Department of Economics

Essays on the Internationalisation of Firms

Hanna Pesola

Aalto University

DOCTORAL DISSERTATIONS

Aalto University publication series
DOCTORAL DISSERTATIONS 12/2011

Essays on the Internationalisation of Firms

Hanna Pesola

Aalto University
School of Economics
Department of Economics

Aalto University publication series
DOCTORAL DISSERTATIONS 12/2011

ISBN 978-952-60-4036-3 (pdf)
ISBN 978-952-60-4035-6 (printed)
ISSN-L 1799-4934
ISSN 1799-4942 (pdf)
ISSN 1799-4934 (printed)

Aalto Print
Helsinki 2011

Aalto University

Abstract

Aalto University, P.O. Box 11000, FI-00076 Aalto www.aalto.fi

Author
Hanna Pesola

Name of the doctoral dissertation
Essays on the Internationalisation of Firms

Publisher School of Economics

Unit Department of Economics

Series Aalto University publication series DOCTORAL DISSERTATIONS 0/2011

Field of research Labour Economics, International Economics

Abstract

This dissertation studies the internationalisation of firms and the consequences of this phenomenon for the employees of firms involved in international activities and for purely domestic firms. These analyses make use of Finnish linked employer-employee panel data. The dissertation consists of four essays.

The first two essays in the dissertation analyse spillovers from multinational to domestic firms. The first essay studies whether employees are able to appropriate returns to knowledge accumulated in foreign-owned firms when moving to domestic firms. The estimates indicate that highly educated employees earn a return to prior experience in a foreign owned firm, over and above the return to other previous experience. These workers do not appear to pay for the accumulation of knowledge in the form of lower wages.

The second essay compares the productivity and wage effects of labour flows between multinational and domestic firms. The results indicate that hiring workers from foreign multinationals is related to both higher productivity and higher wages in local domestic firms. There is no net effect on profitability growth. More detailed analysis of the labour flows indicates that these effects are driven by hiring of relatively young workers who appear able to internalise the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms.

The third essay of the dissertation analyses employee flows in firms subject to foreign acquisitions. The results show that in the industrial sector, the job separation hazard increases in the year following a foreign or domestic acquisition. Neither foreign nor domestic M&A transactions appear to influence the job separation hazard of service sector employees in the first year following the acquisition, but in the second and third years after the transaction the job separation hazard increases with a larger change following foreign than domestic acquisitions.

The fourth essay of the dissertation develops a theoretical model that enables the analysis of the effect of international trade on both intra- and intersectoral wage distributions as well as unemployment. The major results we reach are as follows: a) factor price equalisation does not hold in the H-O-version of the model; b) aggregate changes like a change in the aggregate firm/job destruction rate can have implications for the sectoral allocation of factors of; c) the theory is consistent with the observations that exporting firms tend to be larger firms; d) the firm heterogeneity is endogenous.

Keywords Multinational enterprises, foreign acquisition; knowledge spillovers; labour mobility; wage distributions, international trade, linked employer-employee panel data

ISBN (printed) 978-952-60-4035-6 **ISBN (pdf)** 978-952-60-4036-3

ISSN-L 1799-4934 **ISSN (printed)** 1799-4934 **ISSN (pdf)** 1799-4942

Pages 143 **Location of publisher** Helsinki **Location of printing** Helsinki **Year** 2011

Acknowledgements

I have been fortunate to pursue my doctoral studies at the Department of Economics at the Helsinki School of Economics (now called Aalto University School of Economics). Many people there have contributed to this project in various ways. First and foremost I owe my gratitude to my supervisor Pekka Ilmakunnas. He introduced me to the field of labour economics during my master's thesis and subsequently provided me with the inspiration, opportunity, funding as well as an abundance of both academic and practical advice necessary to complete my doctoral studies. I especially appreciate his encouragement at times when the completion of this thesis did not seem very likely. Participating in his Academy of Finland project has provided welcome structure to my work and working as his co-author has been rewarding. I am also grateful to the other senior members and co-authors in our project, Mika Maliranta and Satu Nurmi, for their co-operation and patient guidance.

I have also been fortunate to have Pertti Haaparanta as my other supervisor. I am grateful to him for introducing me to the world of international economics and the research community involved. His profound knowledge of the field and endless patience in helping a hopelessly non-theoretically minded empiricist stumble through theory has been invaluable in our joint paper. I also wish to thank the other members of the faculty at the department for the support I have received over the years.

I have benefited a great deal from being part of the broader HECER community and appreciate the time that many people have taken to discuss my work. I would especially like to thank Kristiina Huttunen for the interest she has shown in my papers and the constructive comments I have received from her. I was also lucky to have two very knowledgeable economists in my field as pre-examiners of this thesis. Pedro S. Martins and Jakob R. Munch provided thorough and insightful comments that have improved this thesis and will also influence my further research.

This project would have been in serious trouble on many occasions if it hadn't been for the capable administrative staff at both our department and HECER. I am grateful to Jutta Heino, Kristiina Pohjanen and Jenni Rytkönen for their flexibility and willingness to help. No thanks are due to whoever invented HOPS.

I have received funding for my doctoral studies from several sources. I wish to thank the Helsinki School of Economics, the Academy of Finland (project

114827) and the Yrjö Jahnsson Foundation for providing the opportunity to work full time on my doctoral studies. I also thank the Heikki and Hilma Honkanen foundation for financial support in the early stages of my studies and the Government Institute for Economic Research for the possibility to finalise this project.

My doctoral studies would have been a much duller and more difficult project if it hadn't been for my fellow students. I am indebted to Olli Kauppi for all the hours spent together trudging through the first year course work. You have been an invaluable support ever since. I am also grateful to Antti Kauhanen for always being willing to read drafts of my papers and comment on them. I appreciate our discussions on all aspects of economics, not to mention our labour economics reading group together with Sami Napari (who never showed up). Apart from the reading group and numerous other occasions when he failed to show up for various get-togethers, Sami has been a great friend and colleague ever since we shared an office at the beginning of my studies.

Besides those mentioned above, I have been surrounded by wonderful fellow students who have made life both in and outside the office interesting and enjoyable. Thanks are due to Katja Ahoniemi, Anni Heikkilä, Satu Roponen, Torsten Santavirta, Pekka Sääskilahti, Hanna Virtanen and Lotta Väänänen for your friendship and support. I am also grateful to my long-time friends outside academia for trying to convince me that "it's just a job" and for being mostly understanding when it has become obvious over the years that this isn't the case.

This project would not have been possible without the support I have received from my family. I want to thank my parents Ritva and Tauno for everything they have done for me. I am especially grateful for their help in caring for my son. My in-laws Outi and Aaro have also been invaluable in providing childcare and thus enabling me to work on my thesis. I also want to thank my sisters Kaisa and Ulla for being there for me. Of course, I owe my deepest gratitude to my husband Markus for his continuous love and support. You and our son Eero bring joy to my life every day.

Helsinki, February 2011
Hanna Pesola

ESSAYS ON THE INTERNATIONALISATION OF FIRMS

This dissertation consists of an introduction and the following four essays:

Essay 1: "Labour Mobility and Returns to Experience in Foreign Firms". Forthcoming, *Scandinavian Journal of Economics*.

Essay 2: "Labour Market Transitions Following Foreign Acquisitions". HECER Discussion Papers, 2009, No. 251.

Essay 3: "Spillovers From Multinationals to Domestic Firms: An Empirical Analysis of the Profitability Effects of Labour Flows", with Pekka Ilmakunnas and Mika Maliranta. Unpublished.

Essay 4: "International Trade and the Distribution of Wages", with Pertti Haaparanta. Unpublished.

1 Introduction

The internationalisation of firms takes place both through international trade and through expanding operations abroad by undertaking foreign direct investments (FDI). Trade has historically been the most important form of internationalisation with marked increases since the 1960s. Trade liberalisation during this time period has also facilitated increases in FDI as multinational enterprises (MNEs) have been able to spread their production process between different countries. Trade was also one of the building blocks of the financial crisis that broke out in 2008 fuelled by large disequilibria within and among major national economies. Although FDI flows were hit especially hard by the crisis, they had been growing faster than international trade for several years and the expansion of activities abroad remains the driving force in the process of firms' internationalisation.

The internationalisation of firms both through trade and FDI has a particularly large influence on small open economies such as Finland. Finland's exports were almost 50% of GDP in 2006 following strong growth in the 1990s, while the stock of FDI rose rapidly at the end of the 1990s reaching approximately 30% of GDP in 2006. Also FDI by Finnish firms abroad has seen similar developments and totaled 43% of GDP at the end of 2006 (Statistics Finland, 2008). Analysing the effects of firms' internationalisation is, therefore, particularly interesting in the Finnish context.

The internationalisation of firms affects not only the firms actually involved in international markets but also those with only domestic activities. An important area of influence in and through which the internationalisation process operates is the labour market. The potential impacts of firms' international operations on their own employees and on other firms and their employees have been analysed both in the literature on international trade and the literature on MNEs. In international trade theory these issues have mostly been analysed in the context of the traditional factor-proportions models with perfect competition, which still hold certain advantages for e.g. the study of distributional issues compared to the increasing returns models of the 1980s (Krugman, 1980) and the more recent models incorporating firm level heterogeneity into these models of monopolistic competition (Melitz, 2003). In the literature on MNEs most analysis is based on the ownership-location-internalization framework created by Dunning (1977) and developed further into what Markusen (2002) calls the "knowledge capital" model.

Apart from distributional effects tackled by traditional trade theories, many of the issues that relate the internationalisation of firms to labour markets have

to do with firm heterogeneity, and this is what the newer theories of international trade and most theories of MNEs focus on. One of the main features of e.g. the literature on MNEs discussed above is that MNEs are assumed to possess some kind of specific advantage, such as technological, marketing or managerial knowledge, that enables them to operate profitably in foreign markets. Recent theoretical work on heterogeneous firms also implies that only the most productive firms are involved in foreign markets and among these firms it is the most productive ones that perform FDI with the rest only engaging in exports (Helpman et al. 2004). It is an undisputed empirical regularity that firms involved in international operations, be it trade or FDI, are larger, more productive and pay higher wages than their counterparts involved in purely domestic activities. Some of these differences have been shown to exist prior to the internationalisation process with better performing firms self-selecting into exporting and being "cherry-picked" by foreign acquirers. This observed heterogeneity has implications both for employees of these firms and for other firms in the market.

Differences between MNEs and purely domestic firms that can directly affect their own employees are e.g. wage level, skill structure and employment volatility. Domestic firms and their employees, on the other hand, may be influenced by MNEs competing in the same product and factor markets or by accessing knowledge possessed by MNEs either through market transactions or through spillovers. Spillovers may take place e.g. through backward and forward linkages, demonstration effects or labour mobility.

2 Overview of the Essays

This dissertation consists of four independent essays all related to the internationalisation of firms and the effects that this phenomenon has on the employees of firms involved in international activities and on purely domestic firms. The first two essays are related to the issue of spillovers from foreign owned or multinational firms to domestic firms through labour mobility. The first essay considers the issue from the point of view of private returns to employees with experience in foreign owned firms whereas the second concentrates on comparing productivity and wage effects of labour flows from multinational to domestic firms. The third essay considers the one off event of domestic firms moving into foreign ownership and the impact this has on job separations among the firms' workforce. The final essay develops a theoretical model that enables the analysis of the effect of international trade on both intra- and intersectoral wage distributions.

2.1 Knowledge transfer from multinational to domestic firms through labour mobility: who benefits?

Spillovers occur when domestic firms benefit from knowledge diffusing from MNEs, and the MNEs are not able to capture the full return to their knowledge. Such spillovers are expected to arise due to productivity advantages that multinational firms have over domestic firms. These productivity advantages have been documented in several empirical studies (see Barba Navaretti and Venables, 2004). As discussed in the previous section, theories of MNEs imply that productivity advantages are due to the fact that these firms require some type of specific advantage to be able to profitably establish themselves in foreign markets (Markusen 2002). Such an advantage can arise from superior technological know-how, managerial knowledge, brand names etc. To the extent that MNEs are more productive due to knowledge that is implementable within other firms, there is potential for spillover effects from multinational to domestic firms.

Potential channels for spillovers between multinational and domestic firms include i) backward and forward linkages, ii) demonstration effects and iii) labour mobility (Blomström and Kokko, 1998). The first two essays in this dissertation analyse labour mobility as a potential channel of productivity spillovers. If knowledge is transferred from foreign to domestic firms through labour mobility, the extent of the spillover or externality is defined by the division of the costs and benefits of knowledge accumulation between the foreign owned firm, its employees, and the firms these employees move to. In addition to models of spillovers through labour mobility between multinational and domestic firms, this type of phenomenon can be thought of in the context of models of R&D spillovers and models of on-the-job training.

Fosfuri et al. (2001) and Glass and Saggi (2002) develop models of spillovers from multinationals to domestic firms through labour mobility. The models imply a trade-off between technological and pecuniary spillovers to the local economy. The trade-off arises through the multinational firm's choice between allowing technology transfer and preventing it by paying the worker a premium. Malchow-Møller et al. (2007) develop a model where skills learned in high-productivity (foreign) firms are transferable to other firms and where workers joining high-productivity firms may receive a higher average wage and wage growth over their careers but a lower initial wage. Urban (2010) considers a model that differs from those mentioned above in that it distinguishes learning effects from technology spillover effects with these two effects leading to different impacts on host-country welfare.

The spillover models described above are based on workers moving from a firm with better possibilities for knowledge accumulation to firms where this

knowledge is not available. If knowledge diffusion actually takes place from domestic to foreign firms, which could be the case e.g. if FDI were technology sourcing[1], workers would be expected to benefit from mobility in this direction.

Spillovers from multinational to domestic firms have mostly been studied by examining the effect of the presence of a multinational company in an industry on the productivity of domestic firms. Most studies do not explicitly study the channels for these spillovers, and the evidence on the productivity effects of the presence of a multinational company is not conclusive (Barba Navaretti and Venables, 2004). The studies that do consider the mechanisms through which spillovers occur focus mainly on backward and forward linkages between firms (e.g. Smarzynska Javorcik, 2004; Aitken and Harrison, 1999). Also in these studies the evidence on productivity spillovers is mixed.

Empirical evidence on knowledge spillovers from foreign to domestic firms through worker mobility is scarce. Using data from Ghana, Görg and Strobl (2005) study productivity of firms run by owners who previously worked at multinational companies. They find positive productivity effects compared to domestic firms when workers established a company in the same industry as their previous employer. Balsvik (2006) studies Norwegian manufacturing firms, and finds that employees who move from multinational to purely domestically owned firms have a positive effect on total factor productivity. Employees with experience in multinational firms also earn higher wages than their co-workers, but the productivity effect of the increased share of workers with experience in multinational firms is larger than the effect that experience in multinational firms has on employees' wages.

Martins (2005) studies knowledge spillovers from foreign owned to domestic firms in Portugal by examining wages of employees moving from foreign owned to domestic firms. He finds that employees with experience in foreign owned firms earn more than their colleagues in domestic firms, but that workers still suffer sizeable pay cuts when moving from foreign to domestic firms. He finds similar evidence for Brazil (Martins and Estevez, 2008), where movers from foreign to domestic firms take larger wage cuts than movers from domestic to foreign firms. Malchow-Møller et al. (2007) also study a similar issue by considering the effect of experience in large vs. small plants arguing that

[1] Driffield and Love (2003) study panel data on UK industries and find that such "reverse spillovers" exist. They do not, however, consider the mechanisms through which these spillovers arise. Ali-Yrkkö (2006) uses Finnish firm level data to study the effect of patents on the likelihood of being acquired by a foreign firm. He finds that owning patents correlates with becoming a target for a foreign firm, implying that technology sourcing also through labour mobility may be relevant.

multinationals and large firms share relevant characteristics. They find that employees with prior experience in large plants earn a wage premium.

2.2 Labour mobility and returns to experience in foreign firms

The first essay in the dissertation considers the private returns that employees with experience in foreign firms earn when moving to domestic firms. If employees in foreign firms accumulate valuable knowledge, they would be expected to earn a return on this knowledge when moving to domestic firms. The type of knowledge often referred to in the context of spillovers, e.g. technological, managerial or marketing knowledge implies that knowledge transfer may require a certain skill level of the employee moving from a foreign to a domestic firm, so the educational level of employees who change jobs is taken into account. In addition, employees' earnings when they begin working at a foreign owned firm are studied to determine whether they are paying for this knowledge in the form of lower wages. Furthermore, spillovers can also occur from domestic to foreign firms, which could be the case e.g. if FDI were technology sourcing. To take this into account, both mobility from foreign to domestic and from domestic to foreign firms are studied.

The analysis is based on linked employer-employee panel data from Statistics Finland. The extensive data set consists of information on Finnish firms and workers in both services and manufacturing, and covers the period 1994 - 2002. Prior experience in a foreign owned firm has a positive effect on earnings of the university educated, over and above the effect of other previous experience. These employees do not appear to pay in the form of lower wages for the knowledge they accumulate at foreign owned firms.

2.3 Spillovers from multinational to domestic firms: an empirical analysis of the profitability effects of labour flows

The second essay in the dissertation searches for evidence of spillovers from multinational to domestic firms by examining hiring and separation of employees and the impact these have on firms' performance. We decompose firm-level profitability, productivity and wage changes into the effects of hiring from foreign owned multinationals, domestic multinationals and purely domestic firms as well as the effects of separating workers and those who stay at the same firm. This bears a resemblance to the kind of decomposition used frequently to decompose industry level productivity change into the impacts of entry and exit of firms, and productivity growth in continuing firms. The ability to study profitability growth is particularly important when analysing knowledge transfer, since any potential externality may be internalised in the labour market. If hired workers are fully compensated for their contribution to

productivity growth, there is no scope for profitability effects. The analysis of growth rates also enables us to control for any time-invariant unobservable effects that could bias the estimations. In addition, when analysing profitability growth, we are able to account for time-varying unobservable firm differences in productivity and wage levels as long as they are equal in the productivity and wage change equations. Similarly, the analysis of profitability growth tackles the selection bias arising from firms seeking to hire good workers and lay off poor performers. If wage setting is based on productivity, the bias should affect productivity growth and wage growth in the same way and will thus not appear in our measures of profitability growth.

Our analysis is based on a detailed and comprehensive linked employer-employee panel data set from Statistics Finland. The data set covers basically all firms in all sectors in Finland and all of their employees. We analyse performance changes in the two-year intervals 1997-1999, 1999-2001 and 2001-2003. In this study we are able to distinguish between foreign owned multinationals, domestically owned multinationals and purely domestic firms. As emphasised e.g. by Bellak (2004), the important difference is not between foreign and domestic ownership, but rather between multinationals and purely domestic firms. The results show that hiring relatively young workers from foreign multinationals has a positive effect on both productivity and wages. There is no effect on profitability, which would indicate that these workers are fully compensated for their positive effect on productivity, i.e. potential spillovers are internalised by the labour market. Separation of this type of personnel from foreign multinationals does, however, have a negative effect on profitability, implying that these workers capture returns on their productivity by moving to domestic firms.

2.4 Labour market transitions following foreign acquisitions

The third essay in the dissertation studies the impact that foreign acquisitions have on individual level employment outcomes. The analysis of the effects of foreign acquisitions links two distinct strands of literature: theories of multinational enterprises (MNEs) and theories of mergers and acquisitions (M&A). Theories of MNEs imply that employment in MNEs may differ from purely domestic firms both through differences in skill structure (Markusen, 2002) and in terms of the speed and magnitude of employment adjustment (Barba Navaretti et al., 2003). The higher share of skilled workers implies more rigid labour demand[2] but the ability to relocate implies a speedier and potentially larger adjustment.

[2] Hamermesh (1993).

The literature on mergers and acquisitions considers the effects of the actual change of ownership as a one-off event. The hypotheses on the effects of ownership change on employment derived from M&A models vary and are related to the different motives behind the transactions[3]. To the extent that acquisitions in foreign and domestic markets may be undertaken for different reasons and may involve e.g. different degrees of overlapping functions between the firms involved in the transaction, the implications for employees may be quite different following a foreign rather than domestic acquisition.

Empirical research on the employment effects of foreign acquisitions is still quite scarce and conducted on plant and firm level data. Most previous studies also only consider the manufacturing sector. Previous empirical research on the employment effects of foreign acquisitions includes: Girma and Görg (2004) for the UK; Piscitello and Rabbiosi (2005) for Italy; Balsvik and Haller (2007) for Norway; Bellak et al. (2006) for Austria; Bandick and Karpaty (2007) for Sweden; Martins and Estevez (2008) for Brazil; and Böckerman and Lehto (2008) for Finland. The results from these studies are mixed.

This essay seeks to complement earlier studies on the links between foreign acquisitions and the workforce, and contributes to the literature in two ways: firstly, the analysis focuses on the effects of foreign acquisitions for employment outcomes at the individual level, and secondly, all sectors of the economy are covered. By following the employees of firms subject to a foreign acquisition and combining this with information on individual characteristics, we can study whether some employee groups are e.g. more adversely affected by foreign acquisitions than others. Taking into account the subsequent employment status of employees that leave a firm following a foreign acquisition can also give us an idea of how severe the effects of potential workforce restructuring are at the individual level.

We use linked employer-employee data on a representative sample of Finnish employees in all sectors, which enables us to analyse the flow of workers in plants following a foreign acquisition. We decompose these flows by destination states and control for individual and firm characteristics in studying the effect that foreign acquisition has on the probability of ending up in a particular state. We also seek to establish whether the effects of acquisitions are similar regardless of whether foreign companies are involved, i.e. we distinguish between the effects of purely domestic mergers and cross border acquisitions.

[3] E.g. Jensen (1988), Bradley et al. (1983), Salant et al. (1985), Schleifer and Summers (1987).

The analysis shows that in the industrial sector, the job separation hazard increases in the year following a foreign or domestic acquisition. In the case of foreign acquisitions exits to both other jobs and non-employment become more likely with the probability of changing jobs increasing more than the probability of moving to non-employment. However, in certain industrial sectors, where technological know-how may be argued to be important, the job separation hazard does not increase following foreign acquisitions. There is no such difference between different types of industrial sectors following domestic mergers. M&A transactions do not appear to influence the job separation hazard of service sector employees in the first year following the acquisition, but in the second and third years after the transaction the job separation hazard increases with a larger change following foreign than domestic acquisitions. In the industrial sector the job separation hazard decreases in the second and third years following both foreign and domestic acquisitions, implying a one-off restructuring. The impact of a foreign acquisition does not vary by individual characteristics in either sector, whereas following a domestic merger there is an increase in the job separation hazard of university educated employees. Also older workers experience an increase in their job separation hazard following a domestic merger.

2.5 International trade and the distribution of wages

The fourth essay in the dissertation develops a theoretical model that enables the analysis of the effect of international trade on both intra- and intersectoral wage distributions. The discussion on the effects of trade liberalisation on income inequality has been going on for decades. Much of the discussion has been driven by a significant rise in inequality including a large rise in skill differentials in the US starting in the 1980s with trade being one of the most commonly studied causes along with technological change. Within the literature on international trade, most of the analysis on income inequality has taken place in the framework of the simple perfectly competitive factor-proportions model with some recent contributions involving models of firm heterogeneity. Abstracting from trade considerations, several different theories attempt to model wage dispersion. These include compensating differentials, sorting, efficiency wage and search theories of wage dispersion (see e.g. Mortensen, 2003 for an overview).

In this essay we adopt the approach of Burdett & Mortensen (1998), which is based on monopsony labour markets due to search frictions. The idea has been extended further by Acemoglu and Shimer (1999), Manning (2003), and Mortensen (2003) both in theory and empirics. This approach has the advantage of being simple but still able to account for many empirical "puzzles", such as employer characteristics being correlated with wages also

after controlling for worker characteristics. The model does not need the assumption of worker heterogeneity to account for wage distributions. In the model, search frictions give firms some monopsony power and together these two effects lead to an equilibrium where ex ante identical firms will pay different wages and are ex post heterogeneous. In this essay we extend the basic theory to a general equilibrium setting involving several sectors and international trade. In the context of international trade theory our model has the advantage of incorporating both endogenously determined firm heterogeneity and wage distributions.

Endogenous firm heterogeneity linked to international trade has been previously modeled by e.g. Manasse and Turrini (2001) and Yeaple (2005). Manasse and Turrini explain firm heterogeneity through the existence of skill differences between entrepreneurs and Yeaple through skill differences between workers and the selection of technologies. Yeaple e.g. shows that firms selecting new technologies also employ the highly-skilled workers and export. Wage dispersion within models with exogenous firm heterogeneity has been modeled by e.g. Davis and Harrigan (2007) and Helpman et al. (2010). The model in Helpman et al. (2010) is based on search and matching frictions similar to ours.

The theory we develop enables the analysis of endogenous firm heterogeneity as well as both intra- and intersectoral wage distributions. We can thus tackle issues such as the effect of international trade on the distribution of wages and unemployment. This is done by extending the standard Ricardian and Heckscher-Ohlin theories of trade, for which we mostly consider only the small open economy cases. The major results we reach are that: a) factor price equalisation does not hold in the H-O-version of the model despite the fact that sectors are paying at least partly the same wages; b) aggregate changes like a change in the aggregate firm/job destruction rate can have implications for sectoral allocation of factors of production (in contrast to some existing theories where only intersectoral differences matter); c) the theory is consistent with the observations that exporting firms tend to be larger firms; d) the firm heterogeneity is endogenous. We also provide empirical evidence on the differences between wage distributions of exporting and non-exporting firms using a linked employer-employee data set on Finnish firms and workers.

References

Acemoglu, D. and Shimer, R., 1999. Efficient Unemployment Insurance. *Journal of Political Economy* 107, 893-928.

Aitken, B. and Harrison, A., 1999. Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. *American Economic Review 89*, 605-618.

Ali-Yrkkö, J., 2006. Technology Sourcing Through Acquisitions – Do High Quality Patents Attract Acquirers?. Discussion Paper No. 1025, The Research Institute of the Finnish Economy.

Balsvik, R., 2009. Is Mobility of Labor a Channel for Spillovers from Multinationals? Evidence from Norwegian Manufacturing. Review of Economics and Statistics (forthcoming).

Balsvik, R., Haller S. 2007. The contribution of foreign entrants to employment and productivity growth. Manuscript. Norwegian School of Economics and Business Administration.

Bandick, R., Karpaty, P. 2007. Foreign Acquisition and Employment Effects in Swedish Manufacturing. Örebro University Working Papers No. 10/2007.

Barba Navaretti, G., Checchi D., Turrini, A. 2003. Adjusting Labor Demand: Multinational versus National Firms: A Cross-European Analysis. *Journal of the European Economic Association*. 1(2-3): 708-719.

Barba Navaretti, G. and Venables, A.J., 2004. *Multinational Firms in the World Economy*. Princeton University Press, Princeton.

