INFOCUS – II
THE EFFECT OF EMPLOYER CHARACTERISTICS ON WORKER OUTCOMES

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EDITOR'S FOREWORD

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The Effects of Firm Attributes on Worker Outcomes

The wage or employment effects of individual characteristics such as gender, level of education, experience in the labor market or family background have been central questions in labor economics since its beginnings. During the 1980s, however, as databases became more and more sophisticated and firm-level data were made available, a number of economists turned their attention to the linkages between workers' wages and the characteristics of firms they work for. This literature has increased rapidly ever since, and typically focuses on union status, industry and size of firm, ownership (usually foreign, state and employee ownership), and the firm's involvement in international trade.[1]

The first question which may occur to those who try to assess the impact of this large and growing literature is whether it is all that important. Do workers who are identical in their observed and unobserved productive characteristics receive different wages just because they work for different employers? At the first sight, there is no reason to believe this: after all, there is only one labor market on which workers compete for employment opportunities and firms try to choose the best employees they can afford. The labor market, however, is more complex than this rather simplistic view suggests.

The reasons for wage differentials of workers with similar productive capacity are multiple.

First, workers do not consider only the rate of pay when they decide which job offer to accept, but take into account a range of job attributes, of which the pay rate is only one. Such job characteristics are many, some giving extra utility to the worker (such as a pleasant working environment or interesting tasks) while some rather make jobs unattractive (long working hours, night shifts, high risk of injury or death, monotonous work and so on). As firms face different costs to provide amenities and decrease disamenities (for example, by creating a safer environment), and workers have different preferences across these attributes, some will choose firms that provide less of the amenities if they are compensated for them in the form of higher wages (*Rosen*, 1986).[2] Since the level of amenities and disamenities can vary at the industry, occupation or firm level, they create wage differentials which correlate with these firm characteristics (or the firms themselves).

1 *Pencavel* (1991) discusses the theoretical and empirical aspects of the effects of unionization on labor markets while *DiNardo and Lee* (2004) adapt a novel approach to the union wage differential measurement. An early example of inter-industrial wage differentials study is *Groshen* (1991); *Kertesi and Köllő* (2003a, 2003b, in Hungarian) discuss this in the Hungarian context. The effect of firm size and wages is summarized by Oi and Idson (1999). *Brown et al.* (2010) study the employment and wage effects of privatization, *Bonin et al.* (1993) and *Hansmann* (1996) discuss the behavior of employee-owned firms and *Huttunen* (2007) analyzes the effects of foreign ownership on wages and employment composition. *Johnson and Stafford* (1999) provide a synthesis of the labor market effects of international trade.

2 For example, risk averse workers prefer firms (or jobs) which are safer, but they are likely to pay for this in the form of lower wages. Their less risk averse colleagues rather accept jobs which are riskier but provide a higher salary. Note that this is a competitive model of wage determination: it simply replaces the salary of the worker with total compensation, which includes any job attribute that is important to the worker and (potentially) costly to the employer.

The second reason is that it may be beneficial for employers to compensate workers above the market wage: if the productivity of workers is tied to their compensation (so higher wages promote higher effort), then it is rational for a profit-maximizing firm to pay "efficiency wages" – wages above the market clearing level (*Shapiro and Stiglitz*, 1984). A similar reasoning can be applied when not worker effort, but quits alter the profits of the firm. If employers incur fixed costs of labor (which are the hiring and firing costs), it is in their interest to induce workers to stay with the firm as long as possible so the fixed costs are spread across many time units.[3] In this case higher-than-market wages may reduce the workers' incentives to quit and thus can indirectly increase the firms' profits (*Stiglitz*, 1985). If monitoring costs (which are directly related to workers' effort level) and the fixed costs of labor vary by firm type (for example, by industry, or firm size) then the efficiency wage mechanism will bring about wage differentials which are related to such firm characteristics.[4]

Third, the productivity of workers does not depend only on their abilities, but also on whether they and their employers are a good match or not. If labor markets were frictionless, each worker and firm would find the best match and so their joint productivity (and therefore the wage of the worker) would be the best possible achievable. Search and hiring costs, however, hamper the creation of the best employer-employee matches. Getting a suitable employer (or an employee, from the point of view of the firm) is a probabilistic mechanism: some workers find employers they can work well with, while others are less lucky and get into employment relationships which are less successful. This probabilistic process will have an effect on wages, and two very similar workers may end up having very different wages just because one was lucky enough to find a good firm while the other was less successful in her search.[5] Again, if some firms put more effort in their search for potential employees, they will on average find better matches, which will be reflected by their salaries.

Finally, some types of employers may have different objectives than the conventionally assumed profit maximization of investor-owned enterprises. One obvious candidate for such behavior is the employee-owned firm, where the employee-owners may pay themselves all realized surplus in the form of wages, or may be willing to trade off high wages for safe jobs (*Earle and Estrin*, 1996). A second candidate for non-profit maximizing behavior is state ownership. Firms under state ownership may pursue social goals rather than profit maximization, or politicians controlling firms may maximize votes with the help of the firm's resources; either of these objectives may result in higher employment and wages (*Shleifer*, 1998).

Data and Measurement

Studies analyzing the linkage between firms and wages rely heavily on data. Broadly speaking, the quality of the data can be classified by coverage, wheth-

3 Examples of fixed costs of labor are search costs, training costs of workers (including the lost production due to time loss of experienced co-workers), and severance pay.

4 See, for example, the study written by *Krueger and Summers* (1988), who analyze this question in the context of inter-industrial wage differentials.

5 See *Pissarides* (2000) for a general treatment of this subject.

er firms and workers can be followed in time and how long the panel is, and whether they have information on both firms and workers (thus forming a linked employer-employee dataset).

The coverage can be assessed in two different ways: whether it has information from all sectors (usually industries) of the economy, or whether it is a sample or it covers the whole population of firms.[6]

The longitudinal length of the data is also of crucial importance. A common problem in such studies is that firms and workers are not randomly allocated with respect to the variable of interest. For example, firms under foreign ownership may be fundamentally different from domestic ones in many dimensions; those which engage themselves in international trade may also be different from those which buy their inputs and sell the produced output exclusively on the domestic market. Such selection may create channels through which wages are different across types of firms, but this is not caused by the variable of interest but some other firm attribute which is correlated with it. For example, foreign-owned firms may be established in industries which pay higher wages or in regions where wages are high. Exporting firms may have been more productive and paid higher wages already before they engaged in international trade. In these two examples, the wage differential between foreign and domestic firms and exporting and non-exporting firms is not caused by the variables of interest, namely foreign ownership and international trade. Not taking into account such selection may contaminate the measured relationship between firm attributes and worker outcomes. If the characteristics along which the selection takes place are measurable, the researcher may control for them explicitly. Many of these factors, however, are hidden to the researcher (but not to the managers or owners of the company who make the decisions regarding workers' wages). In this case panel data techniques, such as the inclusion of firm fixed effects of firm level trends can attenuate the selection bias. The difference in the estimated effects with and without controls for selection bias is often very large, thus demonstrating that the treatment of the selection problem is of the utmost importance.

Finally, information on workers' individual characteristics and wages also raises the quality of data in several important ways. The inclusion of worker characteristics may remove important biases and thus allow more precise measurement of the effects.[7] Second, some variables – wages, for example – can be measured more precisely at the individual level (if only firm level information is available, the wage measure is usually the average wage at the company). Third, some questions simply cannot be studied without worker information. An example is wage differentials within one firm, across genders, occupations, or age cohorts.[8]

6 This is a self-evident quality measure: one cannot analyze sectors which are not in the data, and the larger the sample is, the better the statistical properties the results will have.

7 Two firms, for example, may have different composition of the workforce. Not controlling for this composition may introduce a bias in the measurement of the firm characteristic on wages.

8 Hungary can boast perhaps the best datasets in the Central and East European region. Its firm-level data (gathered by the National Tax and Customs Authority) covers each double-entry book keeping firm, having information on the balance sheet and income statement (as well as some additional information, such as the employment level of the firm and its main activity). These data can be linked to the Wage Survey data (gathered by the National Employment Foundation) which have information for a sample of workers in a large number of firms, providing data on their individual characteristics, wages, and on their job (such as the exact job code and tenure). The data, unfortunately, is not a panel in workers (only in firms). Both datasets start in 1986 and new waves are continuously appended.

Short Summary of In Focus – II

In Focus – II is composed of four studies, each analyzing the effect of a firm characteristic on workers' wages and sometimes also on the employment level of the firms.

Chapter 1 (written by Mariann Rigó) analyzes how collective contracts (including, but not being restricted to wage contracts) result in a wage differential between covered and uncovered firms' workforce. Using data from the period 1992–2008, the unconditional wage differential between covered and uncovered firms' employees is quite large on average (around 20 percent), falling little when individual characteristics are controlled for. However, observable firm characteristics explain a large portion of the unconditional wage differential, which falls to 3.5–5 percent if these are included among the control variables. The wage gap further drops to 2–2.5 percent if unobserved firm characteristics are also controlled for. Analyzing the periods 1992–2000 and 2001–2008 separately suggests somewhat a larger wage differential for the first period (4.6 percent in 1992–2000 and 2.1 percent in 2001–2008) which is in line with the growing importance of the statutory minimum wages, which were increased substantially after 2000.

Chapter 2 (written by John Sutherland Earle and Álmos Telegdy) analyzes how wages change when a domestic firm is acquired by foreigners. The authors use two datasets, one at the firm level and one when individual worker characteristics and wages are linked to the firm level information, forming a linked employer-employee dataset. They find that foreign firms pay workers a very large premium of 46–60 percent. As practically always in such studies, the selection of target firms by the future foreign owners is likely to be non-random and taking this selection into account changes the results. Controlling for firm attributes (both observable and unobservable, but fixed in time) more than halves the estimated wage effect of foreign ownership. This reduction is sizable, but the estimated effect is still very large, in the order of 16–27 percent. A number of firms undergo two ownership changes during the period studied: from domestic to foreign and back to domestic ownership again. The authors use this subsample to test whether the foreign wage increase lasts even after the firm is sold back to domestic owners, and find that firms indeed pay higher wages after divestment. This wage premium (relative to the never acquired domestic firms), however, is much smaller than the one measured while the firm was in foreign ownership. The foreign wage effect, therefore, is linked to foreign ownership and mostly disappears when foreigners divest the firm back to domestic owners.

The analysis in *Chapter 3* (written by John Sutherland Earle and Álmos Telegdy) aims to understand the effects of another form of ownership: how are the employment size of the firm and the wages of workers altered in the case

of state ownership? This question is very important, especially in the light of the fear shared by both policy makers and the general public that privatization, will lead not only to productivity improvement, but to layoffs and lower wages as well (*Szentpéteri and Telegdy*, 2010). In the first part of the chapter the authors study the employment outcomes of privatization in a comparative perspective, using data from five Central and East European countries (Hungary, Lithuania, Romania, Russia and Ukraine). They control for selection with two econometric methods: firm fixed effects, which removes any observed and unobserved firm attribute fixed in time, and also firm-level trends, which, in addition to fixed effects, also removes any attribute linear in time. Contrary to the expectations of policy makers and the public at large, privatization does not lead to a large drop in firms' employment size, at least not when it is compared to state-owned enterprises. When fixed effects and firm-specific trends are controlled for, the estimated effects of domestic privatization are indeed negative (except in Russia) but their magnitude is smaller than 5 percent. Foreign privatizations, on the contrary, lead to firm growth in all countries except Romania, and the magnitude of the effect is larger than 10 percent in three countries. When the regressions are weighted by the employment size of the firm (and thus the estimated effects refer to the proportion of net employment change as a result of privatization in all initially state-owned firms), the estimated employment effects of domestic privatization are essentially zero (except in Russia, where the effect is still positive) and the beneficial employment effects of foreign privatization are also removed in the three EU countries but remain large and positive in Russia and Ukraine.

In the second part of this chapter the authors use only Hungarian data, and analyze wage changes when the firm is transformed from state into private ownership. Using linked employer-employee data, they find that domestic privatization does reduce the wages of workers, but the magnitude of the reduction varies by worker type. By demographic characteristics, females and young employees experience the smallest drop. Contrary to domestic privatization, the employees of state-owned firms transferred to foreign ownership experience a wage increase, which is especially large in the case of highly skilled workers.

Chapter 4 (written by Miklós Koren and Péter Tóth) analyzes the labor-market impacts of international trade. Using Hungarian firm- and worker-level data, the authors compare wages paid by exporting and importing firms to those paid by non-traders. More specifically, they ask how the wages of workers change when a firm starts exporting or importing. While trade is generally thought to be useful in facilitating the efficient distribution of resources, it is less well understood what effect it has on individual workers. A worker losing her job because of cheap imports will find little consolation in the fact that the country as a whole has become more efficient. The authors look at firm- and worker-level data to uncover the heterogeneity in worker experience.

Firm-level analysis is useful because it can control for broader trends and fluctuations in the economy and in the industry. For example, a sector might experience a surge in exports and a rise in wages because of cyclical demand. But if demand is as cyclical at home as it is abroad, trade has no direct effect on wages. The analysis can control for industry cycles by comparing firms within the same narrow industry. This is also a potential drawback, however. Several theories of trade predict a reallocation of resources across industries: as the country liberalizes, import-competing sectors shrink (resulting in lower labor demand, and, likely, lower wages), while exporting sectors expand.

The main finding of the chapter is that both exporters and importers pay higher wages, but the effect is stronger and more robust for importers. The wage premium paid by exporters seems to reflect firm selection: firms already pay higher wages several years prior to becoming exporters, probably because they have a better workforce. In contrast, the wage premium paid by importers gradually increases after the initial import has taken place. The finding contradicts the conventional wisdom that "exports are good, imports are bad." To understand why this is the case, the authors also present evidence on the effect of imports on firm performance: importing intermediate inputs and capital goods both contribute to higher firm productivity, which may result in greater market share. It seems that the bigger pie can then be shared with the workers of the firm. Hence, allowing firms to access import markets freely can boost demand for local labor.

Not all workers gain from increasing trade, however. Citing a recent study on the Hungarian food and textile sectors, the authors show that workers in certain occupations most affected by outsourced production (i.e., those whose output is now imported) suffer some wage decrease relative to workers at non-importing firms. Moreover, even among positively affected workers, the gains are not distributed equally: managers and highly skilled workers gain more, which suggests that trade might have contributed to the rise in wage inequality in the past two decades.

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1. ESTIMATING THE UNION – NON-UNION WAGE DIFFERENTIAL IN HUNGARY*

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INTRODUCTION

Social dialogue is a traditionally strong institution in continental Western European countries. While social partners exercise their bargaining activity both at firm, sectoral and national level in these countries, and reach a bargaining coverage of close to 100 percent, social dialogue in transitional countries is a fragile institution showing a fragmented structure, and covers only a fraction of the workforce (*Neumann,* 2006b). The large discrepancy between the Western and the transitional countries is not surprising bearing in mind the different historical roots of the social partners. While trade unions in Western Europe inherited their attitudes from the Taylorist and Fordist, and later from the Japanese style organization paradigm,[1] trade unions in the transitional countries had to reorganize themselves, find their new roles in the fundamentally changed economic environment and cope with their social inheritance. The outcome in most transitional countries was an industrial relations system where the firm level is the most (and only) important channel of collective negotiations.

The difference between the two groups of countries (Western vs. transitional) is also mirrored by the number of studies analyzing the union wage differential. Though unionization is one of the most heavily studied topics in Anglo-Saxon countries and in continental Western Europe,[2] much less is known about the nature of industrial relations in transitional countries, and the available evidence is mostly presented by descriptive and case studies.[3] Based on these studies, researchers share the opinion that collective bargaining is weak in transitional countries, and unionism has little or small labour market impact. One aim of this paper is to revisit the assumed weak role of trade unions in these

* This study is based on *Rigó* (2012).

1 In the 50s and 60s, collective agreements in the Taylorist and Fordist work organizations limited employers' flexibility regarding wages and employment conditions to the smallest possible (e.g. rigid wage scale system, exact regulation of fringe benefits, system of job description specifying exactly the content of each job). Starting from the 80s, the Japanese style organization paradigm replaced the former rigid institution leaving some flexibility for the employer e.g. to reward employees by individual performance. The power of collective agreements was reduced later to "maintain a minimum solidarity" between employees and to "limit the flexibility of local bargaining" (*Tóth*, 2006b p. 150). The study by András Tóth in the Hungarian Labour Market, 2006 (*Tóth,* 2006b) yields a detailed analysis about the attitudes of the Western and transitional trade unions.

2 Concerning unionization in the US, see for example *Lewis* (1986)'s comprehensive summary or *Blanchflower and Bryson* (2004) and *Hirsch* (2003). *DiNardo and Lee* (2004), *Freeman and Kleiner* (1990) and *Lalonde, Marschke and Troske* (1996) use US enterprise-level data and focus on the labour market impacts of recent unionization. Regarding the experiences of continental Western European countries, see for example *Hartog et al* (2002), *Card and de la Rica* (2006) or *Gürtzgen* (2006).

3 The In Focus chapter of The Hungarian Labour Market, Review and Analysis 2006 (edited by Károly Fazekas and Jenő Koltay) gives a comprehensive overview of Hungarian industrial relations. For example, the studies by *Tóth* (2006a) and *Neumann* (2006a), (2006b) provide a detailed picture of the the employers' organizations and trade unions, describe the process of reorganization of these institutions after the regime change, and emphasize their current strengths and weaknesses. *Tóth* (2006b) analyzes the characteristics and attitudes of post-guild (Western European) and post-socialist trade unions. The Ministry of Social Affairs and Labour, being responsible for the collection and management of collective agreement records, publishes on its home page case studies of special industries. A country-level comprehensive study based on the industrial case studies is *Fodor, Nacsa and Neumann* (2008). *Pollert* (1999) provides a short overview of industrial relations during the transition in Poland, Hungary, Slovakia and the Czech Republic. The East German and the Hungarian experiences are compared in *Frege and Tóth* (1999).

There are only few studies quantifying the labour market impact of unionism in transitional countries. For an exception, see *Neumann* (2001) and *Kertesi and Köllő* (2003) analyzing Hungarian data, or *Iga et al* (2009) using Hungarian, Czech and Polish data.

countries by quantifying the wage impact of collective agreements based on the Hungarian, large, representative, linked, employer-employee panel data, which covers the period of 1992–2008 and includes detailed information on 17,783 firms.

Institutional Setting

The Hungarian institutional setting can be characterized as a heavily decentralized system where bargaining at the firm level – individual and collective bargaining – are the most important channels of the wage negotiations. Sectoral collective agreements are almost absent, and even if present, they are weak regarding their regulatory power.[4] Most of the employers' organizations are not entitled to sign sectoral agreements, and even if signed, they specify "opt-out" clauses concerning the most important restrictions. This situation results in sectoral agreements being nothing other than a "collection of good wishes" (*Neumann*, 2006b p. 129). Firm-level trade unions should pay 40 to 60 percent of their fees to higher level unions. However, the actual transfers are much smaller. Besides, trade unions at this level also need to cope with the lack of specialized staffs and experts. They have hardly employed any fresh graduates since they were first established, and tend to operate with only a few staff members these not being enough to fulfil the interest representation role.[5]

Union confederations at the national level are also able to influence the bargaining outcomes through their participation on the tripartite forum, which represents trade union confederations, employers' associations and the government, and issue recommendations for the minimum wage and for the annual wage increase. These recommendations serve as a guideline for the firm-level collective negotiations.

Workers at the company level are represented by two institutions: works councils and trade unions.[6] Works councils were set up by the Labour Code in 1992 to introduce a new form of employee representation, which is independent of union membership. The aim was to create an institution, which is close to the German model where works councils operate as a platform for joint decisions by the workers and managers on the most important questions. However, the co-determination rights in the Hungarian version were limited to the use of the social fund; otherwise, the workers were only given information and consultation rights. Moreover, the two institutions often overlap in Hungary having the same people in the works council's and trade union's seats. As the bargaining right of a union depends on the number of votes it gets in the works council, union members have strong incentives to ensure seats for their nominees in the works council. Thus, works councils are mostly regarded as useless and unnecessary institutions without any functional role.

The functionality of trade unions, which form the other channel of employee representation, also lags behind the functionality of their Western Euro-

4 *Neumann* (2006a, 2006b) analyzes the strategies of higher level (sectoral) trade unions and how they work. In the current study we highlight some important conclusions of the above papers.

5 The first wave of sectoral negotiations took place in 1992. The next wave occurred in 2005 when industry level agreements were signed in the construction and in the private security industries. In 2001, the share of employees covered by a sectoral agreement was 5.9 percent, which is quite low compared to the coverage rate of the single employer contracts, which was 37.2 percent (see *Statistical Data*, 2006 p. 295, Table 11.8.).

6 *Benyó, Neumann and Kelemen* (2006) yields a detailed analysis on how works councils function. In the current study we highlight the most important features emphasized in the study.

pean counterparts. While trade unions in Western countries aim to regulate employment relations "in the name of solidarity and equality" (*Tóth*, 2006b p. 151), trade unions in post-socialist countries try to avoid conflicts. Instead of representing the "automatic solidarity between employees" (*Tóth*, 2006b p. 155), collective agreements provide considerable flexibility for the employers to influence work conditions and wages.

Firm-level trade unions have the privilege by law to engage in collective bargaining and to conclude agreements. Once concluded, the agreement is automatically extended to all employees of the firm. While collective agreements in the Anglo-Saxon countries and in continental Western Europe include precise and strict regulations concerning wages, the Hungarian collective agreements have mostly vague or, in some cases, no regulations on wage elements. Collective agreements including regulations on wages are termed separately as wage agreements. Wage agreements have the same legal status as collective agreements, however, wage agreements are negotiated on a yearly basis, while collective agreements are often contracts of indefinite duration (*Neumann*, 2006b).

Fodor, Nacsa and Neumann (2008) provides a comprehensive summary of the concluded collective agreements. The authors, analyzing the text of 304 collective agreements in 20 industries, found that Hungarian collective contracts share the following main features. Most of the agreements include precise regulations on extra working hours, overtime work, non-wage and social benefits.[7] On the other hand, regulations on wage elements are vague specifying mostly only guaranteed wages[8] and formulating target wage recommendations. The elements of modern HR techniques (e.g. the specifications of performance pay, group bonuses etc.) are almost totally absent from the agreements.[9]

The coverage of agreements varies substantially by the size of firm, by industry, and also changes over time. Collective agreements are more likely to be concluded in large companies. For example, in 2004, only 9.4 percent of companies employing less than 50 employees concluded a wage agreement, while the coverage was around 50 percent in companies with more than 300 employees (*Statistical Data*, 2006, Table 11.16.). By industry, the mining, transport, and the electricity industry were the most covered sectors with a coverage rate of around 80 percent, while in construction, trade and financial intermediation the share of employees covered was around 25 percent (*Statistical Data*, 2006, Table 11.15.). Over time, the number of registered collective agreements does not show substantial variation ranging between 1200 and 1300 reported agreements in the period of 1998–2004 (*Statistical Data*, 2006, Table 11.3.). On the other hand, the number of registered wage agreements decreased from around 800 in 1998 to 515 reported cases in 2004. The drop in the number of wage agreements in recent years is due to the growing influence of the national level regulations in the wage determination. In 2001, the statutory minimum wage increased by 60 percent compared to its level in 2000, reaching higher values

7 These areas were traditionally well-regulated in pre-transitional collective contracts as well (*Fodor, Nacsa and Neumann*, 2008).

