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Essays on Labor Economics: Labor Market Laboratory in Central Europe

Dissertation

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Contents

Abstract

The first part of this dissertation evaluates the impact of a large and territorially concentrated foreign direct investment (FDI) inflow on local labor market outcomes in the Czech Republic. A difference-in-differences technique is employed for estimating the impact of a joint investment of Toyota and Peugeot on local labor market indicators. The results indicate a positive and statistically as well as economically significant effect of a large investment project on the local unemployment outflow rate, which is driven mainly by increases in the aggregate unemployment exit hazard rates for unemployment durations smaller than nine months. However, the impact on long-term unemployed was negligible. Moreover, a simple cost–benefit analysis suggests that investment incentives paid from a state budget would pay off only in a horizon of twelve years.

In the second chapter, I analyze the causal effect of investment incentives on regional allocation of FDI in the Czech Republic during 2001-2007. An institutional setup of investment incentives provided foreign investors with financial incentives depending on the particular district's unemployment rate. The identification strategy is based on a regression-discontinuity approach, as the scheme's design introduces three unemployment thresholds differentiating the amount of the subsidy. The results indicate a positive effect of the investment scheme, but this impact is concentrated only at the lowest available unemployment threshold. No impact at higher unemployment thresholds is found. Attracting FDI into the most distressed regions, therefore, remains an important challenge for policymakers.

The last chapter provides an evaluation of the introduction of the euro on international FDI flows. Previous empirical literature has often suffered from a short time span and imperfect identification strategy. This paper analyzes the impact of the euro on FDI flows between 35 OECD economies during 1997-2008 by adopting propensity score matching as an identification strategy. In general, the euro exhibits no significant impact on FDI. However, the impact becomes significant on a subset of EU countries. Furthermore, EU membership fosters FDI flows much more than does the euro. Among other FDI determinants, high gross domestic product, close proximity between countries, and low unit labor costs in the target country have a positive effect on FDI.

Abstrakt

První část disertační páce vyhodnocuje dopad rozsáhlého a geograficky koncentrovaného přílivu přímých zahraničních investic (PZI) na lokální trh práce. Na případu společné investice automobilek Toyota a Peugeot v České Republice analyzuji metodou rozdílů v rozdílech dopad tohoto významného projektu na ukazatele místního trhu práce. Výsledky ukazují, že vlivem investice vzrostla míra odlivu z nezaměstnanosti, a to zejména pro kategorii nezaměstnaných do devíti měsíců. Tyto změny se následně projevily poklesem okresní nezaměstnanosti a nárůstem okresní míry zaměstnanosti. Nicméně, pravděpodobnost přechodu do zaměstanosti pro dlouhodobo nezaměstnané zůstala nezměněná. Placebo simulace fiktivních intervencí odhalily významné podhodnocení směrodatných chyb běžnou metodou nejmenších čtverců, proto byla na výpočet konzistentních směrodatných chyb použita technika "block bootstrapping".

Ve druhé části se věnuji zkoumání efektu investičních pobídek na regionální distribuci PZI v České republice v období 2001-2007. Výše přidělených pobídek byla vyšší v okresech s vysokou nezaměstnaností, čímž systém investičních pobídek lákal investory zejména do regionů nejvíce postižených nezaměstnaností. Identifikační strategie je založena na regresní diskontinuitě, využívající předem stanovená kriteria způsobilosti pro investiční pobídky. Tyto kriteria rozdělily okresy do čtyř skupin v závislosti od okresní míry nezaměstnanosti. Výsledky indikují kladný vliv investičních pobídek na redistribuci PZI, nicméně jen pro nejnižší dostupný práh nezaměstnanosti. Dopad na vyšší prahy nezaměstnanosti nebyl potvrzen. Přilákání PZI do regionů nejvíce postižených nezaměstnaností musí být proto doplněno jinými prostředky, a stále zůstává důležitou výzvou pro tvůrce politik trhu práce.

Třetí část práce poskytuje analýzu vlivu společné evropské měny na přímé zahraniční investice. Ekonometrickou analýzou 35 OECD zemí v období 1995-2008 založenou na technice propensity score matching (párování pomocí tzv. propensity skóre) odhaduji dopad eura na toky PZI mezi jednotlivými zeměmi. Obecně nebyl zjištěn kladný vliv eura na FDI. Nicméně, po omezení analýzy na členské země EU se prokázal pozitivní dopad eura na toky investic. Zajímavostí je, že členství v EU vykazuje řádově mnohem významnější efekt na PZI než společná měna. Z ostatních faktorů mají signifikantní a pozitivní vliv na příliv PZI velikost ekonomik, malá vzdálenost mezi zeměmi a levná pracovní síla v cílové ekonomice.

Introduction

This thesis analyzes the linkages between various labor market indicators on the one side and macroeconomic and institutional factors on the other. In particular, it explores the role of foreign direct investment (FDI), its determinants, as well as its impact on labor market performance. It is an empirical work, yet evaluations are firmly based on theoretical foundations which constitute an indispensable part of all chapters.

The first chapter investigates the impact of a large and territorially concentrated foreign direct investment (FDI) inflow on local labor market outcomes in the Czech Republic. A conditional difference-in-differences technique is employed for estimating the impact, and block bootstrapping is used for computing consistent standard errors. The results indicate a positive and statistically, as well as economically, significant effect of a large investment project on the local unemployment outflow rate, which is driven mainly by increases in the aggregate unemployment exit hazard rates for unemployment durations less than nine months. Subsequent to the investment, the unemployment rate decreased by 1.7 percentage points and the employment rate increased by 3.7 percentage points in the host district. However, the impact on long-term unemployed was negligible as the exit hazard rates for durations longer than nine months remain unchanged.

While the first chapter focuses solely on the impact of FDI on local labor market characteristics, the rest of the thesis is devoted to analyzing the main determinants of FDI. First, a country-specific approach is adopted as the role of an investment incentive scheme on FDI inflow is evaluated. Second, an international context is used to analyze the effect of economic and monetary integration on between-country FDI flows. In particular, the second essay estimates the causal effect of the incentive scheme on regional allocation of FDI in the case of the Czech Republic during 2001-2007. The incentive scheme provided foreign investors with investment incentives depending on the particular district's unemployment rate. The identification strategy is based on a regression-discontinuity approach, as the scheme design introduces three unemployment thresholds differentiating the amount of the subsidy. The results indicate a positive effect of the investment scheme, but this impact is

concentrated only at the lowest available unemployment threshold. No impact for higher unemployment thresholds is found. Among other FDI location factors, a share of a tertiary-educated labor force and wages have a significant positive impact on FDI, albeit only during 2001-2004.

The third chapter studies the effect of a common currency introduction on international FDI flows. Using country-pair data on 35 economies during 1997-2008 and the propensity score matching technique as an identification strategy, the results indicate that the impact of the euro on FDI flows differs for the full sample (OECD) and the subsample (EU). In general, the euro exhibits no significant impact on FDI. However, on the subset of EU countries, the impact becomes significant, increasing FDI flows by 14.3 to 42.5 percent. Furthermore, being in the EU contributes to FDI flows much more than does the euro, increasing FDI flows by 55 to 166 percent. Among other FDI determinants, high gross domestic product, close proximity between countries and low unit labor costs in the target country have a positive effect on FDI, while long-term exchange rate volatility decreases FDI flows.

Chapter 1

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

(Joint work with Daniel Munich)

1.1 Introduction

Improving labor market outcomes is a key goal for most policymakers, and for many economies attracting foreign direct investment (FDI) is viewed as an important tool to improve local labor market conditions. After the collapse of communism, the Central and Eastern European countries (CEECs) have experienced a transition towards a market economy. This process involved a huge inflow of foreign investment,[1] either due to a comparative advantage in low-skill and physical capital-intensive sectors or as a result of the privatization of banks and state-owned enterprises.

The main goal of this paper is to assess the impact of a large, territorially concentrated FDI inflow on local labor market outcomes, using the largest investment project in the Czech Republic during 1993-2006, the Toyota-Peugeot-Citroën joint

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All errors remaining in this text are the responsibility of the author.

[1] The majority of investors have come from Western Europe, although the FDI inflow from Asia has become more prominent especially after 2000 (Woon, 2003). FDI in CEECs has contributed to steady economic growth in this region since 1995 (see Table 1.1).

investment into the automobile sector in Kolín, the Czech Republic. This project is used to quantify the effect of FDI on district unemployment outflow and inflow rates, aggregate unemployment exit hazard rates, and, consequently, both the unemployment and employment rates. Central and Eastern Europe is especially appropriate for such an analysis as there was a lack of FDI under the centrally-planned system up to 1989, and since 1989 it has experienced several huge greenfield investment projects. For policymaking purposes, it is crucial that the impact of such large projects is analyzed rigorously and this study focuses on one of the largest realized projects in the CEEC region. The most appropriate econometric techniques are used, ensuring that estimates are consistent and standard errors are not underestimated.

The motivation for this study is threefold. First, countries promote FDI inflow using various policy incentives - either direct (financial subsidies) or indirect (such as building infrastructure). These incentives require significant government spending,[2] raising questions about the efficiency of such schemes. A rigorous analysis of FDI effects is necessary for a correct assessment of the efficiency of governmental investment policies.[3] In other words, it remains an open question whether the real benefits arising from an investment project in a particular region outweigh the cost of the subsidies for the state budget.[4] FDI subsidies are usually scaled according to the target region. Governments assume the effect of FDI inflow on the local economy is economically significant and thus, firms that invest in regions with higher unemployment rates are preferred and receive more favorable treatment (a higher

[2] Complementary and more general strategies focus on adopting quality legislation, eliminating trade barriers and improving the business environment, law enforcement, labor force skills and infrastructure (Oman, 2000).

[3] 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 the high potential of CEECs but also based on policy-driven factors such as the investment subsidies provided by host countries (Demekas et al., 2005).

[4] Especially in the case of huge greenfield investments, firms have been so aggressive in seeking subsidies that countries have engaged in a "race to the bottom", where foreign firms end up with such generous financial subsidies that it seems unprofitable for countries to host the investment. Government may end up suffering from the "winner's curse", as that term is used in auction theory.

level of financial incentives). From a social standpoint, this regional differentiation is justified only if concentrated FDI inflow substantially improves local labor market outcomes.

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 and Taylor, 2005) but there is limited research evaluating the impact of investment on local labor market outcomes (Mickiewicz et al., 2000). Third, the automobile investment project in Kolín was quite unique in its scale and therefore it provides a good opportunity to accurately evaluate the impact of a large one-off project.

The average effect of the investment project on the local labor market is estimated using matching techniques. The idea is to match a treated district with otherwise similar districts that did not undergo a large FDI inflow so that labor market dynamics can be compared to a counterfactual state for the treated district. We employ the method of propensity score matching as introduced by Rosenbaum and Rubin (1983) and the identification strategy is based on a conditional difference-in-differences estimation, following Heckman et al. (1997). The findings suggest that the one-off investment project has a statistically significant and economically sizeable impact on the unemployment rate and the employment rate, driven by an increase in short-term unemployed exit hazard rates.

1.2 Survey of the literature

Most literature analyzing FDI effects on a host country concentrates on technology spillovers 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 im-

proving the efficiency of complementary or competing firms, leading to changes in labor force demand), crowding-out effects and distributional effects.

The direct effect on the employment rate is straightforward – the new investment project requires a labor force and new hirings positively affect local employment and unemployment rates. The effect of technology spillovers occurs in two forms: horizontal and vertical. 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 result from the 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 the demand for labor. Moreover, the labor market can be affected by a crowding-out effect. This occurs when inward FDI leads to a 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. This process affects the wage distribution. Wage inequality may increase if skilled workers are especially valuable to foreign companies (Tomohara and Yokota, 2007).

In addition, concentrated FDI inflow creates a potential danger of excessive dependence and vulnerability of the local labor market to one source of employment, which can result in massive layoffs of the labor force in the case of industry-specific adverse demand shocks. Other negative effects occur in the form of the opportunity costs of FDI incentives: instead of providing foreign investors with a subsidy, financial resources might have been used for other projects (e.g. active labor market policies, retraining courses, etc.). The total indirect employment effect can, therefore, be either positive or negative and, in some cases, outweigh the positive direct effect, giving an unclear ex-ante total net effect. Overall, the relationship between FDI and employment is influenced by different macro and micro factors, making a comprehensive assessment difficult.

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 CEECs after 1989 and describe changes in the structure and allocation of investments resulting from the quest of foreign investors for new markets and low-cost production. Before the investors' influx into this region, the automotive industry in CEECs was under-developed and technologically outdated (Havas, 2000). Countries in Central and Eastern Europe, however, possessed great potential for growth and development due to the skilled but cheap labor force and a substantial and steady rise in car demand (Van Tulder and Ruigrok, 1998). None of these studies, however, concentrates on the consequences of FDI and its impact on regional development or labor market dynamics.

Considering the literature assessing the effects of FDI, there are numerous studies on FDI's impact on poverty levels and inequality. This literature can be divided into two strands: cross-country studies and within-country studies. Cross-country studies analyze the effect of FDI on growth rates or inequality, while country case studies typically examine the impact of FDI on regional or district-level outcomes. Cross-country studies take advantage of a comparison among several countries and, thus, allow a generalization beyond one specific case study. However, obtaining sufficient data may be difficult for more countries and a lack of observations may yield inconclusive results. Moreover, it can be problematic to measure factors affecting country trade policy, or to approximate other changes occurring in individual countries. Overall, there is no unequivocal evidence that globalization and increased FDI inflow is beneficial for the poor as empirical literature yields ambiguous results.[5] Within-country studies analyze the effectiveness of a government's regional strategies and their impact on the local labor market. In a US study, Greenstone et al. (2008) identify the agglomeration spillovers of a large new manufacturing plant opening and estimate that the plant opening increases the total factor productivity of incumbent plants in the same county by 12 percent. Runner-up counties are used as counterfactuals and difference-in-differences estimation is adopted.

[5] For a summary of FDI's impact on poverty and income inequality, see Harrison (2006).

The empirical literature analyzing the employment effects of FDI is less frequent and 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 local 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 operates as an important buffer to negative employment shocks and contributes to local employment generation. This process serves, however, only as a complement to domestically generated employment rather than its substitute. According to Benacek and Visek (2001), 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 the stabilization and restructuring of the economy with FDI incentive schemes being a relatively unimportant factor.

Hale and Long (2006) show that the presence of FDI ignites a wage increase in privately owned domestic and foreign firms, potentially through productivity growth caused by knowledge and technology transfer. However, the analysis of the impact of the plant's opening on wages is not an objective of this study as the wage pressures initiated by the FDI inflow that determine unemployment dynamics are already reflected in the aggregate net effect on labor market outcomes. Moreover, due to a methodology change in 2002 there are inconsistencies in the reporting of wages.[6]

The focus of this paper is to examine the impact of a one-off, large and concen-

[6]The Czech Statistical Office changed the methodology for reporting wages in 2002 from a 'plant' method to an 'enterprise' method, integrating all firm branches into the district where a firm's head office is located, thus distorting the picture of wage distribution across districts, which makes an unbiased wage analysis impossible. Using data information prior to this break, Galuscak and Munich (2005) estimate a time-varying wage curve in the Czech Republic and find that the elasticity of local wages wih respect to regional unemployment is approximately -0.1, a value in line with previous empirical literature analyzing the relationship between wages and unemployment in European countries (Blanchflower and Oswald, 1994).

trated investment project on local outcomes such as employment generation, exit hazard rates, etc. The region of Central and Eastern Europe is especially appropriate for such an analysis as there was a lack of FDI before 1989 and the region has experienced several huge greenfield investment projects since then.[7] The subject of this study is one of the largest realized projects in the region - an investment in the automotive industry in Central Bohemia.

1.3 Background information

1.3.1 The TPCA investment

In December 2001, PSA Peugeot Citroën and Toyota Motor Corporation[8] announced a plan to establish a new automobile plant in the Czech Republic in the industrial zone Kolín-Ovčáry (located in the Central Bohemia region). The Czech government passed a resolution where it committed 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 greenfield site started. Shortly afterwards, a contract between TPCA and the municipality of Kolín was signed, specifying the road map of the investment project. In September 2002, the 125 hectare site was ready for use and the construction of the plant began. During preparation and construction, 350 construction workers 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 already hired 500 people and by October 2004 already 1,000 manufacturing workers had been employed. In

[7] A majority of these investment projects have been aimed at the manufacturing sector, mostly the automotive industry.

[8] Toyota is the third largest 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 did it decide to invest in this region and use the advantages of the 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 Citroën is in charge of marketing.

mid-November 2004, 1,650 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 3,000 employees worked for TPCA, out of whom 2,000 were blue-collar workers. In mid-2007, the employment level achieved a steady state and the plant had stabilized the number of its employees at 3,500, out of whom 2,600 were blue-collar workers.[9]

Apart from hiring workers in the Kolín district or the Central Bohemia region, the company also searched for new employees in other regions of the Czech Republic.[10] As a result, more than half of the workforce came from outside the Kolín district. In the first months after the start of production, the turnover remained high mainly because of the delayed construction of new flats (only 136 flats out of 850 had been built on time). According to TPCA, each month about 50-60 workers left the company due to inadequate housing conditions.

The overall volume of the investment in the Czech Republic (including start-up costs and research and development) reported by the TPCA upon filing the application for investment incentives was 23.5 billion CZK (700 million Euro) and represents the largest single greenfield investment in the Czech Republic from 1993 to 2007.[11] The investment incentive for TPCA reached 1.78 billion CZK, amounting to more than 40 percent of the total financial incentives awarded during 1998-2004

[9] The number of registered unemployed and the overall labor force in the district was 4,400 and 45,000, respectively, as of the announcement of the investment.

[10] 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 Czech government and the municipality of Kolín. 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 1, 2004 and January 12, 2005, TPCA also organized a massive hiring campaign in Northern Moravia. The main aim of these campaigns was to attract a potential work force willing to move and work in the Kolín plant. Almost 3,000 people expressed interest; according to TPCA, half of them went to the first round of interviews and 712 candidates qualified for the second round. Eventually, more than half of these joined the company.

[11] The data source is the government agency CzechInvest, which was established for FDI promotion. Considering GDP in 2003, the planned investment reached 0.755% of yearly GDP.

in the Czech Republic.[12] For a better illustration of the size of the investment and its regional impact, Table 1.2 presents the size and the share of supported FDI in the overall magnitude of FDI. Two main characteristics can be observed: first, excluding Prague, a vast majority of investment inflow is supported by the state; second, the investment project reported by TPCA exceeds the realized FDI increase in Kolín. This discrepancy can be attributed to the lag in the realization of investment plans or to inaccurate estimation by the company prior to the realization of the investment. Nevertheless, the TPCA plant represents almost 20 percent of overall FDI inflow (and more than 25 percent of all supported FDI) in the Central Bohemia region and virtually all foreign direct investment activity in the district of Kolín. It can be argued, therefore, that any substantial change in labor market behavior relative to the performance of comparable districts is caused by the opening of the TPCA plant.

1.3.2 Information about Kolín

The location of the plant in Kolín's industrial zone (Figure 1.1) was chosen jointly by TPCA and the government. Another location under consideration was Žatec in the district of Louny.[13] According to TPCA, important characteristics favoring the Kolín district were the proximity to the capital city of Prague, the short distance to main railroad and highway corridors and settled land property rights. Specifically, good infrastructure (a connection to main traffic routes and electricity and telecommunication networks) was one of the main factors in attracting the investment.

The district of Kolín (situated in the Central Bohemia region) recorded an average registered unemployment rate of 9.5 percent in 2001, which was slightly above the national average of 8.5 percent. The arrival of a major investment project was expected to decrease this rate, although the net impact of the FDI inflow might have been absorbed to some extent by neighboring districts. Table 1.3 presents

[12] The Czech Republic spent 4.26 billion CZK on financial incentives during that period of time (CzechInvest).

[13] Source: CzechInvest

the unemployment rate, average wage and average commuting time for the district of Kolín and neighboring districts. There are three types of districts in terms of unemployment rates. The low-unemployment group (Prague-East 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 to the plant for fellow high-unemployment districts Kutná Hora and Nymburk disqualifies them as control groups as these districts were most likely also positively affected by the FDI inflow (a discussion about control groups is presented in the next section).

Table 1.4 presents a comparison of the main labor market indicators for Kolín and the Czech Republic. There is a notable fall in the unemployment in Kolín relative to the Czech Republic, especially after 2004. This indicates a possible positive impact of the plant on the local labor market.

Figure 1.2 illustrates the trend in unemployment rates during the period 1997-2006 for Kolín and neighboring districts. The unemployment rate is expressed relative to the unemployment rate in a district as of the investment announcement in December 2001. Prior to this reference date, the unemployment rate in Kolín oscillated around the regional average, while it displayed a sharp relative decrease after the plant's opening. Thus, a visual inspection suggests the investment could have had a positive effect on the local unemployment rate.

The evolution of the unemployment rate in Kolín, the whole Central Bohemia region and the whole country is shown in Figure 1.3. A relatively low unemployment rate in Central Bohemia stems from the possibility of a daily commute to Prague. At the time of the investment announcement, denoted by the left-hand vertical line, the unemployment rate in Kolín was close to the overall unemployment rate in the Czech Republic. Later on, unemployment rates began to diverge (especially after 2003), when Kolín's local unemployment rate started decreasing at a faster rate than the overall one.

Simple graphical analysis therefore suggests a better performance of the Kolín labor market relative to its neighbors or the whole country after the FDI inflow. In order to estimate the net causal impact of the project, however, one needs to filter out other factors affecting the local labor market. In other words, a proper analysis needs to specify a rigorous identification strategy of the net effect of the FDI inflow. The methodology and identification strategy for such an analysis are described in the next two sections.

1.4 Methodology

Unemployment, commonly viewed as a leading labor market indicator, is an outcome of a dynamic process determined by flows to and out of unemployment. Specifically, a change in unemployment U is caused by changes in outflow O from unemployment and/or inflow S into unemployment. Following from this, a separate analysis of unemployment flows offers a more informative insight into unemployment dynamics than the aggregate unemployment rate. The number of reported unemployed at the end of period t is identified as the sum of unemployed at the end of period $t-1$ plus the net inflow into unemployment during period t, expressed by the intertemporal unemployment flow identity

$$U_t \equiv U_{t-1} + S_t - O_t. \tag{1.1}$$

Dividing by total labor force L and rearranging the terms, the unemployment rate can be expressed as

$$u_t \equiv u_{t-1}/(1+g_t) + s_t(1-u_t) - o_t u_t, \tag{1.2}$$

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:

$$u_t \equiv \frac{u_{t-1} + s_t(1 + g_t)}{(1 + g_t)(1 + s_t + o_t)}. \tag{1.3}$$

Considering this identity, a separate analysis of unemployment flows is performed to obtain better information about the sources of unemployment dynamics.[14] Building upon the framework of Burgess and Turon (2005), we assume a linear relationship for the inflow rate and the outflow rate:

$$s_t = \alpha_1 u_{t-1} + \gamma_1 X_t + \eta_1 Q_{t,2} + \psi_1 Q_{t,3} + \varphi_1 Q_{t,4} + \epsilon_{1t}, \tag{1.4}$$

$$o_t = \alpha_2 u_{t-1} + \gamma_2 X_t + \eta_2 Q_{t,2} + \psi_2 Q_{t,3} + \varphi_2 Q_{t,4} + \epsilon_{2t}, \tag{1.5}$$

where u is the unemployment rate, Q_2, Q_3 and Q_4 are quarterly dummies controlling for seasonality, and X contains variables describing district labor supply (educational structure of labor force) and district labor demand (industry structure of employment) for different age categories. This reduced form is estimated to isolate the effect of the investment on the flow rate, in addition to investigating the aggregate impact on the unemployment rate. Hence, the interaction between the unemployment rate and the rates of flow and the contribution of the outflow and inflow to a change in the unemployment rate are studied separately.[15]

Moreover, recognizing that the unemployment outflow is a probability-weighted sum of past inflows, where weights indicate the probability of leaving the pool of unemployed after staying there for different periods of time, the outflow can be expressed as a function of the past inflows and the aggregate exit hazard rates out of unemployment:

[14] The unemployment rate, the outflow rate and the inflow rate in Kolín compared to the rest of the Czech Republic is presented in Table 1.5.

