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The Impact of Territorially Concentrated FDI on Local Labor Markets: Evidence from the Czech Republic

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Abstract

This paper investigates the impact of a large territorially concentrated FDI inflow on local labor market outcomes using district panel data from the Czech Republic. Toyota-Peugeot´s joint investment in Kolín is used to quantify the effect of FDI on the district unemployment outflow and inflow rates, the aggregate unemployment exit hazard rates, and subsequently both the unemployment rate and the employment rate. Using difference-in-differences analysis, labor market performance of `treatment' and `control' districts for two periods (before and after the investment) are compared. Placebo simulations reveal that conventional least squares estimates lead to serious underestimation of standard errors. Therefore, in order to account for serial correlation, the block bootstrapping technique is used to compute consistent standard errors. The results indicate a positive significant impact of the investment on the local unemployment outflow rate driven mainly by increases in the aggregate unemployment hazard rates for durations less than nine months. However, the impact on longer unemployment durations remained negligible. Consequently, the local unemployment rate decreased and the employment rate increased in the `treated' district.

Keywords: labor market, unemployment, employment, foreign direct investment
JEL classification: F21, J21, J61, J64

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Abstrakt

Táto práca analyzuje dopad rozsiahleho a územne koncentrovaného prílivu priamych zahraničných investícii na miestny trh práce na okresných údajoch z Českej Republiky. Na základe skúseností v rámci spoločnej investície automobiliek Toyota a Peugeot v Kolíne skúma analýzou rozdielov v rozdieloch (technika difference-in-differences) efekt jednorázového prílivu PZI na rôzne ukazovatele trhu práce. Simulácie placebo intervencií odhalili významné podhodnotenie smerodajných chýb bežnou metódou najmenších štvorcov, preto bola na vypočítanie konzistentných chýb použitá technika 'block bootstrapping'. Z výsledkov vyplýva, že vplyvom investície stúpla miera odlivu z nezamestnanosti, čo bolo spôsobené najmä zvýšením pravdepodobnosti odchodu z nezamestnanosti kratšej ako deväť mesiacov (pravdepodobnosť pre dlhodobo nezamestnaných zostala nezmenená). Tieto zmeny sa následne prejavili poklesom okresnej miery nezamestnanosti a nárastom okresnej miery zamestnanosti.

1 Introduction

Battling unemployment or improving labor market outcomes are key goals defined by most policymakers. Attracting foreign direct investment (FDI) is viewed as an important tool in improving local labor market conditions. After the collapse of the centrally-planned system of state-owned enterprises, the countries of Central and Eastern European countries (CEEC) have faced a sudden change in the labor demand structure, and the inflow of foreign investment[1] has been a crucial factor in accomplishing the transition to a market economy. The main advantages of the CEEC region have been the proximity of Western markets and relatively cheap labor force. Apart from these exogenous factors, these countries have also used various policy options to promote FDI inflow such as barrier elimination and improving the business environment.

One strategy involves adopting quality legislation, improving national institutions, building infrastructure and educating the labor force (Oman [2000]). Other strategies focus on the use of governmental financial incentives, which is a policy tool used quite extensively by CEEC. These incentives are either direct (financial subsidies) or indirect (infrastructure, construction of the site) and usually scaled according to the target region – firms which invest in regions with higher unemployment rates are preferred and receive a higher level of financial incentives. Governments view these subsidies as a crucial instrument in boosting employment, creating new job opportunities, accelerating economic growth and enhancing competitiveness (Rondinelli and Burpitt [2000]). Indeed, many multinational companies have made their allocation decisions not only based on a high potential of CEEC but also based on policy-driven factors such as investment subsidies provided by host countries (Demekas et al. [2005]).

However, investment subsidies require significant governmental spending, which

[1] The majority of investors have come from Western Europe; the FDI inflow from Asia has become more prominent especially after 2000 (Woon [2003]). Allocation of FDI into CEEC has contributed to steady economic growth in this region since 1995 (see Table 1).

raises a question about the efficiency of such policies. In other words, it is an open question whether real benefits arising from the allocation of an investment project in a particular region outweigh the financial subsidies paid from the state budget. Especially in the case of huge greenfield investments, firms have been so aggressive in seeking subsidies and countries have engaged in a "race to the bottom" when foreign firms end up with such generous financial subsidies that it seems it might be unprofitable for countries to host the investment.[2] A rigorous analysis of FDI effects is necessary for a correct assessment of the efficiency of governmental investment promotion policies.

The aim of this paper is not to evaluate the effect of providing investors with financial incentives for FDI inflow, but to estimate the impact of a large, territorially concentrated FDI inflow on a local labor market. The automobile investment project in Kolín (Středočeský region) is used as a case study since it was the largest one-shot case of FDI inflow in the Czech Republic between 1992 and 2006. This study concentrates on examining the effect of the investment on unemployment and employment rate, flows in and out of unemployment and exit hazard rates from unemployment.

The motivation for this study is threefold. First, a proper evaluation of the investment impact on local labor markets is important for policy implications: if there exists an economically significant positive effect of concentrated FDI inflow on the local economy, it makes sense (from a social standpoint) to encourage investment projects in regions with high unemployment rates. Second, while there seems to be a great deal of literature concerning the effects of FDI on firm performance, there are few studies analyzing the impact of large FDI inflows on local labor markets. Studies have focused on the implication of FDI on the productivity of domestic firms (Aitken and Harrison [1999]; Javorcik [2004]) and on regional development (Harris

[2]In auction theory there exist a term "winner's curse:" The winner of the auction may have overestimated the true value of the prize, which is why he offers the highest bid compared to other buyers.

and Taylor [2005]) but there is limited research evaluating the impact of investment on local labor market outcomes. Third, as already mentioned, the Kolín automobile investment project was quite unique in its scale and therefore it is desirable to rigorously evaluate its impact.

2 The survey of the literature

Most literature analyzing FDI effects on host country concentrates on technology spill-overs to domestic firms. This paper focuses instead on the channels through which FDI affects employment. These channels work directly through creating jobs in new firms or indirectly through spillover effects (transferring technology and improving the efficiency of competing firms, leading to changes in labor force demand), crowding-out effects and distributional effects.

The direct effect on employment rate is straightforward – the new investment project requires a labor force and through hiring job candidates, it can directly affect local employment and unemployment rates. The effect ignited by technology spillovers occurs in two forms: horizontally and vertically. Horizontal spillovers occur when domestic firms improve their efficiency due to the presence of the foreign company through linkages such as spreading knowledge and sharing trained personnel. Vertical spillovers are represented by influences of the foreign company on domestic customers and suppliers (e.g. Dunning [1993a]). These linkages can lead to improved efficiency in production processes and subsequently to changes in labor force demand. Moreover, the labor market can be affected by the crowding-out effect; this effect occurs when inward FDI leads to displacement of regular workers (some workers quit their previous job in order to start a new one) and new employment opportunities arise at the cost of an employment decrease in established enterprises. The distributional effect affects wage distribution; wage inequality may increase if skilled workers are specific to foreign companies (Tomohara and Yokota [2007]).

In addition, concentrated FDI inflow creates the potential danger of excessive dependence and vulnerability of the local labor market on one source of employment, which can ensue in massive layoffs of the labor force if the investor faces decreased demand in the case of an overall economic recession. Other adverse effects occur in the form of opportunity costs if the investment project is awarded public financial incentives, which may have been used for other priorities (different projects, active labor market policies, retraining courses, etc.) and the total indirect employment effect can be either positive or negative. Overall, the relationship between FDI and employment is influenced by different macro and micro factors, which make a comprehensive assessment difficult. Also in this paper, only a particular case of FDI inflow is studied and the conclusions should be applied to a more general situation with caution.

Empirical studies focusing on the recent automobile industry boom in Central Europe are mostly descriptive. Sadler and Swain [1994] analyze the state of the automotive industry in CEEC after 1989 and describe changes in the structure and allocation of investments which has been affected by the quest of foreign investors for new markets and low-cost production. Before the investors' influx into this region, the automotive industry in CEEC was under-developed and technologically outdated (Havas [2000]). Countries in Central and Eastern Europe, however, have possessed great potential for growth and development due to the cheap but skilled labor force and substantial and steady rise in car demand (Van Tulder and Ruigrok [1998]).

Empirical literature analyzing the employment effects of FDI offers mixed results. Dunning [1993b] examines the impact of both inward and outward direct investment on employment and asserts that whereas there exists significant effects on industry structure and productivity, the employment rate remains unaffected. Similarly, Ramirez [2002] shows in his study of the Mexican labor market that the contribution of the automobile industry to long-term employment creation has been

limited since most of the transferred technology had an impact on capital-intensive manufacturing. On the contrary, Mickiewicz et al. [2000] in their analysis of the role of FDI in the restructuring of the CEEC economies find evidence that FDI contributes to employment generation and serves as an important buffer to negative employment shocks. It can operate, however, only as a complement to domestically generated employment rather than as its substitute. According to Benacek and Visek [2000], in the case of the Czech Republic, foreign investment has played an important role during the transition period and foreign capital became 'the engine of growth' for the economy. This growth occurred mainly due to stabilization and restructuring of the economy with FDI incentives schemes being a relatively unimportant factor.

