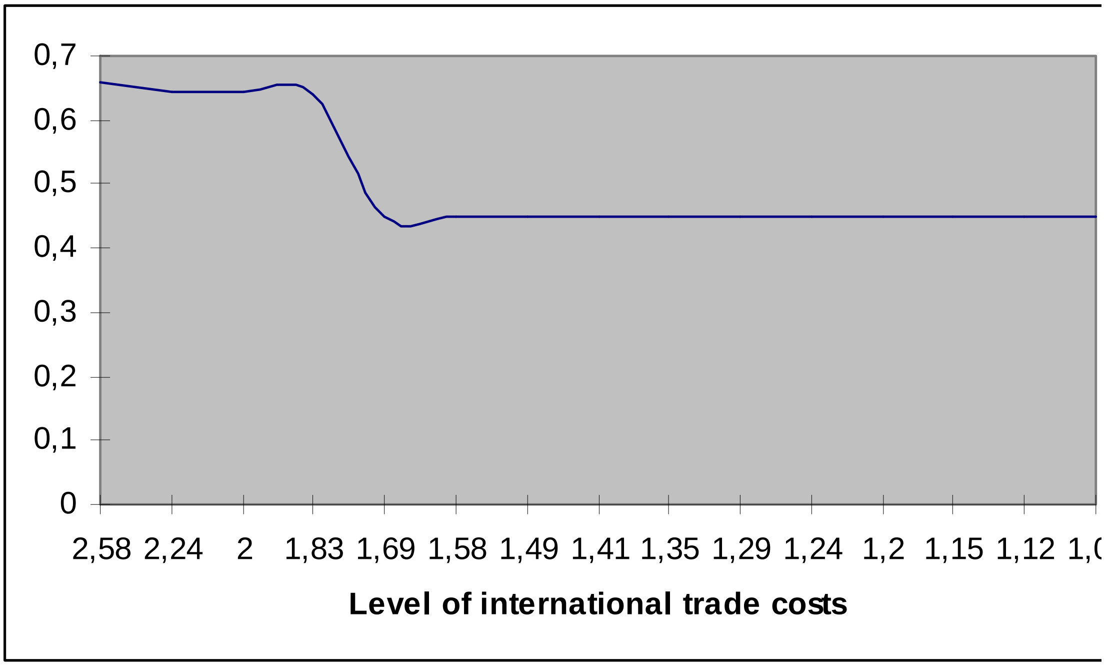

Figure 5: East-West real wage ratio without labor mobility.

had simply disappeared. It was always possible to vary the global mass of varieties and obtain different zero-profit steady states, in such a way that all possibilities were never exhausted.

In order to limit such a complexity, we focused on a given sequence of steady states as trade openness increased, without exploring the whole space of manufacturing shares. During the transition between steady states - each one characterized by a different value of τ_B - we followed a simple law of motion, increasing (decreasing) the local mass of varieties where profits were positive (negative), until the free-entry condition was satisfied.

We must emphasize that - at least under our parameterization - the revival of East relative to West, and of Hinterland relative to Border, would not take place in the absence of internal labor mobility. Initially, trade liberalization involves tougher competition for both Eastern locations, whereas the larger Western market is hardly