[15] 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.

$$O_t = \sum_{i=0}^{\infty} S_{t-i} h_{t,i} \prod_{j=0}^{i-1} (1 - h_{t-j,i-j}). \tag{1.6}$$

Here, variable $h_{t,i}$ is the exit hazard rate out of unemployment at time t and duration i and it indicates the probability that a person who is currently unemployed for i time periods will leave the pool of unemployed during the next period. Exit hazard rates differ for various population cohorts as individuals are heterogenous agents. In the analysis, exit hazard rates for five different unemployment durations are examined, which provides important information about the underlying source of the change in the unemployment outflow and, consequently, in the unemployment rate.

After inspecting aggregate exit hazard rates, the impact of the investment project on the local employment rate is estimated. The examined labor market characteristics may be intertwined and affect each other. Aggregate hazard rates may be determined by the current state of the economy (business cycle, the local unemployment rate). Unfortunately, it is difficult to disentangle the specific effect of the local unemployment rate on the exit hazard rate because of reverse causality and associated endogeneity problems. Omitting this variable from the regression, however, does not present a problem for the empirical analysis as we are interested in the final net effect of the investment and not in the internal endogenous processes.

1.5 Identification strategy

We assess the effect of the investment project on local labor market outcomes by propensity score matching (Rubin, 1974; Rosenbaum and Rubin, 1983), along with the difference-in-differences (DID) matching approach (Heckman et al., 1997). The main idea of the matching method is to approximate the counterfactual to identify the impact of a particular treatment on an outcome variable despite the unavailability of experimental data. The propensity score matching procedure involves two steps: the estimation of the probability of treatment based on observables, established by probit estimation, and the restriction of the sample to units with similar

propensity scores denoting the probability of program participation. The difference-in-differences estimation is conditioned on similar propensity scores and performed only on the ensuing sub-sample. When constructing the propensity scores, it is crucial that these values are independent of the treatment. In order to ensure this, pre-treatment observations and time-invariant exogenous instrumental variables are used for estimating the propensity scores.

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

$$\Pr(Y_i = 1|Z_i = z_i) = \phi(Z_i\beta), \tag{1.7}$$

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), the share of agricultural land in a district[16] and a dummy indicating the designation of an industrial park suitable for hosting foreign investors, and $\Pr(Y_i = 1|Z_i = z)$ indicates the probability that district i belongs ex-ante 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 ex-post into two complementary groups of districts: a "high-FDI" and "low-FDI" group (the distribution of FDI inflow is shown in Figure 1.4). The cut-off point is arbitrarily set at 20,000 CZK, classifying 15 percent of the districts into a "high-FDI" group and the remaining 85 percent into a "low-FDI" group.

The probit estimation (which excluded the district of Kolín) assigns a 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.[17] In

[16] Anecdotal evidence suggests that greenfield investments are usually allocated on previously agricultural land.

[17] The probit estimation used for the calculation of propensity scores is shown in Table 1.7, suggesting a positive impact of the density of the road network, education of young workforce and concentration of productive age workers in a manufacturing sector on the probability of high FDI inflow.

the next step, radius matching is performed and districts with a propensity score within a certain bandwidth around Kolín's propensity score are selected to be in the control group as it can be assumed that districts with a similar score faced the same probability of receiving a large FDI inflow.[18] Among those in the control group, the location of investment projects can be considered as random, conditional on covariates. Two types of district emerge: districts with a propensity score of receiving a lot of FDI that received a lot of FDI ("high-FDI" type), and districts with a propensity score of receiving a lot of FDI that 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 considered as a counterfactual (control group one).

An alternative approach to selecting a control group is to consider all districts in the Czech Republic except Prague[19] (control group two, see Table 1.6) or districts with an industrial zone established in the same year as the TPCA investment was realized (control group three).[20] Our identification strategy rests on two main assumptions ensuring that the treated district (Kolín) would behave similarly to the control group districts in the absence of the investment. First, control group districts should have received a similar amount of FDI as Kolín would, not receiving the treatment. Second, there should be a notable similarity between the control group and Kolín in terms of labor market structure and the propensity to attract a large-scale FDI.

In the case of control groups one and three, the first assumption is satisfied by construction.[21] This is also supported empirically as an increase in FDI stock per capita for the control groups between 2001 and 2006 was comparable to that observed

[18] The similarity measure is arbitrarily set at a three-percent bandwidth around Kolín's propensity score. A robustness check with alternative bandwidths (five percent, seven percent) did not change the sign or significance of the estimates (for the sake of brevity these checks are not reported in the paper).

[19] Prague is excluded due to its specific labor market characterized by an abundance of jobs and an extremely low unemployment rate.

[20] The districts included in the three control groups are presented in Table 1.8.

[21] As stated above, only districts classified as "low-FDI" are considered for those control groups.

in Kolín without the TPCA investment.[22] The second assumption is satisfied for control group one, since the use of propensity score matching ensures its similarity to Kolín conditional on observable covariates, thus, results for the first control group are the most plausible. The second control group poses an intrinsic risk of incorporating districts inherently different from Kolín and the third control group can potentially lead to biased 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 for the TPCA investment) as a suitable control group is made impossible due to the fact that Žatec eventually also became a high-FDI recipient following the designation of the Triangle industrial zone.

A drawback of propensity score matching is that it does not control for unobservable characteristics, which can lead to a bias in the estimate of the true impact when unobservables are heterogeneous and correlated with the error term. One way to overcome 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 appropriate instruments. Using panel data, we can exploit changes in outcomes between the treated and control group over time by including fixed effects capturing unobserved heterogeneity among districts and by performing difference-in-differences regression to obtain unbiased estimates of the treatment effect (Angrist and Krueger, 1997; Heckman et al., 1997).

[22] Between 2001 and 2006, the FDI stock per capita in Kolín increased overall by 257% (from 80.7 thousand to 288.4 thousand CZK), however, excluding the TPCA investment, it increased only by 45.2% (171.2 out of 288.4 thousand CZK corresponded to the TPCA project). FDI per capita in control group 1 increased by 26% (from 83.3 to 104.9 thousand CZK), in control group 2 by 49% (from 109.4 to 162.8 thousand CZK) and in control group 3 by 35% (from 76.5 to 103.3 thousand CZK).

1.5.1 Econometric specification

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

$$\begin{aligned} y_{it} &= \lambda_i + \alpha + \beta MAN30_{it} + \gamma MAN50_{it} + \delta COL30_{it} + \theta COL50_{it} + \mu YEAR_t + \\ &+ \eta Q_2 + \psi Q_3 + \varphi Q_4 + \rho INV_{it} + \epsilon_{it}; \qquad y_{it}: \ u_{it}, \ emp_{it}, \ o_{it}, \ s_{it}, \end{aligned} \tag{1.8}$$

where $MAN30$ and $MAN50$ measure the share of people employed in the manufacturing sector in the population aged 15-29 and 30-49, respectively, and $COL30$ and $COL50$ denote the share of college or university graduates in the population aged 15-29 and 30-49, respectively. The variable $YEAR$ captures the time trend; dummies Q_2, Q_3, Q_4 control for seasonal effects; INV is a dummy indicating the investment project in Kolín;[23] λ_i are fixed effects; α, β, γ, δ, θ, μ, η, ψ, φ and ρ are the parameters of the model and ϵ_{it} is a noise term. The coefficient ρ captures the true causal effect of the investment project on the dependent variable (local unemployment rate, employment rate, inflow rate, 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. The most appropriate model for the analysis of aggregate exit hazard rates is the Seemingly Unrelated Regression (SUR) model (Zellner ,1962) as it accounts for a possible correlation of standard errors across equations. The following specification

[23] The dummy takes value 0 before a structural break and 1 after the break. 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 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 production, indicating a high fluctuation of workers.

is estimated:

$$h_{k.it} = \alpha_k + \boldsymbol{\beta}_k \boldsymbol{X}_{it} + \mu_k YEAR_t + \eta_k Q_2 + \psi_k Q_3 + \varphi_k Q_4 + \rho_k INV_{it} + \\ + \boldsymbol{\omega}_k DISTR_i + u_{k,it} \qquad \text{for } k = 1,\ 2,\ 3,\ 4,\ 5, \qquad (1.9)$$

where the set of five exit hazard equations corresponds to five different unemployment durations: 0-3 months, 3-6 months, 6-9 months, 9-12 months and more than 12 months. The variable $\boldsymbol{X}$ includes characteristics describing the structure of the labor force specified above (share of people employed in manufacturing and share of college or university graduates); $YEAR$ is a time trend capturing aggregate factors affecting the exit hazard rate; Q_2, Q_3, Q_4 are quarterly seasonal dummies; INV is a dummy for the investment project in Kolín; $DISTR_i$ are dummies for each district in the control group and u is an error term. Coefficient ρ then estimates the causal effect of the investment project on the exit hazard rates out of unemployment.

The Ordinary Least Squares (OLS) technique used in the difference-in-differences estimation (1.8) implicitly assumes a normal distribution of the coefficient of key interest. This assumption may lead to an underestimation of its true standard error even after accounting for serially correlated outcomes by clustering across districts due to autocorrelation of the data (Bertrand, Duflo and Mullainathan, 2002). Another factor reinforcing the underestimation of the standard deviation is the fact that the treatment variable rarely changes over time.

One way to correct for the 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. Importantly, the block bootstrapped standard errors do not change the sign or the significance of the estimates.

1.6 Data

Detailed empirical analysis is based on unemployment data from the Unemployment Registry (UR), the Labor Force Survey (LFS) and FDI data from the Czech National Bank (CNB).

The UR data contains information from District Labor Offices on 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 and the structure of unemployment by education, age, gender and unemployment duration on a quarterly basis.

The Labor Force Survey[24] is conducted quarterly using a rotating household sample of around 25,000 households (60,000 individuals) and is representative of the population of the Czech Republic.[25] The survey includes information about individual labor market status, age, education, sector of employment/duration of unemployment and other characteristics which allow specifying the population share of specific age, education and employment cohorts in each district during each quarter. 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 that maintains a permanent equity relation with a company in the source country and owns a defined share of domestic company equity (in the host country).[26] The level of FDI is then measured as a sum of three components: equity capital, reinvested earnings and intra-company loans.

[24] 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.

[25] 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.

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

1.7 Results

We start the evaluation of the FDI impact on the local labor market with an analysis of overall unemployment and overall employment. The next step is to examine unemployment flows since these are the underlying processes behind changes in the stock of unemployed. Finally, we address the role of aggregate exit hazard rates and identify duration categories that contributed the most to the change in unemployment.

1.7.1 Unemployment

Following the specification in equation (1.8), we estimate the impact of FDI on the unemployment rate for the three comparison groups (Table 1.9). Comparison group one (districts with similar propensity scores for receiving investment, but not receiving much FDI) should yield the most precise estimates (as argued above), therefore we focus on this control group.

There is a possibility that neither the start of the construction of the site nor the start of the production process is the most appropriate structural break and it takes some time before the investment affects the local labor market. Therefore, we allow for a delay in the investment taking effect by including a dummy variable *Imp_mid* indicating the length of the transitory period in years. For each comparison group, we report four estimates differing in the length of this transitory period.

There is a statistically significant positive effect on the unemployment rate, which decreased by 1.7 to 3.8 percentage points depending on the time since the investment.[27] A decrease in the local unemployment rate by 1.7 percentage points cor-

[27] As can be seen from Table 1.9, the estimated impact of the plant opening on the unemployment rate is the largest for the first control group and the smallest for the third control group although, intuitively, the third control group (consisting of districts with a designated industrial zone but still a 'low-FDI' category) should be in between the first and the second group; the low estimate for this control group may be explained by the tendency of establishing industrial zones in districts with unobserved relative disadvantage (this decision is at the government's discretion). In addition, industrial zones may have attracted also domestic firms not captured in FDI data, which may have contributed to a small and insignificant estimate of the trend break. A similar argument holds for the outflow rate (Table 1.12).

responds roughly to 800 additional unemployed workers finding a job due to the investment project, which makes the impact of the investment project also economically significant. This number, however, is not necessarily equal to the net impact of the investment on local unemployment due to secondary effects (spillovers, crowding-out) and possible migration and transition from out-of-the-labor-force.

1.7.2 Employment

Figure 1.5 shows the employment rate, labor force, participation rate and unemployment rate for Kolín during the years preceding and following the TPCA investment.[28] Visual inspection suggests that the participation rate maintained its level at approximately 70 percent and experienced an increase starting in 2005. There was a steady increase in the employment rate and a decrease in the unemployment rate over the years 1999-2004, however, this trend is more pronounced after 2004 as evidenced by sharper curves. This may be the effect of inward FDI, but it is possible that the conditions on the labor market were improving prior to the arrival of the investor, giving a significant positive trend throughout the whole period. Filtering out overall trends, a difference-in-differences estimation yields a positive and lasting true impact on the employment rate, which significantly increased by 3.7 percentage points (Table 1.10). Since the productive age population (15-65 years of age) in Kolín during 2002-06 was approximately 68,000, this percentage change corresponds to an absolute increase in employment of almost 2,500 individuals.[29]

The number of created vacancies reported by TPCA was 3,000. From anecdotal evidence it is known that approximately one half of the workers migrated from abroad or from other districts.[30] Presuming that most of these workers are not

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

[29] The discrepancy between the number of unemployed finding a job and net employment generation may be explained by the out-of-the-labor-force individuals becoming employed.

[30] These workers may be underrepresented in the Labor Force Survey data as most of them still possess a different place of residence or live in long-term dormitories, which are not included in the survey. Indeed, examination of the net migration rate shows an increase of 0.2 to 0.5

captured in the LFS, the reported number should be adjusted so that it includes only workers from the district. This gives us 1,500 individuals, which, compared with the estimated 2,500, indicates a positive spillover of approximately an extra 1,000 individuals who found a job due to the plant opening, but not in the plant itself.

Overall, the TPCA automobile investment in Kolín seems to have positively affected local employment. Considering that 1,500 local workers were hired by the investor (one half of the created vacancies reported by TPCA) and the estimated increase in employment was 2,500, there was a positive spillover of roughly 1,000 individuals who found a job indirectly due to FDI inflow.[31]

The increase in employment can be divided into inflows from local unemployment (800 workers) and out-of-the-labor-force or migrants (the remaining 1,700 workers). The medium-term spillover effects on suppliers or other industries have been positive and outweighed possible crowding-out effects due to backward or forward linkages for domestic firms and distributors.

1.7.3 Unemployment outflow and inflow

The evolution of unemployment flows in Kolín is mapped on Figure 1.6. There appears to be a trend of decreasing inflow and less pronounced increasing outflow starting from 2003. Visual illustration, therefore, suggests that there could have been a positive impact of TPCA on the levels of unemployment through a higher outflow rate.

Tables 1.12 and 1.13 present the results of the difference-in-differences estimations of the effect of the investment project on the outflow and inflow rates for the three comparison groups. We focus on comparison group one as above. There is a significant positive effect on unemployment outflow, which experienced a statisti-

percentage points, which corresponds to 200 to 500 registered individuals migrating to Kolín (see Table 1.11). Therefere, it can be inferred that at least 1,000 individuals without permanent or temporary residence were attracted by the plant opening.

[31] This is a lower bound as the estimate does not capture likely positive long-term externalites such as knowledge spillovers and human capital improvement.

cally and economically significant increase by 2.6 percentage points. If allowed for the transitory period between the start of the investment project and the time the effect actually takes place, the impact rises to 3 to 5.5 percentage points (increasing with the length of the delay). In contrast, the impact of TPCA on the inflow into unemployment is always statistically insignificant even when allowing for the time delay (column 3 in Table 1.13). The TPCA investment, therefore, increased the unemployment outflow rate while leaving the inflow rate into unemployment unaffected, thereby implying a decrease in the average duration of unemployment.

1.7.4 Exit hazard rates

The results of equation (1.9) estimating the impact of the TPCA investment project on aggregate exit hazard rates for different durations are displayed in Table 1.14. A positive and statistically significant increase in the aggregate exit hazard rate for leaving unemployment during the following three months for durations of less than 9 months is identified but no significant effect is found for durations greater than 9 months. The probability of leaving unemployment during the following quarter 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. This important result illustrates the fact that the plant opening improves the chances of short-term unemployed to find a job while the prospects of long-term unemployed remained the same as before. Moreover, the findings indicate that aggregate hazard rates are not only smaller for longer durations (due to individual heterogeneity and negative duration dependence)[32] but long-term unemployed possess limited ability to return to employment and capitalize on new job opportunities, which is a key goal of the government in its effort to battle unemployment persistence and decrease the share of long-term unemployed. This observation may be attributed to certain stigma effects of long-term unemployed and

[32] Unemployment dynamics and aggregagate duration data in the Czech Republic are analyzed in Franta (2008) who finds that both unobserved heterogeneity and individual duration dependence contribute to aggregate duration dependence.

a deterioration of skills (duration dependence) but also to initial lower human capital endowment and an ensuing mismatch on the labor market (unobserved heterogeneity of agents).

1.7.5 Placebo simulations

We use placebo simulations to test the bias of the estimates and, using one thousand placebo interventions, we estimate the size of the impact and its standard error for each of them. If the standard errors are unbiased, the fraction of rejected null hypotheses 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. 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 began. The following regression is then estimated:

$$y_{it} = \phi_i + \alpha + \beta MANUF_{it} + \gamma COL30_{it} + \delta COL50_{it} + \mu YEAR_t + \eta Q_2 + \psi Q_3 + \varphi Q_4 + \rho PLAC_{it} + \epsilon_{it}, \tag{1.10}$$

where the explanatory variables are the same as in equation (1.8), 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.

Using placebo interventions, rejection rates for ordinary OLS standard errors and bootstrapped standard errors are compared. Table 1.15 reports 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.[33] The block bootstrapped technique did not change the significance of the estimates, therefore it is reasonable to claim that there really was a significant and positive impact of the project on the local labor market.

1.8 Conclusion

In this paper, we evaluate the impact of the TPCA investment project (the largest foreign investment project in the Czech Republic between 1993-2006) in the district of Kolín on local labor market performance. Our identification strategy rests on a comparison of Kolín with control groups of districts. Control group districts did not experience as large an FDI influx as Kolín, but otherwise resemble Kolín in terms of labor market structure and the propensity to attract a large one-off FDI inflow.

Using difference-in-differences estimation, the investigation of the dynamics of the unemployment rate, the employment rate, unemployment flows and aggregate exit hazard rates out of unemployment indicates a positive and significant (both statistically and economically) impact on the unemployment rate, which decreases by 1.7 percentage points. The impact on the employment rate is also positive as the employment rate increases by 3.7 percentage points following the TPCA investment. Thus, the investment project affected the whole district positively: the estimated number of people who found a job exceeded the number of employees at TPCA. Since it is known from anecdotal evidence that more than half of the workers in

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

the company migrated to get a job at TPCA, there must have been a substantial spillover on suppliers or other industries. To summarize, the local labor market arguably benefited from FDI inflow and a crowding-out effect to counteract direct vacancies created by such a project appears not to have occurred.

The main factor that contributed to the unemployment decrease was an increase in outflow rate from unemployment of 2.6 percentage points while the inflow rate into unemployment remained unaffected. As can be deduced from the exit hazard rates analysis, a higher outflow rate and a subsequent decrease in average duration is driven primarily by a rise in aggregate exit hazard rates from unemployment with a duration of less than 9 months, increasing by 2.5, 3.2 and 4.4 percentage points in the three duration categories. On the other hand, unemployment durations greater than 9 months do not display any significant impact of the investment project, illustrating the alarming fact that only short-term unemployed benefit from a new plant opening. This finding points to a persistence of unemployment and asserts that the long-term unemployed remain intact with government-driven job creation schemes. Returning this group of unemployed into the working process remains one of the main challenges of policymaking.

Various robustness checks such as different specifications of time delay to account for a possible lag in the investment impact, alternative estimates of standard errors (bootstrapped from the data) and simulations of placebo interventions were applied since there is some doubt about the consistency of conventional difference-in-differences standard errors (Bertrand et al., 2003). Indeed, a serious underestimation of the standard deviation of the simple OLS estimates was found and, therefore, a blocked bootstrap technique was used to compute standard errors. The consistency of standard errors was checked by placebo simulations, where a thousand placebo interventions were randomly generated. Block bootstrapping substantially reduces the number of false rejections of the null hypothesis, however, the rejection rate is still slightly greater than five percent. Most importantly, the estimates do not change magnitude or significance and the results remain valid under different specifications.

Considering the investment incentive for TPCA (1.78 billion CZK) and its estimated net impact on unemployment (800 unemployed individuals finding a job), the financial subsidy per one created job amounts to 2.23 million CZK. A simple per capita comparison of pecuniary costs incurred and expenditures saved on benefits to unemployed can provide a useful assessment benchmark of the relative price of this subsidy. Saved benefits can be calculated as the sum of average yearly direct unemployment benefits, taxes and social insurance contributions imposed on wages. Elbona (2005) asserts that the average yearly direct unemployment compensation is about 0.12 million CZK per one unemployed and 0.175 million CZK if lost tax revenues are considered. Based on these approximations, the investment project would pay off, in simple monetary terms, if jobs created would be secured for at least twelve years. Should the investor decide to move the production after 2015, twelve years since the jobs were created, the whole project would bring a net fiscal gain.

However, such approximations should be considered cautiously. Firstly, we provide only the medium-term impact of a relatively recent policy intervention, while long-term outcomes will be revealed only after many years. Secondly, our estimates do not capture the long-term net spillover effect, likely a positive one, affecting the rest of the country beyond the borders of the Kolín district. Thirdly, one can hardly predict whether the large investment project in Kolín prevented some other projects from coming in the future. Therefore, at this moment, it is too daring to hypothesize about the long-term impact on the local labor market or the whole country. However, we can conclude that the FDI incentives seem to fiscally worthy as it is likely the production plant will remain producing for at least twelve years — the upper bound of the minimum time required to produce a payoff.