Bellak, C., 2004. How Domestic and Foreign Firms Differ and Why Does It Matter?. *Journal of Economic Surveys* 18, 483-514.

Bellak, C., Pfaffermayr, M., Wild, M. 2006. Firm Performance after Ownership Change: A Matching Estimator Approach. *Applied Economics Quarterly* 52, 29-54.

Blomström, M. and A. Kokko, 1998. Multinational Corporations and Spillovers. *Journal of Economic Surveys 12*, 247-277.

Bradley, M. Desai, A., Han Kim, E. 1983. The Rationale Behind Interfirm Tender Offers: Information or Synergy? *Journal of Financial Economics*. 11, 183-206.

Burdett, K. and Mortensen, D.T., 1998. Wage Differentials, Employer Size and Unemployment. *International Economic Review* 39, 257-73.

Böckerman, P., Lehto, E. 2008. Analysing the Employment Effects of Mergers and Acquisitions. *Journal of Economic Behavior and Organization* 68, 112-124.

Davis, D. and Harrigan, J., 2007. Good Jobs, Bad Jobs and Trade Liberalization, Working Paper No 13139, NBER.

Driffield, N. and J.H. Love, 2003. Foreign direct investment, technology sourcing and reverse spillovers. *The Manchester School 71*, 659-672.

Dunning, J. H., 1977. Trade, location of economic activity and the MNE: a search for an eclectic approach. In B. Ohlin, P.O. Hesselborn and P.M. Wijkman (eds), *The International Allocation of Economic Activity* (395-418). Holmes and Meier, London.

Fosfuri, A., Motta, M. and Rönde, T., 2001. Foreign Direct Investment and Spillovers through Workers' Mobility. *Journal of International Economics 53*, 205-222.

Girma, S., Görg, H., 2004. Blessing or curse? Domestic plants' employment and survival prospects after foreign acquisition. *Applied Economics Quarterly* 50, 89-110.

Glass, A.J. and Saggi K., 2002. Multinational firms and technology transfer. *Scandinavian Journal of Economics 104*, 495-513.

Görg, H. and Strobl, E., 2005. Spillovers from Foreign Firms Through Worker Mobility: An Empirical Investigation. *Scandinavian Journal of Economics 107*, 693-710.

Hamermesh, D.S. 1993. *Labor Demand*. Princeton, New Jersey, Princeton University Press.

Helpman, E., Melitz, M. and Yeaple, S., 2004. Export Versus FDI with Heterogeneous Firms, *American Economic Review* 94, 300-316.

Helpman, E., Itskhoki, O. and Redding, S., 2010. Inequality and Unemployment in the Global Economy. *Econometrica*, forthcoming.

Jensen, M. 1988. Takeovers: Their Causes and Consequences. *Journal of Economic Perspectives*. 2, 21-48.

Krugman, P., 1980, Scale Economies, Product Differentiation, and Patterns of Trade, *American Economic Review* 70, 950-959.

Malchow-Møller, N., Markusen J.R. and Schjerning, B., 2007. Foreign Firms, Domestic Wages. Working Paper No 13001, NBER.

Manasse, P. and Turrini, A., 2001. Trade, wages, and superstars . *Journal of International Economics*, 54, 97-117.

Manning, A., 2003. *Monopsony in Motion*. Princeton University Press, Princeton.

Markusen, J. R., 2002. *Multinational Firms and the Theory of International Trade*. MIT Press, Cambridge, MA.

Martins, P.S., 2005. Inter-Firm Employee Mobility, Displacement, and Foreign Direct Investment Spillovers. mimeo, Queen Mary, University of London.

Martins, P.S. and Estevez, L.A., 2008. Foreign Ownership, Employment and Wages in Brazil: Evidence from Acquisitions, Divestments and Job Movers. Discussion Paper No 3542, IZA.

Melitz, M. J., 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, 71, 1695-1725.

Mortensen, D.T., 2003. *Wage Dispersion: Why Are Similar Workers Paid Differently*. MIT Press, Cambridge MA.

Piscitello, L., Rabbiosi, L., 2005. The impact of inward FDI on local companies' labour productivity: evidence from the Italian case. *International Journal of the Economics of Business* 12, 35-50.

Salant, S.W., Switzer, S., Reynolds, R.J., 1983. Losses from horizontal merger: the effects of an exogenous change in industry structure on Cournot-Nash equilibrium. The Quarterly Journal of Economics 108, 185-1985.

Shleifer, A., Summers, L., 1988. Breach of trust in hostile takeovers. In: Auerbach, A.(Ed.): Corporate Takeovers: Causes and Consequences. University of Chicago Press, Chicago.

Smarzysnka Javorcik, B., 2004. Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. *American Economic Review* 94, 605-627.

Statistics Finland, 2008. *Yritysten kansainvälistyminen 2006.* Statistics Finland, Helsinki.

Urban, D., 2010. FDI, Technology Spillovers and Wages. *Review of International Economics*, 18, 443-453.

Yeaple, S.R., 2005. A Simple Model of Firm Heterogeneity, International Trade and Wages. *Journal of International Economics*, 65, 1-20.

Labour Mobility and Returns to Experience in Foreign Firms*

Abstract

This paper uses Finnish linked employer-employee panel data to study whether employees are able to appropriate returns to knowledge accumulated in foreign-owned firms when moving to domestic firms. The estimates indicate that highly educated employees earn a return to prior experience in a foreign-owned firm that is over and above the return to other previous experience. These employees do not appear to pay for the knowledge they accumulate in the form of lower starting wages in foreign-owned firms.

JEL classification: C23, F23, J31
Keywords: FDI; Wages; Knowledge spillovers; Linked employer-employee data

1 Introduction

Spillover effects from foreign-owned to domestic firms have been cited as one of the reasons for the creation of policies designed to attract foreign direct investment (FDI). For example, in Finland, a government-funded committee lists the perceived beneficial effects of FDI as arguments in favour of recommendations to increase resources for the promotion of inward FDI (Prime Minister's Office, 2004). The Finnish government currently provides foreign companies with assistance and guidance in establishing a business in Finland free of charge through the Invest in Finland Bureau. These policies stem from claims that foreign-owned firms have superior technological, marketing or managerial knowledge that may spill over to purely domestic firms. However, evidence on spillovers from foreign-owned to domestic firms is not conclusive and has mostly been gathered by examining the effect of the presence of a multinational company in an industry on the productivity of domestic firms (Barba Navaretti and Venables, 2004). The potential channels for spillovers, that is, i) backward and forward linkages between foreign-owned and domestic firms, ii) demonstration effects, and iii) labour mobility (Blomström and Kokko, 1998), have not received as much attention. The studies that do consider the mechanisms through which spillovers occur have focussed mainly on backward and forward linkages between firms (e.g., Smarzynska

*Forthcoming in the Scandinavian Journal of Economics.

Javorcik, 2004; Aitken and Harrison, 1999). These studies also provide mixed evidence on productivity spillovers.

Labour mobility as a channel for spillovers has only recently been studied. Employees may be a source of spillovers if they acquire superior knowledge at a foreign-owned firm and bring this knowledge with them to benefit their new employer when they change jobs. The extent of the spillover or externality is defined by the division of the costs and benefits of knowledge accumulation between the foreign-owned firm, its employees, and the firms these employees move to. Papers by Görg and Strobl (2005) and Balsvik (2009) study spillover effects through labour mobility in Ghana and Norway, respectively. Both find positive productivity effects when employees move from multinational firms to domestic firms in the same industry[1].

Martins (2005) and Balsvik (2009) find that employees with experience in multinational firms earn higher wages than their co-workers. Martins (2005), however, observes that employees on average take a pay cut when moving from a foreign to a domestic firm, whereas Balsvik documents a pay increase upon migration. Whether or not experience in foreign-owned firms has a differing effect on employees with different educational backgrounds has, to the best of our knowledge, not been studied. However, when considering knowledge transfer from foreign-owned to domestic firms through labour mobility, skill level can be important. The issue of employees paying for the opportunity to accumulate knowledge in foreign-owned firms has also not received attention.

The purpose of this paper is to examine whether employees are able to appropriate rents accruing to the potentially superior knowledge that foreign-owned firms possess. In particular, the focus is on distinguishing between the effects of experience in foreign-owned firms on the earnings of employees with high and low education. In addition, employees' earnings when they begin working at a foreign-owned firm are studied to determine whether they are paying for this knowledge in the form of lower wages. Furthermore, spillovers can also occur from domestic to foreign firms, which could be the case, for example, if FDI were technology-sourcing[2]. To take this into account, mobility both from foreign to domestic firms and from domestic to foreign firms is studied.

[1] Görg and Strobl (2005) only consider employees who set up their own firm after leaving a multinational.

[2] Driffield and Love (2003) study panel data on UK industries and find that such "reverse spillovers" exist. They do not, however, consider the mechanisms through which these spillovers arise. Ali-Yrkkö (2006) uses Finnish firm-level data to study the effect of patents on the likelihood of being acquired by a foreign firm. He finds that owning patents correlates with becoming a target for a foreign firm, implying that technology sourcing through labour mobility may also be relevant.

The analysis is based on linked employer-employee panel data from Statistics Finland. The extensive data set consists of information on Finnish firms and workers in both services and manufacturing, and covers the period 1994-2002. The results show that prior experience in a foreign-owned firm has a positive effect on the earnings of the university-educated, with employees moving to domestic firms gaining more than their colleagues moving to other foreign firms. These employees do not appear to pay in the form of lower wages for the knowledge they accumulate at foreign-owned firms.

The remainder of the paper is structured as follows. Section 2 presents a brief overview of the related theoretical literature, and Section 3 describes the data used in the analysis. Section 4 outlines the empirical specification and presents the estimation results. Section 5 concludes the paper.

2 Theoretical background

Spillovers from multinational to domestic firms through labour mobility have been theoretically modelled explicitly by Fosfuri et al. (2001) and Glass and Saggi (2002). The models imply a trade-off between technological and pecuniary spillovers to the local economy. The trade-off arises through the multinational firm's choice between allowing technology transfer and preventing it by paying the worker a premium to stay. Malchow-Møller et al. (2009) develop a model where skills learned in high-productivity (foreign) firms are transferable to other firms and where workers joining high-productivity firms may receive a higher average wage and wage growth over their careers but a lower initial wage.

Models of R&D spillovers through worker mobility, such as those of Pakes and Nitzan (1983), Gersbach and Schmutzler (2003) and Franco and Filson (2006), are similar in spirit to models of spillovers from multinationals. These models incorporate the fact that employees gain access to valuable knowledge, which may benefit them later in their career. On-the-job training models should also be considered in this context. For example, Rosen's (1972) model, where firms differ in terms of their on-the-job training opportunities, provides hypotheses concerning the effect of human capital accumulation on earnings at different career stages.

There are several interesting hypotheses that arise from the theoretical framework described above. First, if workers accumulate productivity-enhancing transferable knowledge at the foreign-owned firm, they would be expected to earn a return on this when moving to a domestic firm. To the extent that wages are related to marginal productivity, productivity spillovers will be reflected in wages. Second, models of human capital accumulation, such as the Rosen (1972) model, incorporate the possibility that formal schooling may influence learning capacity and thereby the

incentives for knowledge accumulation. The type of knowledge potentially being transferred from foreign to domestic firms, such as technological, managerial or marketing knowledge (Bellak, 2004; Markusen, 1995), implies that an employee's education may be relevant in this context.

Third, the models mentioned above imply that employees accept lower wages when they begin working for a foreign-owned firm in order to gain the opportunity to accumulate valuable knowledge that is not available in domestic firms. Once they have accumulated knowledge, their earnings will have to increase corresponding to their value to other firms but also, as discussed in Rosen (1972), because there are fewer learning opportunities that the employees would be willing to pay for in the form of lower wages.

Finally, the theoretical framework described above is based on workers moving from a firm with better possibilities for knowledge accumulation to firms where this knowledge is not available. If knowledge diffusion takes place from domestic to foreign firms as in, for example, technology-sourcing FDI, workers would be expected to benefit from mobility in this direction.

3 Data

This study uses a data set from Statistics Finland that links information on employers, that is, firms and plants, and their employees. The data set is formed by linking data from various Statistics Finland databases: Finnish Longitudinal Employer-Employee Data, Business Register, Industrial Statistics and Financial Statements Statistics. The data set is based on a 1/3 sample of individuals who were 16 to 69 years old in 1990. These individuals were followed until 2002, and the sample was extended each year by adding a 1/3 sample of 16-year-old persons. The data set contains extensive information on individuals' characteristics including details on their education, family, labour market situation, income and so forth. The firm- and plant-level variables include information on industry, ownership and economic activity, among other areas. Information on the employer is linked to each individual based on the employer at the end of the year. Because of confidentiality, some of the firm-level information is in the form of classified variables (e.g., size classes), growth rates (e.g., employment growth), plant averages (e.g., average age of employees), or binary variables (e.g., ownership status). These data are collected for all available years on all firms and plants that employ at least one individual in the sample.

Information on foreign ownership is available from 1994 onwards, which is not a severe restriction, considering that foreign ownership in Finland was scarce before this time due to strict regulations that were not abolished until 1992 (Golub, 2003). The data set used in this study extends from 1994 to 2002 and includes individuals who can be linked to a plant and firm in every year following their first appearance in the data. As the firm panel

consists of only private-sector firms, this restricts our sample to the private sector. Unlike many previous studies, the data set used in this analysis covers both the manufacturing and service sectors. To enable the analysis of mobility, only individuals who can be followed for at least three years are included. The data set thus consists of 198 266 individuals who work in 80 216 different plants, which amounts to a total of 1 899 870 person-year observations.

In order to study whether labour mobility from foreign to domestic firms is a source of knowledge spillovers, the focus should be on voluntary job moves. Therefore, the sample is restricted to include only individuals who are employed at least six months every year from the time they are first included in the sample, which means approximately 85 percent of employees. This restriction implies that the included individuals have a reasonably strong attachment to the labour market and may help to avoid confounding effects of elongated spells of non-employment with the effects of different types of work experience. A total of 95 percent of the included individuals are employed for 12 months every year, which roughly ensures that job moves are voluntary, as discussed in Manning (2003).

The data are checked for and cleared of observations with missing ownership indicators and discrepancies in other key variables. In addition, a lower bound of 500 euros for monthly wages is also imposed. Following these amendments the data set consists of 136 389 individuals, of whom approximately 72 per cent are observed in all nine years. These individuals work in 45 610 different plants. The total number of person-year observations in the restricted sample is 918 251.

In this study, a job is defined as an employee-plant match, and job mobility is defined by combining information on the start date of employment and information on changes in an individual's plant and firm codes. This combination of information is used to ensure as accurate a measure of job mobility as possible and to avoid problems related to the renewal of employment contracts with the same employer on the one hand and administrative changes in plant and firm codes on the other. A worker is classified as having changed jobs if he/she has both changed plants and started a new employment contract during the year.[3] In addition, this measure of job mobility is corrected so that if a worker's firm code does not change, that is, if the worker moves from one plant to another in the same firm, he/she is not classified as a mover. Plant codes are used as the basis of identifying job mobility because they have been found to be more stable and less subject to administrative changes than firm codes in this data set[4].

[3] The information on employment contracts is based on pension records, which implies that as long as an employee is employed by the same company, she should be classified as continuing the same employment contract regardless of whether her tenure consists of, e.g., several consecutive fixed-term contracts.
[4] Acquisitions may lead to a change in the firm code.

The adjustment using information on continuous employment contracts and unchanged firm codes should minimise the classification of plant changes within the same firm as job changes. Obviously a worker could have changed jobs several times during the year, but the data enable only the determination of the start date of the latest employment contract, and the plant and firm codes are based on the last week of the year.

Foreign ownership is defined on the basis of ultimate beneficiary owner (UBO) and a 20 per cent threshold is used in classifying a plant as foreign owned. The 20 per cent threshold is the only ownership indicator in the data available for use in this study and exceeds the 10 per cent ownership threshold that IMF uses in defining FDI. The definition of the ultimate beneficiary owner implies that firms are classified as foreign when at least 20 per cent of a company is directly or indirectly controlled by one foreign party, that is, portfolio investments are not included. It has been suggested in the literature that the focus should actually be on the comparison of multinational and non-multinational firms, rather than foreign-owned and domestic firms (e.g., Bellak, 2004; Heyman et al. 2007). Unfortunately, there is no reliable indicator of multinational status in the data set for this period, so the analysis will be based on comparing foreign-owned and domestic-owned firms.[5] We do, however, attempt to tackle this issue by also separating the analysis with respect to size classes, as multinational firms tend to be larger than purely domestic firms.[6]

After the abolition of strict regulations on FDI in 1992, the share of employees working in foreign-owned plants has risen steadily. While the total number of employees in our estimation sample has increased from 92 733 to 133 622 during our observation period, the share of employees in foreign-owned firms has increased continuously from 10 per cent to 18 per cent. The current data set does not enable the identification of the nationality of the parent company, but other studies (Ali-Yrkkö et al. 2004) indicate that Swedish companies are by far the most significant foreign players in Finland, with approximately one-third of foreign-owned companies in Finland under Swedish ownership. The second-largest group consists of companies with owners based in USA followed by Germany, Denmark, the UK and the Netherlands. The prevalence of foreign ownership differs substantially based on industry, as can be seen in Table 1, with the share of employees in foreign-owned firms highest in certain areas of manufacturing. It should be noted that the motives of foreign acquirers and foreign firms establishing new subsidiaries in Finland differ depending on the industry. Ali-Yrkkö et al. (2004) find that market access is an important motive in all sectors, but in manufacturing, the technological know-how of the target company is viewed as having an equally important

[5] Based on other data, the number of domestic multinationals in Finland is approximately the same as the number of foreign multinational companies.
[6] This is similar to the approach used in Malchow-Møller et al. (2009).

effect as that of most of the market access indicators. In order to capture the industry differences, we include controls for industry in all our analyses.

[Table 1]

Overall job mobility is quite low, around 4 per cent in most years, with the majority of job changes occurring between domestically owned plants. Low mobility is likely to be driven by the fact that the analysis focuses on continuously employed individuals, who are also continuously observed in private-sector firms. Approximately 10 per cent of all job changes occur from a domestic to a foreign firm, and a similar proportion of employees move from a foreign to a domestic firm. Although mobility between foreign and domestic firms is quite low, it should be noted that approximately 10 per cent of the firms in the data employ a person with previous experience from a foreign-owned firm. This implies that the potential for knowledge transfer may not be as limited as the mobility figures suggest.

The purpose of this paper is to study how experience in foreign-owned firms affects earnings in subsequent jobs. It may of course be that workers who have experience from foreign-owned firms and are consequently hired to work for domestic firms differ in terms of other characteristics that affect earnings. In addition, based on previous studies, it is reasonable to also expect foreign and domestic firms to differ in terms of observable characteristics other than nationality. Tables 2, 3 and 4 show characteristics of employees and employers based on ownership of the firm. The differences in means in Table 2 are all statistically significant. Employees are of quite similar age on average in both domestic and foreign firms, and domestic firms employ on average a slightly higher share of female workers. The gender difference may also be related to the difference in the prevalence of foreign ownership in different industries.

[Table 2]

As explained above, the employer-employee link is observed at the end of each year. For every employment contract that is in force at the end of the year, we observe the month when the contract began. This enables us to measure tenure on a monthly basis (we convert the tenure variable to years for our analysis). As we know when each employment contract began, we can also fully account for accumulated tenure for employment contracts that are in force at the beginning of our observation period in 1994. This explains why average tenure in Table 2 exceeds the length of the observation period. Real monthly earnings are higher for employees in foreign firms, which is not surprising, considering the other observable characteristics of foreign-owned firms: higher sales per employee, a higher share of educated employees (Table 3) and a higher share of employees in large firms (Table 4).

[Table 3 and Table 4]

Table 5 documents changes in earnings following a job change. Employees appear to gain on average both from moving from a foreign to a domestic firm and from moving between domestic firms. The average wage gain is highest for job changes from domestic to foreign firms, but the average real wage remains lower than that of employees who move from a foreign to a domestic firm or to another foreign firm. Average earnings both before and after job changes are highest among employees who move between foreign firms. Other factors influencing these unconditional averages will be studied in the next section.

[Table 5]

4 Estimation

4.1 Empirical Specification

In order to examine the possibility that workers moving between foreign and domestic firms appropriate returns to knowledge acquired at their previous employer, earnings are regressed on measures of tenure at the previous job as well as on interactions of this tenure with the nationality (domestic or foreign) of both their previous and current employer. In addition, to determine whether employees pay for the chance to gain experience at a foreign-owned firm by accepting lower wages when they begin working there, the nationality of the current employer is controlled for, as is its interaction with tenure at the current employer. A large set of control variables is also included. The earnings effects of tenure at both the previous and current job are estimated as splines. In its simplest form, without the interaction terms, the specification can be written as

$$
\begin{aligned}
\ln w_{it} = {} & X_{it}\beta_1 + \beta_2 tenure \times 1(0 \le tenure < 3) \\
& + \left[3\beta_2 + \beta_3 (tenure - 3)\right] \times 1(3 \le tenure < 6) \\
& + \left[3\beta_2 + 3\beta_3 + \beta_4 (tenure - 6)\right] \times 1(6 \le tenure < 9) \\
& + \left[3\beta_2 + 3\beta_3 + 3\beta_4 + \beta_5 (tenure - 9)\right] \times 1(tenure \ge 9) \\
& + \beta_6 prior\_tenure \times 1(0 \le prior\_tenure < 3) \\
& + \left[3\beta_6 + \beta_7 (prior\_tenure - 3)\right] \times 1(3 \le prior\_tenure < 6) \\
& + \left[3\beta_6 + 3\beta_7 + \beta_8 (prior\_tenure - 6)\right] \times 1(prior\_tenure \ge 6) \\
& + \mu_i + \gamma_t + \varepsilon_{it}
\end{aligned}
\quad , \qquad (1)
$$

where $\ln w_{it}$ is the log real monthly wage, X_{it} includes personal characteristics and firm characteristics, $\mathbf{1}(\cdot)$ denotes an indicator function,

μ_i is a person-specific fixed effect and γ_t is a time effect. The spline for current tenure has changing slopes at 3, 6 and 9 years of tenure, and the spline for tenure at the previous employer has changing slopes at 3 and 6 years of prior tenure[7]. The interpretation of the coefficients is quite straightforward. For example, if β_2 is positive, earnings increase during the first years on a job. If β_3 is higher than β_2 the returns to tenure increase after the first three years, and if β_3 is lower than β_2 the returns to tenure decrease after three years.

To determine whether workers earn a return to knowledge they accumulate at foreign-owned firms, the variables measuring tenure at the previous employer are interacted with an indicator of foreign ownership of this previous employer. However, as discussed above, there is also the possibility of reverse spillovers; that is, knowledge transfer from domestic to foreign firms, so this is controlled for by interacting previous tenure with an indicator of the foreign ownership of the current firm (the firm that the employee moves to). In addition, to distinguish the effects mentioned above from the effects of mobility between foreign-owned firms, we include an interaction of previous tenure with an indicator of the foreign ownership of both the current and previous firm. The reference case in our analysis is thus an employee who currently works in a domestic firm and has not worked in another firm. The term "Previous tenure" captures the return to having worked in another domestic firm, and the interaction of this with "Previous employer foreign" measures the additional premium from having previously worked in a foreign firm for employees currently employed by domestic firms. Similarly, "Previous tenure" interacted with "Current employer foreign" measures the additional return to previous tenure acquired in a domestic firm for workers whose current employer is foreign. Finally, for employees with previous experience from a foreign firm and who currently work for a foreign firm, the full effect of their previous tenure is captured by taking into account all the terms above and adding the effect of "Current and previous employer foreign" x "Previous tenure".

To capture the possibility that workers accept lower wages in exchange for the opportunity to accumulate knowledge at a foreign-owned firm, tenure at the current firm is interacted with a dummy indicating foreign ownership of the current firm[8]. We also allow for differences between employees who

[7] With the data covering the years 1994 to 2002, the maximum amount of tenure at a previous employer is 8 years. It should be noted that although the unit of measurement for tenure is a year, the start date of each employment spell is known at the monthly level; i.e., the accuracy of the tenure measure is fractions of a year. The results are qualitatively similar when changing the spline cut-offs from the current 3, 6 and 9 years. Changes in the magnitude of the results when applying different cut-offs are consistent with the differences in slopes on either side of the original cut-off.

[8] Foreign acquisitions will, of course, confound the analysis. To control for this, the analysis was run excluding any individuals who were employed at the time of a foreign or domestic acquisition. Although this changes the composition of the work force being studied, the main results remain qualitatively the same.

will stay with their current employer and those who will later switch to another firm by including a dummy for whether the employee will switch jobs later, as well as its interaction with the future employer's ownership. In addition, as discussed in Section 2, knowledge transfer may predominantly be related to the mobility of the more educated employees. Therefore, model (1) is also estimated with interaction terms between university education and different types of experience.

Accumulated experience (in both domestic and foreign firms) may be correlated with individual characteristics that the employers are able to identify but that are not available in the data. In addition, workers with experience from foreign-owned firms may be different from workers with experience only in domestic firms, for example, if foreign firms have a more efficient screening process for new recruits. As the data set is a panel, the estimation can be done using individual fixed effects to control for these unobserved characteristics.[9] We also control for various plant- and firm-level characteristics, that is, plant sales per employee, firm size, an indicator for foreign ownership, 24 industry dummies and 6 region dummies. In addition, an indicator is included for whether the plant that the individual worked for in the previous year reduced employment by 40 per cent or more and similarly for this period's employer. This aims to control for potentially involuntary job mobility. Descriptions of the variables used in the analysis are listed in Table 6. To take into account the fact that observations for individuals in the same firm are unlikely to be independent, we use standard errors that allow for correlation among observations within a firm.

[Table 6]

4.2 Returns to previous experience

The results for the estimation of model (1) with interaction terms added are presented in Table 7. The first column shows results for estimations where educational differences in the impact of experience are not taken into account, whereas the second column includes interactions between the experience variables and a dummy for having completed a university degree. Both estimations include person fixed effects. We will focus on the results that control for educational differences and include the results in the first column mainly as a comparison to previous studies. Panels A and B of Table 7 show results for the impact of tenure at the previous employer on current earnings for employees without and with a university degree

[9] The amount of previous experience is constant within each job spell and changes each time an individual changes jobs. Therefore, only individuals who have changed jobs have previous experience, and these individuals are observed before and after the job change, so the effect of previous experience is identified in the fixed effects estimation.

respectively, Panels C and D depict results for tenure at the current employer, and Panel E includes coefficients for some of the more interesting control variables.

