Organized Labor and Restructuring
Coal Mines in the Czech Republic and Romania

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ABSTRACT

We conduct a case study of the role of organized labor in the restructuring experience of two coal mining regions in the 1990's: Ostrava in the Czech Republic and Jiu Valley in Romania. Under similar external circumstances, the Ostrava region undertook gradual restructuring from early on whereas in Jiu Valley there was no restructuring until 1997, followed by massive layoffs over two years. Our quantitative exercise shows that the delay in restructuring in Jiu Valley was grossly inefficient in view of the region's overall restructuring path and in comparison to Ostrava's path. The proximate reason for the delay was the Jiu Valley miners' action against restructuring. Essential for the miners' success was their alliance with the conservative faction of the government; the alliance itself was arbitrated by the Romanian electorate. We interpret the Jiu Valley miners' militancy as behaviorally conditioned rather than rationally determined, which accords with their history of militancy in contrast to the absence of militancy among Ostravian miners.

Provedli jsme případovou studii, jež se zabývá pracovními vztahy ve dvou hornických oblastech - na Ostravsku v České republice a v regionu Jiu Valley v Rumunsku - v průběhu 90. let. Ačkoli vnější podmínky obou regionů byly podobné, na Ostravsku od počátku 90. let probíhal proces postupné restrukturalizace, kdežto v Jiu Valley neprobíhala restrukturalizace až do roku 1997, což bylo následováno masivním propouštěním během dalších 2 let. Kvantitativní analýza ukazuje, že tento průběh restrukturalizace v Jiu Valley byl ve srovnání s Ostravskem velmi neefektivní. Důvodem byl odmítavý postoj horníků. Nezbytným předpokladem úspěchu zpoždění restrukturalizace byla aliance horníků s konzervativní částí vlády. Úspěšnost této aliance byla rozhodnuta rumunskými voliči. Interpretujeme sklon horníků z Jiu Valley ke konfrontačním akcím a postojům jako behaviorálně spíše než racionálně determinované jednání. Tato interpretace je podpořena historií konfrontačních akcí, která chybí ostravským horníkům.

1. Introduction

Organized labor is often characterized as an obstacle to economic progress. General versions of this view can be found in Olson (1982) and Parente and Prescott (2000), who bill the rent-seeking and rent-preserving activities of interest groups such as labor unions and professional associations as the key factor in stagnating economies.[1] This aspect of organized labor is likely to be the most visible when the status quo is challenged. In this paper we conduct a case study of such an episode in the restructuring of coal mines in the Ostrava region in the Czech Republic and the Jiu Valley region in Romania. The initial motivation for this research came from reading about a violent protest by the Jiu Valley coal miners,[2] which turned out to be a pattern in the restructuring experience of the region. Our objective is to clarify the nature of such an action with a view toward evaluating the connection between organized labor and economic progress.[3] Did the miners' action indeed hinder the path of efficient restructuring? If so, what are the underlying reasons for, and the corroborating factors of, such an action? Along the way, we make useful comparisons with Ostrava's restructuring experience, which was markedly peaceful despite similar external conditions.

In Section 2, we describe the restructuring experiences of the two regions, Ostrava and Jiu Valley. At the beginning of the 1990's, both regions went through a sharp decline in coal production as national industrial drive ceased. Gradual restructuring, mostly downsizing of employment, followed in the Ostrava region. In the Jiu Valley region, on the other hand, there was no restructuring at all until 1997, when the new progressive government managed to carry out massive layoffs over two years. The layoffs created a crisis in the regional labor market. As alluded to above, there was a sharp contrast in the

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[1] For the opposite view that various associations can facilitate politico-economic modernization, see Putnam (1992).

[2] See The Economist (1999).

[3] This spirit of research is shared by Galdon-Sanchez and Schmitz (2002), who study the change in labor productivity under increased competition in the worldwide iron-ore industry.

miners' behavior toward restructuring between the regions. The Ostravian miners cooperated with the government throughout, whereas the Jiu Valley miners fought not only against restructuring the region's mines but also against the reformist agenda in general. The extreme swing in the Jiu Valley restructuring path reflected the initial success and subsequent failure of the miners' action in the context of national politics.

In Section 3, we conduct a quantitative exercise in order to evaluate how (in)efficient the restructuring paths were in the two regions. The presumption would be that the extreme swing in the Jiu Valley restructuring was socially inefficient: either the early stagnant phase or the later massive-layoff phase would have been inefficient. In comparison, the steady pace of Ostrava's restructuring would seem benevolent. By explicitly modeling the optimal path of restructuring, we obtain a degree of clarity on the aspects of the actual restructuring path that were inefficient, which would then need to be explained. Our method is to estimate the value of the (laid-off) miners' labor both inside and outside the mines for various restructuring paths. We take the discounted sum of this value to be the measure of efficiency. We show that in both regions the most efficient path would have been a large-scale layoff over the first few years. The actual restructuring path of Ostrava was not far from the most efficient one whereas that of Jiu Valley was very much so: the efficiency-loss (i.e., the efficiency-gap between the most efficient and the actual path) was three times greater in Jiu Valley than in Ostrava. Therefore, our exercise mainly supports the view that the delay in restructuring Jiu Valley mines was socially inefficient.

In Section 4, we discuss why restructuring was delayed in Jiu Valley. The proximate reason is the miners' action against restructuring in alliance with the conservative faction of the government. Some of the conservatism, shared by a large segment of Romanian society, may have resulted from justifiable caution under the uncertain environment, which is inadequately addressed in our exercise. A probably greater motivation for the conservative faction of the government was the direct benefit of the alliance, namely, the violence that could be unleashed by the miners toward political opponents. On the other hand, the

miners' militancy was ultimately fatal to themselves; negotiating a compensated gradual layoff would have served them better. We interpret the miners' action as a behavioral pattern under a perceived threat to their livelihood, rather than as a rational strategy for safeguarding miners' welfare. The historical militancy of Jiu Valley miners, in contrast to its absence among Ostravian miners, accords with this interpretation. In the end, the success and failure of the miners' actions were determined by the Romanian population. When the electorate turned against the alliance, it crumbled and the miners were finally defeated as a political force.

In Section 5, we summarize the results and draw an overall conclusion.

2. Restructuring Experiences of the Two Regions

In this section, we describe the restructuring experiences of the two regions, Ostrava and Jiu Valley, based on, among other sources, the interviews that we conducted.[4] Each of the two regions is a well-defined geographic and economic zone[5] that produces virtually all deep-mined black coal in the respective country. In the 1980's, coal production was highly valued as a source of energy: the national production structure was skewed toward energy-intense heavy industries. With the beginning of transition came an abrupt decline in industrial production, which led to a sharp reduction in coal production. In Ostrava the reduction was in the order of 10 to 25 percent stretching over a couple of years; in Jiu Valley it was nearly 50 percent, all within the first year. Thus a sort of 'demand' shock set the stage for restructuring. Gradual restructuring, mostly downsizing of employment, followed in the Ostrava region. In contrast, in the Jiu Valley region there was no restructuring at

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[4] We interviewed government officials, mining company managers, union representatives, and researchers. Five interviews were in Prague and Ostrava in 2002, and fourteen in Bucharest, Jiu Valley, and Cluj in 2002 and 2003. These were complemented by previous studies, mainly sociological studies on the effects of restructuring in Jiu Valley, as will be referenced throughout.

