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Market Integration, Scale Economies and Labor Market Imperfection in an Applied General Equilibrium Model

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ABSTRACT. – This paper provides general-equilibrium estimates of the welfare gains and unemployment changes that may be expected from the single European market. The investigation uses a multicountry, multisector applied model with imperfection. The analysis is performed assuming three alternative wage determination mechanisms (flexible wages, wage indexation and efficiency-wage model). Labor market imperfection allows for the existence of involuntary unemployment rate. The main contribution in the paper is that economic integration could imply deterioration in employment in Europe.

Processus d'intégration, économies d'échelle et imperfection du marché du travail dans un modèle d'équilibre général appliqué

RÉSUMÉ. – Cet article évalue les conséquences sur le bien-être et l'emploi du processus d'intégration européen. On utilise un modèle d'équilibre général appliqué multi-pays, multi-sectoriel en concurrence imparfaite. Sur le marché du travail, différentes hypothèses sont formulées (plein-emploi, rigidité des salaires réels et salaire d'efficience), ce qui permet d'introduire un taux de chômage involontaire. L'article montre que le processus d'intégration s'accompagne d'une détérioration de la situation de l'emploi en Europe.

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1 Introduction

Trade liberalization in a group of countries or an economic region, achieved by removing tariff of non-tariff barriers, is a major field of research in international economics. Applied general equilibrium models are particularly appropriate in this field since the analysis of the behavior of different types of agents in many countries is required. The stake in economic integration is high: one has to determine the output and employment perspectives implied by trade liberalization in a common economic space.

Recently, many attempts to provide general equilibrium welfare estimates of Europe's move to a unified market [1] have shown that it was necessary to give up perfect competition assumptions when analyzing market integration. These models have therefore allowed a renewal of this field of research introducing imperfect market structures.

However, the analysis of integration needs to be enriched with work on non-clearing labor markets. For this reason, we build a multicountry multisector applied general equilibrium model with endogenous imperfect market structure in the labor market. More precisely we introduce an involuntary unemployment rate that is determined endogenously in an efficiency-wage framework. Our model allows considering new features on the consequences of integration on employment in Europe. With trade liberalization, the usual scenario tells us that the rationalization effect à la HARRIS [1984] and the pro-competitive phenomena entail a total output increase in the major European countries. When introducing an imperfection in the labor market, this output increase may not be high enough to ensure employment recovery in Europe. Our aim is to measure these effects and analyze how they combine to affect the level and pattern of welfare, production, and employment.

The paper is organized as follows. The first section presents the structure of the basic general equilibrium model upon which the analysis of economic integration is based. This basic model assumes flexible wages and full-employment (2). In section three, we give up this perfect labor market framework and introduce two alternative wage-determination assumptions. These assumptions allow estimating the consequences on employment of the completion of the single European market (3). Finally, the calibration procedure and the results of our numerical experiments are reported in section four (4). The paper ends with a brief conclusion.

1. SMITH and VENABLES [1988], GASIOREK, SMITH and VENABLES [1992], BURNIAUX and WAELBROECK [1992], MERCENIER [1995].

2 The Basic Model

We here provide only a brief unformal description of the basic model (see Appendix A for a formal description).

The model we use is a static European economy model consisting in five countries/regions: France (FRA), the Federal Republic of Germany (DE), Great-Britain (GB), Italy (ITA) and the rest of EEC10 (REEC). Each country has height industries (see table 1), of which one is treated as perfectly competitive, $s \in C$. In this competitive sector, we assume that commodities are differentiated in demand upon the basis of their geographical origin (the ARMINGTON assumption). The other seven industries, $s \in NC$, operate with increasing returns to scale in non-competitive markets, each firm producing a different commodity. Final demand decisions are made in each country by a single representative utility-maximising consumer. A detailed country and sector-specific system of price-responsive intermediate demands is specified. All components of demand – final as well as sector-specific intermediate – recognize differences in products from individual oligopolistic firms à la DIXIT and STIGLITZ [1977]. Both production factors are assumed to be mobile across sectors [2], with country specific labor and international capital mobility.

From a theoretical point of view, the concept of general equilibrium used here is a compromise in terms of informational requirements between the primitive conjectural COURNOT-NASH equilibrium pioneered by NEGISHI [1961] and the objective COURNOT-NASH-WALRAS equilibrium as first introduced by GABSZEWICZ and VIAL [1972]: non-competitive firms are assumed to maximize their profits using the objective (or "true") demand curves they face, but also to neglect the feedback effect of their decisions on their profits through income (the FORD effect). This partial equilibrium compromise, advocated among others by HART [1985], play a major role in reducing the risk of nonexistence of equilibrium, as stressed by ROBERTS and SONNENSCHEIN [1977] [3]. Moreover, it provides realism to the analysis as well as computational advantages. In the applied general equilibrium literature, this approach has been adopted by MERCENIER [1995].

Due to previous results obtained in the literature, we use this general equilibrium concept assuming that the static game played by firms in imperfectly competitive sectors is Nash in output (à la COURNOT [4]). Industry structure is assumed to be fixed in the short run (the number of firms remains constant); oligopolistic firms can therefore experience nonzero profits. In

2. This assumption will be withdrawn later for the labor market in section 3.

3. As a matter of fact, in general equilibrium models, existence proofs can only be given under very specific assumptions on the behaviour of consumers and producers which are generally too restrictive for applied modelling.

4. Though the model may be simulated with BERTRAND-NASH competition, the results of the numerical experiments show that this case is of little interest, because firms then enjoy almost no power to price discriminate.

the long run, however, the entry and exit of competitors in a Chamberlinian fashion ensure that these rents vanish (variable market structure).

The scope of our investigation requires a precise definition of economic market integration. Following SMITH and VENABLES [1988], we assume that there are no tariff barriers remaining in Europe, or at least that they are small and can therefore be neglected. In contrast, significant non-tariff barriers (NTBs) remain – such as norms, government-procurement policies, security regulations, etc. These barriers prevent consumers from equalizing cross-border prices through arbitrage, and firms are able to price discriminate among segmented domestic markets. The ultimate goal of the "1992" programme is to restore cross-border arbitrage by eliminating all forms of NTBs, forcing firms to act on an integrated EEC-wide basis and charge the same price within the Community. The difficulty in describing the integration process stems from complex formalisation and quantification of NTBs in an applied general equilibrium model.

The approach developed here is based upon the analysis of MERCENIER [1995]. Indeed, his modeling strategy consists in treating these NTBs as latent variables, underlying the existence of price-discrimination opportunities for firms among national clients before trade liberalization is enforced. This being admitted, using the data set makes it possible to infer the price-system consistent with the optimal price-discrimination strategies of oligopolistic firms, and to interpret these as resulting from the implicit structure of non-tariff barriers.

The experiments then consists in enforcing individual firms to move to a single pricing rule determined on the basis of their average EEC-wide monopoly power, and to interpret this behavioral change as the optimal strategic reaction to the disappearance of the never-explicitly-modeled NTBs.

In this model, we adopt this type of formalisation. This modeling strategy gives priority to the description of complex market integration mechanisms (economies of scale, differentiation of products, degree of concentration, etc.), hardly compatible with complete formalisation of explicit NTBs.

3 Labor Market Imperfections: Introducing Price Rigidity

In the previous section, we assumed the existence of competitive input markets implying that producers consider the price of factors as given. In this case, the economy is characterized by full-employment of inputs: supplies and demands adjuts ruled by factors' price variations. Of course, this is an extreme unrealistic representation of European economies. There is therefore crucial need for improving the analysis of integration in applied general equilibrium models with imperfect competition with work on non-clearing labor markets.

A more realistic approach is to introduce imperfect input markets to reflect stylized features in most industrialized countries. In particular, a general equilibrium model should be able to capture the effects of integration on employment.

In order to allow for a gap between supply and demand on the labor market, the structure based upon the walrasian model needs to be relaxed. In fact, we can no longer assume that factor prices clear the labor market. On the contrary, we have to assume that adjustments are constrained by a degree of price rigidity. In this model, two alternative rigid price assumptions are introduced:

- a real wage rigidity procedure (1);
- a price-fixing mechanism based on individual behavior with the determination of efficiency wages (2).

By introducing alternative assumptions on the input market, the model is built as a structured succession of improving experiments. Our aim is to explore the implications of each assumption and to identify the role of assumptions in determining the outcome of simulations [5].

3.1. **Stylized Facts and Structural Constraints: Rigid Real Wages**

Here, we introduce constraints to relax the perfect factor mobility assumption and to assume real wage rigidity in a rather "ad hoc" manner. In the short term, the implicit time scale behind the assumption of fixed industry structure (the number of firms on each market is exogenous) identifies a short-run equilibrium consistent with the rigidity of labor mobility assumption. In contrast, when the two assumptions of entry/exit and rigid real wages are simultaneously implemented, it is difficult to justify both the creation and destruction of new firms – which takes time – and the fixity of real wages. So, we specify labor market assumptions which enable us to link the short-run equilibrium with that of the long run [6].

In the short run, real wages are assumed to be fixed and the level of employment is thus determined endogenously. We introduce this assumption for the case of fixed industry structure by substituting the following block to the labor market balance equation (see equation A10 in appendix A):

$$\frac{w_i}{Icv_i} = \frac{w_i^0}{Icv_i^0} \qquad \forall\, i \in W$$

where Icv_i, w_i denote, respectively, the consumer price index and the labor unit cost in country i, with W standing for the set of all countries. The symbol ^{0} refers to reference year values.