[Table 7]

The combined effects of previous tenure and its interactions with ownership and education for different employee groups from the second column of Table 7 are summarised in Table 8. The first column shows the return to previous tenure for *employees without a university education*. In the first part of Table 8, we see that these employees earn a return of 2.9 per cent to the first three years of tenure at their previous domestic employer when they move to another domestic firm. The return for the following three years of previous tenure is lower and then increases again for years exceeding six years of previous tenure. An employee without a university degree who moves from a foreign to a domestic firm earns a return to the first three years of previous tenure that is about one percentage point lower than colleagues with previous experience in domestic firms (0.018 vs. 0.029). The difference is statistically significant and indicates that these employees are not being paid higher wages to attract them from foreign firms. The second part of Table 8 shows that employees in foreign firms with experience in either a domestic or foreign firm earn a return to the first three years of previous experience that is not statistically significantly different from the return received by employees moving between two domestic firms. The returns to the next three years of previous tenure in a domestic firm are lower.

[Table 8]

It was argued above that if there are knowledge spillovers from foreign-owned to domestic firms through worker mobility, these may predominantly be the result of educated workers changing firms. The second column in Table 8 shows returns to previous tenure for *university-educated employees*. Regardless of the ownership of their current or previous employer, these employees earn a higher return to the first few years of previous tenure than their colleagues with no university education. The return is highest for employees moving from foreign to domestic firms after up to three years of tenure at the previous firm. This return is statistically significantly higher than for employees moving from foreign to other foreign firms (0.103 vs. 0.086), which indicates that domestic firms are willing to pay up to gain access to these workers' know-how. The lowest return to the first few years of previous tenure accrues to employees moving from domestic to foreign firms (0.061). Foreign firms do not appear to value experience gained in domestic firms as much as they value experience gained in other foreign firms. These results also indicate that if there are knowledge spillovers between foreign and domestic firms, they are likely to be flowing from

foreign to domestic firms and not vice versa. The fact that the first few years of tenure at the previous employer provide the highest return implies that employees accumulate valuable knowledge quite rapidly.

Figure 1 illustrates wage paths for university-educated employees who either stay at a domestic or foreign firm for 10 years or are recruited by domestic firms after 5 years of tenure.[10] The initial wage profiles for employees in foreign firms are above those for employees in domestic firms and, regardless of ownership, employees who will later change jobs earn slightly less than their colleagues. These initial wage profiles depict the results on returns to tenure at the current employer as shown in panels C and D of Table 7 and will be discussed following the analysis on returns to previous tenure. University-educated employees in foreign firms have higher wages than their colleagues in domestic firms after five years of tenure, and when they subsequently move to a domestic firm, they also benefit more from their previous tenure than those moving from a domestic to another domestic firm. The results imply that domestic firms are willing to compensate university-educated employees for experience in foreign firms to a larger extent than they are for experience in other domestic firms.

[Figure 1]

Wage profiles for university-educated employees who either stay at a domestic or foreign firm for ten years or are recruited by foreign firms after five years of tenure are illustrated in Figure 2. The returns to previous experience in another foreign firm are higher than the returns to previous experience in a domestic firm. As noted above, foreign-owned firms do not appear to value experience gained in domestic firms as highly as they value experience gained in other foreign firms. This would imply that foreign firms also acknowledge that there is a difference in the knowledge accumulation process in foreign and domestic firms. On the other hand, as the results in Table 8 show, domestic firms value experience from foreign-owned firms even more than other foreign firms do.

[Figure 2]

Figure 3 compares wage profiles of university-educated employees who are recruited by either a foreign or domestic firm following five years of experience in either type. This graph thus combines the wage profiles of job switchers from Figures 1 and 2. During the initial five years, employees in foreign-owned firms earn more, as was seen in the previous figures, with the initial wage premium diminishing somewhat due to lower returns to tenure. We see that employees who move from one foreign firm to another gain the most in terms of wages, but, as the results in Table 7 show, the difference compared to employees moving from foreign to domestic firms is due to the

[10] The profiles are calculated at median values of other control variables.

general foreign ownership wage premium, that is, the fact that employees in foreign-owned firms earn more on average regardless of their previous or current tenure. The highest return to previous tenure is received by employees who move from a foreign firm to a domestic firm, as seen in Table 8. The influence of the foreign ownership premium can also be seen in the wage profile of employees moving from domestic to foreign firms, as these workers gain more than their colleagues moving to other domestic firms even though the return to previous experience accumulated in a domestic firm is lower when moving to a foreign firm. All in all, university-educated employees with previous experience in foreign-owned firms earn higher wages than employees with experience only from a domestic firm. Employees who move from one foreign firm to another continue to benefit from the foreign ownership wage premium, whereas those who move from a foreign to a domestic firm forfeit this premium but earn a higher return to their previous tenure as expected if knowledge spillovers exist.

[Figure 3]

These results would imply that there is something different about mobility of educated workers with experience in foreign-owned firms, compared to other types of mobility. This finding is interesting in various respects. Firstly, this type of result is consistent with the view that knowledge transfer depends on the skill level of the employee. Secondly, the fact that it is the mobility of employees with experience in foreign firms and not the mobility from domestic to foreign firms that appears to matter implies that it is experience that educated employees acquire in foreign firms that is valued in domestic firms and not vice versa.[11] This is consistent with evidence that foreign-owned firms outperform purely domestic firms (e.g., Bellak, 2004; Ilmakunnas and Maliranta, 2004 for Finland). In addition, we observe that foreign-owned firms do not appear to value experience gained in domestic firms as highly as they do experience gained in other foreign firms, which indicates that foreign-owned firms also acknowledge a difference in the knowledge accumulation process in foreign and domestic firms. The fact that domestic firms provide a higher return to previous experience accumulated in foreign firms than these employees would receive when moving to another foreign firm can be indicative of the fact that this is a return to knowledge that would otherwise not be available to the domestic firm. When interpreting these results, it should be kept in mind that if job mobility itself is a way of achieving higher earnings, prior experience will be endogenous in the earnings equation. However, comparing the different types of mobility can still give an indication of the differences in how previous experience from foreign and domestic firms is valued. This issue will be discussed in the last section.

[11] Balsvik (2009) finds broadly similar results for Norwegian manufacturing, but does not distinguish between wage effects for employees with and without higher education.

4.3 Do workers pay for knowledge accumulation?

If employees are able to reap returns to the knowledge they accumulate in foreign-owned firms, the models of R&D spillovers and on-the-job training mentioned above imply that this should lead to lower wages for those working (or starting to work) for the foreign firm compared to those who start working at domestic firms[12]. The wage-tenure profiles depicted in Figures 1, 2 and 3 also illustrated the results for returns to current tenure in Panels C and D of Table 7, and we will now discuss these results in greater detail. The combined effects of tenure and its interaction with ownership of the firm and education are summarised in Table 9. The results indicate that the return to tenure for employees with no university education is highest between three and six years. Employees without a university education starting in foreign-owned firms earn on average 4.7 per cent less than their colleagues in domestic firms, but the return to the first years of tenure is 1.5 per cent higher in foreign firms, which implies that those employed by foreign firms catch up with their peers in domestic firms after three years of tenure.
[Table 9]

The results in Table 9 show that employees with a university education earn higher returns to all levels of tenure than those with no university degree, although in foreign firms the difference for tenure between three and six years is not statistically significant. University-educated employees in foreign firms earn a lower return to the first three years of tenure but benefit from an overall foreign ownership premium of 8.5 per cent. The return to tenure between three and six years is similar in foreign and domestic firms, but longer tenure is again more highly rewarded in domestic firms. The substantial initial wage premium in foreign-owned firms thus shrinks with tenure. These features are depicted in Figure 1, where the dotted line illustrates the wage profile for a university-educated employee with 1 to 10 years of tenure in a domestic firm and the dashed-dotted line shows the wage profile for university-educated employees in foreign-owned firms. Employees who will change to a new domestic employer in the future have slightly lower wage profiles than their colleagues who will stay at the firm, but, as seen in Table 9, the difference is not statistically significant. Taking into account the substantial initial wage premium that university-educated employees in foreign firms earn compared to their colleagues in domestic firms, the results do not support the hypothesis that educated employees who benefit from experience in a foreign firm when moving to a domestic firm would initially pay in terms of lower wages for the opportunity to gain this experience.

[12] Møen (2005) finds that employees in R&D-intensive firms pay in the form of lower wages for the knowledge they accumulate.

4.4 Robustness checks

We briefly comment on various robustness checks without presenting the results in tables. The results are available on request. A potential problem in the analysis described above is the endogeneity of the foreign-domestic status of the firms, which could arise, for example, if foreign firms only acquired the best-performing firms in Finland with the potential for positive spillovers. Especially in cases where a domestic multinational firm is acquired by a foreign firm, previous literature indicates that there is no substantial effect on wages (Heyman et al. 2007), which can be viewed as implying no change in the potential for knowledge accumulation. To tackle this issue, we would have liked to have controlled for plant fixed effects in addition to person fixed effects. Due to the number of plants in the data set, estimating the model with both person and plant fixed effects is not currently feasible for us, but we have controlled for both person and plant effects using a subset of the data. As previous experience in foreign-owned firms appears to primarily have an effect on the earnings of the highly educated, we have restricted the estimation to those with a university education. As this does not sufficiently reduce the number of plants, we have further restricted the analysis to manufacturing plants. This leaves us with 18 080 individuals who are employed at 4 359 different plants, yielding a total of 108 191 person years.

Estimating model (1) for this group, including both individual and plant fixed effects as well as interactions of the current and previous tenure variables with ownership of the previous and current employer, gives results that are consistent with those reported above, implying that the plant-level controls we included in our earlier estimations work reasonably well in controlling for differences between plants. For comparison, we have also done the estimations for the full data set using plant fixed effects instead of individual fixed effects. The results from these estimations show even stronger effects for the different types of experience, as may be expected when not controlling for unobserved individual heterogeneity. The relative impacts of the different experience variables remain similar when controlling for plant and not individual fixed effects. To eliminate the confounding effect of foreign acquisitions, the analysis has also been conducted excluding individuals who are employed at the time of a domestic or foreign acquisition. Although this changes the composition of the work force being studied, the main results remain qualitatively the same.

Another issue to consider is that our analysis concentrates on the difference between foreign-owned and domestic firms instead of multinational and local domestic firms, as has been argued to be important. In an attempt to investigate whether this would make a notable difference, we have split our analysis based on firm size rather than on nationality, as in the analysis of

Malchow-Møller et al. (2009)[13]. This approach is based on the fact that multinational firms are on average larger than purely domestic firms. The results for this analysis indicate that returns to both current and previous tenure are somewhat higher in large firms and that the impact of previous tenure in large firms on wages is slightly positive. However, there is no difference in the effect of previous tenure in large firms for employees with and without a university degree. This may be related to the firm size-wage effect[14]; that is, because larger firms pay on average higher wages and employees who voluntarily move from a large firm to a smaller firm will not accept wage cuts, we will observe employees with experience in large firms earning more than their colleagues in small firms. As we found that the educational level of employees plays a role in our analysis of experience in foreign-owned firms, these results imply that, to the extent that firm size can be used to control for multinational status, there are additional differences based on the ownership of the firm that can be meaningful.

The frequency of job switching is often intense at the beginning of the career, when the wage curve is rather steep. This could influence the results on returns to previous experience, so to account for age differences in returns, the estimations have also been done including interactions of age classes with previous tenure. The results show that university-educated workers under the age of 35 benefit from previous experience in a foreign firm that exceeds 6 years but that otherwise, age does not influence the results. This finding indicates that for this group of workers there is an additional gain in accumulating longer experience, which could be related to, for example, being promoted to a managerial position in the foreign firm. These results are also consistent with our analysis on potential spillovers from foreign to domestic firms.

To analyse in greater detail whether employees accept wage discounts when entering foreign firms, we have also conducted the estimation using data on a single cohort of university graduates. Earnings equations for the years 1994 to 2002 were estimated for individuals who obtained a university degree in 1993[15]; that is, their initial years in the labour market are documented in full. However, no wage discount when entering foreign-owned firms was observed.

We have also analysed the robustness of the results presented above to the use of different experience measures and functional forms of the estimation equation. The first modification incorporates a cubic in previous and current tenure instead of estimating the effects as splines. The results are consistent with those above. In addition, an experience measure incorporating previous experience from not only one employer but all

[13] We use a size threshold of 300 employees.
[14] See, e.g., Oi and Idson (1999).
[15] Only those who were under 30 years old in 1993 are included in order to ensure as well as possible that they are actually entering the labour force for the first time.

previous employers observed after 1994 has been used. The results are, again, similar to those above, which may be expected, as we are only able to use data from 1994 onwards. This polynomial regression has also been run using an experience measure incorporating both previous experience and current tenure; that is, tenure was included both in the experience variable and as a separate regressor. This commonly used form of the wage regression also yields results consistent with those above. In addition, to take into account the fact that the distribution of previous tenure is restricted by experience only being measured from 1994 onwards, the model has also been estimated from 1998 onwards, using experience data starting in 1994. The results are also qualitatively robust to this change. Furthermore, to focus more on wage changes around the time of the job change, we have included indicators for the years immediately prior to and after the job change in the estimation with our basic splines. The coefficients on these indicators are not significant, and our main results remain unchanged, indicating that our measures of previous tenure are robust. One further robustness check concerns the size of the firms used in our analysis. The data set used in our estimations consists of firms of all sizes, that is, we include very small firms with fewer than 5 employees. In order to ensure that this is not an issue, we have run the estimations including only firms with at least 50 employees. This does not alter the results.

5 Conclusions

The purpose of this study was to ascertain whether workers are able to appropriate rents to the potentially superior knowledge possessed by foreign-owned firms when moving to a domestic firm and, in particular, whether this is related to the different educational backgrounds of the workers. The analysis shows that previous tenure in a foreign-owned firm has a positive effect on the earnings of the university educated that is over and above the effect of other previous experience. This return is higher for educated employees moving from foreign to domestic firms than for their colleagues moving to other foreign firms. These findings are consistent with models of knowledge diffusion through labour mobility, where a domestic firm may bid for a worker at a foreign-owned firm in order to gain access to her knowledge. The results are also in line with the view that if there is knowledge transfer from foreign-owned to domestic firms, it may require a certain skill level of the employee who is changing jobs. The results also show that the educated workers who benefit from experience in a foreign-owned firm do not earn lower wages while employed by the foreign firm. Foreign firms are not able to capture the full return to their knowledge; as a result, policies designed to attract foreign direct investment can be beneficial.

One needs to be somewhat cautious in interpreting these results, as there

may be some process whereby job mobility in itself is a way of achieving higher earnings, as detailed in the literature on returns to tenure and job mobility[16]. Therefore, prior experience can be endogenous in the earnings equation, as the potential for achieving a higher wage is likely to be one of the determinants of job mobility. With no instrument for previous experience currently available, we include plant fixed effects in addition to person fixed effects in one of our extensions in order to alleviate the problem. The results from this robustness check are consistent with our main analysis. To the extent that we are mostly capturing voluntary job mobility, the bias caused by the endogeneity of previous experience can be thought to be positive for all of the different types of experience under consideration. As a result, it can be interesting to compare the returns found for different types of experience despite the fact that each will contain the mobility bias mentioned above. Indeed, our results can be indicative of how the actual unbiased effects for previous experience in different types of firms differ from each other. It should also be kept in mind that if spillovers occur through labour mobility, they are likely to arise from domestic firms poaching employees with useful expertise. This implies that the results cannot be interpreted as the effect of moving some random worker but can be interesting as an analysis of spillovers.

[16] See Topel (1991), Altonji and Shakotko (1987), Altonji and Williams (1997), Antel (1986), Mincer (1993), Abowd et al. (2006).

References

Abowd, J. Kramarz, F., Roux S. (2006), Wages, Mobility and Firm Performance: Advantages and Insights from Using Matched Worker-Firm Data, *Economic Journal 116*, F245-F285.

Aitken, B. and Harrison, A., (1999), Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela, *American Economic Review 89*, 605-618.

Ali-Yrkkö, J., (2006), Technology Sourcing Through Acquisitions – Do High Quality Patents Attract Acquirers?, The Research Institute of the Finnish Economy Discussion Paper No. 1025.

Ali-Yrkkö, J., Lindström, M., Pajarinen, M., Ylä-Anttila, P., (2004), Suomen asema globaalissa kilpailussa – yritysten sijaintipäätökseen vaikuttavat tekijät, The Research Institute of the Finnish Economy Discussion Paper No. 927.

Altonji, J.G. and Shakotko, R., (1987), Do Wages Rise with Job Seniority?, *Review of Economic Studies 54*, 437-459.

Altonji, J.G. and Williams, N., (1997), Do Wages Rise with Job Seniority: A Reassessment, NBER Working Paper No 6010.

Antel, J.J., (1986), Human capital investment specialization and the wage effects of voluntary job mobility, *Review of Economics and Statistics 68*, 477-483.

Balsvik, R., 2009. Is Mobility of Labor a Channel for Spillovers from Multinationals? Evidence from Norwegian Manufacturing. Review of Economics and Statistics (forthcoming).

Barba Navaretti, G. and Venables, A. J. (2004), *Multinational Firms in the World Economy*, Princeton University Press, Princeton.

Bellak, C. (2004), How Domestic and Foreign Firms Differ and Why Does It Matter?, *Journal of Economic Surveys 18*, 483-514.

Blomström, M. and Kokko, A. (1998), Multinational Corporations and Spillovers, *Journal of Economic Surveys 12*, 247-277.

Driffield, N. and Love, J.H. (2003), Foreign direct investment, technology sourcing and reverse spillovers, *The Manchester School 71*, 659-672.

Fosfuri, A., Motta, M. and Rönde, T. (2001), Foreign Direct Investment and Spillovers through Workers' Mobility, *Journal of International Economics 53*, 205-222.

Franco, A.M. and Filson, D. (2006), Spin-outs: Knowledge Diffusion through Employee Mobility, *Rand Journal of Economics 37*, 841-860.

Gersbach, H., Schmutzler, A. (2003), Endogenous Technological Spillovers: Causes and Consequences, *Journal of Economics & Management Strategy 12*, 179-205.

Glass, A.J. and Saggi K. (2002), Multinational firms and technology transfer, *Scandinavian Journal of Economics 104*, 495-513.

Golub, S. S., 2003. Measures of restrictions on inward foreign direct investment for OECD countries, OECD Economic Studies No. 36, 2003, 85-116.

Görg, H. and Strobl, E. (2005), Spillovers from Foreign Firms Through Worker Mobility: An Empirical Investigation, *Scandinavian Journal of Economics 107*, 693-710.

Heyman, F., Sjöholm, F., and Gustavsson Tingvall, P. (2007), Is There Really a Foreign Ownership Wage Premium? Evidence from Matched Employer-Employee Data, *Journal of International Economics 73*, 355-376.

Ilmakunnas, P. and Maliranta, M. (2004), Foreign medicine: A treatment effect analysis of the productivity effects of foreign ownership, *Applied Economics Quarterly* (Konjunkturpolitik), Special Issue: Effects of Foreign Acquisitions on the Target Firms: Empirical Evidence from EU Countries *50*, 41-60.

Malchow-Møller, N., Markusen J.R. and Schjerning, B. (2009), Foreign Firms, Domestic Wages, CAM Working Paper No 2009-02.

Manning, A. (2003), *Monopsony in Motion: Imperfect Competition in Labour Markets*, Princeton University Press, Princeton.

Markusen, J.R. (1995), The boundaries of multinational enterprises and the theory of international trade, *Journal of Economic Perspectives 9*, 169-189.

Martins, P.S. (2005), Inter-Firm Employee Mobility, Displacement, and Foreign Direct Investment Spillovers, mimeo, Queen Mary, University of London.

Mincer, J. (1993), Wage Changes in Job Changes. *Studies in Human Capital: Collected Essays of Jacob Mincer*, vol. I, Edward Elgar, Brookfield.

Møen, J. (2005), Is Mobility of Technical Personnel a Source of R&D Spillovers?, *Journal of Labor Economics 23*, 81-114.

Oi, W. Y. and Idson, T. L. (1999), Firm Size and Wages, in Orley Ashenfelter and David Card (eds.), *Handbook of Labor Economics, vol. 3B*, North Holland, Amsterdam.

Pakes, A. and Nitzan, S. (1983), Optimum contracts for research personnel, research employment, and the establishment of "rival" enterprises, *Journal of Labor Economics 1*, 345-365.

Prime Minister's Office (2004), Osaava, avautuva ja uudistuva Suomi, Prime Minister's Office Publications 19/2004, Helsinki.

Rosen, S. (1972), Learning and Experience in the Labor Market, *The Journal of Human Resources 7*, 326-342.

Smarzysnka Javorcik, B. (2004), Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages, *American Economic Review 94*, 605-627.

Topel, R.H. (1991), Specific Capital, Mobility and Wages: Wages Rise with Job Seniority, *Journal of Political Economy 99*, 145-176.

Tables

Table 1 Employees by industry and firm ownership

	Total	Foreign	
Industry	Frequency	Frequency	Percent
Mining and Quarrying	3 300	418	13 %
Manufacture of food products, beverages and tobacco	42 104	6 644	16 %
Manufacture of textiles	6 557	910	14 %
Manufacture of wearing apparel, leather and leather products	8 404	481	6 %
Manufacture of wood, wood products, pulp, paper and paper products	81 473	2 420	3 %
Publishing, printing	32 586	1 969	6 %
Manufacture of coke, refined petroleum products, nuclear fuel, chemicals, chemical products and man-made fibres	26 155	7 684	29 %
Manufacture of rubber and plastic products	16 945	2 411	14 %
Manufacture of other non-metallic mineral products	14 660	5 650	39 %
Manufacture of basic metals	25 088	1 594	6 %
Manufacture of fabricated metal products	30 546	5 694	19 %
Manufacture of machinery and equipment n.e.c, electrical and optical equipment	108 612	25 192	23 %
Manufacture of transport equipment	25 187	8 734	35 %
Manufacturing n.e.c.	13 564	1 109	8 %
Electricity, gas and water supply, Construction	63 561	5 222	8 %
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods, Hotels and restaurants	177 664	29 640	17 %
Transport, storage and communication	115 355	7 736	7 %
Financial intermediation	34 121	2 546	7 %
Real estate, renting and business activities	92 369	14 628	16 %
Total	918 251	130 682	14 %

Table 2 Descriptive statistics by firm ownership

	Domestic	Foreign
Means of employee characteristics		
Age	41.01	41.25
	(9.80)	(9.85)
Female	0.33	0.30
	(0.47)	(0.46)
Tenure (years)	12.16	12.71
	(9.42)	(9.46)
Tenure at previous firm (years)	3.11	3.76
	(10.34)	(11.66)
Real monthly earnings (2002 euros)	2 460	2 869
	(1 170)	(1 441)
Means of plant characteristics		
Sales per employee	207 546	272 030
	(1 065 960)	(643 627)
Observations	787 569	130 682

Standard deviations in parentheses

Table 3 Education of employees by firm ownership

	Domestic		Foreign		Total	
Education	Frequency	Percent	Frequency	Percent	Frequency	Percent
Comprehensive school	211 820	27 %	28 747	22 %	240 567	26 %
Secondary education	356 148	45 %	55 443	42 %	411 591	45 %
Bachelor's degree	178 699	23 %	36 738	28 %	215 437	23 %
Master's or PhD	40 902	5 %	9 754	7 %	50 656	6 %
Total	787 569	100 %	130 682	100 %	918 251	100 %

Table 4 Employer size by ownership

	Domestic		Foreign		Total	
Firm size	Frequency	Percent	Frequency	Percent	Frequency	Percent
Less than 5 employees	53 133	7 %	740	1 %	53 873	6 %
5 to 9 employees	51 234	7 %	1 628	1 %	52 862	6 %
10 to 19 employees	59 726	8 %	3 570	3 %	63 296	7 %
20 to 49 employees	82 536	10 %	9 132	7 %	91 668	10 %
50 to 99 employees	58 945	7 %	11 902	9 %	70 847	8 %
100 to 299 employees	100 437	13 %	29 760	23 %	130 197	14 %
More than 300 employees	381 558	48 %	73 950	57 %	455 508	50 %
Total	787 569	100 %	130 682	100 %	918 251	100 %

Table 5 Wage changes following job change

Variable	From domestic to domestic firm	From domestic to foreign firm	From foreign to domestic firm	From foreign to foreign firm
Mean of real monthly earnings before (2002 euros)	2041	2310	2708	3198
	(1157)	(1466)	(1747)	(1955)
Mean of real monthly earnings after (2002 euros)	2185	2533	2846	3521
	(1106)	(1362)	(1683)	(2086)
Average change in real monthly earnings	15.6 %	19.5 %	13.1 %	17.4 %
	(.3989)	(.4257)	(.4444)	(.4163)
Observations	21823	3453	2959	1238

Standard deviations in parentheses

Table 6 Variable descriptions

Variable	Definition / Measurement
Individual characteristics	
Age	Age in years
Tenure	Tenure at current employer. Spline with changing slopes at 3, 6 and 9 years of tenure
Previous tenure	Tenure at firm in which the individual was employed before moving to the current employer. Job change is defined based on start date of employment and information on changes in an individual's plant and firm codes. Spline with changing slopes at 3 and 6 years of prior tenure.
University degree	Dummy variable equal to 1 if the individual has completed a university degree
Wages	Logarithm of real monthly earnings in euros (2002)
Plant[1] level characteristics	
Sales per employee	Plant sales per employee in euros
Employment reduction in previous year	Dummy variable equal to 1 if the plant that the individual worked for in the previous year reduced employment by 40% or more
Employment reduction in current year	Dummy variable equal to 1 if the plant that the individual works for in the current year reduces employment by 40% or more
Industry	24 industry dummies
Region	6 region dummies (NUTS2)
Firm[1] level characteristics	
Firm size	7 indicators for firm size classes: Less than 5 employees, 5 to 9 employees, 10 to 19 employees, 20 to 49 employees, 50 to 99 employees, 100 to 299 employees, more than 300 employees
Foreign ownership	Defined on the basis of ultimate beneficiary owner (UBO) with a 20 % threshold used in classifying a plant as foreign owned.
Other	
Years	9 year dummies