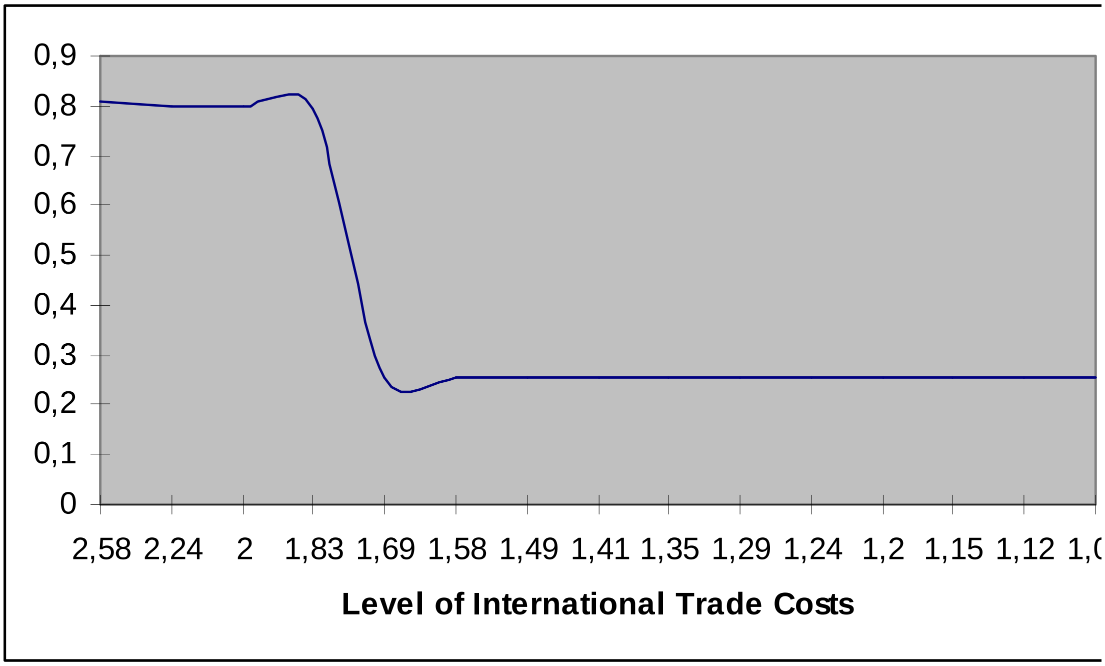

Figure 6: Hinterland-Border real wage ratio without labor mobility.

affected by the scant Eastern competitors. This leads to a process of international (East-West) divergence (see figure 5).

Nevertheless, openness to the large market not only implies tougher competition, but also higher exports and cheaper imports of intermediates for the East, specially for the Border. That proximity to the largest market is crucial for the Border to absorb most of the manufacturing share of the Hinterland, which reduces the standards of living in the latter location and leads to a process of interregional divergence (see figure 6). Both characteristics seem to correspond roughly to the initial years of the transition period, when we know that migrations within East were still subject to significant restrictions.

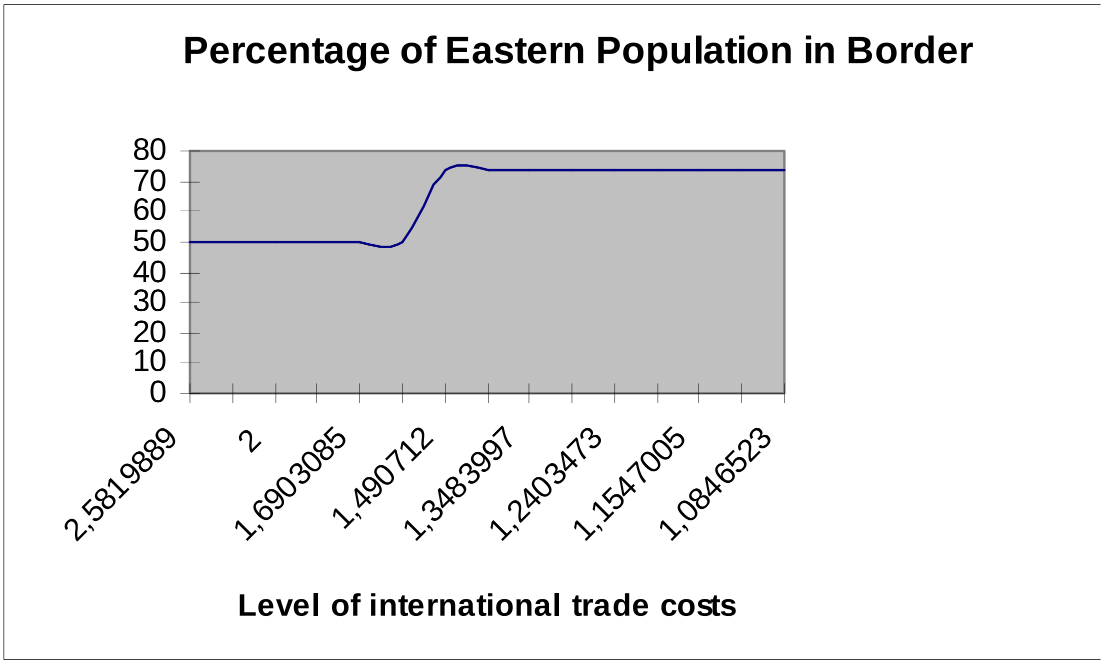

Figure 7: Percentage of Eastern Population in Border.