[5] To be precise, the Ostrava region refers to the districts of Ostrava and Karvina in northern Moravia, and the Jiu Vally region refers to the townships of Petrosani, Aninosa, Lupeni, Petrila, Uricani, and Vulcan in Hunedoara County.

all until 1997, followed by massive layoffs over two years. Tables 1 and 2 present the production and employment figures from 1990 to 2001.[6,7] Figures 1 and 2 visualize the strikingly different paths of restructuring between the two regions.

The differences in the two regions' paths of restructuring mirrored those of their national economy. The Czech Republic made gradual, steady progress toward a market economy. Starting further away from a market economy, Romania undertook few reforms until a new government came to power in 1996. Between the two regions there was a marked difference in the miners' behavior toward restructuring. In the Ostrava region, the miners' union cooperated with the government - and the government consulted with the union - which led to a peaceful process of restructuring despite the significant decline in employment. In the Jiu Valley region, in contrast, the miners' union was not only against mining restructuring but was an active conservative force in national politics. Notably, miners made marches to Bucharest, called *mineriadas*, on several occasions to violently quell the progressive movement. In 1997, however, the new government managed to carry out massive layoffs using a carrot and stick approach: it provided severance payments of up to 20 months of wages while keeping the charismatic union leader Miran Cozma in jail. When the released Cozma mounted another *mineriada* in 1999, the government outwitted him and put him back in jail with a 17 year sentence; the miners were finally defeated as a political force.

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[6] The data for Ostravia are from the yearbooks published by the Czech Mining Institute; the data for Jiu Valley were directly obtained from the CNH, the only mining company in the region. We cautiously present the 1990 data for the Ostravian mines: their only source is the 1993 yearbook and the data from this yearbook are in general somewhat different from the subsequent yearbooks. For both regions the employment figures are for the workers in mines, excluding the headquarters and auxiliary units. Much of the change in the number of these excluded workers represents spin off units (e.g., social service) that are not directly related to mining. We focus on the restructuring of mines proper and abstract from this peripheral issue.

[7] The improvement in labor productivity is largely due to downsizing. In particular, the Jiu Valley mines had a large slack in labor until 1997, given the large initial decline in output. Further, there was little investment in new technology in Jiu Valley throughout the period. Some Ostravian mines, however, adopted new technology in the early years, which contributed to the improvement in productivity.

The gradual and steady path of the Ostravian restructuring path resulted in a favorable unemployment experience for the ex-miners, whereas the delayed and massive layoffs in Jiu Valley created a crisis in the labor market. This can be seen in the unemployment rates presented in Tables 1 and 2.[8] The contrasting unemployment situation stemmed in part from the initial condition. Jiu Valley is an isolated mono-industrial region and could offer few opportunities to ex-miners. The Ostrava region had a larger and more diversified labor market, and could absorb layoffs with relative ease until the late 1990's, when the restructuring of the metallurgical industry strained the market.[9] There was also a marked difference in the ex-miners' behavior toward job searches. The Ostravian ex-miners took more initiatives to find work and had a reputation for making good workers in new occupations. The Jiu Valley ex-miners, on the other hand, were more reluctant to accept low-wage work and had a tendency to protest for governmental help. Notably, following the massive layoffs some ex-miners mounted a hunger strike in order to obtain benefits from the government, which became routinized.[10]

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[8] The labor market data were directly obtained in various bits from the statistics and labor offices at both the regional and national levels. We constructed unemployment rates by subtracting the official employment figure from the labor force. The official unemployment rates only measure registered unemployment, which underestimates unemployment during the downturn of the labor market. This problem was in particular clear and significant in Jiu Valley in the late 1990's. Incidentally, the official labor force is measured by summing up the official employment and unemployment figures. For the Ostrava region we fixed the size of the labor force at the average over the period since there was little population growth or immigration during the period. For the Jiu Valley region the labor force was held at the average until 1996, and afterwards adjusted year-by-year by subtracting the significant net-immigration out of the region. Finally, note the implausibly low unemployment rate in Ostrava in 1996, which is due to an obvious error in the raw data for this year. Not knowing the magnitude of the error, we left it uncorrected.

[9] A 1996 European Union assessment of the labor market conditions of 21 European coal mining regions ranked the Jiu Valley region as the fourth most 'vulnerable' to restructuring, and the Ostrava region as the third least vulnerable (see European Union 1996).

[10] The hunger strike should be understood euphemistically: most participants left the protest site in the evening, presumably discontinuing hunger. Further, the participants considered granting of governmental benefits to non-participants as encouraging 'free riding,' which makes it clear that the participants perceived the strike as a legitimate means of obtaining *personal* benefits.

3. Evaluating the Restructuring Paths

In this section, we quantitatively evaluate the efficiency of the restructuring paths in the two regions from 1990 to 2001. Our main objective is to assess whether the delay of restructuring in Jiu Valley was inefficient in the context of the overall restructuring path. At the outset, we should not discard the possibility that the delay was relatively benign when compared to the massive layoff that followed, or even to the milder but significant layoffs in Ostrava early on. Addressing these issues is the first part of assessing the impact of the Jiu Valley miners' action on the efficiency of the restructuring path; the second part, clarifying the connection between the miners' action and the delay in restructuring, will be done in the next section. Our strategy is to explicitly model the layoff paths, taking the initial and the final mining employment to be given by the actual employment in 1990 and 2001, respectively. This allows us to estimate the value of the (laid-off) miners' labor both inside and outside the mines for a given layoff path. We take the discounted sum of this value to be the measure of social welfare. The optimal layoff path is then what maximizes welfare, and the gap between the maximum welfare and that obtained under the actual path measures the inefficiency of the actual path. The detailed method of measurement is presented below.

3.1 Measuring the Value of Labor inside Mines

To measure the value of miners' labor in coal production, we start with the following production function:

$$Y_t = A_t K_t^\alpha L_t^\gamma \tag{1}$$

where Y_t is the output, A_t is the technology parameter, K_t is all non-labor input, including not only capital but also material, and L_t is labor input. To assess non-labor input during restructuring, we consulted the accounts of the dominant mining companies, the OKD in

Ostrava and the CNH in Jiu Valley, for the 1993-2000 period.[11] The non-labor input cost as a share of revenue is on average .59 and .48, respectively, and there is no upward or downward trend in either company. Based on this, we assume that the observed shares are maintained throughout restructuring,[12] so (1) becomes

$$Y_t = s^{\frac{\alpha}{1-\alpha}} A_t^{\frac{1}{1-\alpha}} L_t^{\frac{\gamma}{1-\alpha}}, \tag{2}$$

where s denotes the non-labor input share.