8 Guaranteed minimum wages are specified in those firms where wages explicitly depend on the performance of the employee. The guaranteed wage is usually the base salary or a certain fraction, usually 70–80 percent of the base salary.

9 There are a few exceptions in the chemical industry with collective agreements defining both the bonus-tasks and the allocation of bonuses.

than the firm-level trade unions hoped for. As a consequence, the number of agreements specifying higher wage increases than the national one dropped substantially.[10]

Comparing the institutional setting to other countries, industrial relations in Hungary can be characterized as being a mixture of the two main regime types, the Anglo-Saxon and the continental European ones. Similarly to the US and UK, the institutional setting is decentralized, the main level of bargaining is the firm, and since industrial agreements are rare and lack an effective extension mechanism, the two most important sectors of the economy are those covered by a firm-level agreement and the non-covered ones.[11] On the other hand, the dominant dimension of industrial relations in the Western European continental countries (e.g. in Spain, Italy, the Netherlands, Portugal) includes a network of sectoral agreements, which are practically extended to all firms in the economy. Firm-level agreements may coexist with industrial agreements or be an alternative to them, but these firm-level contracts cover a much smaller fraction of the workforce.[12] Despite the relatively high degree of centralization of industrial relations compared to the US and the transitional countries, there are substantial differences between the continental Western European regimes. Since *Calmfors and Driffill* (1988) much attention has been paid to the centralization and the coordination dimensions of the regimes. According to the Calmfors-Driffill hypothesis, bargained wages are the highest and macroeconomic outcomes are the worst under intermediate degrees of centralization, which in most cases refer to sectoral bargaining. On the other hand, both decentralized and centralized bargaining produce lower wages and better macroeconomic outcomes.[13] However, in many countries (e.g. Portugal and the Netherlands) there is multiple-level bargaining with coexisting bargaining arrangements, and there is no theory to give guidance in such cases.

According to the ranking of *Calmfors and Driffill* (1988), Austria, Norway and Sweden are the most centralized countries, and the UK, US and Canada are at the other extreme of the scale, while Germany and the Netherlands lie in-between. According to the OECD's ranking (*OECD*, 2004, p.151, Table 3.5) covering the period of 1995–2000, Norway is the most centralized country with the highest level of coordination, followed by Portugal with similarly high centralization and coordination scores. Austria, Germany and the Netherlands are considered to be medium centralized countries with predominantly industry-level bargaining and a high level of coordination. Spain and Sweden are medium centralized with a medium degree of coordination, while Italy is considered to be decentralized with a high degree of coordination. Transitional countries lie at the low end of both the centralization and the coordination scale:[14] fragmented firm-level contracts constitute the most important channel of collective negotiations, and the thin layer of sectoral agreements cover only a fraction of the employees. Due to the small coverage of industrial

10 Despite the minimum wage increases, there would be scope for wage agreements to regulate other aspects of the salary system. However, as highlighted by case studies (e.g. *Fodor, Nacsa and Neumann*, 2008), wage agreements in most cases specify only minimum and guaranteed wages and average wage increases.

11 Note, however, that there are important differences between the institutions of the Anglo-Saxon and transitional countries. For example, trade unions have different historical backgrounds, and the process of negotiation, the relevance of individual membership (whether individual-level or firm-level coverage is relevant) is also different (in the Anglo-Saxon countries firm-level collective contracts cover only member employees). *DiNardo and Lee* (2004) gives a detailed overview of the process of collective negotiation in the US.

12 For example, in Spain, 15 percent of workers was covered by firm-specific contracts in 1991 (*Card and de la Rica*, 2006), and in Portugal, the coverage of firm-specific contracts was less than 10 percent in 2000 (*Cardoso and Portugal*, 2005).

13 When the bargaining is decentralized, which usually corresponds to enterprise level bargaining, unions' wage demands are suppressed by market forces (unable to increase firm's cost level above that of competitors), while under centralized bargaining the wage demands are mitigated by internalizing the various negative externalities (e.g. higher consumer or input prices, unemployment externalities). (*Calmfors and Driffill*, 1988)

14 An exception is Slovakia, which is classified as having a modestly centralized and coordinated institutional structure due to the more important role of sectoral agreements.

agreements and their weak regulatory power, we only investigate the wage impact of firm-level (single- or multi-employer) collective contracts in Hungary.[15]

The empirical findings of the few quantitative studies from Hungary document modest or statistically insignificant wage impacts. *Neumann* (2001) using Hungarian data from 1998 finds a statistically significant wage impact of 5.6 percent in the case of firm-level collective agreements. *Kertesi and Köllő* (2003) analyzing the interaction of market concentration and unionization on the same dataset from 1998 concludes that industrial rents in highly concentrated industries are grabbed by unions, which leads to higher wages in those sectors. *Iga et al.* (2009) uses three transitional datasets, Hungarian and Czech data from 2002 and Polish data from 2004 to estimate the impact of firm-level and industry-level collective agreements. On average, using the cross-sectional data, they do not find a significant wage impact in any of the countries. In Hungary, firm-level collective agreements are found to be associated with 5–7 percent higher wages in those firms which were set up prior to or a few years after the transition. Compared to the above discussed papers, the current study is the first analysis which uses panel data. Therefore, it is the first study, which is able to take into account in the regression analysis both observable and time-invariant unobservable factors, which may influence wages.

Data

Data for the analysis come from two sources. We use the Hungarian Wage and Employment Survey (WES) linked to various workplace characteristics, while data on collective and wage agreements are recorded by the Ministry of Social Affairs and Labour. Our analysis covers the period of 1992–2008. The linked WES database is representative, and provides various information on the workers (wage, gender, age, highest level of education defined by five educational categories, 4 digit occupational code) and also workplace characteristics (balance sheet information, 2-digit industry classification, location, ownership structure, number of employees). The database covers all tax-paying legal entities with double-sided balance sheets that employ at least 20 employees.[16] Within firms, employees are sampled: on average, 6.5 percent of production workers and 10 percent of non-production workers entered into the sample. The database follows firms over time, thus, we have the opportunity to take into account time invariant unobserved firm-level heterogeneities in the regression analysis.

Data on collective and wage agreements are registered and maintained by the Ministry of Social Affairs and Labour.[17] The registration of wage agreements commenced in 1992. Since 1998, the Ministry extended the data collection to all collective contracts. The problem with both the wage and the collective agreement records is that though registration is compulsory, there is no sanctioning in the case of unreported records. Therefore, the number of reported agreements may be biased. On the one hand, existing, but non-reported agree-

15 Multi-employer collective contracts are usually contracts of enterprises having common ownership. Thus, they can be considered as being closer to the company-level contracts (*Neumann*, 2006b). In the current study we define both single- and multi-employer contracts as firm-level collective contracts.

16 Starting from 1995, the data collection was extended to (the sample of) firms with at least 10 workers, and from 1999 on to micro-firms as well.

17 The database on collective agreements are available on the Ministry's webpage.

ments bias the institutional statistics downward. On the other hand, expired agreements may bias the institutional statistics upward if the expiration of the contract was not reported to the Ministry. As wage agreements are negotiated yearly, wage agreement records may be biased mostly downward. However, in the case of the collective agreement records, bias in both directions may be possible, as in many cases the duration of the collective contract is indefinite with no expiration date.[18] The database includes information on the start and the end date of the agreements. In the case of the wage agreements, only the start date is important as their expiration is one year. However, the duration of collective contracts is mostly indefinite unless the expiration date is exactly specified.

The database was restricted to firms employing at least 20 employees. First, union coverage is very low in small firms. Besides, dropping smaller firms also eliminates the changes in the sampling of the database over time. As a next step, we examined the coverage of firms in the different industry categories: coverage ranges from zero coverage to 77 percent through the different 2-digit NACE categories. To get rid of categories with very low coverage, we dropped those industry categories where less than 5 percent of the employees are covered by a collective agreement. The final database includes information on 17,783 firms with 1,493,331 employee-year observations.

Table 1.1: Yearly number of collective and wage agreements, coverage of firms and employees in the database used for the analysis (after the cleaning and the sample selection procedures)

	Collective agreement			Wage agreement		
Year	# agreements	firms covered (%)	employees covered (%)	# agreements	firms covered (%)	employees covered (%)
1992	17	0.4	0.6	6	0.1	0.2
1993	108	2.2	4.2	63	1.3	1.8
1994	292	5.6	16.5	129	2.5	5.9
1995	378	6.6	18.9	102	1.8	3.6
1996	491	8.8	20.1	141	2.5	4.9
1997	669	11.8	25.6	204	3.6	6.6
1998	959	17.0	35.3	473	8.4	19.3
1999	969	16.2	35.5	458	7.6	23.8
2000	995	14.6	34.0	513	7.5	19.7
2001	945	13.7	28.9	438	6.3	13.6
2002	885	18.4	39.0	461	9.6	19.4
2003	859	18.6	41.8	451	9.7	23.3
2004	874	16.9	36.3	485	9.4	25.3
2005	846	16.3	33.4	344	6.6	14.7
2006	763	15.7	32.4	199	4.1	10.6
2007	709	15.1	30.7	72	1.5	3.0
2008	696	14.8	27.1	62	1.3	2.5
1992–2008	11,455	12.5	27.1	4,601	4.9	11.7

18 The problem of upward bias (expired contracts when the expiration is not reported to the Ministry) is mitigated by the careful monitoring activity of the Ministry. Besides, the linked employer-employee database includes only existing firms, therefore, agreements of non-existing companies do not bias the institutional statistics.

Table 1.1 presents the yearly number of firms with collective contract and coverage in the union and non-union categories. Regarding the collective agreement variable, on average, through 1992–2008, the coverage of firms was 12.5 percent, while the coverage of employees was 27 percent. Firms' coverage peaked in 2003 reaching 18.6 percent. From 2003 onwards, the coverage of collective agreements decreased, and in 2008 the coverage of firms was 14.8, while the coverage of employees was 27 percent. In the case of the wage agreement records the statistics are as follows. On average, the coverage of firms through 1992–2008 was 4.9 percent, and the coverage of employees 11.7 percent. Firms' coverage reached its highest value of 9.7 percent in 2003, which dropped to a low level of 1–2 percent by 2007–2008.

Estimation method

The union – non-union wage gap is estimated using individual earning functions. First, we compute the difference in average wages between the two groups of firms (union and non-union firms), termed as the raw union wage gap (*first specification*). However, the raw wage gap may be biased by several factors (e.g. the educational level, the occupation of the employee or the industry classification, ownership structure of the company), which can be controlled for using the linked database. It may happen, for example, that firms having a collective agreement have a more advantageous employee composition, e.g. employ more employees with a higher education level than firms without a collective agreement. In this case, the raw union wage gap also incorporates the higher return to education. The descriptive statistics outlined in the previous Institutional setting section also highlight the fact that firms are not randomly assigned to the union and non-union group: firms with a collective agreement are systematically larger, and are concentrated in certain industries.

After computing the raw wage gap, we estimate the union wage premium[19] taking into account several factors, which may influence the wages. The equations are estimated including controls step by step. In the *second specification* we control for employee characteristics (gender, educational level, age, occupation), while in the *third specification* observable firm variables (size, industry, region, ownership structure of the firm) are also included.

Additionally, the Hungarian linked database provides the opportunity to follow firms over time. Therefore, we can take into account unobservable firm fixed effects (*fourth specification*). Firm fixed effects are time invariant variables, which cannot be observed by the researcher, e.g. managerial efficiency, quality of capital, profit opportunities, organizational structure of the firm, work conditions, location of the firm (e.g. being close to highway, airport), etc. Omitting firm fixed effects among the control variables may bias upward or downward the estimated union wage gap. In the event that firms with a collective agreement are systematically "better" along these unobservable factors,

19 The terms wage gap, wage advantage, wage premium are used as synonyms in the study.

the union wage gap taking into account only observable controls also incorporates the positive impact of firm fixed effects, thus, it will be biased upward.[20]

In the *fourth specification* we take into account observable employee and firm characteristics, as well as time invariant firm fixed effects.[21]

The Hungarian data offers the opportunity to use the collective and/or the wage agreement dummy variables to assess the power of unions.[22] There are several arguments in favor of applying any of the contract dummies. For example, the wage agreement dummy variable is probably downward biased, while the collective agreement variable is less likely to be downward biased, but might be upward biased as well. In principle, wage premium could be attributed only to firms having wage agreement. On the other hand, it is possible that the mere presence of a trade union and its ability to represent the employees and to sign a collective agreement is enough to secure a positive wage premium. In this case union power is better captured by using the collective agreement dummy.

Furthermore, another interesting question is to analyze if signing a wage agreement in firms having an existing collective contract ensures a positive wage premium on top of the collective agreement premium. To assess the above questions, we estimate the wage equation in all four specifications (raw wage gap, including observable employee characteristics, including observable employee and firm characteristics, including firm fixed effects) using first only the collective agreement dummy. In this case the wage gap measures the wage differential between firms with and without a collective agreement. Next, we use only the wage agreement dummy variable, and measure the wage gap between firms having wage agreement and not having any kind of collective agreement.[23] Finally, both agreement variables are jointly included in the analysis to assess the question if signing only a collective contract (without a wage agreement) leads to higher wages, and if additionally a wage agreement (on the top of the collective contract) could secure even higher wages.

Estimation results

Table 1.2 summarizes the estimated average union wage gap for the period of 1992–2008 in all four specifications using the various agreement dummy variables.

The raw wage gap is remarkably large: firms with collective agreement pay, on average, 23 percent higher wages than firms without collective agreement, and the estimated value for firms with wage agreement is 26 percent.[24] The raw wage gap decreases slightly when controlling for employee characteristics (gender, education, occupation, age): the wage gap after taking into account individual controls is 19–22 percent. Observable firm characteristics are responsible for a substantial drop of the wage premium, which decreases by 70 percent to a value of 5–7 percent in the third specification. Thus, after filtering out the impact of observable variables, the wage advantage of a col-

20 The size and the direction of the bias depends on the correlation of the firm fixed effects with the union dummy and with the dependent variable. In the case when both correlations are positive (firms with collective agreement are systematically "better" e.g. due to the more efficient managerial activity, and "better" firms pay higher wages to the employees), then the specification taking into account only observable controls will be upward biased.

21 The econometric specification of the estimated individual earning equation can be found in the Appendix.

22 The collective agreement (wage agreement) dummy variable takes the value of 1 in year *t* if the firm had a collective (wage) agreement in that year. The value of the collective (wage) agreement dummy is 0 if the firm did not have a collective (wage) contract in that year.

23 In this case (if the union presence is captured by the wage agreement dummy), firms having only a collective agreement (without a wage agreement) are left out of the analysis. Including these firms would result in a mixed comparison group of having no collective agreement and only collective agreement. Thus, the wage gap would be composed of the wage agreement – no wage agreement gap and the wage agreement – collective agreement gap. In this way, we omit 5,615 firm-years out of the 81,497 firm-year observations.

24 We estimate the union wage gap using individual earning equation having the natural logarithm of individual wages as the dependent variable. Therefore, the estimated union wage gap is the difference in log wages, which is an approximation of the percentage wage differential (if the gap is sufficiently low).

lective agreement is much smaller than the raw wage gap. The considerably high wages (23–26 percent higher wages in firms with a collective agreement) can be, in large part, explained by various firm-level factors, which may influence wages, e.g. the size or the industrial classification of the firm. Including firm fixed effects further decreases the gap: in the final specification the wage premium of a collective agreement drops to 2.6, while the gap of wage agreements falls to 3.5 percent.

Table 1.2: Average union wage gap estimates using individual wage equations, 1992–2008

	Raw wage gap	+ observable individual controls	+ observable firm controls	+ firm-FE
Including only *one type* of contract variable				
Collective agreement	0.227***	0.185***	0.0534***	0.0259***
	(0.0264)	(0.0192)	(0.0133)	(0.00944)
Observations	1,517,744	1,517,744	1,493,331	1,493,331
Wage agreement	0.262***	0.220***	0.0626***	0.0347***
	(0.0253)	(0.0212)	(0.0143)	(0.00913)
Observations	1,250,041	1,250,041	1,226,778	1,226,778
Including *both* contract variables				
Collective agreement	0.202***	0.161***	0.0353**	0.0208*
	(0.0318)	(0.0216)	(0.0179)	(0.0111)
Wage agreement	0.0574**	0.0572***	0.0440**	0.0101
	(0.0273)	(0.0205)	(0.0198)	(0.00631)
Observations	1,517,744	1,517,744	1,493,331	1,493,331

Dependent variable: log of individual's monthly gross wage specified as base salary, overtime pay, regular payments and 1/12th of the previous year's bonuses.

Notes: The above table shows the estimated parameters of the collective agreement (wage agreement) variable. All specifications include year dummies. Individual observable controls are as follows: gender, education (three categories), age (three categories), occupation (seven categories). Firm-level observable controls are as follows: ownership, size, industrial classification (19 categories), location (seven categories). Standard errors are shown in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

Comparing the results over the various specifications (starting from the raw wage gap to the last specification including firm fixed effects) highlights the point that firms with a collective agreement are "better" than the average along both observable and unobservable characteristics. For example, contract firms are mostly large, they tend to have an advantageous location, therefore they can pay higher wages than smaller firms or those being located in a less advantageous region.[25] Or, as an illustration of the firm fixed effects, it is possible that employees in contract firms are more productive, more motivated workers. Therefore, firms with such employees can pay higher wages than firms employing less productive, less motivated workers.

25 The descriptive statistics also confirm that the coverage is larger among larger firms. For example, the database used in the study shows that more than 60 percent of firms employing more than 300 employees was covered by a collective contract, while the coverage was 5 percent in firms with 20–50 employees in 2000. In the same year, the coverage in the Budapest region exceeded 60 percent, while in the other counties it reached only 21–54 percent.

The union premium using the wage agreement dummy is somewhat higher than employing the collective agreement variable, though the difference between them is tiny. Comparing the results (using either the collective or the wage agreement dummy) suggests that both dummy variables are appropriate to describe the power of unions. Furthermore, the estimates are in line with the results obtained in the specifications, which jointly include the agreement variables. Including both the collective and the wage agreement variables into the earning equation can reveal if the wage advantage associated with the wage agreements exceeds the wage premium of collective agreements. The bottom panel of *Table 1.2* depicts the results of the joint specifications. Taking into account both observable and time invariant unobservable controls, the wage advantage associated with collective agreements is around 2 percent, and is not significantly different from the wage premium of wage agreements. Though in principle wage advantages are associated only with wage agreements, these results suggest that the mere presence of a trade union, which is able to conclude a collective agreement, is enough to secure higher wages even without signing a formal wage agreement.

Given the differences in the estimation method and the underlying institutional setting, the comparison of the Hungarian results to previously reported results from other countries is not straightforward. The modest wage premium found in the current study is comparable both to the estimates from continental Western Europe and to some US studies using company-level data. In one respect, the magnitude of the wage premium (2 percent) found in the final specification of the current study, and the pattern of the results across the specifications are similar to *Gürtzgen* (2006). The author using German linked employer-employee panel data documents that the 18–20 percent raw wage gap of firm-level contracts decreases by roughly 70 percent after including observable firm-level variables. In her final specification taking into account time invariant unobservable fixed effects, the wage premium reaches a maximum of 2 percent. The comparison of the current study to *Gürtzgen* (2006) is straightforward as the results are quantitatively close to each other, moreover, the estimation method and the institutional system also share some common elements.[26] However, there are different reasons behind the modest wage premium in the Hungarian and German case. *Gürtzgen* (2006) proposes as a possible explanation of her results it being the consequence of the highly corporatist system, which prevents unions to behave as "aggressive local rent seekers" (*Hartog et al*, 2002 p. 322). A similar argument applies to the Dutch case as well. *Hartog et al* (2002) using cross-sectional firm-level data finds insignificant wage advantage associated with firm-level agreements relative to the extended sectoral-level contracts.[27] The authors explain their results as probably being due to the characteristics of the Dutch labour market where different bargaining regimes coexist and are "embedded in a corporatist web"

26 *Gürtzgen* (2006) also uses linked employer-employee data, and estimates individual earning equation. However, the German database follows not only firms, but also individuals over time. Therefore, the author can take into account time invariant individual unobserved effects as well. Similarly to the Hungarian case, the collective agreement dummy is defined at the level of the firm, but her study also examines the impact of industrial contracts. In Germany, there are three regimes: the uncovered sector, and the sectors covered by industrial- or firm-level agreements.

27 Comparing the Dutch and the Hungarian case, there are institutional differences between the two countries, and the applied methodologies are also different in the papers. The Dutch study uses cross-sectional data, therefore, cannot control for unobservable firm fixed effects.

(p 320). In this environment, unions do not act as "aggressive local rent seekers" (p. 322). *Card and de la Rica* (2006) using Spanish cross-sectional data finds that firm-level collective agreements are associated with a 5–10 percent wage premium.[28] A possible interpretation of their results refers to the characteristics of firm-level and sectoral-level agreements. While sectoral-level agreements tend to flatten wages across skill groups, firm-level agreements provide a more flexible wage structure.[29]

Estimates from the Anglo-Saxon countries are usually higher than documented in continental Western Europe. The most cited number is that the mean union wage gap is 15 percent based on *Lewis* (1986)'s work. *Blanchflower and Bryson* (2004) and *Hirsch* (2003) document a somewhat higher wage premium of 18–20 percent. However, these studies are based on household surveys and use mostly individual controls as these databases provide only limited information on the firm of the employee. On the other hand, studies based on enterprise-level data (*Freeman and Kleiner*, 1990, *Lalonde, Marschke and Troske*, 1996, *DiNardo and Lee*, 2004) obtain minor or insignificant wage advantages associated with unionism. These authors interpret the contrast of their findings to previous literature as being the consequence of the methodological differences (individual vs. enterprise-level estimation, household survey vs. enterprise-level data, collective agreement statistics based on questionnaire vs. institutional statistics, scarce firm-level controls vs. rich firm-level information). Or, another likely reason behind the differing results is that the above mentioned enterprise-level studies analyze the labour market impact of recent unionization. Unionism in the US started to decline in the 80's due to the increased opposition of managers to unionization and due to the more frequent use of labour-saving technologies (*DiNardo and Lee*, 2004).

