



národní
úložiště
šedé
literatury

Profitability Life Cycle of Foreign Direct Investment and its Application to the Czech Republic

Novotný, Filip
2015

Dostupný z <http://www.nusl.cz/ntk/nusl-202344>

Dílo je chráněno podle autorského zákona č. 121/2000 Sb.

Tento dokument byl stažen z Národního úložiště šedé literatury (NUŠL).

Datum stažení: 04.06.2024

Další dokumenty můžete najít prostřednictvím vyhledávacího rozhraní nusl.cz .

WORKING PAPER SERIES 11

Filip Novotný
Profitability Life Cycle of Foreign Direct Investment and its Application to the
Czech Republic

2015

WORKING PAPER SERIES

Profitability Life Cycle of Foreign Direct Investment and its Application to the Czech Republic

Filip Novotný

11/2015

CNB WORKING PAPER SERIES

The Working Paper Series of the Czech National Bank (CNB) is intended to disseminate the results of the CNB's research projects as well as the other research activities of both the staff of the CNB and collaborating outside contributors, including invited speakers. The Series aims to present original research contributions relevant to central banks. It is refereed internationally. The referee process is managed by the CNB Research Department. The working papers are circulated to stimulate discussion. The views expressed are those of the authors and do not necessarily reflect the official views of the CNB.

Distributed by the Czech National Bank. Available at <http://www.cnb.cz>.

Reviewed by: Stephanie Curcuru (FED)
Joern Kleinert (University of Graz)
Michal Hlaváček (Czech National Bank)

Project Coordinator: Jan Brůha

© Czech National Bank, December 2015
Filip Novotný

Profitability Life Cycle of Foreign Direct Investment and its Application to the Czech Republic

Filip Novotný *

Abstract

The main driver of economic growth in the Czech Republic has been foreign direct investment (FDI). The decisions of foreign direct investors are profit-seeking, so a deterioration in the income balance of the current account has been observed as a consequence. The profitability profile of FDI is estimated on a panel of countries and then applied to the Czech Republic. The FDI profitability life cycle has a non-linear time profile with a duration of between 15 and 16 years. Maximum profitability is reached in the 7th to 8th year after the initial investment. Central and Eastern European (CEE) countries have a higher return on capital compared to the overall sample of countries. Knowing the FDI profitability life cycle enables us to construct various scenarios for the evolution of total FDI earnings depending on the future FDI inflows (changing FDI stock) assumed.

Abstrakt

Hlavním hybatelem ekonomického růstu v České republice jsou přímé zahraniční investice (PZI). Rozhodnutí přímých zahraničních investorů jsou podmíněna snahou o dosažení zisku, a v důsledku toho pozorujeme zhoršení bilance výnosů běžného účtu. Profil ziskovosti PZI je odhadnut na panelu zemí a poté aplikován na Českou republiku. Životní cyklus ziskovosti PZI má nelineární časový průběh, který trvá 15 až 16 let. Maximální ziskovosti je dosaženo v sedmém až osmém roce od původní investice. Země střední a východní Evropy dosahují vyšší návratnosti kapitálu ve srovnání s celým vzorkem zemí. Znalost životního cyklu ziskovosti přímých zahraničních investic nám umožňuje konstrukci různých scénářů vývoje celkových výnosů z PZI v závislosti na předpokládaném budoucím přílivu PZI (měnící se zásobě PZI).

JEL Codes: C33, F21, F32.

Keywords: Balance of payments, life cycle, profits from FDI.

* Filip Novotný, Czech National Bank, filip.novotny@cnb.cz

This work was supported by Czech National Bank Research Project No. D1/14. The author would like to thank Oxana Babecká Kucharčuková, Jan Brůha, Stephanie Curcuru, Michal Franta, Kamil Galuščák, Michal Hlaváček, Tomáš Holub, Joern Kleinert, Evžen Kočenda, and Petr Král for their helpful comments and Tomáš Adam for his technical assistance. The views expressed in this paper are those of the author and not necessarily those of the Czech National Bank.

Nontechnical Summary

This paper is motivated by the fact that FDI earnings account for a substantial part of the overall income balance of the current account in countries such as the Czech Republic. These countries are characterized by a high ratio of the stock of FDI to their GDP. FDI thus plays a significant role on a macroeconomic level. Among other things, it determines the competitiveness and external economic vulnerability of a country.

We assume that the FDI profitability time path is non-linear and has a finite time horizon. Using annual data on the stock of FDI and earnings from the stock of FDI we calculate the FDI profitability in such a way that we ascribe FDI earnings to the particular stock of FDI of the same vintage. We then estimate the time dependence of the cumulative FDI profitability of all these individual stocks of FDI on a panel of mostly European countries. We control for annual PPI growth, real GDP growth, the real effective exchange rate, and the short-term interest rate.

In the next step, the estimated coefficients of the linear, quadratic and cubic time profiles indicate that the FDI financial life cycle is completed in 16 years, when the cumulative profitability reaches its maximum and the implied annual profitability is nearly zero and then negative. The implied annual profitability increases until the 7th year of investment (10% annual profitability) and then starts to decline. The results are in line with previous literature. Furthermore, when we look at the fixed investment business cycle, it typically lasts about 7 to 11 years.

The estimated time profile of the FDI cumulative profitability represents the general shape of the profitability across all countries under examination. Nevertheless, because we intend to apply the derived time profile to simulate the likely future evolution of profits from FDI in the case of the Czech Republic, and since profits from FDI represent the driving force of the overall income balance of the Czech Republic, we need to have a more specific estimation for that purpose.

We therefore do a re-estimation for a subsample of CEE countries only. The subsample contains Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovenia, and Slovakia. Using these countries, we derived an FDI profitability time profile that is slightly different from that for all countries. Only the quadratic and cubic forms of the time variable are statistically significant. The estimated life cycle is one year shorter compared to the whole sample. It lasts 15 years in total and is more dynamic. The implied annual profitability peaks at 16% in the 8th year of the cycle. So, it takes a little longer to reap all the benefits of the initial investment compared to the whole sample of countries, but the implied annual profitability then goes down relatively quickly. Emerging countries of Central and Eastern Europe are characterized by higher yields, which could be explained by the convergence process.

Knowing the FDI profitability life cycle enables us to construct various scenarios for the evolution of total FDI earnings depending on the assumed future FDI inflows (the changing FDI stock). We construct three alternative scenarios for the Czech Republic. In the first one, we assume that the actual average yearly amount of the equity capital inflow in 2010–2014 (EUR 2.6 bn) will persist and, moreover, 50% of total FDI earnings from the previous year will be reinvested. The second scenario assumes FDI inflows take the form of reinvested earnings only, meaning that there will be no new green or brown-field FDI inflows. Specifically, 50% of total FDI earnings from the previous year will be reinvested. This is the most likely scenario in our view. Finally, the third scenario represents an extreme situation where neither new FDI equity inflows nor reinvested earnings are assumed. In this case, foreign investors decide to repatriate all FDI profits and, moreover, the Czech Republic becomes unattractive for new foreign investments as well. The two boundary scenarios

(the first and third ones) serve as the expected borderlines for the possible future evolution of FDI earnings.

The central scenario (scenario 2), which assumes FDI inflows take the form of reinvested earnings only (50% of the previous year's FDI earnings is supposed to be reinvested), suggests that total yearly FDI earnings peaked back in 2012 (EUR 12.2 bn) and FDI earnings are expected to decline steadily in the coming years. Nevertheless, FDI earnings will still be at EUR 9 bn in 2030. The underlying motivation for the central scenario is the following. After an initial period of strong inflows of FDI into the CEE countries, a tranquil period followed. In the Czech Republic, the potential for further privatization FDI inflows and green or brown-field FDI inflows has been practically exhausted and reinvested earnings constitute the main source of FDI inflows since 2006. The income balance of the Czech Republic will therefore be influenced more by the changing term structure of the current stock of FDI in the economy and less by new FDI inflows, which in the central scenario are expected to take the form of reinvested earnings only.

The first scenario assumes both new FDI equity inflows and reinvestment of FDI earnings. This scenario implies that after several years of stabilization at the current level, FDI earnings will start to increase further after 2022. Under the second scenario, the income balance will deteriorate further, while we can expect a proportionate improvement in the trade balance because FDI earnings in the Czech Republic are generated mainly by the export industry.

Finally, the third scenario, which assumes no FDI inflows into the Czech Republic in the future, implies decreasing FDI earnings until 2028, when earnings from the current structure of the FDI stock will be at zero. Since the effects of FDI are not restricted to FDI earnings, but are also reflected in the trade balance (due to the export nature of FDI), we can expect proportionate changes in the trade balance as well.

The estimated future FDI earnings also delimitate the boundaries for hypothetical reinvested earnings. Nevertheless, as many FDI projects are getting older (shifting to stage 3 of the profitability life cycle of FDI) the role of dividends (repatriated profits) will gain over that of reinvested earnings.

1. Introduction

Foreign direct investment (FDI) as a form of private capital investment only started to penetrate the world economy in the 1980s. Although a vast amount of FDI still goes on within developed countries, FDI has been the symbol of economic restructuring and success in the transition countries of Central and Eastern Europe. The Czech Republic in particular has often been appraised as a successful example of FDI inflows. The existing theoretical and empirical literature considers FDI from various perspectives. It focuses mainly on the reasons for doing business in a foreign country and on the host and home country effects of multinational activity.