4.2 Trade Liberalization and Labor Mobility within East

We have checked that, by introducing the migratory liberalization in the midst of the trade liberalization process - as we think it took place in the real world- we are able to replicate more closely our stylized facts, reflected on figures 1-4. To that purpose, we have tentatively chosen a level of $\Phi = 0.45$ as the particular point where migrations within the East are fully allowed. We can observe in figure 7 that, immediately after the migratory liberalization is enacted, an important contingent of population flows from Hinterland to Border in response to higher real wages (net of congestion costs). This higher degree of population concentration within the East enlarges the home-market of this country and attracts a higher world share of manufacturing varieties, in such a way that international real-wage levels start to converge.

If we plot the average real wages of East and West (and Border& Hinterland within the East), we obtain two U-shaped curves very similar to Figure 2. It is noticeable

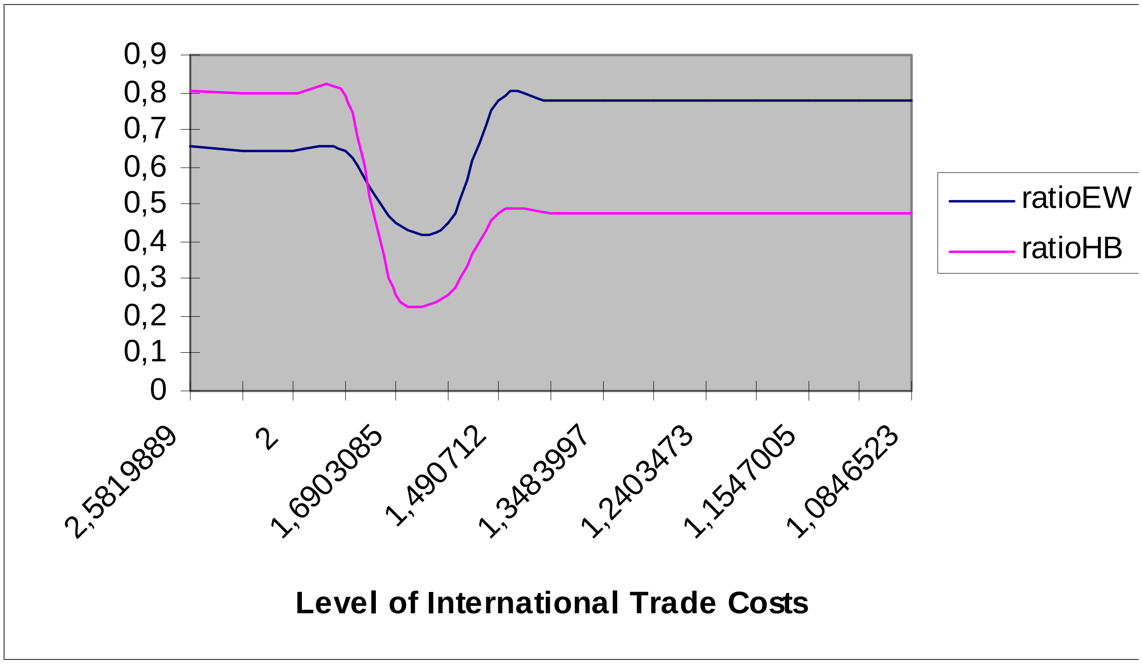

Figure 8: East-West and Border-Hinterland convergence after divergence

that the policy shock triggers an international convergence trend that is reinforced by the last stages of trade openness, once lower labor costs finally induce firms to relocate towards the East. The same policy reform is responsible for the relative improvement of the living standards in the Hinterland relative to the Border, given that the labor-supply effect outweighs the home-market gain in the Border and the deterioration in the Hinterland.

