LABOUR MIGRATION AND INTRA-REGIONAL TRANSFER POLICIES

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Abstract - *We consider a two-region, two-sector model "à la Krugman", where a tendency to geographic concentration of activities does exist. We show that decentralized governments are able, by means of "competitive transfers" within each region, to counteract that tendency. That leads in many cases to worse equilibria. The result is that social optimum can only be restored by a federal government.*

Key-words - ECONOMIC GEOGRAPHY, MIGRATIONS, FEDERALISM.

JEL Classification : R13, R23.

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INTRODUCTION

Decreasing transports costs and an increasing share of the industrial sector characterized by economies of scale lead to geographic concentration of activities. On that ground, a very enlightening model is P. Krugman's one[1]. Remember that in this model there are two regions (a big one and a small one) and two sectors in each region: an immobile one with constant returns to scale an a mobile one with increasing returns to scale. When transportation costs become low enough or when the share of the industrial sector with scale economies becomes large enough, workers leave the smaller region for the larger one. In that model there is no transport cost for agricultural goods and no negative consequence of concentration per se, such as congestion or increase in land prices, that could counteract this tendency to concentration, if correctly internalized by the market. It is possible that these negative consequences are too weak or too poorly internalized to play a role in determining equilibrium. The questions we analyze here are the following:

- a preliminary one: if we consider this model, with the given characteristics (particularly no negative consequences of concentration per se), when concentration occurs, is the resulting equilibrium a social optimum and is it possible to compare it with the initial one?

- the central one: are decentralized governments able, by means of transfers between groups within the same region, to modify this final equilibrium? For instance, are they able to break the tendency to concentration or to reverse this tendency from one region to the other[2]. In a first part we identify why governments may choose to intervene: we apply Krugman's basic model to answer our preliminary question regarding the evolution of welfare with concentration. We show that, when migration occurs, the welfare in the "departure region" decreases. Therefore we assume that, in such regions, the government wants to stop migration and we describe the implementation of a taxation policy using a sequential game approach.

In a second part we define the possible equilibria, the agent's behaviour and the political constraints since, in a democratic region, the decisions depend on which group of agents is holding the political majority.

In a third part, we emphasize the strategies chosen by government according to the political constraints and agent's behaviour.

[1] See Krugman, 1991a and 1991b.

[2] Of course, a federal government is able, by means of transfers from one region to the other, to stop migrations. One could analyze also the case of international transfers initiated by one of the regions (see for instance Burbridge an Myers, 1994). But this case is irrelevant here because there is no negative effect of immigration and no incentive to set transfers in order to stop it.

1. THE NECESSITY OF REGIONAL GOVERNMENTS' INTERVENTION

1.1. The Basic Model

1.1.1. A Reminder of Basic Assumptions and Results

There are two regions, $i = 1,2$ and two categories of consumers, workers and farmers, in each region. The two regions differ only in one respect: the number L_i of workers. Let us assume that the total number of agents is 1, the overall number of workers is μ and assume that $L_1 = f\mu$ and $L_2 = (1-f)\mu$ with $0{,}5 < f \leq 1$ and so that the first region is the "big" one. Farmers and workers have different activities and therefore different incomes. They, otherwise, have identical preferences. Each consumer has the same utility function:

$$S = C_m^{\mu}\, C_a^{1-\mu} \tag{1}$$

C_a is consumption of the homogeneous agricultural good, C_m is consumption of an aggregate of n manufactured goods and is defined by

$$C_m = \left[\sum_{k=1}^{n} C_k^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{2}$$

$\sigma > 1$ is the elasticity of substitution among the manufactured goods.

Then, each consumer devotes a share μ of this total expenditures to manufactured goods and the remaining share $1-\mu$ to the agricultural good. (3)

There are $\left(\dfrac{1-\mu}{2}\right)$ *immobile* farmers in each region. Each farmer produces one unit of agricultural good, and therefore each region produces the same quantity of that good:

$$x_{a1} = x_{a2} = \frac{1-\mu}{2} \tag{4}$$

The agricultural good can be costlessly transported from one region to the other[3], therefore the price of that good is the same in the two regions.

[3] Calmette and Le Pottier (1995) discuss the case where the agricultural good is costly to transport.

Taking P_{a1}, the agricultural good price in Region One, as the numeraire, then we have:

$$P_{a1} = P_{a2} = 1$$
$$\text{and} \quad W_{a1} = W_{a2} = 1 \tag{5}$$

where W_{a1} is the farmer income in each region.

Because $f > .5$, Region One is importing the agricultural good.

On the manufactured goods market, the amount of labor μ_k required to produce a quantity x_k of good $k (k = 1 \ldots n)$ is

$$\mu_k = \alpha + \beta x_k \tag{6}$$

Increasing returns to scale imply that each region is specialized in a given set of varieties. Further, each firm produces a single differentiated product. The firms are Chamberlinian monopolistic competitors and, in equilibrium, set a price that is uniform within each region:

$$\forall k = 1 \ldots, n, \quad P_{ik} = \frac{\sigma}{\sigma - 1} \beta W_i$$

where $W_i (i = 1,2)$ is the wage rate in the region i. Because the prices depend only on wages and because wages are the same inside a region, all the prices of industrial goods produced in a same region are identical. Then we can simplify and write:

$$P_i = \frac{\sigma}{\sigma - 1} \beta W_i \quad i = 1,2 \tag{7}$$

where P_i is the price of any good of the set produced in region i. Free entry implies that

$$\forall k = 1 \ldots n, \quad x_{ik} = x_i = \frac{\alpha}{\beta}(\sigma - 1) \tag{8}$$

where i is the quantity produced by each firm in region i.