The activities of foreign direct investors affect important accounts of the balance of payments. In the initial stage, when FDI flows into a country, the financial account is usually in surplus, causing local currency appreciation. In the next stage, with a time lag, the trade balance of the host country is affected depending on the type of FDI, i.e., market-seeking, efficiency-seeking, or resource-seeking (Dunning, 1993). An improvement in the trade balance is usually observed as a result. On the other hand, as FDI—like any other type of investment—is profit-seeking, countries experience a deterioration in their income balance at the same time. Finally, the contrary effects on the trade balance and the income balance constitute the overall effect on the country's current account.

Positive FDI effects (the boost to exports and economic growth in general, and positive spillovers to the domestic sector in host countries) are examined in Barrell and Holland (2000), who demonstrate a positive FDI effect on labor productivity growth in manufacturing industry in the Czech Republic, Hungary, and Poland using empirical analyses. Geršl et al. (2007) examine productivity spillovers from foreign to domestic firms on firm-level data. Similarly, Havránek and Iršová (2011, 2013) use a meta-analysis to study, firstly, vertical and, secondly, horizontal spillovers from FDI. Weill (2003) shows a positive effect of foreign ownership on the cost-effectiveness of the banking sector. The role of FDI in the process of economic restructuring in European transition countries is examined by Benáček (2000), Jarolím (2000), and Srholec (2003) as well. From another perspective, Buch and Lippuner (2005) analyze the influence of short-term business cycle movements on FDI.

Another strand of literature deals with the export orientation of manufacturing FDI. This is because of the growing role of multinational company-related trade, or intrafirm trade in other words. Intrafirm transactions of multinational companies are assumed not to be valued in an open market; on the contrary, multinational companies choose, within certain limits, the optimal transfer price, which is different from the arms-length (market) price. The determinants of transfer (or intrafirm) prices are represented, for example, by differences in taxation between countries or by the existence of customs duties (Horst, 1971). The Czech Republic is a typical example of a country with a high share of the FDI stock and, accordingly, a high share of multinational company-related trade in total foreign trade (Novotný, 2011). A survey analysis conducted by Babecký et al. (2008) suggests that 25 percent of Czech exporters do not have their own pricing policy and prices on foreign markets are determined by the parent company.

In this paper, we look at FDI from a different perspective. We analyze the profitability life cycle of FDI, i.e., its duration and time profile, and use it to construct various scenarios for the evolution of future FDI earnings, i.e., the external vulnerability of the economy, depending on the existing and assumed future stock of FDI. This analysis is especially important for transition countries, where FDI earnings account for almost the entire income balance and are moreover reflected in trade surpluses. Brada and Tomšík (2003) recognize three theoretical stages of the direct investment life cycle. The entry stage is characterized by investment and no profit, and potentially even a loss. The

second stage is a growth phase characterized by gradually increasing profitability. This is followed by the final stage: stabilization of profitability.

Some stylized facts on the FDI investment cycle are described by Altzinger (2006). He measures the profitability of FDI by the median return on equity (RoE) in the current year (which is an approximation of the life cycle of FDI, as the return is not measured against the initial investment) in four different groups of countries. His RoE was calculated based on unpublished firm-level data (foreign affiliates) from the database of the Austrian National Bank. He observed that after 1991, when the net FDI inflow into the CEE countries took place, profitability tumbled, even resulting in net losses between 1992 and 1995. In the second half of the 1990s, profitability increased significantly. The author then compares the time dependence of profitability in different regions with respect to the different timing of FDI in these regions, where the different regions are treated as homogeneous entities. He concludes that after start-up troubles in the first two years following the initial FDI, the median profitability becomes positive. Profitability improves strongly only during and after the fourth to fifth year of investment. This is in line with Curcuru and Thomas (2012), who claim that apart from relatively high expenses associated with depreciation of newly purchased assets or interest on debt used to finance acquisitions, inexperience can also lead to relatively poor performance for younger foreign affiliates. Geršl and Hlaváček (2007) use financial indicators calculated from firm-level data from the Deutsche Bundesbank's database of German FDI in the Czech Republic. On this subsample of total FDI in the Czech Republic, they confirm that the evolution of the return on equity and intra-group credit on total liabilities in German-owned companies in the Czech Republic has a non-linear shape.

Using macrodata, as opposed to Altzinger (2006) and Geršl and Hlaváček (2007), who use microdata, Novotný (2004) studies the main factors that determine the total amount of FDI earnings in the host economy and their subsequent division between reinvested earnings and repatriated profits. Balance of payments macrodata are also used by Brada and Tomšík (2009), who empirically test the FDI financial life-cycle hypothesis on a sample of eight transition countries¹ with data coverage from 1999 to 2006. The authors point out that the transition countries of Eastern Europe received a large inflow of FDI in a short period of time and thus the synchronization of the FDI financial life cycle of many such investments can have a palpable macroeconomic effect on the balance of payments, causing external economic vulnerability. In accordance with this view, their empirical analysis is built on the assumption that the FDI life cycle of all the FDI stock started approximately at the same time as a single project, which is a similar assumption as in Altzinger (2006). Their estimated FDI profitability time path follows a quadratic function. Moreover, the ratio of the weighted FDI stock to the FDI stock² is used to control for the timing of FDI inflows. The results show that FDI profitability increases, though at a decreasing rate, and then declines. According to the authors, the first two stages (out of three) of the FDI profitability life cycle (Figure 1) last approximately 9 to 11 years.

By contrast, Novotný and Podpiera (2008) alleviate the problems with the measurement of the vintage structure of the total stock of FDI in a particular country. They calculate the cumulative profits which pertain to a particular stock of FDI of the same vintage. Partial linearization of the

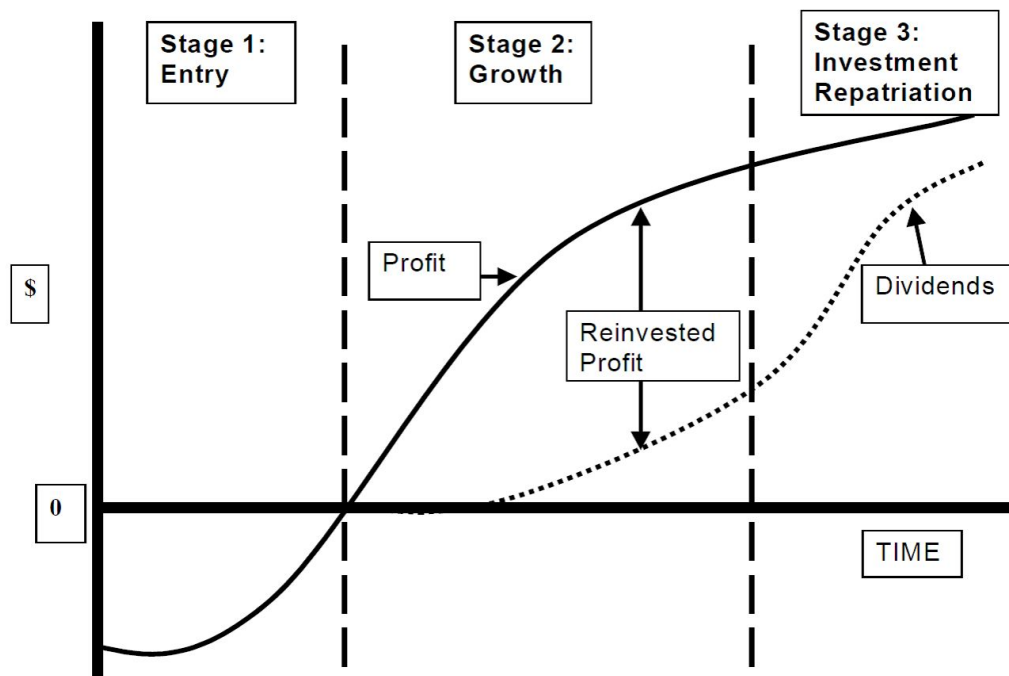
¹ Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, and Slovenia

²

$$V_z = \frac{\sum_{n=1}^{\infty} n FDI_{z-n}}{\sum_{n=1}^{\infty} FDI_{z-n}}, \quad (1)$$

where z is time (year) and FDI is the inflow of FDI in year z .

Figure 1: The Profitability Life Cycle of FDI



Source: Brada and Tomšík (2003, p. 22)

cumulative profitability is employed to decompose the cumulative profits. In this way, the authors compute the profitability time profile for each FDI stock of the same vintage and use it to test its time dependence (a cubic polynomial function). Using balance of payments data they find a non-linear profile for the FDI profitability life cycle, peaking at around the 6th year of the cycle. Because they do not have sufficiently long time series, the estimated shape of the profitability would suggest that the cycle could be completed in 15 years (a projection toward zero annual profitability). Since this methodology enables the time profile of FDI profitability to be derived for both transition and developed countries, we build on a simplified version of their method in this paper.

The rest of the paper is organized as follows. Section 2 presents the methodology. Then, in section 3, data issues are described. Estimation results follow in section 4. Section 5 is devoted to three scenarios for future FDI earnings in the case of the Czech Republic given the expected FDI inflows (the changing FDI stock). Since FDI earnings make up nearly the entire income balance of the Czech Republic, the scenarios will de facto demonstrate the likely future evolution of the Czech Republic's income balance. Section 6 then concludes.