The technology parameter A_t reflects factors such as the upgrading of equipment, the change in work practice, and the temporary impact of closing mines, which are important but not dominant aspects of restructuring in our case (see footnote 7). Since our focus is on labor downsizing, we simply assume that these other aspects of restructuring keep pace with labor downsizing, i.e., A_t only depends on L_t. Further, we assume that the impact of A_t on the production function is to make it linear with respect to L_t during restructuring, so (2) becomes

$$Y_t = \bar{Y} + \tilde{A}(L_t - \bar{L}), \tag{3}$$

where $\bar{Y}$ and $\bar{L}$ are the final fixed levels of output and employment. The production function (3) is drawn as solid lines in Figures 1 and 2.[13] The function approximates the actual path of restructuring for the Ostrava region, while there is little reason to consider a more complex function for the Jiu Valley region. To emphasize, (3) is assumed to be valid

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[11] The OKD produces about 80% of Ostrava's coal and, as mentioned, the CNH is the only mining company in Jiu Valley. The accounts for the earlier years were not publically available.

[12] To elaborate on the rationale for constancy, it is plausible that the OKD could choose output and non-labor input (but not labor input) throughout the period. Then the marginal product of non-labor input would have been equal to the input price level, which implies that the non-labor input share was equal to α in (1). The CNH, on the other hand, probably could not choose output (and labor input) freely due to its more rigid output market, leaving no prediction on whether the non-labor input share should increase or decrease as we move from the early to the late 1990's: the 1997-1998 layoff would have increased the share of non-labor input as a substitute, but the accompanying reduction of output would have had the opposite effect. The CNH account suggests that the two effects roughly canceled each other.

[13] For the Ostrava region, the function is drawn through the 1991 point rather than the 1990 point. The large output drop from 1990 to 1991 largely represents the initial demand shock, as mentioned in Section 2, rather than restructuring.

during the 1990-2001 restructuring period and is not meant to be a long-run production function.

The value of $\tilde{A}$, when production is measured at an annual rate, is 150 tons/worker for the Ostrava region and 52 tons/worker for the Jiu Valley region. The coal price, when measured in USD, was stable over the period except in the early 1990's in Ostrava and in the late 1990's in Jiu Valley, and there is no trend upward or downward over the whole period in either region.[14] Avoiding the nominal noises of the unstable periods, we fix the price at the average, which was 35.4 USD and 22.5 USD, respectively. The upshot of all this is that the value of output that accrued to the would-be-laid-off miners is $p\tilde{A}(1-s)(L_t - \bar{L})$ in units of the current-period USD, where p denotes the coal price.

3.2 Measuring the Value of Labor outside Mines

To measure the value of ex-miners' labor, we start with the following job-finding function:

$$M_t = BU_t^\rho, \tag{4}$$

where M_t is new employment, U_t is unemployment, and B is a parameter that indicates the labor market condition aside from unemployment, and ρ is an elasticity parameter. Let ϕ_t denote the job finding rate:

$$\phi_t = \frac{M_t}{U_t} = BU_t^{\rho-1}. \tag{5}$$

The reciprocal of this rate is the *expected* unemployment duration (i.e., the duration that would be obtained if the rate is maintained into the future). We can estimate the job-finding rate, or equivalently the expected unemployment duration, from the panel data of

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[14] The price was measured by dividing revenue by production volume and then converting this value to USD according to the current exchange rate. If we discount the price by the Consumer Price Index instead, we obtain the same periods of instability and a somewhat downward trend over the whole period, which is expected since the real value of USD depreciated over time.

actual unemployment duration: in each period we follow the cohort of the newly unemployed and see how many of them remain unemployed in the following period.

Estimated this way, in the Ostrava region the expected unemployment duration increased from 7.8 months in the 1993-1995 period to 18.2 months in the 1999-2001 period, an increase by a factor of 2.3.[15] Between the two periods, unemployment increased by a factor of 3.0, which implies that $\rho = .24$ for the Ostrava region. In the Jiu Valley region, unemployment increased by a factor of 4.0 from the 1993-1996 period to the 1999-2000 period. We could estimate that the expected unemployment duration in the latter period was about three years.[16] For the former period, we can only guess that the expected unemployment duration may have been about one year, based on peripheral information.[17] Assuming the three-fold increase in the expected unemployment duration between the periods, we have $\rho = .21$ for the Jiu Valley region.[18] Given the values of ρ, we can calculate from (5) that when new employment is measured on a monthly basis, the parameter B is equal to 222 for the Ostrava region and to 97 for the Jiu Valley region.

Now we specify the unemployment inflow that feeds into the job-finding function (4). Let $\hat{U}_t$ denote the unemployment of ex-miners, and $\check{U}_t$ that of the others: $U_t = \hat{U}_t + \check{U}_t$. The unemployment inflow of miners is given by the layoff path: $\hat{U}_0 = 0$ and

$$\hat{U}_{t+1} = (1 - \phi_t)\hat{U}_t + L_t - L_{t+1}. \tag{6}$$

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[15] We could only obtain the annual data of unemployment duration for the greater Ostrava region, which is composed of five districts including the two districts of our interest, Ostrava and Karvina. Since the drop in the job-finding rate may have been more severe in the two-district region, the following estimate of ρ may be an overestimate.

[16] This is based on Chiribuca, et. al. (2000) and the annual data of unemployment duration for the Hunedoara county that includes Jiu Valley.

[17] Based on the annual data of unemployment duration at the national level, we estimated the expected unemployment duration to be about one year in the mid-1990's. The unemployment rate of Jiu Valley was comparable to the national average prior to 1997. Our guess would be valid if the labor market condition aside from the unemployment rate (i.e., scale-adjusted B in equations 4 and 5) was comparable too.

[18] The lack of precision for ρ is not crucial for the main result, as the sensitivity analysis in Section 3.3 shows.

Similarly, we have

$$\check{U}_{t+1} = (1 - \phi_t)\check{U}_t + Z_{t+1}, \tag{7}$$

where Z_t is the inflow of non-ex-miners.

We set $\check{U}_0$ and Z_t so that the sequence of total unemployment corresponds to the data under the actual layoff path. Recall that in both regions unemployment was steady until 1997, after which it became significantly worse. In Ostrava the worsened situation was largely due to the layoffs in the metallurgical industry, unrelated to mining restructuring. Accordingly, we set

$$Z_{t+1} = \phi_t \check{U}_0 \tag{8}$$

for all periods except for the 1997-2000 period, and

$$Z_{t+1} = \phi_t \check{U}_0 + \bar{Z} \tag{9}$$

for the 1997-2000 period, where $\bar{Z}$ is a fixed additional layoff. In Jiu Valley the worsened situation was virtually entirely due to the layoffs in mining and those linked to mining. To preserve this linkage under various layoff paths, we set

$$Z_{t+1} = \phi_t \check{U}_0 + \theta(L_t - L_{t+1}) \tag{10}$$

for all periods, where θ is the additional layoff as a fixed fraction of the mining layoff.[19] The values of $\check{U}_0$ and $\bar{Z}$ that best simulate the monthly unemployment path for Ostrava were 14,900 and 2,500; the values of $\check{U}_0$ and θ that do the same for Jiu Valley were 8,000 and .78.[20]

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[19] There would have been extra unemployment linked to mining in Ostrava as well, although we don't know its size. Since the extra unemployment linked to mining would lead to a slower pace of optimal restructuring, the bias resulting from the modeled asymmetry between the regions is a safe one: it reinforces the result that the actual restructuring path in Ostrava, although slower than the optimal one, was closer to it than in Jiu Valley.

