Labor Market Effects of Economic Integration – The Impact of Re-Unification in German Border Regions [†]

Thiess Buettner[‡]

Ifo Institute and Ludwig-Maximilians-University Munich

Johannes Rincke

Ludwig-Maximilians-University Munich

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Abstract: This paper exploits the significant reduction in impediments to labor mobility in the process of German re-unification in order to identify labor supply shocks in the West German labor market. The focus is on the quasi-experiment of the border removal in the regions situated at the German–German border which faced a massive increase of cross-border labor supply. The results indicate that despite of a gain in employment, the border removal was accompanied with a decline in wages and an increase in unemployment relative to other West German regions.

Key Words: Economic Integration; Border Regions; EU Enlargement; German Re-Unification; Differences in Differences Estimation

JEL Classification: J61, R23, F15

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[‡]Address: Ifo Institute
Poschingerstrasse 5
D-81679 Munich
Germany

Phone: +49 89 9224 1319
Fax: +49 89 9224 2319

E-mail: buettner@ifo.de

1 Introduction

In its recent past Europe has seen the opening up of several internal borders. Most recently, with the accession of several new members states in Central and Eastern Europe to the European Union, more borders are set to fall. This has been welcomed by many with a sense of relief. The most dramatic single event was the border removal in the city of Berlin in 1989; the pictures of people celebrating on both sides of the border were seen throughout the world. However, in contrast to this historical upheaval, the abolition of barriers to mobility at the border between old and new EU members is regarded with mixed emotions: the removal of the borders is welcomed as they are impediments to travel and trade, but at the same time the competition of cheap labor from across the border is feared as a threat to labor market conditions faced by the resident workers.

There seems to be, however, little empirical substance for those fears. Studies focusing on the consequences of EU accession point to a relatively modest expansion of labor supply (*e.g.*, Boeri and Bruecker, 2001). Moreover, the existing evidence on the impact of immigration on the employment opportunities of native workers generally shows moderate effects for resident workers (for surveys see Friedberg and Hunt, 1995, Zimmermann, 1995, Bauer, 1997). But many studies rely on cross-sectional differences in immigrant density across local labor markets, where it is quite difficult to identify the labor supply effect of immigration. As recently emphasized in Borjas (2003), if immigrants select themselves into specific labor markets with favorable conditions, empirical results with respect to adverse supply effects on resident workers are likely to be biased and some additional information is needed for identification. For the case of EU integration it seems further important to emphasize that mobility takes place not only by means of migration but also by means of cross-border commuting, where workers keep with their residential affiliation. Due to relatively small distances, this and related forms of mobility are quite common at the EU's internal border regions (*e.g.*, de Falleur and Vandeville, 1995). From a German perspective this is of particular importance, since the eastern part of Germany with its already difficult labor market situation is to a major part a border region. This becomes obvious in the case of Berlin – situated only about 50 miles from the border between Germany and Poland. In the available statistics cross-border mobility is, however, not covered comprehensively (Trabold and Truebswetter, 2003).

Given this background, this paper sheds light on the labor market effects of economic

integration, and, in particular, on the impact of cross-border labor mobility. It exploits the significant reduction in impediments to labor mobility in the process of German re-unification in order to identify labor supply shocks in the West German labor market. More specifically, we focus on the impact of the border removal in the regions situated at the German–German border against the reference case of regions in the hinterland. This approach is based on the assumption that the costs of mobility grow with increasing distance, such that border regions face a particularly large increase in the labor supply, both because of a higher migration and commuting potential. This assumption is strongly supported by the facts. Dietz, Gommlich, and Karr (1992) provide a detailed analysis of the regional pattern of the inflow of workers from East Germany to the West German labor market in 1991. According to their analysis the employment share of East Germans is highest in the border-regions, where it is estimated at 12.3% – three times higher than in other West German regions.

In recent history, because the impediments to mobility mainly consisted in the border itself, German re-unification is probably one of the most interesting cases of economic integration and its associated labor market effects. Other impediments to mobility that are often encountered at national borders are largely absent. People at both sides of the border share a common language and cultural background. Possibly even more important, due to their formal status as West German citizens people from East Germany were able to immediately enter the West German labor market even before German re-unification was established at the constitutional level. Moreover, due to drastically different labor market conditions East Germans had strong incentives to move. At the same time re-unification constituted a rather unexpected event, which can be considered a quasi-experiment for the border regions.

Surprisingly little is known about the consequences of this unique experiment of integration in the border regions. Jung (2001) and Kruesemann (2001) provide some descriptive evidence for the eastern border of Lower Saxony, pointing towards a deterioration of labor market condition for resident workers. However, apart from these case studies, to the best of the authors' knowledge this paper provides the first systematic analysis of the labor market integration shock experienced in the regions at the former German–German border.

The paper proceeds as follows. The following section provides a theoretical discussion of the possible labor market effects of economic integration, yielding several testable empirical

predictions. In particular, the model indicates that a reduction in transaction cost arising from a border removal will affect the local labor market in three dimensions: it will lead to an employment expansion accompanied with a decline in wages and participation in the border region of the high-wage country. Section 3 lays out the investigation approach used to test these predictions empirically and discusses the available data. Section 4 presents the results, which confirm that in comparison with the labor market development in other parts of West Germany and controlling for other possibly interfering developments the border regions have, in fact, seen an increase in employment, a reduction in wages, and an increase in unemployment, relative to other regions. The last section provides our conclusions.