2. Methodology

2.1 FDI in the Czech Republic

The current account is the most important internationally comparable indicator of the external economic position of a country. An unexpected worsening of the current account may lead foreign investors to rapidly reassess their strategies, with all the negative effects that has on the domestic economy. The current account consists of three basic balances: the trade balance (or net exports of goods and services), the income balance (which tracks cross-border flows of interest, dividends, reinvested earnings, and wages), and current transfers (comprising, for example, pensions, gifts, foreign aid, and contributions).

In the case of the Czech Republic, the stock of FDI and therefore the activities of multinational enterprises substantially affect the current account, i.e., the external position of the economy. Moreover, there is a relationship between the trade balance and the income balance. FDI started to penetrate the Czech economy mostly in the late 1990s. Figure 2 shows that the goods and services balance was in deficit at that time and, together with a net outflow of FDI earnings, was causing a current account deficit.³ Moreover, the current account was in deficit despite the economic recession in 1998 and 1999. The deficit was much higher before 1998. The situation changed structurally in the mid-2000s, when positive effects of export-oriented FDI caused the goods and services balance to improve and, conversely, net FDI earnings to deteriorate. The rise in net FDI earnings was caused by growing profits of foreign subsidiaries, stemming mainly from growing manufacturing exports.

The overall picture becomes even more complicated when we adjust net FDI earnings for reinvested earnings. Reinvested earnings constitute the part of total FDI earnings which are not repatriated but are instead reinvested in the host economy. Due to reinvestments, which in practice are kept in the host country but statistically are double recorded as an outflow of funds on the current account and an inflow of the same amount on the financial account, the actual external economic imbalance of the Czech Republic was not that pronounced.⁴ By this logic, the current account was in surplus already in 2005 and again in 2013.

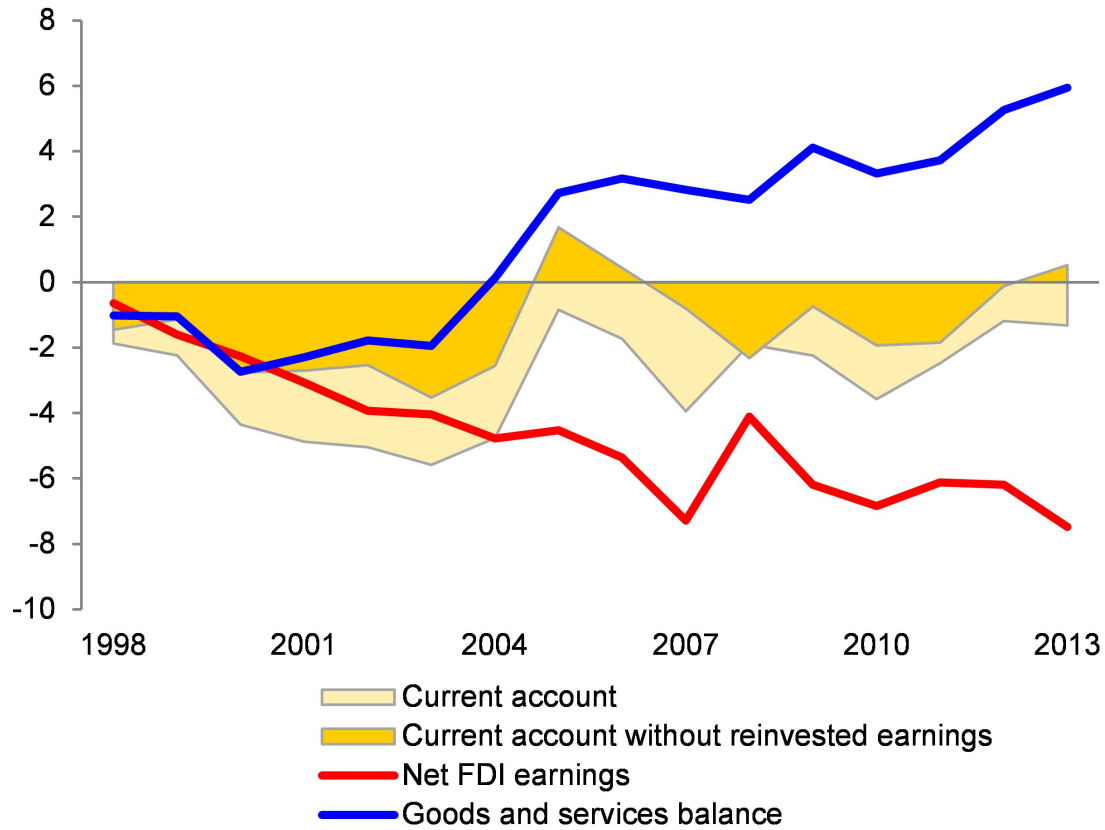
The Czech Republic serves as a typical example of a country with a high ratio of the FDI stock (*SFDI*) to GDP. This ratio stood at 62 percent on average between 2008 and 2012. Moreover, other countries in our sample are in a similar position, as Figure 3 shows. Although the evolution of current accounts is country-specific and the FDI stock varies across countries, the common feature of FDI is that it is profit-seeking, just like any other investment. We assume that FDI is characterized by a common, non-linear profitability time profile, even though the exact level of profitability may vary across countries depending on local conditions. We use a mixed panel of transition and advanced countries (mainly European) to derive a common profitability time profile of FDI.

2.2 Time Profile of FDI Cumulative Profitability

To extract the profitability path of each stock of FDI of the same vintage, we apply a simplified version of the method proposed by Novotný and Podpiera (2008). We use two macroeconomic variables. The first one is the annual stock of FDI (*SFDI*) and the second one is total annual profit from FDI in a particular country. The basic assumption is that we need to isolate all profits which pertain to *SFDI* of the same vintage. We then calculate the cumulative profitability, which is then distributed among the subsequent *SFDI* changes.

³ Net FDI earnings account for almost the entire income balance of the Czech Republic.

⁴ For more details see Brada and Tomšík (2003)

Figure 2: Current Account of the Czech Republic and its Components (% of GDP)

Source: Czech National Bank (author's calculation)

Firstly, we calculate the total cumulative profits from $SFDI_{\tau-1}$ from time τ to time j in country i ($\sum_{m=\tau}^j P_m^i$). Then, the annual profitability of the initial $SFDI_{\tau-1}$ is calculated:

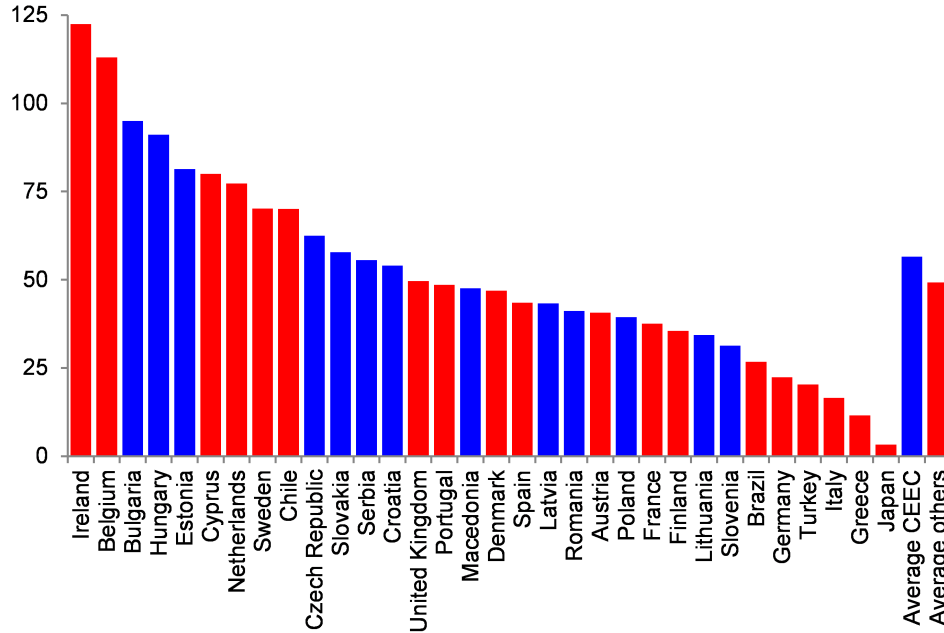
$$\rho_{\tau}^i = \frac{P_{\tau}^i}{SFDI_{\tau-1}^i}. \quad (2)$$

This is a simplifying assumption because $SFDI_{\tau-1}$ usually consists of $SFDIs$ of different vintages in the aggregated statistics we use. The calculated first-year profitability therefore does not necessarily correspond to the actual profitability of an investment in its first year but could be just the first reporting year profitability in the statistics. However, given the high number of observations in our panel and the concentration of FDI inflows in certain time periods (CEE countries) (Brada and Tomšík, 2009) this assumption seems to be plausible.

Moreover, two sensitivity analyses were carried out (see Appendixes B and C). Firstly, we change the initial condition ρ_{τ}^i to the average profitability over the first three years of the available time series. Secondly, we exclude countries with a higher than 20% share of SFDI in GDP in the first year. Both these sensitivity analyses provide similar results to our baseline assumption.