Notes

1. Plant refers to the physical location of a certain economic activity. Firms may consist of many plants.

Table 7 Wage effects of experience in different types of firms

PANEL A	**(1)**	**(2)**
Effects of tenure at previous employer for all employees		
Previous tenure under 3 years	0.047	0.029
	(27.86)**	(14.67)**
Previous tenure between 3 and 6 years	-0.012	-0.009
	(4.71)**	(2.95)**
Previous tenure over 6 years	0.028	0.018
	(4.26)**	(2.54)*
Previous employer foreign		
x Previous tenure under 3 years	0.010	-0.011
	(3.05)**	(2.55)*
x Previous tenure between 3 and 6 years	0.003	0.021
	(0.58)	(2.61)**
x Previous tenure over 6 years	-0.016	-0.026
	(0.82)	(0.98)
Current employer foreign		
x Previous tenure under 3 years	0.004	0.006
	(0.78)	(1.05)
x Previous tenure between 3 and 6 years	-0.010	-0.006
	(1.91)	(0.99)
x Previous tenure over 6 years	0.005	0.006
	(0.29)	(0.28)
Current and previous employer foreign		
x Previous tenure under 3 years	0.007	0.006
	(1.37)	(0.81)
x Previous tenure between 3 and 6 years	-0.009	-0.020
	(0.89)	(1.43)
x Previous tenure over 6 years	0.011	0.026
	(0.32)	(0.48)
PANEL B		
Effects of tenure at previous employer for the university educated		
University education		
x Previous tenure under 3 years		0.051
		(15.34)**
x Previous tenure between 3 and 6 years		-0.007
		(1.48)
x Previous tenure over 6 years		0.044
		(2.88)**
x Previous employer foreign		
x Previous tenure under 3 years		0.034
		(5.85)**
x Previous tenure between 3 and 6 years		-0.025
		(2.01)*
x Previous tenure over 6 years		-0.001
		(0.02)
x Current employer foreign		
x Previous tenure under 3 years		-0.025
		(3.43)**
x Previous tenure between 3 and 6 years		-0.000
		(0.00)
x Previous tenure over 6 years		-0.005
		(0.14)
x Current and previous employer foreign		
x Previous tenure under 3 years		-0.004
		(0.38)
x Previous tenure between 3 and 6 years		0.029
		(1.40)
x Previous tenure over 6 years		-0.039
		(0.54)

Table continues on next page

Table 7 Continued

PANEL C		
Effects of tenure at current employer for all employees		
Tenure under 3 years	0.019	0.005
	(8.99)**	(3.58)**
Tenure between 3 and 6 years	0.014	0.013
	(6.71)**	(6.05)**
Tenure between 6 and 9 years	0.005	0.002
	(4.23)**	(1.82)
Tenure over 9 years	0.009	0.008
	(19.94)**	(18.86)**
Current employer foreign	-0.008	-0.047
	(0.67)	(3.94)**
Current employer foreign		
x Tenure under 3 years	0.006	0.015
	(1.94)	(4.28)**
x Tenure between 3 and 6 years	0.003	0.003
	(1.17)	(1.05)
x Tenure between 6 and 9 years	-0.008	-0.010
	(1.52)	(1.49)
x Tenure over 9 years	0.001	0.001
	(1.51)	(3.40)**
Will change to another employer in the future	-0.004	-0.008
	(0.40)	(0.75)
Will change to foreign employer in the future	-0.011	-0.012
	(0.84)	(0.94)
PANEL D		
Effects of tenure at current employer for the university educated		
University education		
x Tenure under 3 years		0.038
		(9.44)**
x Tenure between 3 and 6 years		0.004
		(1.82)
x Tenure between 6 and 9 years		0.010
		(6.58)**
x Tenure over 9 years		0.004
		(10.81)**
x Current employer foreign		0.132
		(7.87)**
x Current employer foreign		
x Tenure under 3 years		-0.028
		(4.90)**
x Tenure between 3 and 6 years		-0.002
		(0.58)
x Tenure between 6 and 9 years		0.004
		(0.86)
x Tenure over 9 years		-0.002
		(3.85)**
x Will change to another employer in the future		-0.004
		(0.37)
x Will change to foreign employer in the future		0.008
		(0.59)
PANEL E		
Other control variables		
Age^2 / 100	-0.066	-0.064
	(30.10)**	(35.69)**
Firm size 5 to 9 employees	0.042	0.043
	(15.92)**	(16.30)**
Firm size 10 to 19 employees	0.072	0.073
	(22.67)**	(23.39)**
Firm size 20 to 49 employees	0.090	0.091
	(25.54)**	(26.36)**
Firm size 50 to 99 employees	0.097	0.097
	(24.82)**	(25.55)**
Firm size 100 to 299 employees	0.099	0.099
	(24.37)**	(25.24)**
Firm size more than 300 employees	0.101	0.101
	(23.75)**	(24.95)**
Plant sales per employee / 1 000 000	0.001	0.001
	(1.50)	(1.51)
Plant employment reduction in previous year > 40%	-0.002	-0.002
	(0.65)	(0.86)
Plant employment reduction in current year > 40%	0.000	-0.001
	(0.01)	(0.19)
Person fixed effects	Yes	Yes
Observations	918251	918251
R-squared	0.89	0.90
Number of individuals	136389	136389

Notes : The dependent variable is log real monthly earnings. Coefficients on the following variables are not reported: time dummies, regional dummies, industry dummies. The omitted category for firm size is fewer than 5 employees. T statistics in parentheses allow for clustering at the firm level. * significant at 5%; ** significant at 1%

Table 8 Summary of returns to previous experience

	Employees without university degree	University educated employees
Returns to previous tenure for employees currently in a domestic firm		
Previous tenure in domestic firm under 3 years	0.029**	0.080**
	(0.002)	(0.003)
Previous tenure in domestic firm between 3 and 6 years	-0.009**	-0.016**
	(0.003)	(0.004)
Previous tenure in domestic firm over 6 years	0.018*	0.063**
	(0.007)	(0.014)
Previous tenure in foreign firm under 3 years	0.018**	0.103**
	(0.005)	(0.004)
Previous tenure in foreign firm between 3 and 6 years	0.013	-0.019*
	(0.008)	(0.008)
Previous tenure in foreign firm over 6 years	-0.008	0.036
	(0.025)	(0.027)
Returns to previous tenure for employees currently in a foreign firm		
Previous tenure in domestic firm under 3 years	0.035**	0.061**
	(0.006)	(0.005)
Previous tenure in domestic firm between 3 and 6 years	-0.015*	-0.022**
	(0.006)	(0.007)
Previous tenure in domestic firm over 6 years	0.024	0.063*
	(0.020)	(0.029)
Previous tenure in foreign firm under 3 years	0.030**	0.086**
	(0.007)	(0.006)
Previous tenure in foreign firm between 3 and 6 years	-0.014	-0.017
	(0.010)	(0.011)
Previous tenure in foreign firm over 6 years	0.024	0.023
	(0.041)	(0.029)

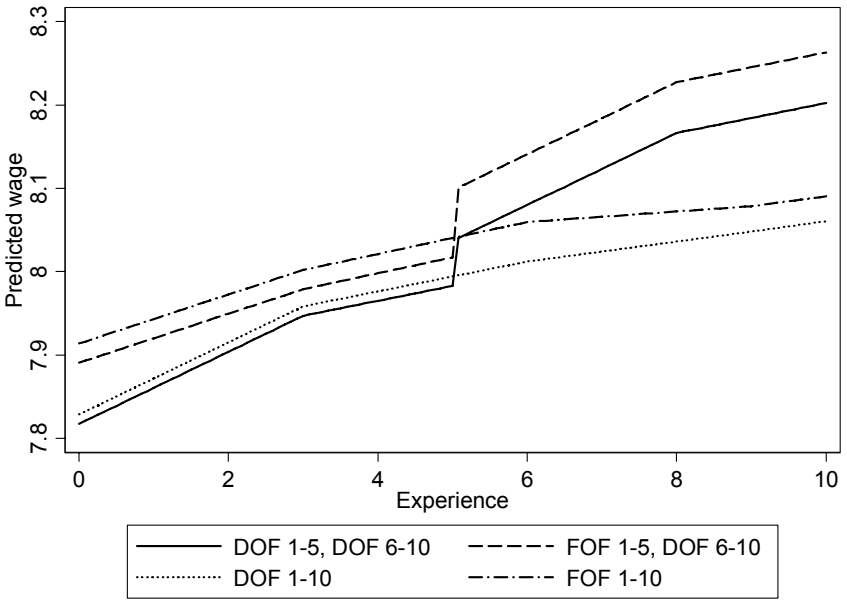
Notes: Based on results reported in column 2 of Table 7. Standard errors in parentheses allow for clustering at the firm level. * significant at 5%; ** significant at 1%

Table 9 Summary of returns to current tenure

	Employees without university degree	University educated employees
Returns to current tenure for employees in domestic firms		
Tenure under 3 years	0.005**	0.043**
	(0.001)	(0.004)
Tenure between 3 and 6 years	0.013**	0.018**
	(0.002)	(0.002)
Tenure between 6 and 9 years	0.002	0.012**
	(0.001)	(0.001)
Tenure over 9 years	0.008**	0.013**
	(0.000)	(0.000)
Returns to current tenure for employees in foreign firms		
Tenure under 3 years	0.020**	0.029**
	(0.003)	(0.003)
Tenure between 3 and 6 years	0.017**	0.019**
	(0.000)	(0.003)
Tenure between 6 and 9 years	-0.008	0.006*
	(0.007)	(0.003)
Tenure over 9 years	0.010**	0.012**
	(0.001)	(0.001)
Ownership of employer		
Current employer foreign	-0.047**	0.085**
	(0.012)	(0.015)
Will change to another employer in the future	-0.008	-0.011
	(0.75)	(0.019)
Will change to foreign employer in the future	-0.012	0.000
	(0.94)	(0.017)

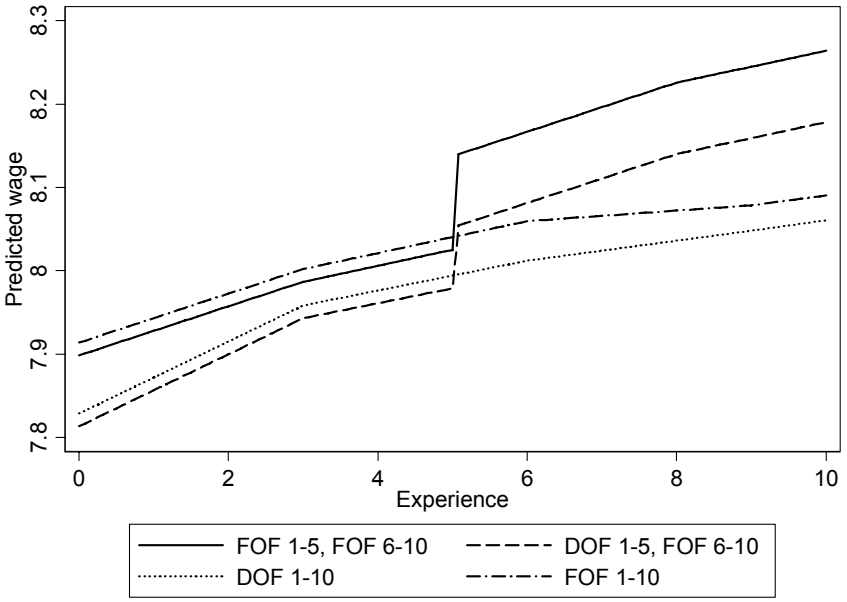
Notes: Based on results reported in column 2 of Table 7. Standard errors in parentheses allow for clustering at the firm level. * significant at 5%; ** significant at 1%

Figure 1 Wage profiles for university-educated employees who are recruited by domestic firms or stay in one firm.



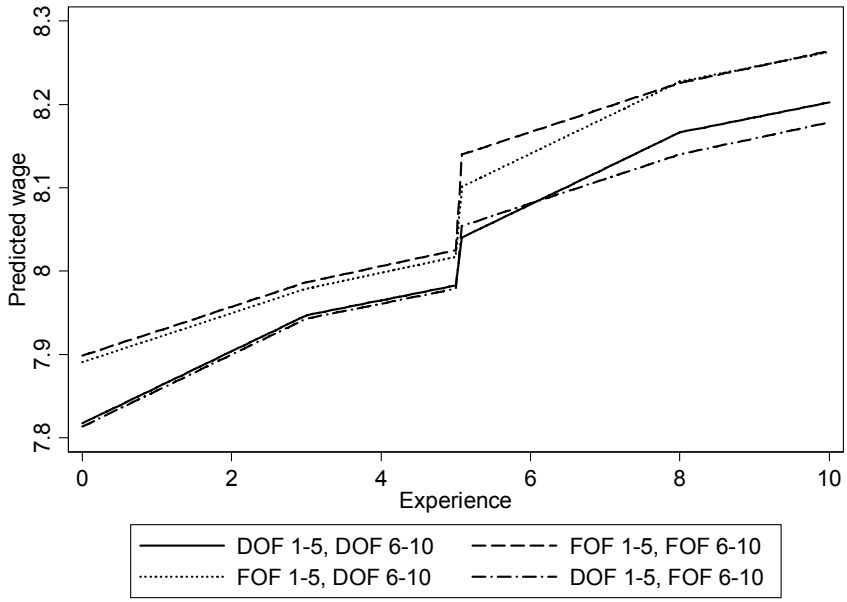
Notes: DOF refers to domestically owned firm, FOF refers to foreign-owned firm. Experience is measured in years. Wage paths are evaluated at median values of other control variables.

Figure 2 Wage profiles for university-educated employees who are recruited by foreign firms or stay in one firm.



Notes: DOF refers to domestically owned firm, FOF refers to foreign-owned firm. Experience is measured in years. Wage paths are evaluated at median values of other control variables.

Figure 3 Wage profiles for university-educated employees recruited by foreign and domestic firms



Notes: DOF refers to domestically owned firm, FOF refers to foreign-owned firm. Wage paths are evaluated at median values of other control variables.

Labour Market Transitions Following Foreign Acquisitions

Abstract
This paper analyses employee flows in firms subject to foreign acquisitions using a large Finnish linked employer-employee data set. The results show that in the industrial sector, the job separation hazard increases in the year following a foreign or domestic acquisition. In the case of foreign acquisitions exits to both other jobs and non-employment become more likely with the probability of changing jobs increasing more than the probability of moving to non-employment. However, in certain industrial sectors, where technological know-how may be argued to be important, the job separation hazard does not increase following foreign acquisitions. Neither foreign nor domestic M&A transactions appear to influence the job separation hazard of service sector employees in the first year following the acquisition, but in the second and third years after the transaction the job separation hazard increases with a larger change following foreign than domestic acquisitions. The impact of a foreign acquisition does not vary by individual characteristics in either sector, whereas following a domestic merger there is an increase in the job separation hazard of university educated employees. Also older workers experience an increase in their job separation hazard following a domestic merger.

JEL classification: J63, C23, F23

Keywords: Foreign acquisition; Job separations; Linked employer-employee panel data

1 Introduction

Cross-border mergers and acquisitions play a major role in the ongoing globalisation process and are often the subject of public debate on the pros and cons of increased economic integration. One of the areas of influence of foreign acquisitions is the labour market. In the public debate foreign acquisitions are often seen as increasing job insecurity due to the perceived ease with which multinational companies can shift their production facilities elsewhere following adverse changes in their operating environment. On the other hand, policy in many countries is designed to attract foreign direct investment because of its perceived positive influence on the host country's economy.

Empirical research on the effects of foreign acquisitions has mainly focused on productivity and wages. There have, nevertheless, also been a number of contributions to the analysis of the impact that transition to foreign ownership has on employment. However, the existing evidence is predominantly based on plant and firm level data, which implies that the

employment effects found in these studies may mask a number of interesting individual level developments taking place following a foreign acquisition. For example, foreign acquisitions may affect different types of workers in different ways. Following the employees of firms subject to a foreign acquisition and combining this with information on individual characteristics will distinguish effects related to changes in workforce composition. Taking into account the subsequent employment status of employees that leave a firm following a foreign acquisition can also give an idea of how severe the effects of potential workforce restructuring are at the individual level. The individual costs of job displacement are typically high, but if most separations are due to job-to-job transitions, the outcomes may not be so adverse. In addition, if the impact on the job separation rate is not substantial, these costs may not be important at the aggregate level.

In addition to being predominantly at the firm and plant level, previous empirical research has been mostly based on data from the manufacturing sector, which is a limitation, considering the increased importance of the service sector. There may be important differences between the motives and impacts of acquisitions in different sectors. For example, to the extent that certain service sector firms may need a customer interface, it may not be as straightforward for an acquirer to restructure the workforce of a service sector firm as it would be in an industrial firm.

When studying the impact of foreign acquisitions on personnel it is also important to try to distinguish between effects that potentially are common to any acquisition, be it cross-border or not, and effects that are unique to transactions where the acquirer is foreign. An acquisition per se may induce restructuring, but to the extent that the motives of foreign and domestic acquisitions differ, there may be quite different implications for the workforce. For example, there is survey evidence from Finland indicating that the most prevalent reasons for acquisitions of Finnish companies by foreign companies have to do with access to the Finnish, Nordic or Russian market (Ali-Yrkkö et al. 2004). There are also differences depending on sector, with technological know-how also being a commonly cited motive for foreign acquisitions in some industrial sectors. Motives for purely domestic mergers may differ from these, which may imply different consequences for employees.

This paper seeks to complement earlier studies on the links between foreign acquisitions and the workforce, and contributes to the literature by conducting an individual level analysis on all sectors of the economy. I use linked employer-employee data on a representative sample of Finnish employees in all sectors, which enables me to analyse the flow of workers in plants following a foreign acquisition. I decompose these flows by destination states and control for individual and firm characteristics in

studying the effect that foreign acquisition has on the probability of ending up in a particular state. I also seek to establish whether the effects of acquisitions are similar regardless of whether foreign companies are involved, i.e. I distinguish between the effects of purely domestic mergers and cross border acquisitions.

The analysis shows that in the industrial sector, the job separation hazard increases in the year following a foreign or domestic acquisition. In the case of foreign acquisitions exits to both other jobs and non-employment become more likely with the probability of changing jobs increasing more than the probability of moving to non-employment. However, in certain industrial sectors, where technological know-how may be argued to be important, the job separation hazard does not increase following foreign acquisitions. There is no such difference between different types of industrial sectors following domestic mergers. This may indicate knowledge sourcing as a motive behind foreign acquisitions in these sectors. M&A transactions do not appear to influence the job separation hazard of service sector employees in the first year following the acquisition, but in the second and third years after the transaction the job separation hazard increases with a larger change following foreign than domestic acquisitions. The finding may be related to the need for a customer interface which restricts the possibilities for immediate restructuring. In the industrial sector the job separation hazard decreases in the second and third years following both foreign and domestic acquisitions, implying a one-off restructuring. The impact of a foreign acquisition does not vary by individual characteristics in either sector, whereas following a domestic merger there is an increase in the job separation hazard of university educated employees. Also older workers experience an increase in their job separation hazard following a domestic merger.

The remainder of the paper is structured as follows. Section 2 presents a brief overview of the related theoretical and empirical literature. Section 3 describes the data used in the analysis. Section 4 describes transitions of workers and presents the analysis of the effect of foreign acquisition on individual employment outcomes. Finally, Section 5 concludes.

2 Related literature

2.1 Theoretical background

The analysis of the effects of foreign acquisitions links two distinct strands of literature: theories of multinational enterprises (MNEs) and theories of mergers and acquisitions (M&A). Theories of MNEs have implications for employment through different routes. Firstly, they imply that the skill structure of the labour force in MNEs may differ from that of purely domestic firms, with MNEs having a higher share of skilled employees

(Markusen, 2002). This may lead to restructuring when a firm develops into a MNE. Secondly, MNEs may differ from purely domestic firms in terms of the speed and magnitude of employment adjustment due to their ability to relocate production on the one hand and the different skill structure of their labour force on the other (Barba Navaretti et al., 2003). The higher share of skilled workers implies more rigid labour demand[1] but the ability to relocate implies a speedier and potentially larger adjustment.

Both of the effects mentioned above arise from the differences between MNEs (both domestically or foreign owned) and purely domestic firms. The literature on mergers and acquisitions, on the other hand, considers the effects of the actual change of ownership as a one-off event. This literature has discussed several different frameworks for thinking about the employment effects of foreign acquisitions. These models link ownership change to e.g. creative destruction, market competition, scale economies and synergies[2]. The hypotheses on the effects of ownership change on employment derived from these models vary and are related to the different motives behind the transactions. For instance, exploiting synergies may lead to higher employment if the rise in efficiency enables an expansion in market share. On the other hand, disposing of overlapping functions to improve efficiency may lead to downsizing. An acquisition may also have different effects on different types of employees. Eg. if an acquisition is undertaken with the intention of changing management practices, this will most likely affect management differently than the rest of the workforce (Shleifer and Vishny, 1988). To the extent that acquisitions in foreign and domestic markets may be undertaken for different reasons and may involve e.g. different degrees of overlapping functions between the firms involved in the transaction, the implications for employees may be quite different following a foreign rather than domestic acquisition.

When considering individual employment outcomes following foreign acquisitions, it is also worthwhile to consider the implications of the literature on MNEs and the literature on M&As in the context of workers flows. In models such as Jovanovic (1979), the job-matching process ensures that workers are optimally assigned to jobs. In such a framework acquisitions may be thought of as causing turnover, if they change the value of a worker-employer match. This may again depend on distinct characteristics of foreign vs. domestic acquisitions.

With increasingly integrated international markets it may be argued that some acquisitions by foreign firms may bear characteristics related more to pure acquisition effects than the multinational aspects of the transaction.

---

[1] Hamermesh (1993).

[2] E.g. Jensen (1988), Bradley et al. (1983), Salant et al. (1985), Schleifer and Summers (1987).

All in all, the theoretical predictions in terms of employment effects of foreign acquisitions are not clear cut and the effects in the short and long run may be quite different. Adjustments leading to job separations in the short run may also lead to improved performance and increases in labour demand later on. Evidence from previous empirical research will be discussed in the next section.

2.2 Previous empirical research

Empirical research on the employment effects of foreign acquisitions has mostly been conducted on plant and firm level data. Studies that consider foreign acquisitions explicitly include the following: Girma and Görg (2004) for the UK, Piscitello and Rabbiosi (2005) for Italy, Balsvik and Haller (2007) for Norway, Bellak et al. (2006) for Austria, Bandick and Karpaty (2007) for Sweden, Martins and Estevez (2008) for Brazil, and Böckerman and Lehto (2008) for Finland. The results from these studies are mixed. In the context of the current analysis, the most relevant is probably the previous on Finnish data by Böckerman and Lehto (2008) who find that acquisitions by foreign based firms have a negative effect on employment only in the manufacturing sector whereas takeovers by foreign-owned companies based in Finland have a substantially negative impact on employment in a group containing firms in construction and services. They also study domestic acquisitions and find that these have a negative effect on employment in all sectors.

Studies that do not take into account the nationality of the acquiring firm have been conducted using both US and European data, but again almost exclusively with plant and firm level data. Research on US data has found both negative and positive effects of employment[3], whereas European evidence implies mainly negative effects of M&A on employment[4]. Gugler and Yurtoglu (2004) compare the effects of M&A in the US and Europe using firm level data and find that in Europe mergers significantly reduce the demand for labour but in the US there is no evidence of significantly adverse effects. They also take into account cross border mergers and acquisitions but do not find significant differences compared to domestic acquisitions.

Individual level employment effects of M&A have previously been studied by Margolis (2006) using French data. He distinguishes between the effects on the acquiring and acquired firm and finds that employees of the acquired

[3] See Brown and Medoff (1988), Bhagat et al. (1990), Lichtenberg and Siegel (1990), McGuckin et al. (1995) and McGuckin and Nguyen (2000).

[4] See Conyon et al. (2002), Siegel and Simons (2006).

firm are less likely to remain with the new entity immediately after the takeover. He also observes that the workers with characteristics typically associated with the fastest subsequent job finding are overrepresented among those leaving a firm following a takeover. Gibbs et al. (2006) study post-merger organisational integration using individual level data from Denmark and find that if employees of the acquiring firm are dominant in the new firm, as measured by number of employees in the two groups, they experience lower turnover. Siegel and Simons. (2008) study individual level employment effects of M&A using Swedish manufacturing data. They find that M&As significantly increase the likelihood of inter-firm mobility and unemployment. These studies do not, however, distinguish between foreign and domestic M&A.

Individual level employment effects of foreign acquisitions are also related to the changes in the skill composition of employment. This issue has been studied using plant level data by Lipsey and Sjöholm (2002) for Indonesia, Almeida (2007) for Portugal and Huttunen (2007) for Finland. The results from these studies differ from one another, and in the context of the current analysis it is interesting to note that using Finnish manufacturing data, Huttunen (2007) finds that the share of highly educated workers decreases a few years after a foreign acquisition. Considering the implications of the theory of MNEs this finding is slightly surprising, and provides a useful comparison for the current individual level analysis.

The previous literature discussed above gives rise to interesting issues that can be studied with the individual level data at hand. The theory on M&A does not provide clear predictions regarding the employment effects of foreign acquisitions. However, previous empirical findings give us reason to expect that the probability of a job separation will go up following a foreign acquisition and that there may be different effects for different types of employees. In addition, analysis of the destinations of workers who leave a firm following a foreign acquisition should shed some light on the severity of employment changes at the individual level.

3 Data

This study is based on a data set from Statistics Finland that links information on employers, i.e. firms and plants, and their employees. The data set is a 1/3 sample of individuals that were 16 to 69 years old in 1990. They are followed to 2002 and the sample is extended each year by adding a 1/3 sample of 16 year old persons. The data set is formed by linking data from various Statistics Finland databases: Finnish Longitudinal Employer-Employee Data, Business Register, Industrial Statistics and Financial Statements Statistics. Information on the employer is linked to each individual based on the employer at the end of the year. Because of

confidentiality, some of the firm level information is in the form of classified variables (firm size), ratios (value added per employee), growth rates (change in firm level employment), or binary variables (foreign ownership). These data are collected for all available years on all firms and plants that employ at least one individual in the sample. The plant and firm panels thus cover most of the business sector in Finland[5].

Information on foreign ownership is available from 1994 onwards, which is not a severe restriction considering that foreign ownership in Finland was scarce before this time due to strict regulations that were not abolished until 1992 (Golub, 2003). Foreign acquisitions can first be identified in 1995, so when analysing the effects of foreign acquisition on subsequent employment status the analysis years are 1996 to 2002. Job spells for employees with a plant code are studied, which basically concentrates the analysis on the business sector. The data set consists of 508 788 individuals who work in 114 996 plants giving a total of 1 871 277 person year observations.

Foreign ownership is defined on the basis of ultimate beneficiary owner (UBO) and a 20 per cent threshold is used in classifying a plant as foreign owned. Foreign acquisitions and foreign divestitures are identified on the basis of the ultimate beneficiary owner changing from domestic to foreign and vice versa. Many differences between foreign owned and domestic firms, such as the ability to shift production from one country to another, relate more to the multinationality of the firm than the actual nationality of ownership, and therefore it may be relevant to control for multinational status of the firm. I can identify domestic and foreign MNEs during the last years of our observation period, and use this information in robustness checks.

Identifying purely domestic mergers and acquisitions is slightly more difficult than identifying foreign acquisitions due to the nature of the data set. Plant codes are very stable and remain the same regardless of the ownership of the plant. Firm codes, however, may change due to other reasons than acquisitions (e.g. change of legal status of the firm). However, there are cases in which changes in firm codes can reasonably unambiguously be identified as mergers[6]. These types of changes are:

- The firm codes of two or more plants change to the same new firm code. Usually the old firm codes of these plants disappear, although it is possible that some part of one or both of the old firms remains outside the new entity.