4.3 Some Normative Implications

Nevertheless, the migratory liberalization has also a different, unexpected effect on real wages. Since almost the whole manufacturing sector gets concentrated in West and Border, there is no longer need to trade in intermediates with Hinterland. Therefore, internal transport costs within the East are mostly skipped, which allows firms to quote lower prices and provide higher real wages everywhere. That is the sense in which internal labor mobility turns out to be Pareto-improving for an appropriate parameterization.

However, it can be shown that any normative implication of the migratory reform lacks generality and robustness in the context of this model. For instance, under an absentee-landownership system (instead of a public one) the migratory balance would have been smaller and the Hinterland would have retained a significant amount of manufactures. The subsequent split of Western vertical linkages would have generated a welfare loss for the West and the Border, together with a gain for the Hinterland.

This happens because, in essence, the migration has a double effect on Western indirect utility: on the one hand, the West loses part of its manufacturing share in favor of the Border, which reduces the effectiveness of vertical linkages; on the other hand, the Hinterland is left 'out of the game', which reduces trade costs and increases that effectiveness. Therefore, the model can help us understand the forces at stake, though we can not make definite predictions about local welfare[9].

5 Conclusions

In this paper we have examined some mechanisms - exclusively related to economic geography, trade openness and freedom to migrate - as possible factors to account for the recent real-income profile of CEE countries. We have deliberately disregarded any interference of technological differences across regions or unrelated public-policy factors. As a result, the belated incorporation of freer international trade and new labor mobility emerge as candidates to explain the evolution of both external and internal disparities.

A different normative implication points at internal labor mobility as a potentially Pareto-improving measure, at least in a context where labor-force heterogeneity, as-

[9] Those predictions would always depend on our particular choice of parameter values. For instance, our choice of δ looks specially relevant for the convenience of agglomeration in a single location.

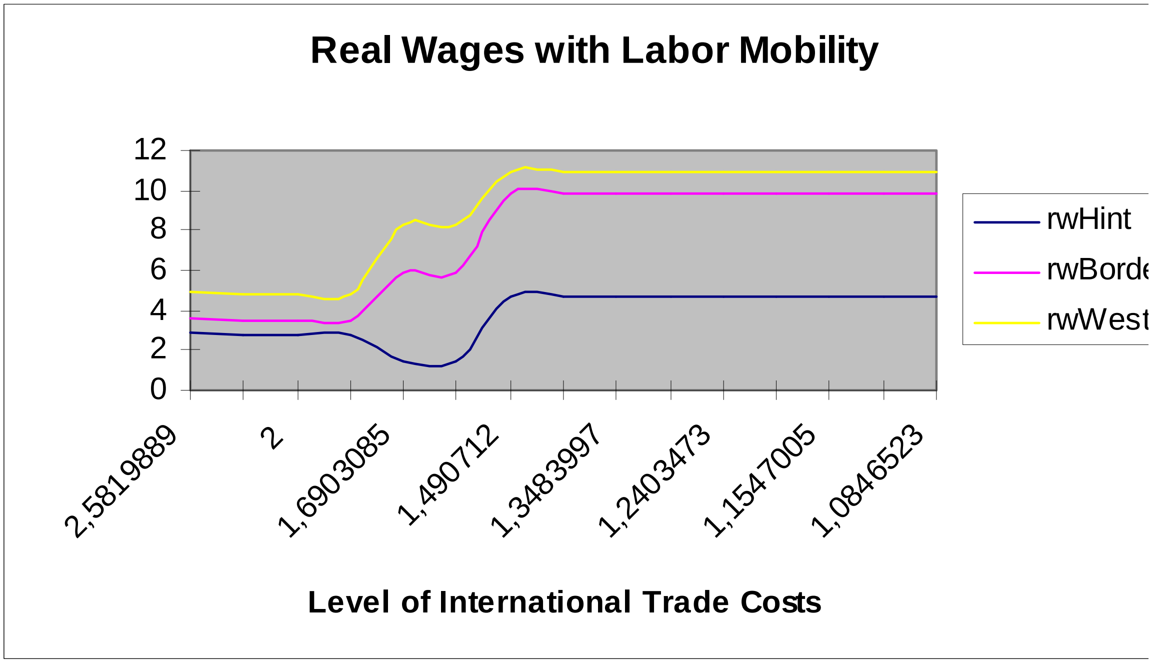

Figure 9: Local real-wage levels with labor mobility.

similation costs, etc. do not play a major role.