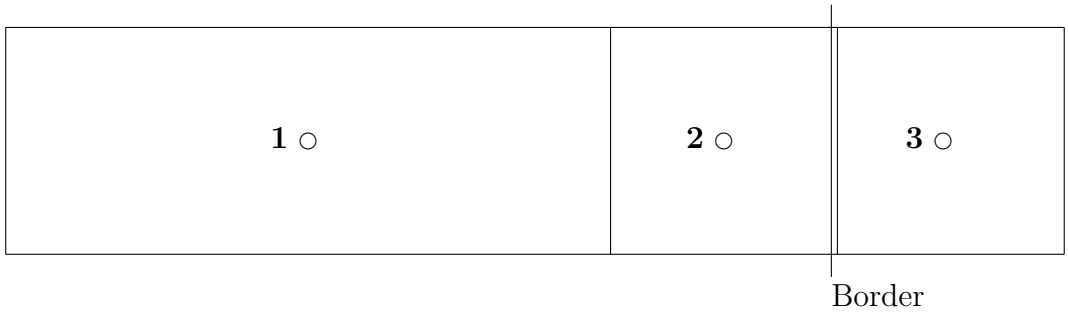
2 Theoretical Considerations

Basically, a border defines the geographic area for which a set of public institutions is defined. As a consequence, by crossing the border an agent may face significant changes in the institutional environment under which he or she operates. As this will often tend to undermine the effectiveness of policies, many borders, national borders in particular, constitute significant barriers to mobility. In the present context, we will focus on the latter aspect of a border and treat the border simply as an institution that imposes (perhaps prohibitive) transaction cost on the mobility between countries.

The removal of a border can be seen as a discrete change in the degree of integration of goods and factor markets. It is obvious that the reduction of transaction cost may be important for all markets. In the following, however, we will focus on local labor market effects in a simple setting where the regions are small, open economies with internationally fixed prices. Rather than providing a general theory of integration we focus in the model on the effects of integration with a low-wage country in the border region of the high wage country. The simple setting will allow us, however, to derive the interesting, empirically testable, implication that the border region hit by an integration shock might experience an employment expansion accompanied with a decline in wages and participation of the resident workers relative to the hinterland.

Consider a country with two regions, a main region (region 1 in Figure 1) and a border region (region 2). The latter is adjacent to a third region, which is part of another country. For simplicity, let regions 2 and 3 be of equal size. In each region there is a set of households

Figure 1: Stylized Map of the Regions



distributed in space such that the households differ in terms of their cost of mobility. Consider households residing in region i. Regarding the option to work in region j the spatial distribution of households gives rise to a distribution of the cost of mobility $m_{i,j}$. In addition to household-specific cost of mobility, further cost result from the existence of the border between region 2 and 3. Due to this border, mobility between regions 2 and 3 is burdened with additional cost of δ.

For simplicity, assume that the costs of mobility are additive. A household in region i faces mobility cost within the region

$$m_{i,i} = \omega.$$

Let ω be distributed across households with density $g(\omega)$ in all regions, where $\omega \in [0, \infty]$ and $g(\omega) > 0 \; \forall \; \omega$. An individual crossing the border to a neighboring region faces additional mobility cost $\mu \in [0, \infty]$ such that the total cost of the transfer from region i to j equals

$$m_{i,j} = \mu + \omega, \quad |i - j| = 1.$$

Again, let the additional component μ be distributed identically in all regions. The density of μ is denoted as $f(\mu)$ with $f(\mu) > 0 \forall \; \mu$. With regard to mobility to more distant regions we assume that for each individual total cost is higher than the cost associated with mobility to adjacent regions. Thus,

$$m_{i,j} > \mu + \omega, \quad |i - j| > 1.$$

In order to keep the theoretical framework as simple as possible, we focus on the case where, initially, the wage in region 3 is lower than the wages in regions 1 and 2 and where wages in regions 1 and 2 are equal. In other words, we look at the impact of integration between a low-wage country, represented by region 3, and a high-wage country, consisting of a border region (region 2) and a region in the hinterland (region 1). With the assumption

that $w_1 = w_2 > w_3$ a household from region 1 will supply labor in region 1 if

$$\omega \quad < \quad w_1,$$

where w_1 is the market wage in region 1. If $\omega \geq w_1$, the household abstains from participating. Households from region 1 will not consider to supply labor to region 2 or 3 as wages there are not higher. A household from region 2 will supply labor to region 2 if

$$\omega \quad < \quad w_2.$$

If $\omega \geq w_2$, the household will not participate. In the initial situation, households from region 2 will not consider supplying labor elsewhere. Only for households from region 3 the initial situation is such that some may want to supply labor to region 2. Households from region 3 supply labor to the low-wage region 3 if their mobility costs are high

$$\mu \geq w_2 - \delta - w_3 \quad \text{and} \quad \omega < w_3,$$

but to region 2 if

$$\mu < w_2 - \delta - w_3 \quad \text{and} \quad \omega + \mu < w_2 - \delta.$$

From the setting described above it is straightforward to derive the regional labor supply functions. The supply of labor in region 3 is

$$L_3^S\left(w_2, w_3, \delta\right) \quad = \quad G(w_3)[1 - F(w_2 - \delta - w_3)], \tag{1}$$

where G and F are the cdf's of ω and μ, respectively, such that the labor supply is determined by all those who are willing to work at wage w_3 but have rather high mobility cost, which prevents them from supplying labor in region 2.

For region 2 the supply of labor is determined by[1]

$$L_2^S\left(w_2, w_3, \delta\right) \quad = \quad G\left(w_2\right) + \int_0^{w_2-\delta-w_3} \int_0^{w_2-\delta-\mu} f\left(\mu\right) g\left(\omega\right) d\omega d\mu. \tag{2}$$

[1]A derivation is given in the working paper version (Buettner and Rincke, 2004), which is available upon request.

Labor supply is determined here by the group of residents who are willing to work at the local wage (first term) and those workers with residence in region 3 who are willing to work and who have sufficiently low cost of cross-border mobility (second term). To avoid tedious case distinctions, we assume that the mobility cost δ is less than prohibitive ($\delta < w_2 - w_3$) such that there is always a strictly positive share of individuals from region 3 supplying labor in region 2. Finally, the supply of labor in region 1 is simply

$$L_1^S(w_1) = G(w_1). \tag{3}$$

With respect to labor demand, assume that employment is chosen such that the marginal product equals the wage rate. Suppose there are two factors of production, a labor input L_i and a region-specific factor ξ_i. Then, with the above assumptions labor market equilibrium is characterized by wages which clear the regional labor markets

$$\begin{aligned} L_1^D(w_1, \xi_1) &= L_1^S(w_1) && (4)\\ L_2^D(w_2, \xi_2) &= L_2^S(w_2, w_3, \delta) && (5)\\ L_3^D(w_3, \xi_3) &= L_3^S(w_2, w_3, \delta), && (6) \end{aligned}$$

where L_i^D is the labor demand function in region i. Of course, this model is tailored to the special situation where, initially, a spatial equilibrium prevails between regions 1 and 2 as wages in the high wage country are equal. However, this situation can be used to derive some interesting empirical implications for the impact of the unification shock on the border regions. This shock can be analyzed by means of a comparative static analysis of the consequence of a decrease in the transaction cost of mobility δ on employment, wages, and participation in region 2 relative to region 1. The results of the comparative static analysis can be stated as follows:

Suppose the slope of the labor demand function is negative. A marginal reduction in the transaction cost of mobility will then reduce the wage rate, raise employment and lower participation in the border region relative to the other region of the high-wage country.