At each time and for each value of f, the full employment condition determines the number of firms (and, therefore, the number of products) in each region.

$$n_i = \frac{L_i}{\alpha \sigma} \quad (i = 1,2) \tag{9}$$

Manufactured goods are costly to transport and transportation costs take Samuelson's iceberg form: $r > 1$ is the fraction of one unit of good that, shipped from one region, reaches the other. The consumer in each region i maximize utility given by (1) subject to his budget constraint. Equating supply and demand for each industrial good in both regions yields a pair of equations[4]

$$x_i = f\left(\mu \frac{P_1}{P_2}, \frac{n_1}{n_2}, r\right) \quad i = 1,2 \tag{10}$$

which, together with the free entry condition (8) and the full employment condition (9), determines the equilibrium prices P_i. For each location of workers among the regions (i.e., for each value of f, then n_1/n_2), the general equilibrium in the economy is, simultaneously, determined on the agricultural and on the industrial markets, r and μ being given and $P_{a1} = P_{a2} = 1$. If workers are now allowed to migrate and if we assume that they can costlessly move from the low to the high real wage region, there are three natural possible long term location equilibria characterized by $f = 1$ or $f = 0$ (concentration of all workers in one region) or $f = 1/2$ (same number of workers with the same satisfaction of all the workers in each region)[5]. We *assume in* all *the paper that we are in the first case*, namely that the satisfaction is higher in the larger region (because the share of industry, μ, and r are high enough): Region One being the "big" one, f will increase until $f = 1$ and $L_1 = \mu$, if regional governments don't interfere to stop migration.

1.1.2. Evolution of Agents' Satisfaction and Social Welfare

In a case where workers are induced to migrate because the real wage is higher in the larger region[6], i.e. a case where concentration occurs, Figure n° 1 shows the variations (%) of individual satisfactions with f, with respect to the satisfaction agents get when $f = .5$. We see that, in the chosen case[7], S_{a2}, satisfaction of farmers in Region Two, is decreasing when f changes from 5 to 1. S_{a1} and S_1, satisfaction of farmers and workers in Region One are increasing.

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[4] See Calmette and Le Pottier, 1995.

[5] See Krugman, 1980, 1991a, 1991b. In this model the real wage is strictly equivalent to satisfaction. Therefore, we will use further "real wage" as well as "satisfaction".

[6] In that model, it is the only reason for migration; but more complex models, explaining migration, focus on another reasons: the difference between the levels of a public good provision (see Cukierman, Mercowitz and Pines, 1993), the difference between social insurance systems offered by the regions (see Bureau and Richard, 1994) or the difference between marginal products of labor (see Myers and Papageorgiou, 1994) for example.

[7] $\alpha = 1$, $\beta = .01$, $\sigma = 3$, $r = .5$, $\mu = .4$.

Figure n° 1: Variations (%) of individual satisfaction according with
$$f = [S(f) - S(.5)]/S(.5) \quad (r = .5\,;\, \mu = .5)$$

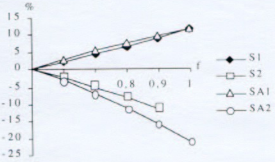
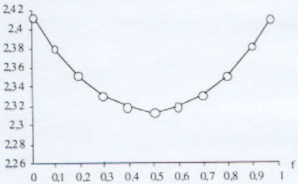


Figure n° 2: Sum of agents' satisfactions according with f



Of course, we cannot compare directly the two situations (for instance the cases where $f = 5$ and $f = 1$) on a Pareto basis, because satisfactions are increasing for some agents while they are decreasing for others. Nevertheless, as our agents have identical tastes, we can use an utilitarian social welfare function:

$$U = f\mu S_1 + (1 - f)\mu S_2 + \frac{1-\mu}{2}(S_{a1} + S_{a2})$$

This function clearly reaches a minimum for $f = .5$ and two maxima, when $f = 0$ and 1. Therefore we may consider that a social optimum with concentration in one region or the other is obtained[8].

Due to increasing returns and transport costs, industrial activities cluster nearest the largest market. If the share of immobile farmers $(1 - \mu)$ in the population is low and/or if transportation costs are low there is no limit to concentration. The problem is that the immobile agents experience reduced welfare as industries concentrate. We can imagine that a federal government[9], concerned about the lowest utility agents, would attempt to correct their situation by setting up transfers. But if a federal authority does not exist, what incentives do the decentralized governments have to stop migration?

1.2. Government Intervention

National governments have only access to domestic national policies. Through these policies, they can redistribute to and from national citizens.

1.2.1. Transfers

The large region government has no motivation here to prevent the concentrated equilibrium: all its citizens[10], farmers and workers, have higher satisfaction when $f = 1$. Indeed, when $f = 1$, all the workers and all the firms are located in Region One and all the manufactured goods are produced in that region where all the inhabitants save the transportation costs and pay only the free on board price[11].