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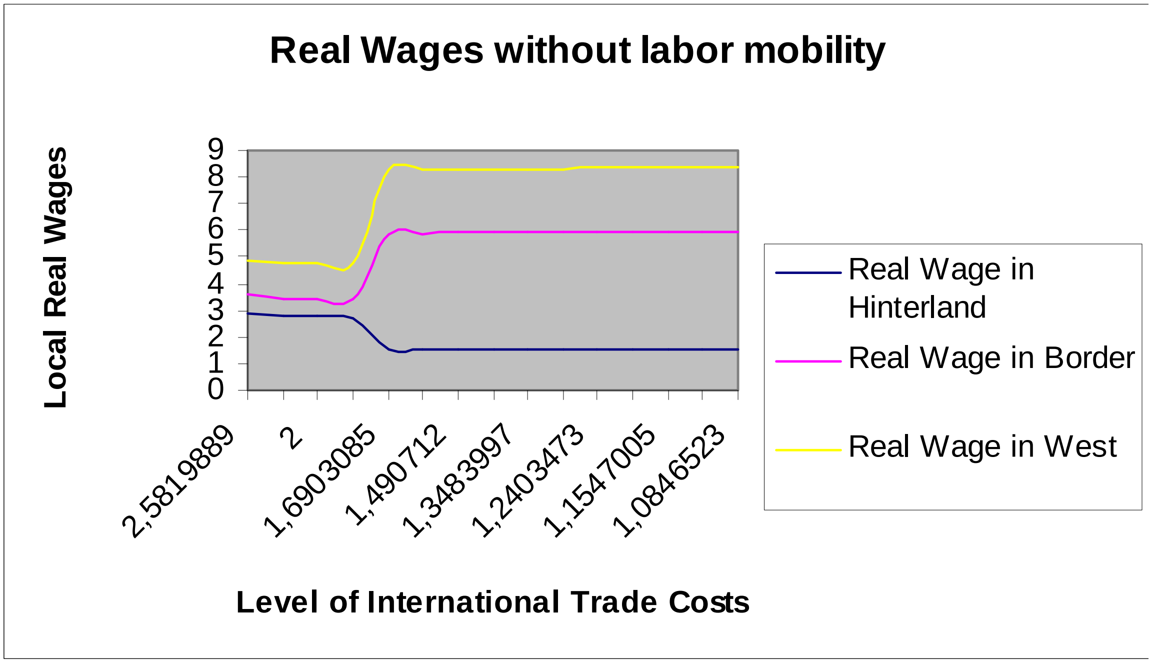