We then assume that, in the long run, i.e., when complete adjustment of industry structure is achieved, wages adjust to maintain employment at the level inherited from the short run.

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5. As pointed out by an anonymous referee, by introducing labour market assumptions, we modify general-equilibrium effects (specifically on the demand side) and consequently the results of these experiments.

6. This treatment is, to a certain extent, similar to the one adopted by ERLICH, GINSBURGH and VAN DER HEYDEN [1987] in a two-period framework and has been used also by MERCENIER [1995] and AKITOBI [1994].

The drawback of this approach is that, in fact, it doesn't allow taking long-term consequences of integration into account, even if the model used is dynamic. Indeed, the long-term simulation assumes that structural constraints on the labor market are eliminated and cannot provide a theoretical explanation of their presence. However, the most severe criticism is that real wage rigidity is assumed, a priori, instead of resulting from endogenous optimization behavior. In fact, this modeling specification may be considered as "ad hoc" since no theoretical element can justify this rigidity. So, our aim is to represent labor market rigidities based on microeconomic foundations thereby embedding the basic multisector model into a wage-efficiency framework [7].

3.2. An Alternative Approach of Labor Market Imperfection: The Labor Turnover Model

Our aim here is to introduce an endogenous theory of labor market imperfection in the basic multisectoral, multicountry model. We use the microeconomic foundations of the turnover model first developed by STIGLITZ [1974]. This modeling assumption has the advantage of providing a helpful tool to describe labor market imperfections which is fully consistent with walrasian microeconomic foundations. Indeed, the turnover model is based upon individual optimization behavior. Also, of all the efficiency wage models, the turnover model is possibly the oldest, the most intuitive, and one of the most widely regarded as being a major cause of unemployment. Here, we only provide the main elements of this theory allowing us to integrate an imperfect labor market framework into our basic model.

With initial partition between competitive and imperfectly competitive sectors, we also assume that the labor market is partitioned into two subsets of competitive and non-competitive labor markets. Besides, labor mobility in the global market in each country is assumed to be imperfect.

- In the competitive industry, and in each country, "*competitive wages*" are assumed to adjust instantaneously to ensure full-employment.
- In non-competitive industries, the introduction of a turnover cost in total production cost of oligopolistic firms acts as an incentive to arbitrate: higher wages are offseted by lower training and hiring costs. The result is the determination of an *efficiency wage* level in non-competitive sectors that imply an equilibrium level of (involuntary) unemployment.

Because of availability constraints on wage differential data, we assume the existence of a single nominal wage rate for all non-competitive sectors in each country (wim_i). In this case, labor costs are equal to wage payments plus training and hiring costs, and therefore the total labor cost of the representative non-competitive firm of sector $s \in NC$ is:

$$CT_{is} = \text{wage payments} + \text{turnover costs} = wim_i L_{is} + T.q(.).L_{is}$$

7. Another possibility would be to introduce wage-fixing mechanisms such as Oswald's [1982] type of bargaining between unions and employers (on this point, see the analysis of GELAUFF *et al.* [1990]). Also, DE MELO and TARR [1993] introduce labor unions selectively into a standard CGE model with imperfect competition.

where

L_{is} is the quantity of labor used by the producer in sector s in country i;

T are training-hiring costs per worker that are assumed, for simplicity, to be constant;

$q(.)$ is the quit rate, i.e., the percentage of the labor force quitting at any time;

wim_i is the wage rate paid in non-competitive sectors in country i.

The turnover-efficiency-wage model highlights the turnover rate to explain worker behavior in the economy. The turnover rate is a decreasing function of wage rate differential between non-competitive sectors and the competitive sector. Therefore, there are incentives for each firm in the non-competitive sectors to pay higher wages (compared to competitive wages). Indeed, if there is a large wage differential between the non-competitive wages and the competitive wages, workers will be encouraged to stay in the firm and not to quit. On the contrary, a low wage differential is an incentive for workers to migrate.

Moreover, when an individual is hired by a firm, there is some probability that he may be unsuitable for the job (so will be fired) or that he will dislike the job and therefore seek another one. The ease with which this is accomplished depends on the unemployment rate.

So, it appears clearly that the unemployment rate in the imperfect labor market (U_i) and the wage differential (wim_i/wo_i) belong to the labor turnover function:

$$q_i = q\left(\frac{wim_i}{wo_i}, U_i\right) \quad \text{with} \quad \frac{\partial q_i}{\partial\left(\frac{wim_i}{wo_i}\right)} < 0 \quad \text{and} \quad \frac{\partial q_i}{\partial U_i} < 0$$

We form specific assumptions about the functional form of the quit rate function. More precisely we impose some restrictions ou our quit-rate function (convexity of $q(.)$. with its arguments (wim_i/wo_i) and U_i). Theoretically, there is a relationship between the magnitude of wage differential and the equilibrium rate of unemployment. Indeed, if there are large differences in wage rates between the non-competitive and competitive sectors, labor will migrate from the competitive to the imperfect competition sectors. More individuals will migrate if they can find jobs, and this leads to an increase in unemployment in non-competitive industries. In fact, unemployment tends to discourage further migration.

We can write this positive relationship $\phi(U_i)$ as,

$$\frac{wim_i}{wo_i}(U_i) = \phi\left(\frac{1}{1-U_i}\right) \tag{1}$$

$$\text{such that} \begin{cases} \phi\left(\dfrac{1}{1-U_i}\right) = \dfrac{\alpha}{1-U_i} \qquad \text{with} \quad \alpha \geq 1 \\ \text{and} \\ \dfrac{d\phi(U_i)}{dU_i} = \dfrac{\alpha}{(1-U_i)^2} > 0 \end{cases}$$

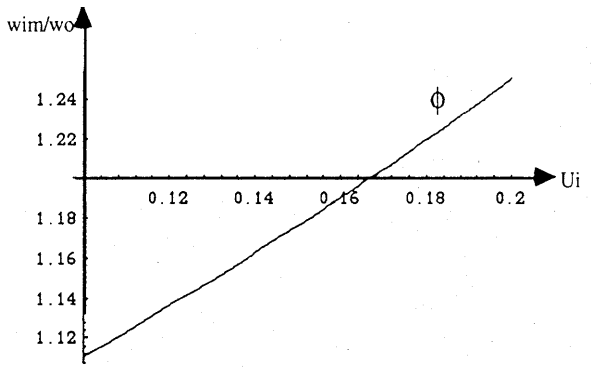

FIGURE 1

Unemployment rate and wage differential.

The considered quit rate function is assumed to be identical in all non-competitive industries. However, due to our country labor mobility assumption, we assume that there is a quit rate function in each country (q_i):

$$(2) \qquad \begin{cases} q_i\left(\dfrac{wim_i}{wo_i}, U_i\right) = q_i\left(\phi\left(\dfrac{1}{1-U_i}\right), U_i\right) \\ q_i\left(\phi\left(\dfrac{1}{1-U_i}\right), U_i\right) = \dfrac{a_i}{\log\left(\phi\left(\frac{1}{1-U_i}\right)\right)} \\ \qquad\qquad\qquad = \dfrac{a_i}{\log\left(\frac{1}{1-U_i}\right)} \qquad \text{with} \quad \alpha = 1 \end{cases}$$

According to the basic assumptions of the turnover model, the quit-rate function is, for a given parameter a_i, a decreasing convex function of the unemployment rate in all non-competitive sectors [8].

Quit rate worker behavior depends on the difference between the competitive and non-competitive wages: we assume that an increase in the wage differential decreases the wage differential sensitivity of the quit rate.

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8. Indeed, we have,

$$\frac{\partial q_i(U_i)}{\partial U_i} = -a_i(1-U_i)^{-1}\left[\log\left(\frac{1}{1-U_i}\right)\right]^{-2} < 0 \qquad \forall\, 0 \le U_i < 1$$

and,

$$\frac{\partial q_i^2(U_i)}{\partial U_i^2} = a_i\left(2 - \log\left(\frac{1}{1-U_i}\right)\right)(U_i - 1)^{-2}\left[\log\left(\frac{1}{1-U_i}\right)\right]^{-3} > 0$$

$$\forall\, 0 \le U_i < \delta \quad (\delta \approx .87).$$

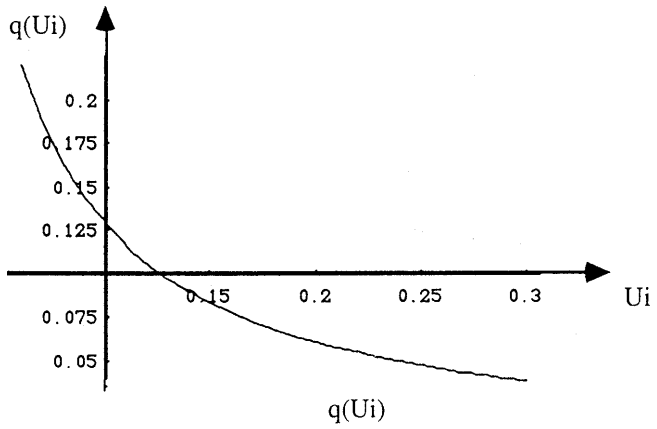

FIGURE 2

The quit rate function.