The Hungarian results of modest wage advantages associated with firm-level contracting are also comparable to the above US enterprise-level estimates. Not only are the magnitude of the estimates very similar, but one feature of the institutional setting is analogous: both of these studies assess the wage impact of firm-level coverage vs. no coverage. However, the underlying reasons behind the small wage impacts are again different. Though the institutional structure in both countries is decentralized, the US and Hungarian trade unions have historically different roots. While unionism in the US was traditionally a strong institution, Hungarian trade unions had to reorganize themselves following the regime change, and find their new roles in the new environment. In most cases, the attitude of these unions became dominated by the social inheritance (wide scope of flexibility for the employer, regulation of non-wage elements of the salary, holiday/recreation possibilities for members, etc.).

The present results based on the 1992–2008 linked employer-employee panel data are also in line with the previous cross-sectional Hungarian estimates. *Neumann* (2001) using the Wage and Employment Survey from 1998 and

28 The Spanish study, due to the universal extension of sectoral agreements, also examines the wage premium of firm-level collective agreements relative to the sectoral-level contracts.

29 The authors find that the wage premium of firm-level collective contracts is higher for skilled employees.

the Ministry's records of collective and wage agreements found a 5–6 percent wage premium as a result of firm-level wage agreements. His estimate is similar in magnitude to our result (6.26 percent) taking into account observable individual and firm-level characteristics. The study by *Iga et al.* (2009) using another database leads to a similar conclusion.[30] The authors found a 5–7 percent wage premium in those firms which were set up prior transition or in the early transitional years. Our study additionally suggests that taking into account unobservable firm-level characteristics further diminishes the wage gap. The panel estimates of the final specification imply that wages in contract firms are only slightly higher than in non-contract firms: the wage gap due to the existence of collective or wage agreements is a maximum of 2–3.5 percent.

Another interesting question deals with the impact of the minimum wage regulation. The statutory minimum wage was increased by 60 percent in 2001 compared to its level in 2000. As a consequence, firm-level wage agreements somewhat lost their importance, which is reflected in the diminishing number of recorded agreements.[31] To analyze the question, we define two periods: the first one covering the years 1992–2000 and the second one including the years 2001–2008, and interact the wage agreement dummy with the period dummies. In this way, we obtain separate estimates for the first and the second periods. Results are shown by *Table 1.3*.

Table 1.3: Union wage gap estimates by period using individual wage equations

	Observable individual and firm controls	+ firm-FE
1992–2000	0.0745***	0.0466***
	(0.0185)	(0.00793)
2001–2008	0.0522***	0.0210*
	(0.0160)	(0.0121)
Observations	1,226,778	1,226,778

Dependent variable: log of individual's monthly gross wage specified as base salary, overtime pay, regular payments and 1/12th of the previous year's bonuses.

Notes: The above table shows the estimated parameters of the interacted wage agreement variables. All specifications include year dummies. Individual observable controls are as follows: gender, education (three categories), age (three categories), occupation (seven categories). Firm-level observable controls are as follows: ownership, size, industrial classification (19 categories), location (seven categories). Standard errors are shown in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

As expected, the results imply that the wage gap is somewhat larger in the first period. The specification taking into account only observable characteristics suggests that the wage advantage due to firm-level wage agreements is 7.5 percent in the first period, and the estimated parameter is somewhat smaller, 5.2 percent after 2000. The gap further diminishes when including unobservable firm fixed effects: the wage premium is 4.7 percent in the first period and

30 *Iga et al.* (2009) uses the European Structure of Earnings Survey from 2002, which includes agreement records from other sources.

31 The statutory minimum wage was increased substantially for the first time in 2001. Starting from 2006, the government introduced a three-tier minimum wage system, in which the guaranteed minimum wages differ by education. Due to these regulations, the number of wage agreements dropped significantly in recent years, especially after 2005. According to the Ministry's records, the number of reported wage agreements dropped to 267 in 2007 and further to 185 in 2009.

drops to 2.1 percent in the second period. Thus, the specifications, which estimate separate parameters for the periods before and after 2000 imply that the importance of firm-level trade unions decreases over time. The change in the national minimum wage regulation probably played a large role behind the diminishing power of firm-level trade unions. Note, however, that it is also possible that the less important role of trade unions is partly due to a general trend (mostly experienced in the US), which emphasizes individual bargaining, individually set wages and flexible job arrangements.

As a summary, we can conclude that the wage premium of firm-level collective contracting is modest in Hungary. This is in line with expectations based on the decentralized, fragmented institutional structure. In our analysis estimating individual wage equation and using the institutional records of collective agreements, we found on average 2–3.5 percent wage gap for the period of 1992–2008 due to firm-level collective agreements. The raw wage gap is mostly explained by observable firm characteristics, but including unobservable firm fixed effects further reduces the gap. This last specification suggests that firms with a collective agreement are "better" (along unobservable characteristics) than the average.

The estimated parameters are similar to the ones obtained in previous studies using data from continental Western Europe, and to US enterprise-level estimates. Nevertheless, the underlying reasons behind the modest wage impacts are different. In continental Western Europe the explanations mostly refer to the corporatist, centralized and coordinated social dialogue. In the US the general declining importance of trade unions is the main reason. On the other hand, in Hungary trade unions could not overcome the social heritage and did not function as "classical" trade unions aiming to ensure the "automatic solidarity" between the employees. The attitudes of employees, employers and trade unions are largely affected by the characteristics of the previous regime: ensuring flexibility for the firm's management, and regulating mostly the non-wage elements. Analyzing the role of trade unions in the regulation of non-wage elements could be the topic of future research.

APPENDIX

The estimated individual wage equation

We estimate the following wage equation:

$$\ln W_{ijt} = \alpha U_{jt} + \gamma \Gamma + \varepsilon_{ijt}, \text{ where } \Gamma = (X_{ijt}, Z_{jt}), \varepsilon_{ijt} = v_j + \eta_{ijt} \text{ and } \eta_{ijt} \sim N(0, \sigma_\eta).$$

W_{ijt} shows the gross wage of the individual: the gross monthly wage of individual i employed by the firm j at time t. On the right hand side, U_{jt} is the collective agreement (wage agreement) dummy variable, which takes the value of 1 if firm j had a collective contract (wage agreement) at time t. In our study we

aim to estimate the α parameter of the U contract dummy. The estimated α parameter quantifies the union power. The matrix $\Gamma = (X_{ijt}, Z_{jt})$ includes further control variables. X_{ijt} summarizes the individual regressors (gender, education level, age, occupation of the employee), and Z_{jt} includes the firm-level controls (size of the company, industrial classification, location, ownership). The error term $\varepsilon_{ijt} = \upsilon_j + \eta_{ijt}$ is composed of a firm fixed effect υ_j and a random noise component $\eta_{ijt} \sim N(0, \sigma_\eta)$. All specifications include year dummies.

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2. THE EFFECT OF FOREIGN ACQUISITIONS ON WORKER WAGES*

JOHN S. EARLE & ÁLMOS TELEGDY

Introduction

This chapter analyzes a question that has been the subject of controversy in the context of both policy and research: the benefits and costs of foreign versus domestic ownership. Indeed, the posture of economic policy towards foreign direct investment (FDI), particularly cases of foreign acquisitions, seems to display a certain degree of ambivalence in many countries. On the one hand, FDI is valued as a source of finance, jobs, and technologies, and governments frequently compete for the favor of investors by offering special preferences and tax abatements. On the other hand, most countries completely prohibit majority foreign ownership in so-called "strategic" sectors – for instance, airlines and (until recently) banking in the US – and they often impose additional regulatory burdens and uncertainties that add to the inherently higher costs of sending capital and monitoring managers across national boundaries. These policies are frequently abetted by public fears of globalization, and a major issue in the debates is the effects of foreign ownership on workers and their wages.

Research on wages and FDI has examined a number of countries and used several types of data, and it has consistently documented a raw wage differential in favor of foreign ownership. A major issue in this research, however, is that FDI may be selective, "cream-skimming" or "cherry-picking" the best domestic firms for acquisition and the best areas and industries for greenfield start-ups. Studies using firm-level data and corrections for this selection bias found that the foreign wage premium survives, but it diminishes in magnitude (e.g., *Conyon et al.* 2002; *Girma and Görg*, 2007). The firm-level data, of course, typically contain little or no information on individual worker wages and characteristics, which makes it difficult or impossible to control for, and analyze, employee composition and relative wages by characteristics of workers within firms. Studies of worker-level data with information on employer ownership can address these issues, but they generally contain no controls for firm selection into ownership type or much employer information, which could be useful for disentangling the possible mechanisms underlying an FDI-wage correlation.

The advantages of both firm- and worker-level data can be exploited only with linked employer-employee data (LEED), and recently there have been several such studies (e.g., *Heyman et al.* 2007; *Huttunen*, 2007). These studies typically conclude that the causal effect of foreign ownership is small or it totally disappears.

* This study is based on *Earle, Telegdy and Antal* (2012). We thank *László Tőkés* for excellent research assistance.

In this chapter we estimate the impact of foreign acquisitions on the level and structure of wages in Hungary, an economy that rapidly reformed and liberalized inward investment during the 1990s. The data we analyze begin in 1986 when the centrally planned regime completely prohibited foreign involvement, they continue through the adoption of a very liberal regulation of FDI in which – despite significant opposition – the government awarded special treatment to many foreign investors, and they end in 2008, several years after accession to the European Union. The result of liberalization was ownership transfer from domestic to foreign owners that took place not only quickly but also broadly across nearly all sectors. At the same time, the tightly controlled wages of the centrally planned systems were abruptly liberalized, permitting organizations to set their own wages and to increase skill differentials, which had tended to be compressed under socialism (e.g., *Kornai*, 1990). We focus on acquisitions both because of their particular interest in the political economy of FDI (greenfield investments tend to be less controversial) and because of the better possibilities of controlling for selection of firms into foreign ownership, a common problem that biases the estimated effects of foreign ownership.

Data Sources and Sample Selection

We analyze data from two sources. The first is the National Tax Authority in Hungary, which provides balance sheet data for all legal entities engaged in double-entry bookkeeping. These data are available annually from 1992 to 2008 for all firms and from 1986 to 1991 for a sample of disproportionately large enterprises. The firm-level data files include the balance sheet and income statement, the proportion of share capital held by different types of owners, and some basic variables, such as employment, location and industrial branch of the firm.

The second source is the Hungarian Wage Survey, which has information on workers' earnings and characteristics every three years between 1986 and 1992, and on an annual basis ever since. The Wage Survey data provide extensive information on employees' earnings, their highest level of education, gender, age, occupation, whether the worker is a new hire and also working hours in some years. In 1986 and 1989 the survey covered all firms. At the start of the transition the sample design was changed to having only firms with more than 20 employees, which was gradually reduced to 5. In 1986 and 1989, workers were selected from narrowly defined occupational and earnings groups within firms randomly (managers were all included in the survey). From 1992 onwards the sample design changed; production workers were selected if born on the 5th or 15th of any month, while non-production workers were chosen if born on the 5th, 15th, or 25th of any month. Therefore, even though the target group of the survey was the population of firms above 20 employees, if a firm did not have any employees born on the given days in a particular year, the firm-year is miss-

ing from the data. This design was maintained for the firms with at least 20 employees by 2001, and for firms with employment above 50 thereafter, but for the smaller firms all employees' information was required. The data provide the number of production and non-production workers which we use to weight up the sample to the firm level employment. With the help of the firm level data we also construct a firm weight which adjusts the sample to the total number of employees in the relevant sectors of the Hungarian economy.

These data are linked to the firm-level data to form a linked employer-employee dataset (LEED), which is a panel in firms but not in individuals. Nonetheless, relying on individual information we linked 44 percent of observed employees that do not change their workplace from one year to the next. Although we cannot identify the effect of ownership change from workers who move between domestic and foreign firms, we can control for unobserved worker heterogeneity in the case of employees that stay with the same firm during a foreign acquisition or divestment.

We restrict our attention to full-time employees only, and we focus our attention to individuals between the age of 15 and 74. The final dataset is composed of 1.9 million firm-year observations on 377 thousand unique firms, to 33 thousand of which we link employee information resulting in a LEED of 2.5 million worker-years.

Ownership Evolution and Summary Statistics

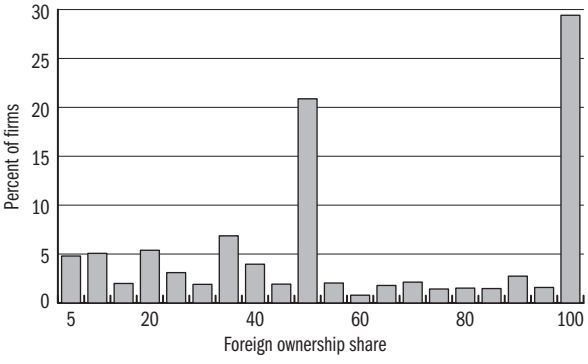
Hungary got off to an early start in corporate control changes with gradual decentralization and increased autonomy provided to state-owned enterprises during the late 1980s (*Szakadát*, 1993). The first foreign acquisitions had already taken place in 1989, the most well-known being the privatization of the lighting company Tungsram, bought up by General Electric. In the early 1990s not only were constraints on foreign investment drastically eased, but tax and other preferences for foreign investors were also provided (*OECD,* 2000). By the mid-1990s, Hungary had the highest value of foreign direct investment per capita among the post-socialist countries.

The share distribution of foreign ownership after acquisitions in 2000 is shown in *Figure 2.1*.[1] Almost one-third of the firms with positive foreign ownership are fully foreign-owned and 20 percent possess exactly 50 percent of the company's shares. The other firms are distributed roughly equally around all possible ownership stakes. The evolution of the foreign acquisitions (defined as an increase in foreign ownership above 50 percent), as well as the total employment of these firms is presented in *Figure 2.2*, which clearly reflects the early start and the importance of foreign acquisitions in shaping Hungarian corporate ownership. The proportion of foreign acquisitions had already started to increase at the beginning of the 90s and quickly reached 3 percent, their aggregate employment raising to about 15 percent of all employment in the

1 Except for several years at the beginning of the time period observed in the data, the share distribution of foreign ownership is very similar to the one presented here.

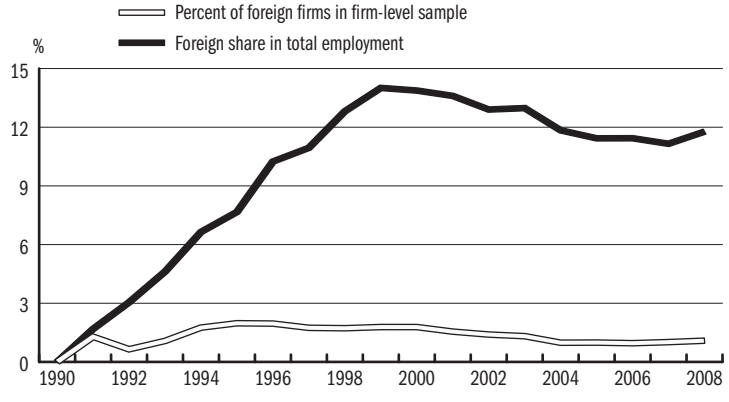
firm-level data by 1999. After this year their share in employment fell but nevertheless remained as high as 12 percent.

Figure 2.1: Distribution of foreign ownership share in 2000



Notes: $N = 4{,}418$ firms. Only firms with positive foreign ownership share included.

Figure 2.2: Evolution of foreign acquisitions

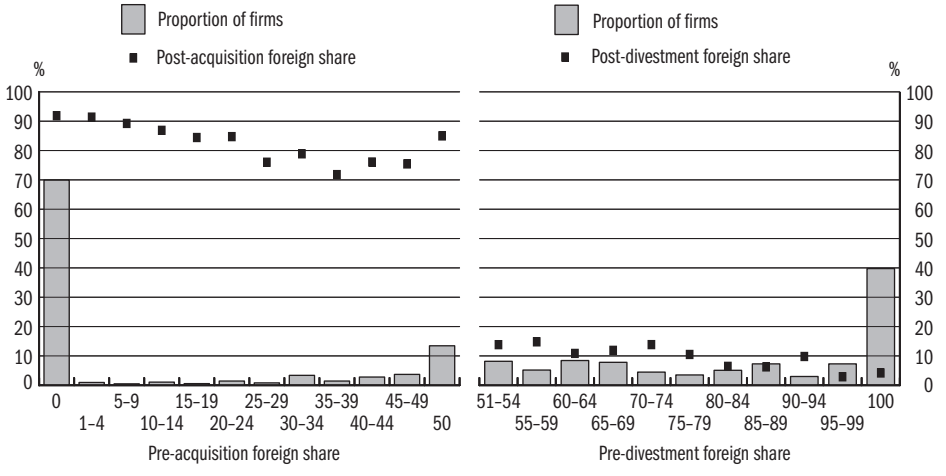


Notes: $N = 1{,}881{,}279$ firm-years in the firm data, 2,475,478 worker-years in the LEED.

According to the definition we use in our analysis, the only condition a firm has to satisfy to be a foreign acquisition or divestment is passing the 50 percent ownership threshold, but firms may differ in the starting and ending proportions of foreign ownership. We look at the foreign share distribution in such firms to understand the typical patterns of ownership change: does the foreign ownership stake change only several percentage points around the 50 percent threshold or do foreigners rather buy and sell large proportions of capital in such firms? We analyze the foreign ownership stakes before and after acquisitions and divestments in *Figure 2.3*. The bars show the distribution of firms by the pre-acquisition (divestment) foreign ownership

share, and the diamonds show the mean share of foreign ownership after the change had taken place. The pre-acquisition share information reveals that 70 percent of the target firms had no foreign ownership. One-fifth of all firms had 50 percent foreign ownership before the acquisition while the remaining 10 percent of firms are distributed roughly equally across other proportions of pre-acquisition foreign ownership. After the foreign takeover, the foreign ownership share is very high, reaching 80 percent on average. Pre-divestment foreign ownership is also concentrated at 100 percent, but less than half of the firms are exclusively owned by foreigners, the others being quite equally distributed around across the whole distribution between 50 and 100 percent. The average foreign ownership stake after the divestment is only about 10 percent, documenting that after divestment foreigners did not retain much of a stake in the firm. Therefore, both foreign acquisitions and divestments result in extreme changes in foreign ownership.

Figure 2.3: Distribution of foreign ownership before and after foreign acquisitions and divestments



Notes: $N = 4{,}928$ acquisitions, 983 divestments. Bars depict the distribution of acquired (left panel) and of subsequently divested (right panel) firms according to size of foreign ownership share in the last domestic year (for acquisitions), or in the last foreign year (for divestments) before the change in majority ownership. Diamonds depict the average foreign share in the first foreign year (for acquisitions), or in the first domestic year (for divestments) after the change in majority ownership.

As most of the previous studies, in the firm data we use the firm-level average wage, defined as the total payments to workers over the average number of employees. Wages are deflated by yearly CPI and are measured in 2008 Hungarian forints. The first row of *Table 2.1* shows that unconditional mean wages are twice as large in foreign-owned firms as in domestic enterprises.

Table 2.1: Firm characteristics of the sample

	ALDO	FOAQ
Average Annual Wage Bill per Worker	1,083.6	2,052.9
	(1,829.4)	(2,634.0)
Tangible Assets	142.1	2,094.6
	(4,803.9)	(30,214.6)
Employment	22.4	119.3
	(366.3)	(651.0)
Labor Productivity	23.0	62.5
	(171.4)	(928.5)
N	1,835,371	47,972
Industry in 2000		
Agriculture, Hunting, Fishing, Forestry	5.0	2.8
Mining, Electricity, Gas, Water Supply	0.6	1.2
Manufacturing	17.3	26.2
Construction	10.2	3.4
Wholesale, Retail Trade, Repair	31.2	36.1
Finance, Insurance, Real Estate	5.2	7.0
Business Services	19.4	12.0
Other Services	11.2	11.3
N (firm-years)	90,171	3,055

Notes: Average earnings measured in thousands, tangible assets and labor productivity in millions of 2008 HUF. Standard deviations in parentheses.

Table 2.2: Individual characteristics by ownership type – LEED

	Domestic	Foreign
Monthly Earnings	137.3	237.2
	(120.9)	(247.6)
Female	38.1	42.4
Education		
Elementary	27.1	16.9
Vocational	33.9	28.7
High school	30.2	36.0
University	8.8	18.4
Experience	22.7	21.6
	(11.0)	(10.8)
New Hire	11.2	10.2
Occupation		
Elementary Occupations	10.1	5.0
Skilled Manual Workers	46.8	46.0
Service Workers	10.3	6.9
Clerks	7.5	6.2
Associate Professionals	12.7	18.2
Professionals	4.1	8.7
Managers	8.6	9.0
N (worker-years)	2,344,622	142,433

Notes: Earnings measured in thousands of 2008 HUF. Standard deviations in parentheses.

The LEED have information on individual wages paid in May. They include the monthly base wage, overtime pay, regular payments other than the base wage (e.g., language and managerial allowances), and $1/12^{th}$ of the previous year's irregular payments (such as end-of-year bonuses). If the worker was hired during the previous year, we divide the last wage component by the number of months the worker spent with the company in that year. *Table 2.2* shows that by this measure the wage premium in firms acquired is similar to the figure in the firm level data.

In addition to wages, *Table 2.2* also presents the characteristics of firms while *Table 2.3* provides the descriptive statistics for worker characteristics. Measured by the value of tangible assets or employment, foreign firms are much larger and they are also much more productive (as measured by labor productivity, the value of sales over the average number of employees). The industrial composition of foreign and domestic firms also differs substantially. Relative to domestic firms, foreign-owned firms predominate in manufacturing, and they are less prevalent in agriculture, construction and business services.

The average characteristics of workers also vary by ownership type. Foreign owners employ a higher proportion of female workers and university graduates; vocational and high school graduates are in similar proportions employed in domestic and foreign companies and those with only elementary education are more likely to be employed by domestic firms. Little difference exists in the length of work experience and the likeliness to be newly hired (defined as hired during the previous calendar year). The occupational distribution differs between foreign and domestic firms: the workforce in foreign-owned companies has a higher proportion of associate professionals and professionals, smaller proportions of workers in elementary occupations, service workers and clerks while the proportion of managers is the same across the two ownership types. Relative to domestic firms, therefore, workers in foreign companies tend to be more educated, somewhat less experienced, and more likely to be female and in professional and associate professional occupations. The firm and worker characteristics, of course, are simple unconditional means that take no account of any other characteristics of foreign and domestic companies, but they are suggestive of the underlying heterogeneity in the population.

Estimation Procedures

Our first firm-level estimating equation is the following:

$$\ln W_{jt} = a + \delta_f FOREIGN_{j,t-1} + \Sigma\gamma_j REGION_j + \Sigma\lambda_t YEAR_t + u_{jt}, \qquad (1)$$

where j indexes firms and t indexes time. $\ln W_{jt}$ is the natural logarithm of the wage bill per employee, and we control for year and regional effects. The regression is weighted by the number of employees in the firm-year. In some specifi-

cations we disaggregate *FOREIGN* into two types of foreign acquisitions: single acquisitions and acquisitions followed later by divestment (i.e. a domestic acquisition) after at least one year of foreign ownership.