We use ρ_{τ}^i as the profitability in the first year of each subsequent FDI inflow ($\Delta SFDI$). We calculate the cumulative profitability of $SFDI_{\tau-1}$ in the second year by subtracting profits which pertain to

Figure 3: Stock of FDI as a Percentage of GDP (2008–2012 average)



Source: Eurostat and national statistical institutions (author’s calculation)

Note: Blue columns are for CEE countries. Red columns are for the others.

the new FDI inflow in the second year ($\rho_{\tau}^i \Delta SFDI_{\tau}^i$). Then, we calculate the cumulative profitability of their initial $SFDI_{\tau-1}$ in the third and all subsequent years in the same way. Formally, we write

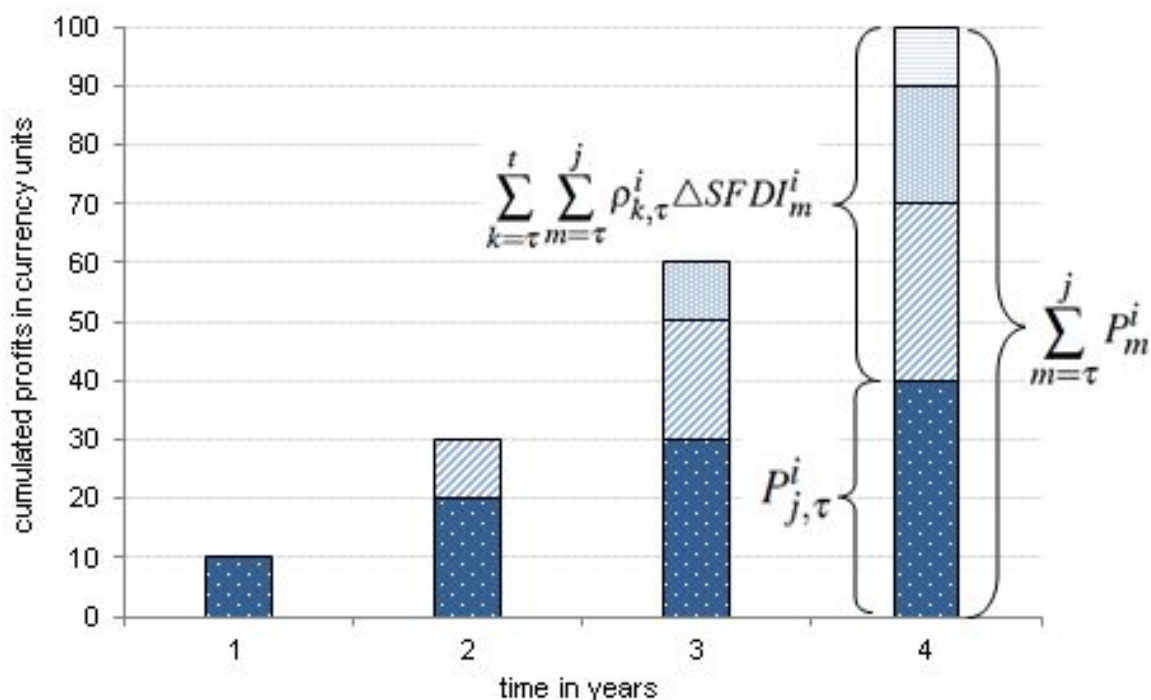
$$\rho_{j,\tau}^i = \frac{\sum_{m=\tau}^j P_m^i - \sum_{k=\tau}^t \sum_{m=\tau}^j \rho_{k,\tau}^i \Delta SFDI_m^i}{SFDI_{\tau-1}^i}, \quad (3)$$

where $\rho_{j,\tau}^i$ is the cumulative profitability at time j from $SFDI$ at time $\tau - 1$ in country i , $t \geq \tau$, and $j = \tau, \tau + 1, \dots, t$. $\sum_{m=\tau}^j P_m^i$ is the total cumulative profit P observed in country i from time τ to time j . The expression $\sum_{k=\tau}^t \sum_{m=\tau}^j \rho_{k,\tau}^i \Delta SFDI_m^i$ represents profits which do not pertain to the initial $SFDI$ at time $\tau - 1$ but which pertain to consecutive (newly invested) $SFDI$ s ($\Delta SFDI$) in subsequent years from time τ to time j . $\rho_{k,\tau}^i$ is the cumulative profitability in the first, second, and all subsequent years of the profitability life cycle of the initial $SFDI$ at time $\tau - 1$ in country i , which is used recursively. In practice, the most recent FDI inflow ($\Delta SFDI$) is multiplied by the profitability of the initial $SFDI_{\tau-1}$ in its first year. Older $\Delta SFDI$ s are multiplied by the cumulative profitability in the second, third, and all subsequent years, respectively.

The cycle is completed when the cumulative profitability of the initial $SFDI$ starts to decline, i.e., when the annual profitability (the first difference of the cumulative profitability) is negative. We simply assume that the initial $SFDI$ is fully exhausted (amortized) at that point in time.

The methodology is graphically described in Figure 4. We used a linear profitability profile for reasons of simplicity. The hypothetical FDI stock is 100 currency units in this case, and new FDI inflows are also equal to 100 currency units.

Figure 4: Decomposition of Cumulative Profits (Linear Time Profile Assumption)



Note: We assume a hypothetical FDI stock of 100 currency units and new FDI inflows equal to 100 currency units as well. Dark blue columns represent cumulative profits of the initial $SFDI_{\tau-1}$ in each year j . The additional colors depict the cumulative profits of new FDI inflows ($\Delta SFDI$).

Cumulative profits pertaining solely to the initial stock of FDI are represented by $P_{j,\tau}^i$ which is de facto the numerator of equation 3. The numerator is obtained by subtracting cumulative profits pertaining to new stocks of FDI from subsequent years from the total cumulative profits observed in a given year. Specifically, the cumulative profits of 10 currency units observed in the first year are all assigned to the initial stock of FDI as in equation 2. Our hypothetical initial stock of FDI is 100 currency units, so the first-year profitability is 10%. Cumulative profits reached 30 currency units in the second year under observation. Because we assume that the 10% initial profitability is the same for all new FDI inflows in the first year of their life cycle and all new FDI inflows amount to 100 currency units, we ascribe 10 currency units to the new FDI inflow in the subsequent year and all remaining cumulative profit in the second year belongs to our initial stock of FDI. This implies a 20% cumulative profitability in the second year of our FDI profitability life cycle. We proceed similarly in subsequent years, assuming that the new FDI inflow in subsequent years is always 100 currency units. In the third year, we observe a cumulative profit equal to 60 currency units. The new FDI inflow in the third year is again 100 currency units multiplied by the initial profitability in the first year (10%), which gives 10 currency units for the new FDI inflow in the third year. We also know that the new FDI inflow in the second year was 100 currency units and that the cumulative

profitability in the second year was 20%, which implies third-year profits of 20 currency units. The remaining 30 currency units then belongs to the initial stock of FDI, i.e., we obtain a cumulative profitability of 30% in the third year. This simplifying theoretical example of a linear cumulative profitability profile implies a constant infinite annual profitability of the initial stock of FDI of 10% (the first difference of the cumulative profitability).

2.3 Hypothesis Tested

The FDI cumulative profitability $\rho_{j,\tau}^i$ from equation 3 is then regressed on time $(j - \tau)$ on a panel of countries to get its common time dependence. We assume that in reality the cumulative profitability time profile has a non-linear shape, because the implied annual profitability initially increases, then peaks, and then declines. We therefore regress the cumulative profitability on a cubic polynomial function to capture all possible time dependences (equation 4).

$$\rho_{j,\tau}^i = \alpha_{\tau}^i + \beta(j - \tau) + \gamma(j - \tau)^2 + \delta(j - \tau)^3 + \zeta \Delta \ln(PPI_{j-\tau}^i) + \eta \Delta \ln(RGDP_{j-\tau}^i) + \theta \Delta \ln(REER_{j-\tau}^i) + \lambda IR_{j-\tau}^i + \varepsilon_{j,\tau}^i, \quad (4)$$

where $\rho_{j,\tau}^i$ is the cumulative profitability of *SFDIs* of the same vintage. The parameter α_{τ}^i represents a specific country effect of the cumulative profitability, such as differences in taxation and country cost effectiveness. Coefficients β , γ , and δ stand for linear, quadratic, and cubic trend, respectively. We also control for variation in the cumulative profitability due to other relevant determinants apart from time. The control variables thus include dynamics in producer prices (*PPI*), as higher local prices are associated with a higher profit, dynamics in real GDP (*RGDP*), as growing economies generate higher profitability, and finally dynamics in the real effective exchange rate (*REER*), as all profits in our panel are denominated in euros. Thus, appreciation of the local currency means extra profit after its conversion into foreign currency (euros in our case). Finally, we also control for the level of local short-term interest rates (*IR*) to capture the money market situation (the monetary policy stance). An increase in short-term nominal interest rates should imply a decrease in profitability because of tighter monetary policy conditions on the local market.