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1.10 Appendix

Figure 1.1: The location of the TPCA investment in Kolín

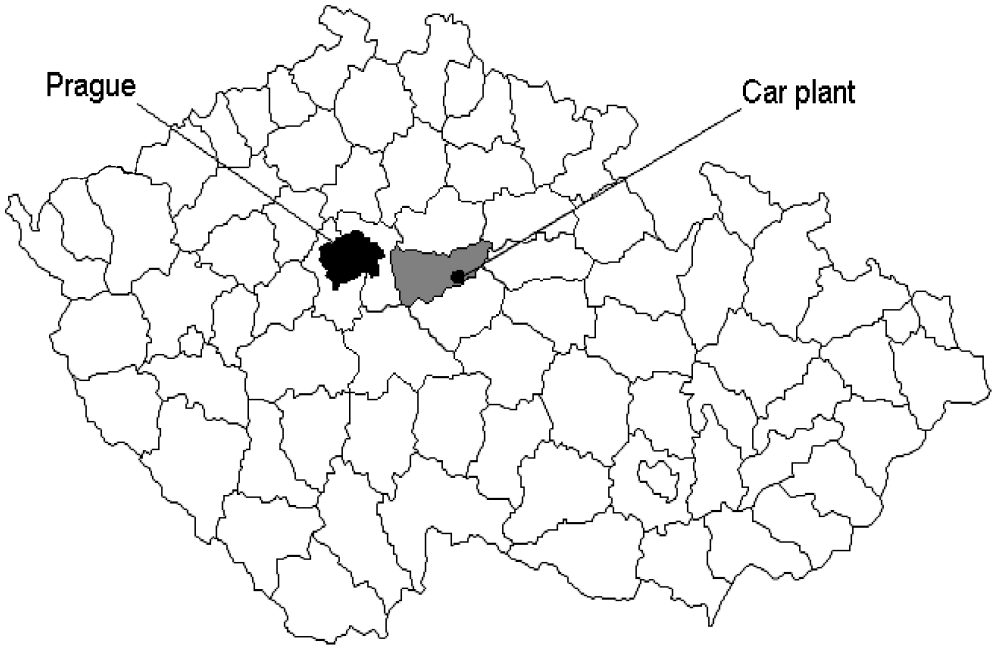

Figure 1.2: The unemployment rate in Kolín and neighboring districts

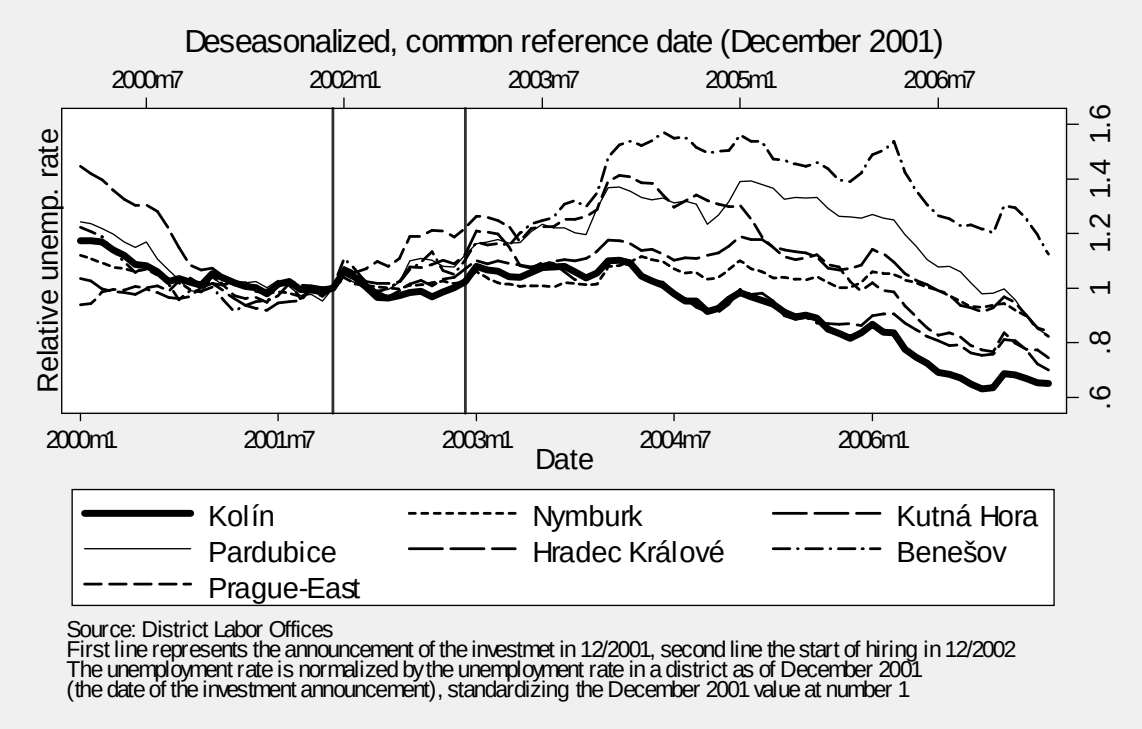

Figure 1.3: The unemployment rate in Kolín, Central Bohemia and the Czech Republic

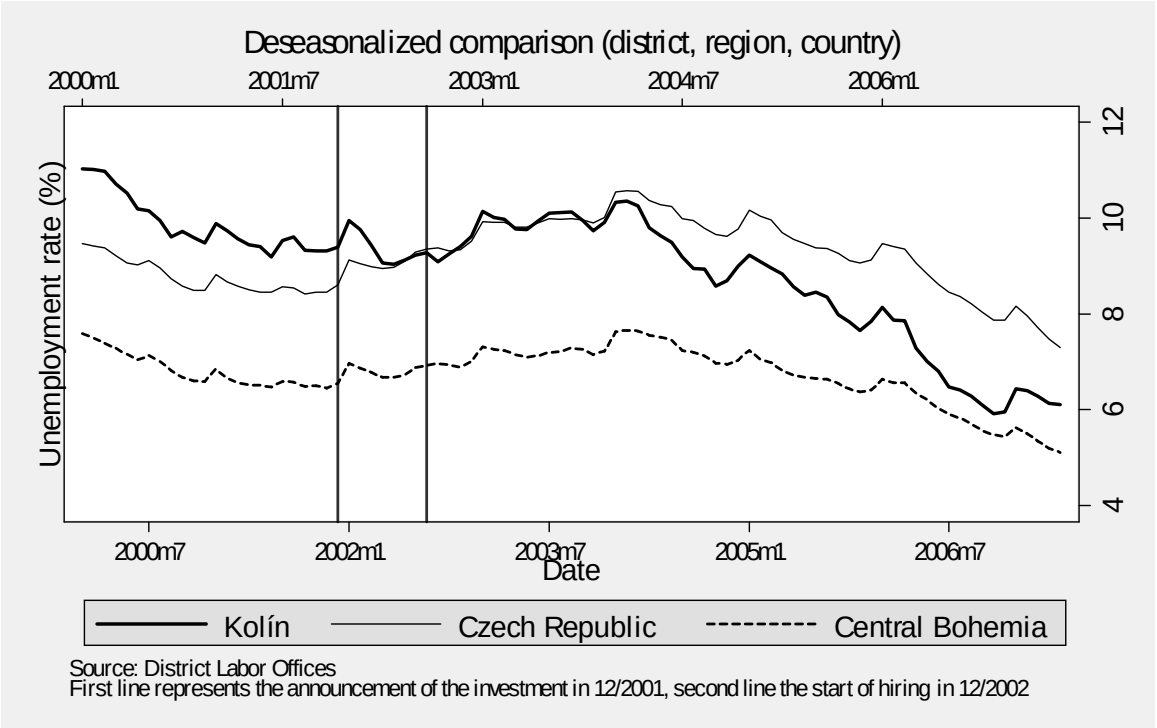

Figure 1.4: The distribution of FDI inflow per capita (excluding Prague)

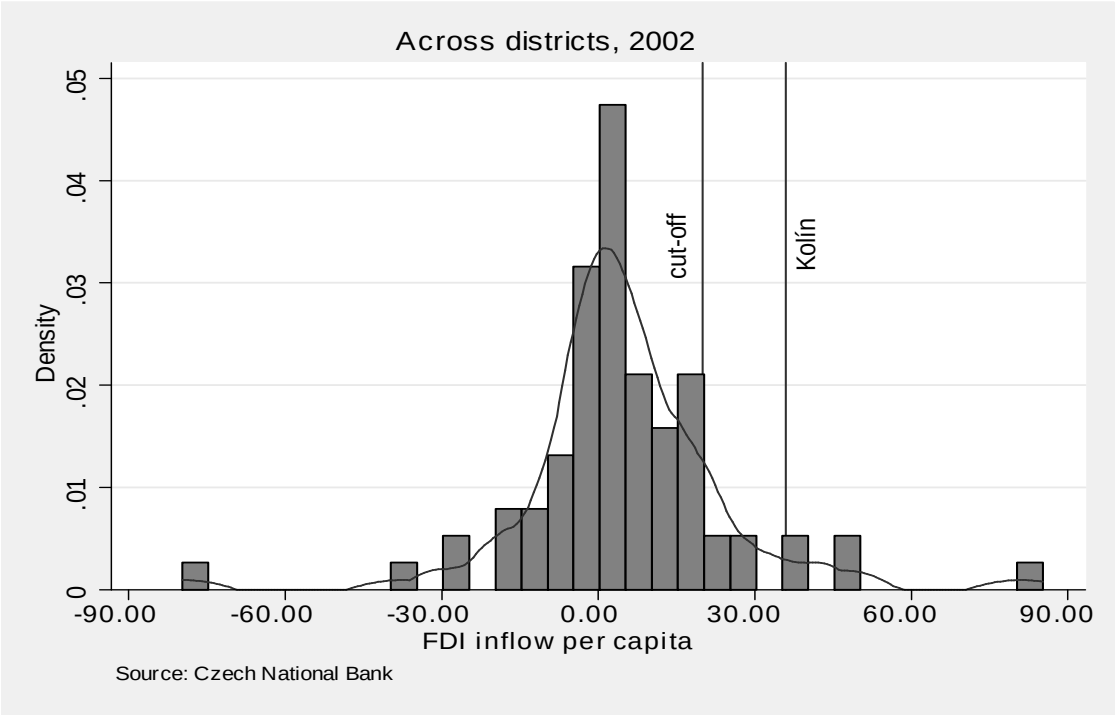

Figure 1.5: Employment, participation and unemployment rates in Kolín

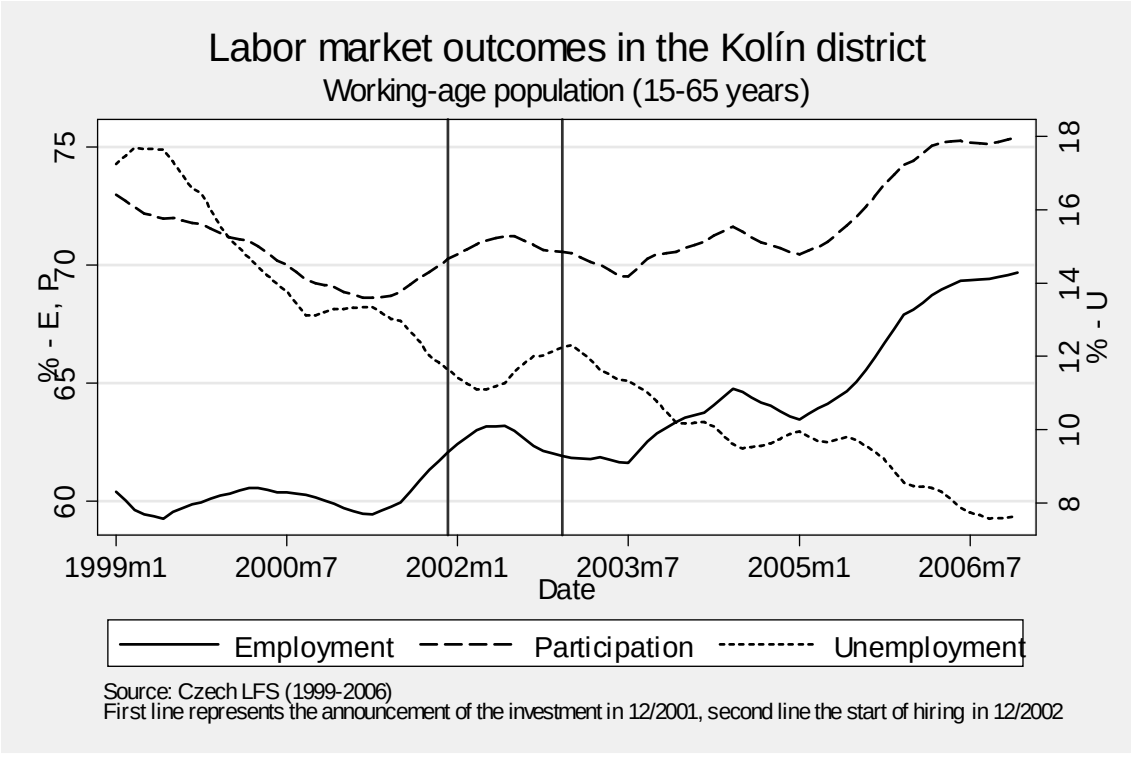

Figure 1.6: Unemployment flows in Kolín

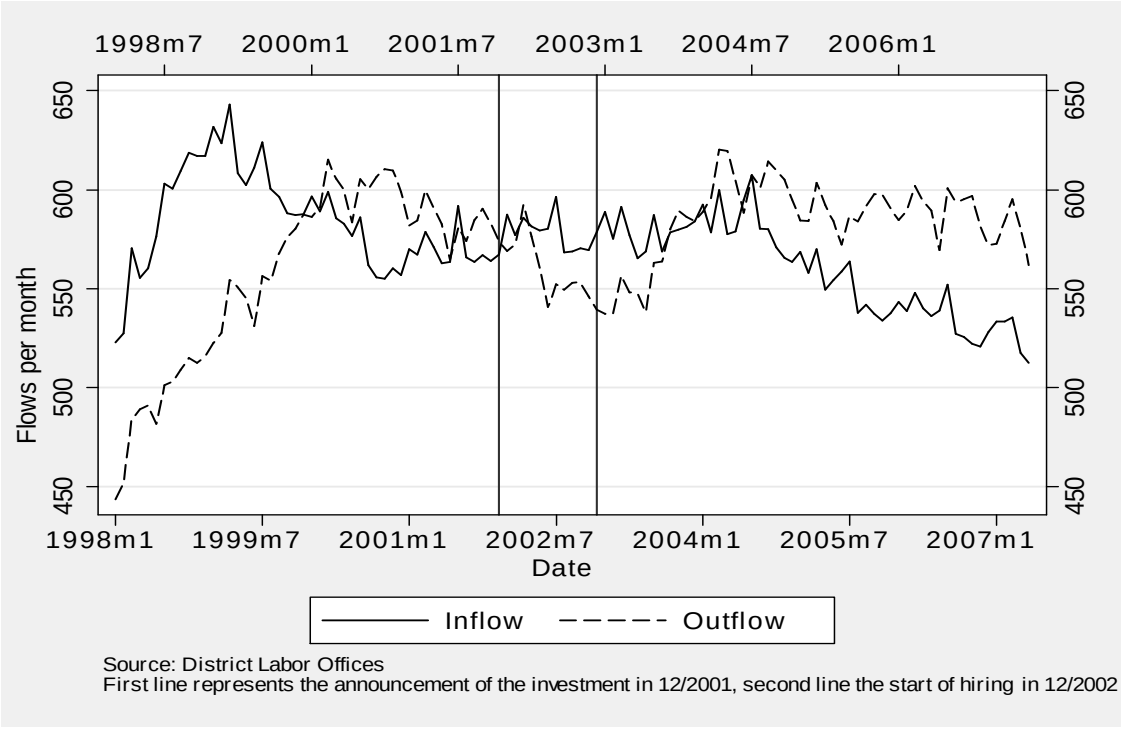

Table 1.1: Yearly GDP growth in real prices (percent)

	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 1.2: FDI over time at the country, regional and district level

The table presents a comparison of overall FDI and the share of state-supported FDI for units with different details of aggregation which are host to the TPCA investment project. The third column presents the change in the stock of foreign direct investment between 1998 and 2006 obtained from the Czech National Bank data. The fourth column contains the amount of supported FDI self-reported by investors to the state agency CzechInvest and the last column reports the share of supported investment on the overall foreign direct investment (the overestimation of eventual FDI may arise from the fact that planned investment magnitude is reported prior to the realization of an investment project and that the completion of the whole project may be distributed over a longer period of time).

	FDI			supported FDI	
bil. CZK	*1998*	*2006*	*1998-2006*	*1998-2006*	*%*
Czech Republic	429,2	1666,8	1237,6	434,2	35,1
Czech Republic (w/o Prague)	227,7	781,4	553,7	424,2	76,6
Central Bohemia region	52,9	183,9	131,0	93,9	71,7
Kolín district	0,8	15,3	14,5	29,6	204,0
TPCA				23,5	

Source: Czech National Bank, CzechInvest.

Table 1.3: Characteristics of Kolin 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
Prague - East	2.9	16,667	50	45

Source: ČSÚ (2001), author's own calculations.

Table 1.4: Characteristics of Kolin compared with the rest of the Czech Republic (excluding Prague)

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

	1999	2000	2001	2002	2003	2004	2005	2006
Kolín								
FDI stock per capita (thous. CZK)	35.33	65.79	80.65	154.19	311.83	189.02	129.16	288.40
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	6.84
% LTU (>1 year)	27.78	36.93	36.73	34.00	35.06	35.57	35.40	31.01
% without a school-leaving certificate*	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 stock per capita (thous. CZK)	72.13	94.14	109.41	120.26	132.96	145.88	146.89	162.75
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 (%)	9.36	9.74	9.26	9.97	10.75	10.96	10.38	9.47
% LTU (>1 year)	27.28	37.21	39.10	38.13	40.42	42.43	43.25	43.02
% without a school-leaving certificate*	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

* - A school-leaving examination at the end of all secondary schools, most specialized schools and some vocational programs ("maturita" in Czech) corresponding approximately to the U.K. General Certificate of Education (GCE) or the German "Abitur" exam.

Source: Labor Force Survey, Czech National Bank, Czech Statistical Office (2007).

Table 1.5: Comparison of Kolin and the rest of the Czech Republic (excluding Prague)

The outflow rate (o) is calculated as a share of people leaving the pool of unemployed among unemployed, the inflow rate is the percentage of people becoming unemployed out of employed individuals and the unemployment rate is calculated as a share of unemployed among the active labor force.

	Kolín			CR (w/o Prague & Kolín)		
	o (%)	*s (%)*	*u (%)*	*o (%)*	*s (%)*	*u (%)*
1998	14.57	1.27	6.92	13.71	1.20	6.76
1999	12.15	1.48	9.91	11.36	1.36	9.38
2000	13.12	1.41	10.24	12.21	1.26	9.74
2001	13.69	1.40	9.48	11.90	1.22	9.26
2002	13.09	1.41	9.35	10.58	1.27	9.97
2003	12.03	1.35	9.96	9.87	1.24	10.76
2004	13.42	1.36	9.43	10.19	1.25	10.96
2005	14.06	1.20	8.43	10.58	1.17	10.38
2006	16.39	1.08	6.84	11.60	1.09	9.47
2007	18.66	1.05	6.29	13.99	1.00	8.52

Source: Unemployment Registry (District Labor Offices), Czech Statistical Office (2007).

Table 1.6: The 76 districts and 13 regions in the Czech Republic

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	

Note: The city of Prague does not belong to the Central Bohemia region.

Table 1.7: Estimates from a probit regression used for the calculation of propensity scores

	probit regression	
	dy/dx	std
AGRI	-0.003	(0.003)
ROAD	0.004*	(0.002)
COL30	0.031*	(0.014)
COL50	-0.003	(0.008)
MANUF30	-0.005	(0.005)
MANUF50	0.010*	(0.006)

Note: Marginal effects from a probit regression evaluated at the means of independent variables with the dummy indicating a "high-FDI" district. Districts with an 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". The variable AGRI indicates the share of agricultural land on the total area of a district, the variable ROAD denotes the density of roads per 100 square kilometres, COL30 and COL50 indicate the share of college educated population between 18 and 30 years and between 30 and 50 years, respectively, and MANUF30 and MANUF50 stand for the empoyment share in a manufacturing sector for the same age cohorts. Significance level: * 5%.

Table 1.8: Control groups

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

Note: Control group 1 is based 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. Control group 2 contains all disticts except Prague. Control group 3 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).

Table 1.9: Impact of the investment on the unemployment rate

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

Note: The table reports estimates from linear regressions with the unemployment rate as a dependent variable. Values denote the impact of the plant opening on the unemployment rate (unemployed divided by the labor force) in percentage points change. 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. 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. The average unemployment rate for Kolín during 2001 (the year prior to the announcement of the investment) was 9.48 percent. Both robust and bootstrapped standard errors are in parentheses. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 1.10: 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	3.752	4.286	5.652	6.200	4.284	4.769	5.917	6.763	1.654	2.030	2.337	2.664
(robust)	(0.62)***	(0.66)***	(0.70)***	(0.79)***	(0.28)***	(0.32)***	(0.42)***	(0.45)***	(0.92)	(1.09)	(1.32)	(1.32)
(bootst)	(1.71)*	(1.98)*	(2.62)*	(2.87)*	(2.09)*	(2.39)*	(2.89)	(3.09)*	(1.13)	(1.43)	(1.94)	(1.92)
Imp_mid		1.733	1.536	2.583		2.372	1.907	2.680		0.353	0.860	1.153
(robust)		(0.60)*	(0.56)*	(0.42)*		(0.20)***	(0.18)***	(0.18)***		(0.40)	(0.55)	(0.75)
(bootst)		(0.85)*	(0.76)*	(1.22)		(1.19)*	(0.96)*	(1.22)*		(0.46)	(0.71)	(0.95)
Const	60.607	60.921	61.950	61.526	63.715	63.764	63.889	63.840	51.837	52.126	52.322	52.193
(robust)	(1.82)***	(1.78)***	(1.93)***	(1.78)***	(1.01)***	(1.01)***	(1.03)***	(1.02)***	(1.80)***	(2.06)***	(2.41)***	(2.20)***
(bootst)	(2.29)***	(1.72)***	(2.08)***	(1.96)***	(0.96)***	(1.17)***	(1.23)***	(0.95)***	(1.99)***	(2.03)***	(2.93)***	(2.46)***
R-sq	0.161	0.168	0.190	0.187	0.087	0.088	0.091	0.171	0.311	0.310	0.310	0.311
N	252	252	252	252	2736	2736	2736	8208	216	216	216	216

Note: The table reports estimates from linear regressions with the employment rate as a dependent variable. Values denote the impact of the plant opening on the net migration rate (the diference between immigrants and emigrants divided by the average population) in percentage points change. 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. The announcement of the investment (at the end of 2001) is taken as a break date and specifications allowing for different potential delay in policy enactment are used for a robustness check. The average employment rate for Kolín during 2001 (the year prior to the announcement of the investment) was 59.91 percent. Both robust and bootstrapped standard errors are in parentheses. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 1.11: Impact of the investment on the net migration rate

Migration 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	0.188	0.262	0.274	0.575	0.183	0.298	0.356	0.565	0.272	0.382	0.455	0.722
(robust)	(0.05)***	(0.08)*	(0.15)	(0.12)**	(0.04)***	(0.05)***	(0.06)***	(0.06)***	(0.16)	(0.21)	(0.31)	(0.28)
(bootst)	(0.09)*	(0.13)*	(0.13)*	(0.28)*	(0.09)***	(0.15)***	(0.18)*	(0.29)*	(0.16)	(0.21)	(0.35)	(0.42)
Imp_mid		-0.131	0.09	0.02		-0.273	-0.068	-0.063		-0.117	0.062	0.055
(robust)		(0.09)	(0.10)	(0.05)		(0.04)***	(0.03)*	(0.03)*		(0.06)	(0.06)	(0.10)
(bootst)		(0.11)	(0.07)	(0.03)		(0.14)*	(0.04)	(0.03)*		(0.08)	(0.06)	(0.11)
Const	-0.479	-0.439	-0.417	-0.326	0.150	0.166	0.176	0.177	-0.497	-0.380	-0.332	-0.306
(robust)	(0.52)	(0.54)	(0.57)	(0.48)	(0.18)	(0.18)	(0.18)	(0.17)	(0.50)	(0.54)	(0.57)	(0.46)
(bootst)	(0.58)	(0.47)	(0.46)	(0.45)	(0.28)	(0.18)	(0.21)	(0.17)	(0.47)	(0.60)	(0.60)	(0.65)
R-sq	0.151	0.166	0.143	0.226	0.083	0.087	0.086	0.092	0.013	0.032	0.022	0.097
N	63	63	63	63	684	684	684	684	54	54	54	54

Note: The table reports estimates from linear regressions with the net migration rate as a dependent variable. Values denote the impact of the plant opening on the employment rate (employed divided by the total working-age population) in percentage points change. 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. The announcement of the investment (at the end of 2001) is taken as a break date and specifications allowing for different potential delay in policy enactment are used for a robustness check. The average net migration rate for Kolín during 2001 (the year prior to the announcement of the investment) was 0.18 percent. Both robust and bootstrapped standard errors are in parentheses. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 1.12: Impact of the investment on outflow from unemployment

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

Note: The table reports estimates from linear regressions with outflow from unemployment as a dependent variable. Values denote the impact of the plant opening on the outflow rate (the outflow divided by the stock of unemployed) in percentage points change. 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. The announcement of the investment (at the end of 2001) is taken as a break date and specifications allowing for different potential delay in policy enactment are used for a robustness check. The average outflow rate for Kolín during 2001 (the year prior to the announcement of the investment) was 13.69 percent. Both robust and bootstrapped standard errors are in parentheses. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 1.13: Impact of the investment on inflow into unemployment

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

Note: The table reports estimates from linear regressions with inflow into unemployment as a dependent variable. Values denote the impact of the plant opening on the inflow rate (the inflow divided by the stock employed) in percentage points change. 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. The announcement of the investment (at the end of 2001) is taken as a break date and various specifications allowing for different potential delay in policy enactment are used for a robustness check. The inflow rate for Kolín during 2001 (the year prior to the announcement of the investment) was 1.40 percent. Both robust and bootstrapped standard errors are in parentheses. Significance levels: *** 0.1%, ** 1 %, * 5%.