While a proof is given in the appendix, let us briefly consider how this result is obtained. A first effect is that at given wages a decrease in the transaction cost of mobility δ will raise labor supply in the border region of the high-wage country (L_2^S). The labor supply increase in the border region is at the expense of the low-wage region which is necessarily losing

labor supply. Given the change in labor supply we would expect wages in the border-region to fall relative to wages in the hinterland. But since labor supply is endogenous this would exert some further impact on labor supply. In fact, a decrease of the wage rate in the border region of the high-wage country (w_2) reduces labor supply in this region and raises labor supply in the low-wage region. This indicates that the response in wages would tend to mitigate the supply effects of a reduction in mobility cost. However, the increase in labor supply in region 2 resulting from the inflow of workers of region 3 can be shown to be larger than the decline of labor supply by resident workers. Therefore, total supply increases, wages fall, and the resident workers will show a decline in participation.

Starting from a situation with equal wages in both regions, the region which is not adjacent to the low-wage country is not immediately affected by changes in the cost of mobility between the low-wage and the high-wage country. The theoretical result is, of course, concerned with a marginal decrease in mobility cost starting from an initial situation where only workers from region 3 might be willing to cross the border and, if so, supply their labor only to region 2. A more comprehensive analysis might take secondary effects into account: resulting from the emerging wage differential between the border region and the hinterland some workers from regions 3 might supply labor not only in the border region (region 2) but also in the hinterland (region 1). A positive wage differential between region 1 and region 2 would also induce some "domino effect", since also workers with residence in the border-region would start supplying labor in the hinterland. Thus, the integration shock would be propagated spatially by the labor supply behavior of residents as is discussed in the case of U.S. immigration (*e.g.*, Filer, 1992, Borjas, Freeman, and Katz, 1997, and Card, 2001). However, given the existence of mobility cost increasing with distance and given an initial situation with equal wages in regions 1 and 2 all those effects are only secondary and will not change qualitatively the basic results from the simplified analysis.

An obvious limitation of the simple theoretical model is the exclusion of long-term considerations, as productivity differences ξ_1, ξ_2 and ξ_3 as well as the number of residents of each region are treated as fixed. In a long-term perspective these restrictions would need to be removed. With convex production technology, it will be difficult to find a long-run perspective without equal conditions in the labor markets of all regions just as we have assumed for the two regions of the high-wage country. Alternatively, taking account of agglomeration effects some interesting dynamics might arise if the attraction of labor to the

high-wage country results in further increases in productivity (Hanson, 1997). However, we leave the analysis of long-term effects for future research.

3 Investigation Approach

Empirical evidence on the impact of the removal of barriers at the border on the labor market is obtained from a panel of counties in West Germany. From the total of 327 counties in West Germany (excluding West Berlin because of its specific geographic situation) 20 counties are directly situated at the inner-German border. Following the above discussion, we can expect that the decline in spatial transaction cost relative to East Germany is particularly effective in these regions since once the border was opened East German workers could commute at rather low cost to workplaces at the other side of the border. Hence, the regions at the border should have been exposed more than other regions to the integration shock from re-unification. Note that this assumption is clearly supported by the facts. While Dietz, Gommlich, and Karr (1992) quantify the average share of East German workers in the West German labor market at the end of 1991 at about 5%, the average figure in the border regions - excluding Berlin - is at 12.3% compared with a figure of about 4.1% in all other West German regions. Note that these figures include not only commuters but also post-unification migrants. Moreover, with the exception of the cities of Kassel and Braunschweig the districts directly situated at the German–German border show the highest employment shares of east German workers among all employment service districts.[2]

Of course, the geographic situation is only one possible dimension along which the local labor markets in West Germany will be differently affected by unification. For instance, if the typical characteristic of East German workers in terms of skills or experience fits better to specific industries, one might expect that workers in those industries will be more affected by integration than others even if located in the hinterland. Or suppose East German workers have preferences for West German regions with a specific cultural or historical background. One might expect that workers in those regions will be more

[2]According to Dietz et al. (1992), the ten West German employment service districts with the highest shares of workers from East Germany are in descending order (share in parentheses): Coburg (20%), Bad-Hersfeld (17%), Goslar (17%), Hof (15%), Bad-Oldesloe (15%), Uelzen (14%), Helmstedt (14%), Fulda (12%), Goettingen (12%), and Lueneburg (10%). Note that all these regions are directly situated at the border. Due to its specific condition Berlin (26%) has been excluded.

affected than others. While all these dimensions might be important, the advantage of the geographic proximity is that it allows us to study the integration shock by means of a quasi-experimental "differences-in-differences" approach with a robust and operational assumption. To put it differently, the empirical analysis exploits differences in the exposure to the unification shock caused by the geographic situation of the counties.

In several respects the labor market integration effect of re-unification in the regions directly situated at the German–German border is a promising subject for a "differences-in-differences" approach. As pointed out by Angrist and Krueger (1999) this approach is "[...] well suited to estimating the effect of sharp changes in the economic environment or government policy" (*ibid.*, p. 1296). Certainly, the total removal of the inner-German border qualifies as such a sharp and drastic change.