[20] Recall that there was a significant emigration out of Jiu Valley in the late 1990's, no doubt as a consequence of the massive layoffs (footnote 8). Since θ is calibrated to the unemployment path *in* Jiu Valley, its value is net of the emigration of the laid-off, including that of ex-miners.

Now we can calculate the sequence of ex-miners' employment using (4) to (10):

$$N_{t+1} = N_t + \phi_t \hat{U}_t \tag{11}$$

where N_t denotes the ex-miners' employment.[21] We estimate the value of newly employed ex-miners' labor using the actual wages in the regions. In the Ostrava region, the gross annual average wage[22] when measured in units of coal and then converted to the USD,[23] was 3,507 USD in 1990 and grew at an annual rate of 4.5% on average over the years, reaching 5,709 USD in 2001. In the Jiu Valley region, for the 1993-2000 period the same method yields an average wage of 2,530 USD and a virtually zero growth rate. Let w_t denote the growth path of the gross average wage as described here. For the years beyond 2001, we assume that in both regions the annual growth rate of w_t will adjust gradually to a more typical rate of 2.0% during the 2001-2005 period, and thereafter stay at this rate.

How did the ex-miner's wage compare to the average wage in the regions? In Ostrava it was probably not far off from the average wage since ex-miners seem to have had little difficulty in adjusting to new occupations. In Jiu Valley, in contrast, ex-miners had great difficulty in adjusting to new occupations, and their wage was as low as half of the average wage in the region.[24] Let λ denote the ex-miner's wage as a share of the gross average wage. As a benchmark, we assume that λ is equal to 1.00 in Ostrava, and to .75 in Jiu Valley. Putting all this together, the value of the ex-miners' labor is $\lambda w_t N_t$ in each period.

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[21] Here we have assumed that the job-finding rate of the emigrant ex-miners is the same as that of the miners who stayed (see the previous footnote). We are not sure about the employment prospects of the emigrant ex-miners, but they were probably not very different from those of the ex-miners who stayed. Many of the emigrants returned after a while, unable to find work elsewhere.

[22] That is, before any taxes including the social security tax paid by the employer, which was 35% in the Czech Republic and 38% in Romania. The gross wage is the proper measure of the market value of labor.

[23] Thus we are measuring the value of labor both inside and outside mines in units of coal, and then multiplying it by the price of coal, which is assumed to be fixed in USD (see Section 3.1). Again, the fixed-price assumption avoids the nominal noises of periods when prices were unstable.

[24] The half figure is the estimate from Chiribuca, et. al. (2000). However, some of this differential is probably transitory and reflects the temporarily worse labor market conditions and the trial-and-error aspect of a job search. Ex-miners typically worked as laborers in construction, in public-works repair, and in the black market (Larionescu, Rughinis, and Radulescu 1999).

3.3 Measuring the Efficiency of Restructuring Paths

Now we are ready to evaluate the paths of restructuring, using the above calibrated model. The value of (laid-off) miners' labor both inside and outside the mines (i.e., $p\tilde{A}(1-s)(L_t-\bar{L})+\lambda w_t N_t$) is a measure of momentary welfare. For the actual path of restructuring, the momentary welfare path, as an annual rate, is depicted by the solid lines in Figures 3 and 4, with the 1990 level normalized as zero. In the Ostrava region, the momentary welfare has been increasing gradually in accordance to the gradual restructuring, except for a mild dip in the late 1990's due to the worsened unemployment situation. In the Jiu Valley region, the momentary welfare changed little until 1997, after which a large downward and then upward swing followed due to the massive layoff.

The welfare proper is the discounted sum of momentary welfare, and the optimal path of restructuring is the one that maximizes welfare:

$$\text{Max}\left\{\sum_{t=1}^{\infty}\beta^t[p\tilde{A}(1-s)(L_t-\bar{L})+\lambda w_t N_t]\right\} \tag{12}$$

where β is the discount rate.[25] Since the labor market flows are on a monthly basis, we set the period to be month-long and adjust output and wage appropriately. We assume $\beta = .995$, which is equivalent to an annual discount rate of about 6%.[26] We solved this maximization problem numerically. Given a sequence of L_t, we can calculate the expected discounted sum of the value of a miner's labor, which only depends on the timing of his layoff. Further, we can calculate the externality that a miner imposes on the other miners by congesting the labor market,[27] that again only depends on the timing of his layoff. The timing of layoffs can then be ordered by the expected discounted sum of the value

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[25] Note that the sum is over the infinite horizon. This is conceptually proper if we view restructuring as a reallocation of labor that will be by default maintained indefinitely.

[26] Since the price and the wage are in units of current USD, the discount rate is a combination of the depreciation of the currency and time preference.

[27] See equation 4. Note that we are abstracting from the externality that miners impose on non-miners or vacant firms in the labor market. Whether this externality is overall positive or negative would depend on the labor market properties, in addition to those that we have assumed.

of a miner's labor net of his externality. By construction, we can increase welfare by moving the timing of layoffs from a low-value period to a high-value period. Starting with an arbitrarily chosen sequence of L_t, we updated it repeatedly by moving the timing of a single miner's layoff from the lowest-value period to the highest-value period until all layoff periods had the equally highest value.

The optimal momentary welfare path, calculated this way, is depicted by the dotted lines in Figures 3 and 4. For both regions, there is a sharp initial decline which indicates a massive layoff. In Ostrava, 63% of all layoffs take place in the first month, and the entire period of layoffs lasts 16 months. Even more dramatic, in Jiu Valley the period of layoffs lasts only 4 months, with 97% of all layoffs occurring in the first month alone. At the beginning of the 1990's, under the benchmark parameter values, the value of a miner's labor in mining as a share of that in alternative employment is 62% in Ostrava and 32% in Jiu Valley. These value differentials largely outweigh the congestion effect of a massive layoff on the labor markets, which were initially in fair condition. Subsequent to the massive layoffs, the momentary welfare improves as ex-miners find jobs. The unemployment duration, on average across ex-miners, is 12 months in Ostrava and 30 months in Jiu Valley. The shorter duration for Ostrava is because of a larger local labor market: the unemployment rate is maintained below 15% throughout, while in Jiu Valley it reaches over 50% in the first few months.[28] The transitional impact of restructuring is over within the first two or three years in Ostrava and by the middle of the 1990's in Jiu Valley, after which the momentary welfare follows the respective wage growth in the regions. The overall inefficiency of actual restructuring can be measured as the difference in welfare (i.e., the sum in (12)) between the optimal and the actual paths as a share of welfare under the optimal path. This

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[28] The relatively favorable labor market outcome in Ostrava may be an exaggeration since we have assumed extra unemployment linked to, and in proportion to, mining unemployment in all periods in Jiu Valley, but not in Ostrava (see Section 3.2). If we assume extra unemployment linked to mining in Ostrava as well, the resulting unemployment rate would be higher although this effect would be mitigated by a slower restructuring pace (see Footnote 19). Regardless, under any reasonable size of extra unemployment, a large difference in the labor market outcome between the regions would remain.

measure of inefficiency is 8.8% for the Ostrava region, and 26.7% for the Jiu Valley region. Thus the actual restructuring path was three times more inefficient in Jiu Valley than in Ostrava.