Table 1.14: Impact of the investment project on aggregate exit hazard rates

	Control group			Reference
	1	**2**	**3**	
Duration 0-3 months				
ρ_1	2.528*	2.023***	2.502*	46.98
	(1.164)	(0.359)	(0.978)	
Const	39.849***	48.228***	47.607***	
	(3.726)	(1.459)	(3.446)	
Duration 3-6 months				
ρ_2	3.152*	1.747**	1.230	35.35
	(1.264)	(0.346)	(1.478)	
Const	30.983***	39.949***	27.205	
	(5.228)	(1.646)	(5.636)	
Duration 6-9 months				
ρ_3	4.377***	2.149***	0.888	38.51
	(1.181)	(0.288)	(1.278)	
Const	37.575***	45.141***	35.728***	
	(4.536)	(1.074)	(2.210)	
Duration 9-12 months				
ρ_4	0.290	-0.899*	-0.538	27.13
	(1.679)	(0.326)	(1.252)	
Const	26.258***	34.456***	25.634***	
	(7.622)	(1.494)	(4.506)	
Duration >12 month				
ρ_5	0.983	0.062	0.777	18.73
	(0.534)	(0.955)	(0.563)	
Const	15.705***	30.579***	17.142***	
	(1.491)	(1.321)	(1.449)	
Joint sign. of ρ	0.012*	0.043*	0.117	
N	252	2584	204	

Note: The table reports estimates from equation (1.9) with aggregate exit hazard rate out of unemployment as a dependent variable. Columns (1)-(3) present the results of the estimation of the effects of the plant opening on the exit hazard rate out of unemployment for different unemployment durations and report the impact on the exit hazard rate in percentage points. Column (4) offers a comparison of the impact with the reference hazard rate in Kolín during 2001 (the year prior to the announcement of the investment project). 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. Standard errors (in parentheses) are robust and clustered from the data. Significance levels: *** 0.1 %, ** 1 %, * 5 %.

Table 1.15: Difference-in-differences rejection rates for intervention effect from placebo simulations

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

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 1,000. 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 consists of districts chosen by propensity matching, the second control group includes all districts except for Prague and the third control group uses districts with a newly designated industrial zone. Standard errors are in parentheses.

Chapter 2

The Role of Investment Incentives in Regional FDI Reallocation: A Regression-Discontinuity Approach

2.1 Introduction

Foreign direct investment (FDI) is often viewed as a crucial part of economic development and job creation. Policymakers, therefore, often employ various FDI promotion measures such as direct FDI subsidies or tax reliefs. On the other hand, a sceptical stance towards FDI promotion finds the costs of such a policy too high and argues that investment inflow would have occurred even in the absence of the investment. Thus, the economic merit of FDI subsidies is not straightforward and should be subjected to careful analysis. An evaluation of the impact of FDI subsidies on the economy can be split into two parts: first, estimating the effect of subsidies on FDI inflow and its distribution, and, second, identifying the effect of FDI on productivity.

This paper concentrates on the former link between FDI subsidies and FDI attraction: it studies the impact of introducing a formal investment incentive scheme in

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the Czech Republic on regional distribution of FDI and assesses whether it is possible to alter location decisions of foreign investors. Specifically, using district-level data, the magnitude and the significance of changes in regional FDI per capita resulting from the adoption of the investment incentive program is quantified.[1] In addition, the importance of conventional FDI determinants such as educational structure, industry structure and geographic factors is inspected.

Concerning the impact of FDI on economic growth and productivity, there exist a fair amount of studies identifying FDI as an engine of economic growth, employment generation and poverty alleviation (Campos and Kinoshita, 2002; Tondl and Vuksic, 2003). Apart from strengthening the competitive environment in a host country, FDI promotes international trade and enhances host country productivity through multiple channels: capital formation, greenfields and takeovers, technology transfers, skill enhancements and knowledge spillovers.[2] These spillovers occur when domestic firms improve their know-how by technology imitation or knowledge diffusion, or domestic workers increase their skills through training programs in foreign companies (Crozet et al., 2004) and can be realized through horizontal (competition within the sector) or vertical (supply) channels. Javorcik (2004) studies horizontal and vertical spillover effects in Lithuania between 1996-2000, finding no significant horizontal spillover effects. However, she finds a positive and significant vertical spillover effect of FDI on domestic firms. Concerning the Czech Republic, Stančík (2007) offers a summary of recent FDI spillover literature and analyzes the effects of FDI on the sales growth rate of domestic companies. He addresses a potential endogeneity of FDI with respect to future industry growth and finds negative horizontal and vertical effects, particularly in upstream sectors. In a more specific study of Czech takeovers, Jurajda and Stančík (2009) find a varying impact of foreign takeovers on

[1] It should be noted that the focus of this analysis is not across-country FDI attraction, but rather within-country FDI allocation. In other words, assuming that FDI comes to the country, we study whether it is possible to direct FDI flows to distressed regions with the aid of government policy tools. Across-country comparison would require analysis of investment schemes of neighboring countries and is beyond the scope of this paper. For an across-country analysis of FDI determinants in transition countries, see, e.g., Bevan and Estrin (2000).

[2] See De Mello (1997) or Ozturk (2007) for a survey of literature on FDI growth effects.

domestic acquisitions according to industry sectors and target markets: the effect of takeovers on firms' various performance indicators is significantly positive for non-exporting manufacturing industries; while it decreases in the case of export-oriented firms and vanishes entirely for service-sector firms.

The role of FDI in the world economy rose steadily during last two decades, in especially in post-communist countries (see Figures 2.1 and 2.2).[3] In the Czech Republic, a systematic approach to FDI promotion was adopted in 2001, providing foreign investors with a possibility to receive a financial subsidy per created vacancy or a retraining subsidy. A fundamental feature of this incentive system is that the exact amount of the subsidy is different across districts, offering higher investment incentives in districts with higher unemployment rates, thereby motivating investors to locate in more distressed regions. The identification strategy is based on a discontinuity represented by an unemployment level threshold which divides districts into several eligibility groups. Districts with the unemployment rate sufficiently close to a cutoff point are considered as randomly assigned into treatment and control groups, and a regression-discontinuity (RD) estimation is employed for identifying the causal impact of the program.

The motivation for this study is threefold. First, the topic is highly policy-relevant, and the evaluation of the investment incentives impact proposes practical implications: understanding the mechanisms behind foreign investors' decision process may improve policymakers' ability to direct FDI inflows into more distressed regions. Second, there is a lot of public money involved in investment policy funding, hence, from a social stance, it is necessary to assess the efficiency of the incentive system. On one hand, FDI inflow contributes to regional development and income growth (Wen, 2007), thereby decreasing public spending on unemployment benefits and social assistance. On the other hand, huge amounts of state subsidies require substantial budget spending. A proper evaluation of investment incentives requires a correct assessment of costs as well as benefits, the keystone being the identifica-

[3] There was a modest decline in FDI flows in 2008 due to the global economic slowdown.

tion of what would happen without the adoption of the scheme. Third, there is a lack of literature that rigorously evaluates investment incentives in the Central European region. This paper presents a contribution to the discussion on the role and appropriateness of public policies in FDI reallocation by combining a rigorous identification strategy and policy relevance.

2.2 Literature survey

Empirical studies on FDI determinants differ in the focus of their analysis - some concentrate on macroeconomic variables (gross domestic product, inflation, unemployment, price level) while others emphasize institutional (political climate, law enforcement) or location factors (quality of infrastructure, human capital endowment, proximity of target markets). Another segmentation of the research regards time horizon: studies adopt a cross-section of countries or panel data. An advantage of a panel dataset is that it allows the identification of important location determinants - such as a policy change - by exploiting the variation over time. Lastly, empirical literature concerning FDI determinants can be divided into between-country and within-country studies depending on whether it focuses on an international comparison or a regional analysis within a particular country.[4]

Considering within-country studies, seminal research on FDI inflow determinants is represented by Carlton (1983) and Coughlin et al. (1991), who analyze U.S. firms' location determinants on state and county levels. Analogical studies emerged in other countries such as Brazil (Hansen, 1987) or China (OECD, 2000). These studies focused on the relation between the characteristics of a region and FDI inflow. In the case of the U.S., states with a higher per capita income and higher manufacturing activity attracted FDI while higher wages and higher taxes deterred it (Coughlin et al., 1991). Specific to automotive-related industries, Smith and Florida (1994) find that agglomeration economies matter for Japanese manufacturing plants. New

[4]See Bloningen (2005) for a comprehensive survey of literature on FDI determinants.

establishments preferred locations in close proximity to Japanese assemblers and with higher overall manufacturing density. Surprisingly, contrary to the prevailing literature, higher wages and higher concentration of minorities are recognized as positive and significant determinants of FDI inflow.

Country-specific studies suggest that significance of various FDI determinants differs across countries: in the case of Portugal, the strongest primary location factor is agglomeration of the service industry and the distance from principal cities, while regional labor costs do not matter in foreign firms' decision processes (Guimaraes et al., 2000). On the contrary, in an analysis of FDI location in Italy during 1986-1999, Basile (2004) finds local labor costs to be significant. Specifically, he claims that the main FDI determinants differ according to the type of foreign entry mode. Acquisitions are attracted by agglomeration economies, emulating the overall distribution of existing firms, and consider high-unemployment regions as less attractive for their location. On the contrary, greenfield investments are not affected by agglomeration economies and view high-unemployment regions as a signal of available labor force and thus attractive. Overall, the author assesses that FDI to the southern part of Italy is below its potential and calls for the implementation of regionally diversified fiscal policies in order to overcome large regional differences in economic growth.

Turning to the empirical evidence from the Czech Republic, Valachyová (2005) emphasizes that FDI inflow into the manufacturing sector follows the geographical distribution of the manufacturing industry at the beginning of transition. In addition, she observes a larger greenfield FDI influx for locations bordering with Germany and Austria and regions with better infrastructure and business services. Also, she finds a positive and statistically significant effect of industry-specific agglomeration.

International studies analyzing country-level FDI determinants find business environment, labor costs and the form of privatization process to be the most important factors influencing FDI inflow during transition (Lansbury et al. (1996) for Central European countries). Similarly, Bevan and Estrin (2000) find labor costs,

the speed of reforms and political signals to significantly affect levels of FDI prior to the EU accession. In a more recent work, Jurajda and Terrell (2009) study regional disparities in post-communist economies and, among other issues, analyze regional patterns of FDI inflow. They find higher FDI flows into regions with a higher initial human capital endowment (measured as a share of college educated people at the end of communism).

Compared to papers studying fundamental FDI determinants, literature on investment incentives and FDI promotion policies is less numerous. There is an ongoing debate about the effectiveness of such policies. Some studies show that there exists a positive albeit small effect of using incentives to induce investment (Rainey and McNamara, 1999). Other papers, however, conclude that their role is insignificant and that investors' location is predominantly affected by primary location factors (Guimaraes et al., 1998; Mai, 2002). Examining agglomeration effects and regional policy impact on FDI in France, Crozet et al. (2004) find no evidence of a positive impact of regional policies on location choices, but they find a strong pattern of firm clustering. However, this effect fades out over time, suggesting a "learning process" of foreign investors as it becomes more important to be near target markets and less important to be a part of a cluster. On the same note, in their study of the Czech Republic, Hungary and Poland, Guagliano and Riela (2005) analyze the impact of industrial park designation on FDI attraction and their results show only a weak causal link between the presence of these special zone and FDI inflows.

As can be seen, the discussion about the purposefulness of investment incentives is far from being settled. This fact is emphasized by a stream of studies claiming the effect of incentives can not be generalized and depends on the form of incentives and its timing as well as the type and the size of the firm (Fox and Murray, 2004). Along this line, focusing on public incentives policy in Ireland, Barrios et al. (2006) find a positive effect of promotion policy only for low-tech firms and only during the period when a more "laissez-faire" approach to regional policy is introduced. Other studies document that the effect of public incentives on the economy is vanishing.

Cannon (1980) analyzes the impact of incentives on employment and finds only transitory effect. Similarly, Schalk and Unitiedt (2000) claim that although the initial impact of incentive policy on attracting new investment is initially positive, it fails to permanently increase regional productivity and competitiveness in the long run.

In the case of the Czech Republic, there is a dearth of rigorous empirical literature evaluating the use of investment incentives, partly due to the initial absence of clear and stable rules for investment incentive schemes and a time delay needed for analyzing the impact of incentives. Valachyová (2005) marginally tackled this issue by analyzing separately FDI determinants for the set of all firms and the subset of firms receiving an investment incentive. The results for the infrastructure variable and foreign firms' agglomeration remained statistically the same, thereby implying a limited effect of an investment subsidy. Nevertheless, the evidence is not completely persuasive due to the lack of more comprehensive data capturing the incentive scheme framework and enabling identification of a causal relationship between FDI incentives and firm arrival. Therefore, the author admits, the results should be interpreted with caution.

2.3 Institutional background

Foreign capital flows into the Czech Republic started in the early 1990s when the centrally-planned economy collapsed. Initially, the governmental stance towards FDI incentives was rather mixed. Soon, the need for foreign know-how and technology was recognized, and systematic state support of FDI began.[5]

Governmental support of FDI inflow started in 1998, providing foreign investors with an option to apply for a financial subsidy. However, the system lacked transparency and a clear set of predefined rules as decisions about FDI incentives, their magnitude, and regional allocation were fully at the discretion of the government.

[5]The government agency CzechInvest was established in 1992 for FDI promotion and administration.

Therefore, the system was elaborated in 2000, when a formalized scheme of investment incentives was established.[6] Since then, three types of investment incentives have been implemented: the "investment incentives program for the manufacturing sector" (program "M")[7], the "job creation support program for regions worst affected by unemployment" (program "U")[8] and the "framework program for the support of technology centers and the strategic services" (program "F").[9]

A primary motivation for the adoption of the investment incentives scheme was to diminish regional disparities, compensate distressed peripheral districts in the Czech Republic and to increase their attractiveness to investors. This strategy was reflected by the setup of the incentive policy - with the exception of the program "F", it introduced different eligibility categories dependent on the district unemployment rate. Based on the local unemployment rate during the previous year, districts were split into four groups: "high-incentive", "medium-incentive", "low-incentive" and "no-incentive" group. The first group included districts with the local unemployment rate of at least 50 percent above the country average, districts with the local unemployment rate 25 percent (but less than 50 percent) above the country average were classified as medium-incentive and districts with above-average local unemployment rate (but smaller than 25 percent above the average) as low-incentive. Finally, no-incentive group consisted of districts with the local unemployment rate below the

[6] An investment incentive law (no. 72/2000) became effective on May 1, 2000, defining the rules and eligibility conditions for foreign as well as domestic investors. The Czech Republic became the first Central or Eastern European country with a clear investment incentive system defined by law.

[7] The program was the first and the largest investment incentive program and started on May 1s 2000, providing investors into the manufacturing sector with income-tax relief, job-creation subsidies and training and retraining subsidies after meeting certain criteria (these were notably the minimum invested amount and the number of created vacancies – see Table 2.1 for a detailed overview of these conditions and the changes in the program).

[8] The program started on June 2, 2004, and ended on December 31, 2007. It was motivated by the intention to attract foreign firms to more distressed regions of the Czech Republic. Firms investing at least 10 mil. CZK and creating at least 10 vacancies were eligible for a financial support which took two forms – either a direct subsidy for each created vacancy or a subsidy for employee retraining (see Table 2.2 for more details about the program).

[9] Program "F", which was launched on June 2, 2002 and ended on December 31, 2007, was designed to attract R&D activities and knowledge-based investors. Technology centers have been defined as establishments oriented towards innovation and strategic services have been specified as manufactures with a high added-value in knowledge-intensive sectors.

country average.[10] Eligibility of individual districts was reassessed every six months and, consequently, districts' eligibility could vary over time as districts could shift from one eligibility category to another (Table 2.3) or even become ineligible for incentives at all (Table 2.4). Unfortunately, it is difficult to identify the impact of investment incentives on FDI in the case of districts with changing eligibility. Therefore, in order to remove noise from the data, we limit the sample to districts that changed eligibility category at most once during a given period.[11] It should be noted that changing categories, particularly moving to a lower subsidy category, is in a sense an outcome of the program. However, studying the ultimate impact of incentives on unemployment is beyond the scope of this paper as we are interested primarily on the impact of investment incentives on FDI inflow.[12]

Only the first two programs are considered when evaluating the effectiveness of incentive policies due to identification issues (eligibility criteria being based on unemployment thresholds; discussed in "identification strategy" section). Nevertheless, these two programs promoted a vast majority of supported FDI projects (more than 97 percent), thereby justifying this approach. Another important feature is an institutional change in the design of program "M", virtually removing incentive eligibility for the first eligibility group (districts with above-average unemployment rate but smaller than 20 percent above the average) starting from 2005. Therefore, in order to reflect this methodical change in the program, the eligibility thresholds separating no- from low-incentive districts and low- from medium-incentive districts are grouped together when estimating a simple regression model. In doing so, the

[10] The medium 25 percent threshold was replaced by 20 percent from 2006 (Table 2.1). Moving from a no-incentive group to a low-incentive group made a company eligible for 80,000 CZK (roughly 3,500 euros) subsidy per each created vacancy and a reimbursement of 25 percent of requalification expenses. Moving from a low-incentive to a medium-incentive group increased the direct subsidy by 50 percent to 4,750 euros and a requalification subsidy by additional 5 percentage points of expenses. A shift from a medium-incentive to a high-incentive group increased the direct subsidy by a 67 percent margin (to 7,000 euros) and the refund for requalification expenses increased by another 5 percentage points (to 35 percent of total expenses overall).

[11] The following districts were dropped due to several changes in eligibility categories: Chrudim, Opava, Břeclav, Vsetín, Kroměříž and Frýdek-Místek.

[12] For an analysis of the impact of FDI on labor market conditions, see, e.g., Dinga and Munich (2010).

coefficient for the grouped variable represents an estimate an effect of the lowest available threshold on FDI inflow. For a regression-discontinuity analysis, the institutional change in design of program "M" is reflected by splitting the sample into periods 2000-2005 and 2006-2007. During the first period the impact at all three thresholds is inspected, while only the medium- and high-unemployment thresholds are studied during the later period.

2.4 Methodology

Following the theoretical literature, we consider a set of traditional FDI determinants, namely, human capital endowment proxied by the share of tertiary-educated productive labor force, industrial structure of employment (the share of employment in the manufacturing sector) and local labor costs. Another set of explanatory variables includes the share of arable land out of the total area of a district, connections to main highways and proximity to target markets. Also, the local unemployment rate and vacancy rate are included in the model.

The impact of human capital endowment on FDI is, ceteris paribus, expected to be positive. Industrial structure is also expected to exhibit a positive influence on FDI inflow due to industry-specific FDI flows (e.g., Guimaraes et al., 2000) and the fact that the majority of inward FDI in the Czech Republic comes into the manufacturing sector (more than 30 percent in 2006).[13] Local labor costs are represented by a logarithm of average local wages. Obviously, holding other independent variables constant, firms are expected to show a strong tendency to locate their labor-intensive production in districts with low labor costs (Basile, 2004). However, low wages might reflect unobserved low productivity of the local labor force, therefore, high wages are expected to decrease FDI flows only if differences in wages are not outweighed by differences in labor productivity.[14] A variable describing the

[13] It is not possible to analyze FDI flows separately for different industries due to the nature of the FDI data – only aggregate values are available at the district level.

[14] Unfortunately, the data on labor productivity at the district-level are not available for the Czech Republic.

share of arable land on the total area of a district is introduced to capture investors' possible preference for agricultural land and is expected to be positive.[15]

In empirical literature, distance between markets implies trade costs. The proximity of target markets exerts a positive influence inward FDI, increasing with the size of these markets and the levels of exports to these markets. In the case of the Czech Republic, Germany and Austria are the main export markets among neighboring countries, thereby justifying the use of a dummy indicating a common border with these countries as an explanatory variable. This dummy is expected to take a positive sign. On the same note, a good connection to target markets diminishes transportation costs and, thus, a dummy indicating a connection of a particular district to the highway network is expected to have a positive sign. The unemployment and vacancy rates describe the tightness of the local labor market. A high unemployment rate increases the pool of available workforce and is expected to attract FDI inflow. On the contrary, a high vacancy rate indicates the lack of suitable workers and deters new FDI.[16] The inclusion of the time trend captures an intertemporal variation in aggregate FDI due to macroeconomic and external factors.

The principal model is augmented by an investment incentive dummy, which indicates the eligibility of a particular district for some form of investment incentives. The purpose of FDI incentives is to increase the propensity of investors to locate in areas preferred by the government and, therefore, the sign of incentive dummy is expected to be positive.

Formally, foreign direct investment is assumed to be a function of following variables:

$$FDI = f(EDUC, UNI, MANUF, AGRI, HIGHWAY, EU15, w, u, v, t, t^2, INC), \tag{2.1}$$

[15] It is known from anecdotal evidence that building up a new plant on agricultural land (green-field investment) is usually cheaper than revitalizing an industrial site (brown-field investment).

[16] High levels of both the unemployment and vacancy rates indicate a skill mismatch when there is a disporportion between skills supplied by labor force and skills demanded by firms.

where $EDUC$ is a share of productive labor force with completed secondary education,[17] UNI is the share of tertiary educated productive labor force, $MANUF$ is the share of employment in the manufacturing sector, $AGRI$ is the share of arable land, $HIGHWAY$ indicates the presence of a highway, $EU15$ stands for the common border with the EU-15 (Austria and Germany), w stands for the local wage level, u is the local unemployment rate, v is the local vacancy rate, t is the time trend and INC is the set of three incentive dummies (low-incentive, medium-incentive, high-incentive) indicating the eligibility category of a district for incentives.

In order to remove potential endogeneity of $EDUC$, UNI, $MANUF$, w, $AGRI$ and $HIGHWAY$, these variables are proxied by their "initial-period" values. Specifically, educational and industrial structure is taken for year 1997 and $AGRI$ and $HIGHWAY$ for year 1996, i.e., years before massive FDI inflow occurred. Explanatory variables constructed in this way can be considered as exogenous with respect to future FDI inflow. Unemployment and vacancy rates can also be endogenous, leading to biased regression estimates. In order to overcome this endogeneity problem, the dependent variable FDI is constructed as a forward-looking average of yearly FDI inflows into a particular district. As a result, current FDI and vacancy rates can be considered as predetermined.

2.5 Data

We make use of various data sources. The information about FDI flows is obtained from the Czech National Bank and covers annual periods between 1998 and 2007 at the district level.[18] Overall FDI consists of basic capital (deposit of non-resident

[17] By completed secondary education we mean having passed school-leaving examinations (roughly corresponding to German "Abitur" exam or the U.K. General Certificate of Education) which are held at the end of all academic secondary schools and some vocational and specialized schools.

[18] FDI is defined according to OECD (1996): "Capital investment abroad is regarded as a foreign direct investment if the purpose is to establish permanent equity relation with a target company. The share of a foreign investment must be at least 10 per cent of the target firm's basic capital." The stock of FDI in a year t is defined as a cumulative amount of FDI starting from 1989 to the end of the particular year. Annual FDI flows are calculated on a net basis as an outcome of credit and debit capital transactions between direct investors and their foreign affiliates. Hence, there

in the form of fixed assets), reinvested earnings (profit not distributed as dividends) and other capital (loans from the parent company). Our goal is to identify the role of financial incentives on actual location decisions of new foreign firms. The best indicator of FDI incoming from new establishments is basic capital, therefore, only this part of FDI is considered for the purpose of our analysis.[19] In addition, three main metropolitan districts - Prague, Brno and Ostrava - are excluded from the analysis as FDI for these cities is affected to a large extent by factors not related to the existence of investment incentive schemes based on unemployment thresholds (programs "M" and "U"). These districts were the main recipients of FDI from program "F", the only program not imposing any criteria regarding the level of unemployment. This program was aimed at supporting FDI into technology centers and strategic services and attracted FDI almost exclusively to these metropolitan areas due to their specific position (university centers, qualified labor force, concentration of hi-tech industries). In addition, Prague, as a capital and the seat of head offices of large financial institutions, has been subject to substantial jumps in FDI flows due to privatization of banks and large one-off sales of state-owned enterprises. Moreover, there exists a discrepancy between actual and reported location of FDI: it is registered in a district where the head office is located, biasing the statistics for companies operating across districts. A typical example would be a large enterprise with its head office located in Prague that sets up a new branch in a particular district outside Prague. In such a case, even though the incentive is spent in this district, the new FDI is recorded in Prague. Fortunately, a list of FDI projects supported by programs "M" and "U" contains only a negligible number of firms operating in more than one district, thus justifying the use of district-level FDI data for analyzing the incentive impact.

Other data sources are the Unemployment Registry (UR), the Labor Force Sur-

exists a possibility of negative FDI flow in the case of reverse investment when some component of FDI (e.g., basic capital of the firm) decreases and this drop is not offset by the remaining FDI components.