Before re-unification, due to the erection of the Berlin Wall in 1961 and the corresponding enforcement of border controls in East Germany, mobility from East to West Germany was severely suppressed.[3] But when the Berlin Wall tumbled in November 1989, people from East Germany were free to leave their country.[4] In the subsequent months, re-unification moved forward in a quick succession of events. Commuting costs across the border were quickly lowered by improving, or reviving, roads, public transport and communication systems. The political decision process accompanying re-unification had its most remarkable points in the treaty concerned with the creation of the monetary and economic union between both German States, which came into force on July 1, 1990, and the treaty concerned with the political re-unification, three months later on October 3.

Already before 1990 citizens from East Germany were formally treated as German citizens in West Germany. Thus, with the barriers to entry falling in November 1989 East German citizens could immediately enter the West German labor market at drastically reduced transaction cost. As the West German labor market was and still is characterized by significantly higher wages, and since unemployment quickly rose in East Germany due to the collapse of the socialist economy, it seems reasonable to expect an expansion of labor

[3]Whereas in the 12 years between 1949 and 1961 approximately 2.7 million people moved to the west, in the period between 1962 and 1989 only 0.6 million people came (Sinn and Sinn, 1992).

[4]Already in 1989 a total of about 0.39 million individuals moved to West Germany, followed by nearly 0.4 million in 1990 (Statistisches Bundesamt, 1999). The mass exodus had begun already before November 9 across the Hungarian-Austrian border and via the West German embassies in Prague and Budapest, but the majority of people who left the GDR in 1989 came across the German–German border after the lifting of the "Iron Curtain".

supply in the West German labor market after re-unification. Due to the lower cost of commuting and migration this effect should be particularly strong in the border regions.

A further, important characteristic of German re-unification is the high degree of unexpectedness. Although difficult to grasp today in 1989 the vast majority of Germans – at least in the West – did not consider the opening of the German–German border as a serious possibility. All this justifies an examination of the removal of barriers at the German–German border as a sharp change in the economic environment of the border regions and, therefore, a "differences–in–differences" approach seems appropriate in order to test its labor market effects. More specifically, we look at the change in the position of labor market indicators in regions at the border relative to other regions.

A first analysis summarizes the development of key labor market indicators before and after the integration shock by regressions of the following type

$$\begin{aligned} y_{i,t} &= \beta_2 \left(d_{2,t} \times Border_i\right) + \cdots + \beta_T \left(d_{T,t} \times Border_i\right) \\ &+ \theta_2 d_{2,t} + \cdots + \theta_T d_{T,t} + \pi_{i,t} + \alpha_i + u_{i,t}. \end{aligned} \tag{7}$$

To capture common trends for each dependent variable $y_{i,t}$ we include a set of time dummies $d_{2,t}, \ldots, d_{T,t}$ such that $d_{s,t} = 1$ if $s = t$, and zero otherwise. Time-invariant characteristics of regions are captured by the fixed regional effect α_i. In contrast to the well–known study of Card (1990) on the "Mariel boatlift", the exposition to the shock is not captured by a single variable but by a couple of interaction terms between the geographic situation of a county at the border and the respective year. However, as a first step it is instructive to carry out estimations over a longer time period as this allows us to more generally consider the relative developments in the border regions. The setting deviates further from the study of Card (1990) in introducing an explicit control variable that reflects the availability of investment subsidies due to German regional policy. More specifically, we introduce a dummy variable $\pi_{i,t}$, which is unity if a county encloses locations eligible for investment subsidies. Note that this variable is time-varying at the local level as the regional policy is revised annually and has been reorganized substantially in the aftermath of re-unification.[5]

[5]In West Germany, regional policy before 1989 was focused on two types of regions. Firstly, a program called "Improvement of Regional Economic Structure" for regions with poor economic performance or suffering from structural change has been in place since 1969. The main tool of this program is investment subsidies. Secondly, regional policy has been concerned with regions at the German–German border, the so-called "Zonenrandgebiet". They were considered to be severely disadvantaged by their location and given access to all measures of the "Improvement (...)" program. After re-unification, the focus

While the panel-data approach suggested by equation (7) is a useful starting point which will allow us to discern the time trend specifically of the border regions, Bertrand, Duflo, and Mullainthan (2004) have criticized the use of panel regressions within the context of "differences–in–differences" analysis due to its neglect of possible autocorrelation. They show that the conventional approach in the presence of autocorrelation tends to overreject the null-hypotheses of no-treatment effect. As a particularly simple but effective remedy against false rejections of the null-hypothesis they suggest first running a basic regression without the treatment effect, and then to test for the treatment effect using averages of the residuals before and after the shock. Formally, the approach starts with estimating

$$y_{i,t} = \theta_2 d_{2,t} + \cdots + \theta_T d_{T,t} + \pi_{i,t} + \alpha_i + u_{i,t},\ t = s-p, ...s+q. \tag{8}$$

with an occurrence of the unification shock in period s and p, q indicating the choice of the length of the pre- and post-unification periods considered. The estimated residuals are then aggregated into two periods, one before ($\widehat{v}_{i,1}$) and the other after ($\widehat{v}_{i,2}$) the unification shock in period s

$$\widehat{v}_{i,1} \equiv \frac{1}{p}\sum_{t=1}^{p} \widehat{u}_{i,s-t} \qquad \widehat{v}_{i,2} \equiv \frac{1}{1+q}\sum_{t=0}^{q} \widehat{u}_{i,s+t}.$$

Finally, the aggregated residuals are regressed on the border-specific time effect as well as on the usual time- and region-specific fixed effects in the two-period panel regression

$$\hat{v}_{i,t} = \beta\left(d_{2,t} \times Border_i\right) + \theta d_{2,t} + \alpha_i + \epsilon_{i,t} \quad t = 1, 2, \tag{9}$$

where period 1 is before and period 2 is after re-unification such that β captures the treatment effect. Apart from its simplicity this approach is appealing due to its transparency and reliance on standard procedures.