The main result of the exercise is that the delay of restructuring in Jiu Valley was indeed inefficient. The layoff of 1997, on the other hand, is justifiable: given that there was no restructuring until then, the optimal path would be a massive layoff as occurred. In Ostrava the pace of restructuring should have been faster too, but the welfare loss is much smaller than in Jiu Valley since there was a substantial layoff from early on while the case for a massive layoff is weaker than in Jiu Vally. A natural question is how sensitive the results are to the assumed parameter values. In this regard there are three key parameters, the productivity parameter $\tilde{A}$, the ex-miner's wage factor λ, and the job-finding elasticity ρ. The first two parameters matter only as a ratio, i.e., holding $\tilde{A}/\lambda$ constant, any change leads to only a re-scaling of welfare (see (12)). To see the extent to which the pace of optimal restructuring can be slowed down, we increase this ratio by 50%, which is probably the reasonable upper bound. We also set $\rho = 0$, which implies that job creation is completely irresponsive to an increase in unemployment. Under these sets of values, the initial layoff as a percentage of the entire layoff decreases to 21% in Ostrava and to 44% in Jiu Valley, and the layoff duration increases to 50 and 68 months, respectively. Therefore, the optimal restructuring path is moderate relative to the benchmark, but still exhibits quicker layoffs than the actual path.[29]

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[29] The inefficiency measure for the actual path, under these alternative parameter values, is 5.6% in Ostrava and 26.5% in Jiu Valley. The little change in inefficiency from the benchmark in Jiu Valley is the result of two off-setting effects: the inefficiency of inaction in the early 1990's is reduced but the speed of layoffs in the late 1990's becomes too fast.

4. Explaining The Restructuring Paths

In this section we address the central question that emerges from the quantitative exercise: why was restructuring delayed in Jiu Valley? At center stage of our explanation is the miners' action against restructuring. The miners were a force to be reckoned with not only in mining restructuring but also in national politics. The *mineriadas*, the miners' marches, in the early 1990's were effective in suppressing progressive voices such as intellectuals and students as well as right-wing politicians. Without the miners' action, the structural reform of the economy would have proceeded faster and, in particular, some kind of mining restructuring would probably have occurred in the early 1990's. Below we delineate why it was effective and what motivated it in turn.

4.1 The Corroborating Factors for The Miners' Action

The miners received at least tacit support from the conservative faction within the government. Without it, their action could easily have failed as the later events under the united successor government demonstrate. It is debatable how much of the support reflected the conservatives' stance on reform policy. Some, notably President Iliescu himself, may have genuinely believed that the reform could do without large-scale enterprise restructuring, in particular the massive layoffs that took place under the successor government. We cannot completely discount the validity of these conservative views. Our exercise does not address the distributive consequences of restructuring or the non-monetary social impact of large-scale restructuring such as the spread of alcoholism and higher crime and divorce rates, as observed in the aftermath of the 1997 layoff (see Larionescu et. al. (1999) and Kideckel (2000)). Also, our exercise is an *ex-post* evaluation, and the economic logic of restructuring may have been less evident in the early 1990's.[30] Further, the government and the mining company may not have had all the necessary expertise to carry out effective

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[30] For a general argument for gradual reform under uncertainty, see Dewatripont and Roland (1995) among others.

restructuring. However, the Ostrava region did carry out substantial restructuring early on, facing similar conditions albeit arguably to a lesser extent. Justifiable caution does not explain why in Jiu Valley restructuring was totally absent for seven years.

A more sinister reason for the conservatives' allying with the miners can be ascertained from the afore-mentioned miners' role in national politics. Notably, a 1991 *mineriada* forced the resignation of reform-minded Prime Minister Roman, the arch-rival of President Iliescu. It was widely believed that the conservative faction of the government called for the miners' action. Thus the conservative faction may have wanted to keep miners as a useful political force. Conversely, the massive layoff of 1997 under the progressive government may have been in part motivated by its desire to eliminate an opposition force while possible. This is a rationalization of the view, expressed by many in our interviews, that the new government took 'revenge' on miners for the earlier *mineriadas*. It corroborates this aspect of the layoff that the final *mineriada* of 1999 seems to have taken place in alliance with the new nationalist party that tried to overthrow the government.

The miners' action was ultimately arbitrated by the Romanian population. Although the *mineriadas* were an extra-legal method of influencing policy, they were sympathetically received by a large segment of the Romanian society. The electoral success of 1990 and 1992 gave basic strength to the conservative faction of the government, which was supplemented by the miners' action. Conversely, the election of 1996 drove out the conservative faction and installed the new progressive government which was willing to confront the miners. When the alliance with the conservatives crumbled, the miners were outmaneuvered in the *mineriada* of 1999 and finally defeated as a political force.[31] Therefore, the success of the miners' action was bound by its appeal to sections of the government and, by extension, to the population at large.

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[31] The epilogue of this sequence of events is the reemergence of the conservative faction in the 2000 election. By then the main phase of mining restructuring was finished.

4.2 The Nature of The Miners' Action

The miners' alliance with the conservative faction of the government was ultimately a failure for the miners themselves: negotiating a compensated gradual layoff from early on would have served them better. Part of this failure could be that miners underestimated the necessity of restructuring,[32] as the conservatives in the government did. Had the miners pursued a compensated layoff, however, it may still have been difficult. The government would have had to fund a large lump-sum payment in the early 1990's, when it was already facing a budgetary problem. Alternatively, the government would have had to offer installments over some duration, but this would have appeared less than credible: there was a general lack of trust in the government and the miners' union, reduced and disorganized as the layoff proceeded, might not have been able to make the government stick to its side of the bargain.[33] Formally speaking, these (and other) reasons make up the 'transaction costs' of negotiating a deal that is otherwise beneficial to both parties, the miners and the government. However, we do not want to bill these costs as a crucial element of the explanation for the delayed restructuring. First, the government was divided about its objective as mentioned earlier and second, we do not have any concrete evidence that the miners sought a compensated gradual layoff at any time.

From our interviews and reading of the descriptive literature on the region, it repeatedly emerged that the miners' action may have been behaviorally conditioned rather than rationally determined. To elaborate, the miners may have myopically pursued the short-term gain, and especially could not tolerate the erosion of the status quo, which is

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[32] A 1993/4 survey conducted by the mining company CNH shows that a majority of employees believed that downsizing would occur, but they were much less concerned about its danger than that of inflation (see Krausz 1999).