But, in the small region, both farmers and workers become poorer and poorer as migrations proceeds (see Figure n° 1). Therefore, we can assume that this regional government wants to stop migration. One way to do this is to redistribute from farmers to workers in order to ensuring them a higher real wage which induces workers to stay at home.

Consider Region Two's policy of reallocating income to workers from farmers. This reallocation can be implemented by the small region government by means of a linear tax t on farmer's income and a lump sum transfer to workers.

T being the collected amount of the tax, we set:

[8] We assume here that there is zero aversion to inequality.
[9] Or a national government if $i = 1,2$ are regions inside a same region.
[10] In this model, we are not in a congested world because of a located fixed resource leading to diminishing marginal and average products of labour (see, for example, Myers and Papageorgiou, 1994). Indeed, farmers are immobile, but the lack of transportation costs for the agricultural good cancels the farmers' immobility, and then the risk of congestion.
[11] See Figure n° 1 and Appendix 1.

$$T = \left(\frac{1-\mu}{2}\right)t \tag{11}$$

and each worker receives now a total income of R_2:

$$R_2 = W_2 + \frac{\left(\frac{1-\mu}{2}\right)t}{(1-f)\mu} \tag{12}$$

Two questions remain:

- Who decides if transfers are to be made (and how much)?

- If one region, the smaller one, stops migration and prevents the long term equilibrium (characterized by concentration in the other region) what reaction can be expected from the region who otherwise benefits from migration?

1.2.2. Implementation

We use a sequential game approach with finite horizon. At the beginning of each period, in Region Two, the group holding the majority (workers or farmers) chooses the magnitude of the tax, $0 \le t \le 1$, taking the reaction of the other government as given. At the end of each period, workers of {the two regions}, taking the transfers and the location of others as given, can move (or not) to get a higher real wage. From the vantage point of the first decision, Region Two majority fully accounts for the consequences of their decision on the choice of workers[12] and solves the Nash equilibrium. Suppose that there are two periods and that the discount rate is $\delta = 1$. Therefore, Region Two majority chooses, at the first period, the magnitude of the tax for the two periods ($\bar{t}$ at period 1, t' at period 2)[13]; $\bar{t}$ and t' are such that they maximize the majority's expected sum of utilities during the two periods and such that the second period is a long term location equilibrium (without incentive to migrate at the end of period 2).

The problem is a little more intricate by the fact that choosing period 1 and 2 transfers must be time consistent, because the population distribution may change in period 2 in such a way that a new majority would not vote[14] the previous tax t'.

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12 With respect to the information they have.

13 But only $\bar{t}$ is voted and announced at period one. $\bar{t}$ and t' may be equal or not.

14 We assume here that immigrants are granted voting rights as soon as they arrive in the host region. This is realistic if $i = 1,2$, are local regions within a region. Indeed, in many democratic regions, immigrants from foreign regions are granted voting rights only some years after their arrival. Cukierman, Hercowitz and Pines (1993) present a political explanation to this phenomenon.

2. POSSIBLE EQUILIBRIA, AGENTS BEHAVIOR AND POLITICAL CONSTRAINTS

The basic point is to study the incentive of decentralized governments to stop migration by transferring resources from farmers to workers to keep the workers at home and to secure a stable location equilibrium of industrial activities.

As we have two groups of agents, the political decision to tax farmers or not depends on what group holds the majority and on groups' behavior. Let us now make precise these points.

2.1. The Possible Location Equilibria

We consider that a long term location equilibrium exists when workers have no more incentive to migrate. In the basic Krugman's model, without transfers, there are three "natural" location equilibria, namely three population distributions without incentive to migrate: if $f = 1$, $f = 0$ or $f = 1/2$, workers have no more incentive to migrate because, then, they all have the same real wage.

Government interventions allow now other possible location equilibria, for any particular population distribution (like $1 > f > .5$), if transfers equalize workers' utility across region and if workers are myopic.

2.2. Agents' Behavior

Consider two periods. Initially the location of workers is given historically by $f = \bar{f}$, with $.5 < \bar{f} < 1$ and borders are closed to migration. For this particular population distribution, $\bar{S}_l$ and $\bar{S}_2$ are the workers utilities (or real wage) observed in regions 1 and 2, during the first period, $\bar{S}_{al}$ and $\bar{S}_{a2}$ being the farmers' utilities, with $0 \leq \bar{t} < 1$.

At the end of each period, borders are opened and workers calculate whether their interest is to flee toward the other region[15]. If one of them decides to migrate to the actual (or anticipated) "rich" region, he will be followed by the others. We call f' the final population distribution, with S'_1, S'_2, S'_{ai} and S'_{a2} the workers and farmers' utilities in Regions One and Two. We assume that agents can be of two types: myopic or far-sighted.

[15] Assume that workers always prefer to migrate to the actual (or anticiped) higher utility region but that they prefer to stay at home if the actual (or anticipated) utility is the same in the two regions.

2.2.1. Myopic Agents

Myopic agents don't know what could happen concerning prices and incomes when migration occurs. They don't know how real wages change with f.

Myopic workers make decisions on the basis of the *current* observed difference between utilities in the two regions.

1) If the present difference between the two regions' real wages is not counterbalanced by a transfer policy, then workers migrate at the end of the first period from the low utility region to the high utility region. Suppose that we start with $f = \bar{f}\left(1 > \bar{f} > .5\right)$ without transfers, $\bar{t} = 0$, workers in region two see that they are poorer than workers in the big region: they migrate, and the result in period 2 is a natural long term location equilibrium characterized by $f = f' = 1$ (concentration in Region One).