However, the approach requires the determination of a time interval of q periods during which the integration shock is expected to be present. On the one hand, it seems reasonable to assume that unification of the two parts of Germany constituted not just a single shock to the border region in 1990, after the border fell, but had an impact over a longer time-period. On the other hand, only the early integration process really fits with the above

of German regional policy shifted to East Germany. The concept of "Zonenrandgebiet" was effectively dropped in September 1991, and already since October 3, 1990 all regions in East Germany had access to the "Improvement (...)" program. However, also after 1990 there have always been several regions in West Germany, both in the former "Zonenrandgebiet" and outside, that had access to measures of German regional policy.

Table 1: Descriptive Statistics

	Nobs	Mean	Std Dev	Min	Max
Unemployment rate (in %)	4562	8.25	3.11	2.27	20.9
Employment per capita	4890	.331	.116	.126	.942
Population (in 1000)	4890	192	163	33.0	1710
Hours per empl. (Manuf.)	3272	1.15	.840	.321	12.1
Investment per empl. (Manuf.) [a]	3273	11.9	5.07	2.89	65.7
Wage (per day) [a]	3912	124	27.8	70.5	198
Salary (per day) [a]	3911	158	35.8	81.6	246
Regional policy	4890	.445	.494	.00	1.00

[a] measured in Deutsche Mark and 2000-Prices. Sample size varies due to missing values.

framework, since only in the first years of unification is it safe to assume that workers would not easily find jobs at the same or higher levels of remuneration in East Germany as compared to West Germany. Some hints at a reasonable definition of the early period are obtained from the development of employment in East Germany. According to the independent German Council of Economic Advisors (SVR, 1993,1994) the first years after unification until 1993 are characterized by mass-layoff of workers in East Germany. This process came to end in 1993 (SVR, 1993: 104) and 1994 is the first year after unification where employment in East Germany shows an increase albeit at a rather low level (SVR, 1994: 93). The employment decline is reflected in the flows into and out of unemployment. While there are many more inflows into than outflows from unemployment in the early years, 1994 is the first year where outflows outnumber inflows (SVR, 1994:101). These statistics suggest that we focus on the first four years of unification 1990-1993.

The theoretical considerations above suggest considering the development of three key indicators of the status of the local labor markets: employment, wages, and labor supply. While detailed definitions and descriptions of sources are given in the appendix, Table 1 provides some descriptive statistics. With regard to wages and employment, the analysis makes use of the regional employment survey (regionale Beschäftigtenstichprobe) supplied by the Institute for Employment Research (IAB) of the Federal Employment Agency located in Nuremberg. This is an exceptionally large dataset comprising a 1% random sample of the complete social security accounts. Thus, employment and wage data available to this study is of high quality and allows us to accurately describe the development of wages and employment for the level of the 327 counties in West Germany. Moreover, the data allows us to address the wage effects of economic integration at a regional and individual

level. The individual level is of particular interest as it enables us to control for the specific characteristics of the worker. In addition, we take account of the potential role of negotiated wages defined in the wage agreements between unions and employers associations. While these agreements define common wage floors for industries regardless of the specific region the average payment is typically higher. Estimates quantify the difference between actual and negotiated wages at about 7% to 12% depending on skills (Meyer, 1995, and Schnabel, 1995). This explains why wage agreements do not effectively restrict local wage flexibility in Germany. Correspondingly, empirical estimates support the existence of significant regional wage flexibility (e.g., Baltagi and Blien, 1998, Buettner, 1999). However, negotiated wages might exert additional shocks to local wages, in particular, if industries are concentrated spatially. To capture those effects we introduce controls for the industry and an indicator for negotiated wages according to the corresponding industry level wage agreement.[6]

The measurement of the labor supply of the resident population is more difficult. What is available are, basically, population figures obtained from the mandatory registration of the residents in the counties' municipalities. More specific information about the fraction of population participating in the labor market could, in principle, be obtained from the German Socio Economic Panel (GSOEP). However, at the level of counties the number of respondents is typically quite small such that several counties report less than five respondents (Spiess, 2005). Given these limitations the analysis below considers the local rate of registered unemployment available from the Federal Employment Agency. The underlying assumption is that if there is a displacement of local workers due to an expansion of labor supply from across the border, this might show up not only in a reduced participation but also in higher rates of unemployment among the resident population. Those who fail to find jobs above their reservation wage are likely to register as unemployed in order to receive unemployment benefits. An increase of unemployment can be expected, in particular, if local wages fall, as reservation wages of workers in West Germany are kept high due to social security and unemployment compensation.

[6]This variable is taken from Buettner and Fitzenberger (2002).

4 Results

Table 2 reports results for the basic descriptive approach, which depicts the development over the period from the mid-eighties until the end of the nineties. The first column shows the development for the rate of unemployment. Starting in 1990, border regions show a significant increase in unemployment relative to 1987, and the differential grows to 2.28% in 2000. Thus, the results indicate that the opening of the border was followed by a strong, persistent, and significant disadvantage of border regions relative to the base year 1987 in terms of unemployment. The dummy for regional policy is positive and significant, indicating that unemployment is higher in regions subject to special investment incentives provided by regional policy. However, note that the coefficient reflects both the distribution of investment subsidies as well as their impact on the economy. Thus, it is not clear whether the positive significance indicates a failure of regional policy to reduce unemployment or just the selection of regions into the program.

Columns (2) to (3) in Table 2 depict results for total employment and population. The employment series shows a positive development after re-unification. For the period between 1991 and 1997 the employment differential relative to the base year is significantly positive. However, at the end of the time period analyzed a decline in employment – albeit not significant – is found. Despite the increase in employment, population shows a growing negative differential in the border regions. In 2000 the population is reduced by almost 3% relative to the period 1986. Altogether, employment per capita is significantly increased in the periods after re-unification.

In order to see whether temporary employment effects in terms of hours have occurred after re-unification, we also tested whether some increase of hours worked is found in the border regions (not shown). However, no significant increase in hours was found.[7]

In order to interpret the border development as indicative of the integration effect in the labor market, it is important to control for the presence of investment subsidies due to regional policy, in particular, because of the cutback of those subsidies in the aftermath of re-unification. Therefore, all regressions employ a variable indicating the presence of those subsidies already mentioned before. To test whether this variable is in fact able to control for the cutback of investment subsidies, an alternative regression has been carried out for

[7]Note that hours worked have been scaled by the total number of employees as the corresponding number of blue-collar workers is not available.