[19]The other two components of FDI - reinvested profit and remaining capital - are influenced by the internal decisions of existing firms and corresponding financial transactions, thereby not related to the existence of an incentive scheme.

vey (LFS), Czech Statistical Office (CSO) and CzechInvest. The UR contains quarterly district-level data on unemployment and the CSO provides information on wages and geographic characteristics. The LFS includes individual data about labor market status, age, education, sector of employment and other characteristics which serve as a basis for calculating the industry and education structure for each district on a semi-annual basis. Investment incentives data are from the government agency CzechInvest and the Ministry of Labor and Social Affairs. It contains a list of subsidized investment projects as well as a list of districts eligible for state support during particular time periods.

The eligibility of the districts was reassessed every six months, therefore the time unit of the analysis is a half-year. In order to obtain half-year frequency for FDI data, we construct forward-looking averages in the following way: for the first half of any year, the FDI variable is calculated as the average of FDI inflow during the current year and the following year; for second half-years, the FDI variable is calculated as the average of FDI inflow during the current year and two following years.

Sample means for the analysis-ready data are showed in Table 2.5. There is a visible parabolic trend in FDI inflow per capita which justifies the use of a squared time trend in the regression.

2.6 Descriptive statistics

Figure 2.3 shows the evolution of the total FDI stock in the Czech Republic between 1998 and 2006. Each box characterizes a regional distribution of overall FDI stock during a particular year on a logarithmic scale. An upward trend reveals a steady increase in the FDI stock, the persistence of regional variation and the dominance of Prague in FDI allocation.[20] In absolute terms, while the overall stock of FDI in

[20]The box plot characterizes the distribution of the FDI stock – the median is represented by the white line inside the box, the quartiles by the edges of each box, the extreme values (thin lines extending from each box) and the outlier (Prague).

the Czech Republic was 429.2 billion CZK (roughly 17.5 billion euros) at the end of 1998, by the end of 2006 it was 1,667 billion CZK (67 billion euros). Thereof, approximately one half of overall FDI stock in the Czech Republic is located in the capital city of Prague. This disproportion is even magnified if per capita levels are considered. Table 2.6 displays FDI inflows per capita for the three largest cities (Prague, Brno and Ostrava) as compared with the rest of the Czech Republic. The specific position of these metropolitan districts is documented by large regional disparities in FDI flows between them and the rest of the country, thereby justifying their exclusion from the analysis as described in the previous section.

In assessing the impact of the incentive scheme, it is important to realize differences in the unemployment rate both geographically and intertemporally. In Table 2.7 we see the evolution of the unemployment rate in the Czech Republic over time. It can be observed that the unemployment rate increased substantially in Ústecký and Moravskoslezský regions after the recession in the 1990s and has remained at high levels ever since. Hence, districts in those two regions were favored by the design of the incentive scheme as foreign investors locating there had an opportunity to obtain the most generous subsidy from the state.

Looking at the regional dimension of FDI, Table 2.8 displays an FDI inflow across regions during 2000-2007 and compares overall realized FDI inflow with the supported FDI inflow and direct investment subsidy. Two main characteristics can be observed from the table: first, a majority of new investment projects in the Czech Republic during 1999-2006 was supported by the state; second, for some regions the size of supported projects exceeds the realized FDI inflow. This observation can be attributed to the delay in the realization of the project awarded with a financial subsidy (towards the end of the time span 2000-2007, "supported FDI" may include also some projects which are yet to be realized and, thus, not included in the "realized FDI" data). Another explanation may be the discrepancy between the planned and realized investment as the amount of supported FDI is based on the data reported by the firm upon filing an application for investment incentive (i.e.,

prior to the realization of the investment) and may overstate the actual amount of realized FDI.[21]

FDI inflow per capita by the districts' eligibility for the financial subsidy after the implementation of the incentive scheme is shown in Table 2.9. One can observe that the basic capital part of FDI inflow is decreasing over time among eligible districts (with the exception of the "high-incentives" group where there is no visible trend). However, such a simple comparison is not enough for evaluating the causal impact of the incentive scheme. In the following section we present a rigorous identification strategy utilizing the regression-discontinuity setup and the role of unobservables in such a design.

2.7 Identification strategy

The identification strategy is based on a strict unemployment threshold set by the Czech government which splits districts into several eligibility groups. Being set exogenously, this threshold provides an opportunity to employ the regression-discontinuity method (Imbens and Lemieux, 2008; Lee and Lemieux, 2010) which is designed to estimate the policy impact in the absence of a randomized controlled experiment. We assess the effectiveness of the incentive programs based on unemployment thresholds by analyzing the impact of the discontinuity in an assignment variable (the unemployment rate) on the outcome variable (the average FDI per capita in a district during three years following the year essential for eligibility criterion).

The main assumption justifying the use of RD design is that the assignment variable is observed and the assignment rule is ex-ante known (sharp RD design). By the setup of the investment incentive scheme, this assumption is satisfied. A key assumption, which we test statistically, is that there should be no discontinuities for

[21] The law n. 72/2000 about investment incentives specifies that the investor must maintain created jobs for at least 5 years and the investment must also contain non-public resources (at least 25 percent).

control variables. Another assumption is that the outcome variable is a continuous and smooth function of the assignment variable in the absence of the treatment. While there exists no statistical way to test this assumption, the inspection of the outcome variable and the assignment variable prior to implementing the incentive scheme suggests that the RD approach is justified.

In the first step, we estimate a regression model characterized by equation (2.1), explaining the variation in FDI caused by observables:

$$\begin{aligned} FDI_{it} &= \alpha + \beta_1 EDUC_{it} + \beta_2 UNI_{it} + \beta_3 MANUF_{it} + \beta_4 AGRI_{it} + \beta_5 HIGHWAY_{it} + \\ &+ \beta_6 EU15_{it} + \beta_7 \ln(w)_{it} + \beta_8 u_{it} + \beta_9 v_{it} + \gamma_1 (LOWINC_{it} + MEDINC_{it}) + \\ &+ \gamma_2 (HIGHINC_{it}) + \phi t + \eta t^2 + \epsilon_{it}, \end{aligned} \tag{2.2}$$

where FDI_{it} is a three-year average basic capital inflow per capita in district i starting in period t; explanatory variables are as described in the model and ϵ_{it} is a noise term. Dummies $LOWINC$ and $MEDINC$ are grouped in order to reflect the institutional change which occurred at the end of 2004, allowing us to identify the impact of receiving "at-least some subsidy" during the whole analyzed period.

Unfortunately, while shedding some light on the importance of time-invariant explanatory variables such as the initial level of the share of tertiary-educated people or manufacturing employment, a regression estimation (2.2) can potentially lead to biased estimates of the incentive dummies as it explains only the part of the variation in FDI caused by observables. However, the error term encompassing the variation caused by unobservables is not generally uncorrelated with the incentive dummy (that would be the case if the program eligibility was given randomly):

$$E(INV'\epsilon) \neq 0. \tag{2.3}$$

In the second step, therefore, we augment equation (2.2) by district-level fixed effects. In this way, we remove the variation caused by unobserved heterogeneity

(as well as time-invariant variables). The coefficients for incentive dummies from fixed-effects specification can serve as a benchmark for comparison with regression-discontinuity estimates which are obtained afterwards.

In the third step, we make use of the discontinuity design of the investment incentive scheme and employ a key regression-discontinuity assumption claiming that unobserved heterogeneity vanishes around the discontinuity points:

$$E(INV'\epsilon) = 0, \quad \text{for subset of districts around cut-off point.} \tag{2.4}$$

In other words, when considering only a subset of observations around the discontinuity points, the whole variation in FDI can be attributed to observables. Filtering out the variation caused by observables minus incentive dummies, all remaining difference in the dependent variable FDI can be attributed to changes in the investment dummies.

The regression-discontinuity estimation is performed by calculating two local linear regressions at both sides of the cutoff point. The difference in outcome predictions between these two regressions represents the impact of the program at the specified threshold.[22] The size of the discontinuity jump is analyzed for all three thresholds and for periods 2000-2004 and 2005-2007, reflecting an institutional change in the scheme design (starting from 2005, the medium threshold actually became the lowest eligibility threshold). Standard errors of the estimates are obtained by the bootstrapping technique.[23]

Two alternative estimates of the policy impact are presented. First, all districts are included in the RD estimation. As a robustness check, the analysis is performed on a subsample containing only districts which have experienced at most one switch between four eligibility categories. We report only estimates of the latter specifi-

[22] The estimation is performed in `Stata`, making use of the command *rd* (Nichols, 2007). Various techniques are available for choosing the bandwidth and kernel. We adopt a triangle kernel and the default bandwidth so that it includes at least 30 observations on both sides of the boundary.

[23] Bootstrapping corrects underestimated standard errors. Conventional standard errors may be biased when the treatment variable rarely changes over time (Bertrand et al., 2004).

cation as using the subsample is more plausible for the purpose of our analysis.[24] Another check of the robustness of the findings is done by using alternative bandwidths around discontinuity points.

2.8 Results

The influence of the initial labor market conditions on FDI inflow is analyzed by running pooled OLS equation (2.2). Table 2.10 reports the coefficients of explanatory variables characterizing wages, educational and industry structure from the mid-1990s, as well as incentive dummies. While the signs of variables capturing educational and industry structure are positive as expected, the finding that high local wages seem to attract FDI inflow are somewhat puzzling. However, it should be re-emphasized that high wages might reflect not only high labor unit costs, but also high productivity.

In order to describe the change in the role of explanatory variables before and after the introduction of the investment scheme, we estimated the regression separately for two periods: the first includes years prior to the establishment of the formal FDI promotion scheme (1999-2002), the second one covers the years after the launch of all FDI incentive programs (2003-2007). It can be observed that during years without systematic state support, an increase in the tertiary-educated workforce by 1 percentage point increased the annual FDI inflow by almost 25 euros per capita. The magnitude and significance of this effect vanishes during years 2003-2007. Similarly, investors were initially inclined toward locations with higher wages (increasing annual FDI inflow by almost 12 euros per capita); this effect is suppressed during later years. Incentive dummies show no significance in this simple specification. However, after removing unobserved heterogeneity by including district-level fixed effects, there is a positive impact on FDI for the lowest threshold

[24] As noted before, numerous shifts hinder a proper causal assessment of the scheme's impact on FDI and may distort the estimates since the dependent variable is calculated as a forward-looking average of FDI inflows.

during both periods (Table 2.11). This result suggests the presence of a positive effect of the incentive scheme.

Refining the analysis, we perform a regression-discontinuity estimation. We inspect the impact of each eligibility category on all three thresholds by exploiting the respective discontinuities. It is necessary to split the time span into two parts in order to reflect the launch of the program "F" and a significant change of the parameters of the program "M" at the end of 2004 (Table 2.1). Periods 2000-2004 and 2005-2007 are, therefore, analyzed separately. Table 2.12 displays regression-discontinuity estimates based on three unemployment thresholds. The first three columns show the impact of the incentive scheme on FDI inflow for the period before 2005 and the next three columns report estimates of the impact of the scheme for the period 2005-2007. It can be observed that during the period 2000-2004, there is no significant impact of the incentive scheme at any threshold with the exception of the first threshold (the average unemployment), where using a short bandwidth indicates some positive effect of investment incentive on FDI inflow. This finding may be explained by the fact that the incremental value of a subsidy at the first threshold is twice as much as at the second threshold (80,000 CZK vs. 40,000 CZK per created vacancy and 25 percent vs. 5 percent of retraining expenses).

In accordance with the institutional setup (the first eligibility category was removed starting from 2005), there is no significant effect of the incentive scheme at this threshold during 2005-2007. However, contrary to the period 2000-2004, the medium threshold displays a significant effect in the later period, increasing annual FDI inflow per capita by 328 euros. This corresponds to the mentioned change in the design: the medium threshold has become, in fact, the lowest threshold during the period 2005-2007 and may have "absorbed" the first-threshold effect on FDI inflow.

Estimates for the highest threshold exhibit a large variation depending on the bandwidth and, thus, no clear conclusion can be made about its impact on investors' choice of location. Moreover, in the case of this threshold, one of the labor market

characteristics (vacancy rate) does not pass the test of being continuous around the threshold, which might affect the estimates for FDI inflow.

A visual presentation of the regression-discontinuity estimates helps to illustrate the findings: Figure 2.4 displays the impact of the incentive scheme on FDI per capita inflow for the lowest threshold. A significant effect is found only for years 2000-2004. Starting in 2005, the impact disappears in accordance with the removal of the eligibility for the first threshold by an institutional intervention. Correspondingly, Figure 2.5 shows that although there is no significant effect for the medium-unemployment threshold before 2005, there is a substantial impact on FDI inflow starting from 2005. In fact, this is now the lowest eligibility category and the effect is even more pronounced than in the case of the first threshold before 2005. Figure 2.6, illustrating the impact for the highest threshold, shows no prevailing trend in FDI inflow, as the estimation is affected by a smaller number of observations and the estimates of the discontinuity impact are insignificant for both periods.

Overall, the results suggest that investment incentives have some potential in relocating FDI. The findings document a positive impact of investment incentives particularly for the threshold splitting districts between ineligibility and "at-least some" eligibility categories. However, there is no evidence of any added value (in terms of increased FDI inflow) of the different scales of eligibilities – districts with more generous subsidies display no extra FDI inflow than districts with less generous investment subsidies. It seems that an option to obtain an investment subsidy played some role in foreign investors' allocation; however, they did not care that much about the amount of the subsidy. This interpretation suggests the extra money spent on increased subsidies for more generous categories were used inefficiently.

This notion leads us to important policy questions: Is it worth spending public money on these policies? Or are there alternative tools of policymaking which could use public funding more efficiently? While a comprehensive answer to this question is beyond the scope of this paper, we partially answer it by roughly calculating the net employment effect of FDI subsidies. In a study of FDI employment effect by

Dinga and Münich (2010), the net employment effect of a large and concentrated district-level FDI inflow in the Czech Republic is found to be 3.7 percent; however, their result regards the specific case of a 700 million euro project and a district of 68,000 residents. Combining that case with this paper's finding that eligibility for the incentive program increases FDI per capita by 320 euros annually (1,000 euros during three years following the eligibility decision), we assume 68 million euros of FDI inflow into this benchmark district over three years. Further, assuming that the employment effect is proportional to the size of the investment gives us an employment impact of 240 jobs due to the investment scheme.[25]

Extending this back-of-the-envelope analysis to some fiscal implications, we assume that all 240 jobs are filled with unemployed people. In other words, we do not take into account potential crowding-out across districts and across jobs and presume budget savings are as high as yearly state costs for 240 unemployed. According to Elbona (2005), annual expense on 240 unemployed including direct unemployment benefits, taxes and social insurance contributions equals 42 million CZK. In comparison, for an investor with 240 job openings, the incentive scheme granted a subsidy of 19 million CZK (first eligibility group) to 48 million CZK (third eligibility group), suggesting that the use of investment incentives is a reasonable option from a policymaker's perspective (at least for the first threshold).

This is only a rough approximation illustrating the magnitude of the employment effect of FDI promotion incentives. The return and the pay-off time of investment incentives depends on the proportion of the crowding-out effect – assuming that all regionally reallocated FDI was attracted to the country just by the incentive scheme itself, the pay-off time would be 6 months and 14 months for the third eligibility group. If one half of the FDI would have come to the country in the absence of the investment incentive scheme anyway (i.e., there has been crowding-out across districts), the pay-off time would be twice as much. According to investment incentive

[25] We assume that a 700 million euro investment attracts 2,500 individuals (3.7 percent x productive labor force 68,000) and a 68 million euro investment attracts roughly 240 individuals (68 mil. / (700 mil. / 2,500)).

law 72/2000, the investor is required to maintain the created job for at least five years after the investment occurs. If this condition is satisfied, the net return on the investment incentives would be positive as long as at least 20 percent of reallocated FDI was not crowded-out from other regions. However, this interpretation should be taken with caution as there were cases of supported companies which were not able to maintain the initial workforce due to the economic crisis.[26] Moreover, government-driven policies did not work for the most distressed regions as there was no significant effect of the investment incentive for the third unemployment threshold.

2.9 Conclusion

This research has the ambition to unveil a source of regional disparities in FDI distribution in the Czech Republic and to identify main location determinants of foreign investors during 2001-2007. The emphasis is put on the role of investment incentives on regional allocation of FDI, as softening regional disparities and fostering new job creation in areas with above-average unemployment can bring substantial relief for public spending in terms of unemployment benefits and social assistance. Quantifying the impact of financial incentives on foreign investors' location decisions can uncover the true effect of these policies and shed more light on the justification of investment incentives.

The design of the investment incentive scheme in the Czech Republic allows the identification strategy to be based on differences around the cutoff discontinuity points. The identification is based on a regression-discontinuity estimation around three thresholds, classifying districts into three eligibility and one ineligibility categories. We estimate the impact of each threshold in FDI district-level reallocation across the Czech Republic. In other words, we only measure the policy impact on

[26] An infamous example of such a problematic investment project is represented by LG.Phillips in district Přerov. The company was not able to maintain the number of job openings as specified in the investment subsidy contract and eventually stopped production due to insolvency four years after the start of production.

redistribution of FDI already attracted to the country (at the international level, FDI may be attracted by country-level variables; Bevan and Estrin, 2000).

During the period before 2004, regression-discontinuity estimates are positive and both economically and statistically significant only for the first threshold (the average unemployment rate) and smaller bandwidth, and the positive effect vanishes at the second threshold (1.25 x the average unemployment rate) and the third threshold (1.5 x the average unemployment rate). After the change in the institutional setup in 2004, implementing stricter unemployment conditions and removing the first eligibility category, there is a positive impact of the second threshold on FDI inflow, increasing annual FDI inflow per capita by 320 euros. Since this threshold became virtually the lowest unemployment threshold after 2004, it can be concluded that there is a positive impact of investment subsidies only for the lowest available unemployment threshold during the whole period. This findings is supported by the lack of the discontinuity impact for the medium threshold during 2001-2004 and for the lowest threshold during 2005-2007, respectively. The results provide no evidence of the significance of the incentive effect for the third threshold.

Overall, investors were initially inclined towards locations with educated workforce and relatively higher wages as rise in the share of tertiary-educated labor force by a percentage point increases the annual FDI inflow per capita significantly by 25 euros per capita during 2001-2004. Afterwards, the composition and determinants of FDI were altered and incentive variables became crucial factors in FDI attraction.

Performing a back-of-the-envelope calculation and comparing the costs of investment incentives with the benefits from saved costs on unemployment benefits, we argue that the adoption of the investment incentive scheme in the Czech Republic exhibits a positive net effect for the lowest unemployment threshold. While such approximations should be taken with caution, it gives the idea of the efficiency of investment subsidies. Summarizing, attraction of FDI can be efficiently supported from the state budget, with the exception of districts with the highest unemployment rate. Attracting FDI into the most distressed regions, thus, remains one of

the important challenges for policymakers.

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2.11 Appendix

Figure 2.1: Overall stock of FDI in transition countries and Germany

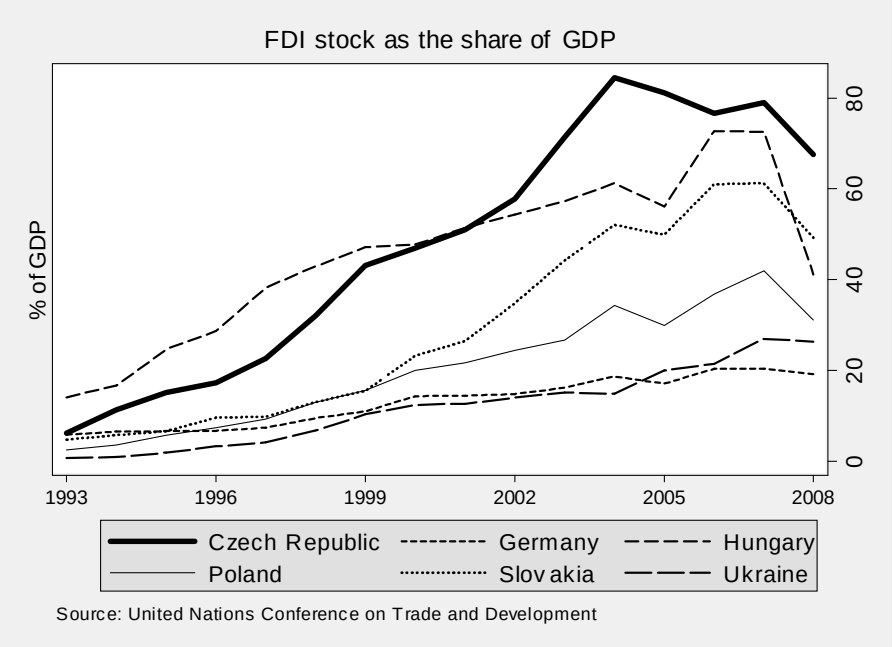


Figure 2.2: FDI inflow in transition countries and Germany

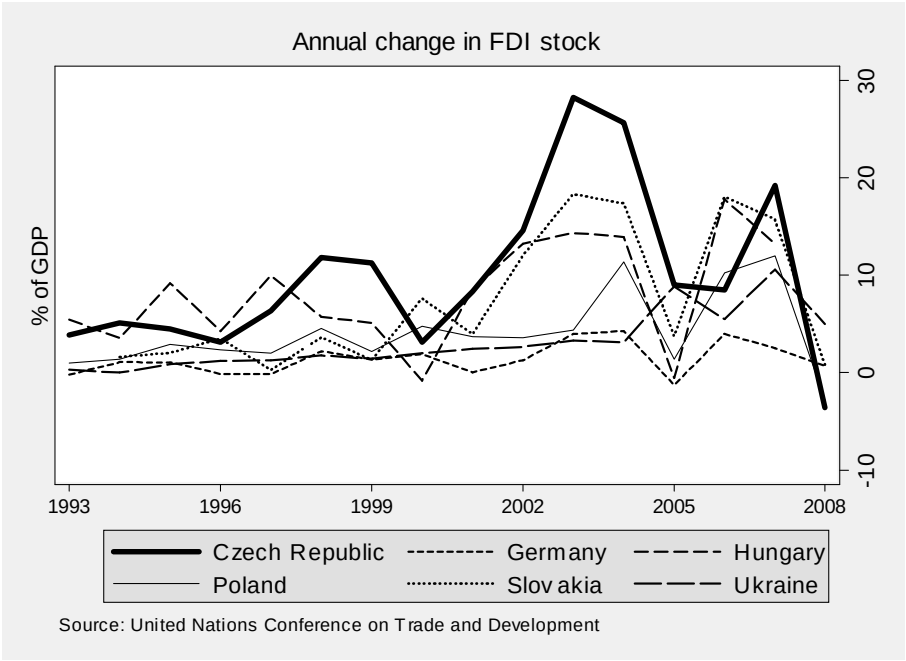


Figure 2.3: Realized stock of FDI across Czech regions (logarithms)