To account for possible differences in workforce composition we use the LEED and control for gender and human capital:

$$\ln w_{ijt} = a + \beta_{it} X_{it} + \delta_f FOREIGN_{j,t-1} + \Sigma\gamma_j REGION_j + \Sigma\lambda_t YEAR_t + z_{ijt}. \quad (2)$$

X_i is a vector of individual characteristics including three educational dummies (*VOCATIONAL, HIGH SCHOOL*, and *UNIVERSITY*, the omitted category being at most 8 years of schooling), (potential) *EXPERIENCE* in level and squared, and a dummy variable for gender = 1 for female employees (*FEMALE*). As education and experience may be correlated, and gender may influence both, we include a full set of interactions among these variables.

There are good reasons to believe that the OLS estimates of the foreign ownership effects are biased: the owners of the acquiring firms are likely to select targets that have better growth prospects or a more skilled workforce, for example. If the firm characteristic upon which the selection is performed is not observed for the researcher, the estimated effect of ownership on wages will be biased. To attenuate this selection bias, we add firm fixed effects to the regression to control for all unobserved time invariant effects at the firm level. In addition, with the help of employee-level variables we link most workers who did not change their workplace from one year to any other (those who changed cannot be linked). This procedure resulted linking almost half of the workers across years. Having obtained the links, we can control for worker effects which takes out all the time-invariant variation from the data for those workers who do not change jobs. Note that these estimates identify the foreign effect from the sample of incumbent workers – those who had already been with the firm before the foreign acquisition took place.

The Effect of FDI on average wages and on the wage structure

Using Equations (1) and (2), we estimate the foreign effect with OLS, firm fixed effects and joint firm-worker effects. Simple OLS regressions (shown in *Table 2.3*) function as benchmarks for our attempts to distinguish selection bias from causal effects, and they provide measures of average wage differentials for firms by all ownership types. The estimated effect on the firm level data implies a 64 percent wage differential controlling only for region and year effects. The simple average FDI effect estimated with the LEED data is smaller, but still large at 46 percent.[2]

The LEED of course permits us to include worker characteristics and control for gender, education, potential experience and interactions between these variables. It is quite striking that the inclusion of these individual controls changes the estimated foreign effect only by 4 log points. The inclusion

2 The two datasets and the dependent variables are different, so it is not surprising that the estimates differ, but they both suggest that the foreign wage effect is positive and large in magnitude.

of firm fixed effects, on the other hand, reduces the coefficients in both samples by a large extent. The firm-level estimate falls to 0.27 and the individual estimate to 0.16.

Table 2.3: The effect of foreign acquisition on wages

	OLS no controls	OLS with controls	FFE	FWFE
Firm Data	0.636**	N.A.	0.270**	N.A.
	(0.041)		(0.024)	
LEED	0.463**	0.420**	0.158**	0.051**
	(0.038)	(0.025)	(0.016)	(0.012)

Notes: $N = 1{,}881{,}267$ firm-years in the firm data, 2,475,478 worker-years in the LEED. N.A. = Not applicable.

As the difference between the OLS and the fixed effects estimates are a measure of selection of target firms of acquisitions, the difference between the estimated coefficients suggests that this is quite large: the future foreign owners carefully select their targets from the high-wage domestic firms. As wages may reflect worker quality, it is likely that foreign acquired firms had a better than average workforce already before the acquisition took place. The further inclusion of worker-firm joint fixed effects further reduces the estimated foreign wage effect to 5 percent. This shows that even those workers, who were already employed with the target firm before the foreign acquisition, received a wage increase of 5 percent on average, relative to the non-acquired counterfactual.

The analysis so far treated all foreign firms equally and did not distinguish single acquisitions from those which were subsequently divested. In the regressions with a single foreign dummy variable we made the implicit assumption that the foreign wage effect is symmetric in both directions, but an interesting question is whether this assumption is correct. These specifications allow us to examine differences between firms that were kept in foreign ownership and those which were further divested to domestic entrepreneurs. In addition, by looking at those firms which experienced both acquisitions and divestments during the period observed, we can estimate the symmetry of the foreign wage effect for both acquisitions and divestments within firms, eliminating any fixed differences between acquisitions and divestments.

Table 2.4 presents these results. Single acquisitions are estimated to increase wages by 28 percent in the firm sample and by 17 percent in the individual sample. When the acquisition is followed by a divestment to Hungarian owners, the effect does not change much. When worker effects are controlled for (and thus the estimation is identified from incumbent workers), the effect is still of 5–8 percent. Thus, both types of acquisition lead to positive wage effects but do they persist if the firm is sold to a domestic owner? The estimations reveal that the reversal of the foreign effect is not complete, but nor is it small. The coefficient for divestments (relative to the initial domestic period) is always

smaller than the acquisition effect and the difference is quite large. For example, in the case of the firm sample, the coefficient on divestment is almost half as large as that of acquisitions. This analysis provides evidence, therefore, that a large part of the foreign wage effect indeed is associated with foreign ownership as it disappears when the foreign owners leave the company.

Table 2.4: The effect of foreign ownership by type of investment

	Firm level		LEED
	FFE	FFE	FWFE
Single Acquisitions			
Acquisition Effect	0.283**	0.169**	0.052**
	(0.031)	(0.020)	(0.016)
Domestic-Foreign-Domestic			
Acquisition Effect	0.298**	0.212**	0.083**
	(0.046)	(0.037)	(0.021)
Divestment Effect	0.164**	0.142**	0.051*
	(0.063)	(0.048)	(0.026)

Notes: See Table 2.3.

Our analysis has established a robust and positive average treatment effect of foreign ownership on wages, but we have not yet studied the effect on various worker groups. Are there some worker types which win, and some others which lose wages as a result of foreign ownership, or everybody benefits and receives a positive foreign wage premium? Foreign ownership is usually associated with high quality products and services, better technology and better corporate culture so one could hypothesize that workers with high levels of human capital get higher wages relative to their less endowed colleagues. To test this, we interact foreign ownership with worker characteristics and run the same regressions as before. In the first set of regressions we test how the foreign wage effect varies with gender, education and experience. *Table 2.5* shows that the wage effect of the reference group (male workers with elementary education and 10 to 20 years of experience) is 13 percent. The estimated effects of the interaction terms show that relative wages indeed change after a foreign acquisition: some of the estimated effects are negative while others larger than zero and their magnitude also varies. Nevertheless, the negative effects are never larger in magnitude than the main effect, showing that foreign ownership increases the wages of both genders, all types of education and experience groups, as well as new hires and workers with longer tenure. As expected, better education is associated with higher foreign wage effects and the wage premium declines with experience. The estimated wage differential across the two genders is small and statistically insignificant, while workers in their first year with the firm get smaller wages by 3 percent than before the acquisition.

Table 2.5: Effects of foreign acquisition on the wage structure by gender, education and experience groups

	FE	Standard error
Acquisition Effect of Reference Group	0.127**	0.021
Female	–0.011	0.011
Vocational	0.021*	0.010
High school	0.046**	0.013
University	0.238**	0.032
Experience: 0–10	–0.032**	0.009
Experience: 21–30	–0.015*	0.007
Experience: 30+	–0.009	0.010
New Hire	–0.033*	0.015

Notes: $N = 2{,}474{,}692$ worker-years. Reference group: Males with elementary education and 11–20 years of potential labor market experience, who are not new hires. Coefficients and standard errors from a regression where the acquisition dummy is interacted with individual characteristics.

The universal increase of wages is true for the occupational structure as well, as demonstrated by the estimated effects in *Table 2.6*, where we interact the foreign acquisition dummy with 1-digit occupational dummies: the estimated effects are all positive and almost always significant. The big winners of foreign ownership are managers and professionals, but occupations requiring lower skill levels are also associated with a 12–16 percent wage premium. The sole exception is the category comprising of service workers, who receive wages 9 percent higher than before the acquisition which is quite sizable economically, but this effect is statistically not significant.

Table 2.6: Effects of foreign acquisition on the wage structure by occupation

	FE	Standard error
Manager	0.474**	0.043
Professional	0.356**	0.043
Associate Professional	0.162**	0.022
Clerks	0.127**	0.021
Service	0.090	0.058
Skilled manual	0.121**	0.019
Unskilled	0.126**	0.022

Notes: $N = 2{,}474{,}692$ worker-years. Coefficients and standard errors from a regression where the acquisition dummy is interacted with occupational group dummies.

One possible objection to the analysis above concerns measurement error in the wage variable correlated with ownership. First, working hours may be different under domestic and private ownership. As the wage variable used in this analysis is the yearly average in the firm data and monthly in the LEED, we do not capture any variation in working hours. The post-1999 LEED, however, provide information on hours worked, and we use this to test for possible bi-

ases. We run similar regressions as before but with working hours as the dependent variable.[3] The estimated coefficients (not shown), are small and imprecisely estimated, showing that hours are probably not very different across ownership types.[4]

Second, wages can be biased due to under-reporting to decrease tax payments. The tax burden on employment is high in Hungary and tax avoidance is widely considered rife. If under-reporting is more prevalent in domestic firms, the estimated foreign effect may be upward biased. To check whether domestic firms are indeed more likely to avoid taxes than foreign-owned enterprises, we carry out two tests. First, we interact the foreign dummy with a cheating index which is defined at the industry level and shows the likeliness of cheating (*Elek et al.* 2009). Our results show that in industries where under-reporting is less likely, the foreign wage difference is larger than in cheating industries. This result rejects the hypothesis of domestic firms being less honest in terms of reporting true earnings, although it is also consistent with other differences across size and industry categories in how foreign firms operate. As a second test, we replace wages with a dependent variable indicating whether the worker was paid very close to the minimum wage that year (defined as being paid less than 3 percent more than the minimum wage). We find that a lower proportion of workers were paid the minimum wage in foreign-owned companies, and the estimated coefficient is significantly different from zero. This result may suggest more misreporting in domestic firms, but the magnitude of the coefficient is rather small (0.038–0.066). As only about 10 percent of workers receive the minimum wage in our sample, this wage differential cannot explain the large estimated foreign wage premium.[5]

To summarize, all of the analyses imply a positive, statistically significant wage effect of foreign acquisitions. The reversal of the FDI effect in cases where acquired firms are subsequently divested to domestic owners also suggests that the wage effect is genuine and not entirely the result of selection. The estimated FDI effect tends to be smaller in the LEED than in the firm-level data, but still higher than those estimated in other countries. But what is the economic mechanism which generates this premium?

We argue that a genuine wage effect of FDI implies a productivity differential across domestic and foreign firms. As we discussed in the introduction, high firm productivity is not sufficient to having higher wages if labor markets are competitive, but combined with different types of rent sharing can lead to it. Also, it is hard to imagine that an unproductive firm would pay higher wages, unless it has some rents to extract (for example, monopoly position). As the foreign firms from out data operate in various kinds of industries, it is unlikely that they all have some rents which they can share with workers. To examine the wage-productivity relationship, we estimate two specifications with the dependent variables being labor productivity (total sales divided by employment)

3 A more natural test would be the replacement of monthly wage with hourly wage in our regressions, but the wage variable includes several types of payments which do not vary directly with hours worked.

4 The measurement of working hours is probably noisy in the case of white collar workers. As a robustness test, we rerun the regressions with only blue collar workers, and obtained similar results.

5 This result can also be interpreted as another piece of evidence for the foreign wage premium.

and average compensation. By comparing the magnitudes of the two estimated coefficients, we can draw conclusions about the similarity of the productivity and wage effects. *Table 2.7* contains the results, which show a wage effect of 24 percent, similar to that which we obtained before. The labor productivity effect of foreign ownership is almost 38 percent, much larger than the wage effect. The difference in the two effects can be the result of the productivity effects of capital and the rents going to the owners of capital – the foreign investors. Indeed, when we control for capital and material costs per worker in Column 2 of the table, we find very similar wage and productivity effects: the foreign coefficient of the wage equation drops to 17 percent, while the labor productivity effect falls much more to 18 percent.

Table 2.7: The effect of acquisitions on labor productivity and average wages

	(1)	(2)
Average Compensation	0.241**	0.172**
	(0.002)	(0.002)
Labor Productivity	0.378**	0.179**
	(0.003)	(0.002)
Controls for Capital Intensity and Material Cost/Worker	No	Yes

Notes: $N = 1\,658\,584$ firms. Regressions are weighted by employment.

Why then are the productivity and wage effects of FDI in Hungary so high? One possibility is that Hungarian firms started the transition in a backward condition, technologically and organizationally far from the frontier, and thus it was relatively easy for foreign investors to raise productivity and wages. To examine this, we carry out further analysis. First, we collected data on the origin of the foreign owner by source country.[6] Our assumption is that owners from more developed countries are likely to bring more up-to-date technology and organizational capital and so increase labor productivity and subsequently wages.[7] We test this assumption by interacting the foreign ownership dummy with the proportional difference between the GDP *per capita* of the source country of FDI and the Hungarian figure.

We also test whether the wage effect varies with the timing of the foreign acquisition. Domestic firms were further away from their production possibilities frontier at the beginning of transition and wages were also smaller than in latter periods. Therefore, in early transition foreign owners had more space for improvement than later. As an additional test, we disaggregate the target firms by their ownership type into state and privately owned firms and test whether the foreign acquisition effect is different across the two types. Here the hypothesis is that state-owned firms are further from their production possibilities frontier so foreign ownership may have a larger effect on them.

In the top panel of *Table 2.8* we first show how the foreign wage effect varies by the grade of development of the sending country of FDI. The interac-

6 Foreign raiders are predominantly from continental European countries.

7 An alternative assumption is that those owners who are used to paying high wages are more likely to raise wages of Hungarian workers for equity reasons or for motivating them to exert more effort or not leave the firm.

tion term between the relative GDP per capita and the foreign acquisition dummy variable is positive and significant in both samples, showing that the foreign wage effect is higher for wealthier sending countries. Early and late acquisitions have similar estimated wage effects in the firm sample, but they do differ in the LEED. While those acquisitions which took place before 1998 raise wages by 30 percent, those which happened after this year have an effect of only 23.5 percent. The next test permits the FDI acquisition effect to vary between state-owned targets (i.e., privatizations) and those that are domestic private. Again, the estimated FDI effect is larger for the former firms, which were inherited from the central planning system, and therefore are likely to be farther from the productivity (and wage) frontiers. The heterogeneity of the wage effect by the ownership of the target firms is quite large in the firm level sample, where foreign ownership raises the average wage of domestic firms by 14, and for state owned firms by 35 percent.

Table 2.8: FDI impact estimates by source of country gdp, acquisition period, and target type

	Firm-Level	LEED
GDP per capita	0.055**	0.036**
	(0.005)	(0.004)
R^2	0.234	0.333
Early Acquisition	0.301**	0.208**
	(0.028)	(0.022)
Late Acquisition	0.235**	0.104**
	(0.090)	(0.017)
R^2	0.251	0.340
State-Owned	0.351**	0.202**
	(0.030)	(0.024)
Domestic Private	0.137**	0.120**
	(0.057)	(0.022)
R^2	0.254	0.340

Notes: In the first panel, $N = 1{,}786{,}859$ firm-years for firm-level sample and 2,430,840 worker-years for LEED; in the next two panels, $N = 1{,}804{,}481$ firm-years for firm-level sample and 2,474,692 worker-years for LEED. All specifications include year and region dummies, and firm fixed effects; in addition, we control for gender, education, experience and their full interactions in the LEED. GDP per capita measures the difference between the source countries' and the Hungarian GDP per capita, relative to Hungarian GDP per capita. All GDP values measured in 2000 US dollars. GDP data is from World Bank.

Conclusions

This paper investigated the effect of inward foreign direct investment on earnings in Hungary. We found that foreign ownership is correlated with higher earnings in a pooled OLS specification, and the wage premium is very large at 40–60 percent, even after controlling for various worker and job character-

istics. However, foreign owners "cherry-pick" high-wage domestic firms, as shown by the reduction of the foreign wage premium when we apply econometric methods that attenuate the selection bias. Nonetheless, even in these specifications, we still find a positive and strongly significant foreign wage effect of 16–27 percent, which is larger than that which most studies find for developed countries. We also find that the wage increase is universal across worker types: some benefit more than others such as high skilled, young workers, but all skill groups, occupations, and both genders experience a foreign wage premium. Those workers who were with the firm already before the acquisition are also estimated to enjoy increasing wages.

Regarding the underlying economic mechanism, we find that the wage premium is associated with the difference in the productivity across domestic and foreign-owned firms. This is underlined by the heterogeneity of the foreign wage effect, which shows that the wage effect is larger in the case of early acquisitions, when the target firm was owned by the state, and when the sending country's grade of development is high. These factors are all likely to be associated with the possibility of high productivity change after the foreign acquisition.

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3. PRIVATIZATION, EMPLOYMENT AND WAGES: EVIDENCE FROM HUNGARY IN COMPARATIVE PERSPECTIVE*

JOHN S. EARLE & ÁLMOS TELEGDY

Introduction

One the most controversial, yet least studied, issues in the economic transition of Hungary and indeed in any reforming economy concerns the impact on employees when their employers are privatized. While many commentators have simply assumed that employment would fall and perhaps wages would as well when new private owners strive for increased efficiency, there have been few careful estimates of these impacts, and essentially none outside of the manufacturing sector. This paper reports research estimating employment effects using firm-level data for Hungary and four other nearby economies (Lithuania, Romania, Russia, and Ukraine) and wage effects using linked worker-firm-level data for Hungary.

The Employment Effects of Privatization

The greatest opposition to privatizing a firm usually comes from the firm's own employees, fearful of job losses and wage cuts. Workers' apprehensions about privatization are consistent with standard economic analyses, whereby new private owners raise productivity and reduce costs in response to harder budget constraints and stronger profit-related incentives (e.g., *Boycko et al.* 1996; *Aghion and Blanchard*, 1998). However intuitive, the empirical basis for these results is remarkably slender, as there have been very few studies that have focused on the employment and wage effects of privatization, still fewer that have used appropriate micro-level databases, and essentially none that provide estimates outside manufacturing.[1]

Previous research on the consequences of privatization for workers has been hampered by small sample sizes, short time series, and difficulties in defining a comparison group of firms. The data limitations have not only reduced the generality of the results but also constrained the use of methods that could account for selection bias in the privatization process. In the first systematic study of the effects of privatization on employment and wages, for example, *Haskel and Szymanski* (1993) analyze 14 British publicly owned companies, of which four were privatized and the others were deregulated. *Bhaskar and Khan* (1995) use data for 1983 and 1988 to estimate employment effects in 62 Bangladeshi jute mills, half of which were privatized. *La Porta and Lopez-de-Silanes* (1999) analyze 170 privatized firms in Mexico, although the post-

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1 The relatively little research on employment and wage effects contrasts with the large literature on privatization and firm performance; see the surveys by *Megginson and Netter* (2001) and *Djankov and Murrell* (2002).

privatization information is limited to a single year. Other studies have sometimes included employment as one of several indicators of firm performance, but not the focus of analysis. Overall, the results from this small body of previous research are inconclusive, containing both negative and positive estimates of the effects on workers.

One partial exception to this characterization of previous research is *Brown et al*.'s (2010) study of manufacturing firm data through 2005 for Hungary, Romania, Russia, and Ukraine. In this paper, we build on and extend research on the employment effects of privatization, adding Lithuania, non-manufacturing firms, and additional years of information (to the extent available), as well as providing a focus on Hungary in comparison to the other economies. We also present employment-weighted estimates that allow us to draw inferences on the overall impact of privatization on numbers of employees, not just on firm-level behavior, and to assess variation in the effect of privatization with firm size. We follow earlier work on privatization (including *Brown et al*. 2006) in distinguishing domestic from foreign owners, post-privatization, and devoting attention to the important problem of selection bias, whereby firms of differential quality are selected to be privatized or to remain in state hands.

An analysis of Hungary in comparative perspective is of particular interest because it is frequently considered one of the most successful transition economies, and the other economies in our data cover the range for degree of success, at least as viewed by the conventional arbiters in the International Financial Institutions.[2] We study these economies using quite comprehensive data that include nearly the universe of firms inherited from central planning, both those eventually privatized and those remaining under state ownership. The total data set contains more than 70,000 firms (by comparison with the 30,000 in *Brown et al*. 2010), and the time series information runs from the Communist and immediate post-Communist period, when all were state-owned, through as late as 2009, well after most had been privatized. For each firm in each country, we have comparable annual information on average employment and ownership, the latter distinguishing foreign and domestic ownership types and allowing us to infer the precise year in which ownership change occurred.

Our aim is to provide consistent estimates of the employment effects of privatization for Hungary and the comparator economies using much larger samples and longer panels than were available to earlier researchers. The data provide comparison groups of state-owned firms operating in the same industries as those privatized, and the long time series permit us to apply econometric methods developed for dealing with selection bias in labor market program evaluations. We estimate regression models including not only firm fixed effects but also firm-specific time trends, which control not only for fixed differences among firms but also differing trend growth rates that may affect the

2 The *World Bank's* (1996) four-group classification of 26 transition economies, for example, puts Hungary in the first group of leading reformers, Romania in the second, Russia in the third, and Ukraine in the last. Similarly, the EBRD's annual indicators of "progress in transition" invariably place Hungary at or close to the top of all transition economies; according to overall "institutional performance" in *EBRD* (2000), Hungary is ranked first, with a score of 3.5, while Romania is awarded 2.3, Russia 1.9, and Ukraine 2.1.

probability of privatization and whether the new owners are domestic or foreign investors.

The substantial variation we find in the estimated employment effect of privatization in our data shows the importance of careful choice of econometric method. The most persuasive specifications, those that include firm fixed effects and particularly those that take into account firm-specific trends, however, show no evidence of large negative impacts of privatization on employment in Hungary or any of the other countries. Privatization to foreign owners is generally estimated to raise employment at a privatized firm, although these effects are strongest in Hungary, Russia, and Ukraine, and weakest in Lithuania and Romania. Weighted results show more variation, but again in the most convincing models including firm-specific trends there are no large, statistically significant, negative effects. The results thus contradict the simple expectation of many workers as well as many economists that privatized firms would reduce employment, but they are consistent with *Brown et al*.'s (2010) finding of a substantial "scale effect" whereby privatized firms expand output, to some extent offsetting employment losses from increased efficiency.

The next section describes our data for Hungary and the other four countries, and *Section 3* discusses their privatization programs. *Section 4* explains the estimation procedures, and *Section 5* presents the results. Conclusions are summarized in *Section 6*.