Table 2: Basic Results: Development in Border Regions

Variable	U.rate	log Emp.	log Pop.	log Inv.	log Wage	log Sal.	log Wage	log Sal.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Border '87		-.002	-.008		-.005	-.002	- .005	-.001
		(.015)	(.013)		(.008)	(.015)	(.007)	(.009)
Border '88	.247	-.008	-.014		-.010	-.010	- .007	-.015
	(.441)	(.014)	(.012)		(.008)	(.012)	(.008)	(.010)
Border '89	.598	-.011	-.017		-.012	-.000	- .008	-.016 **
	(.394)	(.013)	(.011)		(.008)	(.010)	(.007)	(.007)
Border '90	1.16 **	-.000	-.015	-.067	-.010	.013	-.010	.001
	(.370)	(.013)	(.011)	(.102)	(.008)	(.012)	(.007)	(.009)
Border '91	1.34 **	.028 **	-.019 *	-.032	-.021 **	.004	- .015*	.004
	(.362)	(.013)	(.011)	(.110)	(.007)	(.010)	(.006)	(.008)
Border '92	1.19 **	.027 **	-.022 **	.037	-.025 **	-.003	- .013*	-.004
	(.363)	(.013)	(.010)	(.112)	(.007)	(.015)	(.006)	(.011)
Border '93	1.22 **	.028 **	-.022 **	-.083	-.026 **	-.008	- .022**	-.019 **
	(.376)	(.012)	(.010)	(.104)	(.007)	(.012)	(.006)	(.008)
Border '94	1.18 **	.035 **	-.021 **	-.019	-.022 **	-.007	-.018 **	-.023 **
	(.409)	(.012)	(.010)	(.106)	(.008)	(.011)	(.007)	(.008)
Border '95	1.36 **	.040 **	-.021 **	-.060	-.039 **	.000	- .026**	-.018
	(.419)	(.012)	(.010)	(.097)	(.008)	(.013)	(.007)	(.012)
Border '96	1.70 **	.031 **	-.022 **	-.072	-.042 **	-.015	- .028**	-.024 **
	(.419)	(.013)	(.011)	(.109)	(.008)	(.011)	(.007)	(.010)
Border '97	1.90 **	.030 **	-.020 **	-.043	-.032 **	.002	- .027**	-.021 **
	(.384)	(.014)	(.012)	(.113)	(.008)	(.014)	(.007)	(.019)
Border '98	1.98 **	.021	-.021 **	-.162				
	(.371)	(.015)	(.012)	(.115)				
Border '99	2.08 **	.010	-.023 **	-.110				
	(.387)	(.017)	(.013)	(.132)				
Border '00	2.28 **	-.010	-.029 **					
	(.385)	(.017)	(.014)					
Hours[b]							.551 **	
							(.055)	
Neg.wage[b]							.377 **	.029
							(.043)	(.052)
Skill							.088 **	.090 **
							(.001)	(.004)
Age							.333 **	.698 **
							(.003)	(.006)
Age, sq.							-.037 **	-.073 **
							(.000)	(.001)
Reg.policy	.124 **	-.037 **	-.015 **	.081 **	-.006 **	.005 *	-.004 **	.003 *
	(.049)	(.002)	(.001)	(.020)	(.001)	(.003)	(.001)	(.002)
Time period	87-00	86-00	86-00	89-99	86-97	86-97	86-97	86-97
R^2	.937	.996	.999	.602	.978	.935	.366[a]	.416[a]
Nobs.	4,562	4,890	3,272	3,273	3,912	3,911	555,578	280,254

Columns (1) to (6) report heteroskedasticity consistent standard errors in parentheses. Columns (7) and (8) report standard errors obtained from a Huber / White Sandwich estimator taking account of the dependence within regions. A star denotes significance at the 10%–level, two stars denote significance at 5%–level. All estimations include a full set of regional and time fixed effects. Columns (7) and (8) also include industry dummies. *a*: R^2 refers to the data after within transformation. *b*: entered in logs.

investment per employee in manufacturing. If regional policy is sufficiently captured by this dummy variable, the investment series scaled with employment and conditional on the regional policy dummy should not display significant differences in the border regions. Column (4) reports corresponding results. On the one hand, the provision of investment incentives proves highly significant suggesting that, in fact, regional policy has been effective in creating higher investment per worker.[8] On the other hand, investments in manufacturing in border regions show no systematically different reaction to the integration shock than investments in non-border regions. Thus, the results confirm that the variable for regional policy is a sufficient indicator of investment incentives in our specification.

The results for wages and salaries of low and medium skilled employees are presented in columns (5) to (8). Columns (5) and (6) report results for simple regressions using aggregate data. From 1991 on, wages are significantly lower in border regions compared to non-border regions. Once more, the effects are persistent and highly significant. From 1991 to 1997, the average wage in border regions is between 2.1% and 4.2% lower than in the base period. Also for salaries a negative development is found, although the interaction terms between the border and period effects are not significant. Columns (7) and (8) report further results on wages and salaries obtained from regressions using individual data. These regressions include some additional controls for the characteristics of the workers in terms of age and education as in a standard Mincer-type wage regression. In addition, these regressions exploit the information about the industry affiliation of each worker and introduce controls for the industry as well as indicators for hours worked in the industry considered and for negotiated wages according to the corresponding industry level wage agreement. The negative development in the wage level is still confirmed, even though the individual characteristics as well as the industry characteristics are highly significant, pointing to the usual age and education effects and to a significant impact of industry characteristics. This shows that the simple "differences–in–differences" approach does not yield spurious results: differences in the composition of the workforce cannot explain the observed trend towards lower wages in the border region in the aftermath of re-unification.[9]

While the results presented in Table 2 give some general picture of the development in the border region, the more specific information available about the time period during

[8]This finding conforms with Franz and Schalk (1995).

[9]Following conventional practice the results have been obtained relying on robust inference with regard to heteroskedasticity and random group effects (*e.g.*, Moulton, 1990) in case of individual data.