3 Automobile investment project in Kolín

3.1 Chronology

In December 2001, PSA Peugeot Citroën and Toyota Motor Corporation[3] announced their intention to establish a new automobile plant in the Czech Republic in the industrial zone Kolín-Ovčáry (located in the Středočeský region). The Czech government passed a resolution where it committed itself to financing preparation work on the location. In March 2002, the joint company was legally established under the name Toyota Peugeot Citroën Automobile (TPCA) and preparation work on the green field site was started and shortly afterwards, the contract between TPCA, PSA and the city of Kolín specifying an investment road-map was signed. In Sep-

[3]Toyota is the third biggest car producer in the world and by far the largest in Japan. Strong on the domestic market, and present in Western Europe through numerous subsidiaries, Toyota lagged behind in founding branches in Central and Eastern Europe. Only after 1999 it decided to invest in this region and use the advantages of a qualified and cheap labor force (Woon [2003]). In July 2001, Toyota signed a contract with PSA Peugeot Citroen about committing to the joint development of a new car and establishing a new production plant. PSA Peugeot Citroen is one of the top European car producers, especially in the production of diesel engines. The two companies divided the responsibilities: Toyota is in charge of production, and PSA Peugeot is in charge of marketing.

tember 2002, the 125 hectare-large site was ready for use and the construction of the plant began. During the preparation and construction work, 350 people were employed on the site. Additional employment was created at the beginning of 2003 when hiring for the plant started. By March 2004, TPCA had hired 500 workers and by October 2004 already 1000 people out of an eventual total of 3000 workers had been employed. In mid-November 2004, 1650 workers were employed at TPCA and in December 2004 permission for trial operation was issued by the municipality of Kolín.

Most new employees (including workers from other parts of the Czech Republic) joined TPCA in February and March 2005. This corresponds with the start of production, which occurred on February 28th, 2005. Hiring (as part of setting-up the plant) finished in September 2005 and at that time 3000 employees worked for TPCA (2000 blue-collar workers). In mid 2007, the employment level achieved a steady state and the plant has stabilized the number of its employees at 3500, out of whom 2600 are blue-collar workers.

Apart from hiring workers in Kolín or the Středočeský region, the company also searched for new employees in other regions of the Czech Republic.[4] As a result, more than one half of the overall workforce of approximately 3,000 came reportedly from outside the Kolín district. In the first months after the start of production (February 2005), the fluctuation among workers remained high mainly because of the delayed construction of new flats (only 300 flats had been built on time). According to TPCA, each month about 50-60 workers left the job due to inadequate housing conditions.

[4]Before the end of 2002, the Czech government announced it would build 850 flats for future TPCA workers in Kolín. The expenses would be borne by the state and the city. In late 2004, TPCA started a hiring campaign in Northern Bohemia, particularly in the district Mostecko where the unemployment rate was as high as 25 percent. Between November 1st, 2004 and January 12th, 2005, TPCA also organized a massive hiring campaign in Northern Moravia. The main aim of the campaign was to attract a potential work force willing to move and work in the Kolín plant. Almost 3000 people expressed interest; half of them went to the first round of interviews and 712 candidates qualified for the second round. More than one half then joined the company (source: TPCA, 2006)).

3.2 Location

The location of the plant in Kolín's industrial zone (Figure 1) was chosen by TPCA. Another location under consideration was Žatec.[5] Important location characteristics in favor of Kolín were proximity to the capital city, short distance to main railroad and highway corridors as well as settled land property rights,[6] and these factors might have influenced the final location decision.

3.3 Size

The overall volume of the investment in the Czech Republic (including start-up costs and research and development) has reached 1.3 billion Euro (roughly 40 billion CZK). Excluding R&D (which represents one half of the investment), net FDI inflow amounts to 700 million Euro (23.5 billion CZK)[7] and represents the largest single greenfield investment in the Czech Republic ever (amounting to 0.755 % of GDP[8]). Investment incentive for TPCA reached 1.78 billion CZK amounting to more than 40 percent of total financial incentives awarded during 1998-2004.[9]

4 General information about Kolín

The district of Kolín (situated in the Středočeský region) recorded an average registered unemployment rate of 9.5 percent in 2001. The arrival of a major investment project was expected to decrease this level, although the net impact of the FDI inflow might have been absorbed to some extent by neighboring districts. In Table 2 the unemployment rate, average wage and the average calculated time for commuting to the plant from particular districts are shown. Based on unemployment rates, the districts can be classified as low, medium and high-unemployment type:

[5] Source: CzechInvest
[6] Source: TPCA
[7] Source: CzechInvest
[8] GDP for the year 2003 is considered here.
[9] The Czech Republic spent 4.26 billion CZK on financial incentives (CzechInvest).

the low-unemployment group (Prague-East with above-average wage and Benešov) benefits from the large number of jobs in the capital city, the medium-unemployment group consists of regional capitals (Pardubice and Hradec Králové) and the high-unemployment group (Kolín, Kutná Hora and Nymburk) displays an unemployment rate around 10 percent. The short commuting time from the high-unemployment type districts to the plant disqualifies the use of Kutná Hora and Nymburk as a control group as these districts were most likely also positively affected by the FDI inflow (the discussion about control groups is presented in next section).

As other districts in the Central Bohemian region, Kolín benefits from its proximity to Prague, good infrastructure and a highly qualified work force. Good infrastructure (good connection to main traffic routes and prepared electricity and telecommunication networks) was one of the main factors in attracting the investment.[10] Table 3 presents a comparison of main labor market indicators for Kolín and the Czech Republic. There is a notable widening gap between unemployment in Kolín and the Czech Republic, especially after 2004. This indicates at least a possible positive impact of the plant on the local labor market.

Figure 2 illustrates the trend in unemployment rates during the period 1997-2006 for Kolín and neighboring districts.[11] Vertical lines represent the date of the announcement of the planned investment and the start of the hiring process for the company. Visually, the downward trend in Kolín is steeper than in the other districts. This suggests that hiring for the investment had a positive effect on the local unemployment rate.

The evolution of the unemployment rate in Kolín and the Central Bohemian region is shown in Figure 3. The unemployment rate from the whole region is affected by its proximity of the capital city, creating a relatively low overall unemployment rate. At the time when the investment was announced (left vertical line), the unem-

[10] Source: TPCA

[11] Normalized by the December 2001 unemployment rate (the date of the investment announcement).

ployment rate in Kolín was similar to the overall Czech unemployment rate. Later on, unemployment rates began to diverge (especially after 2003), when Kolín's local unemployment rate decreased at a faster rate than the overall one.

Simple graphical analysis therefore suggests a better relative performance for the Kolín labor market compared to its neighbors or the whole country. In order to claim that the substantial FDI per capita inflow contributed to this decreased unemployment, however, a more rigorous analysis has to be undertaken to offer persuasive evidence of the impact of the investment. The methodology and identification strategy for such an analysis are described in the next two sections.

5 Methodology

Unemployment, commonly viewed as a leading labor market indicator, is an outcome of a dynamic process determined primarily by flows in and out from unemployment. Specifically, a change in unemployment U can be caused either by shocks in outflow O from unemployment or inflow S into unemployment (or both), and the number of reported unemployed at the end of period t is identified as the sum of unemployed at the end of period $t-1$ and net inflow into unemployment during the period t, expressed by the intertemporal unemployment flow identity

$$U_t \equiv U_{t-1} + S_t - O_t. \tag{1}$$

In the setup, I assume the out-of-labor-force state is ruled out. After dividing by total labor force L and rearranging the terms, I obtain

$$u_t \equiv u_{t-1}/(1+g_t) + s_t(1-u_t) - o_t u_t, \tag{2}$$

where the inflow rate s is defined as the inflow S divided by the stock of employed E, the outflow rate o as the outflow O divided by the stock of unemployed U,

the unemployment rate u as the stock of unemployed U divided by the labor force $L = U + E$, and g is the labor force growth rate, giving the following identity linking the unemployment rate and the flow rates:

$$u_t \equiv \frac{u_{t-1} + s_t(1 + g_t)}{(1 + g_t)(1 + s_t + o_t)}. \tag{3}$$

Further, building upon the framework of Burgess and Turon [2005], I assume a linear model of behavioral relationship for the inflow and outflow rates:

$$s_t = \alpha_1 u_{t-1} + \beta_1 \lambda_t + \gamma_1 X_t + \eta_1 Q_2 + \psi_1 Q_3 + \varphi_1 Q_4 + \epsilon_{1t}, \tag{4}$$

$$o_t = \alpha_2 u_{t-1} + \beta_2 \lambda_t + \gamma_2 X_t + \eta_2 Q_2 + \psi_2 Q_3 + \varphi_2 Q_4 + \epsilon_{2t}, \tag{5}$$

where u is the unemployment rate, λ_t are quarterly dummies controlling for seasonality, and X_t contains exogenous explanatory variables describing the structure of the labor force with respect to industry, education and age. Hence, there is an interaction between the unemployment rate and the rates of flow.[12] Thus, in addition to investigating the aggregate impact of the investment on the unemployment rate, I concentrate on estimating the effect on the flow rates.