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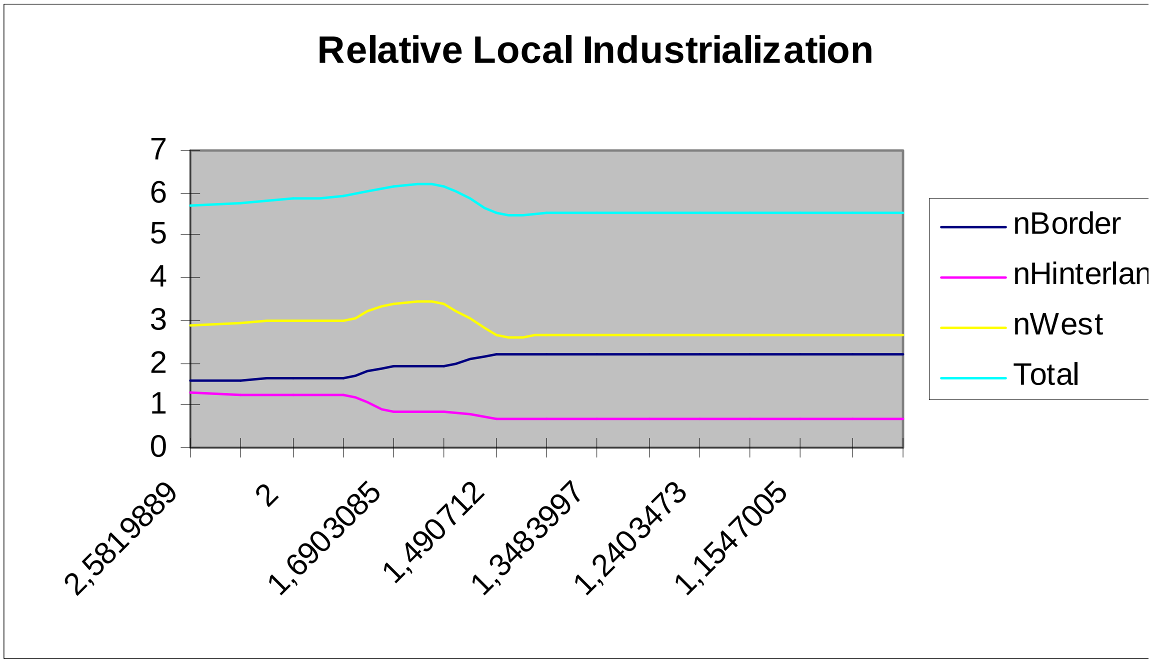

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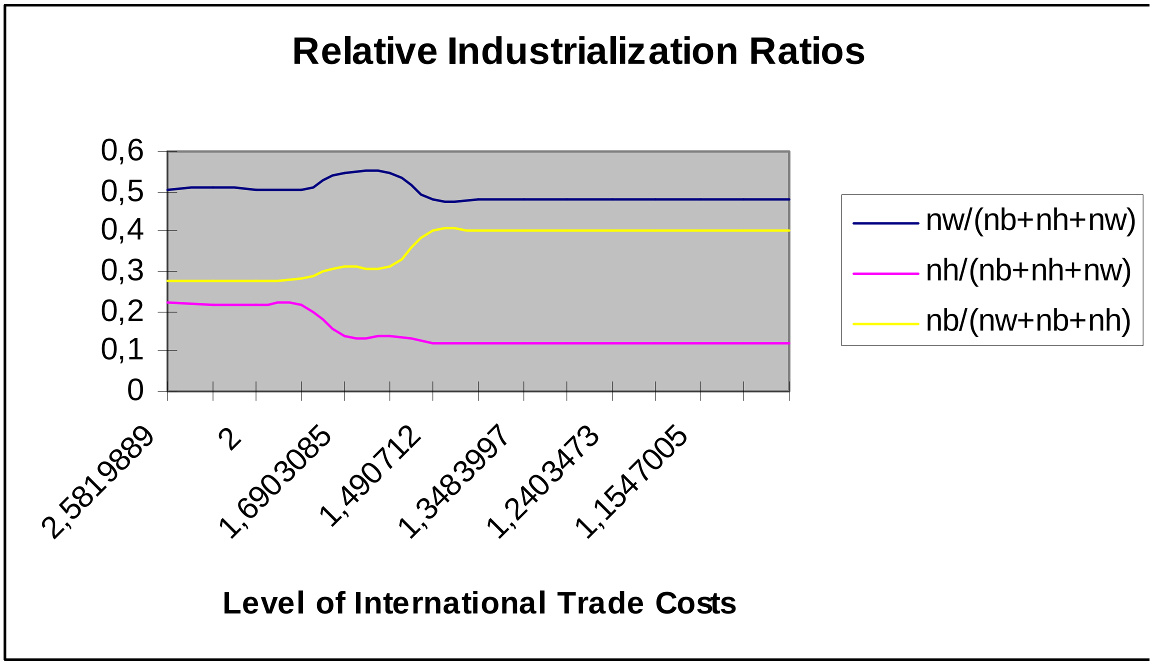

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