

**"LABOUR MOBILITY AND GERMAN INTEGRATION:  
SOME VIGNETTES"**

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## **Labor Mobility and German Integration: Some Vignettes**

### **Summary**

Germany's quick economic and monetary unification, no doubt prompted by the migration tide, has been immediately followed by massive unemployment and a spectacular increase in real wages in the five new states. That migration has then trickled down has led most observers to discount its role and focus instead on firms closure and the attendant increase in unemployment, starting up a debate on the merits of wage subsidies. This paper shows that migration is the central factor that ties together the various elements of the puzzle. Incipient migration impose an arbitrage relationship between Western and Eastern labor costs and is not necessarily socially undesirable. Once this is recognized, the case for wage subsidies is very much in doubt. Working through a variety of plausible examples (including migration and congestion costs, real wage rigidity in the western part of the country, labor force heterogeneity and endogenous growth), we characterize the social optimum and contrast the market outcome. Because migration is an externality, it is generally the case that some form of government intervention is desirable. Whether it takes the form of wage subsidies to the East or wage subsidies to the East, or capital accumulation subsidies, depends very much on the particular example chosen. Simple solutions not based on explicit welfare theoretic grounds just won't do.

## 1. Introduction

The opening of the East-West German border in November 1989, culminating with German unification, was associated with some of the most dramatic population movements in postwar European economic history. While this event stirred feelings of joy, the party is now over and the implications of migration for the evolution of the two regions have assumed paramount policy importance. Even now, while many dismiss the importance of migration, it remains roughly 2000 a week by some estimates, and may increase as hidden unemployment is converted to its open variant. Movements of some 100,000 people a year will have important effects on the supply potential in both regions. It is this issue that we want to explore, pointing out the importance of migration for wage setting and growth, and confronting its policy implications.

The older literature links migration tightly to incentives, which are largely given by wage differentials and/or job availability (see for example Greenwood 1975 or Sjastad 1962). The large wage differentials at the outset -- roughly a 300% difference for the average East versus West wage in July 1990 -- no doubt provoked a large fraction of the flows seen in Table 1. Despite high unemployment, which is normally expected to reduce labor earnings, average wages in the East have increased appreciably over the same period. They are now estimated to be roughly 60% of their Western level. This represents a doubling of their absolute level since April 1990!

Despite recent contracts by the metalworkers' union, which commits to full equalization of wages over the next three years, it seems unlikely that this goal will be achieved on the basis of effective wages (rather than contract wages or *Tariflöhne*).<sup>1</sup> At

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<sup>1</sup>One reason is that Eastern Workers will not receive the generous bonuses and other benefits of their Western colleagues, and will

the same time *incomes* in East Germany have risen by about only about one-fifth, according to a recent DIW study. The distinction arises because (1) wage increases have led to unemployment, (2) income supplements have been less generous and, (3) some East German workers, especially women, have exited from the labor force. This suggests that the process of wage formation is closely interlinked with migration and economic performance. At the same time, the possibility of East-West commuting -- roughly 300,000 currently -- serves as a safety valve on the explosion of unemployment.

**Table 1. Wages and Migration since Monetary Union**

	Average Eastern Wage <sup>a</sup>		Relative to West	Open Unempl (%)	Migration Flows <sup>b</sup>
	Nominal	Real <sup>c</sup>			
January 1990	1184	--	0.31	--	159,000
April 1990	1168	100	0.30	--	131,000
July 1990	1393	124.1	0.35	3.1	52,000
October 1990	1609	137.9	0.40	6.1	70,000
January 1991	1916	151.6	0.50	8.6	77,000 <sup>d</sup>

<sup>a</sup> OM before July 1990; DM afterwards.

<sup>b</sup> Cumulated East-West migration in the three preceding months

<sup>c</sup> Deflated by the consumption price deflator.

<sup>d</sup> Estimated using annual figure of 330,000 estimated by the Berliner Institut für Sozialwissenschaftliche Studien and cited in the Frankfurter Rundschau 6/6/91, p.1.

Source: Burda and Funke (1991); Akerlof et al (1991); Bundesanstalt für Arbeit.

The issue of cause and effect is central to the discussion. Some, including Akerlof et al (1991) have taken the position that

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still work longer hours. See "Alle Dämme sind gebrochen," Der Spiegel 10 June 1991. p.100-102. Another reason to doubt full wage equalization is wage drift. Even before unification, regional wage differences in microeconomic earnings equations signal a difference on the order of 20-30% in some regions of the north (Bremen, Ostfriesland) vis-a-vis the richer south (Bavaria, Baden-Württemberg).

wages and employment should be taken as exogenous to migration. Yet it is not clear why the possibility that migration affects the pattern of wages is ruled out. Once this possibility is explicitly allowed to play a role, we find an explanation for a number of features currently observed and then reach different policy implications.

Since unemployment has risen rapidly in the East -- see Figure 1 -- the specter of migration has not disappeared. As a result the government has initiated extensive fiscal transfers to the East. These have taken the form of direct funding for infrastructure programs, seed funding for social insurance programs and state/local government finances, as well as the usual transfer programs such as unemployment insurance and welfare assistance.<sup>2</sup> While the official unemployment rate is roughly 10% in June 1991, the unemployment rate including short-time work is well over 35%.<sup>3</sup> The number of recipients of unemployment benefits has grown from 87,307 in June 1990 to 575,000 in February 1991. They are currently receiving between 52-68% of their after-tax wage, whereas short-time workers receive up to 90%: 68% paid by the Federal employment office and 22% by the firm.

[Figure 1]

This implies significant transfers from East to West. It is difficult to know the exact costs but the following guesses are illuminating. Suppose three million unemployed and short time workers receives either directly or indirectly 60% of the average wage of about DM 2300 in the East. This comes to  $2.3 \times .6 \times 3 \times 12 =$  roughly 50 billion DM per year, or about 2% of German GNP.<sup>4</sup> The

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<sup>2</sup>For a description of the magnitude of these programs see Siebert (1991).

<sup>3</sup>While reported work hours are often positive, it is clear that the trend in recent months has been towards more "Kurzarbeit auf Null", meaning that officially short time workers are not working at all.

<sup>4</sup>Of course some of these may not take up the claim and some of the short time may not be paid... The short-time program is

overall transfer figure varies considerably, ranging from 50 to 150 billion DM per annum.

It is clear from a neoclassical two-sector model (Sinn 1990) that labor in the West loses, labor in the East gains, and capital wins overall, since the increase in the net relative endowment of labor raises the marginal productivity of capital, no matter where the labor is located. This conclusion is robust and must characterize at least the long run. Yet most of the interesting questions arise in the shorter run and are related to the dynamics between the location of capital on the one hand, and the migration of labor on the other. This is an issue which Sinn does not explore and it is the objective of this paper.

Migration itself might be seen as a welfare-enhancing response to the fall of the wall. Indeed, the literature on optimum currency areas (Mundell (1968)) identifies labor mobility as *the* criterion for success in monetary unions. The perception that migration should be resisted or slowed down must rest on deviations from the neo-classical paradigm. To approach this issue, we identify a number of plausible market distortions or failures and tackle the problem from the point of view of the social planner, asking then whether the social optimum can be supported as a competitive equilibrium. Under certain conditions, tax and transfer policies are justifiable, as would be predicted from the public finance literature. A full elucidation of all the potential market distortions and failures which would call for policy intervention is a hopeless task. Our approach is more limited as we concentrate on a few cases (vignettes) which seem to us to be relevant to the current situation. Organized around the central theme of migration, we provide examples which suggest that hasty conclusions may be unwarranted.

It should be emphasized that we ignore the issue of savings in this paper and focus on productive efficiency, that is to say,

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exceptional for the Eastern Lander and is scheduled to expire in December.

achieving the highest possible level of output in present value terms. Issues of intergenerational welfare are undoubtedly important, but would take us far afield from our current objective, and we leave this important aspect for subsequent work.

The paper is structured as follows. In the next section we present our framework for analysis. The benchmark model emphasizes the similarity of the two regions in terms of available technology and labor force, but distinguishes them in terms of the initial stock of capital. Accounting for equipment installation costs provides the minimum element for a dynamic treatment. This step allows separate consideration of the transition (period 1) from the eventual steady state (period 2). The main result is that real wages in the East rise in a sort of arbitrage relationship which yields an equilibrium where migration stops. This should dismiss the view that high real wages in the new *Länder* cannot be related to migration, given the relatively small numbers of actual migrants. Allowing then for migration and congestion costs, we build up the usual case for wage taxes and subsidies.<sup>5</sup>

In Section 3, we add to the picture the hypothesis that real wages are rigid in the western part of Germany. This seems hardly an unreasonable assumption. Akerlof et al. quote trade union sources as saying they were willing to crush roughly 40% of East German industry to get their demands. In addition, to the extent that unions in the West influence wage setting, real wages may not be flexible downwards. This means that taxes on wages in the West may be the wrong place to start looking for policy prescriptions.

Section 4 departs from the representative worker paradigm. We focus instead on human capital and its distribution between West and East Germany. A key question for migration is which types of workers should be encouraged to move, and in which direction. In this section we draw from the literature on endogenous growth,

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<sup>5</sup> Existing distortions in West Germany complicate the analysis. These include generous housing subsidies for West German residents and operating subsidies for industry.

especially with respect to the evolution of human capital, which suggests that migration may contain other important externalities. As we examine the influence of heterogeneity on migration's interaction with human capital, we qualify the standard prescription to subsidize labor (Klodt 1990, Akerlof et al. 1991).

While we use the principles of endogenous growth to discuss human capital heterogeneity, we do not bring this aspect into play until Section 5. Either because of R&D and Schumpeterian managerial spillovers (Siebert 1991), of learning-by-doing effects, or because of externalities due to public infrastructure investment, endogenous growth may turn out to be an important aspect of German unification. In face of such externalities, capital subsidies emerge as a potential policy prescription.