Moreover, unemployment flows are not independent either, as outflow can be expressed as a function of the past inflows and the aggregate exit hazard rates out of unemployment:

$$O_t = \sum_{i=0}^{\infty} S_{t-i} h_{t,i} \prod_{j=0}^{i-1} (1 - h_{t-j,i-j}), \tag{6}$$

where $h_{t,i}$ is the exit hazard rate out of unemployment at time t and duration i. The exit hazard rate out of unemployment at duration i indicates the probability that a

[12] Burgess and Turon [2005] examine the dynamics of unemployment flows and stock in the UK since the late 1960s and show that while outflow shocks contributed little to unemployment dynamics, changes in unemployment were driven primarily by shocks in unemployment inflow.

person who is currently unemployed for i time periods (usually months) will leave the pool of unemployed during the next period. Exit hazard rates differ for various unemployment durations, for men and woman, and across education or age cohorts.

Changes in the outflow rate are always caused by changes in exit hazard rates from unemployment, and, for policymaking purposes, it is important to disentangle these effects and examine how different durations of unemployment contribute to a change in unemployment outflow. Thus, aggregate exit hazard rates, the inflow rate and the outflow rate are analyzed separately. Afterwards, the impact of the investment project on the unemployment rate and the employment rate is examined.

6 Identification strategy

6.1 Propensity score matching

There are two different approaches ensuring an unbiased estimation of the causal effect: parametric and non-parametric. The parametric approach includes control variables on the right-hand side of the estimated equation while the non-parametric approach is to match districts based on observable district characteristics. In the analysis that follows, a combination of these two approaches is adopted, using similar districts selected by matching in an estimation including controlling for observable characteristics of each district.

Following the framework of Rubin [1974], the assignment to treatment (investment) is denoted by dummy D and the impact of the investment is estimated as the difference between an outcome Y_1 subject to treatment and an outcome Y_0 without treatment:

$$\theta = Y_1 - Y_0. \tag{7}$$

Control groups serve as an approximation of the counterfactual Y_0, using the assumption that the potential outcome for Kolín without the investment would be the

same as was the outcome for the control groups:

$$E(Y_0|D=1) = E(Y_0|D=0). \tag{8}$$

In other words, conditional on observables Z, the potential outcomes are stochastically independent on the treatment ($Y_0 \perp D|Z$).[13] Subsequently, the true effect of the investment can be estimated as

$$\rho = E(\theta|D=1) = E(Y_1-Y_0|D=1) = E(Y_1|D=1)-E(Y_0|D=1) = E(Y_1|D=1)-E(Y_0|D=0).$$

When comparing many characteristics, however, it is difficult to find units exhibiting similarity in all characteristics. One way to avoid this problem is to use a function uniting relevant observed characteristics into a single balancing score (Rosenbaum and Rubin [1983]). Importantly, matching treatment and control units in this way implies the same distribution of observed characteristics for treatment and control units given the balancing score, a necessary assumption enabling true estimation of the effect. This conditional independence assumption states that given the same propensity score, the potential outcome in case of non-treatment is the same for treated and non-treated districts ($Y_0 \perp D|P(Z)$). As a result, the following condition is satisfied:

$$E(Y_0|P(Z), D=1) = E(Y_0|P(Z), D=0), \tag{9}$$

which means that the potential outcome for Kolín without the investment would be the same as the outcome for the control group. In other words, estimation on the sub-sample restricted to a similar propensity score gives an unbiased estimate of the true effect of the treatment.

[13] This assumption is also known as the 'selection on observables' or 'conditional independence assumption' (Lechner [1999]).

The matching indicator used in our evaluation is a propensity score denoting the probability of program participation. The estimation procedure involves two steps. The first step of the analysis is to estimate the probability of treatment based on observables, established by probit estimation. After that, the sample is restricted to units with similar propensity scores and the estimation is performed using the ensuing sub-sample (Heckman, Ichimura and Todd [1997]).

The probit model estimating the probability of investment project allocation into a particular district can be written as

$$\Pr(Y = 1|Z = z) = \phi(Z\beta), \tag{10}$$

where the covariates Z_i include variables describing district industry structure, educational structure of different age groups, infrastructure density (the amount of roads and railroads) and a dummy indicating the designation of an industrial park suitable for hosting foreign investors and $\Pr(Y = 1|Z = z)$ indicates the probability that the district belongs to the 'high-FDI' group of districts conditional on observable characteristics. Based on the FDI inflow per capita during the monitored year 2002, all Czech districts (excluding Prague) were divided into two complementary groups of districts: a 'high-FDI' and 'low-FDI' group (the distribution of FDI inflow is shown in Figure 4). The cut-off point is arbitrarily set at 20,000 CZK, classifying 15 percent of districts as a 'high-FDI' group and the remaining 85 percent as a 'low-FDI' group.

The probit estimation (which excluded the district of Kolín) assigns the propensity score to each district (including Kolín), indicating the probability that the particular district would be a 'high-FDI' type receiving a lot of FDI inflow in 2002. It can be assumed that the districts with a similar propensity score as Kolín faced the same probability of receiving large FDI inflow.[14] Among this control group,

[14] The similiarity measure is based on a propensity score and the margins are arbitrarily set at a three-percent bandwidth around Kolín's propensity score.

the location of investment projects can be considered as random, conditional on covariates. Now one can observe two types of districts in this group: districts with a propensity score of receiving a lot of FDI similar to Kolín's which received a lot of FDI ('high-FDI' type), and districts with a propensity score of receiving a lot of FDI similar to Kolín's which did not receive a lot of FDI ('low-FDI' type). In order to estimate the true impact of the investment project, it is necessary that only the latter group is selected for the analysis as these districts form the best control group approximating the true counterfactual state.

6.2 Difference-in-differences estimation

A drawback of propensity score matching is that it does not control for unobservable characteristics, which can lead to a bias in estimates of the true impact. One way to solve this problem is to include instrumental variables affecting the investment decision but not labor market outcomes. In reality, however, it is often difficult to find such instruments. Another strand of literature resorts to the difference-in-differences technique (Angrist and Krueger [1997]), which is based on the comparison of changes in outcomes of interest between the treated and control group over time. I adopt this approach in evaluating the impact of the TPCA investment project and include fixed effects capturing unobserved heterogeneity among districts.

6.2.1 Econometric specification

Econometric analysis of the impact of the investment on labor market outcomes is then performed by estimating the following difference-in-differences equation:

$$y_{it} = \phi_i + \alpha + \beta MANUF_{it} + \gamma COL30_{it} + \delta COL50_{it} + \mu YEAR_t + \eta Q_2 + \psi Q_3 + \varphi Q_4 + \rho INV_{it} + \epsilon_{it}, \tag{11}$$

where $MANUF$ measures the share of people employed in the manufacturing sector and $COL30$ and $COL50$ denote the share of college or university graduates in the

population aged 15-29 and 30-49, respectively. Variable $Year$ captures time trends, dummies Q_2, Q_3, Q_4 control for seasonal effects, INV is a dummy indicating the investment project in Kolín, ϕ_i are fixed effects, α, β, γ, δ, μ, η, ψ, φ and ρ are the parameters of the model and ϵ_{it} is a noise term with normal distribution. Coefficient ρ estimates the true effect of investment projects on the dependent variable (local unemployment rate, employment rate, inflow, outflow rate).

When estimating the set of equations for exit hazard rates from unemployment, it should be noted that given the nature of flows between unemployment durations, the hazard rates for different unemployment durations are not independent. In order to account for possible correlation of standard errors across equations, the most appropriate model for the analysis of aggregate exit hazard rates is the Seemingly Unrelated Regression (SUR) model (Zellner [1962]):

$$\begin{aligned} h_{0-3} &= \alpha_1 + \boldsymbol{\beta}_1 \boldsymbol{X}_1 + \gamma_1 Kolin + \delta_1 Kolin * After + u_1; \\ h_{3-6} &= \alpha_2 + \boldsymbol{\beta}_2 \boldsymbol{X}_2 + \gamma_2 Kolin + \delta_2 Kolin * After + u_2; \\ h_{6-9} &= \alpha_3 + \boldsymbol{\beta}_3 \boldsymbol{X}_3 + \gamma_3 Kolin + \delta_3 Kolin * After + u_3; \\ h_{9-12} &= \alpha_4 + \boldsymbol{\beta}_4 \boldsymbol{X}_4 + \gamma_4 Kolin + \delta_4 Kolin * After + u_4; \end{aligned} \tag{12}$$

where $\boldsymbol{X}$ includes explanatory variables describing the structure of the labor force, $Kolin$ is a dummy for Kolín and $After$ is a dummy indicating the time after the break (three different possible breaks are used). Quarterly dummies controlling for seasonal effects are included in the model, too. Coefficient δ then estimates the effect of the investment project on the exit hazard rates out of unemployment.