Data

Our analysis draws upon annual unbalanced panel data for most of the firms inherited from the socialist period in each of the five countries we study. The sources and variables are quite similar across countries, although the Hungarian and Romanian data tend to be more similar to each other than to those in the Soviet successor states. The basic data sources are the National Tax Authority in Hungary and the Ministry of Finance in Romania, which provide data for all legal entities engaged in double-sided bookkeeping. In addition, the Romanian data are supplemented by the National Institute for Statistics' enterprise registry and two datasets of the State Ownership Fund, describing its portfolio and the privatization transactions. The Hungarian data are available for 1986–2005 and the Romanian data for 1992–2006.

The State Committees for Statistics in Lithuania, Russia and Ukraine (*Statistikos Departamentas* in Lithuania, *Goskomstat* in Russia and *Derzhkomstat* in Ukraine) are the successors to the branches of the corresponding Soviet State Committee. They compile the basic databases for our analysis in these countries, the annual enterprise registries. These are supplemented by joint venture registries that are available in Russia and a database from the State Property Committee in Ukraine, which we have linked across years. The Lithuanian data cover the period of 1995–2006, the Russian 1985–2005 and the Ukrain-

ian 1989 and 1992–2006. The whole Russian and the early Ukrainian data (until 1996) are based on industrial registries which are supposed to include all industrial firms (manufacturing as well non-manufacturing) with more than 100 employees or more than 25 percent owned by the state and/or by legal entities themselves included in the registry. In fact, the practice seems to be that once firms enter the registries, it remains there even if the original conditions for inclusion are no longer satisfied. The data may therefore be taken as quite comprehensive with respect to the "old" industrial sector of firms that were inherited from the Soviet system. The whole Lithuanian dataset and the Ukrainian data starting with 1996 contain all firms regardless of size and industrial affiliation.[3]

Table 3.1 contains the numbers of firms and firm-year observations for state ownership as well as domestic and foreign privatizations. We base our regression estimates of the effects of domestic privatization on thousands of observations (the smallest number is in the case of the Lithuanian privatization time series, but even this is almost 6,500, while in the case of Russia we have almost 200,000 firm-year observations). The total number of foreign privatizations is much smaller but enough to estimate its effects.

Table 3.1: Number of observations in regressions by ownership type

	Always State		Privatized Domestic		Privatized Foreign	
	Firm-years	Firms	Firm-years	Firms	Firm-years	Firms
Hungary	27,505	6,064	74,763	6,579	9,008	712
Lithuania	9,010	1,353	6,454	705	448	42
Romania	29,686	4,783	69,458	5,739	2,442	184
Russia	79,436	9,933	194,053	13,801	2,959	188
Ukraine	78,437	12,397	86,063	7,540	3,805	283
Total	224,074	34,530	430,791	34,364	18,662	1,409

Privatization Policies

The methods and tempos of large enterprise privatization differed quite significantly across the five countries we study in this paper. Hungary got off to an early start in ownership transformation and maintained a consistent case-by-case sales approach throughout the transition. At the very beginning, the transactions tended to be "spontaneous", initiated by managers, who were also usually the beneficiaries, sometimes in combination with foreign or other investors (*Voszka*, 1993). From 1991, the sales process became more regularized, generally relying upon competitive tenders open to foreign participation, although management usually still had control over the process. Unlike many other countries, there were no significant preferences given to workers to acquire shares in their companies, nor was there a mass distribution of shares aided by vouchers. Hungarian privatization thus resulted in very little worker

3 The data are further described by *Brown et al.* (2006), (2010) who use a subset of the observations we study in this paper.

ownership (involving only about 250 firms), very little dispersed ownership, and instead significant managerial ownership and highly concentrated blockholdings, many of them foreign (*Frydman et al.* 1993a). Although the process appeared at times to be slow and gradual, in fact it was quicker than in many other East European countries.

In Romania, by contrast, the early attempts to mimic voucher programs and to sell individual firms produced few results, and, after a few "pilots", privatization really began in earnest only in late 1993, first with the program of Management and Employee Buyouts, and secondly with the mass privatization of 1995–96 (*Earle and Telegdy*, 2002). The consequences of these programs were large-scale employee ownership and dispersed shareholding by the general population, with little foreign involvement. Beginning in 1997, foreign investors became more involved, and blocks of shares were sold to both foreigners and domestic entities. Similarly, Lithuania went through a mass privatization in the early 1990s and subsequent sales; because our Lithuanian data start only in 1995, our results reflect these later privatizations. In both countries, the result was a mixture of several types of ownership and a slower speed than in Hungary.

Ukraine and Russia's earliest privatization experiences have some similarities to the "spontaneous" period in Hungary, as the central planning system dissolved in the late 1980s and decision-making power devolved to managers and work collectives (*Frydman et al.* 1993b). The provisions for leasing enterprise assets (with eventual buyout) represented the first organized transactions in 1990–1992, but the big impetus for most industrial enterprise privatization in Russia was the mass privatization from October 1992 to June 1994, when most shares were transferred primarily to the concerned firms' managers and workers, who had received large discounts in the implicit prices they faced (*Boycko et al.* 1995). Some shares (generally 29 percent) were reserved for voucher auctions open to any participant, and these resulted in a variety of ownership structures, from dispersed outsiders holding their shares through voucher investment funds to domestic investors who acquired significant blocks; sometimes managers and workers acquired more shares through this means, but there were few cases of foreign investment. Blockholding and foreign ownership became more significant through later sales of blocks of shares and through secondary trading that resulted in concentration. Ukraine used somewhat different mechanisms, but in general followed Russia's pattern at a slower pace. In both countries, the initial consequence was large-scale ownership by insiders and some blockholding by domestic entities. Concentration and foreign ownership increased subsequently.

These general patterns are reflected in *Table 3.2*, which contains the percentage of firms privatized to domestic and foreign owners. We define a firm as private if more than 50 percent of its shares are privately held; it is domestic if it is private and the number of shares held by domestic investors is higher than

those held by foreign owners; it is foreign if it is private but not domestic (nearly all foreign privatized firms by this definition are majority foreign-owned).[4]

Table 3.2: Private ownership shares

		1992	2004
Hungary	Domestic	0.37	0.60
	Foreign	0.03	0.09
Lithuania	Domestic	N.A.	0.37
	Foreign	N.A.	0.02
Romania	Domestic	0.00	0.80
	Foreign	0.00	0.03
Russia	Domestic	0.00	0.58
	Foreign	0.00	0.02
Ukraine	Domestic	0.00	0.48
	Foreign	0.00	0.01

N.A.= Not available.

As of late 1992, 37 percent of the Hungarian firms had already been privatized, while the process had not yet started in Romania, Russia, and Ukraine (for Lithuania we do not have data for this year). By the end of the period, a large proportion of firms had been privatized to domestic or foreign investors in all countries: 83 percent in Romania, 69 percent in Hungary, 60 percent in Russia, 49 percent in Ukraine and 39 in Lithuania.[5] The percentage of firms majority privatized to foreigners is by far the highest in Hungary, reaching 9 percent by 2004, while in the other countries this proportion is 1–3 percent. Given our sample sizes, it is still enough to estimate a foreign effect.[6]

Empirical Strategy

We follow the broader literature on the employment effects of privatization in estimating reduced form equations, while trying to account for potential problems of heterogeneity and simultaneity bias (*Djankov and Murrell*, 2002; *Megginson and Netter*, 2001). Estimating these effects faces some potential problems. The first is the possibility that aggregate shocks may affect employment and ownership.[7] Moreover, the shocks may be industry-specific, and the available deflators may not perfectly capture price changes. Most studies have too few observations at their disposal to be able to account for industry-specific fluctuations; yet if these are correlated with privatization, the estimates may be biased. Taking advantage of the large samples in our data, we include a full set of (2-digit) industry controls in levels and each interacted with a time trend. Unlike most previous studies, our data also contain a comparison group of firms that remain in state ownership throughout the period of observation.

A more difficult problem is the possibility of selection bias in the privatization process. Politicians, investors, and employees of the firms may all influ-

4 Ownership is measured at year-end. The Russian data do not contain an ownership variable before 1993, nor do they provide percentage shareholding. Virtually all the privatizations in our data are mass privatizations so the earliest date they could take place was October 1992. Nearly all these privatizations led to majority private ownership (e.g., *Boycko et al.* 1995).

5 These proportions seem very small compared to what was found in other studies using these data (*Brown et al.* 2010). The main difference in the proportion of firms privatized is that we use firms from all sectors of the economy while they had only manufacturing. We restricted our sample to manufacturing and obtained very high proportions of privatized firms. The energy sector and some services, however, have been privatized to a smaller extent. Industries with low levels of privatization include mining, energy, water distribution, and such service sectors as transportation, post and telecommunication, real estate, garbage collection, and cultural and sporting activities. The proportion of firms privatized by industries is available upon request.

6 See *Table 3.1* for sample sizes. The Russian registries contain codes for state, domestic, joint ventures, and 100 percent foreign firms, but foreign shares are available only for a subset of firms in four years. We classify all joint ventures as foreign.

7 Studies that estimate a privatization effect as the difference between pre- and post-privatization levels for a sample of privatized firms (e.g., *Megginson et al.* 1994) are unable to distinguish the effect of privatization from such aggregate fluctuations.

ence whether a firm is privatized and whether the new owners are domestic or foreign. Politicians concerned with unemployment may prefer to retain firms with the worst prospects in state ownership in order to protect workers from layoffs, and the employees themselves may work to prevent privatization in such cases. Potential investors are also likely to be most interested in purchasing firms with better prospects. To remove such time-invariant differences across firms, we therefore include firm fixed effects (FE) in some specifications. Since firms could also differ in their trend growth rates in ways that are correlated with ownership change, for instance because potential investors see growth opportunities, we add firm-specific trends to some specifications (labeled FE&FT). Taken together with the full set of industry-year interactions, the fixed effect and firm-specific trends also control for changes in the environment, including both competition from other firms and subsidies (implicit or explicit) from the government, that may also influence employment behavior at the firm level.[8]

The basic specification for the panel data model takes the following form for each country separately:

$$\log emp_{ijt} = \alpha_0 + \alpha_1 DO_{it} + \alpha_2 FO_{it} + Ind_j + Ind_j \times Trend_t + Year_t + u_{it}, \quad (1)$$

where *i* indexes firms, *j* indexes industries, and *t* indexes time periods (years). The dependent variable is the natural logarithm of the firm's employment, *Ind* and *Year* represent a set of 2-digit industry and year dummies, *Trend* is a time trend, and u_{it} is an idiosyncratic error.[9] The equation is estimated unweighted and weighted by employment, the latter in order to permit an assessment of the overall employment effect and the degree to which impacts vary with firm size.

Results

Tables 3.3 and *3.4* contain results for the unweighted and employment-weighted regressions estimating relation (1) with the natural log of average number of employees as the dependent variable. Equations are fitted by OLS, fixed firm effects (FE), and firm-specific trends (FE&FT). On an unweighted basis, the OLS specifications produce small negative domestic coefficients in Hungary and the other two non-fSU economies, but large coefficients in Russia and Ukraine, particularly the former. By contrast the foreign coefficients are all positive and large. As the OLS specification provides only a cross-sectional comparison of average employment in privatized years relative to years in state ownership (both for firms never privatized and the pre-privatization years for firms subsequently privatized), containing no control for previous size levels, these estimates cannot be interpreted as causal. Rather, they reflect a mixture of the causal effect and the selection effect of privatization on size, and they provide a useful baseline for the FE and FE&FT estimates.

The FE estimates, and even more so the FE&FT estimates, in *Table 3.3* show a narrower range of domestic coefficients, and some attenuation of the foreign

8 Firm fixed effects and trends also control for regional differences in the economic environment, for instance in labor market conditions that may affect employment and wage behavior.

9 Our estimates permit general within-firm correlation of residuals using *Arellano*'s (1987) clustering method. The standard errors of all our test statistics are robust to both serial correlation and heteroskedasticity.

coefficients. Sizable negative impacts are estimated only under FE for domestic privatization in Lithuania and Ukraine, each of them about –20 percent. In the other countries, as well as for these two in the FE&FT specification, all the estimates lie close to zero. In Hungary, the FE estimate for domestic privatization is actually a positive 0.048, while with FE&FT it is a small –0.029. The foreign coefficients are positive everywhere and they are statistically significantly different from zero. In Hungary, the estimated effect is 0.45 in the FE specification and 0.11 in the FE&FT. Thus, while the estimates do vary substantially across countries and across estimation methods, in no case is there evidence of large negative causal effects of privatization on employment, whether the new owners are domestic or foreign investors. Comparison of the FE and FE&FT results to each other, and to the OLS estimates, also shows that the direction of selection bias, the extent to which unobserved factors correlated with ownership influence the level and growth of employment, varies considerably across countries.

Table 3.3: Estimated effects of privatization on firm employment (unweighted)

		Hungary	Lithuania	Romania	Russia	Ukraine
OLS	Domestic	–0.106***	–0.178**	–0.126***	0.967***	0.077***
		(0.033)	(0.070)	(0.029)	(0.018)	(0.024)
	Foreign	0.698***	1.271***	0.705***	1.674***	1.369***
		(0.074)	(0.233)	(0.114)	(0.098)	(0.096)
FE	Domestic	0.048***	–0.222***	0.014	0.009	–0.186***
		(0.018)	(0.029)	(0.016)	(0.009)	(0.012)
	Foreign	0.450***	–0.091	0.155**	0.243***	0.208***
		(0.041)	(0.114)	(0.076)	(0.047)	(0.055)
FE&FT	Domestic	–0.029**	–0.051**	–0.036***	0.058***	–0.033***
		(0.012)	(0.023)	(0.010)	(0.006)	(0.009)
	Foreign	0.112***	0.014	–0.052	0.152***	0.127***
		(0.029)	(0.069)	(0.050)	(0.035)	(0.036)
N (firm–years)		111,276	15,912	101,586	276,448	168,305

Notes: Dependent variable: log(employment). The equations include industry, year, and industry-time trend interaction controls.
Standard errors (corrected for firm clustering) are shown in parentheses.
*** Significant at the 1% level; ** 5% level * 10% level.

The FE estimates, and even more so the FE&FT estimates, in *Table 3.3* show a narrower range of domestic coefficients, and some attenuation of the foreign coefficients. Sizable negative impacts are estimated only under FE for domestic privatization in Lithuania and Ukraine, each of them about –20 percent. In the other countries, as well as for these two in the FE&FT specification, all the estimates lie close to zero. In Hungary, the FE estimate for domestic privatization is actually a positive 0.048, while with FE&FT it is a small –0.029. The foreign coefficients are positive everywhere and they are statistically sig-

nificantly different from zero. In Hungary, the estimated effect is 0.45 in the FE specification and 0.11 in the FE&FT. Thus, while the estimates do vary substantially across countries and across estimation methods, in no case is there evidence of large negative causal effects of privatization on employment, whether the new owners are domestic or foreign investors. Comparison of the FE and FE&FT results to each other, and to the OLS estimates, also shows that the direction of selection bias, the extent to which unobserved factors correlated with ownership influence the level and growth of employment, varies considerably across countries.

Table 3.4: Estimated effects of privatization on employment (weighted by firm employment)

		Hungary	Lithuania	Romania	Russia	Ukraine
OLS	Domestic	-0.937***	-0.213	-0.717***	0.350***	-0.494***
		(0.092)	(0.129)	(0.121)	(0.064)	(0.098)
	Foreign	-0.083	0.145	0.151	0.712***	0.102
		(0.146)	(0.250)	(0.184)	(0.167)	(0.210)
FE	Domestic	-0.209***	-0.121**	-0.097***	0.061***	0.002
		(0.024)	(0.061)	(0.023)	(0.013)	(0.030)
	Foreign	-0.072	-0.295***	-0.052	0.235***	0.144***
		(0.045)	(0.098)	(0.043)	(0.044)	(0.035)
FE&FT	Domestic	0.037	0.008	-0.002	0.056***	-0.034
		(0.039)	(0.051)	(0.028)	(0.014)	(0.030)
	Foreign	-0.003	-0.085	0.009	0.179***	0.106**
		(0.055)	(0.052)	(0.105)	(0.051)	(0.045)
N (firm-years)		111,276	15,912	101,586	276,448	168,305

Notes: Dependent variable: log(employment). The equations include industry, year, and industry-time trend interaction controls.
Standard errors (corrected for firm clustering) are shown in parentheses.
*** Significant at the 1% level; ** 5% level * 10% level.

The unweighted estimates in *Table 3.3* provide answers to questions about the effects of privatization on firm-level employment behavior by country and estimation method, but without regard to firm size. *Table 3.4* weights the regressions by firm employment and therefore addresses questions on the overall impact of privatization on employment and on how the impact varies with firm size.[10] Again, the OLS estimates are shown only as a baseline, and only the FE and FE&FT estimates provide evidence on causal effects. These FE specifications show some more substantial negative effects for domestic privatization in Hungary, Lithuania, and Romania, and for foreign privatization in Lithuania (but recall the small sample size for the foreign estimates in Lithuania). However, all these coefficients become small and statistically insignificant in the FE&FT specification. Robust positive results emerge only in Russia and Ukraine for foreign privatization and for domestic privatization only in Russia.

10 The "overall impact" does not take into account any indirect effects, as privatized firm behavior may affect other firms through interactions in product and factor markets.

In summary, the FE results for Central Europe imply that the employment effect of privatization was more negative in larger firms, but the FE&FT results suggest little difference once firm-specific trend growth is taken into account.

The Effect of Privatization on Wages

Another interesting aspect of privatization policies is the effect on workers' wages. The effect of privatization on wages may be negative if new private owners are more profit oriented than the state, and in their attempt to reduce costs, expropriate worker rents.[11] But the cost-reduction effect may be offset if privatized firms pay more to attract new workers, elicit more effort, or reward higher productivity. Depending on the relative strength of these mechanisms, wages may either rise or fall as a result of privatization.

The effect of privatization on wage differentials is also ambiguous theoretically. The new private owners strive for cost reduction, which affects the wages of all workers. This would lead to a drop in wages for all worker types. If the state-owned enterprise (SOE) was overstaffed with non-production workers as argued for instance by *Kornai* (1992), it is possible that across-the-board cost cutting will have a larger effect on university graduates and non production workers and so their wages would fall more, at least relative to production workers. On the other hand, if the firm adapts new technology and therefore replaces production workers with more skilled employees (*Katz and Murphy*, 1992), the wages of those with vocational education or in blue collar occupations may fall more. If the skill-biased technological change leads to replacement of workers carrying out routine tasks with robots and computers, it is also possible that low-skilled workers who do non-routine tasks (such as driving or cleaning) would gain relative to skilled production workers and clerks (*Katz et al.* 2006).

Although the effect of privatization on wages has direct policy relevance and its understanding would also shed light on the behavior of state-owned enterprises, surprisingly few papers have studied it. An example of an early attempt to analyze the average wage effects of privatization is *Haskel and Szymanski* (1993), who study a small sample of British privatized firms. *Brown et al.* (2010) use firm level data from four transition countries' manufacturing sectors and find that average wages fall little (less than 5 percent) after domestic privatization, and transfers to foreign owners actually increase workers' wages. Only one study analyzes the effects of privatization on wage differentials: *Melly and Puhani* (forthcoming) look at the personnel records of one large firm which underwent privatization and conclude that women, low skilled workers, older, and high-tenure workers experienced relative wage cuts after privatization.

In this chapter we build on this research but also expand it in several dimensions. We use a linked employer-employee data covering all large Hungarian firms from all industries, and a random sample of their workforce. The panel

11 A related literature discusses such expropriation in hostile takeovers (*Shleifer and Summers*, 1988; *Gokhale et al.* 1995).

is long, covering more than 20 years, and most privatized firms are observed for several years both pre- and post privatization, which enables us to use panel techniques to control for possible selection of firms into privatization. We therefore study not only one firm or a limited set of industries, but the entire enterprise privatization in Hungary. The data allow analyzing not only of average wages but also the wages of various demographic and skill groups and occupations. We produce results for both domestic and foreign privatizations which present very different wage behavior after privatization.

In the following we present the data and the empirical setting, and the results.

Data, Descriptive Statistics, and Empirical Methodology

The dataset used in this paper is the Hungarian linked employer-employee data, which is a large panel in firms which cover all the sectors of the economy. The data are a 23 year long panel in firms (from 1986 to 2008) but not in workers. They cover essentially all large firms of the economy and a sample of smaller enterprises. We include in this study only those firms which were state-owned at one point so they were at risk of privatization. Since we have information on both firms and workers, we can control for selection into privatization at the firm level while the worker level data allow the use of individual wages, controls for individual characteristics and the analysis of wage differentials. Workers are sampled randomly at the firm level, which covers approximately 8 percent of its employment.[12] The number of observations per firm varies, but in some cases, particularly in small firms there are only a few (sometimes only one) employees observed. To study wage differentials, we need firms which have a large enough sample of employees to get consistent and robust estimates on their relative wages. To satisfy this condition, we use only those firms which have observations on more than 10 workers. The resulting sample is quite large, composed of more than 1,200 domestic and 240 foreign privatizations, as well as a control group of 311 never privatized SOEs.[13] *Figure 3.1* presents the evolution of ownership and shows the early start of Hungarian privatizations and the heavy presence of foreign investors. By the turn of the century, the share of state-owned firms declined to 35 percent while domestic and foreign privatized enterprises increased their weight from zero to 40 and 25 percent, respectively.[14]

Firms under the three ownership types differ in many respects, suggesting that selection was indeed non-random and its treatment is important. As *Table 3.5* demonstrates, monthly earnings are quite similar in never privatized and domestically privatized firms, but they are much higher in foreign-owned companies.

The share of workers along various individual characteristics also varies across types of owners: female workers are least prevalent in always state-owned companies, more likely to work in domestically privatized firms and their share is the highest in foreign-owned enterprises. Measured by the highest degree

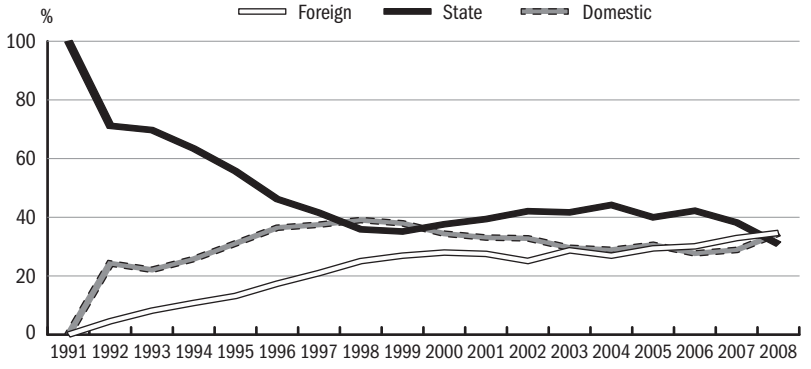
12 For a description of the data, see *Chapter 2* of *Infocus – II*.

13 We define a firm as privatized if it was ever state owned and the state is a minority owner; if the shares owned by domestic private owners exceed those owned by foreigners, the firm is domestically privatized; otherwise it underwent a foreign privatization.