Of course, the issues discussed in the German context are simply a microcosm of the problem facing Eastern Europe as a whole. With appropriate adjustment of key parameters, the model we study will be just as appropriate for analyzing the coming wave of migration from Eastern Europe.

## **2. The Basic Model of Migration Costs**

In this section we characterize unification as merging two economies with sharply different capital endowments but with access to the same technology so that the aggregate production function is the same. The latter assumption can be justified by the fact that new plants established in Eastern Germany should not differ, as far as technology is concerned, from those currently installed or being installed in the western part of Germany. It sidesteps an important aspect, namely what to do with existing firms. By ignoring issues of capital vintage, we essentially overlook the first two or three years following unification. Indeed it is likely that, within just a few years, the plants held by Treuhand will either have been closed down or radically modernized. For further analytical simplification, we assume that the two economies have the same labor force. Rescaling the East to

be, say, one fifth of the West does not raise any new analytical question but would muddle the nice symmetry of the results. Finally, it is assumed initially that the labor force is homogeneous both within and across the former East-West border. In Section 4 we relax this assumption by allowing for heterogeneity within each part, East and West.

## 2.1. The Model

To capture the fundamentally dynamic aspect of the transition at minimum cost, we adopt a two period model. Period 1 represents the transition, period 2 the infinite steady state. It is assumed that in period 0 the West was in steady state. There is no trend growth, although doing so would not alter the conclusions except in the presence of endogenous growth which we consider in Section 5. Each part of Germany is characterized by a production function exhibiting constant returns to scale:

$$(1) \quad Y^W = F(K^W, L^W) \text{ and } Y^E = F(K^E, L^E)$$

where W and E refer to the former FRG and GDR respectively. It is assumed that prior to unification, the labor forces were equal but the effective capital stock in the East was considerably smaller than that in the West:

$$(2) \quad L_0^E = L_0^W \text{ and } K_0^E \ll K_0^W$$

The real rate of interest  $r$  will be taken as given, set at the world level. The justification is that Germany is "small" relatively to world saving and capital accumulation so that unification will leave the world rate of interest unchanged. Given full financial integration, the domestic interest rate thus remains unchanged. None of the substantive conclusions are affected by this admittedly strong assumption. It is further assumed that there exist a single good which can be used for consumption or investment.<sup>6</sup> Complete immediate convergence to the steady state is precluded by adjustment costs in capital accumulation and labor migration. Those costs are captured by two convex functions. For capital accumulation the cost of adding  $I$  new units per unit of time is  $I[1+\psi(I/K)]$ , with  $\psi' > 0$  and  $\psi'' > 0$ . For labor migration, moving  $\Delta L$  workers from East to West, or

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<sup>6</sup>For a distinction between traded and nontraded goods, see Burda (1990).

conversely, implies a social cost  $\theta(\Delta L)$  with  $\theta' > 0$  and  $\theta'' > 0$ . Finally, excessive concentration of population in any part of the country generates congestion costs captured by the function  $\sigma(L^i)$  with  $\sigma' > 0$  and  $\sigma'' > 0$ , where  $i = E, W$ . To ensure that the steady state is reached in period 2, the adjustment costs are only incurred in period 1 for both capital and labor.

The socially optimal solution to unification is described by the standard planner's problem.<sup>7</sup> The objective is to maximize the discounted value of present and future output available for (private and public) consumption, net of adjustment and congestion costs. For that purpose, the social planner is able to choose the amount and location (West or East) of investment  $I_t^i = K_t^i - K_{t-1}^i$  and the location of workers ( $2\bar{L} = L_t^W + L_t^E$ ), subject to available capital  $K_0^E$  and  $K_0^W$ :

$$\begin{aligned}
 (3) \quad \text{Max} \quad & \frac{F(K_1^W, L_1^W) + F(K_1^E, L_1^E)}{1+r} - I_1^W \left[ 1 + \psi\left(\frac{I_1^W}{K_0^W}\right) \right] - I_1^E \left[ 1 + \psi\left(\frac{I_1^E}{K_0^E}\right) \right] \\
 & + \frac{F(K_2^W, L_2^W) + F(K_2^E, L_2^E)}{r(1+r)} - \frac{I_2^W + I_2^E}{1+r} \\
 & - [\theta(L_0^E - L_1^E)] + \frac{\sigma(L_1^W) + \sigma(L_1^E)}{1+r} + \frac{\sigma(L_2^W) + \sigma(L_2^E)}{r(1+r)} ]
 \end{aligned}$$

Note that investment and migration costs are incurred in the period before capital and labor are brought into the production process, while congestion costs are borne in the relevant period. The second period is discounted by  $r$ , not  $1+r$ , to capture the idea

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<sup>7</sup> One can't help noting the irony of the terminology in the current context. Of course, we are simply following the usual practice of identifying the social optimum and asking whether it can be replicated as a market solution.

that it is of infinite duration.

## 2.2. The Case of No Migration Costs

As a first step, it is helpful to characterize the absolute first best solution in the case where there are only adjustment costs associated with the installation of new equipment. In (3), this corresponds to setting  $\theta()$  and  $\sigma()$  equal to zero. The socially optimal outcome is described by the following conditions for both East and West:

$$(4a) \quad F_{K2} = r$$

$$(4b) \quad F_{Lt}^W = F_{Lt}^E \text{ for } t = 1, 2$$

$$(4c) \quad 1 + F_{K1} = (1+r) [1+G(I_1/K_0)] \text{ with } G' > 0, G'' > 0^8$$

The social planner allocates workers so as to equalize their marginal productivity across the country. He then directs capital to be accumulated at an optimal speed given the installation costs and its marginal productivity in each region. In the steady state -- and in the first period -- capital-labor ratios are equal across the two regions. This is an artifact of the assumption of constant returns to economic activity, including adjustment costs.

In the short run (period 1), we show in Figure 2 the capital stocks  $K^W$  and  $K^E$ , as a function of the labor force  $L^E$  in the East, when they are optimally set according to (4c). Quite intuitively, the lower the labor force remaining in the East, the more capital must be accumulated in the West and the less in the East.<sup>9</sup> Figure

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<sup>8</sup> Where  $G(I/K) \equiv \psi(I/K) + I/K\psi'(I/K)$ .

<sup>9</sup> We use the fact that  $L^W + L^E = 2L$ . The slopes of the two schedules are less than 45° in absolute value. Note that in the West, when there is no migration ( $L^E = L$ ) there is no need to increase the capital stock because it was initially at its steady state level. In the East however, the initial capital stock is too low given the labor force so even with  $L^E = L$  some capital must be accumulated.

3 shows how the optimal allocation of labor implied by (4b) depends upon the stock of capital in the East for given capital stock in the West. Since the capital labor ratios are equal, a lower labor force is desirable in the East the lower the capital stock there.<sup>10</sup> For higher capital stocks in the West, more migration from the East is optimal as shown by the fact that, with  $K_a^W > K_b^W$ , the schedule corresponding to  $K_a^W$  lies to the left of the schedule corresponding to  $K_b^W$ . Figure 4 brings these two conditions together and depicts the outcome in period 1: both  $K^W$  and  $K^E$  rise above their initial levels and some transfer of population is desirable. Note that because the capital labor ratios are the same ( $k^W = k^E$ ) by (4c) the rate of investment ( $I_1/K_0$ ) is the same. In absolute terms more capital is accumulated in the West than in the East because of the difference in initial capital stocks (see (2)).

[Figure 2, 3 and 4]

In the long run the capital labor ratio is such that the marginal productivity of capital in both regions is equal to the world rate of interest. Thus the total amount of capital accumulation in both East and West is given by the condition that:

$$(5) \quad k^W = k^E = \bar{k} = F_K^{-1}(r) \text{ where } k^i = K^i/L^i$$

Since the total labor force  $2\bar{L}$  is given, the long run level of total capital is uniquely determined. This is shown in the modified Edgeworth box of Figure 5. Before unification, the FRG is represented by point  $W_0$  and the GDR by point  $E_0$  with a very small capital stock. Period 2 (steady state) occurs along the diagonal where (5) is satisfied.

In period 1, the capital labor ratios are equalized partly

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<sup>10</sup> The schedule is  $K^E = K^W \frac{L^E - E}{2L - L^E}$ . It is upward sloping and  $K^E = K^W$  when  $L^E = \bar{L}$ .

via capital accumulation and by moving Eastern workers to the West (points  $W_1$  and  $E_1$ ). In period 2 any point along the diagonal is a valid steady state equilibrium. The position along the diagonal describes how capital and labor is allocated between East and West. In the absence of congestion costs, the planner is indifferent as to the location of activity as long as she only cares about productive efficiency.<sup>11</sup> As capital installation costs are assumed to vanish in the steady state, in the absence of migration or congestion costs the planner is indifferent as to which point is reached along the diagonal. To get a unique solution, more structure is needed. For example, if we allow for congestion costs (4b) is replaced by:

$$(4b') \quad [F_L^W - \sigma'(L_t^W)] = [F_L^E - \sigma'(L_t^E)] \quad \text{for } t = 1, 2$$

The effect of congestion is not very surprising: from the planner's perspective, it reduces the marginal productivity of labor. This has two effects. In period 1, the capital labor ratios are no longer equalized so with  $k_1^W > k_2^E$  migration is partly held back. In period 2 (4a) requires that the marginal product of capital be equal which, along with (4b') implies that the planner will aim at the center of the box. Thus congestion leads to a unique distribution of capital and population, in the present case to  $L^W = L^E$  and  $K^W = K^E$ . Having clarified the important role of congestion, we will disregard it for the rest of the paper.