3. Data

We need two data series to do the calculations described in the methodological part of the paper. The first is the stock of FDI (*SFDI*) and the second is total earnings (profits) from FDI. We used annual time series until 2012 and we were able to obtain data for these countries: Austria, Belgium, Brazil, Bulgaria, Chile, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Macedonia, the Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, Slovakia, Spain, Sweden, Turkey, and the United Kingdom. In total, we have 32 mostly European countries.

We also use a subsample which consists of Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovenia, and Slovakia to detect specific FDI profitability conditions in Central and Eastern European (CEE) countries.

We are interested in the debit side of the international investment position statistics (IIP) to get data on the stock of FDI in the reporting country. We also use balance of payments (BoP) statistics to get FDI earnings data. We again use the debit side of the BoP statistics, because we need to have profits (or earnings) which flow out of the reporting country. Considering the debit side only, we analyze the SFDIs invested in the host countries listed above and the profits generated by those SFDIs.

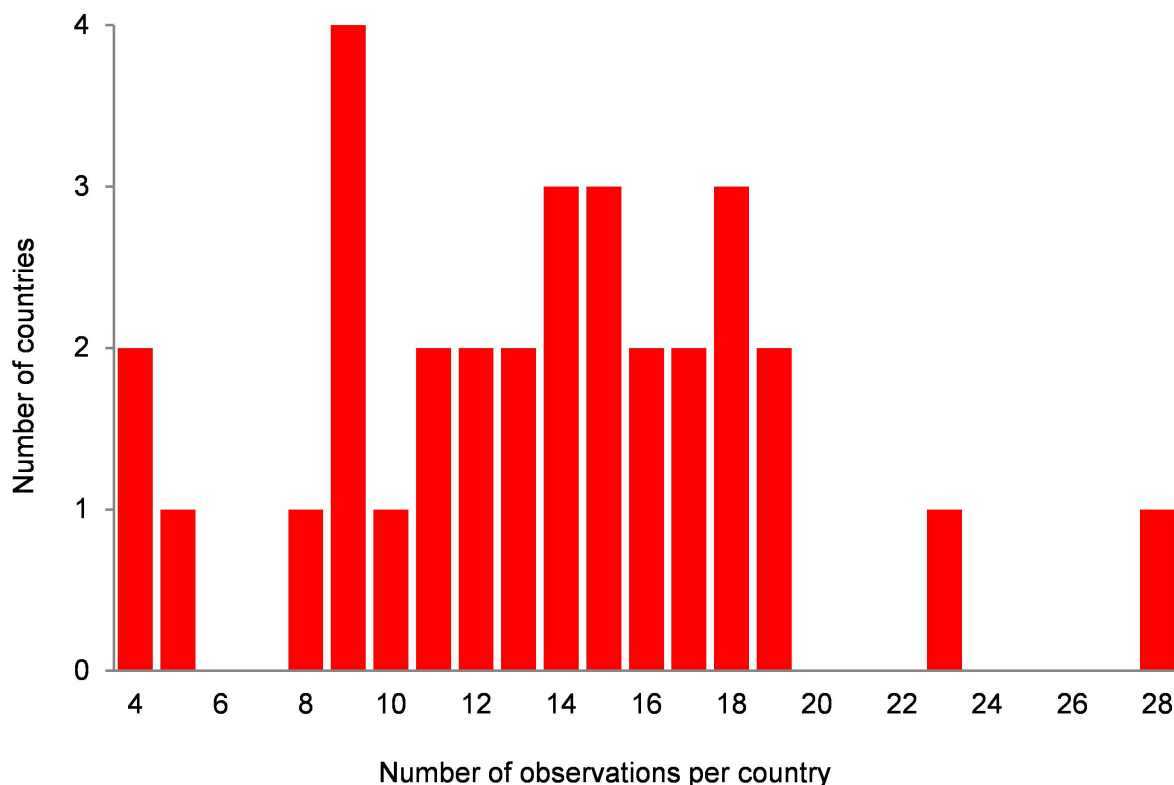
The length of the time series differs across countries. An unbalanced panel is therefore used. The average length of the available time series for each country is 13.6 years and the standard deviation is 5.3 years. We have the most observations for the Netherlands (28 years) and the fewest for Belgium (4 years). See Figure 5. We carry out a sensitivity analysis where we skip series with less than five observations (see Appendix A). The results are similar to those for the whole sample.

The main data source is Eurostat, from which we use the European Union direct investment statistics. These cover both the stock of FDI and earnings from FDI, but are limited to European plus some other countries. Eurostat ensures (at least officially) data comparability across countries. Nevertheless, some other data sources have longer time series available even for European countries. We therefore use mixed data sources in our panel with the aim to find the longest available time series for each country.

The national data sources (central banks, national statistical offices, and ministries of finance) are used for Austria, Brazil, Bulgaria, Chile, the Czech Republic, Finland, Germany, Hungary, Ireland, Italy, Macedonia, the Netherlands, Poland, Serbia, and Turkey. This implies that several data are denominated in local currencies or in the U.S. dollar instead of the euro. These data are converted into euros using yearly averages of the exchange rates. IIP and BoP data are at current prices.

Finally, our control variables for each country (PPI, real GDP, REER, and short-term interest rates) are from the Economist Intelligence Unit (EIU) database.

Figure 5: Length of Time Series



4. Estimation Results

The estimation of the time profile of the cumulative profitability of foreign direct investment is carried out by estimating equation 4 using the fixed-effects panel data estimator on a sample of 2,592 observations. The preference for a fixed-effects estimator is proved by the Hausman test and the results are shown in Table 1.

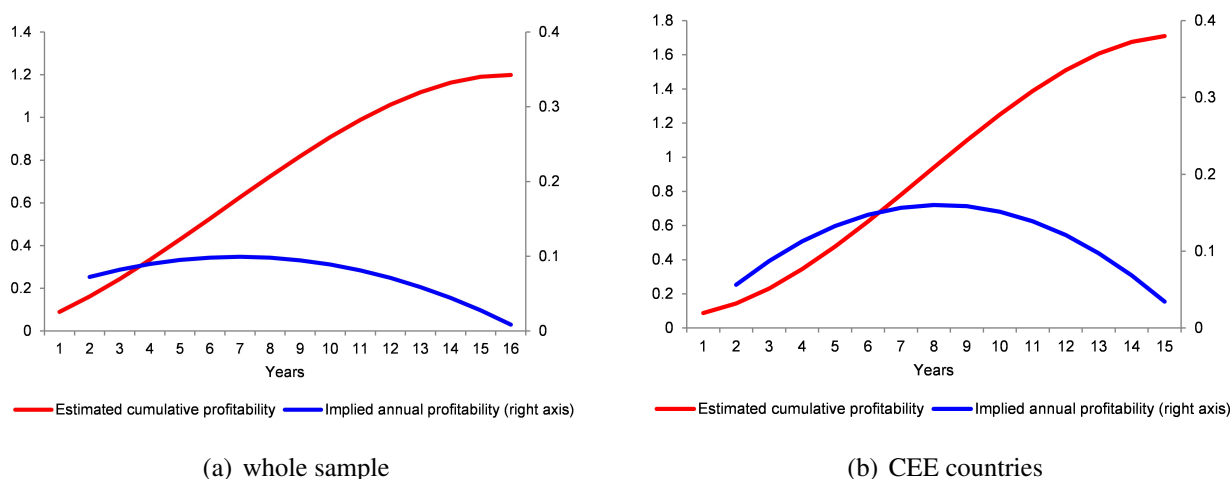
Our regression explains 57% of the variability in the time profile of profitability. The ‘within’ coefficient of determination is even better (0.7) suggesting that the unexplained volatility comes rather from country differences. As is also evident from the table, the higher-order polynomials are statistically significant explanatory variables for the cumulative profitability life cycle. This confirms our initial assumption of a non-linear time profile of the cumulative profitability. Its shape in fact resembles a logistic curve.

Moreover, our control variables are statistically significant as well and have intuitive coefficients. A 1 percentage point increase in the annual growth of the PPI causes a 0.23 percentage point increase in the FDI cumulative profitability. In the case of real GDP growth, the effect is even stronger, causing a 0.5 percentage point increase in profitability. Real appreciation of the local currency is connected with profitability growth of about 0.2 percentage point if one bears in mind that profits are denominated in euros. Conversely, a 1 percentage point increase in the short-term interest rate,

Table 1: Fixed-Effects Estimation Results (Whole Sample)

Intercept	0.029* (0.017)
$j - \tau$	0.054*** (0.007)
$(j - \tau)^2$	0.007*** (0.001)
$(j - \tau)^3$	-0.0004*** (0.00005)
$\Delta \ln(\text{PPI})$	0.233** (0.102)
$\Delta \ln(\text{RGDP})$	0.494*** (0.117)
$\Delta \ln(\text{REER})$	0.194** (0.079)
IR	-0.005*** (0.002)
$\sigma_u / \sigma_e / \rho$	0.161/0.16/0.504
$R^2 / R^2_{\text{within}} / R^2_{\text{between}}$	0.57/0.7/0.56

Number of observations: 2,592; number of groups: 430; obs per group (min/avg/max): 1/6/20; dependent variable: cumulative profitability of FDI stock; asterisks denote significance as follows: *** 1%, ** 5%, and * 10%; standard errors are given in parenthesis.

Figure 6: FDI Profitability Time Profile

which demonstrates monetary tightening, is connected with a decrease in cumulative profitability of similar size as in the case of real GDP growth.