14 The increase of the share of SOEs thereafter is due to sample changes, not nationalizations of already privatized companies.

completed, the skill level of employees is highest in foreign-controlled firms and lowest in SOEs. Average work experience is the lowest in foreign companies, and highest in the domestic ones.

Figure 3.1: Evolution of ownership



$N = 35{,}483$ firm-years.

Table 3.5: Worker characteristics by ownership

	State-owned	Domestic	Foreign
Monthly Earnings	149.2 (109.7)	135.5 (142.9)	236.6 (244.1)
Female (%)	38.3	41.8	43.5
Education (%)			
Elementary	35.3	26.5	16.6
Vocational	27.7	36.7	27.9
High school	29.9	27.8	37.6
University	6.9	9.0	17.9
Experience (years)	22.8 (11.0)	24.0 (10.7)	21.3 (10.7)
Occupation (%)			
Managers	6.2	10.5	9.1
Professionals	4.5	3.3	8.0
Associate Professionals	14.2	10.9	20.2
Clerks	8.3	7.5	6.4
Service Workers	9.4	8.3	6.4
Skilled Manual Workers	46.8	50.2	45.2
Elementary Occupations	10.5	9.3	4.8
Worker–years	1,265,138	287,584	165,539
Firms	311	1,217	240

Notes: Weighted unconditional means (standard deviations). Earnings measured in thousands of 2008 HUF, deflated by CPI. The definition of occupations follows ISCO-88 where Elementary Occupations, Service Workers, Clerks, Associate Professionals, Professionals and Managers coincide with the corresponding major groups; Skilled Manual Workers cover Skilled agricultural and fishery workers, Craft and related trades workers and Plant and machine operators and assemblers.

There are some notable differences in the occupational structure of firms as well. The share of workers engaged in elementary occupations is small in foreign owned firms, while the share of associate professionals and professionals is very high. State owned enterprises have fewer managers than privatized companies.

We estimate the following equation to study the wage effect of privatization:

$$lnw_{ijt} = a_1 + \beta_{it} X_{it} + a_d DOMESTIC_{j,t-1} + a_f FOREIGN_{j,t-1} + \\ + \Sigma\beta_j REGION_j + \Sigma\lambda_t YEAR_t + z_{ijt}. \quad (2)$$

X_i is a vector of individual characteristics including a dummy variable for female, three educational dummies (vocational, high school, and university, the omitted category being at most 8 years of schooling), and three dummies for potential experience (11–20, 21–30, and more than 30 years of experience, the omitted category being 0–10 years of experience). The coefficients of interest, a_d and a_f provide the conditional effect of domestic and foreign privatization. As selection into privatization is likely to be non-random, we add firm fixed effects a_i to the regression.

When we analyze wage differentials, we use the same equation except that the domestic and foreign privatization dummies are interacted with the elements of X_{it}:

$$lnw_{ijt} = a_i + \beta'_{it} X_{it} + a'_d DOMESTIC_{j,t-1} + a'_f FOREIGN_{j,t-1} + \\ + \gamma'_d X_{it} DOMESTIC_{j,t-1} + \gamma'_f X_{it} FOREIGN_{j,t-1} \\ + \Sigma\beta'_j REGION_j + \Sigma\lambda'_t YEAR_t + z_{ijt}. \quad (3)$$

In this specification the parameters of interest are γ'_d and γ'_f, and they show how wages are affected by domestic and foreign privatization relative to the base category of worker. In another specification, we substitute the individual characteristics with occupational categories to see how the wage effect of privatization varies by occupation.

Results

The estimated effects of domestic and foreign privatization on average wages are presented in *Table 3.6*. The OLS estimates represent the difference in wages between SOEs and domestic and foreign privatizations, after controlling for gender, education, experience, region and year. They show that average wages at domestically privatized enterprises are more than 12 percent lower than the average wage in SOEs. Foreign owned companies, on the contrary, pay a wage premium of 24 percent. These results, however, may reflect biased selection of firms into privatization. The fixed effect estimations control for any such selection that is time-invariant. They indeed show that the wage effects of domestics and foreign are smaller than the OLS regressions suggested, but nonetheless they are still large. Domestic private owners are estimated to decrease wages by 9 percent after acquisition while foreign owners increase them by 12 percent.

Table 3.6: Estimated effect of privatization on wages

	OLS	Standard error	FFE	Standard error
Domestic	–0.124***	0.020	–0.093***	0.016
Foreign	0.238***	0.029	0.117***	0.021

Notes: $N = 1{,}718{,}261$ worker–years. Dependent variable = ln(real gross earnings). The equations include year, region, gender, education, experience, and occupation controls.
Standard errors corrected for firm clustering.
*** Significant at the 1% level; ** 5% level * 10% level.

Do these changes in wages affect all workers proportionally, or do they vary by type? To start with wage differentials by gender, education, and experience in *Table 3.7*, the domestic privatization effect for the reference group (male workers with only elementary education and 0 to 10 years of experience) is –8.4 percent. Relative to this group, female workers have a wage gain of 5 percent (so the overall female wage effect of domestic privatization is –3.4 percent). By the level of education there is a slight upward trend in the privatization effect: high school and university graduates have a wage premium of 3.3 and 4.3 percent relative to the reference group. Domestic privatization clearly favors young employees as all workers who have more than 10 years of experience have a wage decline of about 6 percent more than their younger fellows. Therefore, the category which has the smallest drop in wages (they actually have a tiny increase) is young, high-skilled female workers, who are estimated to earn about 1 percent higher wages than before privatization.

Table 3.7: The effects of privatization on the wage structure: gender, education, experience

	Domestic	Standard error	Foreign	Standard error
Privatization Effect for Reference Group	–0.084***	0.014	0.036	0.024
Ownership interactions				
Female	0.049***	0.011	0.050***	0.016
Vocational	–0.004	0.008	0.021	0.012
High school	0.033***	0.013	0.034**	0.017
University	0.043**	0.020	0.168***	0.029
Experience: 11–20 years	–0.058***	0.006	–0.023**	0.011
Experience: 21–30 years	–0.060***	0.008	–0.025	0.013
Experience: 30+ years	–0.053***	0.011	–0.015	0.017
R^2-within		0.365		

Notes: $N = 1{,}718{,}261$ worker-years. Dependent variable: ln(real gross earnings). The estimated coefficients on domestic and foreign wage differentials come from the same regression. Reference group: male with elementary education and 0–10 years of labor market experience. The equations include year, region, gender, education, experience controls and firm fixed effects, and are weighted by employment.
Standard errors corrected for firm clustering.
*** Significant at the 1% level; ** 5% level * 10% level.

The variation of the foreign wage effect is presented in the second column of the table. The reference group has a wage premium of 3.6 percent but this is not significant at any conventional level. There are some similarities in the effects of wage differentials with domestic privatization: females earn 5 percent more than the reference group, and the wage differential measured for vocational and high school graduates is practically the same across the two ownership types. Foreign investors also favor young workers, but the effect is smaller (and statistically less precise than for domestic ownership). The main difference between the foreign and domestic wage effects materializes in university graduates. While the wage premium of this skill category is only 4 percent after domestic privatization, such workers in foreign-privatized companies are estimated to gain 17 percent higher wages relative to the reference group.

The estimated wage effects of privatization by occupations are presented in *Table 3.8*. Domestic privatization is estimated to have no effect on the wages of professionals. Associate professionals, skilled non-manual workers and those in unskilled occupations experience a wage loss of 4–6 percent and managers of 7 percent. The largest wage losers are service workers and skilled manual workers, who earn less by 10 and 14 percent, respectively. Foreign owners raise managers' wages the most (by 34.5 percent) and professionals (by 25 percent). Associate professionals and skilled non-manual workers get a wage increase of 7–10 percent, which is similar to that which unskilled workers obtain. Service and skilled manual workers receive essentially no wage increase after privatization.

Table 3.8: The wage effects of privatization by worker occupation

Ownership interactions	Domestic	Standard error	Foreign	Standard error
Manager	–0.073	0.038	0.345***	0.056
Professional	–0.034	0.023	0.247***	0.032
Associate Professional	–0.055**	0.025	0.095***	0.034
Clerks	–0.044**	0.017	0.070***	0.025
Service	–0.102***	0.028	0.004	0.066
Skilled manual	–0.128***	0.015	0.031**	0.015
Unskilled	–0.060***	0.012	0.100***	0.025
R^2-within		0.343		

Notes: $N = 1{,}718{,}261$ worker-years. Dependent variable: ln(real gross earnings). The estimated coefficients on domestic and foreign wage differentials come from the same regression. Reference group: male with elementary education and 0–10 years of potential labor market experience. The equations include year, region and occupation controls and firm fixed effects, and are weighted by employment.
Standard errors corrected for firm clustering.
*** Significant at the 1% level; ** 5% level * 10% level.

Conclusion

Although economic analyses of the effects of privatization have largely focused on firm performance, the greatest political and social controversies have usually concerned the consequences for the firm's employees. In most cases, it is assumed that the employment and wage effects will be negative, and workers all around the world react to the prospect of privatization, especially when foreign owners may become involved, with protests and strikes. Yet there have been very few systematic studies of the relationship between privatization and outcomes for the firm's workers, and previous research has been hampered by small sample sizes, short time series, and little ability to control for selection bias. It has therefore remained unclear whether workers' and policymakers' fears of privatization are in fact warranted.

In this paper, we have analyzed the effects of privatization on the firm's employment using comprehensive panel data on firms in Hungary and four other transition economies that all adopted large-scale privatization programs but used different methods of privatization. The data for these countries contain similar measurement concepts for the key variables, and we have applied consistent econometric procedures to obtain comparable estimates across countries.

Our results provide no evidence for strong negative effects of any form of privatization on employment. Estimated by FE&FT, the employment effects are seldom both negative and statistically significant, and when they are the magnitudes are not large, nearly always remaining under 5 percent. The FE results for domestic ownership in the Central European economies contain a few more negative coefficients, but none of these are robust to including firm-specific trends (FT). The estimated coefficients on foreign ownership tend to be larger and positive for all countries, except for a few cases of statistical insignificance. It is striking that the absence of large negative employment effects of privatization holds consistently across all five of the countries, which span the distribution of reform experiences. If we had found large negative effects in Ukraine and Russia, towards one end of the spectrum, then we might be able to infer that other less-developed economies, perhaps those in Central Asia, would face similar problems. Or if we had found large negative effects in Hungary, the Eastern European economy closest to a developed market economy at the beginning of the privatization process, then we might deduce that such effects are, contrary to expectation, largest where the deviation from market outcomes is the least. We do not find any such patterns, however; rather, our findings reject the hypothesis of large negative consequences for employment in all 5 countries. Thus, while extrapolation always requires caution, it seems fair to say that our results carry no implication that privatization would be more likely to reduce employment in other contexts.

To study the wage effects of privatization, we used a Hungarian linked employer-employee dataset. The large samples of firms within industries, the long time series of observations before and after privatization, and the availability of state-owned comparison groups enable us to identify privatization effects from variation due to deviations from firm-specific means and trends. Domestic privatization decreases wages by about 10 percent in Hungary while foreign takeovers raise them by about 12 percent. These wage changes are not uniform across worker types. The new domestic and foreign private investors favor young skilled workers and females are also better paid than under state ownership. Wage differentials arise across occupations as well: in the case of domestic (foreign) privatization, the strongest decline (lowest increase) is found for skilled manual and service workers. The analysis, therefore, provides some evidence that privatization brings about skill-biased technological change and polarization, and this effect is stronger when the firm is acquired by foreign owners.

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4. THE IMPACT OF INTERNATIONAL TRADE ON EMPLOYMENT AND WAGES

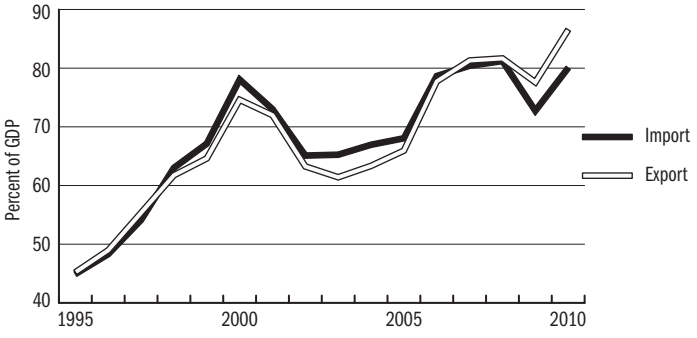
MIKLÓS KOREN & PÉTER TÓTH

Introduction

Since the 2008/2009 crisis the positions of anti-globalist and protectionist views has been strengthening all over the world. International trade, and more importantly, the global supply chains contributed to the fast and worldwide spread of the crisis originally limited to a handful of countries (see *Békés et al.* 2011). As a response to this, some countries introduced regulations that favor domestic firms over foreign companies. Since November 2008 countries of the G20 group have taken approximately 1000 policy measures that discriminate against foreign economic interests (*Global Trade Alert,* 2012). The purpose of this economic policy is understandable: we should protect the domestic firms and the workers from the effects of the global crisis.

However, if these measures become permanent, they will influence economic growth in the long run. Especially in such a small, open economy like Hungary, one cannot disregard the long-term effects of trade protectionism. To understand these, we should look back to a previous period, to the ten years prior to Hungary's EU accession. Privatization took place during this period, and among numerous reforms, international trade became significantly more liberalized. For example, following the trade agreement with the European Economic Community in 1992 the average tariff on products in machine manufacturing decreased from 10 percent to 1 percent by 1997, and tariffs were lifted entirely by 2001.[1] Of course the effect of trade liberalization also appears in the level of magnitude of the imports and exports *(Figure 4.1).*

Figure 4.1: The import and export as a percentage of the GDP over time



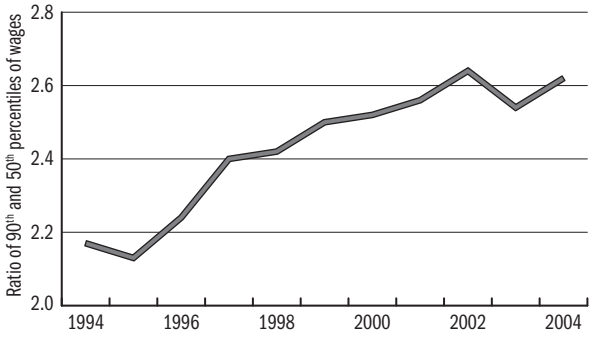
Source: *Hungarian Central Statistical Office.*

1 Hungary's EU accession in 2004 changed the rules of data reporting significantly as well, so our analysis ends with the year 2003.

But what are the effects of this large-scale opening up on the Hungarian labor market? Although most of the theoretical models on international trade show that the country as a whole benefits from trade liberalization, certain groups within society might be more vulnerable. Opening up to international trade necessarily implies a redistribution of wealth. Given the change in the production structure, certain factors of production (for example labor or capital), industries (exporting and import-competing), or even certain firms (large and more productive, small and less productive) and workers (for example according to education) benefit from the aggregate income to a different extent.

It is important to see that the distributional conflict is not between foreign and domestic groups (because in our experience both countries win at the national level), but between groups within a country. This is especially interesting on the labor market, where the employees having different backgrounds (regarding skills and education) have different chances for a higher wage. The beneficial macroeconomic effects of international trade might not be present in every group. As *Figure 4.2* shows, workers with high wages are in a more and more favorable position throughout the examined period.

Figure 4.2: The development of income inequalities. The ratio of the 90th and 50th percentiles of the wage distribution between 1994 and 2004



Source: Authors' calculations from the *Wage Survey* (Bértarifa).

In this chapter we present the effects of the international trade on wages. Besides reviewing the literature we mainly focus on Hungarian firm and worker-level data between 1994 and 2003. Our central question is: how do the wages of the workers change when a firm starts to export or import? The firm and individual-level data help us to distinguish the effect of international trade from the effects of other changes in economic policy in this period. Namely, as we will see, not every firm participates in external trade; this way we can make a comparison between workers exposed and not exposed to international trade who are otherwise from the same occupational group and industry. With this we indirectly examine the changes in the firms' labor demand.[2] The drawback

2 If the labor supply curve experienced by the firm is increasing, the labor demand and the paid wage has a positive upward sloping relationship.

of our method of analysis comes with its strength, since we should abstract from the aggregate effects of international trade that are related to industry or country-level channels. The regression coefficients will not contain those – in the long run potentially significant – effects of trade liberalization that work by, for example, making the firms increase their quality standards in a whole sector affecting the productivity (hence the wages) at the industrial level. This is because in the regressions we take out the variation caused by industrial heterogeneity (we control for it). Similarly, the – more complicated, still probably very important – long term general equilibrium effects will not be identified either. An important example for the latter could be that the opening up for international trade generated a higher wage premium in the groups of skilled workers, which in turn gave an incentive for the younger generation to become better educated, by which they would increase the productivity of the economy *as a whole*, so this effect would appear in every worker's wage. These effects, present on some aggregate level are not identifiable with our methodology and data. However, luckily they all belong to the benefits of liberalization, so in this sense the results enumerated in this chapter can be regarded as lower bounds for the effects of international trade.

One of our main results is that the firms active in external trade are special. They are larger, more productive and pay higher wages. As we will see this is partially the result of self-selection, but in part it signals a causal relationship. This also means that the average Hungarian worker gains from the opening up to international trade, since the ratio of well-paid jobs is increasing in the economy.

A maybe more surprising result is that imports are at least as important as exports. The importer firms are also larger, more productive, and pay higher wages than the non-importers. It is not true that the "export is good, import is bad". The reason for this is that the importers can produce at a cheaper level and become capable of increasing their market share, thus their labor demand increases too. Later we will show in detail how the firm's import can provide growth opportunities. An important consequence of this result is that a discriminatory policy against imported goods holds back the demand for Hungarian labor.

Of course, as we mentioned earlier, not everybody gains in the same way. The middle managers and skilled workers experience the highest increase in wage. Furthermore, we show that one can find certain industries and occupations (for example certain unskilled occupational groups in the food industry), where increasing imports lead to a decrease in wages.

Our chapter summarizes several papers written using foreign and Hungarian microdata. Every Hungarian paper (*Koren and Csillag,* 2011; *Halpern, Koren and Szeidl,* 2011; *Tóth,* 2011; *Halpern et al*. 2012 and *Pető,* 2012) measures the firm's export and import behavior based on the *Customs Statistics* (Vámstatisztika). We regard a firm as an exporter if it pursues export activity

to any extent; respectively we call it an importer if it is importing goods of any value.[3] The latter only includes direct imports, but it does not incorporate the purchase of imported products through wholesalers or distributors. With this we underestimate the level of the actual firm import. Our results, if not stated otherwise in the text, are based on manufacturing data. The worker-level data come from the *Wage Survey* (Bértarifa), which contains a 6–10% sample of the private sector employees. From this dataset we mainly use the gross monthly wage as a dependent variable, but of course we take into account individual-level control variables too.

At first we present the main characteristics, along which the firms that participate in external trade differ from the ones that do not, and we examine if these differences are the result of the exporting or the importing activities. Then we focus on importing as an important, but so far poorly analyzed trade channel. We show that the import increases the firm's productivity, and this way it provides the opportunity for the firm to expand. After this we investigate the effect of the import on the worker's wages, separating the certain effect mechanisms. Finally, we also explore how the firm's activity in international trade affects wage inequality. We conclude our paper with policy recommendations.

The firms involved in international trade

Until the 1990s the literature on international trade considered countries and industries as a unit of analysis, we only have results from the recent period that focus on the firm or the worker. This is an important step forward, because it is not the countries but rather firms that are trading with each other after all; moreover, in this way we can gain an insight into the nature of the wage inequality possibly caused by international trade activity.

Examining data on US firms with trade activity *Bernard and Jensen* (1999) asked if the export or the import increases the productivity of the firm. Although it can be unambiguously established that the importing/exporting firms are more productive, it is unclear which is the cause and which is the effect. Did the firms commence exporting because they were highly productive, or did they become more productive than average because of the export activity? To be able to abstract from the effects of those characteristics in the regressions later, and to have a more accurate view as to what kind of firms participate in international trade, in this part of our paper we explore by what characteristics exactly are the active firms special.

Why would the trading firms be different? The main argument is (for example *Melitz,* 2003 or *Altomonte and Békés,* 2009) that the export and import activity has fixed costs. There are costs of entering a market – for example searching for trade partners, setting up a distribution network, marketing –, which arise even if the firm wants to sell only a small amount in the foreign country. These costs can be so significant that starting to sell internationally

3 Including larger exporters and importers leads to the same qualitative results.

(setting up sales channels etc.) or to import (knowledge of the foreign market and other information problems etc.) is only profitable for firms having considerable resources. In Hungary we need to add to this the cost of bridging the language barrier or the extra uncertainty regarding the future (especially in the mid-1990s), for example to assess in the changing institutional environment whether the German machine that represents cutting-edge technology offsets its cost within ten years.

For these reasons we might suspect that the firms engaged in export or import are larger and more productive than the others; following an economies of scale argument we can see that it is easier for a larger and more efficient firm to outweigh the sunk costs with the possible extra profit from the trade activity. Furthermore, it follows from the former observations that firms involved in international trade probably employ more skilled workers (for example more employees need to speak English), and they reach high productivity with a more advanced technology and a higher capital-labor ratio.

These are more or less the distinctive factors that *Bernard et al.* (2007) also highlight in their article. Looking at the ratio of the exporter/importer firms and the intensity of the activity, the authors establish that trade is very concentrated. For example, only 4 percent of the firms in the US were exporters in 2000. Moreover, they describe the results already mentioned above. The firms engaged in international trade are already more productive before starting the activity; they use more skilled labor and capital in the production process relative to the other firms; they are larger, more productive, and grow faster after becoming involved in trade.[4]

We might suspect that the firms involved in international trade have similar characteristics in Hungary too. It is also likely that the import activity is much more present in the automobile industry than in sylviculture, and that the internationally active firms are concentrated in Budapest and in the more developed counties in West-Hungary, since firms are more productive in general there. *Békés et al.* (2011) gives a detailed descriptive analysis about Hungarian exporting and importing firms, and *Altomonte and Békés* (2009) describe further aspects of the data. These papers confirm that the Hungarian firms behave similarly as in other countries described in the literature.

As *Table 4.1* shows, the firms engaged in international trade are special indeed; the Hungarian data give the same qualitative results along all of the variables analyzed by *Bernard and Jensen* (1999) that we saw in the case of American firms. The table presents the important characteristics of the average firm for the whole 1994–2003 period and for three years (1994, 1998, 2003) in detail: size (number of employees), the logarithm of the capital-labor ratio, the ratio of the employees with higher education and productivity. The last variable is defined as the logarithm of the ratio of the revenues and the number of employees.