[Figure 5]

### 2.3. Migration Costs

When migration costs are accounted for, the optimal capital accumulation conditions (4a) and (4c) remain unchanged and Figure 2 remains the same as before. Labor allocation, on the other hand,

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<sup>11</sup> If the planner cares about equity, this would provide a guide for picking a particular outcome. This may be, in practice, an important consideration.

is not determined by (4b) but by:

$$(4d) \quad F_{L1}^W - F_{L1}^E = (1+r) \theta'(L_0^E - L_1^E)$$

$$(4e) \quad F_{L2}^W = F_{L2}^E$$

Migration costs drive a wedge between labor productivity in the West and the East. Since we start with marginal productivity much higher in the West<sup>12</sup>, in period 1 migration prevents full equalization. This condition, familiar from the migration literature (Greenwood 1975), cannot be overemphasized. It is a sort of arbitrage relationship between Western and Eastern labor costs. It suggests that, even if migration is costly, the surge in labor costs documented in Table 1 is not necessarily undesirable.

Naturally, migration costs make it less desirable to shift workers from East to West. Graphically, the schedule of Figure 3 becomes steeper around the initial situation as shown in Figure 6. The overall effect is depicted in Figure 7. The result is less migration and less capital accumulation in the West, more capital accumulation in the East. Yet the labor productivity wedge implies that the capital labor ratio in the West is now larger than in the East as is shown by points  $W_1^m$  and  $E_1^m$  in the modified Edgeworth box (Figure 5).

[Figures 6, 7]

Because migration costs are assumed to disappear in Period 2, the long run is the same as before. In particular, in the absence of congestion costs the planner is indifferent about the distribution of capital and labor between East and West.

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<sup>12</sup> This is why the planner's problem as set up in (3) does not allow for migration Eastward.

## 2.4. The Market (Decentralized) Solution

We now turn to the outcome when firms and workers optimally react to reunification. Note that in the absence of external migration and congestion costs, the market solution achieves exactly the production optimum described in equations (4a)-(4c).

We consider two representative firms, one in the East and one in the West, and similarly two representative workers. The firms set employment and investment to maximize the present value of profits:

$$(6) \quad \text{Max} \quad \frac{F(K_1^i, L_1^i)}{1+r} + \frac{F(K_2^i, L_2^i)}{r(1+r)} - I_1^i \left[ 1 + \psi \left( \frac{I_1^i}{K_0^i} \right) \right] - \frac{I_2^i}{1+r} \\ - \frac{w_1^i L_1^i}{1+r} - \frac{w_2^i L_2^i}{r(1+r)} \quad \text{for } i = W, E$$

while each worker supplies labor inelastically wherever the present value of her earnings are highest, inclusive of the migration costs that she faces. The firm's optimal choice is the same as the planner's as far as capital accumulation is concerned and (4a) and (4c) apply. Because the firms do not face any direct migration cost, we get the familiar labor demand conditions:

$$(7a) \quad F_{L1}^i = w_1^i$$

$$(7b) \quad F_{L2}^i = w_2^i$$

Because of (4a) the capital labor ratios are equalized in period 2 and so are real wages. The decision to migrate therefore depends only on period 1 wage differentials and the migration costs perceived by each worker. Thus migration occurs to the point where:

$$(7c) \quad F_{L1}^W - F_{L1}^E = c(1+r) \quad \text{where } c = \theta'(1)$$

Here  $c$  represents the cost of migration as perceived by a single worker independently of what the others do. Migration is a non pecuniary externality which introduces an important difference between (4d) and (7c). Since  $\theta'(1) < \theta'(L_0^E - L_1^E)$ , decentralized migration forces a tighter convergence of real wages between West and East. Thus more workers move from East to West than is socially optimal. Firms react by investing more in the West and less in the East than the planner would.

This result raises the issue of a policy response which induces workers to internalize the externality. A combination of taxes levied on wages in the West and wage subsidies in the East would achieve that objective. This has been proposed by Akerlof et al. (1991), although from a different angle.<sup>13</sup> It remains to be seen, however, whether this policy implication survives in a less stylized framework than the one adopted so far. The rest of the paper proposes a number of variations which qualify this suggestion.

### 3. Wage Rigidities

An obvious shortcoming of the benchmark model is that it assumes full employment. The explosion of unemployment, both open and hidden, in the aftermath of unification certainly points to the need to address this issue. Fundamentally, unemployment of such proportions is likely to be related to wage rigidity. In this section, we take the extreme view that real wages are set in the West at the pre-unification level. Along with labor mobility, this puts a tight constraint on real wages in the East. In terms of

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<sup>13</sup> These authors do not identify any externality, relying instead in an unexplained market failure leading to what they see as excessive wages in the East. Consequently, they cannot establish that their policy proposal is welfare increasing for Germany as a whole.

welfare and policy implications, we thus focus on a clearly identified market distortion, yet one which arises in the West.<sup>14</sup> An alternative approach which emphasizes trade union behavior is developed in Burda and Funke (1991).

Formally, we assume that in period 1 real wages in the West are downward rigid and remain unchanged after unification:

$$(8) \quad w_1^W = \bar{w}$$

In order to highlight the role of wage rigidity *in the West* on the East we further make the simplifying assumption that there is no cost of adjustment in investment in the West, i.e. we set the function  $G^W(\cdot)=0$ . In period 2, in line with the rest of the model, all rigidities disappear and full employment occurs, so we focus on period 1.<sup>15</sup> In the East, workers still exert arbitrage between the present value of earnings in the West and those in the East. But now they must take into account the possibility of being unemployed if they stay in the East, so what matters is the *expected* present value.<sup>16</sup> We also assume that there is full employment in the West so that when an individual easterner contemplates migration, she rationally expects to get a job with probability one. Here we follow Harris and Todaro (1970); given that wages are equalized in period 2, the arbitrage condition becomes:

$$(9) \quad w^W - c(1+r) = w^E \frac{L_1^E}{L_1^E + U_1^E} + b \frac{U_1^E}{L_1^E + U_1^E}$$

where L and U represent employment and unemployment, respectively,

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<sup>14</sup> In this respect, while we consider an aspect emphasized by Akerlof et al., we differ in identifying clearly what distortion is at stake and where it originates. This is why our policy conclusions differ.

<sup>15</sup> Whenever possible, the time subscript is omitted.

<sup>16</sup> Obviously, within this model, there cannot be unemployment in the West.

and  $b$  represents the unemployment benefits paid in the East. Given the wage rigidity assumption, this can be written as a wage setting relationship in the East:

$$(10) \quad w_1^E = \left(1 + \frac{U_1^E}{L_1^E}\right) [\bar{w} - c(1+r)] - \frac{U_1^E}{L_1^E} b$$

In the West, employment in period 1 is determined by (4c) and (7a):

$$(11) \quad F_{L1}^W = \bar{w}$$

$$(12) \quad 1 + F_{K1}^W = (1+r)$$

If we denote  $N_{=L+U}^E$  the size of the labor force which remains in the East, the situation is described by:

$$(13) \quad F_{L1}^E = w^E$$

$$(14) \quad 1 + F_{K1}^E = (1+r) (1 + G(I^E/K_0^E))$$

Two aspects of the new situation need to be noted. From (11) and (12) it is clear that the West is fully shielded from the effects of unification. The marginal productivities of both labor and capital remain unchanged because their costs are unaltered. Western firms, therefore, have no incentive to hire or invest and could as well do nothing. Hence there is no migration. We will see later on that this is just one possibility. Second, capital stock in the West no longer affects the East: the link established by (7c) between  $F_L^E$  and  $F_L^W$  means that  $k^E$  is related to  $k^W$ , which via (4c) implies that capital accumulation in the West affects capital accumulation in the East; (13) severs that linkage. In fact, all the burden of adjustment is borne by the East, which behaves as an independent economy, with the crucial difference that migration imposes the arbitrage condition (10).

Figure 8 describes the situation. The supply of labor in the East is driven by the arbitrage condition (10) rewritten as:

$$(10') \quad w^E = \bar{w} - c(1+r) + \left(\frac{N^E}{L^E} - 1\right) (\bar{w} - c(1+r) - b)$$

It is downward sloping because an increase in employment  $L^E$  improves the lot of Eastern workers by reducing the probability of being unemployed and thus leads them to ask for lower real wages. The demand for labor is given by (13) and (14), i.e. taking into account the capital accumulation decision decision by Eastern firms. It is also downward sloping because an increase in real wages decreases labor demand by directly forcing firms to increase the capital labor ratio, which is achieved through a combination of capital accumulation (equation (14)) and labor shedding (equation (13)).<sup>17</sup> Two configurations are possible as shown in panels (a) and (b). In panel (b) the relatively steep labor demand schedule corresponds to a rather inelastic demand for labor. The outcome shows that  $L^E < L_0^E$ , i.e. there is unemployment in the East because, given the lack of capital, the capital labor ratio at full employment implies a too low marginal productivity of labor given the real wage, thus forcing firms to lay off workers.

Migration cum rigid wages in the West have surprising effects. First an increase in unemployment benefits makes the labor supply schedule rotate downward around the full employment position ( $L^E = L_0^E$ ) because higher benefits improve the "package" available to workers in the East for a given level of unemployment, and this effect is stronger the larger the level of unemployment (see (10')). As it becomes less desirable to move to

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<sup>17</sup> We assume that  $\bar{w} > c(1+r) + b$  to get an unambiguously downward sloping labor supply schedule. As for the labor demand schedule, its slope is:

$$\frac{\partial F_L^E}{\partial L^E} = - \frac{F_{KK} F_{LL} - (F_{KL})^2 - F_{LL} (1+r) G'(I/K_0)}{(1+r) G'(I/K_0) - F_{KK}} < 0$$

the West Eastern workers accept lower real wages which in turn raises the demand for labor. . In panel (b) this naturally results in *lower* wages in the East and *less* unemployment. The opposite effect which appears in panel (a) can be ruled out because it is readily seen that this case is *unstable*: lower wages leads to more employment, hence to a further cut in real wages (see the interpretation of (10') above), etc...