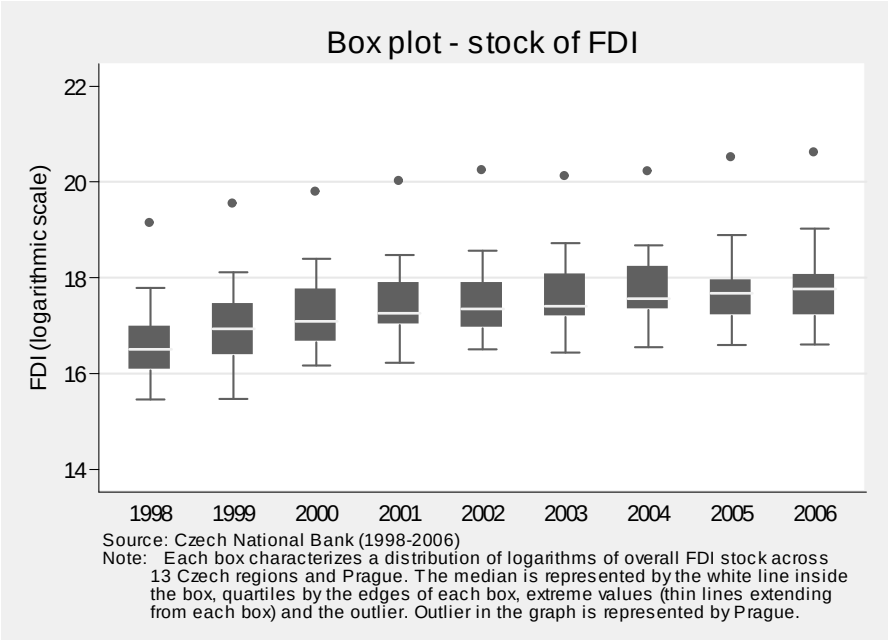
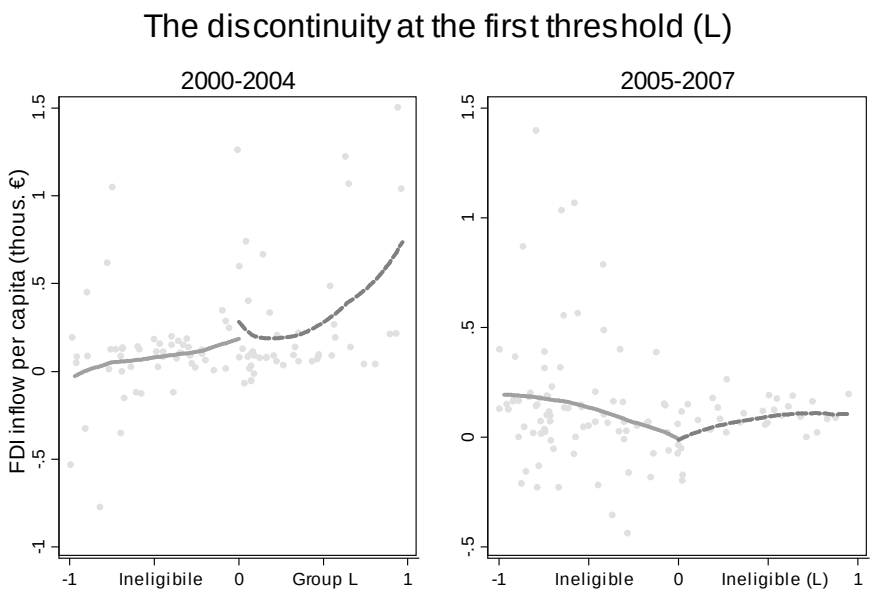
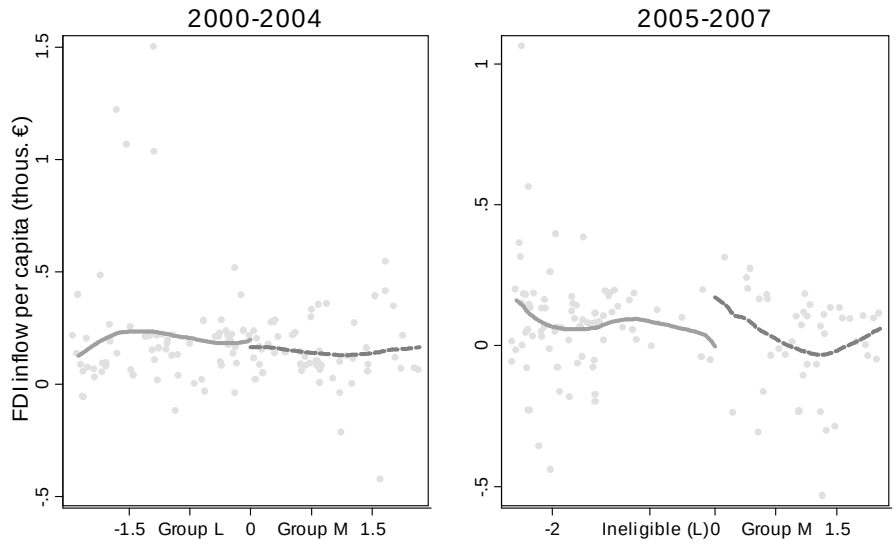


Figure 2.4: Regression discontinuity at the first threshold (low)



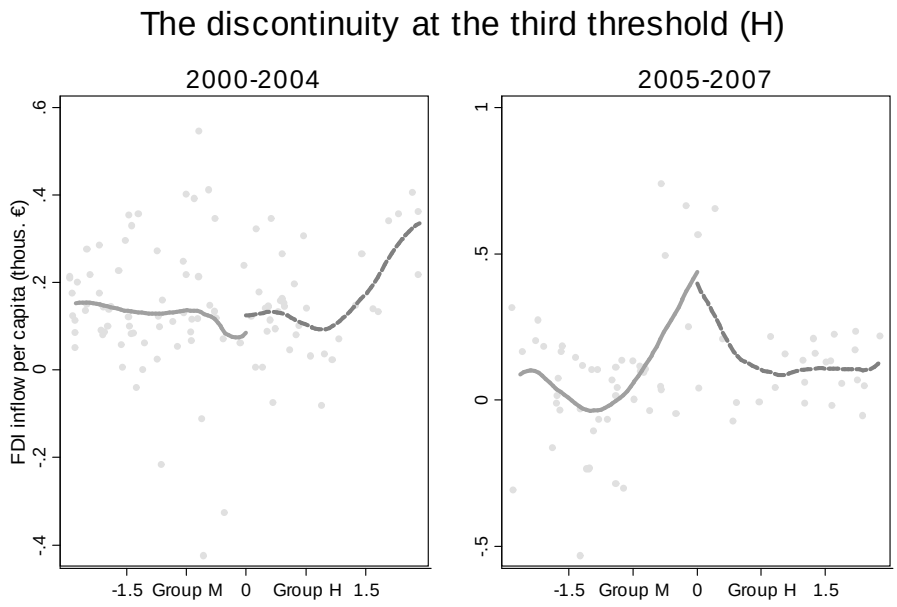
Note: Horizontal axis displays the difference between district-level and country-average Urate
The cutoff point represents the country-average unemployment rate

Figure 2.5: Regression discontinuity at the second threshold (medium)



Note: Horizontal axis displays the difference between the district-level Urate and eligibility Urate (1.25xU_avg)
The cutoff point represents 1.25 x the country-average unemployment rate

Figure 2.6: Regression discontinuity at the third threshold (high)



Note: Horizontal axis displays the difference between the district-level Urate and the eligibility rate (1.5xU_avg)
The cutoff point represents 1.5 x the country-average unemployment rate

Table 2.1: The overview of legislatory changes in the investment incentives programs

Year	Law/ Act	Job creation Support	Requalification
1998-2000	No Law 298/1998 – decree 844/1998 – decree	Investment incentives officially started At the discretion of the government Condition: green-field investment (min 25 mil. USD) green-field investment (min *10 mil. USD)*	At the discretion of the government
2000	72/2000 – investment incentives law, February 24th, 2000 Valid from May 1st, 2000	*Investment at least 350 mil. CZK* *If Ur>1.25*U at least 175 mil. CZK* Condition Ur>U Government decides about the amount of the subsidy	*Investment at least 350 mil. CZK* *If Ur>1.25%U at least 175 mil. CZK* Condition Ur>U Government decides about the amount of the subsidy
	134/2000 – enactment, May 3rd, 2000	Subsidy 200,000 CZK/vacancy if Ur>1.5*U, 120,000 CZK/vacancy if Ur>1.25U 80,000 CZK/vacancy if Ur>1.0*U If Ur>U and #vac./firm>1000 + gravity region – the amount of subsidy according to neighboring region with highest Ur	Subsidy (% of requalification expenses) 35% for Ur>1.5*U, 30% for Ur>1.25*U 25% for Ur>1.0*U +10% increase for disabled person →Dtto
2001	453/2001 – change of investment incentives law, November 29th, 2001	Investment at least 350 mil. CZK If Ur>1.25*U at least 175 mil. CZK, *If Ur>1.5*U at least 100 mil. CZK*	No change
2002	103/2002 - enactment, February 27th, 2002	Subsidy 200,000 CZK/vacancy if Ur>1.5*U 120,000 CZK/vacancy if Ur>1.25U 80,000 CZK/vacancy if Ur>1.0*U *+10% for disabled person or LTU (>12 months) person*	Subsidy (% of requalification expenses) 35% for Ur>1.5*U, 30% for Ur>1.25*U, 25% for Ur>1.0*U *+10% increase for disabled person or LTU (>12 months) person* *Condition Ur>U and #vac./firm >1000* *Subsidy 35% for special training and 60% for general training*
2004	May 1st, 2004 – Law amendment	*Investment at least 200 mil. CZK* *If Ur>1.25*U at least 150 mil. CZK, If Ur>1.5*U at least 100 mil. CZK*	
	515/2004 – enactment, September 21st, 2004, valid form October 1st, 2004	Subsidy 200,000 CZK/vacancy if Ur>1.5*U *+ 50,000 CZK/vacancy for disabled person employed for at least 1 year* *100,000 CZK/vacancy for Ur>1.25*U only for disabled persons*	Subsidy (% of requalification expenses) *35% for Ur>1*U*
	578/2004 enactment (changing 515/2004), October 21st, 2004	Subsidy 200,000 CZK/vacancy if Ur>1.5*U + 50,000 CZK/vacancy for disabled person or *LTU (>12 months) persons* employed for at least 1 year *100,000 CZK/vacancy for Ur>1.25*U +25,000 CZK/vacancy for disabled person or >3 months unemployed persons employed for at least 1 year*	No change
2006	338/2006 enactment, Changing 515/2004, June 21st, 2006	Subsidy 200,000 CZK/vacancy if Ur>1.5*U *200,000 CZK/vacancy if Ur>1.2*U if neighbour with Ur>1.5xU* *100,000 CZK/vacancy for Ur>1.2*U 80,000 CZK/vacancy for Ur>1.0*U* *+ 10% for disabled person or LTU (>12 months) person*	No change
2007	159/2007 – law, June 2nd, 2007	*Investment at least 100 mil. CZK*	No change
2008	68/2008 enactment, hanging 578/2004 and 338/2006, February 4th, 2008	Subsidy *50,000 CZK/vacancy if Ur>1.5*U*	Subsidy (% of requalification expenses) *35% for Ur>1,5*U*

Note: The table presents the list of numerous legislatorial changes concerning the investment incentives scheme. Ur stands for the district unemployment rate, U for the overall unemployment rate in the Czech Republic.

Table 2.2: The overview of the Job Creation Support Program for Regions Worst Affected by Unemployment

Year	Law/ Act	Job creation Support	Requalification
2004	June 2nd, 2004 – enactment 566/2006 Program valid till December 31st, 2006	*Investment at least 10 mil. CZ & at least 10 vacancies created* Condition Ur>1.5*U Subsidy 200,000 CZK/vacancy	*Investment at least 10 mil. CZK & at least 10 vacancies created* Condition Ur>1.5*U Subsidy (% of requalification expenses) 35% for Ur>1.5*U
2006	287/2006 enactment Program prolonged till December 31st, 2007	No change	No change
2007	758/2007 enactment Program terminates December 31st, 2007	No change	No change

Note: This program supplements the investment incentives scheme and is aimed at investors who do not qualify for the investment incentives according to the law 72/2000. An investor can apply only for one type of subsidy, therefore, applying for the support through this program precludes participating in investment incentives scheme.

Table 2.3: The list of districts eligible for investment incentives for the whole period

	2000	2001	2002	2003	2004	2005	2006	2007
Sokolov	L	M	M	M	M	M	M	M
Děčín	H	H	H	H	H	H	H	H
Chomutov	H	H	H	H	H	H	H	H
Litoměřice	M	M	M	M	M	M	M	M
Louny	H	H	H	H	H	H	M	H
Most	H	H	H	H	H	H	H	H
Teplice	H	H	H	H	H	H	H	H
Ústí nad Labem	H	H	H	H	H	M	H	H
Svitavy	M	M	M	M	M	M	M	M
Hodonín	H	H	H	H	H	H	H	H
Třebíč	M	M	M	M	M	M	M	M
Znojmo	M	M	M	M	M	M	H	H
Bruntál	H	H	H	H	H	H	H	H
Frýdek-Místek	H	H	H	H	M	H	M	M
Karviná	H	H	H	H	H	H	H	H
Nový Jičín	M	M	M	M	M	M	M	H
Přerov	H	H	H	H	M	M	M	M
Šumperk	M	M	M	M	M	M	M	M
Jeseník	H	H	H	H	H	H	H	H

Note: H stands for district with the unemployment rate above 1.5*U_avg, M for districts with the unemployment rate between 1.25*U_avg and 1.5*U_avg and L for districts with the unemployment rate between U and 1.25*U_avg.

Table 2.4: The list of districts eligible for investment incentives only during some periods

	2000	2001	2002	2003	2004	2005	2006	2007
Kladno	L	L	L	L	L			
Kolín	L	L	L	L	L			
Břeclav	L	L	L	L	L		M	M
Kroměříž	L	L	L	L	L		M	M
Vsetín	L	L	L	L	L		M	M
Kutná Hora	M	M	M	M	M			
Nymburk	L	L	L					
Opava	M	M	M	M	L		M	M
Olomouc	M	M	M	M	L			
Karlovy Vary			L	L	L			
Česká Lípa	L							
Liberec					L			
Chrudim	L	L		L				
Prostějov	L	L	L	L				
Vyškov	L	L	L	L	L			

Note: H stands for district with the unemployment rate above 1.5*U_avg, M for districts with the unemployment rate between 1.25*U_avg and 1.5*U_avg and L for districts with the unemployment rate between U and 1.25*U_avg. Staring from 2005, category L was abandoned as there remained only eligibility categories M and H.

Table 2.5: Descriptive statistics: the Czech Republic (means)

Year	FDI	EDUC	UNI	MANUF	AGRI	ln(w)	HIGHWAY	EU15	u_rate	v_rate
1998	306.4	78.9	6.26	30.7	39.5	9.27	0.24	0.26	6.87	1.11
1999	320.0	79.5	6.34	31.0	39.4	9.35	0.24	0.26	9.09	0.84
2000	269.6	78.5	6.57	30.9	39.3	9.41	0.24	0.26	8.75	1.18
2001	127.3	78.5	6.82	31.4	39.2	9.47	0.26	0.26	8.48	1.28
2002	97.6	80.0	7.29	31.2	39.1	9.53	0.26	0.26	9.28	0.95
2003	111.3	80.1	7.43	30.6	39.0	9.60	0.26	0.26	9.96	0.85
2004	219.9	81.1	7.72	30.6	38.9	9.66	0.30	0.26	10.08	0.89
2005	330.6	82.1	8.28	31.7	38.8	9.71	0.31	0.26	9.49	0.98
2006	329.2	82.4	8.71	32.3	38.7	9.75	0.34	0.26	8.46	1.65
2007	362.4	82.0	8.90	32.9	38.6	9.79	0.35	0.26	6.82	2.37

Note: FDI is the forward-looking three-year average of basic capital inflow per capita in Euros, EDUC is the share of productive labor force with completed secondary education, UNI is the share of tertiary educated productive labor force, MANUF is the share of employment in manufacturing sector, AGRI is the share of arable land, HIGHWAY indicates the presence of a highway and EU15 stands for the common border with the EU-15 (Austria and Germany).

Table 2.6: Average FDI per capita inflow in the Czech Republic (euros)

Year	Czech Republic	3 largest	Rest
1999	320.0	1,099.4	144.2
2000	269.6	1,016.2	102.0
2001	127.3	362.1	75.5
2002	97.6	212.9	72.0
2003	111.3	332.1	62.4
2004	219.9	1,085.2	28.9
2005	330.6	1,419.8	89.6
2006	329.2	1,305.7	113.1

Note: For the calculation of average FDI per capita inflow the three years following the year pivotal for eligibility decision were considered. The three largest cities are represented by the metropolitan areas of Prague, Brno and Ostrava.

Table 2.7: Unemployment rate in Czech regions over time (% of labor force)

	1995	1999	2003	2007
Prague	0.3	3.2	3.9	2.8
Central Bohemia	2.7	6.9	7.2	5.4
Pardubický	2.7	8.1	8.7	6.8
Královehradecký	2.1	6.9	10.2	5.6
Liberecký	2.3	7.7	9.2	7.4
Ústecký	5.8	14.7	17.4	14.0
Karlovarský	1.8	8.1	10.2	9.3
Plzeňský	2.3	6.9	7.3	5.6
South Bohemia	2.0	6.2	6.4	5.8
Zlínský	2.7	8.1	10.3	8.0
Vysočina	3.6	8.4	8.6	7.1
South Moravia	3.0	9.0	11.1	8.9
Olomoucký	4.6	11.4	12.0	9.0
Moravskoslezský	5.7	13.5	16.4	12.9
Czech Republic	3.1	8.6	10.0	7.8

Note: Regional unemployment rates for years 1995, 1999 and 2003 were calculated by merging together districts corresponding to a particular region according to the structural division as of 2007 (there was a change in regional structure starting June 2004).

Table 2.8: FDI inflow, supported FDI and investment incentives during 2000-2007

(mil. CZK)	Realized FDI	Supported FDI	Paid incentives
Central Bohemia	157,888	61,475	761
South Bohemia	47,552	16,096	5
Plzeňský	32,756	15,879	18
Karlovarský	5,129	6,860	45
Ústecký	52,848	62,725	2,455
Liberecký	39,630	20,952	6
Královehradecký	17,474	13,408	11
Pardubický	18,798	21,550	11
Vysočina	57,035	27,844	55
South Moravia	45,374	26,544	540
Olomoucký	10,846	23,792	1,090
Zlínský	31,627	10,616	25
Moravskoslezský	139,389	28,147	1,360
Czech Republic	656,346	343,815	6,382

Note: Realized FDI is the actual FDI inflow during 2000-2007, supported FDI stands for the overall amount of planned investment (filled in the application for investment incentive) and paid incentives is the sum of total financial state subsidy during the period. The regions with the largest share of paid incentives are Central Bohemia region (TPCA investment - 593 mil. CZK), Ústecký region (Black & Decker Overseas Holdings BV - 200 mil. CZK; IPS Alpha Technology - 140 mil. CZK; Eaton Industries - 130 mil. CZK), Olomoucký region (L.G. Phillips - 800 mil. CZK) and Moravskoslezský region (ASUS - 271,4 mil; Sungwoo Hitech - 150 mil. CZK). There was no individual company with more than 100 mil. CZK subsidy in the remaining regions. Prague is excluded.

Table 2.9: Average FDI per capita inflow by district unemployment rate (euros)

Year	U < U_avg	U_avg < U < 1.25*U_avg	1.25*U_avg < U < 1.5*U_avg	1.5*U_avg < U
2001	75.5	125.8	64.6	43.5
2002	66.6	148.0	17.9	61.2
2003	78.4	138.1	42.1	-35.1
2004	61.7	69.3	-37.7	-82.4
2005	123.1	47.9	-87.6	162.4
2006	117.8	90.6	-98.6	398.6

Note: For the calculation of average FDI per capita inflow the three years following the year pivotal for eligibility decision were considered. According to a change in scheme design, for the year 2006 an alternative grouping is used as 1.25*U_avg is replaced by 1.2*U_avg. Prague, Brno and Ostrava are excluded as FDI flows to metropolitan areas are specific and contain distortions (privatization of banks in the case of Prague, and larger concentration of service industry as compared with the rest of the Czech Republic).

Table 2.10: Pooled OLS estimation: explaining FDI inflow by observables

	coef.	st.err.	coef.	std.err.	coef.	std.err.
	1998-2007		1998-2002		2003-2007	
SECONDARY	2.18	(6.00)	0.01	(3.34)	6.08	(11.63)
TERTIARY	12.34	(8.82)	24.51**	(9.28)	-4.26	(14.44)
MANUF	1.95	(2.31)	2.65	(3.07)	0.87	(3.76)
AGRI	1.24	(0.94)	0.55	(1.32)	1.49	(1.15)
HIGHWAY	55.69	(52.81)	23.00	(33.86)	79.58	(93.40)
EU15	62.29	(42.82)	29.11	(37.57)	99.81	(67.99)
log(WAGE)	693.99*	(388.77)	1174.53***	(346.23)	183.45	(589.85)
u_rate	-6.31	(9.29)	-7.30	(9.22)	-17.43	(12.74)
v_rate	8.71	(80.72)	-24.51	(51.38)	49.39	(98.35)
u x v	0.24	(11.61)	5.12	(6.85)	-2.32	(15.43)
LOW+MEDIUM	-2.36	(46.6)	32.25	(46.57)	39.31	(71.98)
HIGH	34.20	(73.15)	12.56	(90.91)	175.44	(123.21)
N	1480		740		740	
R-squared	0.06		0.16		0.04	

Note: Pooled linear regression explaining heterogeneity in FDI inflow per capita based on pooled data. The regression is estimated for two periods: the first includes years prior to the establishment of the formal FDI promotion scheme (1999-2002), the second one covers the years after the launch of all FDI incentive programs (2003-2007). The dependent variable is the forward-looking average of FDI inflow. The following independent variables are time-invariant and characterize levels prior to the massive FDI inflow: variable SECONDARY indicates the share of population with secondary education and TERTIARY the share of college-educated population; MANUF stands for the employment share in the manufacturing sector, AGRI indicates the share of agricultural land out of the total area of a district and HIGHWAY is a dummy indicating the presence of a state highway. Dummy EU15 indicates a border with Austria or Germany, u_rate is the unemployment rate and v_rate is the vacancy rate. Cities of Prague, Brno and Ostrava are excluded. Time trend coefficients and intercept are not displayed. Standard errors allow for intragroup correlation by clustering observations by district. Significance levels: *** 1%, ** 5 %, * 10%.

Table 2.11: Fixed-effects estimation: the role of incentives in FDI attraction

	coef.	st.err.	coef.	std.err.	coef.	std.err.
	1998-2007		1998-2002		2003-2007	
u_rate	6.60	(13.84)	-6.76	(12.39)	10.53	(20.52)
v_rate	-27.63	(93.59)	-74.84	(92.79)	1.29	(82.77)
u x v	5.81	(10.93)	10.93	(12.21)	5.71	(15.02)
LOW+MEDIUM	57.40	(52.42)	77.213*	(45.93)	165.16*	(98.91)
HIGH	-27.44	(103.27)	-17.50	(116.85)	137.83	(124.73)
N	1480		740		740	
R-sq. (between)	0.07		0.03		0.04	

Note: Fixed-effects estimation explaining heterogeneity in FDI inflow per capita based on pooled data. The regression is estimated for two periods: the first includes years prior to the establishment of the formal FDI promotion scheme (1999-2002), the second one covers the years after the launch of all FDI incentive programs (2003-2007). The dependent variable is the forward-looking average of FDI inflow. Variable u_rate stands for the unemployment rate and v_rate is the vacancy rate. Dummy HIGH indicates the group of districts with the highest subsidy and the grouped variable LOW+MEDIUM indicates the eligibility for the lowest subsidy. Cities of Prague, Brno and Ostrava are excluded. Time trend coefficients and intercept are not displayed. Standard errors allow for intragroup correlation by clustering observations by district. Significance levels: *** 1%, ** 5 %, * 10%.

Table 2.12: RD estimates of the impact of incentive thresholds on FDI

FDI per capita inflow (euros)	(2000-2004)			(2005-2007)		
Bandwidth	medium	short	long	medium	short	long
Impact_U_avg	127.4	417.0**	96.5	-9.2	–72.6	-57.1
standard error	(152.4)	(228.4)	(100.7)	(51.7)	(84.8)	(57.6)
N_used	108	38	254	122	46	264
Impact_1.25	164.4	–11.2	-2.0	321.3**	321.9	223.5***
standard error	(124.5)	(47.2)	(110.0)	(160.0)	(297.9)	(77.5)
N_used	83	44	240	65	30	214
Impact_1.5	-3.1	83.5	–57.1	-287.0	1262.9**	-164.1
standard error	(169.0)	(543.3)	(97.2)	(193.2)	(462.0)	(114.8)
N_used	107	51	265	47	23	122

(2.5)

Note: The table reports local Wald estimates from regression discontinuity estimation with FDI per capita inflow as a dependent variable and the unemployment rate as an assignment variable. In order to reflect major institutional changes to the investment scheme at the end of 2004, it is necessary to run RD estimation separately for periods 2000-2004 and 2005-2007. The bandwidth characterizes the distance of the district from the discontinuity jump in terms of the unemployment rate. A medium bandwidth is set so that at least 30 districts are included on each side of the discontinuity. As a robustness check, alternative bandwidths are used – short and long corresponding to half and double the medium bandwidth, respectively. Three different unemployment thresholds are considered: the average unemployment rate times 1, 1.25 and 1.5, respectively. Values denote the impact of the investment incentive scheme at the margin on the future FDI inflow in a district. Two specifications for each threshold are estimated – the first one explains FDI per capita inflow for the full sample of districts, the second specification uses only a subsample of districts because six districts which changed their eligibility/ineligibility status more than once are excluded due to a potential noise in the data. The findings do not change significantly, thus, results are reported only for the latter specification. Standard errors are obtained by bootstrapping. Significance levels: *** 1%, ** 5 %, * 10%.