4 These results are partially confirmed for other countries as well. For example *Mayer and Ottaviano* (2008) for 8 European countries, *Castellani, Serti and Tomasi* (2010) for Italy regarding the size and productivity of firms. As for developing countries, *Eaton et al.* (2007) show from Colombian data that exporters are more productive already before starting to export. Furthermore, for example *Castellani, Serti and Tomasi* (2010) in their paper also add the spatial and industrial concentration as a new dimension to the original list of characteristics regarding exporters.

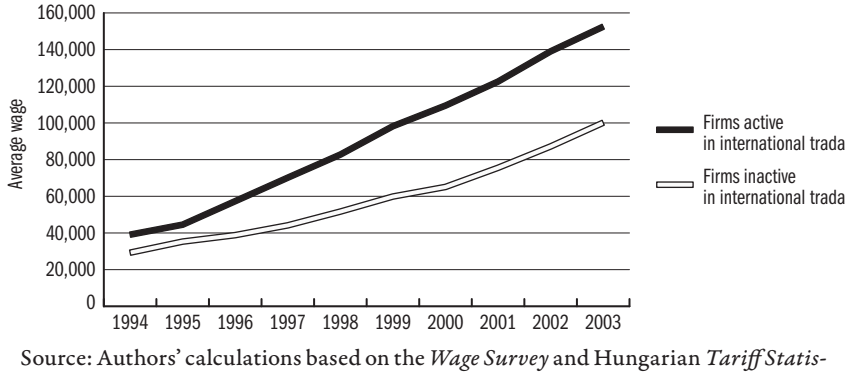
Table 4.1: Some average characteristics of firms participating in international trade compared to internationally inactive firms

	Number of employees		Log of capital-labor ratio		Ratio of employees with higher education		Productivity	
Year	active in trade	not active in trade	active in trade	not active in trade	active in trade	not active in trade	active in trade	not active in trade
1994	465.62	126.23	–0.09	–0.19	0.12	0.10	1.79	–0.29
1998	239.58	58.85	0.38	0.15	0.15	0.09	1.94	1.30
2003	248.19	65.39	1.05	0.68	0.18	0.17	2.56	1.98
1994–2003	302.63	77.81	0.44	0.29	0.15	0.12	2.29	1.64

Note: The main distinctive characteristics of exporting firms stated by *Bernard and Jensen* (1999) are also present among Hungarian firms that participate in international trade.
Source: Calculations of the authors based on Hungarian tariff data from 1994–2003.

We can see from the table that the firms active in international trade have on average approximately 3.5 times more employees compared to other firms. The ratio of the applied capital and labor in the production is also always higher for the firms that are either exporters or importers, and the difference is growing in time – the capital-labor ratio of the firms that are involved in international trade is 110% of the capital-labor ratio of the inactive firms in the first year, and approximately 140% in the last year of the data. Similarly, the ratio of employees with higher education is higher among the firms that are trading, although this variable does not distinguish the two groups as clearly as the former ones; the aggregate difference is only 3 percentage points, and we can find only a 1 percentage point difference for 2003 too. However, productivity shows a more straightforward picture again; the firms with foreign trade partners have on average 82% more revenue per worker, which is a large difference. *Figure 4.3* demonstrates that this difference also appears in the wages.

Figure 4.3: Average wages (HUF) at firms that participate in international trade and in the group of internationally inactive firms



Source: Authors' calculations based on the *Wage Survey* and Hungarian *Tariff Statistics*. The average wages are in Hungarian forint (HUF), one euro is worth about 300 HUF.

The graph also shows that the positive correlation between international trade activity and wages is significant. The difference between the wages paid in the two groups was growing throughout the years, and has stabilized at approximately 30%.

Export or import?

So the firms participating in international trade are special in several ways, and their wages are also higher. What is the reason for this? Are importers also larger and more productive, just as exporters?

It is commonly believed that the export activity shows the success of a firm, industry or even country, since a company is only capable of exporting if its product is competitive on the market, if it offers a good quality product at a cheap price. On the other hand, imports are believed to crowd out domestic producers, so we usually do not associate beneficial aspects to it.

However, the data show that this way of contrasting imports with exports is not justified. In *Table 4.2* we present average wages paid by firms in different categories regarding trade activity (only exporter, only importer, both, none) for the year 2003. Both the exporters and the importers pay higher wages on average compared to the firms that do not participate in international trade. The highest, 45 percent wage difference is between the importer and non-importer firms, while the role of the export seems to be smaller, only 12 percent.

Table 4.2: Average wages paid by exporter and importer firms (Hungarian forint)

	Non-importer	Importer
Non-exporter	100,100	145,200
N (number of firms)	4,349	1,154
Exporter	111,900	157,300
N (number of firms)	418	2,884

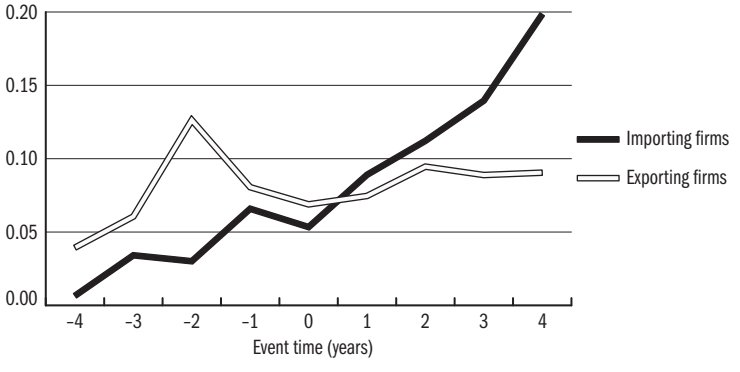
Note: The table shows the average gross monthly wage in manufacturing for the year 2003. Exporter is the firm that made sales abroad of any value in 2003. Importer is the firm that directly bought a product from abroad in 2003.
Source: The authors' calculations based on the *Wage Survey* and *Hungarian Tariff Statistics*.

From these wage differences of course it does not follow that international trade would directly affect wages. According to the last subsection the internationally active firms are in many ways different from their inactive counterparts, and it might be the case that the wage difference only reflects these differences of the firms. For example perhaps a well-educated, skilled manager who speaks foreign languages makes it possible for the firm to pay higher wages through better management practice. At the same time the manager also builds international relations and involves the company into external trade, but this might not have any effect on the wages in itself. In this case

we would observe higher wages at firms that are engaged in export/import activities, although there would be no causal relationship between international trade and the wages.

To be able to distinguish the effect of self-selection from the real causal effect on the wages, let us consider the following event study. We examine how the wage changes before and after the firm starts to export/import. *Figure 4.4* shows the wage difference from the non-exporter/non-importer firms as a function of the "event time". The event time is defined as the number of years which have passed since the first export/import. In the case of a negative number the event has not happened yet, for example t=–2 means that the firm will start to export (or import) two years later.

Figure 4.4: The wage difference through time before and after the start of the export/import activity



Note: The figure shows the difference of the log gross monthly wage at the exporter/importer and the internationally inactive firms. The reference group is the group of firms that do not participate in international trade. Exporter is the firm that made sales abroad in any value between 1992 and 2003. Importer is the firm that directly bought a product from abroad between 1992 and 2003. The estimates are calculated after controlling for occupational heterogeneity (4-digit codes) and time effects (year dummies).

Source: The authors' calculations based on the *Wage Survey* and *Hungarian Tariff Statistics*.

The figure depicts the exporter and importer firms' wage premium separately. The exporters already pay higher wages than the non-exporters four years prior to becoming exporters, and this wage difference does not grow after the start of the trade activity. We could potentially interpret this as follows: these firms are special before the export activity; they are well-managed, employ skilled labor, and this is the reason why they pay higher wages. Exporting is rather a symptom of their success, not the cause of it.

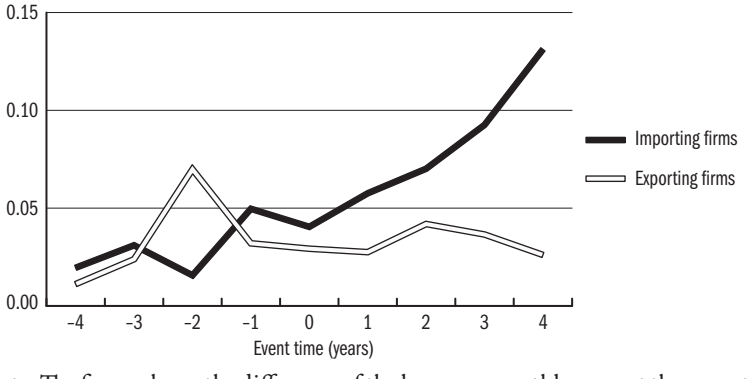
However, the wage difference calculated for importing firms is continuously growing, and it is much higher after becoming an importer than the years before the start of the activity. Nevertheless, it is interesting that this wage growth

is observable before the first importer year, a possible reason for which is that the firm employs workers who can better use foreign products and technology.

Although the increasing wage differences are consistent with the idea that the import causes the wage growth, it does not prove the causal relationship. At the time when the firm starts to import it might also undergo several other organizational changes, and some of them may cause an increase in paid wages (this is true of course for the exporters as well). It might be that the importing firm actually lays off some people, and fires its unskilled workers. Although in *Figure 4.4* we controlled for occupation with 4-digit FEOR codes (Hungarian code system of occupations), of course even within the same occupation there might be higher and lower paid workers. Moreover, it is also possible that the firm imports machines as an investment, and the increase we observe in wages only reflects a higher capital-labor ratio; it is not the effect of the import activity.

In *Figure 4.5* we try to control for these effects by taking out the variation caused by individual-level variables (gender, age, education) and certain firm-level variables (size, fixed assets, foreign ownership). As we can see in the figure, the estimates for the wage differences are smaller than earlier, but the tendency they show is similar. The export wage differential is positive before the start of the actual activity and it is somewhat stable through time, while the import wage differential rather increases.

Figure 4.5: The wage differences before and after the start of the trade activity – after controlling for individual and firm characteristics



Note: The figure shows the difference of the log gross monthly wage at the exporter respectively importer and the internationally inactive firms. The reference group is the group of firms that do not participate in international trade. Exporter is the firm that made sales abroad of any value between 1992 and 2003. Importer is the firm that directly bought a product from abroad between 1992 and 2003. The estimates are calculated after controlling for occupational heterogeneity (4-digit codes), gender, age, education, firm size (number of employees), capital-labor ratio, foreign ownership and time effects (year dummies).

Source: The authors' calculations based on the *Wage Survey* and *Hungarian Tariff Statistics*.

How does the import affect the firm and its employees? Why are importer firms able to pay higher wages? Since these results do not match our preliminary expectations, we believe it is worthwhile to examine the effects of the import more closely.

The effects of imports and offshoring

Offshoring probably belongs to the most heavily debated questions in the literature of international trade. The first thought that comes to mind is that the firm that outsources parts of its own activities necessarily will employ fewer workers. The firm in the textile industry that makes clothes using imported materials must have fewer employees than the firm that do more phases of work, for example weaving and sewing too.

However, neither the definition of offshoring nor its effect is that straightforward. When do we say that the firm is importing goods in order to outsource one or more phases of work? Is it offshoring if the furniture manufacturer buys the wood already processed and painted from abroad? Intuitively, we talk about the firm offshoring part of its production process if in a perfectly closed economy the given firm would produce the goods that are imported in the open economy. Although this definition is useful in terms of economic thinking, it is hard to express or measure it using the data.

So the literature defines the measure of *broad offshoring* as the value of all goods imported by the firm, while the *narrow offshoring* is the value of imported goods that are the products of the industry the firm belongs to. Intuitively, we only want to include those imported goods into the calculations that are the substitutes of the goods which would be produced by the firm in the hypothetical closed economy. As also *Pető* (2012) explains, even the stricter definition might overstate the extent of offshoring; besides, it is obvious that the second measure is sensitive to how narrow we define the industry of the firm.

According to *Grossman and Rossi-Hansberg* (2008) this confusion comes from the fact that – as the name of the phenomenon would also imply – firms are offshoring tasks and activities, not products. This approach, which the authors call *task trading,* throws new light upon the question of drawbacks and benefits of offshoring. First of all, as in the case of trading with goods, offshoring (task trading) means specialization, and because of the economies of scale it increases the firms' productivities in both countries. Furthermore, by delegating certain tasks to partners abroad the firms might be able to procure goods that are cheaper and possibly of better quality than the ones they could produce on their own.

Both mechanisms increase the market share of the offshoring company, also amplifying the demand (and the wages through this) for every type of labor applied in the industry. This effect might even dominate the trivial negative effect that the offshoring implies. That is, for example the firm that only does

sewing may have a higher labor demand than the firm that does weaving as well. In this subsection we examine how much labor receives from the possible surplus caused by offshoring in the form of wage.

Pető (2012) calls the effect of offshoring that works through the growth of productivity the *indirect* effect of offshoring. Even in this case – just as in the models about the trade of goods, where the producers that manufacture the imported products are the losers of the trade liberalization – the demand for the worker's labor that would do the delegated task will decrease. Following the example in the textile industry, after offshoring the firm does not need weavers. Since typically the labor supply is not capable of changing this flexibly, the price of the labor related to this task will be lower in the new equilibrium; that is, the relative wage will decrease. *Pető* (2012) calls this the *indirect* effect of offshoring. This side recieves more attention in the public discourse, because in the developed countries it leads to the further marginalization of unskilled workers.

So to assess the wage effect of imports, our main question is if it ameliorates the growth opportunities of the firm. As we have seen above, in that case the average worker might win with the possibly increased labor demand. The growth and optimal size of a firm is primarily determined by its productivity. So in the following subsection we examine the effect that the import activity has on the firm's productivity. We distinguish between the import of general inputs and intermediate goods (offshoring in the broad and in the narrow sense) from the capital import. While the former ones may allow the firm to produce cheaper, the import of capital goods can be seen as a form of technology import.

Offshoring and the productivity of the firm

Why can a firm that uses imported inputs be more productive? The theoretical literature (*Ethier,* 1982, *Grossman and Helpman,* 1991, *Feenstra,* 1994) distinguishes two separate effects. On the one hand the imported inputs might be of higher quality than their domestically available counterparts at the same price. In this case the firm is able to increase its productivity more with the input from abroad than with the domestic product. (It is also possible that a product of similar quality is much cheaper abroad than at home. From the economics point of view it results in the same effect.) On the other hand there might be some special inputs that are not available domestically at all, and can be substituted only with great loss of efficiency. To give a simple example, a restaurant might substitute the Roman cumin with black pepper but by doing that it will never achieve the same taste.

What do the data tell us about the effect on productivity? *Amiti and Konings* (2007) showed at first on a sample of Indonesian firms that the decrease of tariffs related to imported inputs significantly increases the productivity of the firms. This is consistent with the explanations above, if the decreasing tariffs

increase the use of the imported inputs and through this the firms's productivity. We see for Indian firms that importing companies do not just become more productive, but they also produce a wider variety of products (*Goldberg, Khandelwal and Pavcnik,* 2010). That is, they really increase their size and gain access to new markets.

According to the results of *Halpern, Koren and Szeidl* (2011) also the Hungarian data show that imported inputs significantly increase the firms' productivity. Based on the methodology suggested by *Olley and Pakes* (1996) the first column of numbers in *Table 4.3* presents the estimates of the parameters of a production function augmented with import. Beyond the usual factors of production (capital, labor, raw materials) the import also influences the productivity of the firm. The firms that use imported inputs in the optimal proportion (according to the authors this is 67 percent) are on average $0.78 \times 0.17 = 13$ percent more productive than the ones that do not import at all.

Table 4.3: The productivity effects of import – estimates of the average firm's production function

Dependent variable	Logarithm of the revenue	Logarithm of value added
Capital (log)	0.029***	0.251***
	(0.003)	(0.004)
Labor (log)	0.200***	0.750***
	(0.003)	(0.005)
Materials (log)	0.788***	
	(0.003)	
Per-product import gain	0.174***	
	(0.046)	
Optimal import share	0.666***	
	(0.108)	
Efficiency of imports	1.116***	
	(0.080)	
R&D share of capital		0.091***
		(0.006)
Foreign ownership	0.039***	0.219***
	(0.011)	(0.014)
Industry and year dummies	Yes	
Number of observations	127,374	112,917
R^2		0.788

Note: The definition of the import variables and the parameters see in *Halpern, Koren and Szeidl* (2011). The estimation identifies with the method of *Olley and Pakes* (1996) the differences in productivity using the firm's investment level as proxy. The standard errors are in brackets.

*** Significant at the 1 percent level.

Source: Based on *Halpern, Koren and Szeidl* (2011), and *Halpern et al.* (2012).

By the results of the estimation, given the same prices the imported inputs represent 11.6 percent higher quality than the domestic ones on average. The 40

percent of the whole productivity effect can be attributed to the higher quality of the imported goods, and 60 percent to the imperfect substitution.

Imported machines and firm productivity

How much different is the effect of imported machines? An item of specialized industrial equipment incorporates a serious amount of technological knowledge, and depending on its quality usually allows for a more precise, faster and better quality production process. For example the computer controlled (CNC) lathes are faster and more precise than the manual ones. Moreover, there might be quality differences even between CNC lathes. Surveying managers of Indian metalworking firms *Sutton* (2000) finds that CNC machines imported from Taiwan and Japan are believed to be more reliable and economically efficient than the domestically produced ones. So by importing good quality equipment it is possible to produce at a higher technological level.

How can we measure the quality and technological level of machines? *Halpern et al.* (2012) distinguish the machines imported to Hungary according to the country of origin. Certain countries are very different in the level of research and development in manufacturing and its related industries *(Table 4.4)*.

Table 4.4: The Hungarian machine import according to country of origin

Country of origin	Share of import (percentage)	R&D intensity
Germany	35.9	12.1
Austria	8.8	12.1
Japan	7.6	14.6
Italy	5.5	6.3
United States	3.8	18.2
France	3.4	17.8
United Kingdom	2.5	10.0
Belgium	1.8	9.6
Netherlands	1.4	14.4
Spain	1.4	4.7
Hungary	–	1.2
Total	72.1	12.3

Note: The R&D intensity is the ratio of the expenditure of the firms on R&D and the added value between 1992 and 2003 in the industries with 29–35 NACE codes.
Source: Calculations of *Halpern et al.* (2012) based on OECD and Eurostat data.

For the highest value Hungarian firms buy machines from Germany, where 12.1 percent of the value added is spent on research and development. In Italy the same statistic is 6.3 percent. To compare these values, the expenditure of the Hungarian machine manufacturing sectors on research and development is only 1.2 percent of the value added. Although it is obviously not perfect, the R&D intensity of the country of origin contains some information about the quality of the imported machine.

Halpern et al. (2012) estimate the effect of the imported machines on the productivity of the firm. Since every trade partner of Hungary has higher R&D intensity, it is not surprising that imported machines increase productivity to a larger extent than the domestically manufactured ones. The second column of numbers in *Table 4.3* presents the results of this estimation. (As the dependent variable here is the value added by the firm and not the revenue, the coefficients are not comparable with the first column.) Given the same book value of applied capital (fixed assets) the firm is more productive if it uses machines from countries with a higher R&D intensity. If the average manufacturing firm that has only Hungarian machines was to replace them with German equipment *of the same value*, the R&D intensity of which is ten times higher, the productivity could increase by 20 percent.

The effect of the imports on wages

So both the import of inputs and capital increases the productivity. The increased productivity allows the firm to expand on the market. To satisfy the higher demand, the firm needs more resources; that is, it also demands more labor. The increased demand might result in a higher wage rate – this is the already mentioned indirect effect. It is also possible that the firm needs a special type of labor to operate the foreign machines, to work with the imported input, or because of the offshoring the remaining tasks accommodated by the firm shifts the proportions of the given types of labor required (for example from skilled to unskilled). Either way, the import activity changes the structure of the labor demand, directly affecting the relative wages. This means that the effects induced by capital import and offshoring are different across certain groups of workers (occupation, educational group), so that they also influence wage inequality.

Based on *Pető* (2012) in this subsection we examine through the case of the Hungarian food industry how the imports that are closely related to the company's commercial activities affect the wages of workers having a certain task. The novelty of her approach is that based on 4-digit occupational codes (FEOR-4) *Pető* (2012) is able to identify the effect of offshoring for the different occupations. The usual industry- or firm-level approach of the literature might be deceiving, since they do not take into account that the wages compared before and after the import activity (if offshoring) potentially belong to qualitatively very different parts of the production process.

To enforce an approach that focuses on jobs, *Pető* (2012) categorizes the imported goods of the firms by how closely they are related to the tasks of a worker from a certain occupational group. This is possible because she has detailed universal Hungarian tariff data with 6-digit product codes. The paper distinguishes between three binary variables related to import, following the concepts of narrow and broad offshoring. The first one indicates if the total

import of the firm exceeds a threshold (*import*), the second one signals significant importing activity related to the worker's occupation (*related import;* for example in the case of a butcher any kind of meat), and the third one takes the value 1 if the output of the given task (occupation) is imported by the firm to a substantial extent (*output import,* in the case of the butcher processed chicken).

Table 4.5 shows the estimated parameters of two models from *Pető* (2012). The first is a cross-sectional model estimated by pooled OLS [columns (1) and (2)], the second one is a firm fixed effects model controlling for unobservable characteristics of the firms that are possibly endogeneous. In the latter case we can measure the wage effect only from variation within the firm through time (the wages change after the beginning of the export activity) and through occupations (for example the meat import affects the butchers but not the bakers).

Table 4.5: The effect of imports and offshoring on the wages in the food industry

	Logarithm of gross monthly wage			
	(1)	(2)	(3)	(4)
Import	0.044**	0.047***	–0.005	–0.009
	(0.018)	(0.017)	(0.008)	(0.008)
Related import	0.039**	–	–0.031**	–
	(0.019)		(0.007)	
Output import	–	0.047***	–	–0.014**
		(0.017)		(0.007)
Firm's control variables	size (logarithm of number of employees), logarithm of net revenue, foreign ownership dummy, export indicator variable, region, industry dummies, capital-abor ratio		size (logarithm of number of employees), logarithm of net revenue, foreign ownership dummy, export indicator variable, capital-abor ratio, productivity	
Individual control variables	gender, occupation, education, experience, $(\text{experience})^2$			
Firm fixed effects	no	no	yes	yes
Identified effect	total	total	direct	direct
Number of observations	17,443	17,443	17,478	17,478
R^2	0.78	0.78	0.77	0.77
Number clusters	3,870	3,870	1,285	1,285

Note: The total effect is the sum of the direct and indirect effects. The standard errors are in brackets.
*** Significant at the 1% level; ** 5% level * 10% level.
Source: Based on Tables A3–4. of *Pető* (2012).