[5] The linking of the data set is described in detail in Ilmakunnas et al (2001).
[6] I wish to thank Valerie Smeets for suggesting this method of identifying mergers.

- The firm code of one or more existing plants changes to an existing firm code previously related to one or more other plants. In other words. plants join another firm and their old firm code usually disappears.

This method is not completely flawless but should enable me to control for domestic mergers and acquisitions to a reasonable extent. As my primary focus is on the effects of foreign acquisitions, it is important to be able to control for effects of acquisitions in general, which this method can be argued to accomplish. Table 1 shows the number employees affected by different types of ownership change during our observation period. The number of employees involved in foreign divestitures is low, which should be kept in mind when analysing the results.

[Table 1]

In this study I analyse transitions out of private sector plants by first examining job separations in general and then distinguishing between transitions based on destination state. The different destination states considered are unemployment, outside the labour force, employed without a plant code, and employed with a new employer with a plant code. Employers without plant codes consist of e.g. most of the public sector whereas employers with plant codes cover effectively the whole business sector. Changing to a new employer is defined as a simultaneous change in a worker's plant code and the start of a new employment contract. In addition, if an employee's firm code does not change, then he/she is classified as staying with the same employer, i.e. changing plants within the same firm is generally not regarded as a job change.

The analysis includes a wide range of conditioning variables that previous studies have found to have an impact on employment transitions[7]. I include controls both at the individual and firm/plant level. The individual level variables include socioeconomic characteristics such as age, education, gender, marital status and under-aged children. The job specific control variables I use are measured in the year prior to the year in which labour market status is evaluated. Tenure is included in order to control for duration dependence[8]. In addition, the log of taxable earnings is included as this may control for individual heterogeneity. Firms may also use the wage to lower quit rates.

---

[7] See e.g. Blau and Kahn (1981), Light and Ureta (1992), Lynch (1992), Royalty (1998), Anderson and Meyer (1994).

[8] The data are left censored, i.e. also job spells that begin before our observation period are included. The start date of each spell and thus tenure is, however, known also for those spells that begin prior to our observation period.

The firm and plant level control variables include firm size, value added per worker, industry dummies as well as an indicator for declining employment in the year prior to the year in which I determine whether a plant has been acquired. This is done in order to account for reductions in employment that can not be attributed to the change of ownership. In addition I control for exporter and importer status of the firm so as to not confuse effects of this type of internationalisation with the influence of a foreign acquisition.

The ownership variables included in the analysis are used to distinguish between the impact of different types of acquisitions. I include separate indicators for whether the employer was involved in a domestic M&A transaction, was subject to a foreign acquisition or was divested by a foreign firm in the previous period. As discussed above, if there are differences in the motives for foreign and domestic acquisitions, the consequences for the workforce may be quite different. I also include indicators for whether one's employer is in foreign ownership at some stage in the observation period or is involved in either a foreign or purely domestic M&A transaction at some point in the observation period. This enables me to control for persistent differences between these groups of firms.

In order to determine whether the consequences of M&A transactions differ for different types of employees, I interact the indicators for ownership change with individual education and age. I also include interactions of sector with the ownership change variables to take into account potential differences in the service sector as opposed to the industrial sector as found by Böckerman and Lehto (2008). As motives for acquisition may differ depending also on more detailed industry characteristics, I also conduct robustness checks with more detailed industry splits.

4 Empirical analysis

In this section I first provide some descriptive statistics and then analyse the changes in the probability of separating from a job following foreign and domestic acquisitions. After this I disaggregate the job separations based on destination states in order to study the employment outcomes of workers involved in M&A transactions. Finally, I conduct robustness checks on the chosen specifications.

Descriptive statistics of the control variables are displayed in Table 2 and Table 3. The individual characteristics of employees do not vary substantially between firms subject to different types of M&A transactions. Employees in firms subject to foreign acquisitions and foreign divestitures have on average marginally higher education than those in firms that are involved in domestic M&A or not involved in M&A. Average tenure and

earnings are somewhat higher in firms involved in M&A. Employees were more likely to have experienced declining employment in firms subsequently subject to foreign acquisitions and purely domestic mergers than in firms not involved in M&A or involved in a foreign divestiture. In addition, employees in firms involved in international trade are to a larger extent affected by any type of M&A transaction. Some of these differences are related to the employer size distribution shown in Table 3, which indicates that employees of large firms are more likely to be affected by M&A transactions. The fact that domestic mergers appear to involve larger firms may be related to the fact that large foreign owned multinationals may acquire Finnish firms with e.g. only one plant. The size of the foreign acquirer is not recorded in our data.

[Table 2, Table 3]

Table 4 presents a sectoral breakdown of employees affected by M&A. We can see that most of the employees affected by both purely domestic mergers and foreign acquisitions work in the sector consisting of wholesale, retail trade and hotels and restaurants. The share of workers involved in these transactions are, however, proportionate to the overall employment share of the sector. On the other hand, employees the food and beverage industry are disproportionately affected by both purely domestic mergers and foreign acquisitions. In the wood and paper industry the number of employees involved in purely domestic mergers is high relative to the sector's employment share. In addition, employees in the manufacture of machinery and equipment n.e.c, electrical and optical equipment as well as those employed in financial intermediation are disproportionately affected by foreign acquisitions during our observation period.

[Table 4]

Table 5 shows job separation rates separately for employees in the industrial and service sectors following different types of M&A activity. Without controlling for any firm and worker characteristics it actually appears less likely that an employee will leave the current employer following an M&A transaction. Following a foreign acquisition in the industrial sector the frequency of job separation is slightly lower than in firms not involved in M&A, although the transition rates are almost identical.

[Table 5]

4.1 Job separations following foreign acquisitions

To analyse job separations following foreign acquisitions I estimate a duration model in order to take into account the differences in time in which workers are at risk of separating from their job. As I am using annual data, i.e. the data is grouped into intervals, I use a discrete time version of a proportional hazards model, the complementary log-log model. In this model the discrete time hazard of separating from a job can be expressed as:

$$h(t) = 1 - \exp\left[-\exp(x'\beta + \gamma_t)\right], \qquad (1)$$

where $\boldsymbol{x}$ is a 1 x K vector of characteristic of the individual, $\boldsymbol{\beta}_j$ is K x 1, γ characterises duration dependence and t refers to the time period. As I am dealing with discrete time, this hazard is the probability of having spell length t, conditional on survival up to time t.[9] I estimate the complementary log-log model assuming normally distributed unobserved heterogeneity at the plant level. It seems reasonable to assume that firm and plant level characteristics are the primary determinants of an acquisition. However, it should be noted that acquisitions may be correlated with unobservable individual characteristics, and due care needs to be taken when interpreting the results. As I am able to control for a variety of individual characteristics the problem may be less severe than in similar plant-level studies. I have also conducted the analysis controlling for individual level unobserved heterogeneity and experimented with different types of distributions for the individual heterogeneity[10]. These analyses were done on smaller sample due to computational issues, and the results assuming a normal distribution, gamma distribution (Meyer, 1990) and a discrete distribution (Heckman and Singer, 1984) are consistent with those presented here. Using indicators for whether a firm is involved in a domestic or foreign M&A transaction at some stage during the observation period should control for persistent differences between firms that are targeted by acquirers and others, and plant level controls such as value added per worker should also alleviate the potential endogeneity problem. These concerns should, however, be kept in mind when interpreting the findings[11].

Table 6 presents the results of estimation of different specifications of the complementary log-log model. Results are presented in the form of hazard ratios, with numbers greater than one indicating that the covariate has a positive proportional impact on the hazard and numbers less than one

[9] See e.g. Jenkins (2005).
[10] Results not shown, available on request.
[11] Unfortunately, there are currently no convincing instruments available for the acquisition variable.

implying a negative proportional impact on the hazard. Column 1 of Table 6 shows results from a complementary log-log model where we take into account whether the firm was involved in an M&A transaction in the previous period and interact this with indicator for the firm being in the industrial sector (as opposed to services)[12]. The upper part of Table 6 shows the effects of the individual and firm/plant level control variables we include in the analysis. I will briefly discuss these first.

[Table 6]

The effects of the control variables in column 1 are mostly as expected based on previous research. Females with young children are more likely to leave the firm, most likely reflecting transitions out of the labour force. This can be determined in more detail in the next section where flows are decomposed based on destination state. Employees with more tenure are slightly less likely to leave the firm which implies positive duration dependence. As discussed above, I include income to control for unobserved individual heterogeneity and the results show that individuals with higher earnings are less likely to separate from their job. This is consistent with search theory and findings in other empirical studies. Since earnings are potentially endogenous, I also ran the estimations without this variable, and my main results are robust to this change.

The plant and firm level control variables in column 1 also have expected impacts. To control for reductions in employment that are not related to ownership change, I include an indicator for declining employment at the plant between years t-2 and t-1. Unsurprisingly, previous downsizing increases the hazard of job separation. Higher labour productivity as measured by value added per worker decreases the job separation hazard. Firm size also has a significant effect on the job separation hazard, with employees in larger firms less likely to leave their job. This most likely reflects a broader range of employment possibilities within the firm and can be examined more closely using disaggregated flows in the next section.

To control for persistent differences between firms that are involved in foreign or domestic acquisitions and those that are not, I also include indicators for whether the firm in question is part of an M&A deal, be it foreign or domestic, at some point during our observation period and also an indicator for being foreign owned at some stage. These indicators therefore take the same value for a given firm during the whole observation period. We can see in column 1 in the first part of Table 6 that the hazard of job separation is higher in firms that at some point are foreign owned.

[12] The industrial sector is defined as manufacturing, utilities, construction and mining and quarrying.

By contrast, firms targeted by acquirers, be they foreign or domestic, do not appear persistently different from other firms in terms of job separation probabilities.

The primary variables of interest are those related to ownership change in the second part of Table 6. As discussed above, in the specification in column 1 I interact the indicators of ownership change with an indicator for the firm being in the industrial sector. The ownership variables without the interaction term therefore give the estimates for the service sector.[13] In the service sector the job separation hazard actually decreases following a purely domestic merger and a foreign divestiture, and there is no significant change after a foreign acquisition. These results are at odds with the plant level results in Böckerman and Lehto (2008), who found that domestic mergers had a significantly negative effect on employment in the service sector. This difference may be related to the different definitions used for defining domestic mergers. However, our results for later years after the transaction reported below are in line with the aggregate level findings of Böckerman and Lehto (2008). With respect to foreign divestitures, it should be noted that the number of employees involved in these transactions is limited, as seen in Table 1, so the economic significance of the results concerning them is not substantial. I will therefore not concentrate on the impact of foreign divestitures in our analysis of the results.

By contrast, in the industrial sector the hazard of job separation increases following both domestic mergers and foreign acquisitions. For employees in industrial firms that are involved in a domestic merger, the hazard of exiting the job rises by approximately 12 per cent[14] and for employees in firms subject to a foreign acquisition the increase is as high as 24 per cent. In the industrial sector there does, therefore, appear to be restructuring taking place after both domestic and foreign M&A deals. This is consistent with the more aggregate level findings of Böckerman and Lehto (2008). The difference between the change in the job separation hazard following M&A transactions in services and the industrial sector may be related to e.g. requirements of a customer interface in certain service sector firms. In such cases, restructuring the workforce within a short time horizon may not be possible.

Since the potential impact of ownership change may take some time to materialize as implied by Huttunen's (2007) study, I also consider the

[13] I have also conducted the estimations separately for the industrial sector and services. The results (not reported, available on request) are consistent with those presented here.

[14] The overall estimated impact of a domestic merger on the job separation hazard in the industrial sector is given by the hazard ratio for the indicator of a domestic merger (i.e. the impact in the service sector) multiplied by the hazard ratio of the interaction term of the domestic merger and the industrial sector dummy.

effects of M&A deals two and three years after the transaction. The specification is otherwise similar to that in column 1 of Table 6. It should be noted, that as all individuals included in the estimation need to be observed for at least four periods, the number of observations available for estimation drops and the structure of the estimation sample also changes. The results are shown in column 2 of Table 6.

The results show that in the service sector there is a significant increase in the job separation hazard in the second and third years following both a purely domestic merger and a foreign acquisition. Employees in firms subject to a domestic merger experience a 10 per cent increase in the job separation hazard in both the second and third years after the transaction. Workers in the service sector whose employer was subject to a foreign acquisition two to three years earlier have a job separation hazard that is 25 per cent to 30 per cent higher than the hazard for employees in firms not involved in such a transaction. As discussed above, the finding that there is no change in the service sector job separation hazard in the first year after an M&A transaction but an increase is observed in the following years may be related to the structure of some service businesses requiring a continuing customer interface.

In the industrial sector, on the other hand, following the first year increase in the job separation hazard that was found above to be related to both domestic and foreign acquisitions, there is actually a decrease in the job separation hazard in the second and third years following both domestic and foreign acquisitions. Taking into account the total change, i.e. the combination of the impact on the reference group of service sector employees and the interaction term, indicates that the decreases in the job separation hazard in the industrial sector are 3 per cent and 6 per cent in the second year after domestic and foreign acquisitions respectively and 15 per cent and 10 per cent in the third year. In this specification, the first year increase in the hazard appears slightly stronger following domestic mergers. These results indicate that in the industrial sector there is restructuring taking place in the first year following the transaction, but following these initial changes, the job separation hazard of remaining employees actually decreases compared to their colleagues in other firms.

As I am using individual level data I am also able to examine the impact that different types of M&A have on particular groups of employees. The results in column 3 of Table 6 show estimation of the same specification as in column 1, but with the ownership change variables additionally interacted with the education and age of the individual. As should be expected, the impacts of the individual level control variables in the first part of Table 6 are the same for the extended specification in column 3 as for the estimation shown in column 1.

Turning to the variables indicating ownership change in the lower part of Table 6, the interaction terms with the individual level characteristics now indicate differences in the consequences of M&A transactions for different types of employees. The results indicate that the increase in the job separation hazard following a domestic merger that was found above is driven by older employees. Comparing employees of similar age, there is actually a slight decrease in the job separation hazard following a domestic merger. However, the job separation hazard after a domestic merger increases with age, with the hazard ratio indicating a 0.4 per cent increase per additional year of age. Following a foreign acquisition, there do not appear to be differences in job separation hazards between employees of different age.

Education also appears to make a difference for job separation probabilities following a domestic merger. Having a university education increases the job separation hazard by 15 per cent compared to colleagues of similar age following a domestic merger. This would indicate restructuring at more skill intensive levels of the organisation. This is in line with the findings of Margolis (2003) who notes that workers with characteristics typically associated with the fastest subsequent job finding are overrepresented among those leaving a firm following a takeover. In contrast, education does not appear to affect the job separation hazard following a foreign acquisition. There may, of course, be a longer term effect as found in Huttunen (2007).

4.2 Exits to different labour market states following foreign acquisitions

The single risk model discussed in the previous section indicated that e.g. in the industrial sector, the job separation hazard increased following both domestic and foreign acquisitions. However, this does not shed light on how adverse the effect of such an increase is for the employees in question. If most of the separations are due to transitions to other jobs, the individual level costs may not be substantial[15]. In addition, if job separations are mostly due to transitions to unemployment, this is most likely not voluntary and can be related to significant adjustment costs at the individual level. In order to study this issue, I next estimate a multinomial logit model to analyse the effect that a foreign acquisition has on the probability of exiting a job to different labour market states compared to staying with the same employer. This estimation method is essentially a competing risks duration model for discrete time data with the somewhat

[15] These individuals may, of course, earn a lower wage even if they do change to another employer.

restrictive assumption that spell length is intrinsically discrete rather than continuous but grouped into intervals[16].

The alternative destination states are those described above, i.e. unemployment, outside the labour force, employed outside the business sector, employed with a new business sector employer and employed with the same employer[17]. The destination-specific hazards are:

$$\Pr(y = j) = \frac{\exp(x'\beta_j)}{\sum_{h=1}^{J} \exp(x'\beta_h)}, \qquad (2)$$

where $\boldsymbol{x}$ is a 1 x K vector, $\boldsymbol{\beta}_j$ is K x 1, j=1, ... , *J*. To identify the model, I set the parameter vector related to the outcome "Same employer" to 0, i.e. $\boldsymbol{\beta}_1 = 0$. Thus the remaining coefficients will measure the change relative to the group who stay with the same employer. I will discuss the results in the form of the relative probability of a certain transition to the probability of staying at the same firm, i.e. odds ratios (or ratios of relative risk). These are defined as:

$$\frac{\Pr(y = j)}{\Pr(y = 1)} = \exp(x'\beta_j) \qquad (3)$$

With this model, the ratio of relative risk for a one unit change in $x^{(i)}$ is

$$\frac{\exp(\beta_j^{(1)}x^{(1)} + ... + \beta_j^{(i)}(x^{(i)} + 1) + ... + \beta_j^{(k)}x^{(k)})}{\exp(\beta_j^{(1)}x^{(1)} + ... + \beta_j^{(i)}x^{(i)} + ... + \beta_j^{(k)}x^{(k)})} = \exp(\beta_j^{(i)}) \qquad (4)$$

and subsequently the ratio of relative risk for one unit changes in two variables is obtained by multiplying the exponentiated coefficients for these variables.

Table 7 presents the results from the estimation of the multinomial logit model comparing the probability of exiting to different destination states

[16] See Jenkins (2005) for a discussion. An alternative approach would be to explicitly take into account the interval censored data as in e.g. Sueyoshi (1992).
[17] Transitions into self-employment are excluded from the current analysis. Observations on these are very infrequent and do not affect the results.

vs. staying with the same employer. The results are presented in the form of odds ratios as described above[18]. I include interactions with individual characteristics, i.e. in terms of covariates the specification corresponds to that in column 3 of Table 6.

[Table 7]

The main variables of interest are those related to ownership change in the second part of Table 7. Similar to the estimations above, to control for persistent differences between firms that at some point are foreign owned or subject to an acquisition, I include an indicator for both of these groups. Employees in firms that are involved in an M&A transaction do not differ to a large extent in terms of their likelihood to leave their job rather than stay at their current job. They appear about 6 per cent less likely to change to a job outside the business sector than to stay with the same employer. However, being employed in a firm that at some point is foreign owned has quite a large impact on the relative risk of exiting a job to several different destination states, with an increase of 21 per cent to 40 per cent in the likelihood of changing jobs and an increase of 16 per cent in the likelihood of becoming unemployed compared to staying with their current employer. Consistent with the results above, these findings imply that worker mobility from firms that become foreign owned is different from mobility from other firms in addition to the possible one-off effect of the actual acquisition. The fact that there is a difference in both transitions to unemployment and new jobs indicates that these findings are not driven only by differences in voluntary turnover.

Looking at the results on transitions to different states following M&A transactions we first compare employees of similar age and education and then turn to the effects of individual characteristics. The results show that in the service sector there is a decrease in the probability of changing jobs compared to staying at the same firm after both domestic and foreign acquisitions. There is also a decrease in the probability of moving into unemployment following a purely domestic merger, although the estimate is not as precise. For employees in the industrial sector, there is again a slight decrease in the job separation hazard following domestic mergers when comparing employees of similar age as was found in column 3 of Table 6 and this appears to be due to a decreased likelihood of transitions to employment outside the business sector[19]. Following foreign acquisitions the increase in the job separation hazard found above consists of increased

[18] The standard errors are corrected for clustering at the individual level.
[19] As we are studying ratios of relative risk, the combined effect of two control variables is obtained by multiplying the two ratios. So the total impact for industrial sector employees is the odds ratio for ownership change in the service sector times the odds ratio for the industrial sector interaction.

probabilities of exit to both other jobs, unemployment and out of the labour force. However, when using different reference outcomes[20], I find that the likelihood of changing jobs either within the business sector or to an employer outside the business sector increases more than the likelihood of non-employment. These findings indicate that the increased hazard of job separations following foreign acquisitions found also in the single risk model is not due merely to voluntary job mobility, but the higher likelihood of changing jobs compared to transitions to non-employment may attenuate the individual level costs of the adjustment.

In considering next the influence of individual characteristics on the impact that M&A transactions have, I find that the increase in the job separation hazard of university educated employees following a domestic merger is related to an increased likelihood of changing to other jobs. The likelihood of becoming unemployed or moving out of the labour force compared to the likelihood of staying at the same firm does not change significantly. This finding is consistent with previous research showing that educated workers have higher job finding rates and would indicate that despite the increased job separation hazard, educated employees are not too adversely affected by the transaction. Consistent with the findings above, education does not have much influence on labour market transitions following a foreign acquisition. The only change shows up in a decreased likelihood of becoming unemployed, which would indicate that, if anything, layoffs of skilled employees are less likely following foreign acquisitions.

The increased job separation hazard following domestic mergers that was found above for older workers in the single risk model also shows up in this estimation. The increase is driven by higher probabilities of both changing jobs and becoming unemployed. As discussed above, this type of finding is consistent with increased involuntary job turnover implying adjustment costs at the individual level. Transitions out of the labour force do not change significantly indicating that the increased job separation hazard is not to a great extent related to the oldest employees moving into early retirement. In line with the results above, age does not have a significant impact on transitions following foreign acquisitions, with only marginally significant changes in exit probabilities.

The effects of the other covariates can also be interpreted in more detail when considering various destination states. The results in the first part of Table 7 show that e.g. older employees are slightly less likely to change jobs than to stay at the same firm. They are, however, more likely to become unemployed than to remain with the same employer. Also, compared to their male colleagues, women are more likely to become unemployed and

[20] Results not shown, available on request.

change to a firm outside the business sector, but less likely to change to other business sector jobs. Women on average are also less likely to move out of the labour force, but this effect changes drastically when interacted with an indicator for having children under the age of 7. These women are unsurprisingly much more likely to move out of the labour force than to stay at the same firm compared to their colleagues.

More educated employees are more likely to change jobs and less likely to become unemployed or move out of the labour force than stay at their existing job. Employees with higher tenure are less likely to exit a firm to any destination state, implying positive duration dependence. Higher earnings also reduce the likelihood of exiting a firm. Again, since earnings are likely to be endogenous, the model was also estimated without this variable. The effects of interest were robust to this change. Compared to employees in small firms, employees of larger firms are less likely to change jobs, which provides support to the hypothesis that the lower separation hazard in larger firms that was found in the single risk model reflects a broader range of job opportunities within large firms. As found above, declining employment implies that also in the following year employees are more likely to exit than stay in the same firm and this effect extends to all the different destinations considered.

4.3 Robustness checks

In this section I consider some alternative specifications and extensions to the analysis. First, I analyse the effects of a different sectoral division on the results. Since my main results differ depending on whether a firm is in the service or industrial sector, I attempt to deepen the analysis by splitting the firms into narrower sectors and then interacting these with the variables indicating ownership change. As argued above, it could be that certain service sector firms need to maintain a customer interface, which could influence the ability of the firm to restructure its workforce in the short run. In addition, in the industrial sector, there may be differences in the motives of acquisitions in different sectors, as e.g. Ali-Yrkkö et al. (2004) report survey evidence indicating that technological know-how is an important reason for foreign acquisitions in some sectors. I use alternative sectoral divisions attempting to capture differences in the need for a customer interface in services on the one hand and importance of technological know-how in the industrial sector on the other (see Table 4).

The results show[21] that the impact of M&A transactions is similar in different service sectors, which may indicate that if the results reported above are driven by time needed to cope with the need for a customer interface, then this is true on a broad scale in the service sector. It should

[21] Results not shown, available on request.

be noted, that the information on sectors is not very detailed (see Table 4) which may also influence the results. By contrast, when studying differences in the impact that foreign acquisitions have in different sectors in industry, I find that in sectors Manufacturing of machinery and equipment n.e.c and Manufacturing of electrical and optical equipment, the increase in the job separation hazard found in the rest of industry is absent[22]. No such difference between industrial sectors is found following domestic mergers. This finding indicates that the motives for foreign acquisitions in these sectors may differ from motives in other sectors, e.g. by having to do with access to technological know-how. This in turn is likely to influence the impact that foreign acquisitions have on employment outcomes in these sectors.

Next, I consider the possibility that foreign acquisitions may have a different impact in cases where the acquired firm is already a multinational. This is related to the discussion that it is primarily differences between multinational and purely domestic firms rather than foreign and domestic firms that are relevant. In the context of foreign and domestic acquisitions this may not be as important, as many potential differences in the impacts of these transactions may be argued to mostly be related to whether the acquisition takes place in the local or foreign market. In any case, I run a similar estimation as that presented in column 3 of Table 6 but including interactions of the indicator for a foreign acquisition with an indicator for whether the firm is a multinational. Information on multinational status is only available for the last years of our observation period, so this analysis includes data from 1999 onwards. The results show[23] that in industrial sector firms that are already multinational, the job separation hazard of employees increases by slightly less than in purely domestic firms. This may obviously also be related to the prevalence of multinationals in the technologically intensive sectors discussed above. I also consider the possibility that the influence that an acquisition has on job separations may be related to the size of the acquired firm. This is related to multinational status in that multinationals are typically larger. The results show that in the largest firms the job separation hazard actually increases more than in smaller firms following a foreign acquisition. There is no difference following a domestic merger.

Finally, I also conduct a robustness check using a linear probability model to describe job separations as opposed to the duration model I have discussed above. I run an OLS specification with covariates similar to those

[22] In this specification, the industrial sectors are split in two: Manufacturing of machinery and equipment n.e.c and Manufacturing of electrical and optical equipment form one group and the rest of the industrial sectors form the other. A further division becomes problematic due to limited numbers of observations.
[23] Results not shown, available on request.

in the specification presented in column 3 of Table 6. I include plant fixed effects which may to some extent also alleviate the problem of the endogeneity of acquisitions. The results from this specification are qualitatively similar to the results obtained using the duration model[24], and thereby support our earlier findings.

5 Conclusions

The purpose of this study was to examine the individual level employment effects of foreign acquisitions. The analysis shows that firms that become foreign owned are persistently different from firms that are continuously in domestic ownership, and employees in the firms that are, were previously, or will later be foreign owned are more likely to separate from their job. In the industrial sector, the job separation hazard increases in the year following a foreign or domestic acquisition. In the case of foreign acquisitions exits to both other jobs and non-employment become more likely with the probability of changing jobs increasing more than the probability of moving to non-employment. This difference can attenuate the individual level adjustment costs of the increased separation hazard. In certain industrial sectors, where technological know-how may be argued to be important, the job separation hazard does not increase following foreign acquisitions. There is no such difference between different types of industrial sectors following domestic mergers. M&A transactions do not appear to influence the job separation hazard of service sector employees in the first year following the acquisition, but in the second and third years after the transaction the job separation hazard increases with a larger change following foreign than domestic acquisitions. In the industrial sector the job separation hazard decreases in the second and third years following both foreign and domestic acquisitions, implying a one-off restructuring.