2) If, during the first period, region two government gives an allocation to his workers such that they get the same real wage as workers in region one ($\bar{S}_I = \bar{S}_2$ with $\bar{t} > 0$), then, they stay at home.

Starting with $f = \bar{f}\left(1 > \bar{f} > .5\right)$ this population distribution can be sustained only as long as transfers continue to equalize the utility of workers across regions. This implies, ceteris paribus, that for all period $f = f' = \bar{f}$ with the same transfer than in period one $\bar{t} = t'$, in order to obtain $S'_1 = S'_2 = \bar{S}_1 = \bar{S}_2$.

Since farmers can't leave their region, when they are myopic, they perceives taxes only as current burdens. They completely discount any future benefits of retaining workers. Therefore, myopic farmers prefer $t = 0$.

2.2.2. Far-Sighted Agents

In contrast, far-sighted agents are well informed of how their satisfaction envolves from the first to the second period, if migration occurs. They make their decisions on the basis of a comparison of the expected satisfactions in both periods: *workers* know that migration will improve their satisfaction, because they know that worker's satisfaction is maximum when concentration occurs. Then, they all flee at the end of period 1, even if a transfer *just* equalize $\bar{S}_2$ with $\bar{S}_I$ during the first period. The only case for which far-sighted workers stay in Region Two is when they get a transfer from farmers such that $\bar{S}_2 > \bar{S}_I$ and such that migration occurs in the opposite direction, from Region One to Region Two, so that their own region becomes the "large" region. In particular they must also know that Region One does not react. The result is $f' = 0$ and $\mu = L_2$.

Farmers, in order to agree or not with a transfer that would stabilize (or even attract) workers, compare the expected sum of their utilities $\left(\overline{S}_{a2} + S'_{a2}\right)$ in the two cases, with and without transfers[16]; if workers are myopic, farmers could stabilize the population distribution (if they decide it) with a transfer that just equalize $\overline{S}_1 = \overline{S}_2$. But, because workers can migrate at the end of any period, that transfer must be kept up during the following periods: the threat of migration will be enough to enforce commitment and the result is a location equilibrium $f = f' = \bar{f}$ with $S'_1 = S'_2 = \overline{S}_1 = \overline{S}_2$ and $t' = \bar{t} > 0$.

If workers are far-sighted, farmers know that workers will stay at home only if they succeed in attracting workers from the other region. Therefore the transfer in the first period (if decided) must be such that $\overline{S}_2 > \overline{S}_1$. Then, without response from Region One, the result is $f' = 0$ and $\mu = L_2$; because this result is a natural location equilibrium, during the second period, no more transfer is necessary, and $t' = 0$. But in this case, farmers' decision in period 1 about period two transfers may not be time consistent: majority may change with migration at the end of period 1 and the new majority of workers could vote a tax $t' > 0$.

2.3. Political Constraints

Political constraints are very simple to describe, for, within each group, all the agents are similar:

in Region One, majority belongs to farmers when

$$\frac{1-\mu}{2} > f\mu$$

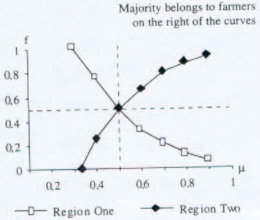
and, in Region Two, when

$$\frac{1-\mu}{2} > (1-f)\mu$$

In Figure n° 3 we see the majority sets for the two regions.

[16] We assume that agents, in both regions have no access to credit markets: no intertemporal smoothing is possible.

Figure n° 3: Majority sets



3. EQUILIBRIA UNDER POLITICAL CONSTRAINTS

Assume that, at the first period, $1 > \bar{f} > .5$.

3.1. Equilibria Without Response of Region One

We assume here that Region One doesn't reply anti-migration policy of Region Two. The probable reason of this absence of reply is that agents in Region One have no information (are myopic).

Proposition 1: *When majority belongs to myopic farmers in Region Two, concentration of workers in the big region occurs, whether workers are myopics or far-sighted. Final equilibrium is $f' = 0$.*

That is obvious from 2.2.1.: when farmers are myopic, they always disagree with a tax decreasing their actual satisfaction. Then, their strategy is $\bar{t} = 0, t' = 0$. Therefore, $\bar{S}_2 < \bar{S}_1$ and workers migrate to region one. At the second period $L_1 = \mu$.

Proposition 2: *When majority belongs to myopic workers in region two, whether farmers are myopic or far-sighted, the final location equilibrium is indeterminate. Concentration in Region Two may occur or not. The magnitude of the tax depends on the workers' discretionary resolution.*

Myopic workers in the small region just want to get the same real income workers get in the large one: they have the choice to migrate or to vote a tax just large enough to obtain that. As they prefer this last case (see footnote 15) their strategy is $\bar{t} = t'$, where the minimum tax rate is given by[17]

$$R_2 = W_2 + \frac{\left(\frac{1-\mu}{2}\right)\bar{t}_{\min}}{(1-f)\mu} \tag{13}$$

Such that $\bar{t}_{\min} = t'_{\min}$ equalize $\bar{S}_2 = \bar{S}_l = S'_1 = S'_2$. Obviously, if workers are less naïve, they can vote a larger tax that depends on the farmers' willingness to pay or revolt. But, if myopic workers decide a tax $\bar{t}$ larger than the minimum tax, then $\bar{S}_2 > \bar{S}_l$ and migration occurs (without region two workers deciding it) from Region One to Region Two, and $f' = 0$. And, during the second period, the numerous workers can hold any tax, although it becomes useless as a means to prevent migrations.