Table 3: DID Estimation Results

Dep. Variable	U.rate	log Emp.	log Pop.	log Inv.
	(1)	(2)	(3)	(4)
Border×(year ≥ 1990)	.939 **	.026 **	-.009 *	.020
	(.254)	(.006)	(.005)	(.042)
Period before unif.	1987-89	1986-89	1986-89	1989-89
Period after unif.	1990-93	1990-93	1990-93	1990-93
Nobs.	652	652	652	448

Dep. Variable	log Wage	log Salar.	log Wage	log Salar.
	(7)	(8)	(9)	(10)
Border×(year ≥ 1990)	-.012 **	.006	-.009 **	-.002
	(.005)	(.012)	(.005)	(.011)
Period before unif.	1986-89	1986-89	1986-89	1986-89
Period after unif.	1990-93	1990-93	1990-93	1990-93
Nobs.	652	652	652	652

Results of estimations following the suggestions of Bertrand, Duflo, and Mullainthan (2004), see text for further explanation. Estimations (1) to (6) use residuals from panel regressions using county-level data including region- and year-fixed effects. Estimations (7) and (8) use average residuals for each year-county cell obtained from individual-level panel regressions including controls for hours, negotiated wages, skill, age, and age squared, as well as region and year fixed effects. Heteroskedasticity consistent standard errors in parentheses. A star denotes significance at the 10%–level, two stars denote significance at 5%–level. All estimations include a constant, a time-specific fixed effect and a full set of regional fixed effects.

which the main cross-border effect should have occurred and the problem of autocorrelation suggest that we apply the two step-procedure discussed above in order to focus on the early integration period. Table 3 displays corresponding results for each of the series analyzed above. Following the above discussion we restrict attention to the period in the first four years after re-unification (1990-1993) relative to the periods before re-unification, using up to four periods (1986-1989).[10] Nevertheless, the preliminary results obtained above are clearly confirmed. In the period after re-unification, unemployment and employment are significantly higher, and wages are significantly lower in the border regions. Note that as above, salaries do not show a significant effect. With regard to the size of the effects, the results indicate that employment went up by about 2.5%, wages declined by 1%, the unemployment rate rose by 1 percentage point, and population declined by 1%.

[10]Sensitivity analysis reveals that extending or reducing the pre- and post-unification periods considered has little effects on the results.

Taken together the results are in accordance with the predictions of our theoretical model. If in fact the removal of the border barriers has contributed to a higher labor supply in the regions situated in West Germany close to the German–German border, total employment should have increased. At the same time wages should have been reduced, relatively, and, furthermore, the participation of the residents in these regions should have been falling, possibly accompanied with an increase in the local unemployment rate. The empirical analysis has shown that, within the constraints imposed by data availability, these predicted trends are supported by the data. The adverse population trend is in accordance with the decline in the relative attractiveness of the labor market of border regions and points to some further adjustment in the long-run.

5 Conclusions

From the analysis presented in this paper we can conclude that labor market competition from across the border is a plausible explanation for the joint movement of labor market conditions in West German border regions in the aftermath of German re-unification. More specifically, the results suggest that in line with the predictions from a simple theoretical model, workers from East Germany commuting but not necessarily migrating to West German border regions expanded the labor supply and led to lower wages and higher unemployment among resident workers even though employment in these regions has been increased.

Of course, we cannot completely rule out that the divergent development in the regions close to the German–German border has other causes. But given that the employment shares of East Germans in the border-regions after unification rose to more than 12% on average as compared to 4% in other West German regions, is seems fairly reasonable to assume that the most important shock specific to the labor market of these regions in this period was a labor supply shock. Another important event which took place in the first years after re-unification in these regions seems to be the change of the regional investment aid policy. However, we have controlled for the change in this policy and provided evidence that the corresponding control variable fully explains differences in regional investment activity conditional on employment.

The results cast doubts on the short and medium term labor market prospects for residents

in EU regions situated at the EU border with the accession countries in Central and Eastern Europe in the course of EU enlargement. However, due to language barriers and a more positive economic development in the accession countries as compared to eastern Germany, the competitive pressure might be smaller than in the case of German unification. Another important difference between EU enlargement and the integration at the German–German border is that the accession of the Central and Eastern European Countries was an expected event; individuals and firms had years to anticipate integration before it now takes place. Already before EU accession, workers from these countries started commuting across the border into the EU and goods markets were partly integrated. Therefore, we would expect to find less pronounced integration effects for the EU border regions to Central and Eastern Europe after the accession of these countries to the EU.

Notwithstanding substantial gains from economic integration, the German example shows that there are some adverse integration effects in the labor market which are unevenly distributed across space since, *ceteris paribus*, resident workers in border regions of high wage countries may suffer from a deterioration of labor market conditions due to cross-border labor mobility. This finding places further doubts on the labor market prospects of the eastern part of Germany.

6 Data Sources and Definitions

The dataset consists of all 327 counties and independent cities (*Kreise und kreisfreie Städte*) in West Germany. The city of Wolfsburg is excluded due to some data restrictions.

Annual population : Average of quarterly figures, official projections based on census data and resident registration information.

Unemployment rate : Official annual figure for the city or county as reported in the statistics provided by the Federal Employment Service.

Total employment : Number of employed at the end of June at each year at local establishments as reported in the employment statistics based on the complete set of social security accounts.

Manufacturing employment : Employment in manufacturing establishments (Produzierendes Gewerbe) as reported by the Statistical Offices of the German States.

Wages and salaries : The wage rate refers to the gross daily wage for a male full-time (blue-collar) worker with low or medium skill level as taken from the IABS-REG scientific use file of a 1% random sample of the social security accounts. As the data are top-coded at the upper social security threshold, we restrict attention to low and medium skilled workers. Specifications (7) and (8) employ average figures of the daily remuneration as of June 30th in the considered region and period. Specification (9) and (10) use the underlying individual data.

Age and skill : The age is the individual age as reported in the IABS-REG. Skill is a dummy reflecting the existence of a vocational training degree. Note that highly skilled employees, *i.e.* with a technical college ("Fachhochschule") or university degree, are removed entirely from the dataset in order to avoid problems from the top-coding of the remuneration figures.