The second result is that higher migration costs also reduce real wages and improve employment in the East, for very similar reasons. Graphically (not shown in Figure 8), the demand for labor schedule shifts downward because there is less incentive to migrate and therefore staying in the East is more attractive and leads workers to accept lower real wages.

Two comparisons are interesting and can be observed in the modified Edgeworth box (Figure 5) where the new situation is represented by points  $W^r$  (unchanged at  $W_0$ ) and  $E^r$ . Relative to the market solution in the absence of wage rigidity, unemployment replaces outmigration. Relative to both the market outcome and to the social optimum, there is even more capital accumulation in the East than was the case with the market solution.<sup>18</sup>

The story is not complete, however, since unemployment benefits must be paid out. What is missing is the government budget constraint. A return to the social optimum would again call for a combination of wage taxes in the West and wage subsidies in the East. Indeed, one argument advanced by Akerlof et al. is that paying out wage subsidies is preferable to unemployment benefits during the transition. This neglects the fact that wage rigidity affects *after-tax* wages. This observation effectively rules out raising wage taxes in the West. The third best solution is not easily found. It is likely, however, to focus on capital

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<sup>18</sup> Comparing (4d) or  $E$  (7c) with (13) and (10'), the arbitrage condition implies that  $k_1^E$  is larger with rigid wages in the West. The capital accumulation equation (4c) or (14) implies more investment in the East when real wages are rigid in the West.

accumulation. In order to move towards the social optimum, we want to increase capital accumulation in the West, and possibly to slow it down in the East (Figure 5). Indeed firms in the West are too content with the *statu quo*. Yet, since they operate under constant returns to scale, they do not mind to hire more workers and increase in the same proportion the capital stock. Simply they have no incentive to do so since their profits would remain unchanged. The social best would provide with such incentives. Curiously therefore, taxing investment in the East, to pay for investment subsidies in the West and unemployment benefits in the East, would seem to achieve that objective. The paradox -- in the spirit of the principle of second best -- comes from the fact that the labor market distortion cannot be addressed directly if the assumption of real wage rigidity is taken seriously.

[Figure 8]

#### 4. Labor Heterogeneity and Human Capital

##### 4.1. The Model

In this section we return to the benchmark model to examine an important and widely reported aspect of German unification. It has been noted that among the migrating population, highly skilled workers are more highly represented than average. This raises the prospect of a dynamic depletion of human capital described by Myrdal (1957) and Romans (1964) in the development context.<sup>19</sup> To approach this issue, we adapt the model of Lucas (1988). Thus the aggregate production function of each part of Germany is described by a function of the form:

$$(15) \quad Y = H^\alpha F(K, L) \quad \text{with } 0 < \alpha < 1$$

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<sup>19</sup> It is estimated that roughly half of all East-West migrants are less than 30 years old and that three-quarters are skilled workers, including doctors and engineers ("Auf Wolke Sieben," Der Spiegel No 25, June 17 1991, pp 39-42).

The assumption that  $\alpha < 1$  rules out endogenous growth, which is taken up in the following section. The term  $H$  measures the region's accumulated human capital and comes as an externality not appropriable by any particular firm or worker but available to all of them. It is the average of all workers' individual human capital. To capture heterogeneity, we rank all workers, separately in each region, along a continuous scale which goes from zero to  $L^i$  ( $i=W, E$ ) and identify each one by the index  $v$ . Thus total human capital is:

$$(16) \quad \bar{H}^i = \int_0^{L^i} h(v) dv$$

where  $h(v)$  is a (nondecreasing) density function. Therefore  $H^i$  is defined as:

$$(17) \quad H^i = \bar{H}^i / L^i$$

#### 4.2. The Planner's Choice

The first question that we face is which workers the social planner would wish to move to the West if that were her intention. We first reason heuristically and consider the decision of moving one worker, overlooking migration and congestion costs. The marginal return to Germany as a whole from moving worker  $v$  from East to West is the benefit that accrues to the West less the cost to the East:

$$(19) \quad MR^{E \rightarrow W} = (H^W)^\alpha \left( F_L^W - \alpha \frac{F^W}{L^W} \right) - (H^E)^\alpha \left( F_L^E - \alpha \frac{F^E}{L^E} \right) \\ + \alpha h(v) \left[ \frac{(H^W)^\alpha F^W}{H^W L^W} - \frac{(H^E)^\alpha F^E}{H^E L^E} \right]$$

This expression can be decomposed in three parts. The two

first elements in the first line of (19) show the effect of moving one worker irrespective of her human capital. This effect itself can be broken down into two parts:

$$(20) \quad H^\alpha F_L - \alpha H^\alpha \frac{F}{L}$$

The first part is simply total marginal productivity of an additional warm body, as in neoclassical theory. The second term represents the *dilution effect*: a worker who would come without human capital would reduce the average of the region's human capital. As (20) shows, it is positive for the West if  $\alpha$  is not too large.<sup>20</sup>

However, the worker does not come alone, she brings along her contribution to the aggregate human capital and this is captured by the third term. This captures effect of the quality of the worker transferred on average human capital in both regions. One is reminded of a popular joke told just about everywhere in the world.<sup>21</sup>

Since the capital stock is larger in the West, it seems safe to assume that the average technical productivity per capita ( $F/L$ ) and the average total productivity per effective worker ( $H^\alpha F/HL$ ) exceed those in the East. This ensures that the last term is always positive: moving any worker to the West raises the country's total output because of the human capital externality. Then, if the sum of the two first elements is positive, it is indeed optimal to move workers to the West. The maximum benefit

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<sup>20</sup> More precisely, if workers are paid their marginal product, as long as  $\alpha$  is less than the labor share. To see this rewrite (20) as  $H^\alpha F_L / [F_L / F - \alpha]$ . But  $F_L / F$  is simply the fraction of value added going to that worker. Note that in this model we have suppressed all privately appropriable human capital in order to highlight the point we wish to make.

<sup>21</sup> Substitute for X and Y your favorite choice: "Did you hear about the fellow who migrated from X to Y? He reduced the IQ in both countries."

then accrues the larger is the last expression, i.e. by moving the most skilled workers (maximizing  $h(v)$ ). If on the contrary, the sum of the two first elements is negative and large in absolute value so that the total marginal return is negative, then it is optimal to move workers from the West to the East. In that case, the social best is achieved when the last term, which is positive and detracts from the overall gain, is as small as possible. This is achieved by moving East the least skilled workers from the East.

When is each case likely to happen? There is no general criterion as can be seen in the special case where the production function is Cobb-Douglas ( $F(K,L) = K^\beta L^{1-\beta}$ ):

$$(20) \quad MR^{E \rightarrow W} = (H^W)^\alpha (k^W)^\beta \left[1 - \alpha \frac{h(v)}{H^W}\right] - (H^E)^\alpha (k^E)^\beta \left[1 - \alpha \frac{h(v)}{H^E}\right]$$

The larger the stock of physical and human capital in the West, the more it is likely that migration from East to West is desirable, in accord with intuition.

### 4.3. Market Outcome

In order to understand the market solution, it is best to start with the planner's optimum.<sup>22</sup> She will shift workers and skills until there is no marginal benefit left, which occurs when the labor force in the East is  $L^E$  such that:

$$(21) \quad (H^W)^\alpha F_L^W + \alpha (H^W)^{\alpha-1} [h(L^E) - H^W] (F^W/L^W)$$

$$= (H^E)^\alpha F_L^E + \alpha (H^E)^{\alpha-1} [h(L^E) - H^E] (F^E/L^E)$$

(1)
(2)

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<sup>22</sup>Since the capital accumulation issue remains unchanged, we focus on labor migration exclusively.

The expression labelled (2) in (21) captures the human capital externality, the difference between the positive effect of additional human capital and the adverse dilution effect. The market solution will simply overlook this effect (it sets  $\alpha=0$ ) and equalizes the marginal productivity of workers as captured by the expression labelled (1). The resulting distortion may have a variety of effects, some of which are described in the following examples.

First, consider the case  $h(L^E)-H^W < 0$  and  $h(L^E)-H^E > 0$ . This is when the marginal migrant contributes negatively to the human capital of both the East and the West. Then (21) shows that the social optimum occurs when marginal productivity of labor is higher in the West than in the East while the market solution will equate them. As a consequence there will be too much migration and capital accumulation in the West and not enough capital in the East, much as with migration costs. Here the reason is that the marginal migrant lowers average human capital in both West and East. This could occur if the distribution of skills is skewed upwards in the West and downwards in the East. If the distribution is similar and overall migration moderate, we may have the opposite configuration:  $h(L^E)-H^W > 0$  and  $h(L^E)-H^E < 0$ . In that case there is not enough migration and capital accumulation in the West.

Without taking a stand on which case is more likely to correspond to reality, it is clear that corrective policy action is desirable but its very objective ambiguous.

#### 4.4. A Specific Example

We now consider a tractable version of the above problem. Suppose that human capital in the first period is distributed across East and West as follows:

$$h_1^E(v) = h^E$$

$$h_1^W(v) = h^W, \text{ with } h^W > h^E$$

In the second period (the steady state), the regional transfer of human capital is complete so that all have the same (Western) level:

$$h_2^E(v) = h_2^W(v) = (1+\delta)h_1^W = \bar{h}.$$

Note that the following setup implies at the opening of the border  $H^E < H^W$  and for each migrant from East to West,

$$-\partial H^E / \partial L^E = 0$$

$$-\partial H^W / \partial L^E = [h^E - H^W] / [L^W + \bar{L} - L^E]$$

Since  $h^E < H^W$  at the opening of the wall, East-West migration decreases human capital in the West in the first period, but leaves the Eastern level unaffected.