It implies that the wage differential elasticity of the quit rate ($Eq_{(wim/wo)}$) is an increasing (negative) function of (wim_i/wo_i) such as:

$$Eq_{(\frac{wim_i}{wo_i})} = \frac{\partial q_i\,(\frac{wim_i}{wo_i},\, U_i)}{\partial\,(\frac{wim_i}{wo_i})}\,\frac{\frac{wim_i}{wo_i}}{q_i\,(\frac{wim_i}{wo_i},\, U_i)}$$

$$Eq_{(\frac{wim_i}{wo_i})} = \frac{\partial q_i\,(\phi\,(U_i),\, U_i)}{\partial\,(\phi\,(U_i))}\,\frac{\phi\,(U_i)}{q_i\,(\phi\,(U_i),\, U_i)}$$

such that

$$Eq_{(\frac{wim_i}{wo_i})} = \frac{-1}{\log\,(\frac{wim_i}{wo_i})} < 0$$

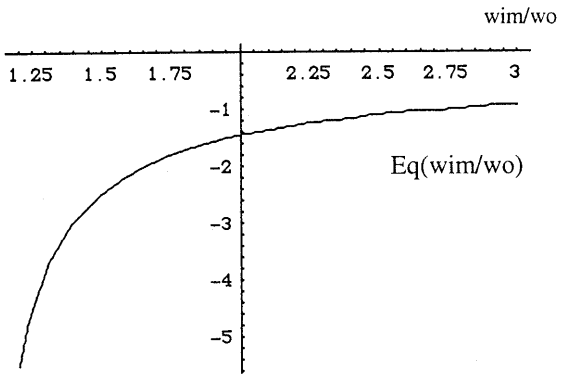

FIGURE 3

Elasticity of the quit rate with respect to the wage differential.

In this case, for a low initial wage differential, a variation in this differential will lead to a relatively low migration. Equally, it can be said

that an increase in the unemployment rate decreases the sensitivity of the quit rate to the unemployment rate. Thus, the elasticity of the turnover rate with respect to the unemployment rate is an increasing (negative) function of U_i:

$$Eq_{(U_i)} = \frac{\partial q_i\left(\phi\left(U_i\right), U_i\right)}{\partial\left(U_i\right)} \frac{\left(U_i\right)}{q_i\left(\phi\left(U_i\right), U_i\right)}$$

such that

$$Eq_{(U_i)} = -\frac{U_i}{\left(1-U_i\right)\left[\log\left(\frac{1}{1-U_i}\right)\right]^2} < 0$$

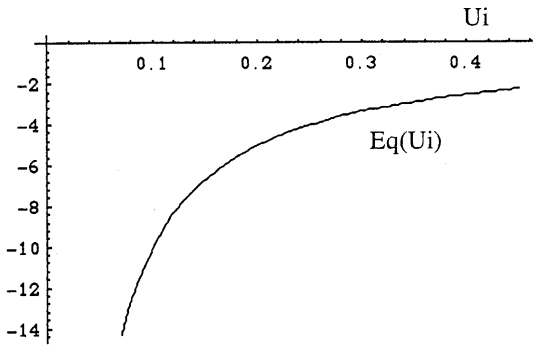

FIGURE 4

Elasticity of the quit rate with respect to the unempolyment rate.

For a given quit-rate function, the firm seeks to minimize the labor cost per employee,

$$wim_i^* \text{ is the solution of } \underset{wim_i}{\text{Min}}\ CT_{is} = \left(wim_i + Tq\left(\frac{wim_i}{wo_i}\right)\right) L_{is}$$

We assume that wage determination arises from monopolistic competition in all non-competitive industries: each producer minimizes its total labor costs taking the wage rate of other firms, as well as the competitive wage rate and the quit-rate function, as given. This yields the following first-order condition:

$$wim_i = -T\left[\frac{\partial q_i\left(\phi\left(\frac{1}{1-U_i}\right), U_i\right)}{\partial\phi\left(\frac{1}{1-U_i}\right)} \phi\left(\frac{1}{1-U_i}\right)\right] = h\left(U_i\right)$$

when the wage rate paid in non-competitive sectors, wim_i, depends only on the unemployment rate in the economy. The relationship between the optimal wage rate chosen by the firm and the unemployment rate that follows is then:

$$wim_i^* = wim_i + T.q_i\left(U_i\right) = h\left(U_i\right) + T.q_i\left(U_i\right)$$

Since we know the quit-rate function (2), we can therefore determine non-competitive wages (wim_i) and the total unit labor costs in non-competitive sectors (wim_i^*) [9]:

$$(3) \qquad wim_i = h(U_i) = \frac{a_i T}{[\log(\frac{1}{1-U_i})]^2}$$

$$(4) \qquad wim_i^* = \frac{a_i T}{[\log(\frac{1}{1-U_i})]^2} + \frac{a_i T}{\log(\frac{1}{1-U_i})} = \frac{a_i T[1+\log(\frac{1}{1-U_i})]}{[\log(\frac{1}{1-U_i})]^2}$$

The, from (1) and (3), we get the competitive wage rate (wo_i):

$$(5) \qquad wo_i = \frac{wim_i}{\phi(\frac{1}{1-U_i})} = \frac{h(U_i)}{\phi(\frac{1}{1-U_i})} = \frac{a_i T(1-U_i)}{[\log(\frac{1}{1-U_i})]^2}$$

For given positive values of parameters T and a_i, figure 5 shows that non-competitive and competitive wages, as well as total unit labor costs in imperfect sectors (wim_i, wo_i and wim_i^* respectively) and the wage differential, (ϕ), can be simply written as functions of U_i:

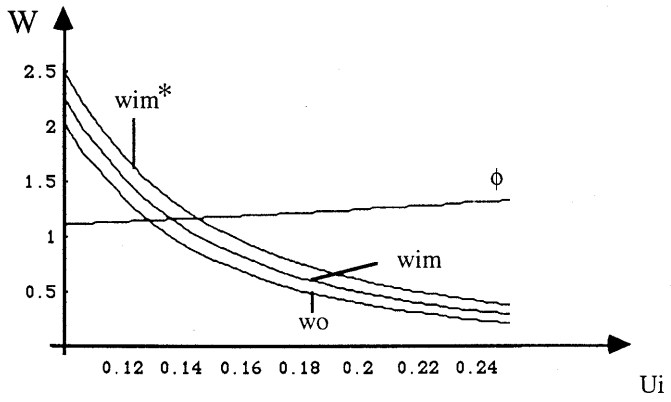

FIGURE 5

Optimal wage rate and wage differential.

9. Note that we have,

$$\frac{dwim_i}{dU_i} = -2a_i T(1-U_i)^{-1}\left[\log\left(\frac{1}{1-U_i}\right)\right]^{-3} < 0$$

and,

$$\frac{dwim_i^*}{dU_i} = -a_i T\left[2+\log\left(\frac{1}{1-U_i}\right)\right](1-U_i)^{-1}\left[\log\left(\frac{1}{1-U_i}\right)\right]^{-3} < 0.$$

The introduction of an imperfection on the labor market alters the production technology of non-competitive firms. Since producers choose a wage rate higher than that of full-employment, it implies an involuntary unemployment rate which discourages migration. Since the chosen wage rate is efficient or optimal, firms are not willing to decrease the wage rate in order to improve the level of employment.

The structure of the basic model is modified as we have to take into account the joint determination of unit labor costs in imperfectly competitive industries (4) and of the competitive wage rate (5). We also add the equations (2) which specify the quit-rate function (4).

In our previous non-competitive firm cost function as well as our labor costs payment specification (consumer's income), we now have to consider the unit labor cost wim_i^*.

4 Calibration and Main Results

4.1. Data Base and Calibration Procedure

The chosen reference data year is 1985 because of availability constraints. The EEC set should therefore be understood as the EEC-10. The data set includes bilateral trade flows, separate input-ouput tables for domestic and imported inputs, final demands by type and sectoral origin, output, and labor earnings figures, all collected from EUROSTAT [1985] and CHELEM-CEPII data base [1994]. The latter data base has been used only for the computation of domestic share parameters of total imports. Therefore, the data set is based on statistical sources that ensure its consistency.

Table 1 indicates the adopted sectoral disaggregation of activities and the choice of reasonable values for the differentiation elasticities [10]. Table 2 indicates the European standardized unemployment rates in 1985.

The calibration procedure used here is based upon the framework of MERCENIER [1995] [11]. This procedure has the advantage of providing a good consistency in the computation of imperfect sector parameters: indeed, the joint determination of the reference year price system and scale economies (see tables 3 and 4) is established only with data contained in the social accounting matrices (and not with different statistical sources as it has been done in different studies). Moreover, this calibration procedure does

10. The values for elasticities of substitution is supplied from joint estimations of MERCENIER [1995] and GASIOREK *et al.* [1992]; the number of symmetric firms in non-competitive sectors (n_{is}) is inferred from Herfindahl indices (EUROSTAT), Structure and Activity of Industry, Data by size of enterprises, [1984] and estimations of GASIOREK [1992] for services and construction activities.

11. The calibration procedure is presented in detail in PETIT [1996] and will not be repeated here in order to save space.

TABLE 1

Sectoral Disaggregation and Elasticities of substitution between products of different firms within an industry (σ).