As *Table 4.5* shows in columns (1) and (2), the effects of all imports are positive. However, this is not only the aggregate of the indirect and direct effects mentioned above, but includes the effect of the demand shift that follows from the changed set of skills required by the remaining tasks done at the firm after offshoring. For example if a wine producer makes a decision that they will no longer process its plants created by the firm, but rather work with vines created by French food engineers, then the wine makers might have to possess up

until then atypical skills and special knowledge to design a new production process (different timing, temperature, barrels of maturing etc.) that can use the advantages of the new technology (the special, imported types of plants). If this is the case, then the workers with the special skills might expect to receive their share from the extra profit. The regression results show that a worker earns on average 3.9 percent more if the firm imports a product related to his or her task and by 4.7 percent more if some imported goods are the output of the workers task (occupation). At first sight we could interpret these results as evidence that offshoring is beneficial even for the employees working in the directly related occupation. It is necessary to note however, that the wage difference probably contains the effects of self-selection, since in columns (1) and (2) we did not control for firm fixed effects. Also, these coefficients give estimates for the sum of the direct and indirect effects, because this model – unlike the equations following this – does not control for productivity, which is the channel of the direct effect.

Column (3) and (4) in *Table 4.5* controls for firm fixed effects. This time we compare occupations that are affected by imports in the firms with those that are not, as well as wages before and after the start of the import activity. The parameters related to offshoring change their signs and are just as significant as in the first two models. The workers whose firm imports products related to their occupation suffer from a wage loss of between 1.4–3.1 percent. It is important to see as well that the employee whose task is not related to the imported goods does not experience a significant wage drop.

To summarize, regarding the signs of the effects the results meet our expectations and are in accordance with the literature (*Helpman,* 2011): the empirical results show that the workers in the Hungarian food industry are right to be afraid of offshoring in their sector. But this income effect is relatively small, and the results are not necessarily true for other industries. According to *Pető* (2012) the same estimates for the Hungarian textile industry show a positive wage effect because of the productivity increasing effect of the imported goods.[5]

These results lead to further questions. We saw that the import increases productivity, but who gets the surplus from it? The results presented here suggest that the effect of import is heterogeneous regarding different occupational groups. Is there another dimension along which we can observe such heterogeneity? In the following subsections we examine this question.

The effect of international trade on wage inequality

Based on the results presented above we can state that external trade increases the productivity of the firms and that they at least partially share the revenues coming from this enhancement with their workers. However, not every employee is affected by the increased labor demand. In this subsection we examine how international trade influences wage differences. Since the firms that are

5 It is also true that in these regressions we examine the effect on the wages, and for example it is possible that the firm leaves the wages unchanged after offshoring, but terminates jobs; that is, it adapts by adjusting its labor demand.

engaged in international trade are different from the others in several aspects, it is natural that the composition of their labor demand is also different. If as a result of the trade activity the labor demand grows more in those groups of workers that already had a relatively high wage before importing, it leads to an increase in the wage inequality.

Pavcnik and Goldberg (2007) enumerate several mechanisms through which international trade could affect the distribution of wages. We can sort them according to the dimensions (variables) along which they create winners and losers. The simplest dimension is, as we have already mentioned, the level of education. The sign of the effect along education is not that straightforward however. The Stolper-Samuelson effect would imply that the trade liberalization does not necessarily increase the wage inequality (*Stolper and Samuelson,* 1941). This early classical theorem says that as an effect of international trade, the relative wage of unskilled workers grows in emerging economies; in this way the wage inequality decreases in those economies. The reason for this is that in these countries the skilled labor is the scarcer factor, so the economy will specialize in the production of those products that require relatively more unskilled labor, and this increases the demand for this type of workers. There is specialization because it is cheaper to produce the less skill-intensive goods in the developing or emerging countries, while because of the relative abundance of skilled labor the conditions to produce more skill-intensive goods are more favorable in the developed countries (*Feenstra,* 2004, 1–31. p.). Although the Stolper-Samuelson effect is present to a certain degree, according to the larger share of the literature the data do not support its primary importance. For example while analyzing Argentinean data from the time of the trade liberalization related to the creation of Mercosur *Bustos* (2011) finds a significant effect with the opposite sign: as a result of the liberalization the wages of the skilled workers grew more than the wages of the unskilled workers.

The model of offshoring from *Feenstra and Hanson* (1997) might give an explanation for the empirical facts contradicting the classical theorem, because in that model the tasks that are not skill-intensive in the developed country (and being offshored) belong to the skill-intensive tasks in the developing country because of the big technological gap. This way from the point of view of the developing country the demand for the skilled workers will increase. *Acemoglu* (2002) and *Koren and Csillag* (2011) argue that usage of advanced technologies requires higher education and better skills from the average worker. This implies that in mechanisms stressing the connection between trade and technology import, imports induce skill biased technological growth through their effect on productivity. The most straightforward example for such a mechanism is the import of capital goods (machines), since this can be regarded as direct technology import; we will examine this channel in detail below. But the earlier example of the wine maker also belongs to this group of mechanisms;

when the imported input is of better quality, and the handling of it requires a higher level of knowledge during the production process. In the literature we can also find examples for the export activity causing an urge to improve on the quality of the product, which in turn requires higher skills and level of knowledge from the workers (see *Verhoogen,* 2008 for details). Although the results in these papers taken one by one are very plausible, unfortunately the econometric identification of the effects of the export/import induced skill biased technological growth is very problematic. As *Spitz-Oener* (2006) describes, one of the most important obstacles is that it is vital to enforce the above mentioned approach that puts the occupation (the tasks in fact) into the focus of the identification strategy (see also in *Pető,* 2012).

The second dimension along which the heterogeneity in the wage effect of import might be significant from the point of view of wage inequality is the employee's place in the firm's hierarchy; that is, how many managerial tasks the employee has. This dimension appears as occupation in the data. The literature on this topic is much smaller and recent. Here the basis of the heterogeneity is that the managers have special tasks, which are inherently different from the work of the machine operators for example.

It would not be unrealistic to make the hypothesis that the managers get the extra profit from the increased productivity. *Tóth* (2011) argues that it is also possible that we will find the wage surplus related to import at the lower levels of management (supervisors) – thanks to their private information regarding the production process as direct supervisors. At the same time *Eaton et al.* (2009) present some evidence that since the top managers initiate the import activity, and they also play a decisive role in establishing a trade relationship, which task requires their specific skills, they should be the ones who benefit from the extra trading profit.

The demand for skills

One criterion that the literature finds important from the point of view of the effects of international trade is the quality of the labor force. In the countries where human capital is abundant international trade necessarily increases the demand for skilled labor. But from the point of view of the classical theoretical literature it is surprising that according to the results presented the developing countries experience the same, even though skilled labor there is a relatively scarce resource.

As *Koren and Csillag* (2011) argues, the increase of the demand is a direct effect of the import. As we saw already, imported machines represent a higher technological level than the domestically produced ones. This means that the worker needs more education or more work experience to operate them as well. That is, the machine import increases demand exactly for those workers who are already valued higher by the labor market.

Let us consider those workers whose occupation includes operating some industrial equipment. Machine import might have a very direct effect on them, since they come into contact with it through their everyday work, not only through the increase of the firm's productivity. The exact classification of the employees' occupations and the detailed classification of the imported goods makes it possible to measure the import exposure more accurately. For example "printing machine operators" are directly affected by the import of offset import machinery, but not by the import of "metal lathes", maybe only indirectly.

We find 99 thousand machine operators in the *Wage Survey* between 1994 and 2004. 39 thousand of them have worked for a firm that has imported machinery earlier that can be linked to their occupation. They earn 20 percent more on average compared to other workers who have the same occupation and are not exposed to imports (*Koren and Csillag,* 2011, Table 1 and 2). But this wage difference might be attributed to other differences between firms (the importers are larger, more likely foreign-owned and more likely to export). To identify the effect of machines on labor demand we need to control for more firm and individual control variables.

Column (1) in *Table 4.6* shows the results of a linear regression that regresses the logarithm of the wage on the import variable (now only taking into account the machine import), besides having the size of the firm, an indicator of foreign ownership, occupation (4-digit FEOR) and year dummies, respectively the gender, age and education of the worker as control variables. (We do not present the coefficient of the control variables.) After accounting for the effect of these variables there only remains a 10.5 percent wage difference between the wages of the machine operators who work for an importer firm and who are employed by a non-importer firm.

In column (2) of *Table 4.6* we distinguish the general machine import from the machine import related to the individual's occupation. If for example a printing machine operator works at a company that imported a metal lathe, then the worker gets on average a 5.5 percent higher wage than the printing machine operators that work for firms that do not import machines. This can be the result of the self-selection of the firms, but also the indirect effect of the import. If on the other hand the firm of the worker imports a printing machine, then the operator receives a 5.5 + 8.2 = 13.7 percent higher wage compared to other workers with the same attributes whose firms do not import industrial equipment. The 8.2 percent difference is the direct effect of machine import. The wage difference can be attributed partly to the different educational background and partly to the increasing return to education. The wage premium of secondary education[6] among workers who operate domestically produced machines is 6.9 percent. In the group of workers who work on imported machines the same surplus is 11.3 percent (first column of Table 6. in *Koren and Csillag,* 2011). That is, the return on formal education is higher on the imported equipment.

6 The average wage of high school and vocational school graduates relative to the wages of workers with primary school education

Table 4.6: The effect of machine import on the wages of the machine operators

	Logarithm of gross wage					
	(1)	(2)	(3)	(4)	(5)	(6)
Machine import related to occupation	0.105***	0.082***	0.028**	0.032**	0.053***	0.004
	(0.012)	(0.013)	(0.013)	(0.013)	(0.016)	(0.016)
Import of any machine	–	0.055***	–	-0.019	–	–
		(0.013)		(0.017)		
Machine import related to occupation, with high levels of R&D	–	–	–	–	0.72***	0.036**
					(0.016)	(0.017)
Firm control variables	logarithm of number of employees, foreign ownership status					
Worker control variables	occupation (FEOR-4) and year fixed effects, gender, high school education indicator variable, age, age-square					
Number of observations	543,175	543,175	32,549	32,549	543,175	32,549
R^2	0.404	0.409	0.862	0.862	0.404	0.862

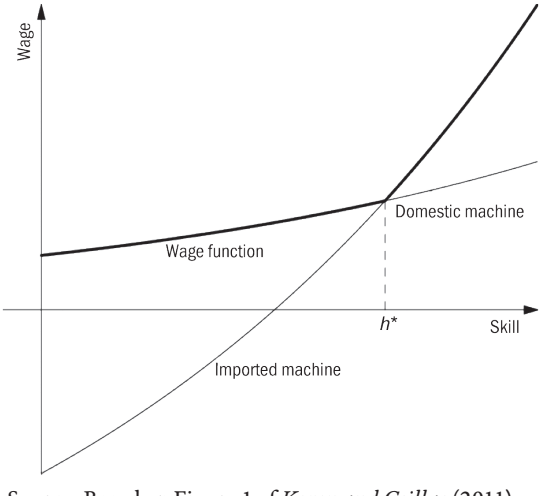
Note: We do not present the coefficients of the control variables of the firm and the worker. The coefficients of columns (1), (2) and (5) are estimated by pooled OLS, models in columns (3), (4) and (6) have panel fixed effects. The brackets contain the clustered standard errors (by firms).

*** Significant at the 1% level; ** 5% level * 10% level.

Source: Based on Table 4. and 5. in *Koren and Csillag* (2011).

However, education explains only a small part of the relevant skills of machine operators. We cannot measure the effect of on-the-job training, job experience or the original differences in skills and abilities. If the marginal revenue produced by these skills is higher when working on imported machines, then the firm obviously will assign the more skilled worker to those machines.[7]

Figure 4.6: The marginal product of skills on imported and domestic machines



Source: Based on Figure 1 of *Koren and Csillag* (2011).

Figure 4.6 demonstrates a framework in which we can think about this issue; it depicts the possible wages of workers with different skill levels if they work

7 See for example about the selection of the workers using computers *DiNardo and Pischke* (1997) and *Entorf, Gollac and Kramarz* (1999).

on domestic or imported machines. Workers aim for the highest wage, so they will work on the machine that comes with the higher wage curve. The productivity (and this way the wage) is increasing in conjunction with the skills on both types of machinery, but their return is higher on the imported ones. So above a given h^* skill level every worker works on imported machines, below that level everybody operates the domestically produced equipment.

How can we control for the effects of unobservable skills? In the *Wage Survey,* due to the lack of a worker identification variable the individuals cannot be followed through the years, but they can be assigned into groups based on their age, gender, education and occupation; then we can measure the changes in the average wages of these groups. We can compare for example the wages of a female machine operator in the textile industry with a high school degree and born in 1948 within the firm before and after the import activity. Since these groups are rather homogeneous (sometimes they contain only one observation), using the differences calculated above it is possible for the most part to control for the effects of unobserved skills.

The results of this within-group estimation is presented in columns (3) and (4) of *Table 4.6* We find that after the purchase of the imported machine wages increase by 3 percent on average in these groups; that is, the causal effect of the imported equipment is around this value. The detailed structure of the import data makes it possible to take a closer look at the effects on wages. Namely, the R&D intensity of the countries of origin might be substantially different. In the models (5) and (6) in *Table 4.6* we distinguished the imports from countries with high R&D intensity.[8]

The wage effect of the import coming from these countries is much higher; 60–90% percent of the whole wage surplus can be attributed to the high R&D. This is consistent with the argument that the machine imports affect the wages through the technology they represent.

In a simple model *Koren and Csillag* (2011) also investigate the general equilibrium effects of the imported machines. As the price of the machines decreases due to the trade liberalization, more and more firms start to import. The productivity of the machine operators working at these firms increases, and they receive higher wages than before, but those operators who have been working on imported machines for some time experience an increase in wages as well. The reason for this is that the machine required for their work became cheaper and more available, so they too would have more opportunities on the labor market. By raising the wage the firm can prevent those skilled machine operators who have been working with imported machines for a more extensive period from quitting. This effect can be easily observed in the data: In the occupations where the ratio of machine operators working with imported equipment grows faster, the wage premium of these workers increases faster as well. If for example the ratio of workers using imported machines grows by 10%, it will

8 Those countries belong to this group that are among the top ten in the R&D ranking of the OECD: Sweden, Norway, Japan, Belgium, South Korea, Finland, Germany, Denmark, the United States and the United Kingdom.

increase the wages of the machine operators who have already been working with imported capital by 0.5 percent compared to employees from the same profession (*Koren and Csillag,* 2011, Table 7, column 2).

The demand for managers and other occupational groups

In this section based on *Tóth* (2011) we examine if the effect of importing machines has a different effect on the groups of managers and production workers, and if so, who gets the premium for the import activity. While there are many papers on the heterogeneity of wages across educational groups, the literature pays much less attention to the variation due to workplace hierarchy or occupations in general. The topic is especially relevant for Hungary, because after the transition to the market economy – with the increasing number of firms – the number of management positions rose suddenly and the roles of the managers also changed in the production process. In the market economy there was an increased need for managers who were able to cope with (new) managerial tasks. This period also played an important role in shaping today's wage distribution in Hungary, so it is an interesting question as to how much the trade liberalization contributed to the jump in the income of people at the top of the hierarchy. *Tóth* (2011) examines the wage effect of export and import in four groups of employees: top managers, departmental (middle) managers, supervisors and other production workers. (The categorization of the employees is based on their 4-digit FEOR code.)

As we argued in the last section, the possible positive wage effect of international trade may be attributed to any of the managerial groups. Because either the employee plays a vital role in realizing the potential productivity enhancing effect of international trade (middle manager), or his/her special skills and social network is important in establishing a profitable relationship (top manager), or simply (s)he can enjoy some sort of informational rent as a direct supervisor of the production.

Similarly to the papers mentioned earlier, *Tóth* (2011) also uses a merged data set from the *Wage Survey* and the *Customs Statistics* for the years between 1994 and 2003. Using 4-digit occupation codes the author is able to match the employees to the right managerial category. Exporters are the firms whose export constitutes at least 10% of their revenue, and the indicator variable for capital imports takes the value 1 if the firm has ever imported a valuable machine needed for production. *Tóth* (2011) estimates the wage effect of the export and import with a Mincer-equation for each managerial group separately; the wage premium is the coefficients of the *exporter* and (capital) *importer* variables. There are firm-level (size, region) and worker-level control variables (gender, educational background, experience), and the paper estimates pooled OLS and firm fixed effects regressions. In this latter case the coefficients of the *import* and *export* variables are meant to measure the increase of the wages af-

ter the start of exporting and importing. Lastly, *Tóth* (2011) re-estimates the regressions for each year. In the following paragraphs we summarize the main conclusions drawn by the author from the results.

In order to get comparable results with the literature *Tóth* (2011) estimates the wage effect of the export without including the variables for import activity and foreign ownership in the regression. The wage premium of export is sizable in every managerial category (4–21 percent), and is significant at every conventional confidence level (*Tóth,* 2011, Table 7.1.). According to the regressions the higher the employee is in the managerial hierarchy, the stronger is the positive wage effect of the export. These results fit in the picture described by *Bernard et al.* (2007), but they practically collapse if we put the other two indicator variables denoting international involvement in the regressions. In this case the wage effect of export is not significantly different from zero anymore (see *Table 4.7*). This suggests that it is not the export that is related to a premium but the import activity. This corresponds to the results cited in the previous sections, according to which it is a questionable view that the export is the key for technological growth and every import activity is suspicious.

Table 4.7: The effect of import and export on the wages in various occupational groups (cross-section results)

	Log wage			
	production workers	supervisors	middle managers	top managers
Exporter	–0.00281	–0.0412*	–0.0328	–0.00564
	(0.0100)	(0.0242)	(0.0331)	(0.0445)
Capital importer	0.0763***	0.129***	0.139***	0.0755**
	(0.0115)	(0.0213)	(0.0418)	(0.0359)
Foreign ownership	0.197***	0.249***	0.348***	0.475***
	(0.0161)	(0.0257)	(0.0429)	(0.0563)
Worker characteristics	yes	yes	yes	yes
Firm characteristics	yes	yes	yes	yes
Firm fixed effects	no	no	no	no
Year fixed effects	yes	yes	yes	yes
Number of observations	501,590	33,155	8,712	6,928
R^2	0.740	0.663	0.613	0.554

Note: We do not show the coefficients of individual and firm-level control variables. The worker-level control variables: *occupation* (4-digit FEOR), (employment) *experience, experience*^{2}, *educational background*, *gender*. The firm-level control variables: *size* (number of employees), *region*. Estimation method: OLS. The firm clustered standard errors are in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

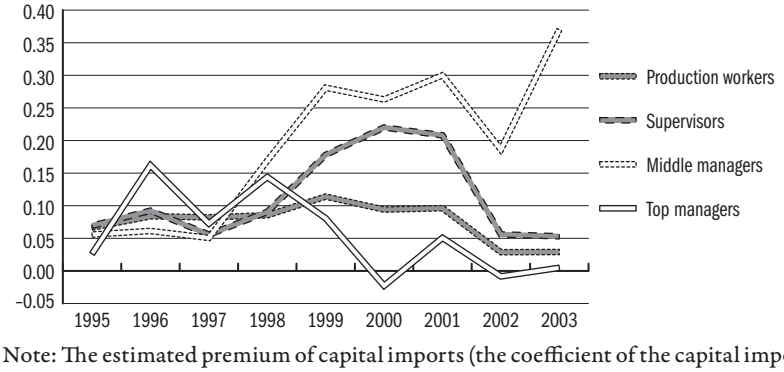
Source: Based on *Tóth* (2011) Table 7.1.

We can state that the import, if it represents a more advanced technology (for example the capital import from the United States), has a positive premium not only with respect to productivity but in the wages as well. How does the

capital import affect wages in the various occupational groups? As *Table 4.7* shows, the import variable is always significant, its coefficient reaches its peak around 13–14 percent in the regressions of supervisors and middle managers, while the wage premium of import in the group of top managers and production workers is around 7.5 percent. This gives an inverted-U shaped pattern, that is, the middle managers and supervisors get more from the surplus generated by the import activity. We can interpret this as the market rewarding the specific skills of these managers, like being able to reshape the production process so that the opportunities offered by the imported capital can be realized. This mechanism is emphasized by *Tóth* (2011) and partly by *Mion and Opromolla* (2011) as well. Another result related to this is from *Caliendo, Monte and Rossi-Hansberg* (2012). Their model shows that just like the contraction or expansion of a firm, international trade activities are also followed by reorganizing the managers' hierarchy.

Tóth (2011) runs the same regressions separately for each year in the sample, so that we can have an idea how the wage effect of import evolved over time. *Figure 4.7* shows the import premium in each managerial group; the coefficients are from regressions that – besides the mentioned factors – also control for the capital-labor ratio of the firm. Putting this variable in the regression (along with other variables that are correlated with the import status) is important to control for endogeneity, but at the same time it can be an important channel for the effect of the imports on productivity,[9] that is the reason why it is not in the baseline model (*Table 4.7*). Surprisingly, the coefficients from these regressions show the above mentioned pattern in wage premia even more clearly.

Figure 4.7: The wage effect of export and capital import for each occupational group and year (cross-section results)



Note: The estimated premium of capital imports (the coefficient of the capital import indicator variable) for each year from 1995–2003; the model of *Table 4.7* was used without the time fixed effects, but we also controlled for the capital-labor ratio (that reinforces our results).
Source: *Tóth* (2011), Table 6.

9 For example imported machines are more expensive and delicate to handle, so the supervisor just makes the worker take more care during work.

The results described above are also based on data from the years after 1998; until that year it is not straightforward which occupational group profited the most (if at all) from the capital import. The 1998 boundary is close to the time determined by *Kézdi* (2002) when the first period of the transition of the Hungarian labor market characterized by inter-sectoral reallocation ended. As *Tóth* (2011) explains this phenomenon, probably the reform rush of the transition, the effect of the radical institutional changes of the Hungarian economy can be seen on the magnitude of the coefficients from the regressions of the first years.

Conclusion

In this paper we showed that international trade – especially import – has mostly a positive effect on wages. Not everybody gains equally, and we found example of a wage decrease as well, but the primary effect tends to increase wages. What is the economic policy that could exploit these opportunities to increase income?

First of all, only a small share of the firms participates in international trade, despite the fact that this would generate a significant productivity growth on the micro-level as well. Especially small firms have limited international connections. With targeted information and financial support campaigns the participation rate could be increased. It is important however, that the policy should not only focus on helping with the launching of a product on the external market and increasing the competitiveness of export, but also needs to help the firms to access the potential partners for import. The majority of small firms are probably not aware of the opportunities related to imports, how much they could reduce costs and what kind of organizational and technological changes are needed to realize these gains. In the light of the results cited above, we would especially recommend giving firms incentives to import machines with more advanced technology.

Secondly, we saw that imports have a particularly sizable effect on the wages of skilled labor and lower-level managers such as supervisors and middle managers. Often technology import is the only opportunity for an employee to work with cutting-edge technology, and acquire skills related to it. We did not study the long-run and general equilibrium effect of import that potentially increases the average skill of workers, but we think it is important that the economic policy should help this mechanism instead of hindering it. Moreover, the negative wage effects that are associated with unskilled workers should be mitigated with targeted policy measures not with trade discrimination.

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