The planner now faces an interesting problem: moving an individual from East to West diminishes the short run level of human capital in the West, but moving individuals in the opposite direction increases that of the East. Suppressing migration as well as congestion costs, the planner's now solves

$$\begin{aligned} \text{Max} \quad & \frac{(H^W)^\alpha F(K_1^W, L_1^W) + (H^E)^\alpha F(K_1^E, L_1^E)}{1+r} - I_1^W \left[1 + \psi\left(\frac{I_1^W}{K_0^W}\right)\right] - I_1^E \left[1 + \psi\left(\frac{I_1^E}{K_0^E}\right)\right] \\ & + \frac{\bar{h}^\alpha F(K_2^W, L_2^W) + \bar{h}^\alpha F(K_2^E, L_2^E)}{r(1+r)} - \frac{I_2^W + I_2^E}{1+r} \end{aligned}$$

where the maximization is over  $L_1^E, L_1^W, L_2^E, L_2^W, I_1^E, I_1^W, I_2^E$  and  $I_2^W$ . Note that the planner may choose to allocate Westerners to the East as well as Easterners to the West, so  $L^E$  and  $L^W$  are properly thought of as the natives of the respective regions who actually remain at home. (In the second period this distinction is

irrelevant). Under these conditions the problem is subject to the restrictions

$$H^W = [h^E(\bar{L} - L^E) + h^W L^W] / \tilde{L}^W$$

$$H^E = [h^W(\bar{L} - L^W) + h^E L^E] / \tilde{L}^E$$

where  $\tilde{L}^W \equiv L^W + \bar{L} - L^E$  and  $\tilde{L}^E \equiv L^E + \bar{L} - L^W$  are actual employment in the West and East respectively.

The first order conditions are:

$$(22) \quad \bar{h}^{\alpha}_{FK2}{}^i = r \quad \text{for } i=W,E$$

$$(23) \quad \bar{h}^{\alpha}_{FL2}{}^W = \bar{h}^{\alpha}_{FL2}{}^E$$

$$(24) \quad 1 + (H^i)^{\alpha}_{FK1}{}^i = (1+r)[1+G(I_1^i/K_0^i)] \quad \text{for } i=W,E$$

$$(25) \quad (H^i)^{\alpha}_{FL}{}^i + \alpha(H^i)^{\alpha-1}(F^i/L^i) [h(L^j) - H^i] \\ = (H^j)^{\alpha}_{FL}{}^j + \alpha(H^j)^{\alpha-1}(F^j/L^j) [h(L^j) - H^j]$$

for  $i=W,E$ .

From (22) and (23) immediately follow that in the steady state,  $K/L$  is the same as in both regions as would be expected. (24) has the same interpretation as in section 3, except that now the marginal product of capital depends (crucially!) on average human capital in each region. Equation (25) says that at the margin, the planner balances the productive gain of a marginal "citizen" of region  $i$  at home against the opportunity cost of putting her to work in region  $j$  as a migrant.

Conditions (25) together imply that  $(H^W)^{\alpha-1}(F^W/\tilde{L}^W) = (H^E)^{\alpha-1}(F^E/\tilde{L}^E)$ ; combining this with the two first order conditions for investment (24) we have

$$\frac{F_L^W - \alpha F^W / \tilde{L}^W}{F_{K1}^W} - [(1+r)[1+G(I_1^W/K_0^W)-1]] = \frac{F_L^E - \alpha F^E / \tilde{L}^E}{F_{K1}^E} - [(1+r)[1+G(I_1^E/K_0^E)-1]]$$

a condition which is independent of H in both regions.

Consider first the limiting case of  $G=0$ . Then

$$\frac{F_L^W - \alpha F^W / \tilde{L}^W}{F_{K1}^W} = \frac{F_L^E - \alpha F^E / \tilde{L}^E}{F_{K1}^E}$$

which uniquely determines the capital labor ratio as being equal in both regions. But if  $K/L$  is equal in both regions in the first period, so must be  $H$ . This is given as point A in the space of  $L^E$ ,  $L^W$  drawn in Figure 9 and is the intersection of the equal capital-labor ratio ( $k^W = k^E$ ) schedules and equal human capital ( $H^W = H^E$ ) schedules. If there are no adjustment costs, the planner chooses  $K^E = K^L$ . He also sends half of the population eastward to boost its external human capital. He brings over half of the Easterners to replace them.

With nonzero adjustment costs which are nevertheless characterized by constant returns, the same capital-labor ratio can be supported, but only if  $G^E = G^W$ . This implies that in the first period there is more capital in the West (not unreasonable) since  $K_0^W \gg K_0^E$  by assumption. Consequently, fewer Westerners go east, but more Easterners go West. This is point B in the figure.

The market solution is pretty straightforward. No Westerner in this example will be tempted to migrate Eastward, since  $H^W > H^E$  at the outset and westward migration does not influence  $H^E$ . In contrast, Easterners will be delighted to migrate, and will do so until the wage is equal in both regions. At this point we have, again ignoring migration costs,

$$(h^E)_F^E = (H^W)_F^W$$

Since  $h^E = H^E < H^W$ , it must be the case that  $k^W < k^E$ . From the firm's decision however,

$$(24) \quad 1 + (H^i)^\alpha F_{K1}^i = (1+r)[1+G(I_1^i/K_0^i)] \quad \text{for } i=W,E$$

so it follows that the left-hand side of (24) is unambiguously smaller in the East, meaning a smaller investment rate than in the West. Migration will be much higher than in the planner's problem, and there will be too little investment in the East as well.

Here is the catch. A single subsidy to workers in the East will certainly keep them there if sufficiently high, and thereby keep  $k^E$  low. But this cannot solve the problem of raising human capital in the East in the first period. This was of course exactly what the planner chose to do. A second subsidy on Westerners to move East will be required. Since Westerners are already earning more than Easterners (and perhaps may be more or less indistinguishable from them), such a two-subsidy solution may be discriminatory and impossible to implement. An alternative would be to subsidize capital in the first period in the East: this will encourage investment to compensate for their disadvantaged initial condition.<sup>23</sup>

## 5. Capital Externalities

Following the explosion in the literature on endogenous growth, our last vignette considers the possibility that some of the productive effects of capital is external to the individual firm. This could be infrastructure capital, although we do not consider this case explicitly. In line with the literature on endogenous growth, we rather intend to capture technological progress and knowledge (see Romer (1990)). The externality can be either limited to each region or extend to the whole union. In the

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<sup>23</sup> Recently the government has faced difficulties inducing officials (judges, bureaucrats, etc) to move to the East, even with substantial bonuses.

latter case, regional aspects play no role and this case is not considered here.

We consider the case when the production function of each region ( $i=W,E$ ) is:

$$(25) \quad \kappa^\beta (K^i)^{1-\beta} (L^i)^\beta \quad i = W, E$$

where  $\kappa$  represents the part of aggregate capital which is not perceived as under the control of the representative firm.<sup>24</sup> Thus the firm will choose  $K$  and  $L$  taking  $\kappa$  as given while the planner will recognize that  $\kappa=K$  and that the aggregate production function is in fact  $K L^\beta$ . That the exponent of  $\kappa$  is  $\beta$  gives rise to endogenous growth.<sup>25</sup>

We first consider the planner program as set up in (3), but without congestion and migration costs and with flexible real wages. In period 1, the planner chooses capital and employment such that:

$$(26) \quad \frac{K_1^W}{K_1^E} = \left( \frac{L_1^W}{L_1^E} \right)^{1-\beta}$$

$$(27) \quad 1 + (L^i)^\beta = (1+r) [1 + G(I^i/K_0^i)]$$

The market would also deliver (26) but (27) is replaced by:

$$(27') \quad 1 + (1-\beta) (L^i)^\beta = (1+r) [1 + G(I^i/K_0^i)]$$

It is clear that the decentralized solution does not have any effect on the allocation of capital and labor between West and

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<sup>24</sup> As in Romer (1990), this can be thought of as representing the aggregate of a large number of identical firms.

<sup>25</sup> That is, there is constant returns in the factor that can be accumulated. See Sala-i-Martin (1990).

East.<sup>26</sup> Because of the initially lower capital stock, it is optimal for the planner to shift labor to the West. Firms in the West have a higher marginal productivity of labor and offer higher wages until they attract workers from the East. However because firms underestimate the full return to capital accumulation investment is less than socially optimal (this is the effect of the coefficient  $1-\beta$  which appears in (24') but not in (24)).

What are the policy implications for the transition period? It might seem that there is no unification-related need for action since the only externality is unrelated to the allocation of resources across West and East. Yet, that is not quite the case. Unification triggers a new process of capital accumulation which can be improved by incentives provided to capital accumulation in both West and East.<sup>27</sup>

In period 2, the new steady state, the labor allocation condition (23) still applies. Capital accumulation is different because of the endogeneity of growth related to the constant returns to capital built in the production function. Concerning the social optimum an interior solution occurs when:

$$(25) \quad (L_2^W)^\beta = (L_2^E)^\beta = r$$

Then capital and labor should be set at the same level in West and East.<sup>28</sup> The question is whether labor supply allows (25) to be satisfied. Three cases can be distinguished. If total labor supply  $\bar{L}$  is such that  $\bar{L}^\beta < r$ , the best is to actually close down Germany! A

<sup>26</sup> Taking the ratios for East and West in (24) and (24'), along with (23) deliver the same condition:

$$\frac{L_1^W}{L_1^E} = \frac{(1+r)[1+G(I^W/K_0^W)]}{(1+r)[1+G(I^E/K_0^E)]} = \left( \frac{K_1^W}{K_1^E} \right)^{1/(1-\beta)}$$

<sup>27</sup> This seems to be well-recognized in Germany, at least for infrastructure investment.