6.2.2 The Placebo Simulation Technique

The Ordinary Least Squares (OLS) technique used in the difference-in-differences estimation implicitly assumes the normal distribution of the estimated effect. This assumption may underestimate its true standard error even after accounting for se-

rially correlated outcomes by clustering across districts (Bertrand, Duflo and Mullainathan [2003]). Conventional difference-in-differences standard errors may, thus, substantially understate the standard deviation of the estimator due to autocorrelation of the data. Another factor reinforcing the underestimation of the standard deviation is the fact that the treatment variable usually changes very little for an observed unit over time.

I use placebo simulations to test the bias of OLS estimates and, using one thousand placebo interventions, the size of the impact and its standard error is estimated for each of them. If the conventional standard errors are unbiased, the fraction of rejected null hypothesis of no impact should be roughly five percent (under the 95 percent significance level). If the rejection rate is considerably higher, the standard errors are likely to be biased downwards. One way to correct for this bias is to create standard errors and critical values based on the actual distribution of the estimator bootstrapped from the data. Thus, besides using conventional standard errors, alternative standard errors generated by the bootstrapping technique are reported and rejection rates for both methods are compared. Placebo interventions are, therefore, adopted as a robustness check for the consistency of standard errors.

A simulation of an intervention is performed by randomly choosing a district and a point in time, and then a dummy variable $PLAC_{it}$ is created indicating that at that time and in that given district a large concentrated FDI project was begun. The following regression is then estimated:

$$y_{it} = \phi_i + \alpha + \beta MANUF_{it} + \gamma COL30_{it} + \delta COL50_{it} + \mu YEAR_t + \eta Q_2 + \psi Q_3 + \varphi Q_4 + \rho PLAC_{it} + \epsilon_{it}, \tag{13}$$

where the explanatory variables are the same as in equation (11), the only difference being the variable $PLAC$ indicating the placebo intervention. Estimated coefficients are stored and the procedure is repeated a thousand times in order to obtain coefficients for the supposed placebo intervention and its significance. If standard errors

are consistent, the rejection rate for the intervention variable $PLAC$ should be approximately five percent. In other words, the coefficient ρ should be statistically significant in five percent of the cases.

6.2.3 Control groups

In order to evaluate the true effect of investment incentives, one needs to know the counterfactual: what would have happened had the investment not been realized? The fundamental evaluation problem is that one can not observe what labor market outcomes the district would have exhibited had the investment not been realized. Therefore, as discussed above, a control group of districts without the investment is needed, enabling a comparison of the treated and control districts. An ideal control group would be districts identical to Kolín but which have not experienced large FDI inflow. Since it is impossible to find districts with exactly the same characteristics as Kolín, I approximate such an ideal control group as closely as possible and in the analysis use districts in a way similar to Kolín. The use of control groups is necessary because there is a possibility that any potential change in unemployment in Kolín may be due to other factors common to all districts, e.g. a boom in the economy could have easily drawn workers in Kolín (as well as elsewhere) out of the pool of unemployed, even in the absence of the investment.

Three different control groups are constructed. The first is a general control group containing all districts in the Czech Republic (see Table 4) except Prague, which is excluded due to its capital city status and specific labor market. The second control group consists of districts with similar conditions for hosting FDI (measured by the designation of an industrial zone in the district in the same year as Kolín), while the third control group consists of districts facing the same probability of investment allocation (measured by a propensity score of receiving FDI). In addition, second and third control groups are restricted to districts which, in contrast to Kolín, did not receive a high inflow of FDI, i.e., were not subject to treatment

(districts included in the three control groups are presented in Table 5). The most precise estimate of the impact of the investment can be expected in the case of the third control group, since the use of propensity matching scores yields the most plausible comparison group consisting of districts most similar to Kolín conditional on observable covariates. (The second control group can potentially lead to inaccurate estimates due to the fact that the decision about industrial zone creation may be affected by unobservable factors.) The use of the district of Louny (containing Žatec, which was the other location under consideration) as a suitable control group is made impossible due to the fact that Žatec eventually also became a high-FDI recipient thanks to the designation of the Triangle industrial zone.

6.2.4 Structural break date

The date of the announcement of the TPCA investment was December 2001 and, therefore, the beginning of 2002 is used as a trend break. Alternative dates are used for a robustness check, given that the very announcement may not have had an immediate impact on the labor market, and a time delay in the effectivity of the impact is allowed for. A dummy indicating the transitory period after the announcement is introduced and several specifications with different spans of this time period are examined.

Zivot & Andrews' test for determining structural breaks is performed for unemployment outflow and inflow. This test suggests that the trend break for outflow is September 2002 (a date corresponding to the start of the hiring process for the company) and the break for inflow is May 2005 (a date two months after the full production process began). These findings indicate that the start of the hiring process had a big impact on the outflow rate from unemployment. On the other side, the inflow rate changed substantially after the start of the production, indicating a high fluctuation of workers.

7 Data

The empirical evaluation is based on data from the Unemployment Registry (UR), the Labor Force Survey (LFS) and the Czech National Bank (CNB).

The UR data contains information from District Labor Offices about the number of registered unemployed. The data covers the period 1998 - 2006 and includes district-level information about unemployment flows into and out of unemployment on a monthly basis as well as about the structure of unemployment across education, age, sex and unemployment duration on a quarterly basis.

The Labor Force Survey[15] is conducted quarterly using a rotating household sample of around 25 thousand households (60 thousand individuals). Households are chosen randomly and each member of a chosen household is interviewed so that all age, social and economic groups are represented in the sample. Based on the most recent demographic census, each individual is assigned a weight representing the overall district-, age- and gender-specific cohorts in the population to remove any discrepancy between the structure of the sample and the structure of the population.

The Labor Force Survey includes information about individual labor market status, age, education, sector of employment/duration of unemployment and other characteristics which allow (multiplying each individual by the corresponding weight) specifying the share of individuals according to age, education and labor market status in each district during each quarter. In addition, the information about the sector of employment enables construction of the industry structure of each district (shares of different sectors in total employment). In the analysis, the LFS data during the years 1998-2006 are used in constructing district-level panel data for eight consecutive quarters.

The CNB provides district-level FDI data on a yearly basis. FDI is defined as a capital investment from abroad which maintains a permanent equity relation with

[15] The survey is conducted according to the recommendations of the International Labour Organization and Eurostat methodology which ensures that the obtained data are in line with the standard interpretation of labor market characteristics.

a company in the source country and owns a defined share of domestic company equity (in the host country).[16] The level of FDI is then measured as a sum of three components - equity capital, reinvested earnings and intra-company loans.

8 Results

The evaluation of FDI impact on the local labor market starts with an analysis of unemployment flows since these are the main underlying processes behind changes in the stock of unemployed. The next step is to examine how possible changes in unemployment flows have affected aggregate exit hazard rates and overall unemployment. Finally, the assessment of the impact on total employment concludes the analysis.

8.1 Unemployment outflow and inflow

In Tables 6 and 7, the main labor market indicators are reported for Kolín (in both the period before and after the TPCA investment). It can be seen that before the investment almost 580 people became unemployed every month on average and about the same amount left unemployment. This can be compared with an average unemployment stock of more than 4,400. Mean values for labor force and unemployment flow rates relative to unemployed as well as labor force are presented too. In the period after the investment, on average the unemployment outflow decreased to 567, outflow increased to 587 and overall unemployment stock decreased to 4,313. Significance testing for the difference before and after the TPCA investment showed no difference for outflow, inflow and outflow rate at 5 percent significance level but a difference for overall unemployment, unemployment rate, labor force and inflow rate. A statistically significant change in labor force indicates there has been a positive net migration into Kolín after 2002.

[16] Firms with at least 10 percent of foreign ownership share are defined as foreign.

Evolution of unemployment flows for Kolín is mapped in Figure 5. There appears to be a trend of decreasing inflow and less pronounced increasing outflow from 2003. Visual illustration, therefore, suggests that there could have been some positive impact of TPCA on levels of unemployment through shifts in outflow and inflow.

Tables 8 and 9 present results of difference-in-differences estimations of the effect of the investment project on these flows. Districts with similar propensity scores for receiving investment (but which did not receive much FDI) should yield the most precise estimate, therefore, the focus is put on this set of districts (control group 3). There is a significant positive effect on unemployment outflow which increases by 2.5 percentage points overall, while if allowed for the transitory period between the start of the investment project and the time the effect actually takes place (captured by dummy variable *Imp_mid*), the impact rises to 3 to 5.5 percentage points (increasing with the length of the delay). On the contrary, the impact on the inflow into the pool of unemployed is always statistically insignificant even when allowing for the time delay (column 3 in Table 9).

Thus, it seems that the TPCA investment has increased unemployment outflow rate while the inflow rate into unemployment was unaffected, thereby implying a decrease in the average duration of unemployment and a positive effect on the local unemployment rate. Before turning our attention to this indicator, I examine which cohorts of unemployed have benefited the most from the investment by looking at the aggregated exit hazard rates out of unemployment for different unemployment durations.