Aggregate Production Sectors	Sectoral disaggregation (Nace)		Elasticity σ
Agriculture, food and primary products	01, 06 and 36	C	2
Chemical products	17	NC	5
Agriculture and industry machinery	21	NC	10
Office machinery	23	NC	10
Electrical goods	25	NC	6
Transport equipment	28	NC	7
Other manufacturing industries (textile, wood, paper, metallurgy, minerals, etc.)	13, 15, 19, 42 and 47-49	NC	5
Services and construction	53, 68 and 86	NC	18

TABLE 2

European Standardized unemployment rates in 1985.

GB	DE	FRA	ITA	RCEE
11.2	7.2	10.2	10.1	17.2

Source: OCDE, Main Economic Indicators, 1986.

TABLE 3

Calibrated Price Spread within the EEC.

	COURNOT competition	Chemis.	Agri & ind. mach.	Office Mach.	Elec. goods	Transp	Other indus.	Serv.
GB	domestic price [a]	1.015	1.002	1.005	1.001	1.002	1.001	1.000
	average export price [b]	0.969	0.993	0.999	0.994	0.990	0.994	0.997
DE	domestic price	1.003	1.001	1.008	1.002	1.004	1.000	1.000
	average export price	0.991	0.996	0.981	0.994	0.991	0.997	0.997
FRA	domestic price	1.004	1.003	10.18	1.002	1.003	1.001	1.000
	average export price	0.990	0.988	0.963	0.990	0.989	0.995	0.997
ITA	domestic price	1.002	1.005	1.022	1.003	1.005	1.001	1.000
	average export price	0.981	0.981	0.945	0.985	0.977	0.992	0.997
RCEE	domestic price	1.012	1.007	1.006	1.006	1.004	1.001	1.000
	average export price	0.977	0.979	0.998	0.985	0.988	0.994	0.997

[a] *price charged on domestic market;* [b] *average export price to EEC.*

not exogenously impose identical scale economies accross countries (see table 3), as is the case in GASIOREK, SMITH and VENABLES [1992]. Of course, there are alternatives that are just as consistent. For example, DE MELO and TARR (MIT Press, 1993) use econometric estimates of scale economies as their starting point, before calibrating the Cournot-equivalent number of firms. Tables 3 and 4 report on the calibrated price spread

TABLE 4

Calibrated elasticity of scale (ratios of average to marginal costs).

	Chemis.	Agri. & ind. mach.	Office Mach.	Elec. goods	Transp.	Other indus.	Services
GB	1.295	1.120	1.121	1.208	1.179	1.258	1.062
DE	1.263	1.117	1.143	1.209	1.181	1.255	1.062
FRA	1.264	1.125	1.166	1.213	1.181	1.256	1.062
ITA	1.275	1.135	1.187	1.219	1.195	1.261	1.062
RCEE	1.286	1.137	1.149	1.221	1.182	1.258	1.062

and the calibrated scale elasticities consistent with the data base and the optimal price discriminating COURNOT-NASH behavior of non-competitive firms (see footnote 4). Despite the complexity of the calibration procedure, the computed scale elasticities are within the expected range of magnitude. Moreover, price-discrimination strategies seem to be less pronounced than those described by MERCENIER (1982 data reference year).

We can now focus on what is specific in our calibration procedure when introducing an imperfect labor market. In particular, we have to compute the parameters of quit-rate functions as well as the initial level of the unit labor costs in imperfectly competitive industries. The data base used in this procedure is provided by the domestic accounting matrices or by data on unemployment rates in Europe in 1985. Due to the complexity of functional forms, the computation is performed with a system of equations.

If val_{is} is the labor value added in sector s country i given by the domestic accounting matrices, then the labor force used in the competitive sector in country i, L_{ci}, is,

$$L_{c_i} = \sum_{s \in C} val_{is} \qquad \text{with} \quad wo = 1$$

The calibration of parameter values is performed with the following system of equations,

$$wim_i^* L_{nc_i} = \sum_{s \in S} val_{is} - L_{c_i} \qquad \forall i \in W$$

$$\overline{L}_i = L_{c_i} + \frac{L_{nc_i}}{(1 - U_i)} \qquad \forall i \in W$$

$$U_i = \frac{TU_i \overline{L}_i}{(L_{nc_i} + TU_i \overline{L}_i)} \qquad \forall i \in W$$

$$wim_i^* = \frac{1 + \log[\frac{1}{1-U_i}]}{(1 - U_i)} \qquad \forall i \in W$$

where TU_i is the unemployment rate in country i (given by the data base) and L_{nci} is the labor force used in all imperfect sectors in country i.

The computation of this non-linear system gives the calibrated values of wim_i^*, U_i, L_{nci} and $\overline{L}_i$. We can then easily determine the calibrated values

of parameter a_i, and those of the initial values of the quit rate and of the unit labor cost, wim_i,

$$a_i = \frac{[\log(\frac{1}{1-U_i})]^2}{T(1-U_i)} \qquad \forall i \in W$$

$$q(U_i) = \frac{a_i}{\log(\frac{1}{1-U_i})} \qquad \forall i \in W$$

$$wim_i = h(U_i) = \frac{a_i T}{[\log(\frac{1}{1-U_i})]^2} \qquad \forall i \in W$$

4.2. The Results

• Effects of Market Integration in the Case of a Perfect Labor Market

The results of our basic scenario with flexible wages are presented in tables 5a and 5b. These results confirm that the basic theoretical mechanisms of the integration process are indeed at work. This process has a double effect on market structures: a pro-competitive phenomenon when the international degree of firm mobility is zero (short-term effect) and a rationalization effect when this degree is high (long-term effect).

The pro-competitive effect implies a more elastic demand (fall in the firm's perceived elasticity of demand) that involves a domestic market price drop (we can note a large drop of average selling prices to EEC in spite of rising exports prices). Output is stimulated, thereby improving domestic firms efficiency (fall in scale elasticities).

As import competition stiffens, domestic firms market power erodes, thereby reducing markups and profits and stimulating output. The intensity of this effect depends on the degree of segmentation and concentration at the reference period.

We note that although welfare effects are in all cases unambiguously positive for Europe, the gains remain quite modest (0.004% in Germany, 0.21% in Italy). In Europe, total output increases by 0.35% and 0.56% in the short and long run, respectively. Also, real wages unambiguously increase in all countries.

The rationalization effect does not seem to significantly affect the level of output, even though in some sectors/countries entries/exits may account up to 17%. However, welfare gains do not vary significantly. In fact, in the model, consumers value product diversity, and thus rationalization achieved by increased industry concentration has a cost in terms of welfare.

An interesting result is that integration leads to many adjustments within EEC countries on an unequal basis. In particular, the case of Germany (short-term case) and RCEE (long-term case) does not seem so good. We can see that, when the rest of the world is not taken into account in the simulation, European integration favours many countries at the cost of others being less well-off.

TABLE 5a

Short-term effects of European Market Integration: COURNOT competition, without entry/exit of firms, flexible wages.

Aggregate indicators (% changes)	GB	DE	FRA	ITA	RCEE
Welfare	0.15	4.1 E-3	0.07	0.21	0.17
Output	0.53	0.01	0.21	0.60	0.55
Wage rate	0.16	–0.32	–0.05	0.11	0.30
Cost-of-living index	–0.32	–0.44	–0.32	–0.47	–0.32
Terms of trade	0.01	–0.23	0.04	0.18	0.09
Employment	–	–	–	–	–
Output CEE (% changes)	0.35	Employment CEE (% changes)			–

	Agri., energy	Chemis.	Agri. & ind. mach.	Office Mach.	Elec. goods	Transp.	Other indus.	Services
Output (% changes)								
GB	0.31	5.19	1.07	–3.82	0.80	1.10	1.00	0.24
DE	–0.13	0.40	–1.09	–0.31	0.26	0.04	0.33	9.1 E-3
FRA	–0.03	0.23	1.62	5.80	0.90	1.30	0.63	–2.8 E-3
ITA	0.03	2.79	1.96	6.74	2.51	4.04	1.01	0.11
RCEE	0.05	2.53	5.33	1.63	2.04	1.42	1.17	0.25
Average selling price to EEC (% change)								
GB	–0.19	–2.79	–0.93	–0.68	–0.71	–1.02	–0.67	–0.25
DE	–0.20	–0.97	–0.75	–1.26	–0.67	–1.14	–0.59	–0.38
FRA	–0.12	–0.87	–1.17	–2.47	–0.87	–1.29	–0.53	–0.21
ITA	–0.07	–1.46	–1.86	–3.29	–1.42	–2.10	–0.78	–0.23
RCEE	–0.06	–1.90	–1.76	–1.32	–1.17	–1.13	–0.71	–0.20
Profits (% of value added)								
GB	–	–2.95	–1.36	–2.93	–0.65	–1.44	–0.36	–0.18
DE	–	–1.64	–1.42	–2.14	–0.69	–2.52	–0.31	–0.15
FRA	–	–2.22	–2.32	–3.17	–1.09	–2.48	–0.35	–0.13
ITA	–	–1.24	–4.44	–5.68	–1.21	–2.61	–0.52	–0.13
RCEE	–	–2.03	–1.80	–1.95	–0.99	–1.13	–0.37	–0.21
Elasticity of scale (% change)								
GB	–	–0.84	–0.05	0.49	–0.05	–0.07	–0.09	2.3 E-4
DE	–	6.3 E-3	0.15	0.07	0.08	0.07	–0.02	6.5 E-3
FRA	–	0.03	–0.13	–0.73	–0.10	–0.09	–0.07	6.6 E-3
ITA	–	–0.43	–0.13	–0.94	–0.31	–0.50	–0.10	4.5 E-3
RCEE	–	–0.35	–0.54	–0.12	–0.27	–0.11	–0.12	–1.7 E-3

It is interesting to note the reversed tendency for Germany which gains from integration only in the long term (welfare, + 0.43%; output, +1.58%). In fact, German producers highly increase their performances in specific sectors (chemistry, + 22% and other manufacturing industries, + 2%) when rationalization is at work (rising number of firms).