The impact of a foreign acquisition does not vary by individual characteristics in either sector, whereas following a domestic merger there is an increase in the job separation hazard of university educated employees. However, this increase is driven by job-to-job transitions implying that the individual level costs may not be severe. Also older workers experience an increase in their job separation hazard following a domestic merger, but in their case the increase is related to both transitions to other jobs as well as unemployment. All in all, the largest differences between changes in job separation hazards after M&A transactions appear to be related to sectoral differences. The changes observed following domestic and foreign acquisitions indicate similar types of restructuring, but the magnitudes of

[24] Results not shown, available on request.

the changes are somewhat larger in the case of foreign acquisitions. The finding that the job separation hazard does not increase following foreign acquisitions in certain industrial sectors that may be considered knowledge intensive may well be indicative of different motives for these transactions compared to purely domestic mergers. In addition, the fact that the development of job separation hazards varies based on individual characteristics following domestic mergers but no such difference is found following foreign acquisitions, may be indicative of slightly different motives behind the transactions. Contrary to commonly expressed views in the public debate, the consequences of foreign acquisitions do not appear strictly more adverse than the consequences of purely domestic acquisitions.

References

Ali-Yrkkö, J. 2004. Finland in global competition – determinants of firms' locational decisions (in Finnish). Etla - The Research Institute of the Finnish Economy, Discussion Paper No. 927.

Almeida, R. 2007. The labor market effects of foreign owned firms. *Journal of International Economics* 72, 75-96.

Anderson, P.M., Meyer, B.D. 1994. The Extent and Consequences of Job Turnover. Brookings Papers on Economic Activity: Microeconomics 177-248.

Balsvik, R., Haller S. 2007. The contribution of foreign entrants to employment and productivity growth. Manuscript. Norwegian School of Economics and Business Administration.

Bandick, R., Karpaty, P. 2007. Foreign Acquisition and Employment Effects in Swedish Manufacturing. Örebro University Working Papers No. 10/2007.

Barba Navaretti, G., Checchi D., Turrini, A. 2003. Adjusting Labor Demand: Multinational versus National Firms: A Cross-European Analysis. *Journal of the European Economic Association*. 1(2-3): 708-719.

Bellak, C., Pfaffermayr, M., Wild, M. 2006. Firm Performance after Ownership Change: A Matching Estimator Approach. *Applied Economics Quarterly* 52, 29-54.

Bhagat, S., Shleifer, A., Vishny R.W. 1990. Hostile take-overs in the 1980s: the return of corporate specialization. Brookings Papers on Economic Activity: Microeconomics, 1-72.

Blau, F.D., Kahn, L.M. 1981. Race and Sex Differences in Quits by Young Workers. *Industrial and Labor Relations Review* 34, 563-577.

Brown, C., Medoff, J.L., 1988. The impact of foreign acquisition on labour. In: Auerbach, A. (Ed.): *Corporate Takeovers: Causes and Consequences*. University of Chicago Press, Chicago.

Bradley, M. Desai, A., Han Kim, E. 1983. The Rationale Behind Interfirm Tender Offers: Information or Synergy? *Journal of Financial Economics*. 11, 183-206.

Böckerman, P., Lehto, E. 2008. Analysing the Employment Effects of Mergers and Acquisitions. *Journal of Economic Behavior and Organization* 68, 112-124.

Conyon, M.J., Girma, S., Thompson, S., Wright, P.W., 2002. The impact of mergers and acquisitions on company employment in the United Kingdom. *European Economic Review* 46, 31-49.

Gibbs, M., Ierulli K., Smeets, V. 2006. Mergers of Equals and Unequals. IZA Discussion Paper No. 2426.

Girma, S., Görg, H., 2004. Blessing or curse? Domestic plants' employment and survival prospects after foreign acquisition. *Applied Economics Quarterly* 50, 89-110.

Golub, S. S., 2003. Measures of restrictions on inward foreign direct investment for OECD countries. OECD Economics Department Working Papers No. 357.

Gugler, K., Yurtoglu, B.B., 2004. The effects of mergers on company employment in the USA and Europe. *International Journal of Industrial Organization* 22, 481-502.

Hamermesh, D.S. 1993. *Labor Demand*. Princeton, New Jersey, Princeton University Press.

Heckman, J.J., Singer, B., 1984. A Method for Minimizing the Impact of Distributional Assumptions in Econometric Models for Duration Data, *Econometrica* 52, 271-320.

Huttunen, K., 2007. The effect of foreign acquisition on employment and wages: evidence from Finnish manufacturing. *The Review of Economics and Statistics* 89, 497-509.

Ilmakunnas, P., Maliranta, M., Vainiomäki, J. 2001. Linked Employer-Employee Data for the Analysis of Productivity, Wages and Turnover. Tampere Economic Working Papers No. 1/2001.

Jenkins, S.P. 2005. Survival Analysis. Manuscript. Institute for Social and Economic Research.

Jensen, M. 1988. Takeovers: Their Causes and Consequences. *Journal of Economic Perspectives*. 2, 21-48.

Lichtenberg, F.G., Siegel, S., 1990. The effect of ownership changes on the employment and wages of central office and other personnel. *Journal of Law and Economics* 33, 383-408.

Light A., Ureta, M. 1992. Panel Estimates of Male and Female Job Turnover Behaviour: Can Female Non-Quitters Be Identified? *Journal of Labor Economics* 10, 156-181.

Lipsey, R.E. and Sjöholm, F., 2004, FDI and wage spillovers in Indonesian manufacturing, *Review of World Economics / Weltwirtschaftliches Archiv* 134, 321-332.

Lynch, L. M. 1992. Differential Effects of Post-school Training on Early Career Mobility. National Bureau of Economic Research Working Paper No. 4034.

Margolis, D.N. 2006. Should Employment Authorities Worry About Mergers and Acquisitions? *Portuguese Economic Journal* 5(2).

Markusen, J., 2002. *Multinational Firms and the Theory of International Trade*. The MIT Press, Cambridge MA.

Martins, P.S., Estevez, L. A. 2008. Foreign Ownership, Employment and Wages in Brazil: Evidence from Acquisitions, Divestments and Job Movers. IZA Discussion Paper No. 3542.

Matsusaka, J.G. 1993. Takover Motives during the Conglomerate Merger Wave. *Rand Journal of Economics*, 24, 357-379.

McGuckin, R.H., Nguyen, S.V., 2001. The impact of ownership changes: a view from labour markets. *International Journal of Industrial Organization* 19, 739-762.

McGuckin, R.H., Nguyen, S.V., Reznek, A.P., 1995. On Measuring the Impact of Ownership Change on Labor: Evidence from U.S. Food-Manufacturing Plant-Level Data, in: J. Haltiwanger, M. E. Manser and R.H. Topel (Ed's.), *Labor Statistics Measurement Issues* (National Bureau of Economic Research

Studies in Income and Wealth). University of Chicago Press, Chicago, pp. 207-248.

Meyer, B., 1990. Unemployment Insurance and Unemployment Spells, *Econometrica* 58, 757-782.

Piscitello, L., Rabbiosi, L., 2005. The impact of inward FDI on local companies' labour productivity: evidence from the Italian case. *International Journal of the Economics of Business* 12, 35-50.

Royalty, A.B. 1998. Job-to-Job and Job-to-Nonemployment Turnover by Gender and Education Level. *Journal of Labor Economics* 14, 392-443.

Salant, S.W., Switzer, S., Reynolds, R.J., 1983. Losses from horizontal merger: the effects of an exogenous change in industry structure on Cournot-Nash equilibrium. *The Quarterly Journal of Economics* 108, 185-1985.

Shleifer, A., Summers, L., 1988. Breach of trust in hostile takeovers. In: Auerbach, A.(Ed.): *Corporate Takeovers: Causes and Consequences*. University of Chicago Press, Chicago.

Shleifer, A., Vishny, R., 1988. Value Maximization and the Acquisition process. *Journal of Economic Perspectives* 2, 7-20.

Siegel, D.S., Simons, K.L., 2006. Assessing the effects of mergers and acquisitions on firm performance, plant productivity, and workers: New evidence from matched employer-employee data. Rensselaer Working Papers in Economics, No. 0601.

Siegel, D.S., Simons, K.L., 2008. Evaluating the Effects of Mergers and Acquisitions on Employees: Evidence from Matched Employer-Employee Data. Rensselaer Working Papers in Economics, No. 0804.

Sueyoshi, G. T., 1992. Semiparametric Proportional Hazards Estimation of Competing Risks Models with Time-Varying Covariates. *Journal of Econometrics,* 51, 25-58.

Table 1 Employees affected by M&A

	Employees	%
Employer not involved in M&A in previous year	1 773 439	94.8 %
Employer involved in domestic merger in previous year	58 981	3.2 %
Employer subject to foreign acquisition in previous year	31 926	1.7 %
Employer subject to foreign divestiture in previous year	6 931	0.4 %
Total	1 871 277	100 %

Table 2 Descriptive statistics

Variable	Employer not involved in M&A in previous period		Employer involved in domestic merger in previous year		Employer subject to foreign acquisition in previous year		Employer subject to foreign divestiture in previous year	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Age	39.79	11.15	40.78	10.80	40.79	10.68	39.70	10.75
Female	0.36	0.48	0.38	0.49	0.43	0.50	0.42	0.49
Married	0.36	0.48	0.34	0.47	0.33	0.47	0.36	0.48
Children under age 7	0.20	0.40	0.19	0.39	0.19	0.40	0.20	0.40
Female* Children under age 7	0.06	0.24	0.06	0.24	0.08	0.26	0.07	0.26
Schooling years	11.36	2.14	11.31	2.08	11.57	2.20	11.56	2.12
Tenure (months)	96.27	107.04	140.42	123.27	127.17	121.36	111.88	114.49
Log of taxable income	9.99	0.65	10.15	0.54	10.14	0.55	10.11	0.55
Declining employment	0.36	0.48	0.45	0.50	0.42	0.49	0.35	0.48
Log of firm labour productivity	10.62	0.63	10.81	0.56	10.78	0.62	10.66	0.47
Exporting firm	0.49	0.50	0.76	0.43	0.62	0.49	0.66	0.47
Importing firm	0.56	0.50	0.83	0.38	0.73	0.44	0.76	0.43
Employer foreign owned at some point	0.17	0.37	0.28	0.45	1.00	0.00	1.00	0.00
Employer involved in M&A deal at some point	0.32	0.47	1.00	0.00	1.00	0.00	1.00	0.00
Employer in industrial sector	0.49	0.50	0.67	0.47	0.55	0.50	0.62	0.49
# of observations	1 773 439		58 981		31 926		6 931	

Table 3 Descriptive statistics: firm size

	Employer not involved in M&A in previous year		Employer involved in domestic merger in previous year		Employer subject to foreign acquisition in previous year		Employer subject to foreign divestiture in previous year	
Size of firm	Employees	%	Employees	%	Employees	%	Employees	%
Under 5 employees	240 276	13.6	51	0.1	123	0.4	48	0.7
5-9 employees	142 922	8.1	227	0.4	412	1.3	67	1.0
10-19 employees	154 729	8.7	614	1.0	714	2.2	217	3.1
20-49 employees	198 088	11.2	1 503	2.6	2 160	6.8	561	8.1
50-99 employees	136 531	7.7	2 444	4.1	2 381	7.5	542	7.8
100-299 employees	216 796	12.2	7 103	12.0	6 758	21.2	1 913	27.6
Over 300 employees	684 097	38.6	47 039	79.8	19 378	60.7	3 583	51.7
Total	1 773 439	100	58 981	100	31 926	100	6 931	100

Table 4 Firms involved in M&A by sector

Industry	Employer NOT involved in M&A deal during observation period		Employer involved in domestic merger in previous year		Employer subject to foreign acquisition in previous year		Employer subject to foreign divestiture in previous year		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Mining and Quarrying	3 901	0.33	206	0.35	72	0.23	7	0.10	4 186	0.3 %
Manufacture of food products, beverages and tobacco	26 240	2.19	7 829	13.27	3 215	10.07	745	10.75	38 029	2.9 %
Manufacture of textiles	8 351	0.70	316	0.54	299	0.94	52	0.75	9 018	0.7 %
Manufacture of wearing apparel, leather and leather products	13 795	1.15	157	0.27	273	0.86	0	0.00	14 225	1.1 %
Manufacture of wood, wood products, pulp, paper and paper products	37 441	3.12	12 152	20.60	816	2.56	126	1.82	50 535	3.9 %
Publishing, printing	38 390	3.20	1 850	3.14	1 031	3.23	24	0.35	41 295	3.2 %
Manufacture of coke, refined petroleum products, nuclear fuel, chemicals, chemical products and man-made fibres	12 015	1.00	2 475	4.20	696	2.18	112	1.62	15 298	1.2 %
Manufacture of rubber and plastic products	14 928	1.24	606	1.03	816	2.56	742	10.71	17 092	1.3 %
Manufacture of other non-metallic mineral products	10 024	0.84	2 122	3.60	639	2.00	374	5.40	13 159	1.0 %
Manufacture of basic metals	12 925	1.08	167	0.28	625	1.96	0	0.00	13 717	1.1 %
Manufacture of fabricated metal products	44 043	3.67	1 526	2.59	741	2.32	294	4.24	46 604	3.6 %
Manufacture of machinery and equipment n.e.c, electrical and optical equipment	101 363	8.45	5 363	9.10	5 424	16.98	1 365	19.69	113 515	8.7 %
Manufacture of transport equipment	22 864	1.91	409	0.69	1 260	3.95	161	2.32	24 694	1.9 %
Manufacturing n.e.c.	20 487	1.71	599	1.02	292	0.91	101	1.46	21 479	1.7 %
Electricity, gas and water supply, Construction	148 068	12.34	3 773	6.40	1 411	4.42	183	2.64	153 435	11.8 %
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods, Hotels and restaurants	307 373	25.62	13 280	22.52	6 106	19.12	1 869	26.96	328 628	25.3 %
Transport, storage and communication	189 146	15.77	3 054	5.18	1 450	4.54	92	1.33	193 742	14.9 %
Financial intermediation	11 143	0.93	34	0.06	2 579	8.08	30	0.43	13 786	1.1 %
Real estate, renting and business activities	177 270	14.77	3 063	5.20	4 181	13.10	654	9.44	185 168	14.3 %
Total	1 199 767	100	58 981	100	31 926	100	6 931	100	1 297 605	100 %

Table 5 Job separations following M&A activity

Industrial sector	Employer's M&A activity in previous period							
	Employer not involved in M&A		Employer involved in domestic M&A		Employer involved in foreign acquisition		Employer involved in foreign divestiture	
Employment status	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Same employer	742,763	85.9	35,461	89.7	14,970	85.0	3,806	88.8
Unemployment	38,938	4.5	1,344	3.4	842	4.8	136	3.2
Out of the labour force	24,438	2.8	905	2.3	490	2.8	110	2.6
New employer outside business sector	18,354	2.1	811	2.1	494	2.8	93	2.2
Self-employment	3,221	0.4	63	0.2	24	0.1	9	0.2
New business sector employer	37,005	4.3	966	2.4	790	4.5	132	3.1
Total	864,719	100	39,550	100	17,610	100	4,286	100

Services	Employer's M&A activity in previous period							
	Employer not involved in M&A		Employer involved in domestic M&A		Employer involved in foreign acquisition		Employer involved in foreign divestiture	
Employment status	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Same employer	725,960	79.9	16,039	82.5	11,895	83.1	2,190	82.8
Unemployment	31,490	3.5	561	2.9	374	2.6	70	2.7
Out of the labour force	43,553	4.8	876	4.5	519	3.6	106	4.0
New employer outside business sector	39,346	4.3	714	3.7	655	4.6	90	3.4
Self-employment	5,413	0.6	83	0.4	36	0.3	13	0.5
New business sector employer	62,958	6.9	1,158	6.0	837	5.9	176	6.7
Total	908,720	100	19,431	100	14,316	100	2,645	100

Table 6 Estimation results: single risk duration model

Hazard ratio estimates	(1)	(2)	(3)
Age	0.996***	0.999***	0.996***
	(0.000)	(0.000)	(0.000)
Female	0.939***	0.920***	0.939***
	(0.005)	(0.009)	(0.005)
Married	1.081***	1.068***	1.081***
	(0.006)	(0.010)	(0.006)
Children under age 7	0.920***	0.968***	0.920***
	(0.006)	(0.011)	(0.006)
Female* Children under age 7	1.141***	1.276***	1.141***
	(0.011)	(0.023)	(0.011)
Schooling years	1.021***	1.018***	1.020***
	(0.001)	(0.002)	(0.001)
Tenure	0.987***	0.989***	0.987***
	(0.000)	(0.000)	(0.000)
Tenure squared	1.000***	1.000***	1.000***
	(0.000)	(0.000)	(0.000)
Log of taxable income	0.646***	0.604***	0.646***
	(0.002)	(0.004)	(0.002)
Declining employment	1.053***	1.078***	1.053***
	(0.004)	(0.009)	(0.004)
Log of firm labour productivity	0.932***	0.886***	0.931***
	(0.004)	(0.007)	(0.004)
Exporting firm	1.008	0.928***	1.008
	(0.009)	(0.016)	(0.009)
Importing firm	0.946***	0.894***	0.946***
	(0.007)	(0.014)	(0.007)
Firm size 5-9 employees	1.027***	1.038**	1.027***
	(0.009)	(0.017)	(0.009)
Firm size 10-19 employees	0.999	1.018	0.999
	(0.010)	(0.017)	(0.010)
Firm size 20-49 employees	0.980*	0.981	0.980*
	(0.010)	(0.018)	(0.010)
Firm size 50-99 employees	0.934***	0.928***	0.934***
	(0.012)	(0.021)	(0.012)
Firm size 100-299 employees	0.860***	0.834***	0.861***
	(0.012)	(0.019)	(0.012)
Firm size over 300 employees	0.811***	0.755***	0.812***
	(0.010)	(0.016)	(0.010)
Employer foreign owned at some point	1.061***	1.127***	1.061***
	(0.016)	(0.027)	(0.016)
Employer involved in M&A deal at some point	1.02	1.01	1.021
	(0.013)	(0.020)	(0.013)

Table continues on next page

Table 6 continued

Hazard ratio estimates			
Employer involved in domestic M&A deal			
1 year ago	0.945***	1.056	0.815***
	(0.019)	(0.040)	(0.034)
2 years ago		1.096**	
		(0.050)	
3 years ago		1.100*	
		(0.055)	
Employer involved in foreign acquisition			
1 year ago	0.971	0.924*	0.895**
	(0.023)	(0.044)	(0.047)
2 years ago		1.259***	
		(0.060)	
3 years ago		1.317***	
		(0.068)	
Employer involved in foreign divestiture			
1 year ago	0.902*	0.759***	0.992
	(0.047)	(0.069)	(0.120)
2 years ago		0.894	
		(0.091)	
3 years ago		1.08	
		(0.103)	
Employer in industrial sector			
* employer involved in domestic M&A deal			
1 year ago	1.182***	1.225***	1.161***
	(0.033)	(0.065)	(0.032)
2 years ago		0.887*	
		(0.055)	
3 years ago		0.766***	
		(0.049)	
* employer involved in foreign acquisition			
1 year ago	1.245***	1.223***	1.240***
	(0.041)	(0.078)	(0.041)
2 years ago		0.745***	
		(0.051)	
3 years ago		0.688***	
		(0.050)	
* employer involved in foreign divestiture			
1 year ago	1.044	1.124	1.044
	(0.076)	(0.148)	(0.076)
2 years ago		1.404**	
		(0.206)	
3 years ago		0.865	
		(0.133)	
University education			
* employer involved in domestic M&A deal 1 year ago			1.153***
			(0.045)
* employer involved in foreign acquisition 1 year ago			1.045
			(0.047)
* employer involved in foreign divestiture 1 year ago			1.049
			(0.105)
Age			
* employer involved in domestic M&A deal 1 year ago			1.004***
			(0.001)
* employer involved in foreign acquisition 1 year ago			1.002
			(0.001)
* employer involved in foreign divestiture 1 year ago			0.997
			(0.003)
Observations	1871277	725386	1871277
Sectors	All	All	All
Unobserved heterogeneity	Gaussian	Gaussian	Gaussian

Notes

1. Reference category for firm size is under 5 employees

2. Standard errors in parentheses: * significant at 10%; ** significant at 5%, *** significant at 1%.

3. Coefficients for industry, region and year dummies as well as 2nd and 3rd lags of labour productivity, export and import status in model (2) not reported

Table 7 Estimation results: multinomial logit model

Odds ratio estimates with reference category "Same employer"	Unemployment	Out of the labour force	New employer outside business sector	New business sector employer
Age	1.0321***	0.9982**	0.9906***	0.9674***
	(63.31)	(-2.65)	(-16.65)	(-68.94)
Female	1.0351***	0.8613***	1.1029***	0.8664***
	(3.37)	(-14.02)	(9.29)	(-16.16)
Married	1.3567***	1.4070***	0.9315***	0.9179***
	(28.43)	(32.39)	(-6.33)	(-9.14)
Children under age 7	0.8600***	0.4507***	0.9777	1.0390***
	(-10.30)	(-38.74)	(-1.56)	(3.61)
Female* Children under age 7	1.0459	5.3053***	0.8308***	0.6497***
	(1.95)	(68.85)	(-8.55)	(-23.54)
Schooling years	0.9102***	0.9731***	1.0950***	1.0497***
	(-37.43)	(-10.83)	(40.45)	(26.58)
Tenure	0.9841***	0.9838***	0.9914***	0.9836***
	(-121.13)	(-104.02)	(-57.12)	(-109.06)
Tenure squared	1.0000***	1.0000***	1.0000***	1.0000***
	(107.05)	(109.51)	(45.47)	(69.57)
Log of taxable income	0.5725***	0.3273***	0.6258***	0.7531***
	(-78.44)	(-154.03)	(-57.09)	(-42.25)
Declining employment	1.1054***	1.1039***	1.1148***	1.1382***
	(12.45)	(11.27)	(12.37)	(18.31)
Log of firm labour productivity	0.7744***	0.9431***	0.8782***	0.8175***
	(-38.05)	(-7.60)	(-17.83)	(-36.81)
Exporting firm	1.0520***	1.0472***	0.9245***	0.9264***
	(3.75)	(3.31)	(-5.50)	(-6.64)
Importing firm	0.8957***	0.9898	0.9031***	0.8700***
	(-8.42)	(-0.77)	(-7.38)	(-12.80)
Firm size 5-9 employees	1.1883***	1.0995***	0.8886***	1.0908***
	(10.93)	(5.47)	(-6.63)	(6.78)
Firm size 10-19 employees	1.0932***	1.1040***	0.8826***	1.0723***
	(5.49)	(5.69)	(-7.02)	(5.40)
Firm size 20-49 employees	1.1241***	1.1398***	0.9331***	1.0284*
	(7.41)	(7.83)	(-4.12)	(2.21)
Firm size 50-99 employees	1.0885***	1.1617***	0.9580*	1.0328*
	(4.51)	(7.61)	(-2.18)	(2.14)
Firm size 100-299 employees	1.0085	1.0535**	0.8844***	0.8605***
	(0.46)	(2.73)	(-6.59)	(-10.03)
Firm size over 300 employees	0.8687***	1.0816***	0.8874***	0.6641***
	(-7.98)	(4.45)	(-6.82)	(-28.39)

Table continues on next page

Table 7 continued

Odds ratio estimates with reference category "Same employer"	Unemployment	Out of the labour force	New employer outside business sector	New business sector employer
Employer foreign owned at some point	1.1601***	1.0261	1.3960***	1.2066***
	(9.88)	(1.67)	(21.44)	(14.51)
Employer involved in M&A deal at some point	1.0145	1.0075	0.9583**	1.0246*
	(1.10)	(0.57)	(-3.01)	(2.11)
Employer involved in domestic M&A deal in previous year	0.8339*	0.9428	0.7080***	0.8944
	(-1.99)	(-0.62)	(-3.56)	(-1.42)
Employer involved in foreign acquisition in previous year	0.8782	1.2528	0.8792	0.7007***
	(-1.12)	(1.72)	(-1.17)	(-3.72)
Employer involved in foreign divestiture in previous year	0.4824*	1.2497	1.1915	0.7792
	(-2.40)	(0.77)	(0.62)	(-1.12)
Employer in industrial sector				
* employer involved in domestic M&A deal in previous year	1.0770	0.9729	1.3409***	0.9869
	(1.37)	(-0.49)	(5.43)	(-0.28)
* employer involved in foreign acquisition in previous year	1.3196***	1.1998**	1.4186***	1.6308***
	(4.18)	(2.59)	(5.53)	(9.06)
* employer involved in foreign divestiture in previous year	0.8205	0.9992	1.6959***	0.9463
	(-1.29)	(-0.01)	(3.48)	(-0.45)
University education				
* employer involved in domestic M&A deal in previous year	1.0083	1.0924	1.1747*	1.3736***
	(0.08)	(0.86)	(2.21)	(5.02)
* employer involved in foreign acquisition in previous year	0.6769**	1.2220	0.9127	1.0727
	(-2.73)	(1.69)	(-1.09)	(0.98)
* employer involved in foreign divestiture in previous year	0.9373	1.1928	0.9540	1.2283
	(-0.21)	(0.67)	(-0.23)	(1.32)
Age				
* employer involved in domestic M&A deal in previous year	1.0047*	1.0025	1.0066**	1.0055*
	(2.23)	(0.94)	(2.77)	(2.55)
* employer involved in foreign acquisition in previous year	1.0048	0.9921*	1.0021	1.0061*
	(1.81)	(-2.20)	(0.79)	(2.40)
* employer involved in foreign divestiture in previous year	1.0179**	0.9919	0.9805**	1.0015
	(2.62)	(-0.99)	(-2.69)	(0.24)
Observations	1871277			
Pseudo R-Square	0.1232			

Notes

1. The reference category is "Same employer"

2. Reference category for firm size is under 5 employees

3. Cluster robust (by individual) t-statistics in parentheses: * significant at 5%; ** significant at 1%, *** significant at 0.1%.

4. Coefficients for industry, region and year dummies not reported

Spillovers From Multinationals to Domestic Firms: An Empirical Analysis of the Profitability Effects of Labour Flows*

Abstract

This paper uses linked employer-employee panel data to search for knowledge spillovers from multinationals to domestic firms. Explicit analysis of the profitability effects of labour flows between these firms indicates that hiring workers from foreign multinationals has a positive effect on both productivity and wages in local domestic firms. There is no net effect on profitability growth. More detailed analysis of the labour flows indicates that these effects are driven by hiring of relatively young workers. By contrast, separation of this group of relatively young employees from foreign MNEs leads to a negative profitability effect due to their higher than average influence on productivity and lower than average wages compared to staying workers in these firms. The results indicate that these workers are able to internalize the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms.