8.2 Exit hazard rates

The results of the SUR model estimating the impact of the TPCA investment project on aggregate exit hazard rates for different durations are displayed in Table 10. A positive and statistically significant increase in the aggregate exit hazard rate for leaving unemployment with durations less than 9 months during the following three

months is identified but no significant effect for durations greater than 9 months is confirmed. The probability of leaving unemployment during the following quarter has increased by 2.5, 3.1 and 4.4 percentage points for durations less than 3, 6 and 9 months, respectively. The effect seems to vanish, however, for unemployment durations more than 9 months. An important finding is that the FDI inflow has helped people who have experienced only short unemployment spells: chances for short-term unemployed to find a job have increased while individuals with unemployment duration more than 9 months, on the contrary, have not benefited from the FDI inflow.

8.3 Unemployment

The observed impact of FDI on the unemployment rate is shown in Table 11. There is a statistically significant positive effect on the unemployment rate, which decreased by 1.7 to 3.8 percentage points depending on the allowed length of the time delay (captured by the dummy variable *Imp_mid*). As can be deduced from the exit hazard rates analysis, this decrease in unemployment is driven by the higher rate of outflow of short-term unemployed from the pool of unemployed.

A decrease in the unemployment rate by one percentage point corresponds roughly to 470 additional unemployed workers finding a job. It can be, therefore, claimed that the true impact of the investment project (a 2.7 percentage point decrease) corresponds to roughly 1,260 unemployed people who found a job due to the investment project, which makes the impact of the investment project also economically significant.

8.4 Employment

Figure 6 shows the employment rate, labor force, participation rate and unemployment rate[17] for Kolín during the years preceding and following the TPCA investment. The participation rate maintains its level at approximately 50 percent while there is a modest increase in the employment rate and decrease in the unemployment rate over the years 1999-2004. This may be the effect of inward FDI, but it is possible that the conditions in the labor market were improving prior to the arrival of the investor, giving a significant positive trend throughout the whole period. In order to filter out overall trends, a difference-in-differences estimation is performed, with the estimated impact of the FDI inflow on the employment rate presented in Table 12. The results indicate that there was a positive and lasting true impact on the employment rate, which significantly increased by 3.7 percentage points. The productive age population (15-65 years of age) in Kolín during 2002-06 was approximately 68,000; this percentage change, therefore, corresponds to an absolute increase in employment by almost 2,500 individuals. Considering the fact that initially more than half of the 3,000 employees hired by the TPCA came from other districts or abroad (most of these individuals were not covered by the Labor Force Survey as employed in Kolín nor registered as previously unemployed by the Kolín district labor office due to having a different place of residence), the investment has generated extra jobs in the local labor market through spillovers on domestic suppliers or increased demand in other sectors.

Overall, the TPCA automobile investment in Kolín positively affected local employment. Given than at most 1,500 workers residing in Kolín were hired by the investor (one half of reported vacancies) and the observed increase in employment was 2,500, there has been a positive spillover of roughly 1,000 individuals who found

[17] Employment rate is calculated as a fraction of currently employed people divided by the total working-age population (15-65 years of age), participation rate as a percentage of active people (employed or currently searching for a job) to total working-age population and unemployment rate as a fraction of unemployed divided by the active labor force.

a job indirectly due to FDI inflow. The increase in employment can be divided into inflows from unemployment (1,200 workers) and out-of-local-labor-force (the remaining 1,300 workers). To conclude, spillover effects on the local labor market have outweighed possible crowding-out effects thanks to backward or forward linkages for domestic firms and distributors.

8.5 Placebo simulations

As noted before, difference-in-differences estimation may lead under some circumstances to inconsistent standard errors. Rather than concentrating on correct standard errors, I calculate how often various specifications would falsely reject the null hypothesis of no effect. Using placebo interventions, a sensitivity check is performed by inspecting rejection rates for ordinary OLS standard errors and bootstrapped standard errors.

In Table 13 I report rejection rates of the null hypothesis of no effect for different specifications. Using 1,000 simulations, a serious overestimation of the significance levels is found in the case of conventional standard errors (between 30 and 46 percent for control group 3). Block bootstrapping helps to deal with this issue and, compared to conventional standard errors, block bootstrapped standard errors lead to a decrease in the number of falsely rejected null hypotheses for all analyzed labor market indicators (e.g. from 30.6 to 12 percent in the case of the employment rate), though there remains a slight over-rejection even when using bootstrapped standard errors.[18] Importantly, the block bootstrapped standard errors did not change the significance of the estimates, therefore it is reasonable to claim there really was a significant and positive impact of the project on the local labor market.

[18] Bertrand et al. [2003] note that block bootstrap performs well when the number of groups is large enough.

9 Conclusion

In this paper, the impact of the TPCA investment project in Kolín on the local labor market performance is evaluated. The TPCA investment project was the largest investment project in the Czech Republic between 1993-2006. I have investigated the dynamics of unemployment flows, unemployment rate and employment rate using aggregate exit hazard rates out of unemployment. Using difference-in-differences estimation, the results indicate a positive and significant (both statistically and economically) impact on outflow rate from unemployment and aggregate exit hazard rates from unemployment with a duration of less than 9 months. This change resulted in a decrease in the total number of unemployed by 1.7 percentage points, mainly due to a drop in short-term unemployment.

There is some doubt about the consistency of conventional difference-in-differences standard errors and, indeed, a serious underestimation of the standard deviation of the estimated treatment effects is found. Therefore, a blocked boostrap technique has been used to compute standard errors. The consistency of standard errors has been checked by placebo simulations when a thousand placebo interventions were randomly generated. If standard errors are estimated consistently, the rejection rate should not differ too much from the significance level. I find that block bootstrapping substantially reduces the number of false rejections of the null hypothesis. Even after accounting for the autocorrelation of the data, however, the rejection rate is still greater than 5 percent, which casts some doubt on the analysis and, therefore, should be taken into account when interpreting significance levels.

There has also been an apparent positive influence of the investment on local employment, which increased by 3.7 percentage points following the TPCA investment. Thus, the investment project has affected the whole district positively and more people benefited from its presence than the reported number of employees at TPCA. Since it is known from anecdotal evidence that more than one half of the workers in the company migrated to get a job at the TPCA, there must have

been a substantial spillover on suppliers or other industries. To summarize, it can be argued that the local labor market benefited from FDI inflow and fears that a crowding-out effect would negate direct vacancies created by inward FDI were not confirmed. It should also be noted that this study concerns solely the impact of FDI without analyzing the role of public incentives for FDI inflow and allocation. The evaluation of the system of financial incentives and its effect on foreign investors' allocation decision remains a subject for further research.

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A Appendix

Figure 1: The location of the TPCA investment in Kolín

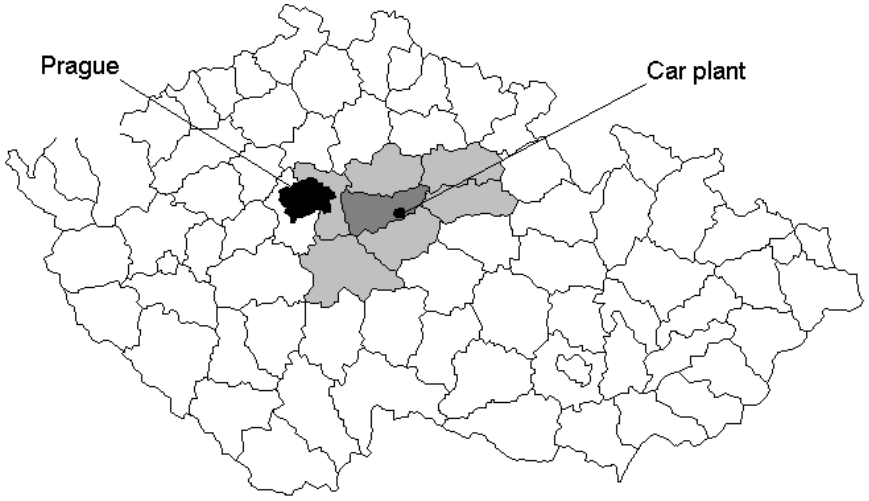

Figure 2: The deseasonalized unemployment rate in Kolín and neighboring districts

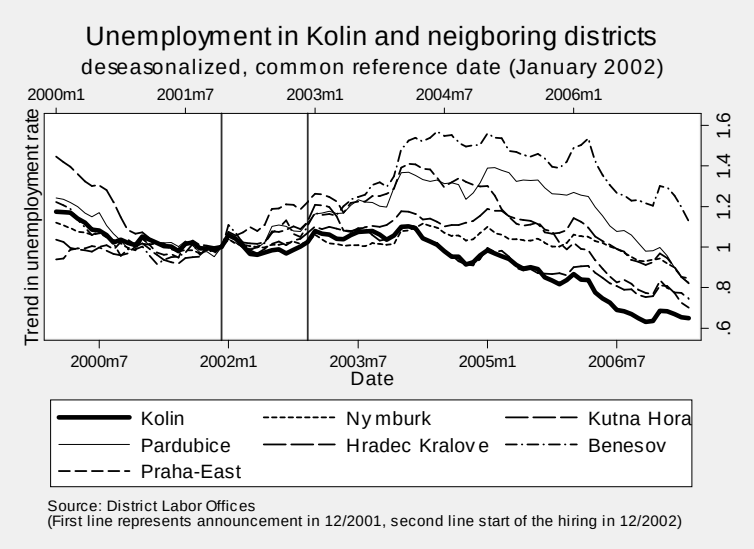

Figure 3: The unemployment rate in Kolín, the Central Bohemian region and the Czech Republic (deseasonalized)