TABLE 5b

Long-term effects of European Market Integration: COURNOT competition, with entry/exit of firms, flexible wages.

Aggregate indicators (% changes)	GB	DE	FRA	ITA	RCEE
Welfare	0.09	0.43	0.04	0.12	–0.03
Output	0.39	1.58	0.20	0.31	–3.6 E-4
Wage rate	0.03	0.93	–0.23	–0.40	–0.28
Cost-of-living index	–0.07	0.09	–0.13	–0.25	–0.08
Terms of trade	0.14	–0.55	0.05	0.29	0.25
Employment	–	–	–	–	–
Output CEE (% changes)	0.56	Employment CEE (% changes)			–

	Agri., energy	Chemis.	Agri. & ind. mach.	Office Mach.	Elec. goods	Transp.	Other indus.	Services
Output (% changes)								
GB	0.16	–2.16	2.93	–2.44	1.63	1.63	0.86	0.30
DE	1.21	22.24	–1.17	–5.89	–1.00	–0.76	2.04	0.50
FRA	0.02	–2.04	2.47	–0.63	1.11	1.03	0.68	0.14
ITA	0.13	0.59	–0.47	–0.88	1.59	2.26	0.46	0.21
RCEE	–0.18	–15.13	4.94	–42.41	4.73	2.97	–0.40	0.42
Average selling price to EEC (% change)								
GB	–0.04	–1.56	–0.58	–0.35	–0.42	–0.62	–0.32	–0.15
DE	0.15	–2.77	–0.08	–0.58	–0.14	–0.62	–0.51	–0.17
FRA	–0.05	–0.38	–0.84	–2.03	–0.66	–0.82	–0.30	–0.19
ITA	–0.11	–1.07	–1.29	–2.59	–1.04	–1.58	–0.55	–0.26
RCEE	–0.03	–0.52	–1.40	–1.44	–0.96	–0.77	–0.23	–0.24
Number of firms (% change)								
GB	–	–8.58	–1.33	–4.52	–0.37	–2.00	–0.47	–1.50
DE	–	–16.47	–3.46	–11.32	–2.92	–4.19	–0.41	–1.06
FRA	–	–4.10	–4.20	–13.60	–1.84	–2.80	–0.31	–1.17
ITA	–	–3.11	–9.02	–16.57	–2.66	–5.75	–1.04	–1.08
RCEE	–	–18.36	–5.62	–33.45	–0.13	–1.08	–1.53	–1.73
Elasticity of scale (% change)								
GB	–	–1.47	–0.42	–0.21	–0.32	–0.52	–0.25	–0.10
DE	–	–0.37	–0.18	–0.67	–0.24	–0.40	–0.12	–0.08
FRA	–	–0.48	–0.73	–1.85	–0.51	–0.57	–0.21	–0.08
ITA	–	–0.76	–1.01	–2.50	–0.73	–1.26	–0.29	–0.07
RCEE	–	–0.96	–1.21	–0.74	–0.79	–0.60	–0.27	–0.13

• Effects of Market Integration in the Case of Rigid Real Wages

Tables 6a et 6b provide a detailed account of these simulations while table 9 reports on sensitivity analysis. The results are very close to those provided by MERCENIER [1995]. For most European countries, productivity gains induced by the elimination of price-discrimination strategies allow

TABLE 6a

Short-term effects of European Market Integration: COURNOT competition, without entry/exit of firms, rigid real wages.

Aggregate indicators (% changes)	GB	DE	FRA	ITA	RCEE
Welfare	1.34	–0.12	0.16	0.48	0.68
Output	2.04	–0.30	0.18	0.86	1.15
Wage rate	–0.90	–0.62	–0.53	–0.76	–0.71
Cost-of-living index	–0.90	–0.62	–0.53	–0.76	–0.71
Terms of trade	–0.23	–0.10	0.14	0.15	0.07
Employment	1.64	–0.14	0.21	0.68	1.06
Output CEE (% changes)	0.68	Employment CEE (% changes)			0.64

TABLE 6b

Long-term effects (with entry/exit of firms, flexible wages and modified labor supply).

Aggregate indicators (% changes)	GB	DE	FRA	ITA	RCEE
Welfare	1.49	–0.15	0.09	0.42	0.68
Output	2.66	–0.30	6.7 E-3	0.66	1.29
Wage rate	0.07	–0.94	–0.94	–1.14	–0.59
Cost-of-living index	–0.46	–0.45	–0.39	–0.57	–0.49
Terms of trade	–0.13	–0.09	0.11	0.16	0.03
Employment	1.64	–0.14	0.21	0.68	1.06
Output CEE (% changes)	0.75	Employment CEE (% changes)			0.64

increasing job creations. Productivity gains are not absorbed by wage increases but by job creation. This is achieved by assuming European wages indexed to the consumer price index, so that workers that had a job before 1992 do not experience decreases in their standard of living.

In the short run, welfare and output gains are more than doubled for most European countries (1.34% for Great-Britain). In the EEC as a whole, the increase in output is significant (0.68%) and this is accomplished with an improvement in the employment level (0.64%).

In the long run, industry rationalization increases welfare and output in Great Britain (1.50% and 2.66%, respectively) and RCEE (0.68% and 1.29%) while other countries do not benefit from international firm mobility. In these countries, a large real wage cut is necessary to maintain employment at the level inherited from the short run.

In any case, the welfare gains from "1992" remain far below those suggested by the Cechini report and are also less significant than those

provided by MERCENIER [1995] [12]. Besides, it appears that expected integration effects are not homogenous in Europe: Germany seems to suffer from integration in terms of welfare (–0.15%) and employment (–0.14%). However, in all other countries, the rigid real wages scenario leads to an improvement in the labor market (1.64% for GB and 1.06% for RCEE).

One explanation of these results is that we have only considered the internal integration process in Europe. That is, the increase in European firm competitiveness appears only within the economic region considered and has no effect on the external competitiveness of firms outside Europe. So, Germany, which formerly benefited from a high degree of competitiveness in Europe, is now facing fierce European competition. Its export performances drop thereby reducing its output (–0.30%). In the long run, we can also note that a real wage decrease is necessary to prevent Germany from worse labor market deterioration.

A first conclusion here is that when internal structural industry changes are taken into account, all member countries are not sure to gain from European integration. Table 9 summarizes the sensitivity analysis that has been performed with respect to two important parameters: product differentiation and industry concentration. We can see that the simulation results seem to be quite robust.

• Effects of Market Integration in the Case of Endogenous Imperfect Labor Market

The results obtained in the case of endogenous imperfect labor market (tables 7a and 7b) reveal a very different view of the consequences of integration on employment in Europe. Indeed, simulations show that the completion of the single European market may lead to global employment deterioration. Moreover, the results in terms of welfare give substance to the idea that some union members could suffer from integration.

In the short-term simulation, these effects are non homogeneous and may be very significant: output, employment and welfare changes are negatives in Germany (–1.12%, –1.28% and –0.88%, respectively). Also, the case of France is not very good since pro-competitive phenomena imply a negative welfare effect (–0.27%) and job destruction (–0.69%). We can also note that output increases (in Italy and RCEE) don't necessarily prevent domestic countries from increases in unemployment. Finally, within the Community, only the UK seems to really benefit from the elimination of price-discrimination strategies (average price drop). All things considered, in Europe, the short-term results suggest net labor market deterioration (–0.59%) and a very low output increase (0.02%).

The introduction of an imperfection based on endogenous behavior in the labor market may affect the usual intuitive story behind the integration process. Indeed, it it easy to imagine how general-equilibrium effects

12. In MERCENIER [1995], the reduction in unemployment is estimated between 2.7 and 0.5% depending on the country considered (with an EEC average of 1.5%) and welfare gains range between 2.1 and 0.4%.

TABLE 7a

Short-term effects of European Market Integration: COURNOT competition, without entry/exit of firms, imperfect labor market (turnover model).

Aggregate indicators (% changes)	GB	DE	FRA	ITA	RCEE
Welfare	0.21	–0.88	–0.27	0.09	0.06
Output	0.75	–1.12	–0.14	0.60	0.56
Efficiency wage rate	0.44	0.69	0.72	0.65	0.79
Competitive wage rate	0.50	0.75	0.80	0.73	0.97
Cost-of-living index	–0.12	0.05	–0.01	–0.27	–0.09
Terms of trade	–0.12	0.05	0.06	0.07	–0.03
Employment	0.08	–1.28	–0.69	–0.32	–0.28
Output CEE (% changes)	0.02	Employment CEE (% changes)			–0.59

TABLE 7b

Long-term effects (with entry/exit of firms, turnover model).