JEL classification: J62, J24, F23, L25, D62

Keywords: Labour mobility; Multinational enterprises, Knowledge spillovers, Profitability, Linked employer-employee panel data

* This is joint work with Pekka Ilmakunnas and Mika Maliranta

1 Introduction

Spillovers from foreign to domestic firms are commonly cited as an argument in favour of policies to promote FDI in both developing and developed countries. These spillovers are expected to arise due to productivity advantages that multinational firms have over domestic firms. Such productivity advantages have been documented in several empirical studies (see Barba Navaretti and Venables, 2004). Theories of multinational firms imply that productivity advantages are due to the fact that these firms require some type of specific advantage to be able to profitably establish themselves in foreign markets (Dunning 1988, Markusen 2002). Such an advantage can arise from superior technological know-how, managerial knowledge, brand names etc. Recent theoretical work on heterogeneous firms also implies that only the most productive firms have the resources to set up their business in foreign countries (Helpman et al. 2004). To the extent that multinational firms are more productive due to knowledge that is implementable within other firms, there is a potential of spillover effects from multinational to domestic firms. If multinational firms are not able to capture the full return to such knowledge, it may be beneficial for the host country to promote FDI.

Potential channels for spillovers from multinational to domestic firms include: 1) backward and forward linkages between foreign owned and domestic firms, 2) demonstration effects and 3) labour mobility (Blomström and Kokko, 1998). Spillovers from foreign owned to domestic firms have mostly been studied by examining the effect of the presence of a multinational company in an industry on the productivity of domestic firms. The channels for these spillovers are more rarely considered, and the evidence on the productivity effects of the presence of a multinational company is not conclusive (Barba Navaretti and Venables, 2004). The studies that do consider the mechanisms through which spillovers occur, focus mainly on backward and forward linkages between firms (e.g. Smarzynska Javorcik, 2004; Aitken and Harrison, 1999). Also in these studies the evidence on productivity spillovers is mixed. Labour mobility as a channel for spillovers has been studied in papers by Görg and Strobl (2005) and Balsvik (2009) using data from Ghana and Norway respectively. Both find

positive productivity effects when employees move from multinational firms to domestic firms in the same industry[1].

This study searches for evidence of spillovers from multinational to domestic firms by examining hiring and separation of employees and the impact these have on firms' performance. It is important to note that the theoretical work on multinationals discussed above does not assume that multinationals are foreign owned, i.e. also domestically owned multinational companies may potentially be a source for spillovers. That is, the important difference is not between foreign and domestic ownership, but rather between multinationals and purely domestic firms, as emphasised e.g. by Bellak (2004). We decompose firm-level productivity change into the effects of hiring from foreign owned multinationals, domestic multinationals and purely domestic firms as well as the effects of separating workers and those who stay at the same firm. This bears a resemblance to the kind of decomposition used frequently to decompose industry level productivity change into the impacts of entry and exit of firms, and productivity growth in continuing firms. These kinds of methods have been popularised by e.g. Foster et al. (2001), but the decomposition we use is more closely related to formulas proposed by Maliranta (1997), Vainiomäki (1999) and Diewert and Fox (2007). A difference between the method we use and the earlier productivity decompositions is that while individual productivity cannot be directly observed, the decomposition forms the basis for an equation from which the relative productivities of the different employee groups can be estimated. A similar decomposition can be made for firm wage growth, and combining the productivity and wage growth decompositions provides us with an equation for firm profitability growth. This is particularly important when analysing knowledge transfer, since any potential externality may be internalised in the labour market. If hired workers are fully compensated for their contribution to productivity, there is no scope for profitability effects.

[1] Görg and Strobl (2005) only consider employees who set up their own firm after leaving the multinational.

Our analysis is based on a detailed and comprehensive linked employer-employee panel data set from Statistics Finland. The data set covers basically all firms in all sectors in Finland and all of their employees. We analyse performance changes in the two-year intervals 1997-1999, 1999-2001 and 2001-2003. Our approach contributes to the literature on spillovers from foreign owned to domestic firms through labour mobility in a number of ways. Firstly, we utilise data on both the industrial and service sectors and, given the current importance of the service sector, are therefore able to provide a more complete picture of potential spillover effects. Secondly, we explicitly consider how the structure of the workforce is determined by studying both hiring and separation flows. By comparing productivity and wage effects, we are able to assess whether any potential productivity effect is an actual externality or whether spillovers are internalised in the labour market. Balsvik (2009) also studies both productivity and wage effects. However, in that study wage effects are examined at the individual level by comparing recent hires from multinationals to stayers in domestic firms. If the share of workers with experience in multinational firms increases the wage level of incumbent workers as in Poole (2010), the individual level wage premium will not be comparable to the productivity effect at the establishment level and will, therefore, not reveal the extent of the externality.

Our results show that hiring workers from foreign multinationals has a positive effect on both productivity and wages in local domestic firms. These effects cancel each other out, leading to no significant net effect on profitability. More detailed analysis of the labour flows indicates that these effects are driven by hiring of relatively young workers. By contrast, separation of this group of relatively young employees from foreign MNEs leads to a negative profitability effect on these firms due to their higher than average influence on productivity and lower than average wages compared to staying workers. The results indicate that these workers are able to internalise the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms. A similar effect is observed for low tenured older workers who move from domestic multinationals to local domestic firms. Hiring of workers from domestic multinationals to foreign multinationals has a negative effect on profitability due to these workers' productivity being lower than that of the

existing employees of foreign multinationals. This indicates that there are meaningful differences also between foreign and domestic multinationals.

The next section briefly reviews previous research related to this study, section 3 describes the empirical methodology and section 4 describes the data. Section 5 presents the results of our econometric analysis and section 6 concludes.

2 Previous research

Spillovers through labour mobility between multinational and domestic firms have been explicitly modelled in some recent theoretical contributions, but knowledge transfer related to FDI can also be thought of in the context of models of R&D spillovers.

Fosfuri et al. (2001) and Glass and Saggi (2002) develop models of spillovers from multinationals to domestic firms through labour mobility. The models imply a trade-off between technological and pecuniary spillovers to the local economy. The trade-off arises through the multinational firm's choice between allowing technology transfer and preventing it by paying the worker a premium. Models of R&D spillovers through worker mobility, such as those of Pakes and Nitzan (1983), Gersbach and Schmutzler (2003) and Franco and Filson (2006), are similar in spirit and also provide a framework for thinking of spillovers from foreign owned to domestic firms. These models incorporate the fact that employees gain access to valuable knowledge, which may benefit them later in their career.

The theoretical framework described above is based on workers moving from a firm with better possibilities for knowledge accumulation to firms where this knowledge is not available. If knowledge diffusion actually takes place from domestic to foreign firms, which could be the case e.g. if FDI were technology sourcing[2], workers would be expected to benefit from mobility in this direction.

[2] Driffield and Love (2003) study panel data on UK industries and find that such "reverse spillovers" exist. They do not, however, consider the mechanisms through

Empirical evidence on knowledge spillovers from foreign to domestic firms through worker mobility is scarce. Using manufacturing data from Ghana, Görg and Strobl (2005) study productivity of firms run by owners who previously worked at multinational companies. As mentioned above, they find that companies managed by entrepreneurs with experience from a multinational in the same industry are more productive than other domestic companies. In the context of this study, the most relevant piece of prior evidence is provided by Balsvik (2009) who studies Norwegian manufacturing firms, and finds that a higher share of employees with experience in a multinational firm increases total factor productivity. Employees with experience in multinational firms also earn higher wages than their co-workers, but the wage premium received by these employees is lower than the effect that their employment share has on plant level productivity. As noted above, the productivity effect and wage effect in Balsvik (2009) are, however, not completely informative as to the extent of the possible externality. If the share of employees with experience from multinational firms also affects the wages of their co-workers in domestic firms as observed by Poole (2010), the observed contribution to establishment level productivity can be higher than the individual level wage difference even though their impact on the establishment's overall wage level may be closer to the productivity effect.[3] Previous empirical research on productivity spillovers from multinational firms has not included the service sector, which is arguably increasingly important.

In the general context of knowledge transfers, spillovers from foreign owned to domestic firms are also related to R&D spillovers. Empirical evidence on R&D

---

which these spillovers arise. Ali-Yrkkö (2006) uses Finnish firm level data to study the effect of patents on the likelihood of being acquired by a foreign firm. He finds that owning patents correlates with becoming a target for a foreign firm, implying that technology sourcing also through labour mobility may be relevant.

[3] Poole (2010) studies knowledge spillovers indirectly by examining how wages of incumbent domestic-establishment workers increase as a function of the proportion of workers employed at the domestic establishment with some multinational experience. There are also some recent studies that analyse knowledge spillovers indirectly by looking at the effect of experience in foreign owned firms on individual employees' earnings at subsequent jobs. These are similar to the wage analysis in Balsvik (2009). These studies include Martins (2005) for Portugal, Pesola (2010) for Finland and Malchow- Møller et al. (2007) for Denmark.

spillovers through labour mobility is provided by, among others, Almeida and Kogut (1999) who study the mobility of patent holders between firms. They find that labour mobility does influence the transfer of knowledge and that the flow of knowledge seems to be embedded in regional labour networks. Møen (2005) studies R&D spillovers empirically in a human capital framework. He shows that workers pay for the possibility to accumulate knowledge in R&D intensive firms by accepting lower wages early in their career. The return to these implicit investments is obtained later on, when wage increases reflect the increased value of their knowledge. Maliranta et al. (2009) use a similar decomposition as the current study to track knowledge spillovers through mobility of workers with R&D experience and find that hiring workers previously engaged in R&D into non-R&D activities increases both productivity and profitability.

3 Empirical methodology

In order to estimate the productivity and profitability effects of labour flows between foreign owned and domestic firms, we employ a variant of a micro-level productivity decomposition method, presented by Maliranta (1997), Vainiomäki (1999), Maliranta et al. (2009) as well as Diewert and Fox (2007). These authors have discussed the role of entry and exit of firms for productivity change, whereas Maliranta and Ilmakunnas (2005) and Ilmakunnas and Maliranta (2007) have developed this kind of decomposition to include entry and exit of employees, i.e. labour flows.

Our decomposition of firm level productivity change assumes that a firm's labour force in period 1 can be divided into workers who were employed by the firm in the previous period 0 and are still working at the firm, i.e., stayers (*stay*), and those who were not, i.e., were hired after 0 (*hire*). We assume that the firm's output (value added) in period 1 can be defined as the sum of outputs of staying and hired workers:

$$Y_1 = Y_{1,stay} + Y_{1,hire} \tag{1}$$

The firm's labour productivity is the average of labour productivities of the staying and hired workers, weighted by labour shares:

$$\frac{Y_1}{L_1} = \frac{L_{1,stay}}{L_1}\frac{Y_{1,stay}}{L_{1,stay}} + \frac{L_{1,hire}}{L_1}\frac{Y_{1,hire}}{L_{1,hire}} + \varepsilon_{Y/L,1}, \tag{2}$$

where $L_1 = L_{1,stay} + L_{1,hire}$ and the error term $\varepsilon_{Y/L,1}$ has been included to reflect approximation errors and unobservable factors in our formulation. The group of hired workers can further be divided into subgroups depending on what type of firm they were previously employed by (e.g. multinational/non-multinational). The firm's labour productivity level can then be expressed as follows:

$$\frac{Y_1}{L_1} = \frac{L_{1,stay}}{L_1}\frac{Y_{1,stay}}{L_{1,stay}} + \sum_e \frac{L_{1e,hire}}{L_1}\frac{Y_{1e,hire}}{L_{1e,hire}} + \varepsilon_{Y/L,1} \ , \tag{3}$$

where e denotes type of previous employer. Because the shares of stayers and hired workers add up to one,

$$\frac{L_{1,stay}}{L_1} + \sum_e \frac{L_{1e,hire}}{L_1} = 1,$$

(3) can be written as follows:

$$\frac{Y_1}{L_1} = \frac{Y_{1,stay}}{L_{1,stay}} + \sum_e \frac{L_{1e,hire}}{L_1}\left(\frac{Y_{1e,hire}}{L_{1e,hire}} - \frac{Y_{1,stay}}{L_{1,stay}}\right) + \varepsilon_{Y/L,1}. \tag{4}$$

Similarly, in period 0 the firm's work force consists of those workers who will stay in the firm at least up to period 1, i.e., stayers, and workers who will leave the firm before period 1 (*sepa).* Of course it holds that

$$L_{0,stay} = L_{1,stay} \ .$$

.

The labour productivity level of the firm in period 0 can then be written in an analogous way:

$$\frac{Y_0}{L_0} = \frac{Y_{0,stay}}{L_{0,stay}} + \frac{L_{0,sepa}}{L_0}\left(\frac{Y_{0,sepa}}{L_{0,sepa}} - \frac{Y_{0,stay}}{L_{0,stay}}\right) + \varepsilon_{Y/L,0}. \tag{5}$$

Equation (5) is simpler than (4), since the destination of the separating employees has no influence on productivity. We are interested in labour productivity growth, i.e., the difference in productivity level between periods 0 and 1, i.e.

$$\Delta\frac{Y}{L} = \frac{Y_1}{L_1} - \frac{Y_0}{L_0} \ . \tag{6}$$

Using (4) and (5) we obtain

$$\begin{aligned} &\frac{Y_1}{L_1} - \frac{Y_0}{L_0} = \\ &\frac{Y_{1,stay}}{L_{1,stay}} - \frac{Y_{0,stay}}{L_{0,stay}} + \\ &\sum_e \frac{L_{1e,hire}}{L_1}\left(\frac{Y_{1,e,hire}}{L_{1,e,hire}} - \frac{Y_{1,stay}}{L_{1,stay}}\right) + \\ &\frac{L_{0,sepa}}{L_0}\left(\frac{Y_{0,stay}}{L_{0,stay}} - \frac{Y_{0,sepa}}{L_{0,sepa}}\right) + \varepsilon_{Y/L,1} - \varepsilon_{Y/L,0} \end{aligned} \tag{7}$$

The first term on the right-hand side of the equation shows productivity growth attributable to staying workers. It can be thought of as accumulation of human capital through experience. A firm has a rapid productivity growth when a large proportion of workers have a high productivity growth. These workers may have human capital that enables them to adopt or develop more productive techniques[4].

The second set of terms indicates productivity effects of hiring workers from different types of firms. As can be seen from (7), hiring of workers from type e employers has a positive impact on productivity when these hired workers have a higher productivity level than the average staying workers. Newly hired workers may be more productive e.g. because they have acquired knowledge or skills when working for their previous employer. Adjustment costs related to hiring are implicitly included in our formulation. The relative productivity of the hired workers should therefore be understood as productivity net of adjustment costs.

Finally, the third term indicates productivity effects of employees that leave the firm between periods 0 and 1. Quite analogously to the hiring effect, separation of workers has a positive effect of productivity change when the average productivity level of these workers is lower than the average productivity level of stayers in period 0.

The terms of (7) can be turned into growth rates by dividing them by the average productivity level in the periods 0 and 1. The growth rate is then a close approximation of a more common log-difference, i.e.,

$$\frac{\Delta(Y/L)}{\overline{(Y/L)}} = \frac{Y_1/L_1 - Y_0/L_0}{0.5(Y_1/L_1 + Y_0/L_0)} \cong \ln \frac{Y_1/L_1}{Y_0/L_0} \tag{8}$$

[4] This effect can be called the Nelson-Phelps effect according to the seminal work by Nelson and Phelps (1966).

Besides labour productivity, we can use a similar decomposition for the average wage level in the firm by just replacing Y in the equations above with W.

In this paper we are particularly interested in profitability effects. Profitability is measured as follows:

$$\Pi = 1 + \frac{OPM}{W(1+a)} = \frac{Y}{W(1+a)} = \frac{Y/L}{(1+a)(W/L)} \tag{9}$$

where OPM denotes operating margin $OPM=Y-W(1+a)$ where a is the ratio of payroll taxes to wages assumed to be constant over time and across worker groups. The growth rate of profitability is thus simply the difference between the growth rates of productivity and wages, which is approximated by

$$\frac{\Delta\Pi}{\overline{\Pi}} \cong \frac{\Delta(Y/L)}{\overline{(Y/L)}} - \frac{\Delta(W/L)}{\overline{(W/L)}} \quad , \tag{10}$$

where $\overline{(\Pi)} = 0.5\left[\Pi_0 + \Pi_1\right]$.

Without the error terms, equations (7) and (8), and corresponding equations for wage growth are in principle identities. We can observe the labour flows, but we do not know the productivities, so the equations cannot be used directly for assessing productivity differences between workers hired from different types of firms. There are some influences, however, that have not been taken into account that allow us to use the equations as a basis for estimating the productivities. First of all, there are likely to be differences across firms in the productivities of different worker groups. If we use (7) as a model for estimating parameters that correspond to the group specific productivities, we will estimate average productivities. Any firm differences will therefore be included in an error term. Secondly, so far we have not taken into account other inputs, especially capital that affect productivity. We will therefore include control variables Z to account for other exogenous influences on firm productivity, wage, and profits. Inclusion of a constant term takes into account productivity growth trend. After these observable influences are taken

into account, the error accounts for all unobservables. We obtain the following estimation models:

$$\frac{\Delta(Y/L)}{\overline{(Y/L)}} = \alpha_{Y/L} + \sum_e \beta_{(Y/L),e,hire} HR_e + \beta_{(Y/L),sepa} SR + \delta' \mathbf{Z} + \Delta\varepsilon_{Y/L} \quad (11)$$

$$\frac{\Delta(W/L)}{\overline{(W/L)}} = \alpha_{W/L} + \sum_e \beta_{(W/L),e,hire} HR_e + \beta_{(W/L),sepa} SR + \delta' \mathbf{Z} + \Delta\varepsilon_{W/L} \quad (12)$$

where $\overline{(Y/L)} = 0.5\left[(Y_0/L_0) + (Y_1/L_1)\right]$ and $\overline{(W/L)} = 0.5\left[(W_0/L_0) + (W_1/L_1)\right]$

are the average productivity and wage levels, $HR_e = \frac{L_{1e,hire}}{L_1}$ and $SR = \frac{L_{0,sepa}}{L_0}$ are the hiring and separation rates. In the estimations, we use firm panel data, so the equations to be estimated will be indexed with i (firm) and t (period), which are not shown in (11)-(12).

The productivity and wage gaps between workers hired from different types of previous employment can then be interpreted from equations (11) and (12) as being:

$$\beta_{(Y/L),e,hire} = \frac{(Y/L)_{1,e,hire} - (Y/L)_{1,stay}}{\overline{(Y/L)}} \quad (13)$$

and

$$\beta_{(W/L),e,hire} = \frac{(W/L)_{1,e,hire} - (W/L)_{1,stay}}{\overline{(W/L)}} \ , \quad (14)$$

i.e. they measure the relative productivity and wage, respectively, of workers hired from type e firms compared to all staying workers. On the separation side, the estimable coefficients have similar interpretations:

$$\beta_{(Y/L),sepa} = \frac{(Y/L)_{0,stay} - (Y/L)_{0,sepa}}{\overline{(Y/L)}} \tag{15}$$

and

$$\beta_{(W/L),sepa} = \frac{(W/L)_{0,stay} - (W/L)_{0,sepa}}{\overline{(W/L)}} \ . \tag{16}$$

The intercept α indicates the growth rate among staying workers.

We also have the profitability change equation

$$\frac{\Delta\Pi}{\overline{\Pi}} = \alpha_{\Pi} + \sum_e \beta_{(Y/L),e,hire} HR_{ej} + \beta_{(Y/L),sepa} SR + \delta' \mathbf{Z} + \Delta\varepsilon_{\Pi/L} \tag{17}$$

where the following approximations hold

$$\beta_{\Pi,e,hire} \approx \beta_{(Y/L),e,hire} - \beta_{(W/L),e,hire} \text{ and} \tag{18}$$

$$\beta_{\Pi,sepa} \approx \beta_{(Y/L),sepa} - \beta_{(W/L),sepa} \tag{19}$$

Since

$$\beta_{(Y/L),e,hire} = \frac{(Y/L)_{1e,hire} - (Y/L)_{1,stay}}{\overline{(Y/L)}} \approx \ln \frac{(Y/L)_{1e,hire}}{(Y/L)_{1,stay}} \tag{20}$$

and

$$\beta_{(W/L),e,hire} = \frac{(W/L)_{1e,hire} - (W/L)_{1,stay}}{\overline{(W/L)}} \approx \ln \frac{(W/L)_{1e,hire}}{(W/L)_{1,stay}} \tag{21}$$

we can write

$$\begin{aligned} &\beta_{\Pi,e,hire} \approx \ln \frac{(Y/L)_{1e,hire}}{(Y/L)_{1,stay}} - \ln \frac{(W/L)_{1e,hire}}{(W/L)_{1,stay}} = \ln \frac{(Y/W)_{1e,hire}}{(Y/W)_{1,stay}} \\ &\Leftrightarrow \beta_{\Pi,e,hire} \approx \ln \frac{\Pi_{1e,hire}}{\Pi_{1,stay}} \end{aligned} \tag{22}$$

which shows that the parameter of the hiring variable for workers hired from firm type e in the profit equation (17) can be interpreted as a measure of the profitability level of the these workers relative to stayers in period 1.

Analogously we obtain that

$$\beta_{\Pi,sepa} \approx \ln \frac{\Pi_{1,sepa}}{\Pi_{1,stay}}, \tag{23}$$

which provides us a measure of the relative profitability level of the separated workers before they leave.

It is straightforward to show that hired, staying and separating workers can be further divided into various subgroups by worker type. This is of interest when considering productivity and wage gaps not only based on type of previous employer but also on certain individual characteristics such as age and experience. Derivations for estimation equations with worker subgroups are provided in the appendix.

There are possible sources of bias when estimating the above model. First, there can be unobservable firm heterogeneity both in productivity and wage levels, which is correlated with employee characteristics (productivities and shares of different types of employees). For example, new firms often start with a new work force which only slowly evolves over time (Haltiwanger et al., 1999, 2007). Therefore, firm vintage and worker cohorts tend to be tied together. Since we are using growth rates as the dependent variables, this is not an issue of great concern here. Assume that the error term in the productivity level for firm i in period t can be written as $\varepsilon_{Y/L,it} = \mu_{Y/L,i} + \nu_{Y/L,it}$, where $\mu_{Y/L,i}$ is the firm-specific, time-invariant unobservable that is correlated with the employee characteristics. When productivity growth is investigated, this component is eliminated in differencing, i.e. $\Delta\varepsilon_{Y/L,it} = \Delta\nu_{Y/L,it}$. A similar argument applies to the wage growth equation. Our approach is related to the use of long differences in fixed effects models (e.g. Griliches & Hausman, 1986). We define the growth rates and labour flows in three different two-year periods and pool

them in estimation. We also control for some observable firm characteristics, included in *Z*.

Second, if there are time-varying unobservable firm differences in productivity and wage levels, they will show up in the growth rates. I.e., if the error is $\varepsilon_{Y/L,it} = \mu_{Y/L,it} + \nu_{Y/L,it}$, the unobservables are not eliminated in differencing: $\Delta\varepsilon_{Y/L,it} = \Delta\mu_{Y/L,it} + \Delta\nu_{Y/L,it}$. However, they are eliminated in the analysis of profitability change to the extent that the effects $\Delta\mu$ are equal in the productivity change and wage change equations. It seems reasonable to assume that high productivity growth firms are also high wage growth firms. In this case,

$$\Delta\varepsilon_{Y/L,it} - \Delta\varepsilon_{W/L,it} = \Delta\mu_{Y/L,it} + \Delta\nu_{Y/L,it} - \Delta\mu_{W/L,it} - \Delta\nu_{W/L,it} = \Delta\nu_{Y/L,it} - \Delta\nu_{W/L,it}.$$

This is also related to the issue of hiring and separation rates being based on firms' decisions and therefore possibly correlated with the error terms. For example, positive productivity shocks may lead to the hiring of new workers, which then causes an overestimate of their productivity effect (see Olley & Pakes, 1996; Levinsohn & Petrin, 2003). As we are examining hiring flows from different types of firms, shocks that change the propensity to hire new employees in general will not be a problem for interpreting the differences in the impact of hiring flows from various sources. However, if there is a productivity shock that only affects the probability of hiring workers from MNEs, this will bias the difference in the effects of the hiring flows. We have attempted to address this issue by using instrumental variables that take into account exogenous variations in labour supply in the local labour market. To instrument for hiring from foreign MNEs we use job destruction in foreign MNEs in the area the hiring firm is located in, and similarly for hirings from domestic MNEs and purely domestic firms, we use job destruction in these types of firms in the vicinity of the hiring firm. While the instruments are somewhat correlated with the respective flows, they are very weak and our subsequent estimation results are not significant. It should, therefore, be kept in mind that the results can not straightforwardly be interpreted as causal effects.

Third, there is heterogeneity across workers. This would not be an issue if the firms randomly chose new employees from the pool of applicants or randomly picked those who are laid off. This is not likely to be the case, however, since the firms look to hire the best applicants and lay off poor performers. Our hiring and separation flows may therefore be unrepresentative. However, the selection bias should affect productivity growth and wage growth in the same way if wage setting is based on productivity (see Hellerstein & Neumark, 2007) and therefore be eliminated when we examine their difference, i.e. the productivity wage gaps which directly relate to our measure of firm performance. In addition, as we are primarily interested in potential spillovers, and domestic firms can be expected to poach workers from multinational firms on purpose to gain access to their knowledge, we are not particularly interested in the impact of moving some random worker. Our results on productivity and wage effects should, therefore, not be interpreted as the effects of moving a random worker but can still be interesting in the context of spillovers.

Fourth, there can be productivity differences across firms in the productivity of a certain employee group. This can arise from decreasing returns. For example, extensive use of employees with multinational experience in a firm lowers their marginal productivity. There may also be genuine technological differences between firms or industries. These factors would imply that the coefficients vary across firms. We can still obtain an unbiased estimate of the mean coefficient and account for the firm differences by correcting standard errors for clustering within firms.

Finally, price differences across firms may cause biases when a common deflator is used for all firms in an industry (see e.g. Foster et al., 2008). For example, the profitability level of a low-price firm will be underestimated and that of a high-price firm underestimated. However, to the extent that there are firm differences in price levels (but not in price growth), they are eliminated when profitability changes are examined.

4 Data

The unique identification codes for persons, companies and plants used in the different registers forms the backbone of the Finnish administrative register network and the Finnish statistical system. This provides an excellent opportunity to construct cross-sectionally and dynamically representative data for various research purposes by linking different administrative data sources (see Abowd & Kramarz, 1999).