[33] More generally, there is an argument that the workers' union fights over the size of its membership as a means of ensuring future rents. See Acemoglu and Robinson (2001) for a formal treatment of this. An extension of this argument would be that a government tries to affect the size of a union as a means of ensuring the benefit, or eliminating the harm, from the union, as alluded to in Section 4.1.

a behavioral pattern rooted in history and psychology.[34] During the communist era, the miners acquired the reputation for militancy and considered themselves as the backbone of labor. For example, the 1977 revolt, the last before the 1990's, was a reaction to the belt-tightening policy of industrialization under Ceausescu's regime, and achieved various improvement in miners' livelihood and heralded a series of similar actions in the other regions. The miners' actions in the 1990's may have been a repetition of past actions under the similarly-perceived threat to their livelihood. In particular, the rational for the last *mineriada* of 1999 is hard to imagine: it took place facing the united progressive government after the massive layoff was nearly finished. On the other hand, the miners may have tried to repeat the series of successful actions earlier in the decade. Only this time, the opposing forces were insurmountable.

Further evidence of the miners' myopic behavior can be found in their *individual* reaction to the restructuring initiative by the new government in 1997. Chiribuca, et. al. (2000) argues that it was irrational short-sighted behavior for the miners to accept the compensation package and become unemployed in 1997 and 1998 when they had little prospect of finding alternative employment. The authors point out that the less educated and thus lower-prospect miners were more likely to accept the compensation package. The government may have chosen the compensation package rather than a more comprehensive labor conversion program because the compensation package minimized the resistance from the irrational miners.[35] Most miners largely consumed away the compensation payment rather than used it to prepare themselves for new work (e.g., training, relocation). Having exhausted the payment, some miners resorted to ways of obtaining short-term benefits

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[34] The following discussion can be placed in the context of the 'socialist patrimonialism' in the Romanian society during the communist era (see Linden 1986).

[35] This is in line with the political aspect of restructuring, discussed in Section 4.1. Even then, the large number of miners who opted for the layoff was beyond expectation and the government took some measures to curb the layoff after the initial round.

from the government rather than actively searching for new work, as highlighted by the hunger-strikes.

The above instances of the miners' behavior can be perhaps interpreted as rational in some way, but the myopic behavioral interpretation seems to have an advantage of parsimony. The behavioral pattern of Jiu Valley miners is sharply contrasted with that of Ostravian miners, who have cooperated with the government and carried out gradual restructuring from early on. The initial demand shock and the necessity of subsequent restructuring in Ostrava were similar to, in fact weaker within our exercise than, those in Jiu Valley. A significant advantage of Ostrava was the larger labor market that could absorb layoffs more easily. Assuming the difficulty of effectively compensating the Jiu Vally miners for the worse employment prospect, the labor market condition goes some way toward explaining the contrasting collective - collective since individually the Jiu Valley miners were willing to accept being layed off for the short-term gain of a lump-sum payment - behavior of miners between the regions. It is, however, no less significant that the Ostravian miners did not have the history of revolt and confrontation as Jiu Valley miners did.

Looking beyond the two regions of our inquiry, that a labor union may fight a losing battle to the end is not new. A good example is the 1984 British coal miners' strike.[36] The British miners went on a year-long strike against restructuring despite the offer of generous severance payment. In the end the strike achieved nothing but lost pay and a ruined reputation for the miners. The miners, at least the union leadership, seem to have been driven by more than the narrow economic interests of the miners, perhaps the ideology of socialist order or, more specifically, the involvement of the union in management decision making. The tripartite agreement, achieved ten years earlier through a series of strikes, indeed guaranteed something of this nature. The turning point was the attempt by the Thatcher government to null this arrangement. Under a threat to the status quo

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[36] See Edwards and Heery (1989) for an excellent study of labor relations leading up to the episode.

and under the memory of previous successful strikes, the miners may have been overly bolstered for action, not unlike the Jiu Value miners.

5. Conclusion

Our exercise shows that the delay in restructuring Jiu Valley mines was indeed inefficient: it stands out as the main source of inefficiency in the overall restructuring path, all the more so when compared to Ostrava's restructuring path. The proximate reason for the delay was the miners' action against restructuring. Essential for its success was the miners' alliance with the conservative faction of the goverment; the alliance itself was arbitrated by the Romanian electorate. It is easier to understand the miners' action as a behavioral pattern under the perceived threat to their livelihood, rather than as a rational strategy for safeguarding their welfare.

Based on this episode of restructuring, we can draw some lessons, which are necessarily illustrative only, on the role of organized labor in economic stagnation. First, organized labor may indeed fight for a grossly inefficient status quo that cannot be sustained. Second, organized labor may behaviorally react by fighting rather than negotiating a compensated change that would be beneficial, socially and ultimately to itself. Third, organized labor can fight successfully only when it receives sufficient support from the government and, by extension, from the electorate. We are admittedly vague about the historical development of organized labor into a militant one and about the political process by which the societal support for organized labor changes. We can only muse that the Jiu Valley restructuring may represent a sort of adaptive learning experience for the Romanian society, whereby economic conflicts are increasingly resolved in the market rather than in the political arena.

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Table 1: Ostrava Region

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Mines:												
Production in thousand tons	29,843	24,749	23,437	23,351	22,448	21,849	21,854	21,312	20,599	18,478	18,898	19,331
Employment in mines	62,087	60,796	53,553	44,448	38,429	36,652	35,131	33,306	31,208	25,140	22,714	21,482
Labor productivity	481	407	438	525	584	596	622	640	660	735	832	900
Labor Market:												
Unemployment rate in percent	1.2	6.5	4.8	7.1	6.5	5.6	1.7	8.7	14.5	18.3	19.8	20.2
Average gross annual wage in crowns	43,284	50,916	62,640	78,432	92,076	109,296	128,076	139,356	151,608	159,612	161,436	166,524
Average gross annual wage in USD	2,096	2,331	2,993	3,632	4,319	5,558	6,371	5,933	6,342	6,228	5,648	5,910

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Table 2: Jiu Valley Region

| Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Mines:												
Production in thousand tons	4,998	4,527	4,921	5,040	5,450	5,368	5,972	4,927	3,962	3,502	3,701	4,033
Employment in mines	33,562	34,433	34,648	35,275	36,307	35,247	35,061	18,578	16,109	15,601	15,591	15,029
Labor productivity	149	131	142	143	150	152	170	265	246	224	237	268
Labor Market:												
Unemployment rate in percent				8.7	9.1	9.5	11.9	18.8	33.2	44.9	43.4	
Average gross annual wage in thousand lei				1,191	2,998	4,619	6,691	12,081	17,948	25,449	37,243	
Average gross annual wage in USD				2,163	2,500	3,135	2,994	2,326	2,791	2,290	2,367	