Aggregate indicators (% changes)	GB	DE	FRA	ITA	RCEE
Welfare	0.38	–0.53	0.30	1.13	0.27
Output	0.87	–0.99	0.60	2.32	0.64
Efficiency wage rate	–0.08	–1.02	–0.55	–0.88	–0.32
Competitive wage rate	–0.09	–1.10	–0.62	–0.99	–0.40
Cost-of-living index	–0.22	–0.32	–0.34	–0.83	–0.27
Terms of trade	0.07	0.09	–0.02	–0.42	0.08
Employment	0.34	–0.50	0.46	1.75	0.32
Output CEE (% changes)	0.53	Employment CEE (% changes)			0.29

– complex interactions between income and substitution effects on the demand side and changes of steepness of the average-cost curve affected by movements in primary factors price on the offer side – can change the usual scenario described before.

An endogenous imperfect specification on the labor market – that is based entirely upon microeconomic foundations – has the advantage of providing a helpful tool to explain clearly the results of simulations (see figure 6).

The turnover model is based upon firms' optimization behavior. This modeling assumption therefore helps explaining that the arbitrage between wage payments and turnover costs is an incentive for the firm to limit the variability in the wage differential. The idea is simply that the greater the wage differential is, the greater the incentive to migrate will be. So, when the competitive wage increases, non-competitive firms are willing to rise their wage rate. For example, in Italy, the competitive and the non-competitive wage increases are quite close (+0.73% and 0.65%). It implies that real wages increase since, meanwhile, the consumer price index decreases (–0.27% in Italy). So, real wage increases affect firm

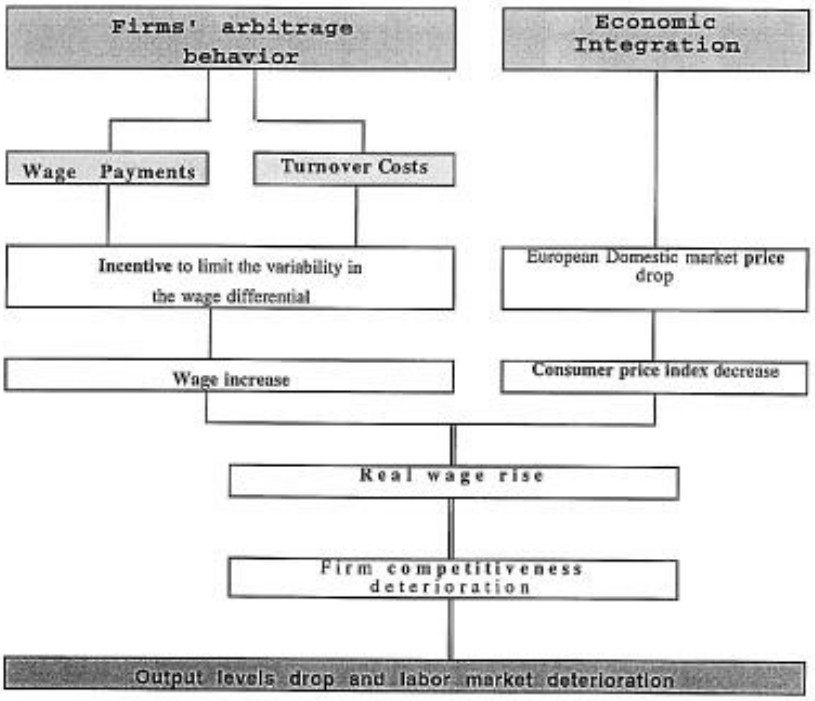

FIGURE 6

The Integration Scenario Explanation (Turnover Model).

TABLE 8

Welfare effects of European Market Integration: Sensitivity analysis with flexible wages (%).

	Base case (σ_s, n_{is})	Higher product differentiation $(.80\,\sigma_s, n_{is})$	Lower product differentiation $(1.20\,\sigma_s, n_{is})$	Higher industry concentration $(\sigma_s, .85\,n_{is})$	Lower industry concentration $(\sigma_s, 1.15\,n_{is})$
COURNOT competition with fixed number of firms					
GB	0.15	0.17	–0.13	0.18	0.13
DE	4.1 E-3	0.02	–8.5 E-3	6.1 E-3	3.0 E-3
FRA	0.07	0.08	0.06	0.08	0.06
ITA	0.21	0.23	0.19	0.25	0.18
RCEE	0.17	0.19	0.15	0.20	0.14
COURNOT competition with variable number of firms					
GB	0.09	0.14	0.09	0.11	0.07
DE	0.43	–0.44	0.18	0.43	0.42
FRA	0.04	0.10	0.05	0.05	0.03
ITA	0.12	0.15	0.13	0.15	0.09
RCEE	–0.03	0.40	0.06	1.4 E-3	–0.05

TABLE 9

Welfare and Employment effects of European Market Integration: Sensitivity analysis with rigid real wages (%).

	Base case (σ_s, n_{is})	Higher product differentiation $(.80\,\sigma_s, n_{is})$	Lower product differentiation $(1.20\,\sigma_s, n_{is})$	Higher industry concentration $(\sigma_s, .85\,n_{is})$	Lower industry concentration $(\sigma_s, 1.15\,n_{is})$
COURNOT competition with fixed number of firms: welfare gains (%)					
GB	1.34	1.17	1.52	1.59	1.16
DE	–0.12	–6.4 E-4	–0.23	–0.13	–0.11
FRA	0.16	0.18	0.14	0.19	0.14
ITA	0.48	0.47	0.50	0.57	0.42
RCEE	0.68	0.65	0.71	0.80	0.59
COURNOT competition with variable number of firms: welfare gains (%)					
GB	1.49	1.40	1.64	1.76	1.28
DE	–0.15	–0.14	–0.27	–0.20	–0.11
FRA	0.09	0.08	0.09	0.11	0.08
ITA	0.42	0.39	0.45	0.50	0.36
RCEE	0.68	0.70	0.71	0.82	0.58
Short-term effects: employment changes (%)					
GB	1.64	1.31	1.96	1.93	1.42
DE	–0.14	–4.2 E-3	–0.29	–0.16	–0.12
FRA	0.21	0.22	0.19	0.25	0.19
ITA	0.68	0.57	0.78	0.79	0.59
RCEE	1.06	0.91	1.19	1.24	0.92
CEE	0.64	0.57	0.70	0.75	0.56

competitiveness and the result is a very low increase in output that directly affects job creation.

Our labor market specification has the advantage of providing numerical experiments that estimate the long-run consequences of integration on employment. In particular, these simulations show clearly that industry rationalization increases output in most countries and consequently reduces the negative short-run effect of market integration on labor market situation. For example, Italy really benefits from this positive effect in all its production sectors. Its global output increase is very significant (2.32%) and allows increasing job creation (1.75%). However, the EEC global output increase remains quite modest (0.53%) since output levels have dropped in many countries. The European labor market situation is better than in the short-term simulation but this improvement seems to be relatively low (0.29%). In spite of this slight improvement, Germany still suffers from integration in terms of welfare (–0.53%), ouput (–0.99%) and employment (–0.50%). The labor market inprovement in domestic economies can be explained by a real wage drop that implies a higher output increase.

The sensitivity analysis (table 9) allows us to show again that our estimates are globally robust with respect to changes in parameters values. In any case, market integration leads to substantial labor market deterioration in the short-term simulation and a slight recovery in employment in the long run.

TABLE 10

Welfare and Employment effects of European Market Integration: Sensitivity analysis with imperfect labor market (turnover model).

	Base case (σ_s, n_{is})	Higher product differentiation $(.80\,\sigma_s, n_{is})$	Lower product differentiation $(1.20\,\sigma_s, n_{is})$	Higher industry concentration $(\sigma_s, .85\,n_{is})$	Lower industry concentration $(\sigma_s, 1.15\,n_{is})$
COURNOT competition with fixed number of firms: welfare gains (%)					
GB	0.21	0.36	0.41	0.59	0.38
DE	–0.88	–0.83	–1.22	–0.77	–0.73
FRA	–0.27	–0.11	–0.26	–0.08	–0.11
ITA	0.09	0.18	0.18	0.34	0.21
RCEE	0.06	0.27	0.20	0.45	0.26
COURNOT competition with fixed number of firms: employment changes (%)					
GB	0.08	0.24	0.39	0.57	0.34
DE	–1.28	–1.17	–1.81	–1.11	–1.05
FRA	–0.69	–0.37	–0.68	–0.32	–0.35
ITA	–0.32	–0.12	–0.08	0.19	0.06
RCEE	–0.28	0.13	0.05	0.47	0.21
CEE	–0.59	–0.37	–0.60	–0.17	–0.27
COURNOT competition with variable number of firms: welfare gains (%)					
GB	0.38	0.26	0.36	0.65	0.39
DE	–0.53	–0.34	–0.32	–0.26	–0.30
FRA	0.30	0.32	0.39	0.52	0.42
ITA	1.13	0.97	1.26	1.45	1.017
RCEE	0.27	0.23	0.53	0.61	0.37
COURNOT competition with fixed number of firms: employment changes (%)					
GB	0.34	0.16	0.38	0.68	0.41
DE	–0.50	–0.24	–0.33	–0.16	–0.24
FRA	0.46	0.43	0.71	0.91	0.72
ITA	1.75	1.21	2.29	2.41	1.94
RCEE	0.32	0.24	0.90	0.99	0.62
CEE	0.29	0.24	0.57	0.75	0.51

5 Conclusion

Previous attempts to assess the welfare costs of price discrimination within the European Community conclude that although unambiguously positive for all countries, these costs are quite modest. We have shown here that they seem much lower than those estimated by the Cechini group and that they are less pronounced than those obtained by MERCENIER [1995]. By contrast, one conclusion of this study is that, when an endogenous labor market structure is taken into account, all member countries are not sure to gain from European integration. In fact, we have shown that, in this case, market integration may lead to global European labor market deterioration. Equally, welfare and employment effects may be negative in most of European countries. The advantage of introducing an endogenous labor market imperfection consistent with walrasian microeconomic foundations is that it ensures the reliability of the simulation results.