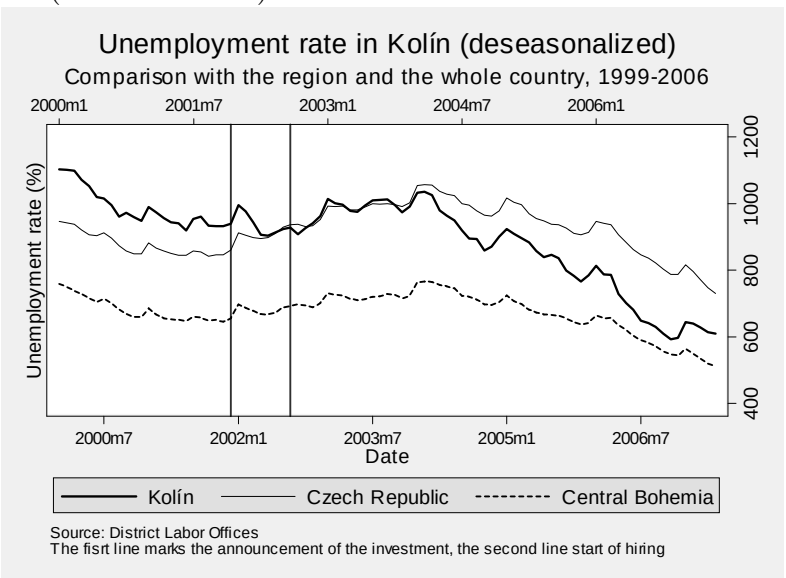

Figure 4: The distribution of FDI inflow per capita (excluding Prague)

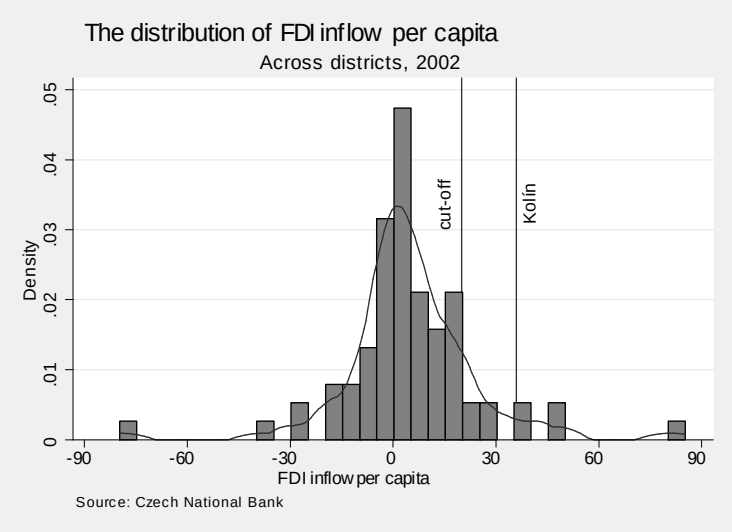

Figure 5: Unemployment flows in Kolín

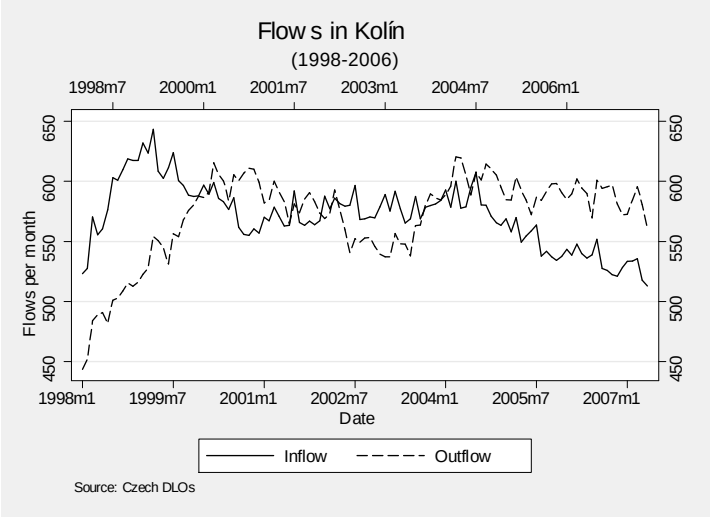

Figure 6: Employment, participation and unemployment rates in Kolín

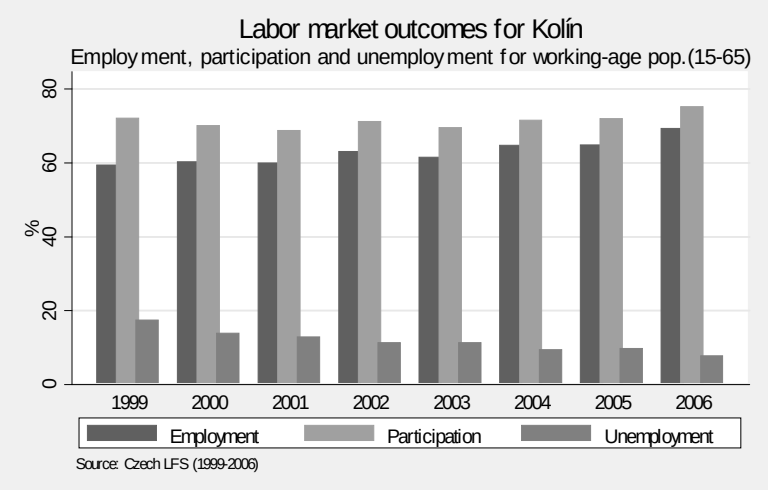

Table 1: Yearly GDP growth in real prices (percent)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Czech Republic	6.4	4.0	-0.7	-0.8	1.3	3.6	2.5	1.9	3.6	6.1
Hungary	1.5	1.3	4.6	5.1	4.2	5.2	3.8	3.5	2.8	3.8
Poland	7.0	6.2	7.1	5.0	4.5	4.2	1.1	1.4	3.8	5.3
Slovakia	6.9	6.6	5.7	3.7	0.3	0.7	3.2	4.1	4.2	5.4

Source: World Bank, Czech Statistical Office, Slovak Statistical Office.

Table 2: Characteristics of Kolín and neighbouring districts

	U_r (%)	Wage (CZK)	Distance (km)	Time (min)
Kolín	9.5	13,476	5	6
Benešov	3.2	13,080	55	55
Hradec Králové	6.1	14,015	71	60
Kutná Hora	10.5	12,454	12	15
Nymburk	8.6	12,962	21	20
Pardubice	5.4	13,800	48	45
Praha - East	2.9	16,667	50	45

Source: ČSÚ (2001), own calculations.

Table 3: Characteristics of Kolín compared with the rest of the Czech Republic (excluding Prague)

Unemployment rate is calculated as a share of unemployed among active labor force, employment rate—also called the employment-to-population ratio—is the percentage of employed working-age individuals out of overall population and participation rate is the share of active labor force out of total population. For all three measures only individuals aged 15-64 years are considered.

	1999	2000	2001	2002	2003	2004	2005	2006
Kolín								
FDI per capita (thous. CZK)	35.33	65.79	80.65	154.19	311.83	189.02	129.16	
Employment rate (%)	60.33	61.43	64.80	64.07	62.04	65.40	65.63	69.80
Participation rate (%)	73.15	71.39	69.63	72.03	70.02	72.29	72.76	76.72
Unemployment rate (%)	9.92	10.24	9.48	9.35	9.96	9.43	8.43	6.83
% LTU (>1 year)	27.78	36.93	36.73	34.00	35.06	35.57	35.40	31.01
% without *maturita*	74.20	76.05	76.45	75.42	74.29	74.91	74.59	73.43
% of females unemployed	57.28	56.47	54.91	54.28	54.12	54.48	55.61	56.64
Czech Republic (except Kolín & Prague)								
FDI per capita (thous. CZK)	72.13	94.14	109.41	120.26	132.96	145.88	146.89	
Employment rate (%)	64.97	64.41	64.41	64.80	64.07	63.42	63.92	64.37
Participation rate (%)	71.65	71.10	70.56	70.28	69.86	69.67	69.92	69.82
Unemployment rate (%)	9.40	9.74	9.26	9.97	10.81	10.95	10.37	9.46
% LTU (>1 year)	27.28	37.21	39.10	38.13	40.42	42.43	43.25	43.02
% without *maturita*	73.21	74.72	75.82	75.71	75.89	75.63	75.72	75.69
% of females unemployed	51.57	50.67	50.77	50.38	50.38	51.11	52.28	53.06

Source: DLO, ČSÚ, ČNB (2006).