<sup>28</sup> Since the outcome is a continuously growing economy there is no steady state capital stock. To determine the rate of growth we would need to model explicitly the saving choice.

more realistic case is when  $(\bar{L}/2)^\beta > r$ ; then the best is to accumulate as much capital as is possible in both West and East. In the intermediate case  $(\bar{L}^\beta/2) < r$  and  $\bar{L}^\beta < r$  the social optimum is to concentrate all activities in one part of the country, no matter which one is chosen.<sup>29</sup>

In the decentralized case, (25) is replaced by:

$$(25') \quad (1-\beta) (L_2^W)^\beta = (1-\beta) (L_2^E)^\beta = r$$

This contributes to make the growth outcome in both parts of the country less likely. For example if  $(1-\beta)(\bar{L}^\beta/2) < r$  while  $(\bar{L}^\beta/2) > r$  a capital subsidy is clearly desirable *forever!*

## 6. Conclusion

The presumption that the only policy intervention called for by German unification is to subsidize labor in the former GDR is not warranted. While some labor market distortions support this policy prescription, the case has not been made that these are the main distortions, that these distortions are worth the deadweight losses incurred in financing the recommended transfers, nor that such policies would actually be effective (if real after tax wages are rigid in the West, section 3 show that the proposed policy will fail). Our purpose here has not been to propose particular policy actions. This would require a more elaborate treatment, including the principles of efficient dynamic taxation which go far beyond this paper (and our competence!).

Rather, the purpose has been to illustrate the generally valid argument that policy intervention must be justified by market failures (this being a sufficient, not a necessary condition). This is why we have proposed, within a unifying

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<sup>29</sup> Of course other considerations (migration, congestion, or installation costs) might bias choice in favor of one over the other.

framework, a number of examples which we believe are relevant to today's process of unification in Germany. They may explain why the government continues to offer extremely generous subsidies to new investment in the East.<sup>30</sup> Our vignettes suggest that policy intervention might be desirable, but that the choice of what to subsidize and what to tax is far less obvious than it is sometimes believed.

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<sup>30</sup> For example, in February 1991 generous accelerated depreciation allowances and tax credits were extended to German businesses investing in the East.

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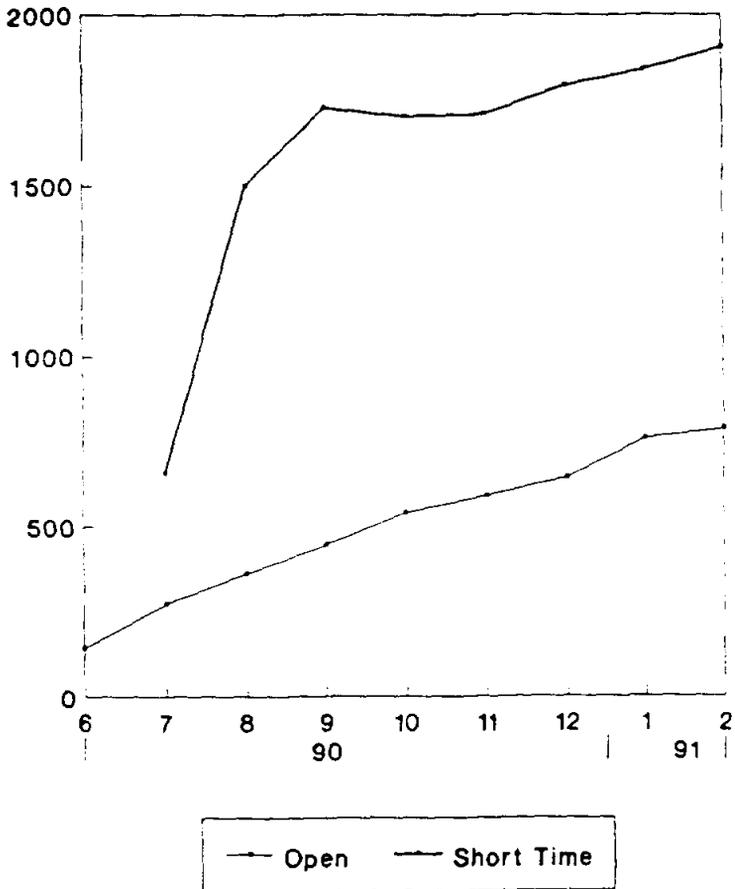
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Figure 1. Unemployment in the ex-GDR  
(Thousands)