APPENDIX A

Formal Description of the General Equilibrium Model

Sectors of activity are identified by indices s, $t \in S$, with S representing the set of all industries. Set S is partitioned into the subset of competitive, constant returns-to-scale sector, $s \in C$, and the subset of non-competitive, increasing returns-to-scale industries, $s \in NC$, with $C \cup NC = S$. Countries are identified by indices i, j, $k \in W$. We keep track of the trade flows by following the usual practice that identifies the first two indices, with, respectively, the country and the industry supplying the commodity and, when appropriate, the next two with the client country and industry. Thus, a subscript $isjt$ indicates a flow originating in sector s of country i with industry t of country j as recipient.

1. The Households' Static Decision Problem

It is assumed that domestic final demand decisions in country $i \in W$ are made by a single representative agent. The domestic household values products of competitive industry from different countries as imperfect substitutes (the Armington assumption), while it treats as specific each commodity produced by individual firms operating in the non-competitive industries. This is represented by a two level-utility function. The first level combines consumption goods, U_{si}, assuming constant expenditure shares (γ_{si}). The second level determines the optimal composition of the consumption aggregates in terms of geographical origin for competitive industry or in terms of the individual firm's product for the noncompetitive sectors. Assuming symmetry between the n_{js} non-competitive firms operating within country j's industry s, the consumer's preferences are represented as follows,

$$U_i = \sum_{s \in S} \gamma_{si} \log U_{si} \qquad \sum_{s \in S} \gamma_{si} = 1 \tag{A1}$$

$$U_{si} = \left[\sum_{j \in W} \alpha_{jsi} \frac{1}{\sigma_s} y_{jsi}^{\frac{\sigma_s - 1}{\sigma_s}} \right]^{\frac{\sigma_s}{\sigma_s - 1}} \qquad s \in C \tag{A1a}$$

$$U_{si} = \left[\sum_{j \in W} n_{js} \alpha_{jsi} \frac{1}{\sigma_s} y_{jsi}^{\frac{\sigma_s - 1}{\sigma_s}} \right]^{\frac{\sigma_s}{\sigma_s - 1}} \qquad s \in NC \tag{A1b}$$

where α_{jsi} are share parameters and σ_s are substitution elasticities. Observe that when $s \in C$, y_{jsi} denotes the sales of the whole industry s of country j, whereas when $s \in NC$, it represents the sales of a *single* firm.

Final demands y_{jsi} of country i result from maximisation of (A1) subject to the following budget constraint (A2):

$$\underset{y_{jsi}}{\text{Max}}\, U_i \quad \text{s.t.} \quad (\text{A2}) \quad R_i \geq \sum_{s\in C}\sum_{j\in W} p_{js}\, y_{jsi} + \sum_{s\in NC}\sum_{j\in W} n_{js}\, p_{jsi}\, y_{jsi} \quad \forall\, i = 1, \ldots, W$$

where p_{jsi} denote prices. In this formulation, non-competitive firms have the possibility to price discriminate between client countries (p_{jsi}).

2. The Behavior of Firms

Competitive Firms

In competitive industry, the representative firm of country i-sector s, operates with constant return-to-scale technologies, combining capital, labor and intermediate inputs. Material inputs are introduced in the production function in a similar way as consumption goods are treated in the preferences of households: with an Armington specification for goods produced by the competitive industry, with product differentiation at firm level in the imperfectly competitive sectors. Input demands by producer $s \in C$ result from minimization of variable unit cost cv_{is}:

$$(\text{A3}a) \quad cv_{is}\, x_{is} = \sum_{j\in W}\sum_{t\in C} p_{jt}\, x_{jtis} + \sum_{j\in W}\sum_{t\in NC} p_{jt}\, x_{jtis} + rK_{is}^{v} + w_i\, L_{is}^{v}$$

such that:

$$(\text{A3}b) \quad \log(x_{is}) = \alpha_{Lis}\log(L_{is}^{v}) + \alpha_{Kis}\log(K_{is}^{v}) + \sum_{j\in W}\alpha_{.tis}\log x_{.tis}$$

$$(\text{A3}c) \qquad \begin{cases} x_{.tis} = \left[\sum_{j\in W} \beta_{jtis}\, x_{jtis}^{\frac{\sigma_s}{\sigma_s-1}}\right]^{\frac{\sigma_s-1}{\sigma_s}} & \forall\, s \in C \\ x_{.tis} = \left[\sum_{j\in W} n_{jt}\,\beta_{jtis}\, x_{jtis}^{\frac{\sigma_s}{\sigma_s-1}}\right]^{\frac{\sigma_s-1}{\sigma_s}} & \forall\, s \in NC \\ \text{and} \quad \alpha_{Lis} + \alpha_{Kis} + \sum_{t\in S}\alpha_{.tis} = 1 \end{cases}$$

where w_i and r are the labor and capital unit cost, respectively. In the model, the international rental rate of capital is chosen as *numéraire.* Observe that although goods are introduced in consumers' technologies with the same degree of differentiation (substitution elasticities are identical), price responsiveness will not be the same as the β_s are sector specific.

Cost minimization implies marginal cost pricing ($p_{isj} = v_{is}$) and zero profit ($\pi_{is} = 0$) in the competitive sector.

Non-Competitive Industries

Non-competitive industries have increasing returns to scale in production. We model this by assuming that in addition to variable costs associated with technological constraints similar to (A3a) individual firms face fixed primary factor costs. This introduces a wedge between total unit costs, CMO_{is}, and marginal costs, cv_{is}:

$$\text{(A4)} \qquad CMO_{is} = cv_{is} + \frac{w_i\, cfl_{is} + rcfk_{is}}{x_{is}} \qquad \forall i \in W, \quad \forall s \in NC$$

where x_{is}, cfl_{is}, cfk_{is}, denote, respectively, the individual firm's output, fixed labor and fixed capital.

With initial segmentation, the non-competitive firm exploits the monopoly power it has on each individual country market. So, the firm has the possibility to price discriminate among segmented domestic markets. The objective of the firm is to maximize its profits such that:

$$\text{(A5)} \qquad \Pi_{is} = (\sum_{j \in W} n_{is}\, p_{isj}\, [y_{isj} + \sum_{t \in S} x_{isjt}]) - n_{is}\, CMO_s\, x_{is} \qquad \forall i \in W, \quad \forall s \in NC$$

To reach its objective, each producer is endowed with the full knowledge of the preferences (A1a et A1b) and technologies of its clients (A3a, A3b, A3c). Using this information, he performs a partial equilibrium calculation assuming that in each country, each individual client's current-price expenditure on the whole industry is unaffected by his own strategic action, $\Delta\,(y_{isj} + \sum_{t \in S} x_{isjt})$, so that:

$$\text{(A6}a\text{)} \qquad \frac{\partial\,(\gamma_{sj}\, R_j)}{\partial\,[y_{isj} + \sum\limits_{t \in S} x_{isjt}]} = 0$$

and

$$\text{(A6}b\text{)} \qquad \frac{\partial\,(\alpha_{.sjt}\, cv_{jt}\, x_{jt})}{\partial\,[y_{isj} + \sum\limits_{t \in S} x_{isjt}]} = 0 \qquad \forall j \in W, \quad \forall t \in S$$

On the basis of the resulting perceived demand curves, the firm chooses country specific profit maximizing prices using the LERNER formula:

$$\text{(A7)} \qquad \frac{p_{isj} - cm_{is}}{p_{isj}} = \frac{1}{\varepsilon_{isj}\,(C)} \qquad \forall i,\, j = 1, \ldots, W; \quad \forall s \in NC$$

where $\varepsilon_{isj}\,(C)$ is the firm's perceived elasticity of demand for market j. We make the COURNOT assumption of noncooperative behavior with sales

to each individual market as the strategic variables (see Appendix B for the computation of these elasticities):

$$\varepsilon_{isj}(C) = -\frac{d \log p_{isj}}{d \log [y_{isj} + \sum_{t \in S} x_{isjt}]} \tag{A8}$$

3. The General Equilibrium

A general equilibrium is a vector of price (p_{isj}, w_i, r) such that:

- supply equals demand on each market:

$$x_{is} = \sum_{j \in W} [y_{isj} + \sum_{t \in S} x_{isjt}] \qquad \forall s \in S, \quad \forall i \in W \tag{A9}$$

$$\sum_{s \in C} L_{is} + \sum_{s \in NC} n_{is} L_{is} = \overline{L_i} \qquad \forall i \in W \tag{A10}$$

$$\sum_{i \in W} \sum_{s \in C} K_{is} + \sum_{i \in W} \sum_{s \in NC} n_{is} K_{is} = \sum_{i \in W} \overline{K_i} \tag{A11}$$

where $\overline{L_i}$ and $\overline{K_i}$ represent fixed primary factor endowments;

- profits equal zero in all competitive industries;
- in non-competitive sectors, the number of firms is fixed and possibly differs from zero (short-term equilibrium with fixed industry structure) or alternatively, the number of firms is endogenous and profits are null (long-term equilibrium with entry/exit);
- the perceived elasticity $\varepsilon_{isj}(C)$ is evaluated at equilibrium prices and demands, so that, even though the firm may be slightly mistaken on the true demand curve it faces, for the quantities actually produced, it correctly perceives the prices that will clear the market.