Chapter 3

The Effect of Economic and Monetary Integration on FDI: The European Experience

(Joint work with Vilma Dingova)

3.1 Introduction

In 1999, the euro was introduced as a common currency in eleven countries of the European Union (EU). The establishment of the European Monetary Union (EMU), or formally the euro area, was viewed as a necessary step towards closer political and economic integration. From the political perspective, the common currency was expected to become a unifying symbol of European identity. From the economic perspective, the common currency was supposed to enhance the free movement of capital, which is a fundamental principle of the EU. At the same time, it would promote trade through diminishing transaction costs and trade costs such as exchange rate volatility (Rose, 1999). In a broader context, the common currency was believed to ensure better functioning of an integrated market (Delors, 1989).

The euro project has been generally supported by policymakers and politicians. Expectations about the economic gains of the common currency were ambitious and

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All errors remaining in this text are the responsibility of the author.

several waves of enlargement took place over the last decade (Table 3.1).[1] Nevertheless, eurosceptics objected that one currency does not fit the monetary needs of diverse economies and the initial weak growth of the euro area fueled their arguments. Among academics, the decision to form a common currency area led to a considerable research interest. The literature ranged from assessing the fulfillment of Mundell-McKinnon-Kenen criteria and evaluating arguments in favor and against a currency union (e.g. Giavazzi and Torres, 1993) to comparing the co-movements in macroeconomic variables between the EU and the USA and analyzing their asymmetric shocks (e.g. Bayoumi and Eichengreen, 1993).

The debate on the contribution of a common currency to economic development is vital. In our paper, we contribute to the mosaic of impacts of a common currency on the economy by investigating one specific aspect of a common currency: the link between the introduction of the euro and the inflow of foreign direct investment (FDI). Two main research questions regarding the euro and FDI are asked: first, has the common currency enhanced FDI flows for countries that adopted the euro as compared with the rest of the OECD countries and, second, has the euro fostered capital reallocation for euro countries as compared with the rest of the EU? In addition, the role of both economic and monetary integration is examined and the impact of introducing the euro is compared with the impact of EU membership.

The euro exerts an influence on many economic activities, one of them being the flow of capital among countries resulting from the removal of restrictions on investment location decisions (Baldwin et al., 2008). It is important to understand firms' international strategies as FDI is associated with higher economic growth, developed technologies and knowledge spillovers among countries (Harris and Taylor, 2005). The literature has shown that uncertainty negatively affects investment and, more specifically, that uncertainty about exchange rate movement has an adverse effect on FDI decisions (Carruth et al., 2000). In particular, a persistent deviation

[1] Greece joined the club in 2001. The EMU was later enlarged by Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009, and the newest euro area member is Estonia which joined the EMU in 2011. Thus, 17 of 27 EU countries now use the euro as an official currency.

of the exchange rate from the long-run equilibrium negatively affects FDI flows (Campa, 1993). Thus, it is natural to ask whether the elimination of exchange rate movements resulting from the introduction of a common currency influences firms´ long-term investment decisions and FDI in general.

The common currency can affect FDI inflows through three channels: reduced exchange rate uncertainty, reduced transaction costs, and increased price transparency. First, the elimination of exchange rate risk leads to cost saving stemming from the absence of a need for hedging, thereby positively affecting expected returns to firms. Many multinational enterprises (MNEs) are export-oriented and FDI serves mainly as a production platform for their exports (Bergstrand and Egger, 2006). Naturally, a motivation of MNEs to locate their operations in the EMU increases as foreign investors' expansion into the euro area opens access to the rest of the euro area countries and to the surrounding EU market. Secondly, the reduction of transaction and operational costs incurred by the use of several currencies reduces the cost of capital. Thirdly, the common currency enhances price transparency, facilitating a comparison of factor prices and cost calculations. Many investments abroad are motivated by firms' efforts to produce efficiently and the endowment and prices of primary factors of production – land, labor and capital – are important determinants of firms' localization decisions.

Determining the euro's impact on capital reallocation through FDI would have broad policy implications. Apart from traditional location determinants (infrastructure, human capital), countries use various institutional factors to attract FDI. Specifically, governments spend vast amounts of public money on FDI promotion policies and investment incentive schemes. Thus, quantifying the impact of the euro on FDI flows might become a considered factor for EU countries that have not yet adopted the euro..

The remainder of the paper is organized as follows. In Section 2 we analyze global FDI flows and the role of FDI in the EU. In Section 3 we review related literature. Sections 4 and 5 are devoted to methodology issues and data description,

and Section 6 presents the identification strategy. In Section 7 we present our results and robustness checks. Section 8 summarizes and provides concluding remarks. All tables referenced in the text may be found in the appendix.

3.2 FDI in the EU

Global FDI flows have grown dramatically over the past three decades, increasing from $54 billion in 1980 to $1,771 billion in 2008. In the 1980s and early 1990s, there was an evident increasing trend in FDI to developing countries as productive factors were emphasized as one of the most important motivations for FDI.[2] These countries capitalized on the advantage of lower productive costs, mainly labor costs, and their share in global FDI flows rose from 14 percent in 1980 to 37 percent in 2008, as shown in Table 3.2. There is a dip in world FDI flows starting in 2001, which is related to the slowdown in the world economy and to a decline in cross-border mergers and acquisitions. After recovering during 2004-2007, there was a more recent decline in 2008, mainly due to the imminent economic and financial crisis. However, the overall share of FDI flows to developing countries has remained significantly lower than the share of flows to developed economies (37 vs. 57 percent in 2008).

Europe absorbs about two thirds of total FDI inflows to developed economies, followed by North America with a share of 26 percent (Table 3.3). Besides being the main recipient of world FDI flows, Europe is also a main source of these flows, followed by the United States and Japan. Disentangling FDI flows further, approximately 96 percent of flows into Europe are aimed at the EU and more than 66 percent at the EMU. From 1995, FDI inflows to Europe have increased, with an exception in the periods 2001-2004 and 2008-2009 when the world FDI flows decreased due to the financial and economic crisis. However, it has remained the prevalent global recipient of FDI flows.

[2]Locating a firm's activities to countries with the lowest production costs leads to vertical FDI.

FDI is believed to promote economic growth and development (Tondl and Vuksic, 2003); therefore, understanding the mechanism of FDI location should be a key focus of responsible policymaking. In the case of developed economies, FDI spillovers through managerial expertise are a dominant factor (Ghosh and Wang, 2009). The common euro area, a single market with more than 300 million consumers, attracts FDI by its enormous size, economic power and no exchange rate risk. Furthermore, it serves as a production platform for exports, which is an important decision aspect for investors from outside the EU. From a country-level point of view, joining the common currency area diminishes currency volatility and transaction costs.[3] This feature is especially important for countries with a substantial share of export-oriented firms such as the Czech Republic or other Central and Eastern European countries.

3.3 Literature survey

The rapid growth of investment flows in the globalized world economy over the last decades has sparked academic interest in FDI determinants and the FDI effects on both host and home economies. The empirical literature acknowledges that foreign investors' location decisions are influenced by firm-level factors as well as macro-economic, geographic and institutional variables. One strand of literature on FDI determinants arises from the eclectic paradigm (Dunning, 1997), also known as the OLI model.[4] Based on the new trade theory, this model emphasizes ownership and location advantages and analyzes FDI from the investors´ point of view. Investors' decisions whether to become a multinational enterprise is examined mainly through firm costs represented as plant-level costs and trade costs (Markusen and Venables, 1998; Kleinert 2001). Another strand of literature looks at determinants of FDI

[3]Increasing market size of the euro area strengthens its economic power. Moreover, the two largest EU markets - Germany and France - are member states of the euro area.

[4]The OLI model is based on three categories of advantages of foreign investment: O – Ownership advantage (trademark, entrepreneurial skills, etc.), L – Location advantage (access to raw materials, prices of production factors, etc.), I – Internalization advantage (licensing, joint venture, etc.).

location from the perspective of country differences, attempting to identify how country-level factors such as size, institutions, taxes, exchange rate, trade protection, production factor prices and human capital endowment affect FDI flows.[5]

Literature focusing on the effect of exchange rate on FDI has two branches, one examining the relation between exchange rate levels and international investment flows and the second focusing on exchange rate volatility and the role of uncertainty and expectations about the future exchange rate. Studies based on the firm-level framework and option theory find that greater exchange rate uncertainty increases the outside option for firms so that it pays off to delay their investment, which depresses current FDI (Dixit and Pindyck, 2004).[6]

Since the formation of the European Monetary Union (EMU), analysis of the role of exchange rate uncertainty on FDI flows has been supplemented by the aspect of common currency and its impact on investment flows. The literature studying the link between the euro and FDI finds a significant positive impact of the euro on FDI (Petroulas, 2007; Schiavo, 2007; De Sousa and Lochard, 2006; Buch et al., 2003). However, there is no consensus regarding the size of the effect, and thus the exact magnitude of the impact of the euro on FDI remains unclear.

Baldwin et al. (2008) highlight that the usual shortcoming preventing a proper estimation of the euro effect on FDI is a less-developed methodology and identification strategy. In our paper, we use a rigorous identification technique to obtain more reliable estimates of the common currency impact on international investment.

The standard approach to analyzing the impact of the euro on FDI employs a gravity model augmented with a dummy variable for a common currency. De Sousa and Lochard (2006) investigate the FDI decision of a firm to set up an affiliate abroad and estimate the effect of the euro on FDI for 21 OECD countries. They find that a common currency has a positive impact on FDI within the euro area. They also find that the impact of the euro on FDI is higher in the EU peripheral

[5] Bloningen (2005) offers a good survey of literature on FDI determinants.

[6] Dixit (1989) models a firm's entry and exit decisions under uncertainty theoretically, and Carruth et al. (2000) provide a complete survey of empirical literature on exchange rate volatility and FDI based on option theory.

countries like Greece or Italy. When they drop these two countries from the sample, the effect of the euro on FDI decreases by 10 percentage points to 19 percent. However, the question whether the euro has also attracted capital from the rest of the world is not addressed. Petroulas (2007), using a difference-in-differences approach for a panel of unilateral FDI flows for 18 countries, also tackles this issue as he explores changes in FDI flows within the euro area, between euro area countries and non-euro area countries, and between non-euro area countries. He finds that the introduction of the euro raised inward FDI flows by approximately 16 percent within the euro area and by about 11 percent for non-member states. FDI flows from the non-member countries into the euro area increased by 8 percent. On the same note, Schiavo (2007) estimates the effect of a common currency on bilateral FDI flows among 25 OECD countries, by applying a gravity-type empirical model with a parsimonious set of explanatory variables. He concludes that a reduction in exchange rate uncertainty due to the introduction of the euro increases cross-country investment flows by 160 to 320 percent. An alternative specification using three-year averages in order to eliminate a high variability in FDI flows decreases the magnitude to 70 to 250 percent. The endogeneity of FDI with respect to GDP is partly resolved by the use of fixed effects. However, the wide range of the results suggests that estimates should be interpreted with caution.

The majority of mentioned papers (De Sousa and Lochard, 2006; Petroulas, 2007; Schiavo, 2007) use country-pair fixed effects, capturing time-invariant heterogeneity between country pairs, thereby reducing concerns about the endogeneity of investment flows. However, this variation also includes time-invariant observable controls (e.g. common language) and, consequently, precludes the quantification of their impact separately. This poses a serious concern for the validity of the gravity model, as the model's intuition is built upon the incorporation of time-invariant factors like land area and distance between countries.

Apart from examining FDI flows using the data from balance of payments, there are studies inspecting plant-level micro data. Buch et al. (2003) analyze the impact

of the euro on capital inflow using German data from a mandatory firm-level survey organized by the Bundesbank.[7] They find that FDI from the EU significantly increased after the introduction of the euro. The effect is present to a smaller extent also for non-euro countries. The advantage of Buch et al.'s approach is the use of reliable firm-level data as compared to general capital account FDI data. However, they face the problem of using a single nation's data and the uncertainty that the results are driven by national asymmetric shocks. These suspicions are partly confirmed by Petroulas (2007) who finds that Germany, Belgium and Luxembourg act as a hub for FDI flows of the euro area.[8] Thus, the size of the impact of the euro on FDI flows for individual countries seems to be ambiguous as Schiavo (2007), contrary to Petroulas (2007) and De Sousa and Lochard (2006), does not find that any country faces a higher impact of the euro on its FDI flows.

Summarizing, exchange rate uncertainty has received considerable interest in the empirical literature on FDI in recent years. However, all papers work with data ending by the year 2001 or 2002, and thus whether the euro has influenced firms' long-term investment decisions and their FDI location decisions still remains mostly unanswered. Furthermore, since the common currency affects international investments via various channels, we might suspect that some of these channels would need a longer period for transmission than two or three years after the common currency is introduced. Therefore, our paper investigates the impact of the euro using data on FDI flows until 2008. It allows us to examine the effect of the common currency on FDI in the longer term (nine years after EMU establishment) and to shed light on foreign investors' motivation by including countries from the latest wave of euro area enlargement.

[7] In general, firm-level studies on FDI issues are not numerous due to unavailable or insufficient data.

[8] After excluding Germany, Belgium and Luxembourg, most of the euro effect disappears. On the other hand, if they are excluded only as a receiver country or only as an investor country, the euro effect remains nearly the same.

3.4 Methodology

We adopt the approach commonly used in the trade literature employing the gravity-equation model which specifies trade flows between countries as a function of the GDP of each country and the distance between these two countries.[9] Recently, the gravity-equation models have also proven to be useful in explaining international investment flows.[10] The focus is put on time-invariant exogenous and policy variables so that the endogeneity problem is eliminated. Explanatory variables such as geographic distance, cultural ties (common language) and policy changes are used. The advantage is that panel data make it possible to analyze structural policy breaks. In our paper, such an exogenous break is represented by the accession of a country to the euro area.

The model thus combines institutional factors with environmental factors. The traditional gravity literature (e.g. Brainard, 1997) specifies financial flows between countries as a function of various institutional and geographical factors. Following this approach, the amount of FDI flow from a country i into a country j at time t can be expressed as

$$\begin{aligned} \ln FDI_{ijt} &= \phi(\ln dist_{ij}, \ln GDP_{ijt}, \ln ULC_{ijt}, EERSR_{ijt}, EERLR_{ijt}, \\ &\quad border_{ij}, lang_{ij}, t, EU_{ijt}, euro_{ijt}), \end{aligned} \tag{3.1}$$

where FDI_{ijt} is FDI flow from a country i into a country j , $dist$ represents the geographical distance between countries, GDP stands for a product of countries' gross domestic products, ULC is a ratio of exchange rate adjusted unit labor costs, $EERSR$ stands for a short-term exchange rate volatility and is expressed as a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, $EERLR$ stands for a long-term exchange rate volatility and is expressed as a five-

[9] Anderson (1979) presented a theoretical foundation for the gravity model. This approach has been widely used to inspect trade flows between countries (e.g. Anderson and Wincoop, 2003). Frankel and Wei (1996) first applied the gravity equations on FDI flows.

[10] See Bergstrand and Egger (2007).

year coefficient of variation of a ratio of countries' real effective exchange rate indices, *border* indicates a common border, *lang* is a dummy indicating countries share the same language,[11] *EU* is a dummy indicating presence of both countries in the EU and *euro* is a dummy indicating that both countries belong in the euro area.

The semi-log functional form is chosen over the linear specification due to a better fit of the model. Given the skewness of FDI data, this specification more likely leads to robust standard errors (Bloningen and Davies, 2004). Moreover, it reduces the weight of outliers with very large FDI flows and it allows us to interpret the estimated coefficients of continuous variables as elasticities. However, this transformation is at the expense of losing information from negative flows (this issue is addressed later).

The above-mentioned variables are traditional determinants of FDI flows, each having its economic rationale.[12] The size of the two economies measured as a product of their GDP approximates the market potential of these countries. The empirical literature finds that increasing size of two economies enhances FDI flows between them. International price competitiveness expressed by unit labor costs affects FDI negatively. An improvement in ULC may occur via increases in labor productivity or cuts in taxes, and the size of this effect on FDI depends on the sensitivity of a particular type of FDI. The sensitivity of FDI to a change in unit labor costs varies across sectors; FDI demanding a highly-qualified labor force is not very sensitive, while FDI demanding a low-qualified labor force is very sensitive to changes in unit labor costs.[13] The effective exchange rate as a measure of whether a currency is appreciating or depreciating to the exchange rate against a basket of foreign currencies with whom the country trades enhances the effect of the exchange rate and its volatility on FDI flows. The literature supposes a negative relation between FDI and exchange rate volatility as volatility increases macroeconomic uncertainty, thereby

[11] In case a country has more than one official language, it is sufficient if any of these languages is shared with the second country in a pair.

[12] Billington (1999) offers summary of economic and political determinants of FDI. Chakrabarti (2001) examines the impact of the whole set of variables on FDI and checks their robustness to small changes in conditioning information set. Martín and Velázquez (1997) present FDI determinants for OECD countries.

[13] Bellak et al. (2008) investigate the effect of labor costs on FDI.

reducing the attractiveness of domestic assets. We distinguish between a short-term volatility of the exchange rate and long-term misalignments. The distance between countries is another factor affecting the FDI location mechanism. The empirical literature typically finds that it has a negative impact on FDI flows as greater distance between countries makes a foreign affiliation more difficult to establish, manage and monitor.[14] Following the same logic, the border dummy is expected to affect FDI flows positively as a common border represents smaller communication costs and closer ties between countries. The effect of the common language on FDI is also expected to be positive as the common language decreases communication costs for FDI flows. These three variables - geographical distance, border, and language (often named as cultural distance) - are proxies for time-invariant asymmetries between countries which can strengthen the investment linkages between countries. EU membership captures the overall benefits of the single market on FDI flows and is expected to be positive. Finally, the euro dummy is pivotal for our paper as it expresses the effect of the common currency on FDI.

3.5 Data

Annual FDI flow data during the period 1997-2008 are used for the analysis. The availability of such a span presents an advantage over previously mentioned studies on the FDI impact of the euro, which use only a limited number of years (one to three) after the euro's introduction. As the focus of this paper is the analysis of European FDI flows, the main source of data on investment flows is Eurostat, compiling harmonized FDI from regulatory reports to central banks and surveys filled by resident business units.[15] Eurostat provides data on unilateral FDI flows for each reporting country by the partner country. Both FDI inflows and outflows

[14] Egger and Pfaffermayer (2001) analyze the effect of distance on trade and FDI.

[15] FDI benchmark definition, according to the OECD, regards FDI as "direct investment positions (equity and debt), direct investment income flows (distributed earnings, reinvested earnings, interest income) and direct investment financial flows (equity and debt) between the direct investor and its direct investment enterprises abroad" (OECD, 2008, page 17).

are reported for 35 countries (29 OECD members and 6 non-OECD countries).[16] The choice of countries is motivated by the effort to cover FDI flows between the majority of European countries and their major FDI partners. Overall, the data sample consists of 589 country pairs, providing us with an unbalanced panel of 11,457 observations.[17]

One-way outward investment flows FDI_{ijt} are used, representing investment from country i to country j in period t. It can occur that FDI flow from country i to country j is measured in two different ways – either reported by investing country i as an outflow to country j or reported by recipient country j as an inflow from country i. In reality, there is often a discrepancy between these two values. There is no information indicating that either of these values is "better", therefore, we ameliorate this measurement error by constructing the average of the two series.

Table 3.4 displays the descriptive statistics of covariates for both euro and non-euro country pairs.[18] The majority of observations belongs to non-euro country pairs (10,367 vs. 1,090 observations). With the exception of FDI flows, exchange rate volatility, language and border dummy, observable characteristics for euro and non-euro pairs are not very different. This is not surprising as most OECD member states are developed and quite homogeneous economies. More important, the similarity suggests that the variance in FDI flows is not directly attributable to the level of GDP or distance between countries.

Table 3.5 compares the trend of FDI for euro and non-euro pairs over time. It

[16] Out of a total of 34 OECD countries, Luxembourg, Israel, Chile, Mexico and Switzerland are omitted. Unit labor cost data for Switzerland are not available. In the case of Luxembourg, balance of payment data displays large FDI flows associated with the favourable bank environment which is not a primary focus of this paper. Israel, Chile and Mexico exhibit a considerable number of missing values on bilateral FDI flows. The six non-OECD countries are Bulgaria, Cyprus, Latvia, Lithuania, Malta, Romania.

[17] Although the 35 considered countries constitute 35*34/2 = 595 country pairs, we do not possess information for FDI flows between Australia, Canada, New Zealand and South Korea (6 country pairs) for any year during 1997-2008. Out of 589 country pairs, there is information on both FDI inflow and outflow during the whole period of 12 years for 191 country pairs; the rest contain at least one missing value. However, we have at least 20 observations for 353 country pairs and at least 10 observations for 567 country pairs.

[18] As stated above, a pair is viewed as a "euro pair" during a given period if both countries use the euro as a currency at this point in time. Otherwise (when one or both countries do not use the euro), the pair is referred to as a non-euro pair.

illustrates the U-shaped behavior of both groups of country pairs, with a modest decline during 2000-2003, indicating that time trend is not a significant factor in explaining the difference in FDI flows between euro vs. non-euro country pairs.

The source of unit labor cost data is the OECD and we construct the unit labor cost ratio as a fraction of unit labor costs in an originating country over unit labor costs in a recipient country. The source of data on GDP is the International Monetary Fund (IMF) and the real effective exchange rate indices (REER) are obtained from the Bank of International Settlements (BIS) database.[19] A short-term exchange rate volatility is expressed as a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, and a long-term exchange rate volatility is expressed as a five-year coefficient of variation of a ratio of countries' real effective exchange rate indices. Additional data include geographical and cultural factors such as distance between countries, common border and language dummies.[20]

3.6 Econometric analysis

Empirical results of the euro's impact on FDI have been less numerous than on other issues concerning the impact of a common currency (e.g. trade effect), mainly due to a less developed empirical methodology and a lack of data (Baldwin et al., 2008). A simple OLS estimation may be potentially biased due to the self-selection of countries to adopt the euro. Therefore, after presenting OLS results, we address this shortcoming by exploiting variation in FDI flows before and after the introduction of the euro and by performing a Tobit estimation due to the left-censored character of the dependent variable.[21] Moreover, a pivotal aspect of our paper is that we account for potential selection bias for euro adoption: the estimation is performed only for a comparable subset of country pairs matched by a propensity score matching

[19] The BIS real effective exchange rate indices are calculated as the geometric weighted average of a country's currency relative to an index of other major currencies adjusted for the effects of inflation.

[20] Geographical distance between countries is measured as the distance between capital cities.

[21] Due to disinvestment, many FDI flows are negative, thereby precluding a conversion into a logarithmic scale. These missing observations are considered as censored from the left.

technique. Using this approach, the analysis is based on the comparison of otherwise similar country pairs (identified by a similar propensity to share the euro), the only difference being the adoption of the euro.

3.6.1 Difference-in-differences estimation

A difference-in-differences estimation allows us to exploit policy change and estimate the impact of euro adoption on FDI flows. The following econometric specification is estimated:

$$\begin{aligned} \ln FDI_{ijt} &= \beta_1 \ln dist_{ij} + \beta_2 \ln GDP_{ijt} + \beta_3 ULC_{ijt} + \beta_4 EERSR_{ijt} + \beta_5 EERLR_{ijt} + \\ &\quad \beta_6 border_{ij} + \beta_7 lang_{ij} + \beta_8 t + \gamma_1 EU_{ijt} + \gamma_2 euro_{ijt} + \epsilon_{ijt}, \end{aligned} \tag{3.2}$$

where γ_1 and γ_2 are the coefficients estimating the impact of the EU and the euro on FDI flows, respectively.