Figure 1: Restructuring Path in Ostrava
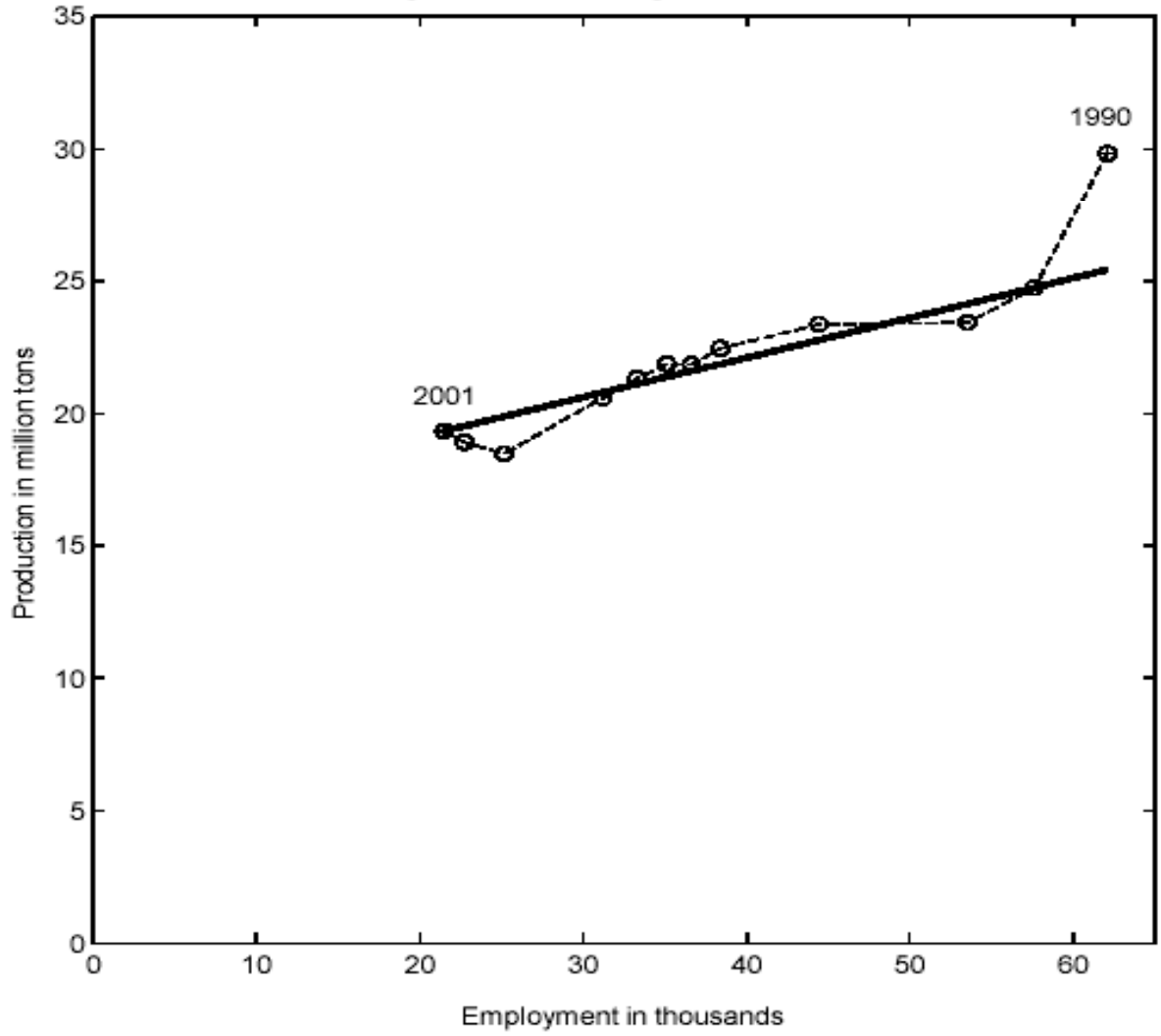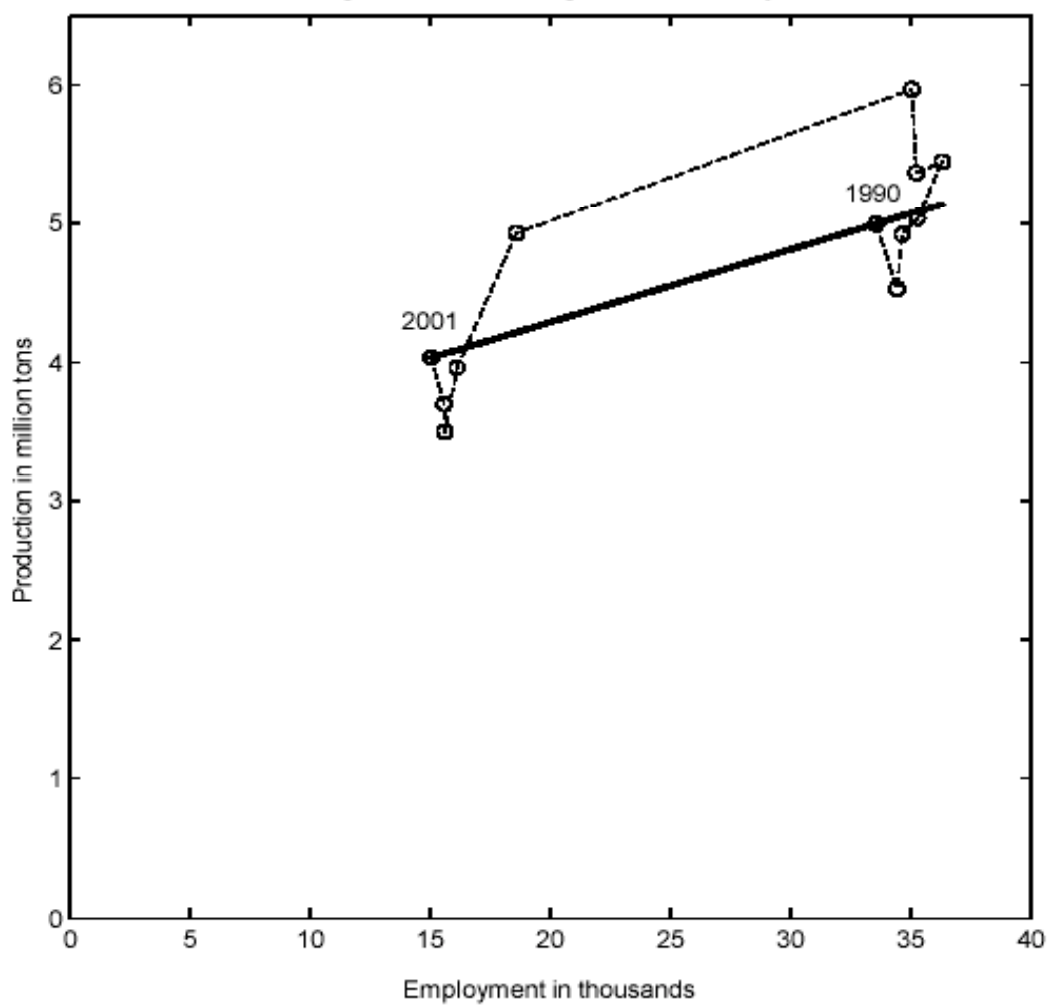
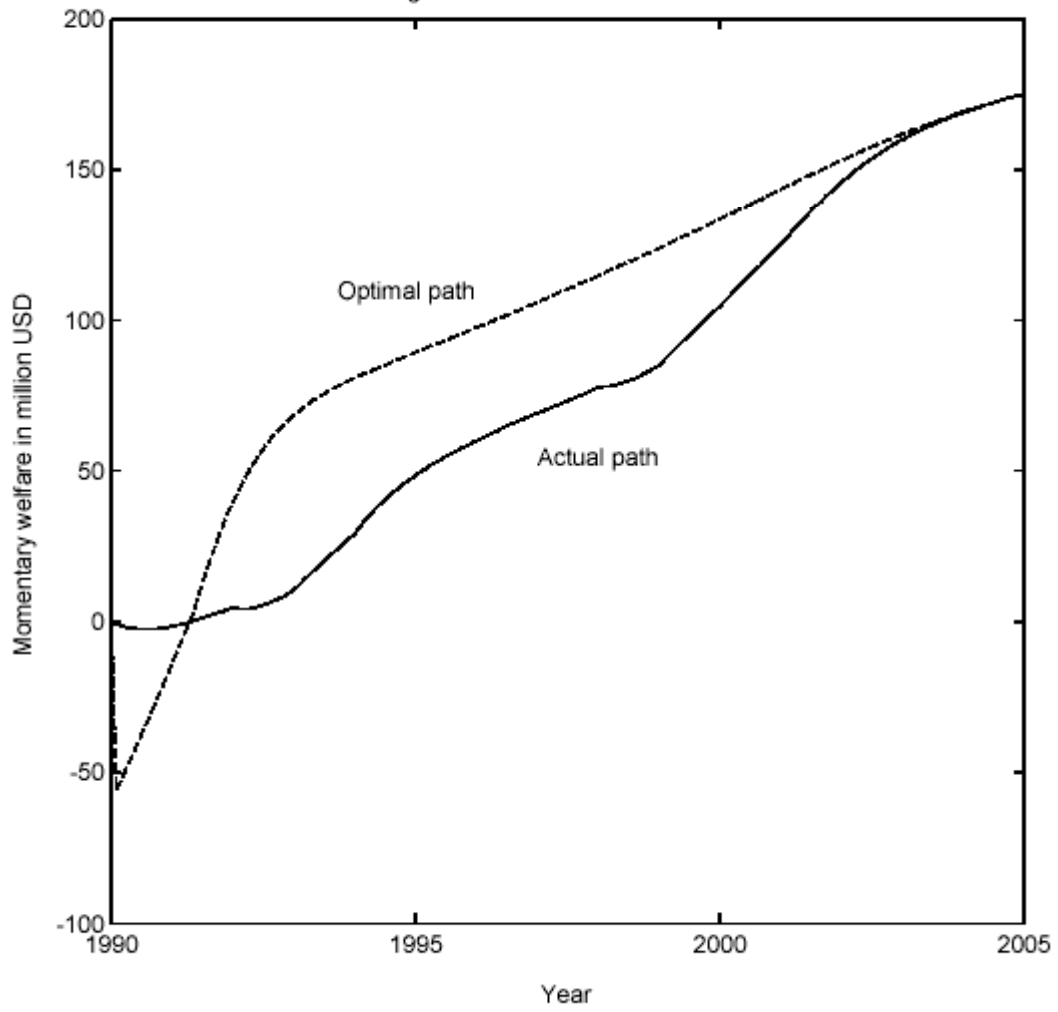