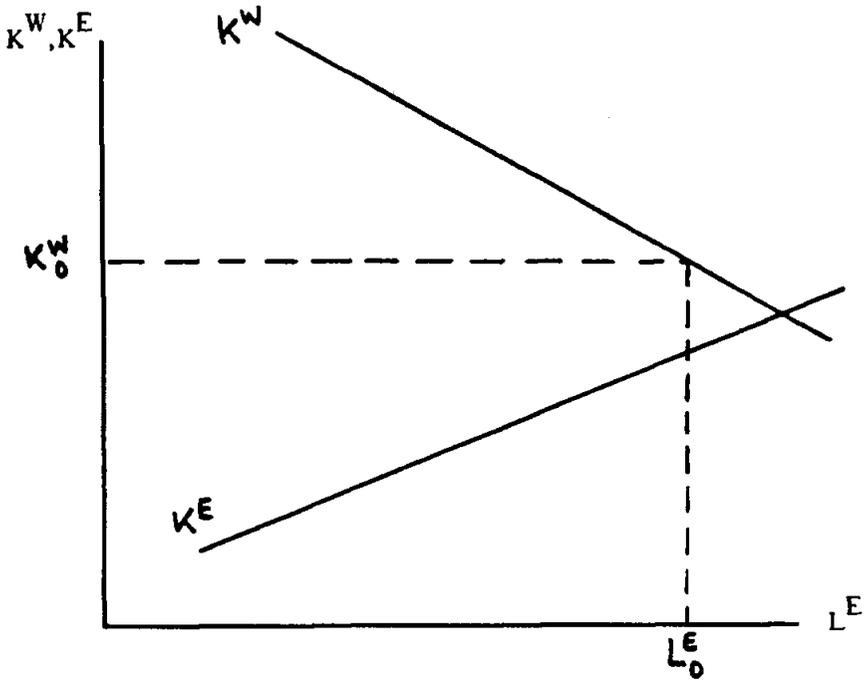


Figure 2. Capital Accumulation Schedules

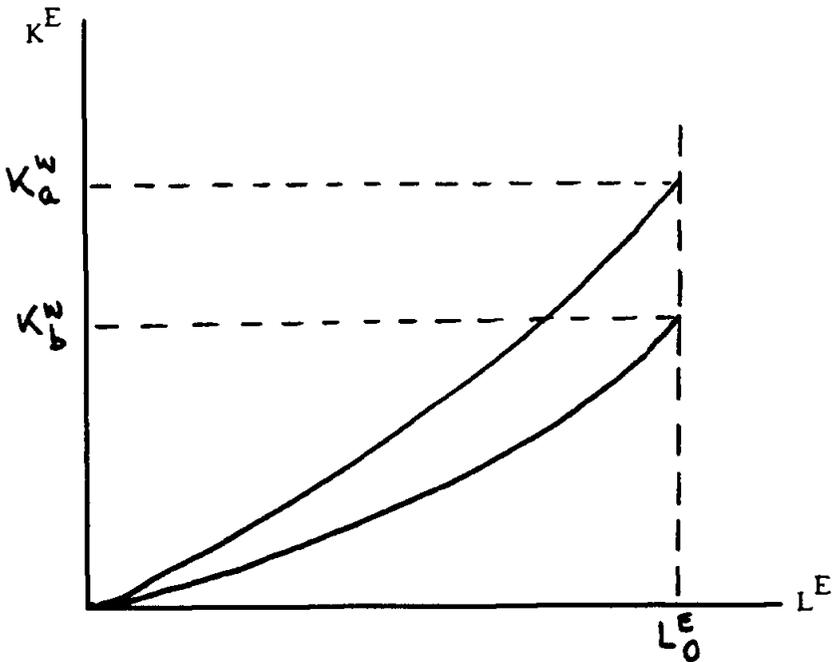


Figure 3. Labour Allocation Schedule

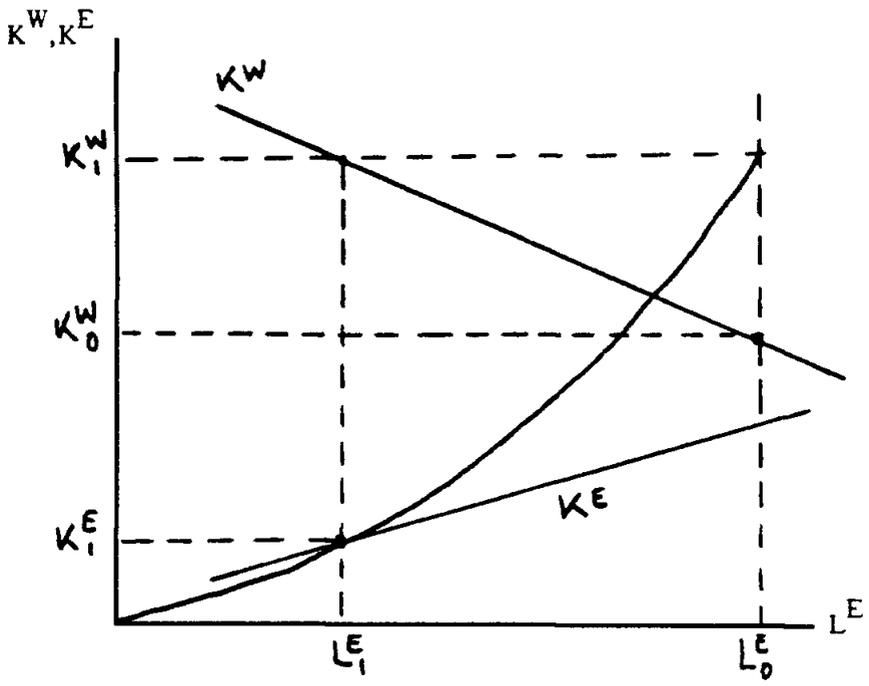


Figure 4. The Case of No Migration Costs

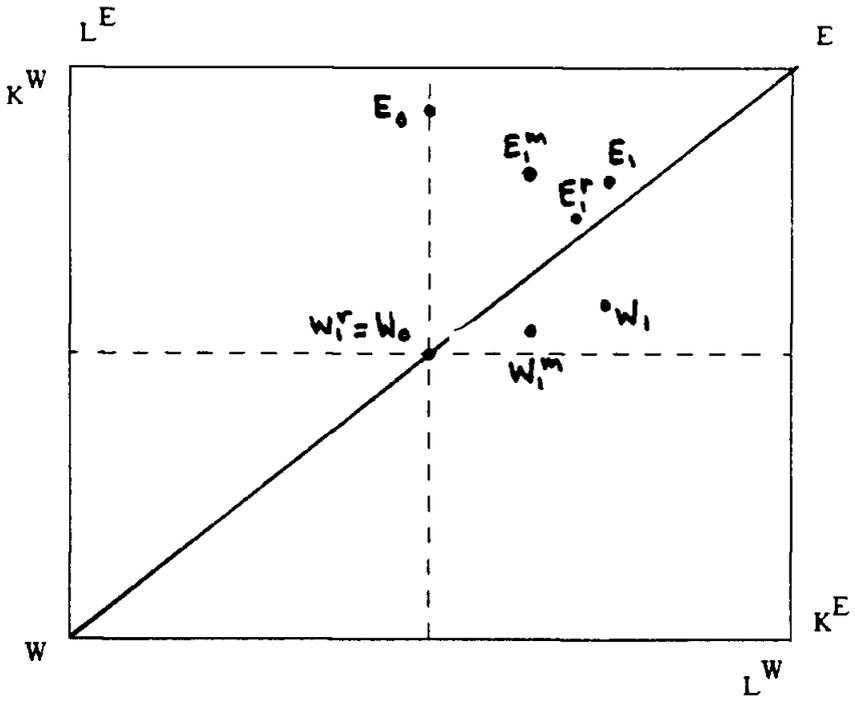


Figure 5. Modified Edgeworth Box

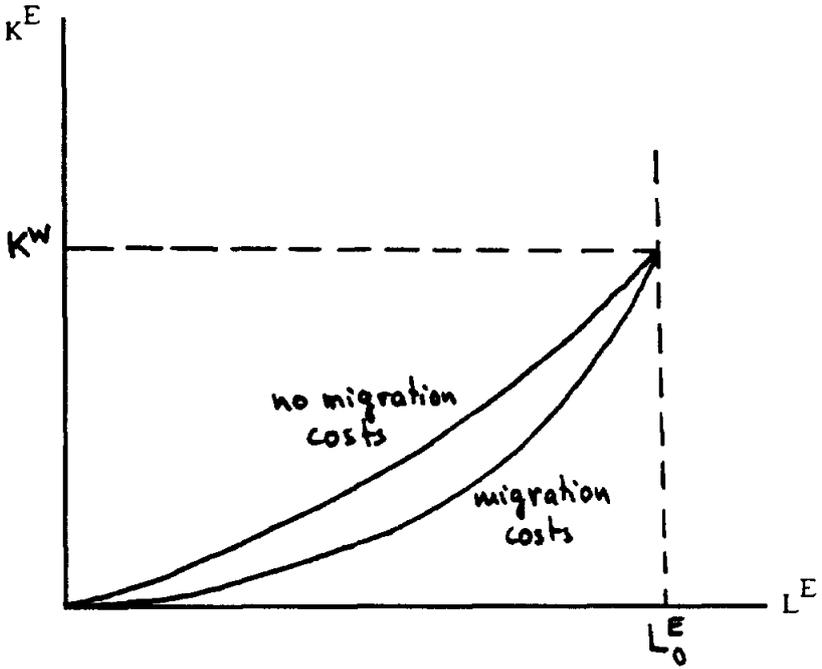


Figure 6. Labor Allocation Schedule

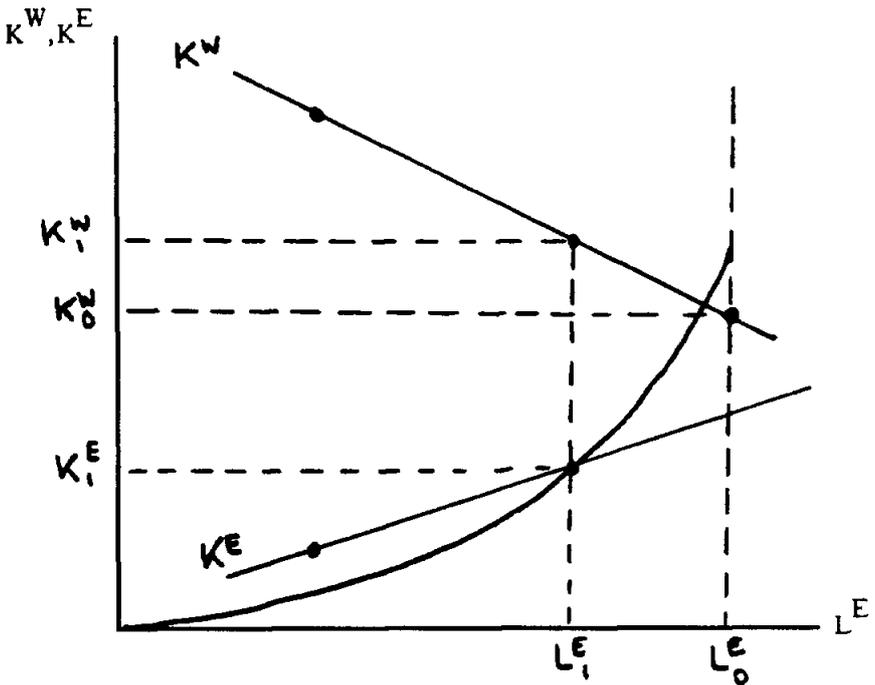


Figure 7. The Case of Migration Costs

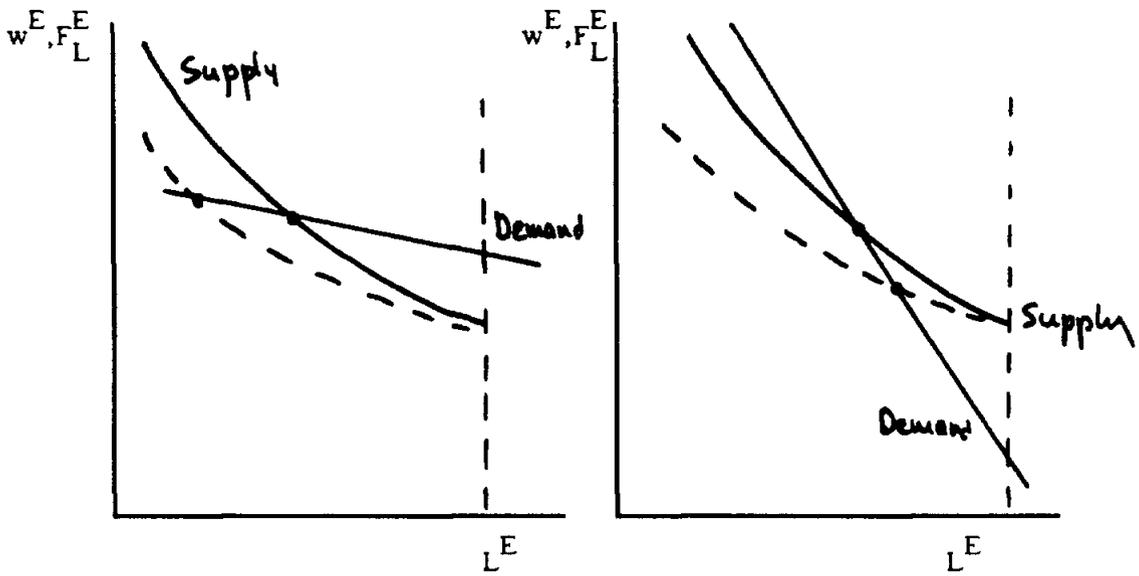


Figure 8. Wage Rigidity in the West

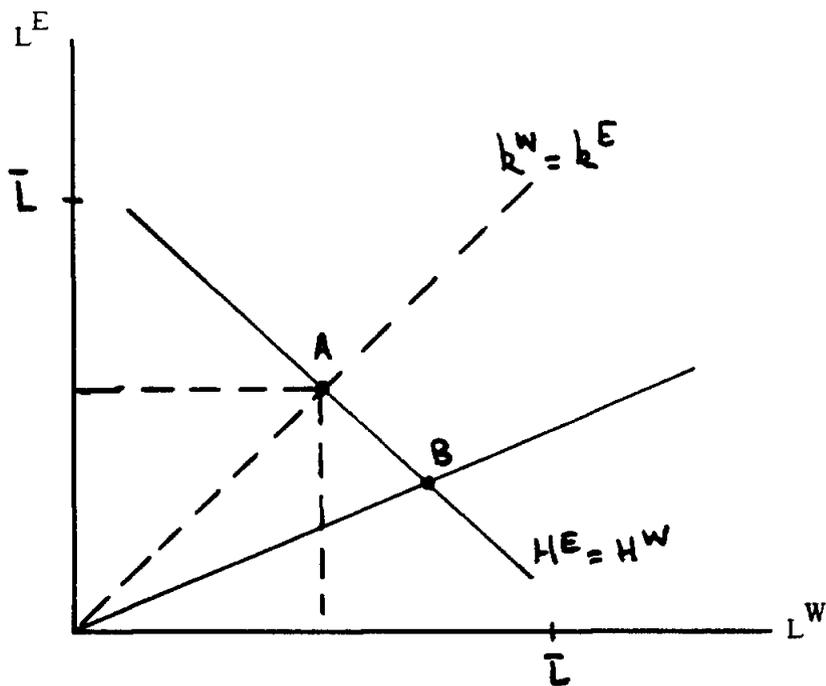


Figure 9. Worker Heterogeneity

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90/75 MKT	Roger BETANCOURT and David GAUTSCHI	"The Outputs of Retail Activities: Concepts, Measurement and Evidence", October 1990	90/87 FIN/EP	Lars Tyge NIELSEN	"Existence of Equilibrium in CAPM: Further Results", December 1990
90/76 MKT	Wilfried VANHONACKER	"Managerial Decision Behaviour and the Estimation of Dynamic Sales Response Models", Revised October 1990	90/88 OB/MKT	Susan C. SCHNEIDER and Reinhard ANGELMAR	"Cognition in Organisational Analysis: Who's Minding the Store?" Revised, December 1990
90/77 MKT	Wilfried VANHONACKER	"Testing the Keyck Scheme of Sales Response to Advertising: An Aggregation-Independent Autocorrelation Test", October 1990	90/89 OB	Manfred F.R. KETS DE VRIES	"The CEO Who Couldn't Talk Straight and Other Tales from the Board Room," December 1990
90/78 EP	Michael BURDA and Stefan GERLACH	"Exchange Rate Dynamics and Currency Unification: The Ostmark - DM Rate", October 1990	90/90 MKT	Philip PARKER	"Price Elasticity Dynamics over the Adoption Lifecycle: An Empirical Study," December 1990
90/79 TM	Anil GABA	"Inferences with an Unknown Noise Level in a Bernoulli Process", October 1990			
90/80 TM	Anil GABA and Robert WINKLER	"Using Survey Data in Inferences about Purchase Behaviour", October 1990	<u>1991</u>		
90/81 TM	Tawfik JELASSI	"Du Présent au Futur: Bilan et Orientations des Systèmes Interactifs d'Aide à la Décision," October 1990	91/01 TM/SM	Luk VAN WASSENHOVE, Leonard FORTUIN and Paul VAN BEEK	"Operational Research Can Do More for Managers Than They Think!," January 1991
90/82 EP	Charles WYPLOSZ	"Monetary Union and Fiscal Policy Discipline," November 1990	91/02 TM/SM	Luk VAN WASSENHOVE, Leonard FORTUIN and Paul VAN BEEK	"Operational Research and Environment," January 1991
90/83 FIN/TM	Nathalie DIERKENS and Bernard SINCLAIR-DESGAGNE	"Information Asymmetry and Corporate Communication: Results of a Pilot Study", November 1990	91/03 FIN	Pekka HIETALA and Timo LÖYTTYNIEMI	"An Implicit Dividend Increase in Rights Issues: Theory and Evidence," January 1991
90/84 MKT	Philip M. PARKER	"The Effect of Advertising on Price and Quality: The Optometric Industry Revisited," December 1990	91/04 FIN	Lars Tyge NIELSEN	"Two-Fund Separation, Factor Structure and Robustness," January 1991
90/85 MKT	Avijit GHOSH and Vikas TIBREWALA	"Optimal Timing and Location in Competitive Markets," November 1990	91/05 OB	Susan SCHNEIDER	"Managing Boundaries in Organisations," January 1991
90/86 EP/TM	Olivier CADOT and Bernard SINCLAIR-DESGAGNE	"Prudence and Success in Politics," November 1990	91/06 OB	Manfred KETS DE VRIES, Danny MILLER and Alain NOEL	"Understanding the Leader-Strategy Interface: Application of the Strategic Relationship Interview Method," January 1990 (89/11, revised April 1990)

91/07 EP	Olivier CADOT	"Leading to Insolvent Countries: A Paradoxical Story," January 1991	91/19 MKT	Vikas TIBREWALA and Bruce BUCHANAN	"An Aggregate Test of Purchase Regularity", March 1991
91/08 EP	Charles WYPLOSZ	"Post-Reform East and West: Capital Accumulation and the Labour Mobility Constraint," January 1991	91/20 MKT	Darius SABAVALA and Vikas TIBREWALA	"Monitoring Short-Run Changes in Purchasing Behaviour", March 1991
91/09 TM	Spyros MAKRIDAKIS	"What can we Learn from Failure?", February 1991	91/21 SM	Sumantra GHOSHAL, Harry KORINE and Gabriel SZULANSKI	"Interunit Communication within MNCs: The Influence of Formal Structure Versus Integrative Processes", April 1991