Proposition 3: *When majority belongs to far-sighted workers in Region Two, the final equilibrium is a* ***concentration*** *of* ***all the workers in Region Two****, whether farmers are myopic or far-sighted. Final equilibrium is $f' = 0$. The magnitude of the tax is indeterminate.*

Workers in Region Two know that their satisfaction reaches a top when complete concentration occurs $f' = 1$ or $f' = 0$. Further, they will not be induced to stay at home by a transfer that just guarantees $\bar{S}_l = \bar{S}_2$ with $\bar{f} = f'$, because they know that, if they migrate to the large region, their real wage will be higher and higher, until $f' = 1$. But they know that they will reach the same utility if $f' = 0$. So, to keep workers at home, the small region's government has to guarantee $\bar{S}_2 > \bar{S}_l$, in order to attract region one's workers and become the large region ($f' = 0$).

Because Region One doesn't reply, to attract foreign workers, Region Two only needs to advertise, in the first period, a higher real wage for his home workers, then to tax farmers' income and redistribute to his workers, sufficiently to obtain $\bar{S}_2 = \bar{S}_l + \varepsilon$ [18]. Then, migration occurs from Region One to Region Two. Taxation could be abolished during the second period, because $f' = 0$ is a natural equilibrium. Therefore the majority of workers' strategy could be, in the first period, $\bar{t}$ just large enough to guarantee $\bar{S}_l < \bar{S}_2$, and $t' = 0$ in the second

[17] See, in Appendix 2, the sensitivity of the minimum tax rate to the parameters.
[18] Where $\varepsilon > 0$, $\varepsilon \to 0$.

period. But if workers are selfish and grasping, they also can vote any larger tax[19] for the two periods because they are sure to keep the majority voting power. That decision depends again of the farmers' willingness to pay or to revolt. Note, at last, that with $f = 0$, Region One's farmers become the victims of reverse concentration.

Proposition 4: *When majority belongs to far-sighted farmers in Region Two.*

1. if $\mu < 1/3$, whether workers are myopic or far-sighted, the final equilibrium is $f' = 0$.

When $\mu < 1/3$, farmers in Region Two are sure to keep majority even with $f' = 0$ (see Figure n° 3) and their strategy is to vote a tax $\bar{t} = \min \bar{t} + \varepsilon$ during period 1, just enough to obtain $\bar{S}_2 = \bar{S}_1 + \varepsilon$ and $t' = 0$: during the second period taxation is useless because $f' = 0$ is a natural location equilibrium. Farmers are sure that these decisions will be time consistent.

2. if $\mu > 1/3$ and workers are far-sighted, the final equilibrium is $f' = 1$.

With far-sighted workers, the only possible equilibria are $f' = 0$ or $f' = 1$. But if $\mu > 1/3$, farmers loose majority when $f' = 0$ (Figure n° 3) and they fear that the new majority of workers maintain taxation during period 2, voting $t' > 0$. Therefore, farmers' strategy is $\bar{t} = 0, t' = 0$ and $f' = 1$ because they prefer to secure their reservation income ($R_{a2} = 1$).

3. if $\mu > 1/3$, and workers are myopic, the final equilibrium is $f' = \bar{f}$ or $f' = 1$. It depends on the value of the parameters (μ and r) and on $\bar{f}$.

Farmers could stabilize the population distribution, voting $\bar{t} = t'$ just enough to ensure $\bar{S}_1 = \bar{S}_2$ and keep $f' = \bar{f}$. The other strategy is to reject taxation, $\bar{t} = 0$, and $f' = 1$. They choose the strategy to maximize $E(\bar{S}_{a2} + S'_{a2})$. The result depend on μ, r and $\bar{f}$ (see Appendix 3). The second strategy ($\bar{t} = 0$) is optimal when μ and $\bar{f}$ are large. When a majority belongs to farmers, if a government wants to stop migration, it must act before $\bar{f}$ and μ are not too large.

19 The maximum tax is $1 - \varepsilon$, $\varepsilon > 0$ and $\varepsilon \to 0$, because farmers must not loose their whole income.

3.2. Equilibria when Region One reacts

Assume now that Region One reacts to Region Two taxation policy: as soon as the little region decides transfers, the big one decides also transfers in order to counteract Region Two's strategy.