In the next step, the estimated coefficients of the linear, quadratic, and cubic time profile ($j - \tau$) are used to construct Figure 6(a), which shows that according to the estimated results the FDI financial life cycle is completed in 16 years, when the cumulative profitability peaks and the implied annual profitability is nearly zero and then negative. The implied annual profitability increases until the 7th year under observation (10% annual profitability) and then starts to decline. Three sensitivity analyses were carried out (see Appendixes A to C) and their results are very similar.

The results are in line with previous literature, as Novotný and Podpiera (2008) suggest that the cycle could be completed in 15 years. Unfortunately, their sample is not long enough (11 observations) to cover the entire cycle. They therefore use a projection toward zero annual profitability and support their findings by looking at the fixed investment business cycle, which typically lasts about 7 to 11 years. For comparison, Brada and Tomšík (2009) claim that the first two stages (out of three) of

the FDI profitability life cycle (Figure 1) last approximately 9 to 11 years. Our complete FDI life cycle of 16 years in the case of the whole sample thus seems plausible in this light.

The estimated time profile of FDI cumulative profitability represents the general shape of profitability across all the countries under examination. However, as we intend to apply the derived time profile to simulate the likely future development of profits from FDI in the case of the Czech Republic, and since profits from FDI represent the driving force of the total income balance of the Czech Republic, we need to have a more specific estimation for that purpose.

We therefore re-estimate equation 4 on a subsample of CEE countries only. The subsample contains Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovenia, and Slovakia. Using these countries, we derived an FDI profitability time profile that is slightly different from that for all countries. Only the quadratic and cubic forms of the time variable $(j - \tau)$ are statistically significant. Regarding control variables, annual changes in real GDP, the REER, and the level of the short-term interest rate are statistically significant, with real GDP growth displaying the strongest effect. The specific coefficients are shown in Table 2.

Table 2: Fixed-Effects Estimation Results (CEE Countries)

Intercept	0.068*** (0.018)
$(j - \tau)^2$	0.021*** (0.0008)
$(j - \tau)^3$	-0.0009*** (0.00007)
$\Delta \ln(\text{RGDP})$	1.356*** (0.127)
$\Delta \ln(\text{REER})$	0.623*** (0.109)
IR	-0.008*** (0.002)
$\sigma_u / \sigma_e / \rho$	0.075/0.152/0.194
$R^2 / R^2_{\text{within}} / R^2_{\text{between}}$	0.85/0.84/0.9

Number of observations: 910; number of groups: 159; obs per group (min/avg/max): 1/5.7/14; dependent variable: cumulative profitability of FDI stock; asterisks denote significance as follows: *** 1%; standard errors are given in parenthesis.

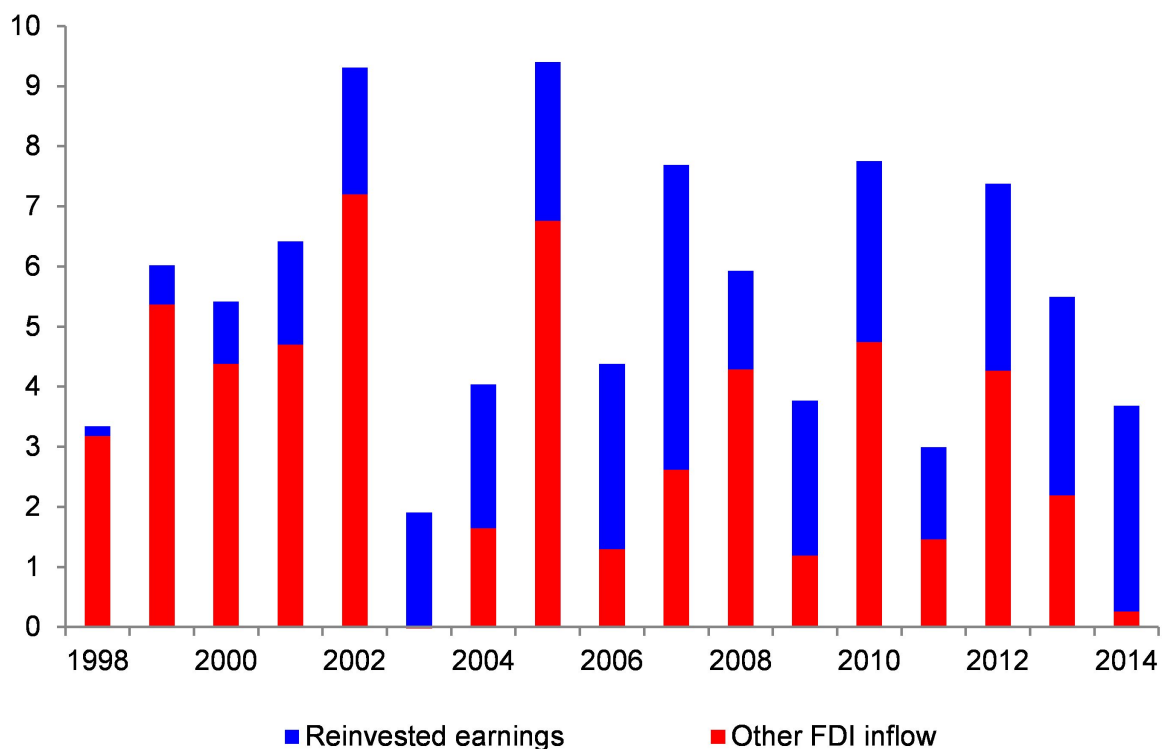
The total regression explains 85% of the variability in the profitability time profile in CEE countries. Moreover, the ‘within’ and ‘between’ coefficients of determination are very similar, suggesting a high level of similarity across the countries. The estimated time profile quite closely resembles actual FDI earnings in the case of the Czech Republic in the period from 1993 to 2014 (see section 5).

The time profile of the estimated cumulative and implied annual profitability in the case of CEE countries is shown in Figure 6(b). It is apparent that the estimated life cycle is one year shorter compared to the whole sample. It lasts 15 years in total and is more dynamic. The implied annual profitability peaks at 16% in the 8th year of the cycle. So, it takes a little longer to reap all the benefits of the initial investment compared to the whole sample of countries, but the implied annual profitability then goes down relatively quickly. CEE emerging countries are characterized in general by higher yields. This may be explained by these countries’ convergence process, which is associated with more profitable investment opportunities. Return on capital is thus higher in these countries compared to the whole sample.

5. Scenarios for Future FDI Earnings in the Czech Republic

In this section, we apply the estimated time profile of FDI profitability in the case of CEE countries (Table 2) to the Czech Republic. As we have already estimated the profitability time path of FDI, the only variable we need to make an assumption about is the future stock of FDI in the country. The future stock of FDI depends on the likely future inflows of new FDI. Figure 7 shows that at the beginning, FDI flowed into the Czech Republic predominantly in the form of equity capital investment (both green and brown-field). But subsequently, as FDI became more established in the Czech economy, reinvested earnings started to play a more significant role in total FDI inflows.

Figure 7: FDI Inflow into the Czech Republic (EUR bn)



Source: Czech National Bank (author's calculation)

Note: Other FDI inflow comprises equity investment (green and brown-field) and intercompany loans (other capital).

Preliminary figures for 2014 indicate that a full 93% of total FDI inflows were in the form of reinvested earnings. The average figure between 2010 and 2014 was 57%, which is quite high indeed. This indicates that the Czech economy is relatively saturated with FDI, and our scenarios reflect this fact.

Specifically, we assume three alternative scenarios for future FDI inflows. The first one assumes that the average yearly amount of the equity capital inflow in 2010–2014 (EUR 2.6 bn) will persist and, moreover, 50% of total FDI earnings from the previous year will be reinvested. The central scenario (scenario 2) assumes no new green or brown-field FDI inflows. Specifically, 50% of total

FDI earnings from the previous year will be reinvested. This is the most likely scenario in our view. Finally, the third scenario represents an extreme situation where neither new FDI equity inflows nor reinvested earnings are assumed. In this case, foreign investors decide to repatriate all FDI profits (stage 3 of the profitability life cycle of FDI; see Figure 1) and, moreover, the Czech Republic becomes unattractive for new foreign investments as well. The two boundary scenarios (the first and third ones) serve as the expected borderlines for the possible future evolution of FDI earnings.

The estimated FDI earnings fit the actual historical FDI earnings in the period from 1993 to 2014 quite well (see Figure 8(a)). This fact supports the validity of our estimation.

The central scenario (scenario 2), which assumes FDI inflows take the form of reinvested earnings only (50% of the previous year's FDI earnings is supposed to be reinvested), suggests that total yearly FDI earnings peaked back in 2012 (EUR 12.2 bn) and FDI earnings are expected to decline steadily in the coming years. Nevertheless, FDI earnings will still be at EUR 9 bn in 2030. The underlying motivation for the central scenario is the following. After an initial period of strong inflows of FDI into the CEE countries, a tranquil period followed. In the Czech Republic, the potential for further privatization FDI inflows and green or brown-field FDI inflows has been practically exhausted and reinvested earnings constitute the main source of FDI inflows since 2006. The income balance of the Czech Republic will therefore be influenced more by the changing term structure of the current stock of FDI in the economy and less by new FDI inflows, which in the central scenario are expected to take the form of reinvested earnings only.