91/10 TM	Luc Van WASSENHOVE and C. N. POTTS	"Integrating Scheduling with Batching and Lot-Sizing: A Review of Algorithms and Complexity", February 1991	91/22 EP	David GOOD, Lars-Hendrik RÖLLER and Robin SICKLES	"EC Integration and the Structure of the Franco-American Airline Industries: Implications for Efficiency and Welfare", April 1991
91/11 TM	Luc VAN WASSENHOVE et al.	"Multi-Item Lotsizing in Capacitated Multi-Stage Serial Systems", February 1991	91/23 TM	Spyros MAKRIDAKIS and Michèle HIBON	"Exponential Smoothing: The Effect of Initial Values and Loss Functions on Post-Sample Forecasting Accuracy", April 1991 (Revision of 90/46)
91/12 TM	Albert ANGEHRN	"Interpretative Computer Intelligence: A Link between Users, Models and Methods in DSS", February 1991	91/24 TM	Louis LE BLANC and Tawfik JELASSI	"An Empirical Assessment of Choice Models for Software Evaluation and Selection", May 1991
91/13 EP	Michael BURDA	"Labor and Product Markets in Czechoslovakia and the Ex-GDR: A Twin Study", February 1991	91/25 SM/TM	Luk N. VAN WASSENHOVE and Charles J. CORBETT	"Trade-Offs? What Trade-Offs?" April 1991
91/14 MKT	Roger BETANCOURT and David GAUTSCHI	"The Output of Retail Activities: French Evidence", February 1991	91/26 TM	Luk N. VAN WASSENHOVE and C.N. POTTS	"Single Machine Scheduling to Minimize Total Late Work", April 1991
91/15 OB	Manfred F.R. KETS DE VRIES	"Exploding the Myth about Rational Organisations and Executives", March 1991	91/27 FIN	Nathalie DIERKENS	"A Discussion of Correct Measures of Information Asymmetry: The Example of Myers and Majluf's Model or the Importance of the Asset Structure of the Firm", May 1991
91/16 TM	Arnoud DE MEYER and Kasra FERDOWS et.al.	"Factories of the Future: Executive Summary of the 1990 International Manufacturing Futures Survey", March 1991	91/28 MKT	Philip M. PARKER	"A Note on: 'Advertising and the Price and Quality of Optometric Services', June 1991
91/17 TM	Dirk CATTRYSE, Roelof KUIK, Marc SALOMON and Luk VAN WASSENHOVE	"Heuristics for the Discrete Lotsizing and Scheduling Problem with Setup Times", March 1991	91/29 TM	Tawfik JELASSI and Abbas FOROUGHJI	"An Empirical Study of an Interactive, Session-Oriented Computerised Negotiation Support System (NSS)", June 1991
91/18 TM	C.N. POTTS and Luk VAN WASSENHOVE	"Approximation Algorithms for Scheduling a Single Machine to Minimize Total Late Work", March 1991			

91/30 MKT	Wilfried R. VANHONACKER and Lydia J. PRICE	"Using Meta-Analysis Results in Bayesian Updating: The Empty Cell Problem", June 1991	91/43 SM	Sumantra GHOSHAL and Christopher BARTLETT	"Building Transnational Capabilities: The Management Challenge", September 1991
91/31 FIN	Rezaul KABIR and Theo VERMAELEN	"Insider Trading Restrictions and the Stock Market", June 1991	91/44 SM	Sumantra GHOSHAL and Nitin NOHRIA	"Distributed Innovation in the 'Differentiated Network' Multinational", September 1991
91/32 OB	Susan C. SCHNEIDER	"Organisational Sensemaking: 1992", June 1991	91/45 MKT	Philip M. PARKER	"The Effect of Advertising on Price and Quality: An Empirical Study of Eye Examinations, Sweet Lemons and Self-Deceivers", September 1991
91/33 EP	Michael C. BURDA and Michael FUNKE	"German Trade Unions after Unification - Third Degree Wage Discriminating Monopolists?", June 1991	91/46 MKT	Philip M. PARKER	"Pricing Strategies in Markets with Dynamic Elasticities", October 1991
91/34 FIN	Jean DERMINE	"The BIS Proposal for the Measurement of Interest Rate Risk, Some Pitfalls", June 1991	91/47 MKT	Philip M. PARKER	"A Study of Price Elasticity Dynamics Using Paradoxical Replacement/Multiple Purchase Diffusion Models", October 1991
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91/37 EP	Ingo WALTER and Hugh THOMAS	"The Introduction of Universal Banking in Canada: An Event Study", August 1991	91/50 SM/TM	Luk VAN WASSENHOVE and Charles CORBETT	"How Green is Your Manufacturing Strategy?" October 1991
91/38 EP	Ingo WALTER and Anthony SAUNDERS	"National and Global Competitiveness of New York City as a Financial Center", August 1991	91/51 MKT	Philip M. PARKER	"Choosing Among Diffusion Models: Some Empirical Guidelines", October 1991
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91/42 TM	Rob R. WEITZ and Tawfik JELASSI	"Solving A Multi-Criteria Allocation Problem: A Decision Support System Approach", August 1991			