Proposition 5: *When majority belongs to far-sighted workers in Region Two, whether farmers are myopics or far-sighted, the final cooperative is $f' = 5$.*

Region Two knows that the other region will reply and because it takes this reaction as given the war strategy would be to give the greatest allocation to its workers, charging a maximum tax on farmers. In Region One, workers have also political majority (see Figure n° 3), and government replies, charging also a maximum tax on farmers. The winner of this "war" would be the region that can finally give the largest income to its workers, each one being limited in its transfers by the income of its farmers:

- In each region the maximum lump sum transfer is:

$$T = \left(\frac{1-\mu}{2}\right)(1-\varepsilon)$$

Therefore, the maximum nominal income for a worker would be, in Region One, during the first period

$$\overline{R}_1 = W_1 + \frac{\left(\frac{1-\mu}{2}\right)(1-\varepsilon)}{\bar{f}\mu}$$

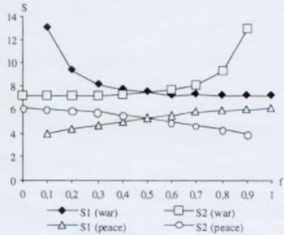
- and in Region Two:

$$\overline{R}_2 = W_2 + \frac{\left(\frac{1-\mu}{2}\right)(1-\varepsilon)}{\bar{f}\mu}$$

Remember that $\bar{f}$ is the proportion of workers in region one. Since W_i are endogenous with respect to f, the required transfers must be computed numerically. All simulations show that the small region is always able to offer to its workers a larger real wage than in the big one in case of war transfers[20] (see Figure n° 4).

[20] Access to capital markets is not allowed. Indeed international borrowing could change our conclusions: it seems that the big region could borrow in the first period. Gourinchas (1994) emphasizes that borrowing regions have a lower expected total income and that, with perfect access to capital markets, decentralised fiscal policy is ineffective.

Figure n° 4: Workers' satisfaction in cases of peace and war ($\mu = .7, r = .5$)



Since $\overline{R}_1 < \overline{R}_2$, at the end of period one with this strategy, workers of Region One have incentives to migrate to Region Two which then becomes the big one. Region One, looser of the battle during the first period is now the small country, able to win the battle during the next period. Each government, taking the strategy of the other as given, is reduced to choose a cooperative strategy from the beginning of the game, in order to obtain the unique location equilibrium, $f' = .5$. That can be implemented by a transfer during the first period in Region Two (no transfer in Region One) such that $\overline{S}_1 < \overline{S}_2$, the two governments binding themselves to fix quotas for migration at the end to the first period (such that $f' = 5$) and to vote exactly the same tax, $0 \le t' \le 1 - \varepsilon$, during the following periods. The threat of reprisals is enough to enforce commitment. It is interesting to note that governments need not to hold taxation to maintain equilibrium. Therefore, $f' = 5$ is a long term equilibrium. The choice to tax (or not) farmers during the following periods (at the same level) in the two regions depends on workers' discretionary decision.

Proposition 6: *When majority belongs to far-sighted farmers, in Region Two, whether workers are myopic or far-sighted, the final cooperative equilibrium is $f' = .5$ if $\mu < .5$. But, concentration occurs in Region One and the final equilibrium is $f' = 1$, if $\mu \ge .5$.*

Far-sighted farmers in Region Two, taking the Region One's reaction as given, know that a cooperative strategy is the only strategy leading to an equilibrium $f' = 5$. *If* $\mu < 5$, they are sure to keep majority when $f' = .5$, then their strategy is $t = \bar{t}$, such that $\bar{S}_1 < \bar{S}_2$, during the first period and $t' = 0$ during the following periods (with an agreement between the two governments about quotas for migration such that $f' = .5$ and $t' = 0$. But, if $\mu > .5$, far-sighted farmers know that workers have majority in *each regions* when $f' = .5$ (Figure n° 3) and then could set them any discretionary tax during the following periods. Therefore they prefer to secure their reservation income $R_{a2} = 1$ and let workers migrate to Region One. Their strategy is $\bar{t} = t' = 0$ and $f' = 1$.

4. CONCLUSION

The aim of this paper was to study migration issues and the incentives of decentralized regional governments in a Krugman type increasing returns model. Trying to capture the political economy of migration, we stress several results:

1) A democratic region is not always able to prevent its industrial activities from leaving. It is the case when a majority of immobile agents fear to be heavily taxed and prefer to secure their reservation income;

2) Without reaction of the departure region, a non cooperative strategy of a decentralized government can lead to induce migration in opposite side: the concentration occurs in the other region and the same problem about immobile agents' welfare follows naturally;

3) Decentralized governments often leads mobile agents majorities to set discretionary taxes on immobile agents. The magnitude of the transfers is undetermined;

4) In the case of cooperative game, local governments can avoid concentration, but, because of increasing returns, this equilibrium is not a social optimum. Furthermore, the immobile agents' welfare is threatened with workers' discretionary decisions;

5) These results lead to the conclusion that in a Krugman type increasing returns world, without negative external effects of industrial concentration, a federal government (or a centralized government, in the case of regions inside one nation) is necessary to prevent disoderly strategy of decentralized governments: such a federal authority could guarantee an efficient exploitation of increasing returns to scale, while canceling the harmful effects of concentration on immobile agents, by transfers from the rich to the poor region.

Future research

Studying migration issues and the incentives of federal or decentralized governments is definitely worth exploring. This paper raises a lot of problems. Much remains to be done. First, the framework of the paper is based on characterizing a social optimum by maximizing an utilitarian welfare function. It would be interesting to consider the case where one has a high aversion to inequality. Second, in this model, immobile agents are completely idle in front of workers' discretionary decisions especially because they are on a competitive market and because industrial transportation cost is higher than agricultural one. We would like to imagine other farmers' strategy: for example a federal government could give them incentives to produce differentiated goods or to have collusive strategy.

Finally, it would be profitable to remain more long over some aspects of political economy of migration, like the timing of voting grant rights or the possibility to use different contracts with different vintage of immigrants or with immigrants and regional agents.