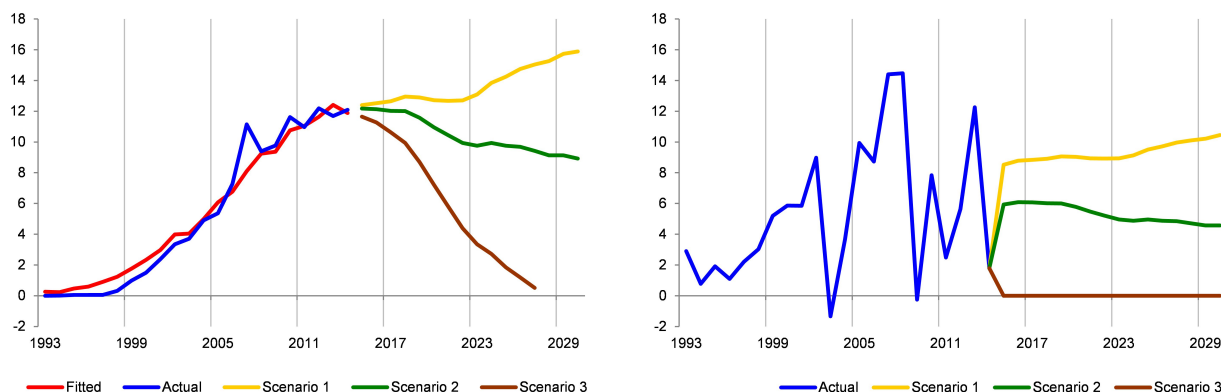
More specifically, we expect the total amount of FDI earnings to reach approximately EUR 12 bn in 2015, which is, of course, the outcome of the other two scenarios as well. Nevertheless, the scenarios diverge in the following years. Specifically, the second scenario will be steady at EUR 12 bn until 2019 and then decrease slightly toward EUR 9 bn in 2030. We thus expect FDI to continue to play an important role in determining the balance of payments in the Czech economy in the coming decades in spite of the fact that according to our central scenario (scenario 2) the economy will record no new green or brown-field FDI inflows (just reinvested earnings).

The first scenario assumes both new FDI equity inflows and reinvestment of FDI earnings. This scenario implies that after several years of stabilization at the current level, FDI earnings will start to increase further after 2022. Under the second scenario, the income balance will deteriorate further, while we can expect a proportionate improvement in the trade balance because FDI earnings in the Czech Republic are generated mainly by the export industry.

Finally, the third scenario, which assumes no FDI inflows into the Czech Republic in the future, implies decreasing FDI earnings until 2028, when earnings from the current structure of the FDI stock will be at zero (see Figure 8(a)). Since the effects of FDI are not restricted to FDI earnings, but are also reflected in the trade balance (due to the export nature of FDI), we can expect proportionate changes in the trade balance as well.

The estimated future FDI earnings also delimitate the boundaries for hypothetical reinvested earnings. Nevertheless, as many FDIs are getting older (shifting to stage 3 of the profitability life cycle of FDI) the role of dividends (repatriated profits) will gain over that of reinvested earnings.

As noted at the beginning, all three scenarios are conditional on the future evolution of new FDI inflows. The past and expected future FDI inflows are therefore shown in Figure 8(b). These FDI inflows delimitate the stock of FDI at the same time.

Figure 8: Scenarios of Future Profits from FDI Conditional on Expected FDI Inflows (EUR bn)

(a) Fitted FDI profits and their future evolution

(b) Past and expected FDI inflows

Note: ‘Actual’ depicts the actual historical FDI profits (earnings) data. ‘Fitted’ is for a model simulation of past FDI earnings based on the results of our estimation in Table 2. ‘Scenario 1,’ ‘Scenario 2,’ and ‘Scenario 3’ represent our three different scenarios conditional on different assumptions about future FDI inflows.

6. Conclusion

We used a specific method to derive the profitability life cycle of FDI on a panel of both advanced and emerging mostly European countries. Our estimations prove that the cumulative profitability time profile is non-linear, implying that the annual profitability initially increases faster, then slows down, and then decreases. When the annual profitability is zero and the cumulative profitability is at its maximum, the FDI financial life cycle is completed. This process takes 16 years in the case of the panel of all the countries under investigation. This result is comparable with the previous literature. The maximum annual profitability is achieved in the 7th year after the initial investment (10% annual profitability).

In the next step, we estimated the cumulative FDI profitability time profile on the panel of CEE countries only. The results are slightly different. The total FDI life cycle is one year shorter, but it takes one year longer to reap all the benefits (maximum annual profitability). The profitability life cycle is more dynamic and the return on capital is higher in the case of CEE countries. This may be explained by the convergence process of these countries.

Finally, we apply the estimated profitability time profile of CEE countries to the Czech Republic. The estimated FDI earnings fit the actual historical FDI earnings in the period from 1993 to 2014 quite well. This fact supports the validity of our estimation. We then assume three scenarios for the possible future evolution of FDI inflows into the Czech economy. The first and third scenarios delimitate the likely future path of total FDI earnings. The central scenario (scenario 2) implies that the absolute value of total FDI earnings will stay at approximately the current levels until 2019 (EUR 12 bn) and then decline very slightly.

References

- ALTZINGER, W. (2006): "On the profitability of Austrian firms in the new EU member states." *The Vienna Institute for International Economic Studies Monthly Report No. 3/2006*, 4–10.
- BABECKÝ, J., K. DYBCZAK, AND K. GALUŠČÁK (2008): *Survey on wage and price formation of Czech firms*. Czech National Bank Working Papers No. 12.
- BARRELL, R. AND D. HOLLAND (2000): "Foreign direct investment and enterprise restructuring in Central Europe." *Economics of Transition*, 8(2):477–504.
- BENÁČEK, V. (2000): "Přímé zahraniční investice v české ekonomice." *Politická ekonomie*, 1: 2000.
- BRADA, J. C. AND V. TOMŠÍK (2003): *Reinvested Earnings Bias, The 'Five Percent' Rule and the Interpretation of the Balance of Payments - With an Application to Transition Economies*. William Davidson Institute Working Paper No. 543.
- BRADA, J. C. AND V. TOMŠÍK (2009): "The Foreign Direct Investment Financial Life Cycle: Evidence of Macroeconomic Effects from Transition Economies." *Emerging Markets Finance and Trade*, 45(3):5–20.
- BUCH, C. M. AND A. LIPPONER (2005): "Business Cycles and FDI: Evidence from German Sectoral Data." *Review of World Economics*, 141(4):732–759.
- CURCURU, S. E. AND C. P. THOMAS (2012): *The return on US direct investment at home and abroad*. Board of Governors of the Federal Reserve System International Finance Discussion Papers No. 1057.
- DUNNING, J. H. (1993): *Multinational enterprises and the global economy*. Addison-Wesley Publishing Company, Wokingham.
- GERŠL, A., I. RUBENE, AND T. ZUMER (2007): *Foreign direct investment and productivity spillovers: Updated evidence from Central and Eastern Europe*. Czech National Bank Working Papers No. 8.
- GERŠL, A. AND M. HLAVÁČEK (2007): "Foreign direct investment, corporate finance, and the life cycle of investment." *Czech Journal of Economics and Finance (Finance a úvěr)*, 57 (9–10):448–464.
- HAVRÁNEK, T. AND Z. IRŠOVÁ (2011): "Estimating vertical spillovers from FDI: Why results vary and what the true effect is." *Journal of International Economics*, 85(2):234–244.
- HAVRÁNEK, T. AND Z. IRŠOVÁ (2013): "Determinants of horizontal spillovers from FDI: evidence from a large meta-analysis." *World Development*, 42:1–15.
- HORST, T. (1971): "The theory of the multinational firm: Optimal behavior under different tariff and tax rates." *The Journal of Political Economy*, 1059–1072.
- JAROLÍM, M. (2000): "Zahraniční investice a produktivita firem." *Finance a úvěr*, 50(9):478–487.
- NOVOTNÝ, F. (2004): "Foreign direct investment earnings and their division in the Czech Republic." *Politická ekonomie*, 2004(6).
- NOVOTNÝ, F. (2011): "Exchange Rate Effects in a Globalized Economy: Evidence from the Czech Republic." *Ekonomický časopis*, (06):636–646.

NOVOTNÝ, F. AND J. PODPIERA (2008): “The profitability life-cycle of direct investment: an international panel study.” *Economic Change and Restructuring*, 41(2):143–153.

SRHOLEC, M. (2003): “Přímé zahraniční investice a technologická změna.” *Politická ekonomie*, 695–713.

WEILL, L. (2003): “Banking efficiency in transition economies.” *Economics of transition*, 11(3): 569–592.

Appendix A: Sensitivity Analysis: Excluding Short Data Series

This sensitivity analysis consists in excluding time series which are shorter than five observations. Belgium, Croatia, and Serbia are excluded from the sample, as we have at most only five observations per country. Also excluded are initial FDI stocks with less than five observations of cumulative profitability in the case of all other countries. The results are presented in Table A1. The length of the life cycle is the same as in the case of the basic estimation (see Table 1). The maximum annual profitability is shifted one year backwards, i.e., the maximum annual profitability is reached in the 6th year.