Industry : Dummies for 40 manufacturing and non–manufacturing sectors according to the industry classification used by the Federal Labor Office.

Hours : Average weekly hours paid at the industry level for 40 manufacturing and non–manufacturing sectors (for male blue collar workers only). Source: German Statistical Office ("Statistisches Bundesamt", FS 16,2, Segmente 1612-1615, 5565-5568).

Negotiated wages of blue collar workers : Industry specific index of hourly negotiated wages of male blue collar workers (1991=100). Source: German Statistical Office ("Statistisches Bundesamt", FS 16,4.3, Segment 2561).

Negotiated wages of white collar workers : Industry specific index of monthly negotiated wages of male white collar workers (1991=100). Source: German Statistical Office ("Statistisches Bundesamt", FS 16,4.3, Segment 2554).

Regional policy : Dummy variable for counties enclosing locations eligible for investment subsidies. For all years up to 1991, it is set to unity if for county i in year t either the county encloses locations eligible for investment subsidies from the "Improvement of Regional Economic Structure" program, or if the county encloses locations which belong to the so-called "Zonenrandgebiet". For all years after 1991, the second condition is dropped since from the year 1992 onwards belonging to the former "Zonenrandgebiet" does no longer affect on the eligibility for investment subsidies. If all locations in county i lose their status of being eligible for subsidies during year t, π_{it} was set to $m/12$, where m is the number of months in year t in which firms could still apply for subsidies. All information concerning eligibility was taken from the annual report "Rahmenplan der Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur".

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Appendix: Comparative Static Effect of Mobility Cost

In order to obtain the comparative static result of a reduction in cost of mobility δ, it is helpful to first show that a decrease in the transaction cost of mobility δ will raise labor supply in the border region of the high-wage country if wages were constant. To see this we simply have to differentiate (2). This yields

$$\frac{\partial L_2^S}{\partial \delta} = -f\left(w_2 - \delta - w_3\right) G\left(w_3\right) - \int_0^{w_2-\delta-w_3} f\left(\mu\right) g\left(w_2 - \delta - \mu\right) d\mu$$

which is strictly negative. At the same time a decline in mobility cost causes a reduction of labor-supply in the low-wage region. This can be show by differentiation of (1) yielding

$$\frac{\partial L_3^S}{\partial \delta} = f\left(w_2 - \delta - w_3\right) G\left(w_3\right)$$

which is strictly positive. However, note that the total labor supply increases as the sum of the partial derivatives is strictly negative ($\frac{\partial L_2^S}{\partial \delta} + \frac{\partial L_3^S}{\partial \delta} < 0$).

Having shown how labor supply responds to a decline in cost of mobility at given wages, we would expect that wages will fall in the border-region of the high wage country and increase in the low-wage country. However, in order to derive the impact on the labor market equilibrium we need to see how labor supply would respond to a change in wages. With regard to the impact of wages in the border region on labor supply, we can find that a decrease of the wage rate in the border region of the high-wage country would lower labor supply in this region and raise labor supply in the low-wage region. To see this we differentiate (2). This gives us

$$\frac{\partial L_2^S}{\partial w_2} = g\left(w_2\right) + f\left(w_2 - \delta - w_3\right) G\left(w_3\right) + \int_0^{w_2-\delta-w_3} f\left(\mu\right) g\left(w_2 - \delta - \mu\right) d\mu.$$

As this is positive, labor supply in region 2 declines if w_2 is lowered. Labor supply in region 3 is, however, increased since differentiation of (1) yields

$$\frac{\partial L_3^S}{\partial w_2} = -f\left(w_2\delta - w_3\right) G\left(w_3\right).$$

Note that the sum of the two effects $(\frac{\partial L_2^S}{\partial w_2} + \frac{\partial L_3^S}{\partial w_2})$ is strictly positive. This indicates that the decrease of labor supply in the border region of the high-wage country is larger than the increase of labor supply in the low-wage region.

Now we are in a position to derive the impact of the border related mobility cost δ on the equilibrium wages. Differentiation of equations (5) and (6) results in

$$\begin{aligned}
\frac{\partial L_2^D}{\partial w_2} dw_2 &= \frac{\partial L_2^S}{\partial w_2} dw_2 + \frac{\partial L_2^S}{\partial w_3} dw_3 + \frac{\partial L_2^S}{\partial \delta} d\delta, \\
\frac{\partial L_3^D}{\partial w_3} dw_3 &= \frac{\partial L_3^S}{\partial w_2} dw_2 + \frac{\partial L_3^S}{\partial w_3} dw_3 + \frac{\partial L_3^S}{\partial \delta} d\delta.
\end{aligned}$$

Solving for $dw_2/d\delta$ yields

$$\begin{aligned}
\frac{dw_2}{d\delta} &= \frac{\frac{\partial L_2^S}{\partial \delta} + \gamma \frac{\partial L_3^S}{\partial \delta}}{\frac{\partial L_2^D}{\partial w_2} - \frac{\partial L_2^S}{\partial w_2} - \gamma \frac{\partial L_3^S}{\partial w_2}}, \\
&\text{where} \\
\gamma &\equiv \frac{\frac{\partial L_2^S}{\partial w_3}}{\frac{\partial L_3^D}{\partial w_3} - \frac{\partial L_3^S}{\partial w_3}} = \frac{f(w_2 - \delta - w_3) G(w_3)}{-\frac{\partial L_3^D}{\partial w_3} + f(w_2 - \delta - w_3) G(w_3) + g(w_3)[1 - F(w_2 - \delta - w_3)]}.
\end{aligned}$$

Note that $0 < \gamma < 1$. We have already seen that the sum of the two terms in the numerator is negative, even if γ were unity. We also know that the denominator is negative if labor demand is inversely associated with the wage rate. This implies that

$$\frac{dw_2}{d\delta} > 0.$$

The increase of employment in the high-wage country follows from the negative slope of the labor demand function. The decline in participation in region 2 simply follows from the cdf. of the reservation wage. ■