APPENDIX 1

Agent's satisfaction without governments' intervention

Real wage and satisfaction are equivalent is this model.

1) For every value of f, different from the natural long term equilibria, we can write with (1), (2), (3), (5) and (7) and with the maximization of agents utility subject to their budget constraint[21], for each worker in Region One

$$S_1 = \mu^{\mu}(1-\mu)^{1-\mu}.R_1\left(n_1\left(\frac{1}{n_1 p_1 + p_1^{\sigma}\left(\frac{p_2}{r}\right)^{1-\sigma} n_2}\right)^{\frac{\sigma-1}{\sigma}} + n_2\left(\frac{r}{n_2 p_2 + p_2^{\sigma}(p_1 r)^{1-\sigma} n_1}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\mu\sigma}{\mu-1}} \qquad (14)$$

and for each worker in Region Two

$$S_2 = \mu^{\mu}(1-\mu)^{1-\mu}.R_2\left(n_1\left(\frac{r}{n_2 p_2 + p_1^{\sigma}(p_2 r)^{1-\sigma} n_2}\right)^{\frac{\sigma-1}{\sigma}} + n_2\left(\frac{1}{n_2 p_2 + p_2^{\sigma}\left(\frac{p_1}{r}\right)^{1-\sigma} n_1}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\mu\sigma}{\mu-1}} \qquad (15)$$

Where R_1 and R_2 are workers' income in Region One and Two. Without transfer, $R_1 = W_1$ and $R_2 = W_2$. If $1 > f > .5, W_1 > W_2, n_1 > n_2$ and $S_1 > S_2$.

[21] See Calmette and Le Pottier, 1995.

Farmers' satisfaction are, in Region One:

$$S_{a1} = \mu^{\mu}(1-\mu)^{1-\mu} W_{a1}\left(n_1\left(\frac{1}{n_1 p_1 + p_1^{\sigma}\left(\frac{p_2}{r}\right)^{1-\sigma} n_2}\right)^{\frac{\sigma-1}{\sigma}} + n_2\left(\frac{r}{n_2 p_2 + p_2^{\sigma}(p1r)^{1-\sigma} n_1}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\mu\sigma}{\mu-1}} \tag{16}$$

and in Region Two:

$$S_{a2} = \mu^{\mu}(1-\mu)^{1-\mu} W_{a2}\left(n_1\left(\frac{1}{n_1 p_1 + p_1^{\sigma}(p2r)^{1-\sigma} n_2}\right)^{\frac{\sigma-1}{\sigma}} + n_2\left(\frac{r}{n_2 p_2 + p_2^{\sigma}\left(\frac{p1}{r}\right)^{1-\sigma} n_1}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\mu\sigma}{\mu-1}} \tag{17}$$

without taxation $(\bar{t} = 0)$, $W_{a1} = W_{a2} = 1$ (see (5)).

2) When $f = 1$, we have:

$L_1 = \mu$, $n_2 = 0, n_1 = \dfrac{\mu}{\alpha\sigma}$, $w_1 = p_{a1} = p_{a2} = 1$ and $p_1 = \dfrac{\sigma\beta}{\sigma - 1}$.

Then, all the agents, workers and farmers, in Region One have the same satisfaction:

$$S_1 = S_{a1} = (1-\mu)^{1-\mu}\left(n_1\left(\frac{\mu}{n_1 p_1}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\mu\sigma}{\sigma-1}}$$

But farmers' satisfaction in Region Two is:

$$S_{a2} = (1-\mu)^{1-\mu} \left(n_1 \left(\frac{\mu r}{n_1 p_1} \right)^{\frac{\mu\sigma}{\sigma-1}} \right) \tag{18}$$

and $S_{a2} < S_1$ since $r < 1$.

3) When $f = \frac{1}{2}$, we have, without taxation:

$$n_1 = n_2 = \frac{\mu}{2\alpha\sigma},\ W_1 = W_2 = P_{a1} = P_{a2} = 1,\ P_1 = P_2 = \frac{\sigma\beta}{\sigma-1}$$

All the agents in the two countries have the same satisfaction:

$$S = (1-\mu)^{1-\mu} \left[\left(n_1 \left(\frac{\mu}{n_1 p_1 \left(1 + r^{\sigma-1}\right)} \right)^{\frac{\sigma-1}{\sigma}} \right) + \left(n_2 \left(\frac{\mu r}{n_2 p_2 \left(1 + r^{1-\sigma}\right)} \right)^{\frac{\sigma-1}{\sigma}} \right) \right]^{\frac{\mu\sigma}{\mu-1}}$$

APPENDIX 2

The sensitivity of the minimum tax rate to the parameters

When Region Two government wants to just stabilize the population distribution, he only needs to vote a tax that equalize $\bar{S}_1 = \bar{S}_2$ in (14) and (15). The minimum tax rate is given by:

$$R_2 = W_2 + \frac{\left(\frac{1-\mu}{2}\right)\bar{l}}{(1-f)\mu} \tag{12}$$

such that $\bar{S}_1 = \bar{S}_2$.

When government wants to attract the other region's workers, he must vote a tax such that $\bar{S}_1 < \bar{S}_2$, namely the minimum tax $+\varepsilon$.