Table 4: 76 districts and 13 regions in the Czech Republic (The city of Prague is not in the Central Bohemia region)

1 - Prague-city	21 - Domažlice	40 - Liberec	59 - Hodonín
Central Bohemia	22 - Tachov	*Královehradecký region*	60 - Vyškov
2 - Benešov	23 - Klatovy	41 - Rychnov n. Kněžnou	61 - Znojmo
3 - Beroun	24 - Plzeň-city	42 - Trutnov	*Olomoucký region*
4 - Kladno	25 - Plzeň-south	43 - Hradec Králové	62 - Jeseník
5 - Kolín	26 - Plzeň-north	44 - Jičín	63 - Olomouc
6 - Kutná Hora	27 - Rokycany	45 - Náchod	64 - Prostějov
7 - Mělník	*Karlovarský region*	*Pardubický region*	65 - Přerov
8 - Mladá Boleslav	28 - Sokolov	46 - Chrudim	66 - Šumperk
9 - Nymburk	29 - Cheb	47 - Pardubice	*Zlínský region*
10 - Prague-East	30 - Karlovy Vary	48 - Svitavy	67 - Kroměříž
11 - Prague-West	*Ústecký region*	49 - Ústí nad Orlicí	68 - Uherské Hradiště
12 - Příbram	31 - Teplice	*Vysočina*	69 - Vsetín
13 - Rakovník	32 - Děčín	50 - Třebíč	70 - Zlín
South Bohemia	33 - Chomutov	51 - Žďár nad Sázavou	*Moravskoslezský region*
14 - České Budějovice	34 - Litoměřice	52 - Havlíčkův Brod	71 - Bruntál
15 - Český Krumlov	34 - Louny	53 - Jihlava	72 - Frýdek-Místek
16 - Jindřichův Hradec	35 - Most	54 - Pelhřimov	73 - Karviná
17 - Písek	36 - Ústí nad Labem	*South Moravia*	74 - Nový Jičín
18 - Prachatice	*Liberecký region*	55 - Blansko	75 - Opava
19 - Strakonice	37 - Semily	56 - Brno-city	76 - Ostrava
20 - Tábor	38 - Česká Lípa	57 - Brno-around	
Plzeňský region	39 - Jablonec nad Nisou	58 - Břeclav	

Table 5: Control groups used in the analysis

The table presents three control groups of districts used in the econometric evaluation of the FDI impact on Kolín local labor market.

Control group		
1	2	3
all districts	Litoměřice	Kladno
excluding Prague	Louny	Sokolov
	Chrudim	Děčín
	Jičín	Jičín
	Frýdek-Místek	Svitavy
		Trutnov

Note: All districts were split into two groups based on the per-capita FDI inflow: 'high-FDI' and 'low-FDI' groups. Districts with FDI-per-capita inflow above 20 thousand CZK during 2002 were classified as 'high-FDI' (about 20 percent of all districts) and the remaining districts were classified as 'low-FDI'. Control group no. 2 then consists of districts where a new industrial zone started in 2002 (as in Kolín) but which despite this fact still belong to the 'low-FDI' category (Kolín belongs to the 'high-FDI' category due to the TPCA investment). Control group no. 3 is based not on the industrial zone designation, but on the propensity score of belonging to a 'high-FDI' group. A simple probit estimation (excluding Kolín) controlling for district infrastructure, educational and industry structure is used to estimate the propensity of receiving treatment (a lot of FDI) and the subgroup of districts with a similar propensity score as Kolín (within a certain bandwidth) that belongs to a 'low-FDI' group represents the appropriate control group.

Table 6: Unemployment stocks and flows 2000-2002 in Kolín

Variable	Mean	Std. Dev.	Min.	Max.	N
Inflows	579.18	114.32	434	838	44
Outflows	575.73	106.77	341	811	44
Unemployment	4413.27	255.02	3938	5031	44
Labor force	45286.38	805.92	44446	47583	44
Inflow Rate	0.0142	0.0028	0.0106	0.0208	44
Outflow Rate	0.1306	0.0258	0.0749	0.1907	44
Unemployment Rate	0.0978	0.0062	0.0864	0.1132	44

Table 7: Unemployment stocks and flows 2003-2006 in Kolín

Variable	Mean	Std. Dev.	Min.	Max.	N
Inflows	566.91	112.18	424	813	46
Outflows	587	121.31	303	809	46
Unemployment	4313.12	367.44	3380	4963	46
Labor force	48580.22	1900.99	46163	52458	46
Inflow Rate	0.0129	0.0028	0.0089	0.0194	46
Outflow Rate	0.1356	0.0328	0.0653	0.2024	46
Unemployment Rate	0.0883	0.0102	0.0644	0.1063	46

Note: The means of the time series are not significantly different for outflow, inflow and outflow rate, and they are significantly different for unemployment, unemployment rate, labor force and inflow rate. Overall unemployment, unemployment rate and inflow rate are lower and labor force higher for the later period at the 5 percent significance level.

Table 8: Impact of the investment on outflow from unemployment

Unem. outflow	Control group											
	1				2				3			
	Delay (years)				Delay (years)				Delay (years)			
	0	1	2	3	0	1	2	3	0	1	2	3
Impact	1.823	2.206	3.107	3.843	0.858	1.060	1.854	2.499	2.584	3.096	4.759	5.512
(robust)	(0.14)***	(0.18)***	(0.21)***	(0.23)***	(0.48)	(0.53)	(0.63)*	(0.68)*	(0.60)**	(0.63)**	(0.57)***	(0.65)***
(bootst)	(0.81)*	(1.07)***	(1.59)	(1.87)*	(0.49)	(0.65)	(1.10)	(1.25)*	(1.16)*	(1.42)*	(2.18)*	(2.76)*
Imp_mid		0.316	-0.045	0.516		0.160	-0.301	0.044		0.646	0.046	1.185
(robust)		(0.16)	(0.14)	(0.11)		(0.35)	(0.31)	(0.30)		(0.51)	(0.46)	(0.35)*
(bootst)		(0.19)	(0.11)	(0.25)		(0.36)	(0.30)	(0.22)		(0.43)	(0.36)	(0.66)
Const	13.474	13.512	13.610	13.576	9.112	9.268	9.820	9.692	13.013	13.506	14.551	14.112
(robust)	(0.57)***	(0.57)***	(0.57)***	(0.57)***	(0.99)***	(0.98)***	(1.10)***	(0.99)***	(1.94)***	(1.86)***	(1.56)***	(1.49)***
(bootst)	(0.67)***	(0.77)***	(0.81)***	(0.61)***	(0.61)***	(0.74)***	(0.99)***	(0.81)***	(1.85)***	(1.56)***	(1.32)***	(1.38)***
R-sq	0.170	0.170	0.171	0.171	0.181	0.181	0.188	0.192	0.224	0.229	0.253	0.253
N	8208	8208	8208	8208	648	648	648	648	756	756	756	756

Note: The table reports estimates from linear regressions with outflow from unemployment as a dependent variable. All regressions include fixed-effects, quarterly dummies controlling for seasonal effects and variables capturing district industry and educational structure. The impact of the investment project is estimated using three different control groups. The first control group includes all districts except for Prague, the second control group uses districts with a newly designated industrial zone and the third control group consists of districts chosen by propensity matching. The announcement of the investment (at the end of 2001) is taken as a break date and various specifications allowing for potential delay in policy enactment are used for a robustness check. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 9: Impact of the investment on inflow into unemployment

Unem. Inflow	Control group											
	1				2				3			
	Delay (years)				Delay (years)				Delay (years)			
	0	1	2	3	0	1	2	3	0	1	2	3
Impact	-0.034	-0.061	-0.085	-0.150	0.127	0.121	0.165	0.117	-0.016	-0.042	-0.086	0.156
(robust)	(0.01)**	(0.02)***	(0.02)***	(0.02)***	(0.04)*	(0.05)	(0.06)*	(0.07)*	(0.06)	(0.06)	(0.07)	(0.08)
(bootst)	(0.02)	(0.03)*	(0.04)	(0.08)*	(0.07)	(0.07)	(0.09)	(0.09)*	(0.04)	(0.05)	(0.06)	(0.08)
Imp_mid		0.055	0.031	0.035		0.149	0.083	0.133		0.082	0.065	0.050
(robust)		(0.01)***	(0.01)***	(0.01)***		(0.03)**	(0.02)**	(0.03)**		(0.05)	(0.04)	(0.04)
(bootst)		(0.03)*	(0.02)	(0.02)		(0.07)*	(0.04)*	(0.07)*		(0.06)	(0.04)	(0.05)
Const	1.429	1.427	1.424	1.423	2.127	2.122	2.154	2.123	1.403	1.388	1.3541	1.351
(robust)	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.11)***	(0.12)***	(0.10)***	(0.12)***	(0.17)***	(0.14)***	(0.16)***	(0.15)***
(bootst)	(0.07)***	(0.07)***	(0.07)***	(0.06)***	(0.21)***	(0.19)***	(0.21)***	(0.23)***	(0.18)***	(0.20)***	(0.17)***	(0.16)***
R-sq	0.160	0.161	0.161	0.161	0.206	0.204	0.205	0.204	0.177	0.178	0.180	0.184
N	8208	8208	8208	8208	648	648	648	648	756	756	756	756