Table A1: Fixed-Effects Estimation Results

Intercept	0.016 (0.022)
$j - \tau$	0.066*** (0.009)
$(j - \tau)^2$	0.0055*** (0.001)
$(j - \tau)^3$	-0.00031*** (0.00006)
$\Delta \ln(\text{PPI})$	0.373*** (0.132)
$\Delta \ln(\text{RGDP})$	0.483*** (0.15)
$\Delta \ln(\text{REER})$	0.247** (0.1)
IR	-0.006*** (0.002)
$\sigma_u / \sigma_e / \rho$	0.205/0.175/0.577
$R^2 / R^2_{\text{within}} / R^2_{\text{between}}$	0.52/0.71/0.26

Number of observations: 1,963; number of groups: 229; obs per group (min/avg/max): 1/8.6/20; dependent variable: cumulative profitability of FDI stock; asterisks denote significance as follows: *** 1%, ** 5%, and * 10%; standard errors are given in parenthesis.

Appendix B: Sensitivity Analysis: Initial Condition Changed to Average Profitability over First Three Years

This sensitivity analysis takes the average profitability of the first three years as the initial profitability (see equation 2 in section 2) instead of the profitability of just one year at the beginning of the cycle, which is the initial assumption of the basic estimation presented in the paper. The results of the sensitivity analysis are shown below in Table B1. The length of the profitability life cycle is two years longer (18 years) and the maximum annual profitability is reached in the 8th year, i.e., one year later compared to the basic estimation.

Table B1: Fixed-Effects Estimation Results

Intercept	0.092*** (0.017)
$j - \tau$	0.044*** (0.006)
$(j - \tau)^2$	0.0052*** (0.0009)
$(j - \tau)^3$	-0.00024*** (0.00003)
$\Delta \ln(\text{PPI})$	0.13 (0.107)
$\Delta \ln(\text{RGDP})$	0.477*** (0.12)
$\Delta \ln(\text{REER})$	0.023 (0.08)
IR	-0.006*** (0.002)
$\sigma_u / \sigma_e / \rho$	0.2/0.18/0.56
$R^2 / R^2_{\text{within}} / R^2_{\text{between}}$	0.46/0.65/0.38

Number of observations: 2,977; number of groups: 366; obs per group (min/avg/max): 2/8.1/22; dependent variable: cumulative profitability of FDI stock; asterisks denote significance as follows: *** 1%, ** 5%, and * 10%; standard errors are given in parenthesis.

Appendix C: Sensitivity Analysis: Excluding Countries with Initial Share of SFDI to GDP Higher than 20%

Finally, we do a sensitivity analysis where we exclude countries which have a higher than 20% ratio of the FDI stock (SFDI) to GDP in the first year. Therefore, our estimation sample contains only 20 countries out of 32 (Austria, Bulgaria, the Czech Republic, Finland, France, Germany, Greece, Italy, Japan, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, Sweden, Turkey, and the UK). The estimation results of this sensitivity analysis are shown below in Table C1. The length of the profitability life cycle is the same as in the basic estimation (16 years) and the maximum annual profitability is reached in the same year as well (in the 7th year).

Table C1: Fixed-Effects Estimation Results

Intercept	0.032* (0.019)
$j - \tau$	0.041*** (0.008)
$(j - \tau)^2$	0.008*** (0.001)
$(j - \tau)^3$	-0.00039*** (0.00005)
$\Delta \ln(\text{PPI})$	0.27** (0.13)
$\Delta \ln(\text{RGDP})$	0.88*** (0.15)
$\Delta \ln(\text{REER})$	0.41*** (0.09)
IR	-0.007*** (0.002)
$\sigma_u / \sigma_e / \rho$	0.13/0.16/0.39
$R^2 / R^2_{\text{within}} / R^2_{\text{between}}$	0.64/0.71/0.68

Number of observations: 1,919; number of groups: 309; obs per group (min/avg/max): 1/6.2/20; dependent variable: cumulative profitability of FDI stock; asterisks denote significance as follows: *** 1%, ** 5%, and * 10%; standard errors are given in parenthesis.

CNB WORKING PAPER SERIES

11/2015	Filip Novotný	<i>Profitability life cycle of foreign direct investment and its application to the Czech Republic</i>
10/2015	Jitka Lešánovská Laurent Weill	<i>Does greater capital hamper the cost efficiency of banks?</i>
9/2015	Tomáš Havránek Zuzana Iršová Jitka Lešánovská	<i>Bank efficiency and interest rate pass-through: Evidence from Czech loan products</i>
8/2015	Tomáš Havránek Zuzana Iršová Jiří Schwarz	<i>Dynamic elasticities of tax revenue: Evidence from the Czech Republic</i>
7/2015	Volha Audzei František Brázdík	<i>Exchange rate dynamics and its effect on macroeconomic volatility in selected CEE countries</i>
6/2015	Jaromír Tonner Stanislav Tvrz Osvald Vašíček	<i>Labour market modelling within a DSGE approach</i>
5/2015	Miroslav Plašil Tomáš Konečný Jakub Seidler Petr Hlaváč	<i>In the quest of measuring the financial cycle</i>
4/2015	Michal Franta	<i>Rare shocks vs. non-linearities: What drives extreme events in the economy? Some empirical evidence</i>
3/2015	Tomáš Havránek Marek Rusnák Anna Sokolova	<i>Habit formation in consumption: A meta-analysis</i>
2/2015	Tomáš Havránek Diana Žigraiová	<i>Bank competition and financial stability: Much ado about nothing?</i>
1/2015	Tomáš Havránek Zuzana Iršová	<i>Do borders really slash trade? A meta-analysis</i>
16/2014	Mark Joy Marek Rusnák Kateřina Šmídková Bořek Vašíček	<i>Banking and currency crises: Differential diagnostics for developed countries</i>
15/2014	Oxana Babecká Kucharčuková Peter Claeys Bořek Vašíček	<i>Spillover of the ECB's monetary policy outside the Euro Area: How different is conventional from unconventional policy?</i>
14/2014	Branislav Saxa	<i>Forecasting mortgages: Internet search data as a proxy for mortgage credit demand</i>
13/2014	Jan Filáček Jakub Matějů	<i>Adverse effects of monetary policy signalling</i>
12/2014	Jan Brůha Jiří Polanský	<i>The housing sector over business cycles: Empirical analysis and DSGE modelling</i>
11/2014	Tomáš Adam Miroslav Plašil	<i>The impact of financial variables on Czech macroeconomic developments: An empirical investigation</i>
10/2014	Kamil Galuščák Gábor Kátay	<i>Labour force participation and tax-benefit systems: A cross-country comparative perspective</i>
9/2014	Jaromír Tonner Jan Brůha	<i>The Czech housing market through the lens of a DSGE model containing collateral-constrained households</i>

8/2014	Michal Franta David Havrlant Marek Rusnák	<i>Forecasting Czech GDP using mixed-frequency data models</i>
7/2014	Tomáš Adam Soňa Benecká Jakub Matějů	<i>Risk aversion, financial stress and their non-linear impact on exchange rates</i>
6/2014	Tomáš Havránek Roman Horváth Zuzana Iršová Marek Rusnák	<i>Cross-country heterogeneity in intertemporal substitution</i>
5/2014	Ruslan Aliyev Dana Hájková Ivana Kubicová	<i>The impact of monetary policy on financing of Czech firms</i>
4/2014	Jakub Matějů	<i>Explaining the strength and efficiency of monetary policy transmission: A panel of impulse responses from a Time-varying Parameter Model</i>
3/2014	Soňa Benecká Luboš Komárek	<i>International reserves: Facing model uncertainty</i>
2/2014	Kamil Galuščák Petr Hlaváč Petr Jakubík	<i>Stress testing the private household sector using microdata</i>
1/2014	Martin Pospíšil Jiří Schwarz	<i>Bankruptcy, investment, and financial constraints: Evidence from a post-transition economy</i>

CNB RESEARCH AND POLICY NOTES

4/2014	Josef Brechler Václav Hausenblas Zlataše Komárková Miroslav Plašil	<i>Similarity and clustering of banks: Application to the credit exposures of the Czech banking sector</i>
3/2014	Michal Franta Tomáš Holub Petr Král Ivana Kubicová Kateřina Šmídková Bořek Vašíček	<i>The exchange rate as an instrument at zero interest rates: The case of the Czech Republic</i>
2/2014	František Brázdík Zuzana Humplová František Kopřiva	<i>Evaluating a structural model forecast: Decomposition approach</i>
1/2014	Michal Skořepa Jakub Seidler	<i>Capital buffers based on banks' domestic systemic importance: Selected issues</i>

CNB ECONOMIC RESEARCH BULLETIN

November 2015	<i>Monetary policy challenges in a low-inflation environment</i>
May 2015	<i>Forecasting</i>
November 2014	<i>Macroprudential research: Selected issues</i>
April 2014	<i>Stress-testing analyses of the Czech financial system</i>

Czech National Bank
Economic Research Department
Na Příkopě 28, 115 03 Praha 1
Czech Republic
phone: +420 2 244 12 321
fax: +420 2 244 14 278
<http://www.cnb.cz>
e-mail: research@cnb.cz
ISSN 1803-7070