The minimum tax depends on the parameters:

- The tax rate is decreasing with r, μ being given: when transportation costs are high, the real wage in the small region is low because national consumers have to pay these costs on imported products. Then, the difference $S_1 - S_2$ is large, so government has to give a large allocation to workers to keep them in the region.

- The tax rate is increasing with μ, no matter how high transportation costs are. That is obvious from (12) and (13): if μ is large, farmers become few and each of them has to be more taxed to redistribute to the numerous workers ; further, the share, μ, of the total expenditures to manufactured goods, and then the imported consumption, is more important.

- When f is increasing, two forces play in opposite side. First, $S_1 - S_2$ is increasing with f because the large region workers become richer and region two workers demand a large allocation in order to stay. But, when f becomes near one, workers in Region Two are few and the immobile farmers may be less taxed.

APPENDIX 3

Farmers' choice

Assume that events unfold as follows: in Region Two, farmers have to compare two strategies.

First strategy

Farmers reject taxation $\bar{t} = 0$. Then, in the first period, with $f = \bar{f}$, their satisfaction is $S_{a2}\left(\bar{t} = 0, f = \bar{f}\right)$ defined by (17), with $W_{a2} = 1$. And, because $\bar{S}_1 > \bar{S}_2$, in the second period, all the workers are in Region One, $f' = 1$, and farmers in Region Two have to pay transport costs on all the industrial goods. Therefore, their satisfaction is:

$$S'_{a2}\left(t' = 0, f' = 1\right) \text{ defined by (12)}$$

Second strategy

Farmers vote taxation $\bar{t}$ (minimum tax rate). Then, in a first period, with $f = \bar{f}$, farmers pay a tax $\bar{t}$ defined by (13) and their satisfaction is $\bar{S}_{a2}\left(t = \min \bar{t}, f = \bar{f}\right)$ defined by (17), with $W_{a2} = 1 - \bar{t}$. Then, $\bar{S}_1 = \bar{S}_2$, because transfers just equalize workers' satisfaction in the two regions and migration doesn't occur if workers are myopic. At the second period, $f' = \bar{f}$, but farmers have to go on with taxation and their satisfaction is again

$$S'_{a2} = \bar{S}_{a2} \text{ with } t' = \min t' \text{ and } f = \bar{f}$$

The problem for farmers is to compare the anticipated utilities of the two strategies.

If:

$$\bar{S}_{a2}\left(\bar{t} = 0, f = \bar{f}\right) + S'_{a2}\left(t' = 0, f' = 1\right) > \bar{S}_{a2}\left(t = \min \bar{t}, f = \bar{f}\right) + S'_{a2}\left(t = \min \bar{t}, f = \bar{f}\right)$$

then, farmers choose the first strategy. They choose the second strategy in the other case and migration is stopped.

Farmers' decision depends on μ and r. Clearly, during the first period, farmers are poorer with the second strategy.

Because of the sensitivity of the minimum tax rate (Appendix 2), we can say that min$\bar{t}$ (and, therefore, the farmers' sacrifice) is increasing with μ and decreasing with r. During the second period, in second strategy, farmers' satisfaction is exactly the same than in period one. In the first strategy, we can see in (18), that S'_{a2} is increasing with r and μ for the admissible values of parameters. The relation with r is obvious; but the relation with μ runs counter the intuition that farmers in Region Two will be poorer when the share of industry is large. Actually we have here a price effect: when $f = 1$, and μ is large, the farmers in Region Two do have to import a large number of industrial good and to export agricultural good; but the price of this agricultural good is always equal to one, and because of the balance of payments, the industrial goods price has to decrease as soon as μ is increasing.

In conclusion, we can say that farmers in Region Two choose taxation policy only when μ and f are low:

- first, because, in that case, the minimum taxation rate is lower and the sacrifice not too big,

- second, because if they don't choose to be taxed in the first period, then, in the second period their satisfaction will be worst.

About r, the conclusion is more ambiguous: on the one hand, $\bar{t}$ is high when r is low and farmers will hesitate to agree with the transfer. On the other hand, if they don't transfer, their real wage at the second period will strikingly decrease with a high transport cost.

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MIGRATION DE LA MAIN D'ŒUVRE ET POLITIQUES DE TRANSFERTS INTRA-RÉGIONAUX

Résumé - *Nous considérons un modèle à deux régions et deux secteurs, "à la Krugman", dans lequel il y a tendance à la concentration géographique des activités. Nous montrons que les autorités, à l'intérieur de chaque région, peuvent combattre cette tendance par une politique de "transferts compétitifs". Dans de nombreux cas, cela conduit à des équilibres tels que ceux qui résultent de la concentration leur sont préférables. Une conclusion est que l'optimum social ne peut être rétabli que par un gouvernement de type fédéral.*

MIGRACION DE LA MANO DE OBRA Y POLITICAS DE TRANSFERENCIAS INTRA-REGIONALES

Resumen - *Consideramos un modelo a dos regiones y dos sectores "a la manera de Krugman", en el cual hay una tendencia a la concentración geográfica de las actividades. Mostramos que las autoridades, al interior de cada región, pueden luchar contra esta tendencia gracias a una política de "transferencias competitivas". En numerosos casos, esto conduce a equilibrios peores que se les prefieren los que resultan de la concentración. Una conclusión es que el óptimo social sólo puede ser restablecido por un gobierno federal.*