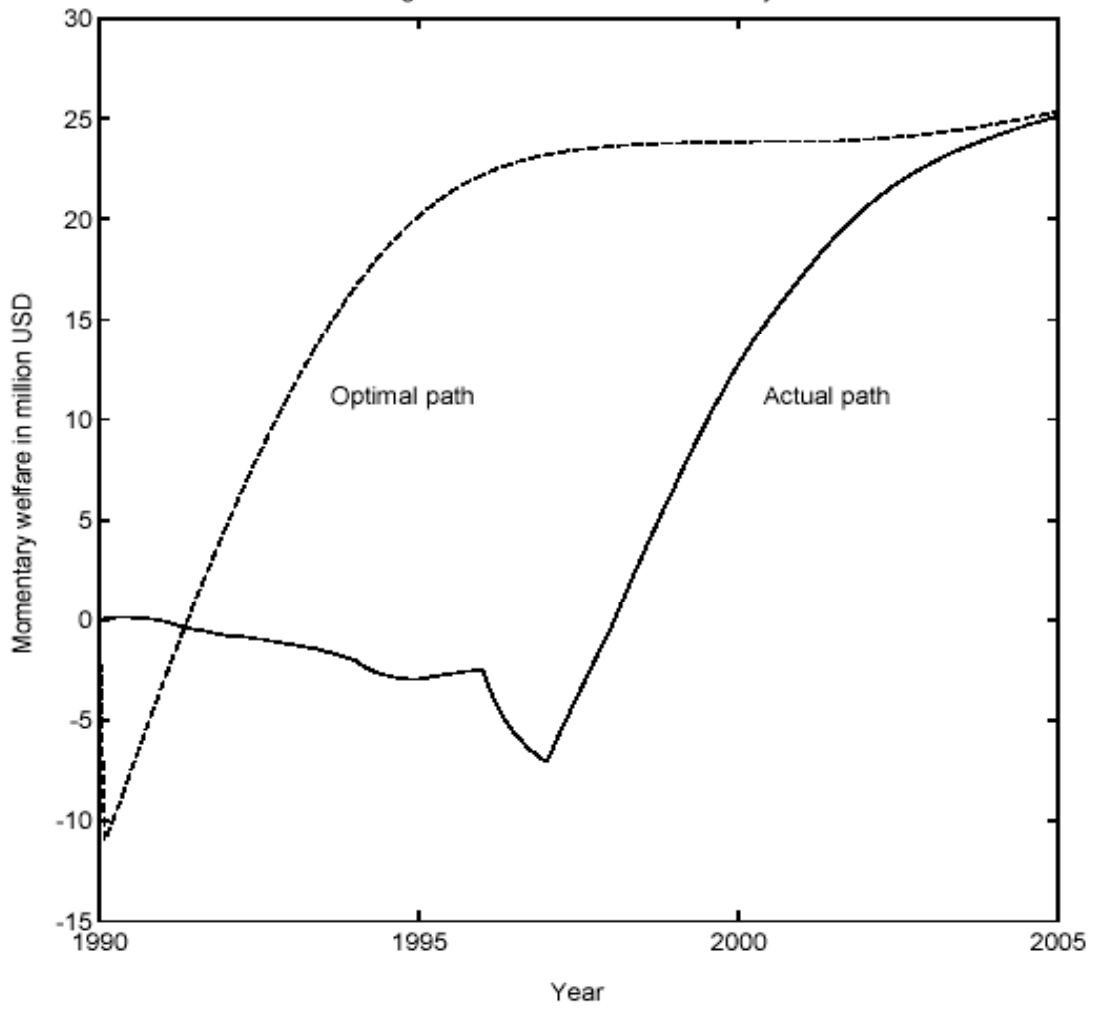Figure 2: Restructuring Path in Jiu Valley

Figure 3: Welfare Path in Ostrava

Figure 4: Welfare Path in Jiu Valley