APPENDIX B

1. The Computation of COURNOT Elasticities

The computation of these elasticities is made extremely complex because of the distinction between final and intermediate demands. However, MERCENIER [1995] has shown that it was possible to compute these elasticities inverting the log-linearized aggregate demand system. To determine $\varepsilon_{isj}(C)$, it may be shown that for each $s \in NC$, $i \in W$, $j \in W$, the following system has to be solved:

$$(\text{B1}a) \qquad \sum_{k \neq i} n_{ks}\, \varepsilon^{k}_{hsj}\, \tilde{\varepsilon}^{i}_{ksj} + (n_{is} - 1)\, \varepsilon^{i}_{hsj}\, \tilde{\varepsilon}^{i}_{isj} - \sigma_s\, \tilde{\varepsilon}^{i}_{hsj} + \frac{\varepsilon^{i}_{hsj}}{\varepsilon_{isj}(C)} = 0$$
$$h \in W, \quad k \in W$$

$$(\text{B1}b) \quad \sum_{k \neq i} n_{ks}\, \varepsilon^{k}_{isj}\, \tilde{\varepsilon}^{i}_{ksj} + (n_{is} - 1)\, \varepsilon^{i}_{isj}\, \tilde{\varepsilon}^{i}_{isj} + \frac{(\varepsilon^{i}_{isj} - \sigma_s)}{\varepsilon_{isj}(C)} = 1 \quad k \in W$$

where variables $\tilde{\varepsilon}^{k}_{isj}$ are cross-elasticities determined jointly with $\varepsilon_{isj}(C)$ and coefficients, ε^{k}_{isj}, are cross-elasticities:

$$(\text{B2}a) \qquad \tilde{\varepsilon}^{k}_{isj} = \frac{\partial \log p_{isj}}{\partial \log \left[y_{isj} + \sum\limits_{t \in S} x_{ksjt} \right]} \quad k \in W$$

$$(\text{B2}b) \quad \varepsilon^{k}_{isj} = -\frac{d \log \left[y_{isj} + \sum\limits_{t \in S} x_{isjt} \right]}{d \log p_{ksj}}$$
$$= (\sigma_s - 1) \left\{ \frac{y_{isj}}{\left[y_{isj} + \sum\limits_{t \in S} x_{isjt} \right]} \frac{p_{ksj}\, y_{isj}}{\gamma_{sj}\, R_j} \right.$$
$$\left. + \sum_{t \in S} \left[\frac{x_{isjt}}{\left[y_{isj} + \sum\limits_{t \in S} x_{isjt} \right]} \frac{p_{ksj}\, x_{ksjt}}{\alpha_{.sjt}\, cv_{jt}\, x_{jt}} \right] \right\}$$

2. The Numerical Experiment: the European Market Integration

According to the modeling strategy we used until now, the representation of the market integration experiment consists of assuming the elimination of all trade barriers so that individual firms can no longer price discriminate among their national clients. At the European scale, it implies that one has to deal with the EEC aggregate demand system rather than with demands

from individual countries. So, the experiment of market integration consists in imposing the following restriction on the pricing rule:

$$\text{(B3)} \qquad \varepsilon_{isj} = \varepsilon_{isEEC} \qquad \forall j \in W$$

where ε_{isEEC} is the firm's perceived elasticity of demand computed from the aggregated EEC market. When firms are assumed to play BERTRAND [13], the price elasticity of demand on the integratred market is a weighted average of the price elasticities on each individual country market within the EEC:

$$\text{(B4)} \qquad \varepsilon_{isEEC}(B) = \frac{\sum_{j \in W} (\varepsilon_{isj} [y_{isj} + \sum_{t \in S} x_{isjt}])}{\sum_{j \in W} [y_{isj} + \sum_{t \in S} x_{isjt}]}$$

In the alternative case where firms are assumed to play COURNOT, the perceived elasticities $1/\varepsilon_{isEEC(C)}$ are computed from the log-linearized inverse EEC-aggregated demand system. The systems to be solved are those of Appendix B1, after substitution of the EEC-aggregated elasticities $\tilde{\varepsilon}^k_{isj}$ and ε^k_{isj} by $\tilde{\varepsilon}^k_{isEEC}$ and ε^k_{isEEC} where appropriate.

• References

BROOKE, A., HENDRIK, D., MEERAUS A. (1988). – "GAM: A User's Guide", Scienctific Press.

BURNIAUX, J. M., WALBROECK, J. (1992). – "Preliminary Results from Two Experimental Models of General Equilibrium with Imperfect Competition", *Journal of Policy Modeling*, 14, pp. 65-92.

CARRUTH, A., OSWALD, A. J. (1987). – "On Union Preferences and Labor Market Models: Insiders and Outsiders", *The Economic Journal*, vol. 97, june 87, pp. 431-445.

CHELEM-CEPII (1994). – "Comptes Harmonisés sur les Échanges et l'Économie Mondiale : les nomenclatures détaillées et les indicateurs", *CEPII.*

COMMISSION OF THE EUROPEAN ECONOMY (1988). – "The economics of 1992", *The European Economy*, n° 35.

DIXIT, A. K., STIGLITZ, J. E. (1977). – "Monopolistic Competition and Optimum Product Diversity", *American Economic Review*, 67, pp. 297-308.

ERLICH, S., GINSBURGH, V., VAN DER HEYDEN, L. (1987). – "Where Do Real Wage Policies Lead Belgium? A General Equilibrium Analysis", *European Economic Review*, 31, pp. 1369-1383.

EUROSTAT (1984). – "Structure et Activité de l'Industrie, Données selon la taille des entreprise".

EUROSTAT (1985). – "Comptes Nationaux SEC – Tableaux entrées-sorties".

GABSZEWICZ, J., VIAL, J. P. (1972). – "Oligopoly "à la Cournot" in a General Equilibrium Analysis", *Journal of Economic Theory*, 4, pp. 381-400.

13. The results of the simulation with BERTRAND competition are not presented in the paper, see footnote 4.

GASIOREK, M., SMITH, A., VENABLES, A. J. (1992). – "Trade and Welfare, a General Equilibrium Model", *CEPR Discussion Paper*, 672, London.

GELAUFF, G. M. M., VAN ERP, F. A. M., GRAAFLAND, J. J., VAN HIEN, A. E., NIBBELINK, A. G. E. (1990). – "Towards an Analysis of Tax Effects on Labour Market and Allocation: a Micro/Macro Approach", *Central Planning Bureau*, The Hague, pp. 105-133.

HARRIS, R. G. (1984). – "Applied General Equilibrium Analysis of Small Open Economies with Scales Economies and Imperfect Competition", *American Economic Review*, december 1984, pp. 1016-1032.

HART, O. D. (1985). – "Imperfect Competition in General Equilibrium: An Overview of Recent Work", in ARROW K. J. et HONKAPOHJA S. (eds). "Frontiers of Economics", Blackwell, Oxford.

KATZ, L. F., SUMMERS, L. H. (1989). – "Industry Rents: Evidence and Implications", *Brookings Papers on Economic Activity*, pp. 209-290.

MELO, J. DE, TARR, D. (1993). – "Industrial Policy in the Presence of Wage Distorsions: The Case of the US Auto and Steel Industries", *International Economic Review*, 34, n° 4, pp. 833-851.

MELO, J. DE, TARR, D. (1993). – "A General Equilibrium Analysis of US Foreign Trade Policy", *The MIT PRESS.*

MERCENIER, J. (1995). – "Can 1992 Reduce Unemployment in Europe? – On Welfare and Employment Effects of Europe's Move to a Single Market", *Journal of Policy Modeling*, vol 1, n° 1.

MERCENIER, J., AKITOBY, B. (1994). – "On Intertemporal General Equilibrium Reallocation Effects of Europe's Move to a Single Market", *C.R.D.E.*, october.

NEGISHI T. (1961). – "Monopolistic Competition and General Equilibrium", *Review of Economics Studies*, 28, pp. 196-201.

PETIT E. (1996). – "L'introduction des imperfections des marchés dans les modèles d'équilibre général calculable", Thèse de Doctorat, Université de Limoges.

ROBERTS, J., SONNENSCHEIN, H. (1977). – "On the Foundations of the Theory of Monopolistic Competition", *Econometrica*, 45, pp. 101-113.

SMITH, A., VENABLES, A. J. (1988). – "Completing the Internal Market in the European Community – Some Industry Simulations", *European Economic Review*, 32, pp. 1501-1525.

STIGLITZ, J. E. (1974). – "Alternative Theories of Wage Determination and Employment in LDC's: The Labor Turnover Model", *Quarterly Journal of Economics*, vol. 88, pp. 194-227.