However, because of the nature of the data, using simple OLS regression would bias our estimates. Due to disinvestment, reported FDI flow is often zero or even negative, which imposes a serious limitation when using a logarithmic form of the dependent variable.[22] In order to exploit the maximum amount of information from the available dataset, data are modified in a way that observations with negative FDI flows can also be used. One means of data modification is to perform a transformation $\ln FDI_{ijt} \equiv \ln(x + FDI_{ijt})$, where x is a positive scalar (Gujarati, 1995). However, in such a case, it would be difficult to correctly interpret the parameter estimates. An alternative transformation enables the adoption of the Tobit model (Tobin, 1958), defining the dependent variable in the following way:

$$\begin{aligned} \ln FDI_{ijt} &\equiv 0 && \text{if } FDI_{ijt} \leq 0 \\ \ln FDI_{ijt} &\equiv \ln(1 + FDI_{ijt}) && \text{if } FDI_{ijt} > 0. \end{aligned}$$

[22] Out of 11,457 observations, 1,908 report negative FDI flows.

This specification of the dependent variable exhibits a left-censoring threshold at zero. Tobit estimation controls for this feature of the data and yields consistent parameter estimates.

3.6.2 Propensity scores matching

The propensity score matching technique (Rosenbaum and Rubin, 1983) approximates a counterfactual outcome despite the lack of experimental data. It allows us to match country pairs based on their observable characteristics and to compare the potential outcomes between country pairs which share the euro with countries that do not. In this way, we identify a control group of country pairs with a similar propensity to share the euro but which actually do not share the euro.

Let FDI^1_{ijt} denote the value of FDI flow from country i to country j in the case they both use the euro at time t and let FDI^0_{ijt} denote the level of FDI flows from country i to country j in the case they do not share a common currency. The impact of adopting the euro is then estimated as $FDI^1_{ijt} - FDI^0_{ijt}$.

The main problem in identifying the effect of the euro on FDI flows is that FDI is observed only for one scenario of the treatment variable ($euro_{ijt}$) and remains unobserved for the other. One way to solve this problem is to use similar countries selected by some matching mechanism and utilize this group as an approximate counterfactual. This identification strategy assumes that the potential amount of FDI between countries that adopted the euro would be the same as was the amount of FDI for the control group that did not adopt the euro:

$$E(FDI^0_{ijt}|euro = 1) = E(FDI^0_{ijt}|euro = 0). \tag{3.3}$$

However, it is difficult to match country pairs based on many observable characteristics. A more lucid way is to construct a one-dimensional metric as a matching indicator. For this purpose, we employ a method uniting relevant observed characteristics into a single score known as a propensity score (Rosenbaum and Rubin,

1983). These propensity scores are obtained from the probit equation estimating the probability of the event that a country pair shares the euro as a function of specified independent variables. After obtaining propensity scores, each treated pair is matched to one or more control pairs (depending on the matching technique) and the differences in the outcome variable between matches serve as an estimate of the euro's impact on FDI flows.

The probability of receiving the treatment (sharing the euro) is estimated as follows:

$$P(euro_{ijt} = 1) = \phi(\ln dist_{ij}, \ln GDPcap_{ijt}, \ln area_{ij}, lang_{ij}, bord_{ij}, landlock_{ij}), \tag{3.4}$$

where $P(euro_{ijt} = 1)$ stands for the probability that countries i and j both use the euro at time t, explanatory variables are as in equation (3.1), augmented by the number of landlocked countries in a country pair ($landlock$) and the product of countries' area and GDP per capita ($area_{ij}$ and $GDPcap$, respectively). This unrestricted specification does not require matched observations to be from the same year, matching a combination of a treated country pair/year to control country pair/year. In order to perform a robustness check, we estimate an alternative specification of the probit equation:

$$P(euro_{ij} = 1) = \phi(\ln dist_{ij}, \ln GDPcap_{ij}, \ln area_{ij}, lang_{ij}, bord_{ij}, landlock_{ij}), \tag{3.5}$$

where $P(euro_{ij} = 1)$ is the probability that countries i and j adopted the euro between 1999-2008 and $\ln GDPcap_{ij}$ denotes the logarithm of $GDPcap$ for 1998 (prior to euro adoption). This specification matches a treated country pair to a control country pair. Including all observations for treated and control country pairs in difference-in-differences estimation (3.2) effectively compares FDI flows from the same year (heterogeneity across country pairs is controlled by fixed effects and differences between years is partly captured by the trend), thereby the specification (3.5) will be referred to as 'restricted'.

It is crucial to stress that the objective of the probit equation is not to build a statistical or even a political model explaining EMU membership in the best possible way. It is even possible that some relevant variables affecting eurozone membership are missing. Indeed, a close-to-perfect match would make matching more difficult as there would be only a few country-pair matches with a similar probability of sharing the euro, the only difference being the euro currency. The imperfect prediction of the treatment does not present a problem as long as the omitted variables are unrelated to other FDI determinants. The aim is not to obtain the best fit for euro membership in probit estimation, but to obtain a tool to identify and evaluate the impact of the euro's introduction.

A propensity matching setup requires the fulfillment of some assumptions. First, the potential amount of FDI in the case of not sharing the euro is equal for euro and non-euro country pairs so that the latter group can serve as an adequate control group (conditional independence assumption). This assumption is satisfied as the explanatory variables in the FDI equation include a vast set of indicators affecting FDI flows such as distance between countries, variable for GDP measure, unit labor cost ratio, exchange rate volatility, border and language dummies and time trend, filtering out heterogeneity in FDI flows caused by observable characteristics. All remaining differences can be attributed to the common currency dummy. Second, country pairs with similar values of the relevant covariates have a positive probability of sharing and non-sharing the euro (common support assumption). In other words, there should be no significant difference between the means of explanatory variables in equation (3.4) for euro and non-euro country pairs. Based on the descriptive statistics displayed in Table 3.4 this condition is assumed to be satisfied. Third, FDI of a country pair sharing the euro is not affected by another country-pair's euro or non-euro state (stable unit treatment value assumption). Here, it can not be assumed that there are no spillovers since a particular country pair's assignment into the eurozone might be affected by other country-pairs' assignments.

Nevertheless, we can still draw some inference about the impact of the euro by

redefining the causal effect: instead of measuring the effect as "the difference between what would have been observed in a world in which units received the treatment and what would have been observed in a world where no treatment exists", we define the effect as "the difference between the particular unit's observed outcome and what would have been observed had that unit received no treatment". The average of these estimated unit-level effects gives us the demanded estimate of the average effect for the treated. Therefore, even in the absence of the stable unit treatment value assumption, a well-defined causal question enables an attempt at analysis.

3.7 Results

3.7.1 The gravity model

Results for several baseline specifications using the full sample of country pairs are reported in Table 3.6. The first specification is a simple OLS and the second specification is a Tobit estimation which accounts for the left-censoring character of the dependent variable. The third and fourth specifications are augmented by country-pair fixed effects, helping to control for unobserved heterogeneity among various country pairs.

Before focusing on the relationship between a common currency and FDI flows, we briefly present the results for other explanatory variables. Results confirm the idea behind a gravity model – the product of countries' GDP has a positive and significant impact on FDI flows, which indicates a link between the economic strength of particular countries in a country pair and FDI flows. Geographical distance between two economies has a significant negative effect as expected. On the same note, a common border and cultural proximity (measured by a common language) both exhibit a positive and significant effect on FDI flows. These findings confirm the positive role of geographic factors in FDI allocation.

The unit labor cost variable indicates that the higher the relative labor costs in the originating country, the higher the FDI flow in the recipient country, which

is also in line with the theoretical proposition that investors seek a cheap labor force. Finally, we find a negative impact of exchange rate long term volatility, while short-term volatility remains insignificant. These findings reflect the easier and less expensive possibility of firms to insure against the risk of short-term volatility by foreign exchange market instruments; long run exchange rate misalignments are more costly and hardly avoidable, and thus have a deterrent effect on FDI flows.

3.7.2 EU vs. euro impact

Further interpreting the results displayed in Table 3.6, the main contribution is the segregation of the effect of EU membership on FDI flows from that of EMU membership. In a simple OLS specification, the impact of the euro is estimated to be positive. However, in more appropriate specifications accounting for unobserved heterogeneity (fixed effects) or left-censoring (Tobit), this effect becomes insignificant. On the contrary, the magnitude of the EU dummy capturing the benefits of the common market remains significant even with the inclusion of fixed effects. As can be observed in the last column, EU membership increases bilateral FDI flows by exp(0.732)-1 = 107.9 percent. On the other hand, the EMU impact is insignificant, increasing FDI flows only by exp(0.138)-1 = 14.8 percent.[23]

The findings from the baseline specifications become even more robust by using the propensity score matching technique. Elaborating the analysis, the Tobit estimation is run for country pairs matched by propensity score matching. Table 3.7 reports the coefficients for the EU and the euro variables. Under unrestricted matching (linking a country pair in a particular year to other country pairs in other years), the impact of belonging to the EU on FDI flows ranges from 54.5 to 71.9 percent. In a restricted-matching specification (matching a treated country pair with control country pairs and using this match for the whole period), this impact increases to 150.7 to 166.2 percent. On the contrary, the effect of sharing the euro ranges around

[23]The interpretation of a dummy coefficient γ when the dependent variable is log-transformed is given by $\Delta = 100^*(\exp(\gamma)\text{-}1)$.

zero (from -5.6 to 7.4 percent) and is clearly insignificant. The robustness of the results is checked as different versions of matching techniques are used.[24]

The sign and significance of other estimates are similar to those from baseline specifications. In particular, long-term exchange rate volatility reduces FDI between countries, high gross domestic product in both the originating and target country encourages FDI flows, while the distance between countries and the unit labor cost gap decrease FDI flows.

Overall, the findings suggest a limited impact of the common currency on FDI flows. Being an EU member proves to be a far more crucial factor in boosting FDI. However, it should be noted that euro adoption inherently reduces exchange rate volatility. As a result, the coefficient of the euro dummy in Table 3.7 captures the part of the euro effect on FDI not caused by a reduction of exchange rate volatility.[25]

3.7.3 Euro impact within the EU

In our dataset, all countries using the euro are members of the European Union.[26] In order to extend our analysis, we investigate the impact of the common currency solely for EU countries. It should be noted that the new sample does not contain countries like the U.S., Canada or Australia, which should be taken into consideration when interpreting the estimates.

Table 3.8 presents the effect of the common currency on FDI flows within the European Union. Under the Tobit specification, the euro dummy is significant, increasing bilateral FDI flows by exp(0.338)-1 = 40.2 percent. Table 3.9 shows more precise estimates obtained on a subsample restricted by propensity score matching. In case of EU countries, the euro increases bilateral FDI flows by 16.8 to 42.5

[24] We use following matching techniques: three nearest neighbours (NN3), Kernel matching, and Radius matching.

[25] Indeed, excluding short-term and long-term exchange rate volatility variables from the model slightly increases the euro impact; however, it remains statistically insignificant. For the sake of brevity, these results are not reported.

[26] Strictly speaking, it is possible for a country to use the euro without being an EU member. There are formal agreements between the European Central Bank (ECB) and Vatican City, San Marino and Monaco, specifying use of the euro as a legal tender. In addition, Montenegro and Andorra and Monaco use the euro without formal approval from the ECB.

percent in the unrestricted specification and by 14.3 to 36.5 percent in the restricted specification. Overall, this finding suggests that the common currency positively affects FDI flows within a group of relatively integrated markets. These results should be viewed in the context of the hypothesis of endogeneity (Rose, 1999), which assumes that stronger economic linkages among the members of a currency union lead to the creation of an optimal currency union ex post (Frankel and Rose, 1998). Thus, the findings of a positive effect of the euro on FDI flows might also indicate the creation of closer linkages between countries.

3.7.4 Time dimension of the euro effect on FDI flows

Results on the link between the common currency and FDI flows are somewhat contradictory to the existing literature on the FDI effect of the euro, as most of the existing literature finds a positive and significant effect (Petroulas, 2007; Schiavo, 2007). We test the hypothesis that this ambiguity may be caused by a short time span used in these studies by exploring the time dimension of the euro's impact on FDI. We perform the analysis separately on the shortened period 1997-2003 which corresponds roughly to the time span used in the previously mentioned studies.

Table 3.10 offers a comparison of restricted-specification estimates for the initial period (1997-2003) and the full time span (1997-2008). Results reveal that the euro's impact is more pronounced in the first years after the launch of the euro (ranging from 23.7 to 54.1 percent), becoming negligible only in the longer run. It should be recognized that the euro dummy covers a different set of country pairs for different years as new countries adopted the euro as the official currency.

The findings indicate a positive initial impact of the euro on FDI. However, this effect is only temporary and vanishes over subsequent years. A possible explanation for this might be a saturation of investors inclined to locate in the euro area. Arguably, it can be concluded that the impact of a common currency union is present in the form of one-off capital reallocation of multinational companies, reverting to pre-euro levels in the longer run.

3.8 Conclusion

In this paper we investigate the impact of the euro on international FDI flows. Analyzing bilateral FDI flows between 35 developed countries during 1997-2008, we estimate the difference in FDI flows for country pairs sharing the euro and country pairs with at leastone country using another currency. The identification strategy is based on propensity score matching, ensuring that the control group of country pairs is similar in terms of the probability to share the euro.

The findings indicate that the impact of the euro on FDI flows is negligible (-5.6 to 7.4 percent). Interestingly, being in the EU contributes much more to FDI flows than does the common currency, increasing FDI flows by 54.5 to 166.2 percent (depending on the matching specification).

The effect of the euro on FDI flows, however, differs for the sample of OECD countries and for the subsample of EU countries. In the former case it does not significantly increase FDI flows, while in latter case it accelerates FDI flows by 14.3 to 42.5 percent.

The results suggest that the impact of the euro on FDI flows is smaller than suggested in the recent literature. One reason of this discrepancy may be the use of a more elaborated econometric technique (propensity score matching). Another reason may be longer time span used in this thesis, which captures the latest wave of EMU enlargement between 2006-2008. Indeed, shorter time span of three years used in previous studies exhibits a positive effect of the euro on FDI also in our setup. Nevertheless, considering the high variability of FDI flows, the estimate of the impact should be interpreted with caution. EU membership, being a more dominant factor in FDI attraction than the euro, also contributes to a weakening

The reason may be the use of a different econometric technique and longer time span, capturing also the latest wave of EMU enlargement between 2006-2008. The time span of roughly three years, used in previous studies, should be interpreted with caution, considering the high variability of FDI flows. In addition, the EU membership is a stronger factor than the euro in affecting FDI flows, which contributes to

a weakening role of the euro in boosting FDI over time.

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3.10 Appendix

Table 3.1: A timeline of the euro area enlargement

EMU membership	1997-98	1999-2000	2001-06	2007	2008	2009-10	2011
Austria		x	x	x	x	x	x
Belgium		x	x	x	x	x	x
Cyprus					x	x	x
Estonia							x
Finland		x	x	x	x	x	x
France		x	x	x	x	x	x
Germany		x	x	x	x	x	x
Greece			x	x	x	x	x
Ireland		x	x	x	x	x	x
Italy		x	x	x	x	x	x
Luxembourg		x	x	x	x	x	x
Malta					x	x	x
Netherlands		x	x	x	x	x	x
Portugal		x	x	x	x	x	x
Slovakia						x	x
Slovenia				x	x	x	x
Spain		x	x	x	x	x	x

Note: Sign "x" indicates EMU membership during a particular period of time.

Table 3.2: World FDI flows by recipient country

FDI flows	World	Developing	Transition	Developed	EU	EMU
year	bil. USD (at current prices)	%	%	%	%	%
1980	54	14	0	86	39	-
1990	208	17	0	83	47	-
2000	1382	19	1	81	49	36
2001	825	26	1	73	47	35
2002	628	28	2	70	49	39
2003	566	33	4	82	46	39
2004	733	40	4	56	29	17
2005	986	34	3	63	51	27
2006	1459	30	4	67	40	23
2007	2100	27	5	69	43	28
2008	1771	37	7	57	30	17

Source: http://unctadstat.unctad.org/

Note: According to the UN classification, countries are divided into the following groups: developed economies, developing economies, and transition economies. The development of a country is measured with the Human Development Index (HDI), a compound indicator of the following indexes: income per capita, life expectancy, and the literacy rate.

Table 3.3: Annual FDI flows to developed economies

FDI flows	Europe	America	Asia	Oceania	Developed Total
mil. USD (current prices)					
1995	137	68	2	16	222
1997	155	115	5	10	285
1999	532	308	16	3	851
2001	395	187	8	11	601
2003	280	61	10	12	362
2004	218	136	11	45	410
2005	509	131	8	-23	625
2006	628	297	9	36	970
2007	988	375	31	49	1,444
2008	551	380	35	52	1,018
2009	378	149	16	23	566

Source: http://unctadstat.unctad.org/

Note: North America is represented here by the United States, Bermuda, Canada, Greenland, Saint Pierre and Miquelon.

Table 3.4: Averages of descriptive statistics for euro/non-euro country pairs (1997-2008)

	$euro_{ij} = 1$	$euro_{ij} = 0$
$\log(FDI_{ij})$	4.49	2.77
$\log(GDP_i * GDP_j)$	39.19	37.62
log(distance)	7.14	7.84
ULC ratio	1.00	1.02
EER short	0.11	0.44
EER long	0.03	0.07
common border	0.18	0.06
common language	0.09	0.05
landlocked	0.18	0.24
# observations	1,090	10,367

Note: Dummy $euro_{ij}$ equals 1 if both countries in a pair use the euro; otherwise it equals 0. FDI_{ij} stands for FDI flows from country i to country j in mil. USD, GDP is a gross domestic product per capita in USD (deflated to year 2000), ULC ratio is a ratio of exchange rate adjusted unit labor costs in country i compared to country j, EER short is a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, EER long is a five-year coefficient of variation of a ratio of countries' real effective exchange rate indices, landlocked takes values 0, 1 or 2 according to the number of landlocked countries in a country pair.

Table 3.5: Average log(FDI) for euro vs. non-euro country pairs, by year

year	$euro_{ij} = 1$	(# obs.)	$euro_{ij} = 0$	(# obs.)
1997			2.50	679
1998			2.61	711
1999	4.83	78	2.37	708
2000	5.30	78	2.25	793
2001	4.70	98	1.02	892
2002	4.11	109	1.89	948
2003	4.17	110	1.87	989
2004	4.18	110	2.09	1026
2005	4.46	110	2.18	1047
2006	4.74	110	2.46	1060
2007	4.72	132	2.75	918
2008	4.03	155	2.82	596

Table 3.6: Baseline results: FDI inflow determinants

	OLS		Tobit		Fixed effects		Tobit (FE)	
	(1)		(2)		(3)		(4)	
$\log(GDP_i * GDP_j)$	0.602***	(0.008)	0.895***	(0.014)	0.471**	(0.220)	0.613***	(0.022)
log(distance)	-0.603***	(0.026)	-1.026***	(0.043)				
ULC ratio	0.872***	(0.103)	1.377***	(0.163)	0.105	(0.113)	1.449***	(0.143)
EER short	-1.609*	(0.856)	-1.777	(1.393)	0.101	(0.733)	-0.252	(1.289)
EER long	-1.834***	(0.636)	-4.102***	(1.042)	-0.706	(0.619)	-2.734**	(1.091)
EU	0.493***	(0.058)	0.653***	(0.090)	0.447***	(0.064)	0.732***	(0.112)
euro	0.178**	(0.080)	- 0.084	(0.121)	0.124	(0.113)	0.138	(0.192)
common border	0.488***	(0.093)	0.344**	(0.141)				
common language	1.562***	(0.095)	1.904***	(0.143)				
Country-pair dummies	No		No		Yes		Yes	
Observations	11,457		11,457		11,457		11,457	
			4,613	censor.			4,613	censor.
R2	adj.	0.401	pseudo	0.108	overall	0.319	pseudo	0.175

Note: The dependent variable is the logarithm of FDI flow from originating to recipient country. Unit labor cost ratio is a fraction of unit labor costs in the originating country over unit labor costs in the recipient country, short exchange rate volatility is a two-year coefficient of variation of a ratio of countries' real effective exchange rate indices, long exchange rate volatility is a five-year coefficient of variation of a ratio of countries' real effective exchange rate indices. Time and country-pair dummies are not reported. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 3.7: The impact of the EU and the euro on FDI inflow: matching

Model	PSM algorithm	NN3		Kernel		Radius	
		EU	Euro	EU	Euro	EU	Euro
Unrestricted	coef	0.435*	0.014	0.508***	-0.016	0.542***	-0.013
	std	(0.26)	(0.18)	(0.17)	(0.14)	(0.11)	(0.13)
	% impact	54.5*	1.4	66.2***	-1.2	71.9***	-1.3
Restricted	coef	0.979***	0.028	0.924***	0.022	0.919***	-0.098
	std	(0.17)	(0.18)	(0.14)	(0.15)	(0.23)	(0.21)
	% impact	166.2***	2.5	152.1***	7.4	150.7***	-5.6

Note: The table contains results of the Tobit estimation on the dataset containing treated country pairs with control country pairs identified by propensity score matching: NN3 - nearest three neighbors, kernel matching, radius matching. The dependent variable is the logarithm of FDI flow from originating to recipient country. The impact on FDI flows in percentages is calculated as 100*(exp(coef)-1). Unrestricted specification performs matching of country pair/year to a country pair/year, i.e., allows different control country pairs for different years. Restricted specification matches a country pair with a different country pair (based on observables from 1998 – prior to euro adoption) and uses this match for the whole period 1997-2008. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 3.8: Baseline results: Euro impact on FDI flows for EU countries

	OLS		Tobit		FE(3)		Tobit	
	(1)		(2)		(3)		(4)	
$\log(GDP_i * GDP_j)$	0.627***	(0.019)	0.786***	(0.026)	0.821*	(0.487)	0.285	(0.195)
log(distance)	-0.855***	(0.085)	-1.091***	(0.116)				
ULC ratio	0.243	(0.353)	0.280	(0.480)	0.178	(0.367)	0.396	(0.416)
EER short	1.294	(2.899)	3.100	(3.933)	-1.528	(2.685)	-0.832	(3.698)
EER long	-1.652	(1.745)	-2.231	(2.391)	1.113	(2.314)	1.324	(3.107)
Euro	0.215**	(0.102)	0.264*	(0.138)	0.227	(0.149)	0.338*	(0.205)
common border	0.343**	(0.164)	0.302	(0.219)				
common language	1.178***	(0.183)	1.273***	(0.245)				
Country-pair dummies	No		No		Yes		Yes	
Observations	3,966		3,966		3,966		3,966	
			1,141	censor.			1,141	censor.
R-2	adj.	0.356	pseudo	0.083	overall	0.301	pseudo	0.147

Note: The dependent variable is the logarithm of FDI flow from originating to recipient country. Time and country-pair dummies are not reported. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 3.9: The impact of the euro on FDI inflow for EMU countries: matching

Model	Matching algorithm	NN3 Euro	Kernel Euro	Radius Euro
Unrestricted	coef	0.354*	0.155	0.238*
	std	(0.18)	(0.15)	(0.14)
	% impact	42.5*	16.8	26.9*
Restricted	coef	0.311*	0.134	0.234
	std	(0.17)	(0.15)	(0.20)
	% impact	36.5*	14.3	26.4

Note: The table contains results of the Tobit estimation on the dataset containing a sample of EU countries during 1997-2008. The dependent variable is the logarithm of FDI flow from originating to recipient country. Alternative PSM algorithms are used: NN3 - nearest three neighbors, kernel matching, radius matching. The impact of the euro on FDI flows in percentages is calculated as 100*(exp(coef)-1). Unrestricted specification performs matching of country pair/year to a country pair/year, i.e., allows different control country pairs for different years. Restricted specification matches a country pair with a different country pair (based on observables from 1998 – prior to euro adoption) and uses this match for the whole period 1997-2008. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.

Table 3.10: The impact of the euro on FDI inflow: by time period

Model	PSM algorithm	NN3	Kernel	Radius
1997-2003	coef	0.280	0.213	0.432*
	std	(0.24)	(0.20)	(0.26)
	% impact	32.3	23.7	54.1
1997-2008	coef	0.024	0.071	-0.058
	std	(0.17)	(0.15)	(0.21)
	% impact	2.5	7.4	-5.6

Note: The table contains results of the Tobit estimation with the logarithm of FDI flow from originating to recipient country as a dependent variable. Alternative PSM algorithms are used: NN3 - nearest three neighbors, kernel matching, radius matching. The impact of the euro on FDI flows in percentages is calculated as 100*(exp(coef)-1). The specification matches a country pair with a different country pair (based on observables from 1998 – prior to euro adoption) and uses this match for the whole period. Standard errors in parentheses. Significance levels: *** 1%, ** 5 %, * 10%.