Note: The table reports estimates from linear regressions with inflow into unemployment as a dependent variable. All regressions include fixed-effects, quarterly dummies controlling for seasonal effects and variables capturing district industry and educational structure. The impact of the investment project is estimated using three different control groups. The first control group includes all districts except for Prague, the second control group uses districts with a newly designated industrial zone and the third control group consists of districts chosen by propensity matching. The announcement of the investment (at the end of 2001) is taken as a break date and various specifications allowing for potential delay in policy enactment are used for a robustness check. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 10: Impact of the investment project on aggregate exit hazard rates

	Control group		
	1	**2**	**3**
Duration 0-3 months			
Kolín x After	2.023***	2.502*	2.528*
	(0.359)	(0.978)	(1.164)
Const	48.228***	47.607***	39.849***
	(1.459)	(3.446)	(3.726)
Duration 3-6 months			
Kolín x After	1.747**	1.230	3.152*
	(0.346)	(1.478)	(1.264)
Const	39.949***	27.205	30.983***
	(1.646)	(5.636)	(5.228)
Duration 6-9 months			
Kolín x After	2.149***	0.888	4.377***
	(0.288)	(1.278)	(1.181)
Const	45.141***	35.728***	37.575***
	(1.074)	(2.210)	(4.536)
Duration 9-12 months			
Kolín x After	-0.899*	-0.538	0.290
	(0.326)	(1.252)	(1.679)
Const	34.456***	25.634***	26.258***
	(1.494)	(4.506)	(7.622)
Duration >12 month			
Kolin x After	0.062	0.777	0.983
	(0.955)	(0.563)	(0.534)
Const	30.579***	17.142***	15.705***
	(1.321)	(1.449)	(1.491)
Joint sign. of Kolin x After	0.043*	0.117	0.012*
N	2584	204	252

Note: The table reports estimates from seemingly unrelated regressions with aggregate exit hazard rate out of unemployment as a dependent variable. The estimation includes fixed-effects, quarterly dummies controlling for seasonal effects and variables capturing district industry and educational structure. The impact of the investment project is estimated using three different control groups. The first control group includes all districts except for Prague, the second control group uses districts with a newly designated industrial zone and the third control group consists of districts chosen by propensity matching. Significance levels: *** 0.1%, **1 %, *5%.

Table 11: Impact of the investment on the unemployment rate

Unempl. rate	Control group											
	1				2				3			
	Delay (years)				Delay (years)				Delay (years)			
	0	1	2	3	0	1	2	3	0	1	2	3
Impact	-1.489	-1.782	-2.354	-3.060	-0.325	-0.510	-0.727	-1.300	-1.739	-2.144	-3.106	-3.785
(robust)	(0.13)***	(0.15)***	(0.20)***	(0.21)***	(0.30)*	(0.31)	(0.42)	(0.46)*	(0.57)*	(0.58)*	(0.57)**	(0.69)**
(bootst)	(0.72)*	(0.82)*	(1.17)	(1.42)*	(0.38)	(0.43)	(0.57)	(0.78)	(0.69)*	(0.96)*	(1.54)*	(1.89)*
Imp_mid		-0.330	-0.229	-0.471		0.316	0.142	0.158		-0.209	-0.146	-0.763
(robust)		(0.09)***	(0.09)*	(0.09)***		(0.32)	(0.26)	(0.21)		(0.53)	(0.48)	(0.41)
(bootst)		(0.17)*	(0.13)	(0.22)*		(0.32)	(0.23)	(0.16)		(0.30)	(0.30)	(0.46)
Const	9.300	9.270	9.208	9.220	15.080	14.937	14.795	14.736	9.271	9.033	8.305	8.503
(robust)	(0.46)***	(0.46)***	(0.47)***	(0.47)***	(0.91)***	(1.03)***	(1.25)***	(1.24)***	(1.24)***	(1.21)***	(1.14)***	(1.05)***
(bootst)	(0.62)***	(0.78)***	(0.78)***	(0.66)***	(1.94)***	(1.72)***	(2.15)***	(2.09)***	(1.42)***	(1.68)***	(1.36)***	(1.24)***
R-sq	0.287	0.288	0.291	0.293	0.273	0.275	0.277	0.288	0.393	0.410	0.445	0.457
N	8208	8208	8208	8208	648	648	648	648	756	756	756	756

Note: The table reports estimates from linear regressions with the unemployment rate as a dependent variable. All regressions include fixed-effects, quarterly dummies controlling for seasonal effects and variables capturing district industry and educational structure. The impact of the investment project is estimated using three different control groups. The first control group includes all districts except for Prague, the second control group uses districts with a newly designated industrial zone and the third control group consists of districts chosen by propensity matching. The announcement of the investment (at the end of 2001) is taken as a break date and various specifications allowing for potential delay in policy enactment are used for a robustness check. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 12: Impact of the investment on the employment rate

Employment rate	Control group											
	1				2				3			
	Delay (years)				Delay (years)				Delay (years)			
	0	1	2	3	0	1	2	3	0	1	2	3
Impact	4.284	4.769	5.917	6.763	1.654	2.030	2.337	2.664	3.752	4.286	5.652	6.200
(robust)	(0.28)***	(0.32)***	(0.42)***	(0.45)***	(0.92)	(1.09)	(1.32)	(1.32)	(0.62)***	(0.66)***	(0.70)***	(0.79)***
(bootst)	(2.09)*	(2.39)*	(2.89)	(3.09)*	(1.13)	(1.43)	(1.94)	(1.92)	(1.71)*	(1.98)*	(2.62)*	(2.87)*
Imp_mid		2.372	1.907	2.680		0.353	0.860	1.153		1.733	1.536	2.583
(robust)		(0.20)***	(0.18)***	(0.18)***		(0.40)	(0.55)	(0.75)		(0.60)*	(0.56)*	(0.42)*
(bootst)		(1.19)*	(0.96)*	(1.22)*		(0.46)	(0.71)	(0.95)		(0.85)*	(0.76)*	(1.22)
Const	63.715	63.764	63.889	63.840	51.837	52.126	52.322	52.193	60.607	60.921	61.950	61.526
(robust)	(1.01)***	(1.01)***	(1.03)***	(1.02)***	(1.80)***	(2.06)***	(2.41)***	(2.20)***	(1.82)***	(1.78)***	(1.93)***	(1.78)***
(bootst)	(0.96)***	(1.17)***	(1.23)***	(0.95)***	(1.99)***	(2.03)***	(2.93)***	(2.46)***	(2.29)***	(1.72)***	(2.08)***	(1.96)***
R-sq	0.087	0.088	0.091	0.171	0.311	0.310	0.310	0.311	0.161	0.168	0.190	0.187
N	2736	2736	2736	8208	216	216	216	216	252	252	252	252

Note: The table reports estimates from linear regressions with the employment rate as a dependent variable. All regressions include fixed-effects, quarterly dummies controlling for seasonal effects and variables capturing district industry and educational structure. The impact of the investment project is estimated using three different control groups. The first control group includes all districts except for Prague, the second control group uses districts with a newly designated industrial zone and the third control group consists of districts chosen by propensity matching. The announcement of the investment (at the end of 2001) is taken as a break date and various specifications allowing for potential delay in policy enactment are used for a robustness check. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 13: Difference-in-differences rejection rates for intervention effect from placebo simulations

Placebo laws	Control group					
	1		2		3	
	OLS	Block Bootstrap	OLS	Block Bootstrap	OLS	Block Bootstrap
outflow	0.684	0.398	0.316	0.192	0.298	0.226
	(0.381)	(0.500)	(0.493)	(0.455)	(0.390)	(0.469)
inflow	0.712	0.416	0.310	0.208	0.382	0.276
	(0.391)	(0.500)	(0.492)	(0.462)	(0.400)	(0.485)
unemployment	0.702	0.408	0.554	0.264	0.460	0.242
	(0.399)	(0.500)	(0.376)	(0.481)	(0.497)	(0.473)
employment	0.698	0.420	0.250	0.124	0.306	0.120
	(0.402)	(0.500)	(0.477)	(0.330)	(0.491)	(0.415)

Note: The table reports rejection rates of the null hypothesises that there is no effect (at the 5 percent significance level) of the intervention on the dependent variable based on randomly generated placebo simulations. The number of simulations is 500. All regressions include fixed-effects accounting for district industry and educational structure and quarterly dummies controlling for seasonality. The impact of the investment project is estimated using three different control groups. The first control group includes all districts except for Prague, the second control group uses districts with a newly designated industrial zone and the third control group consists of districts chosen by propensity matching. Standard errors in parenthesis.

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