The data for this study are drawn from the *Finnish Longitudinal Employer–Employee Data* (FLEED). The data set merges comprehensive administrative records of all labour force members as well as all employers/enterprises (including information also on their establishments) subject to value added tax (VAT). It can be complemented by a range of additional information from both private and public sources. FLEED currently covers the years 1990–2002 with near-perfect traceability of employers and employees across time. The employment statistics, educational statistics, taxation records, business register, financial statement statistics, manufacturing census as well as various surveys are among the original sources of the FLEED variables. To define the labour flows and changes in productivity, wage, and profitability, we use 2-year windows. The flows and changes are defined for the three periods 1997-99, 1999-2001 and 2001-2003. The observation period is restricted by the fact that information on foreign ownership is available from 1994 onwards. However, before this foreign ownership in Finland was scarce in any case due to strict regulations that were not abolished until 1992 (Golub, 2003). We restrict our observation period to start in 1997 in order to allow for the possibility of some years of work experience in foreign owned firms before the observation period.

The observation unit is a firm. In principle we also have data on establishments, but information on value added, our preferred measure of output, and some other relevant variables, like capital intensity, about establishments are lacking beyond the manufacturing sector. Further, the links between employees and firms are more reliable than those between employees and establishments, especially in multi-unit firms.

Our estimation sample covers the industry sector and service sector. The industry sector
consists of mining, manufacturing, public utilities and construction. The service sector comprises retail and wholesale trade, business services and personal services. Real estate and financial intermediation are excluded due to problems in measuring output in a reliable manner.

The dependent variables are defined as follows. Labour productivity growth is measured as a two-year rate of change in value added per employee, average wage growth is correspondingly a two-year rate of change in wage sum per employee, and change in profitability is a two-year relative change in value added per labour costs (wages and social security payments). These variables are measured in nominal terms, and price changes (and other industry-specific effects) are controlled by a set of industry dummies that are interacted with the period dummies.

The labour flows are based on comparisons of employees in the firms in two time periods, *t-1* and *t+1*, where *t* is 1998, 2000 or 2002. In our analysis, the hiring flows will be divided into groups according to the nationality of the hired worker's employer in *t-1*. The groups considered are 1) hires from foreign owned multinationals, 2) hires from domestically owned multinationals, 3) hires from local domestic firms, 4) hires from other employment and 5) hires from non-employment. Foreign owned multinationals are defined as firms that are at least 50 per cent owned by a foreign firm, domestically owned multinationals are Finnish firms that have majority owned subsidiaries abroad and local domestic firms are firms that are neither foreign owned nor owners of foreign firms. We have excluded firms that experience a change in multinational status between years *t-1* and *t+1*. Appendix Table 1 shows the number of firms that undergo such changes during our observation period. Hires from other employment consist e.g. of employees hired from the public sector, and hires from non-employment include e.g. those hired following full-time studies or unemployment.

The staying and separating employees in a firm are, of course, by definition all related to an employer of the same nationality, but we run the estimations separately for local domestic firms, domestic multinationals and foreign multinationals to see if there are differences in the profitability, productivity and wage effects of different labour flows between different types of firms. We also conduct analyses in which we further split the labour flows according to a combination of age and tenure: 1) age max. 35 in *t-1*, 2) age over 35 in *t-1* and not employed in the same firm in *t-5*, 3) age over 35 in *t-1* and employed in the same firm in *t-5*.

The hiring rate HR_{ejit} for group e*j* is the number of new employees in firm *i* in the group (those in the firm in *t+1*, but not in *t-1*) divided by the number of all employees of the firm in *t+1*. The separation rate SR_{jit} is correspondingly the number of exited employees of firm *i* in group *j* (those in the firm in *t-1*, but no longer in *t+1*), divided by the number of all employees in the firm in *t-1*. When only considering differences amongst workers based on type of previous employment, i.e. when not dividing workers based on individual characteristics, the separation rate is obviously just the total number of exited employees in the firm divided by all employees in the firm in *t-1*. The share of stayers, $STAYSH_{jit}$, is the number of staying employees of firm *i* in group *j* (those in the firm both in *t-1* and *t+1*), divided by all stayers of the firm in *t-1*. The sum of these stayer shares is therefore one, so one of the groups is left out of the estimation. This also implies that when not dividing staying employees into groups, the stayer share is always one and is left out of the estimation.

As controls we use the various characteristics of the plants. We control for the log of capital per employee, which is entered in difference form to be consistent with the form of the dependent variables. The initial levels (in *t-1*) of log of value added per worker and log of average wage account for catching-up effect. We also control for the log of firm age. Finally, we include interacted industry and period dummies (35 industries) to account for, besides price changes, also the effects of idiosyncratic industry shocks, and likewise a set of dummies as controls for regional effects (20 regions).

Before conducting the econometric analysis we leave out some potentially erroneous observations that may distort our results. First, we remove those observations where the number of linked employees differs more than 10 per cent from the number of employees in the company data. This indicates that the linking of the individual and firm data is incomplete. Second, we remove some potentially influential outliers that we detect by using the method proposed by Hadi (1992; 1994). The method is useful for detecting multiple outliers in multivariate data. Identification of outliers is made on the basis of four variables: 1) the productivity growth rate, 2) the growth rate of average wage calculated from the company data, 3) the growth rate of employment according to company data and 4) the growth rate of employment according to individual data (the Employment Statistics). Wage growth is usually correlated with productivity growth, but sometimes they may be very different because of measurement errors in output and/or wages. The last two variables should be highly correlated with each other because they are essentially gauging the same thing, but may sometimes differ due to possible inaccuracies in the links between employees and their employers. The identified outliers (735 out of 17 694 firm-period observations at this stage) are removed from all estimations. In the baseline estimations we include firms that employ at least 20 persons. The main reason for leaving out the smaller firms is that their employment numbers are sometimes imputed on the basis of wages, which could badly distort the analysis in our setting. As discussed above, we conduct the estimations separately for local domestic firms, domestic MNEs and foreign MNEs. Our baseline estimations for domestic firms, domestic MNEs and foreign MNEs include 6350, 1390 and 1279 observations respectively.

5 Empirical analysis

5.1 Basic estimation results

Table 1 shows descriptive statistics for our basic estimation sample split by the type of firm. The total number of observations including domestic firms, domestic MNEs and foreign MNEs is 9019. Average end-year employment is highest in domestic MNEs, which can be related to the fact that foreign MNEs may only have one plant in Finland, whereas domestic MNEs often have

several[5]. Both average labour productivity and earnings are highest in foreign multinationals and also higher in domestic multinationals than in local domestic firms. This is in line with previous research. Table 2 shows statistics regarding labour mobility in our estimation sample. We observe just under 5000 new hires by domestic firms from foreign MNEs and approximately 9000 hires by domestic firms from domestic MNEs. The average hiring rate is 29.2 per cent in domestic firms, 22.2 per cent in domestic MNEs and 24.6 per cent in foreign MNEs. As we discuss below, we use employment weights in estimation to account for the fact that small firms will have high flow rates and large firms will have low flow rates. The largest shares of hiring in all three types of firms come from domestic firms and non-employment. Most hires from non-employment are included in the group of young workers which implies that they are likely to be recent graduates. The shares of hiring from foreign and domestic MNEs are highest for foreign MNEs. The average separation rate is 25.5 per cent for domestic firms, 20.8 per cent for domestic MNEs and 23.1 per cent for foreign MNEs[6].

[Table 1 and Table 2 here]

Table 3 shows descriptive statistics separately for domestic firms that hire and do not hire employees from multinational firms. Firms with hiring flows from multinational firms are on average larger and have slightly higher average labour productivity and earnings. The differences are, however, much smaller than those shown in Table 1 between domestic firms and multinational firms. For firms that hire from multinationals, the average number of hired workers is 1.3 from foreign MNEs and 2.4 from domestic MNEs. Conditional on positive hiring from foreign MNEs, domestic firms hire on average 2.3 workers from these firms and conditional on positive hiring from domestic MNEs, domestic firms hire on average 3.0 workers from them.

---

[5] The 20 person threshold used in the estimations refers to the average of start and end year employment in each period, whereas the figures in Table 1 refer to end year employment. This accounts for the 1st percentile for domestic firms being under 20.

[6] Note that hiring and separation figures underestimate total turnover, since e.g. hiring of an employee after the start of a two-year period and subsequent separation of the same employee before the end of the period is not included in the turnover rates.

[Table 3 here]

Based on previous literature on spillovers from multinational firms to local firms discussed above, our main interest lies in analysing labour flows from multinationals, both foreign and domestically owned, to local domestic firms. However, there may also be potential for reverse spillovers, e.g. if FDI is technology sourcing, so we conduct the estimations separately for local domestic firms, domestic multinationals and foreign multinationals. We have also done the analysis using pooled data on all the firms with interactions for multinational status. The results are in line with those presented here, and therefore we use the current set up for ease of exposition. All the estimations we analyse here are weighted using firm employment (the average of the initial and the last year's employment). A justification for using weighting comes from the fact that we are interested in the profitability and productivity effects of the employment flows. Unweighted estimation gives equal weight to large firms with low flow rates and small firms that have high flow rates but account for a small share of employment.

Table 4 shows the results for our basic estimations of profitability, productivity and wage equations for local domestic firms. Here we split hiring flows based on type of previous employment, i.e. we do not yet take individual characteristics into account. The results show that employees hired from foreign multinationals are indeed relatively more productive than continuing workers, which is in line with e.g. Balsvik's (2009) previous findings. However, when examining the related wage changes we find that these workers are also paid more than staying workers, and thus explicitly comparing these two results leads to an insignificant difference in their impacts on profitability. When comparing the coefficients for different types of hiring flows[7], we note that employees hired from foreign MNEs have a statistically significantly higher impact on productivity than e.g. hiring from domestic firms. The difference between the productivity effects of hiring from foreign and domestic MNEs are not significant, with the coefficient on flows from domestic MNEs imprecisely estimated.

[7] See Appendix Table 2

[Table 4 here]

The results in Table 4 also show that employees hired from all other types of employment be it in or outside the business sector are paid more than stayers, but their productivity effects are not significant. Higher wages for recruits from other purely domestic firms and outside the business sector with no compensating productivity effect lead to negative effects on profitability. Hires from non-employment, e.g. full-time studies and unemployment have a negative effect on productivity, but these workers also earn lower wages and thus there is no adverse profitability effect. On the separation side we may note that exiting workers have on average higher productivity than stayers, i.e. the productivity effect of them leaving is negative, but these workers were also earning more than the average stayer, so their effect on profitability is not significant.

Table 5 presents the results of the same estimations for domestically owned multinational firms. The signs on different hiring flows are similar to those in local domestic firms, but the effects are not statistically significant. Interestingly, domestic multinationals appear to be able to achieve productivity and profitability gains through separation of workers. Separating workers are on average less productive than stayers and with no wage effect this leads directly to a profitability increase when they leave. We also run our basic estimations separately for foreign MNEs. The results are reported in Table 6 where we can observe indications of the productivity advantages of foreign firms documented in previous literature. Hiring from domestic MNEs has a negative effect on both productivity and profitability of foreign MNEs which would be expected if foreign firms are more productive, i.e. if the advantage is not multinationality, but being foreign owned.

[Table 5 and Table 6 here]

5.2 Results for disaggregated labour flows

In this section we discuss estimations of profitability, productivity and wage equations where labour flows are further divided based on age and/or tenure of the workers. As discussed in section 4, we split workers into three categories: "Young", i.e. at most 35 years old in *t-1*, "Old with low tenure", i.e. over 35 in *t-1* and not employed by the same firm in *t-5* and "Old with high tenure", i.e. over 35 in *t-1* and employed in the same firm in *t-5*. Tenure is not defined for workers from outside the business sector, i.e. those from "Other employment" and obviously also not available for hires from non-employment. These flows are only divided based on age. Considering the age limit of 35, our labels of "young" and "old" are obviously used purely for convenience. The reference group for staying workers is the group of young workers. As above, hiring flows are also divided based on type of previous employment, and the estimations are run separately for domestic firms, domestic multinationals and foreign multinationals. We present here the results for labour flows in domestic firms, the results for multinationals can be found in the appendix.

Table 7 reports results for estimation of profitability, productivity and wage equations for domestic firms. We can see that the positive productivity and wage effects found in Table 4 for hiring from foreign MNEs are driven by hiring of younger workers. We also see that there is a positive productivity effect accompanied by a similar wage effect for hiring of older employees with relatively short tenure from domestic MNEs. This effect did not show up in our more aggregate results above. However, neither hiring from foreign or domestic MNEs has a net effect on profitability. Hiring of short tenured older workers from other domestic firms and young employees from employment outside the business sector both have a negative effect on profitability, with the first effect driven by low productivity and the latter by high wages relative to stayers. We can also see that the low wage, low productivity hiring flows from non-employment observed in Table 4 are driven by hiring of young workers, i.e. this effect is most likely due to people moving from full-time studies into employment. The net effect on profitability for these flows is again insignificant.

[Table 7 here]

In line with our more aggregate results in Table 4, separations do not affect profitability. The results show that the negative productivity and wage effects of job leavers arise from young workers leaving, i.e. these workers have higher productivity and higher wages than the average stayer. There are no differences between the contributions of older stayers to profitability and productivity changes as compared to the reference group of young staying workers, and marginally lower wage growth in these groups compared to the reference group.

Results for similar estimations for domestic MNEs and foreign MNEs can be found in the appendix. The results for domestic MNEs are similar to those for domestic firms with most of the differences between the two types of firms apparent already in our more aggregate results above. The negative profitability effects of separation in foreign MNEs observed in Table 6 are driven by highly productive young workers leaving. The difference in their contribution to productivity compared to stayers is significantly higher than the difference in wages between these two groups. This may be indicative of foreign MNEs losing recently trained productive young employees and implies that Balsvik's (2009) finding of future movers to MNEs having lower wages may not reveal the whole picture. Interestingly, as seen in Table 7, domestic firms need to pay young workers hired from foreign MNEs according to their productivity. Thus, if there is knowledge transfer from foreign MNEs to domestic firms taking place through mobility of these young workers, the workers appear able to internalise the returns to this knowledge when changing jobs. These findings could be interpreted in the context of a Loewenstein and Spletzer (1998) type model, where employees do not realise the full return to training until they change jobs.

5.3 Robustness checks

In this section we discuss some robustness checks related to the set-up of our data and empirical specifications. First we consider labour flows split based on educational background instead of age and tenure. This should enable us to gauge whether productivity effects of experience in MNEs are related to skill

level. This could be the case if the knowledge being transferred is e.g. related to management practices. New hires are grouped based on multinational status of their previous employer as well as educational level, and staying and separating workers are grouped based on educational level. The education levels considered are comprehensive, intermediate and university level. Otherwise the specifications used in the analysis are the same as those in the previous section.

The results do not indicate significant profitability effects for most labour flows, but there are, however, some findings worth noting[8]. Hiring of highly educated workers from foreign MNEs into purely domestic firms has a positive effect on wages but no corresponding effect on productivity. This leads to a negative profitability effect for hiring of these workers. However, highly educated workers who stay with the firm have a positive and significant effect on productivity. These results are in line with evidence in Maliranta and Asplund (2007), where it is shown that hiring highly educated workers is initially costly to the firm, but that these workers contribute markedly to productivity growth in the long run due to the strong positive effect of the share of staying highly educated workers. This is consistent with the so-called Nelson–Phelps hypothesis mentioned in section 3, i.e. highly educated workers may have human capital that enables them to promote technical change and productivity growth in a firm. Also consistent with the analysis of Maliranta and Asplund (2007), separation of highly educated workers has a positive effect on profitability in domestic firms as well as in both domestic and foreign MNEs.

Secondly, we extend our basic analysis of the previous section to include firms with at least 10 employees instead of the previous 20 person limit. This basically adds to our group of domestic firms, and we find that our previous results of e.g. positive productivity and wage effects of hiring from foreign MNEs are robust to this change. Consistent with the results above, the wage effect offsets the productivity effect leading to no change in profitability growth.

[8] Results not shown, available on request.

6 Conclusions

This study has searched for evidence of spillovers from multinational to domestic firms by examining hiring and separation of employees and the impact these have on firms' performance. The analysis is based on detailed linked employer-employee panel data which enables explicit comparison of productivity and wage effects. This focus on profitability allows us to assess the extent to which potential knowledge flows from multinational firms are actual spillovers as opposed to being internalised by the labour market. We are also able to distinguish between domestic firms, domestically owned multinationals and foreign owned multinationals and can therefore study whether there are differences based on multinational status and not ownership per se.

The results show that hiring workers from foreign multinationals is related to both higher productivity and higher wages in local domestic firms. These effects cancel each other out, leading to no significant net impact on profitability. More detailed analysis of the labour flows indicates that these findings are driven by hiring of relatively young workers. By contrast, separation of this group of relatively young employees from foreign MNEs is related to a negative profitability effect due to their higher than average influence on productivity and lower than average wages compared to staying workers in these firms. The results indicate that these workers are able to internalise the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms. However, due care should be taken when interpreting these results in case there are unobserved productivity shocks that are related to hiring flows from a specific type of firm. Hiring of workers from domestic multinationals to foreign multinationals has a negative effect on profitability due to these workers' productivity being lower than that of the existing employees of foreign multinationals. This indicates that there are meaningful differences also between foreign and domestic multinationals.

References

Aitken, B. and Harrison, A., 1999. Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela. American Economic Review 89, 605-618.

Ali-Yrkkö, J., 2006. Technology Sourcing Through Acquisitions – Do High Quality Patents Attract Acquirers?. Discussion Paper No. 1025, The Research Institute of the Finnish Economy.

Almeida, P. and Kogut, B., 1999. Localization of Knowledge and the Mobility of Engineers in Regional Networks. Management Science 45, 905-917.

Balsvik, R., 2009. Is Mobility of Labor a Channel for Spillovers from Multinationals? Evidence from Norwegian Manufacturing. Review of Economics and Statistics (forthcoming).

Barba Navaretti, G. and A. J. Venables, 2004. Multinational Firms in the World Economy. Princeton University Press, Princeton.

Bellak, C. 2004. How Domestic and Foreign Firms Differ and Why Does It Matter?. Journal of Economic Surveys 18, 483-514.

Blomström, M. and A. Kokko, 1998. Multinational Corporations and Spillovers. Journal of Economic Surveys 12, 247-277.

Diewert, W. E., & Fox, K. J., 2007. On Measuring the Contribution of Entering and Exiting Firms to Aggregate Productivity Growth. In W.E. Diewert, B.M. Nalk, D. Fixler, K. Fox & A. Nakamura (Eds.), Index Number Theory and the Measurement of Prices and Productivity. Victoria, Trafford Publishing.

Driffield, N. and J.H. Love, 2003. Foreign Direct Investment, Technology Sourcing and Reverse Spillovers. The Manchester School 71, 659-672.

Dunning, J., 1988. The Eclectic Paradigm of International Production: A Restatement and Some Possible Extensions. Journal of International Business Studies 19, 1-31.

Fosfuri, A., Motta, M. and Rönde, T., 2001. Foreign Direct Investment and Spillovers through Workers' Mobility. Journal of International Economics 53, 205-222.

Foster, L., Haltiwanger, J. and Syverson, C., 2008. Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability? American Economic Review 98, 394-425.

Franco, A.M. and Filson, D., 2006. Spin-outs: Knowledge Diffusion through Employee Mobility. Rand Journal of Economics, 37, 841-860.

Gersbach, H. and Schmutzler, A., 2003. Endogenous Technological Spillovers: Causes and Consequences. Journal of Economics and Management Strategy 12, 179-205.

Glass, A.J. and Saggi K., 2002. Multinational Firms and Technology Transfer. Scandinavian Journal of Economics 104, 495-513.

Golub, S. S., 2003. Measures of Restrictions on Inward Foreign Direct Investment for OECD Countries. OECD Economic Studies No. 36, 2003, 85-116.

Griliches, Z. and Hausman, J., 1986. Errors in Variables in Panel Data. Journal of Econometrics 31, 93-118.

Görg, H. and Strobl, E., 2005. Spillovers from Foreign Firms through Worker Mobility: An Empirical Investigation. Scandinavian Journal of Economics 107, 693-710.

Haltiwanger, J.C., Lane, J.I. and Spletzer, J.R., 1999. Productivity Differences across Employers: The Roles of Employer Size, Age and Human Capital. American Economic Review, 89, 94-98.

Haltiwanger, J.C., Lane, J.I. and Spletzer, J.R., 2007. Wages, Productivity, and the Dynamic Interaction of Businesses and Workers. Labor Economics, 14, 575-602.

Hellerstein, J. K. and Neumark, D., 2007. Production Function and Wage Equation Estimation with Heterogeneous Labor: Evidence from a New Matched Employer-Employee Data Set. In C. Hulten and E. Berndt, eds., Hard-to-Measure Goods and Services: Essays in Memory of Zvi Griliches. Chicago: University of Chicago Press, 31-71.

Helpman, E., Melitz, M. and Yeaple, S., 2004. Export Versus FDI with Heterogeneous Firms, American Economic Review 94, 300-316.

Ilmakunnas, P. & Maliranta, M., 2007. Aging, Labor Turnover and Firm Performance. Discussion Paper No. 164, Helsinki Center of Economic Research.

Levinsohn, J. and Petrin, A., 2003. Estimating Production Functions Using Inputs to Control for Unobservables. Review of Economic Studies. 70, 317-341.

Loewenstein, M. A. and Spletzer, J.M., 1998. Dividing the Costs and Returns to General Training. Journal of Labor Economics 16, 142-171.

Malchow-Møller, N., Markusen J.R. and Schjerning, B., 2007. Foreign Firms, Domestic Wages, NBER Working Paper No. 13001.

Maliranta, M., 1997. Plant-Level Explanations for the Catch-Up Process in Finnish Manufacturing: A Decomposition of Aggregate Labor Productivity Growth. In S. Laaksonen (Ed.), The Evolution of Firms and Industries: International Perspectives. Helsinki: Statistics Finland.

Maliranta, M. & Asplund, R. 2007. Training and hiring strategies to improve firm performance. Discussion Paper No. 1105, The Research Institute of the Finnish Economy.

Maliranta, M. and Ilmakunnas, P., 2005. Decomposing Productivity and Wage Effects of Intra-Establishment Labor Restructuring. ETLA Discussion Paper, 993.

Maliranta, M., Mohnen P. and Rouvinen P., 2009. Is Inter-Firm Labor Mobility a Channel of Knowledge Spillovers? Evidence from a Linked Employer-Employee Panel. Industrial and Corporate Change 18, 1161-1191.

Markusen, J.R., 2002. Multinational Firms and the Theory of International Trade. Cambridge, MIT Press.

Martins, P.S., 2005. Inter-Firm Employee Mobility, Displacement, and Foreign Direct Investment Spillovers. mimeo, Queen Mary, University of London.

Møen, J., 2005. Is Mobility of Technical Personnel a Source of R&D Spillovers?. Journal of Labor Economics 23, 81-114.

Olley, G.S. and Pakes, A., 1996. The Dynamics of Productivity in the Telecommunications Equipment Industry. Econometrica 64,1263-1297.

Pakes, A. and Nitzan, S., 1983. Optimum Contracts for Research Personnel, Research Employment, and the Establishment of "Rival" Enterprises. Journal of Labor Economics 1, 345-365.

Pesola, H., 2010. Labour Mobility and Returns to Experience in Foreign Firms. Scandinavian Journal of Economics (forthcoming).

Poole, J. P., 2010. Knowledge Transfers from Multinational to Domestic Firms: Evidence from Worker Mobility. mimeo, University of California, Santa Cruz.

Smarzynska Javorcik, B., 2004. Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. American Economic Review 94, 605-627.

Vainiomäki, J., 1999. Technology and Skill Upgrading: Results from Linked Worker-Plant Data for Finnish Manufacturing. In J. Haltiwanger, J. Lane, J. R. Spletzer, J., J. M. Theuwes & K. R. Troske, eds., The Creation and Analysis of Employer-Employee Matched Data. Amsterdam; New York and Oxford: Elsevier Science, North-Holland, 115-145.

Tables

Table 1 Descriptive statistics

	N	Average	St.Dev	p1	Median	p99
Local domestic firms						
Employment	6350	60	109	18	35	436
Labour productivity	6350	46 468	32 418	16 917	41 097	131 580
Monthly earnings	6350	2 136	572	1 160	2 061	4 039
Profitability growth rate	6350	-0.029	0.196	-0.639	-0.022	0.523
Labour productivity growth rate	6350	0.026	0.238	-0.644	0.031	0.683
Wage growth rate	6350	0.064	0.149	-0.383	0.064	0.488
Log change in capital per labour	6350	0.050	0.555	-1.526	0.010	1.849
Domestic multinationals						
Employment	1390	396	1152	20	124	5348
Labour productivity	1390	63 818	46 308	14 991	52 288	285 795
Monthly earnings	1390	2 624	604	1 492	2 555	4 400
Profitability growth rate	1390	-0.019	0.256	-0.768	-0.020	0.816
Labour productivity growth rate	1390	0.046	0.279	-0.711	0.045	0.887
Wage growth rate	1390	0.072	0.099	-0.209	0.072	0.344
Log change in capital per labour	1390	-0.033	0.484	-1.405	-0.024	1.538
Foreign multinationals						
Employment	1279	178	326	20	73	1703
Labour productivity	1279	74 627	68 671	16 812	61 105	347 184
Monthly earnings	1279	3 035	984	1 460	2 870	6 268
Profitability growth rate	1279	-0.017	0.278	-0.903	-0.010	0.796
Labour productivity growth rate	1279	0.043	0.304	-0.918	0.048	0.928
Wage growth rate	1279	0.070	0.116	-0.298	0.069	0.421
Log change in capital per labour	1279	-0.127	0.630	-2.105	-0.097	2.048

Note: Labour productivity, monthly earnings and employment are end year values

Table 2 Labour mobility

	Local domestic firms			Domestic MNE			Foreign MNE		
	Average share	Average #	Total #	Average share	Average #	Total #	Average share	Average #	Total #
Hire, from For. MNE	0.012	0.77	4 919	0.016	4.59	6 380	0.043	6.49	8 295
Hire, from Dom. MNE	0.021	1.42	9 019	0.043	15.56	21 630	0.033	5.95	7 605
Hire, from Dom.	0.108	6.22	39 489	0.067	20.13	27 984	0.078	12.38	15 828
Hire, from other empl.	0.007	0.40	2 530	0.004	1.07	1 489	0.004	0.60	763
Hire, from non-empl.	0.143	8.68	55 087	0.092	34.51	47 965	0.088	17.09	21 858
Separated	0.255	14.07	89 373	0.208	76.51	106 344	0.231	40.09	51 280

Table 3 Descriptive statistics for local domestic firms by type of hiring

	Local domestic firms that hire from multinational firms			Local domestic firms with no hiring from multinational firms		
	Observations	Average	St.dev.	Observations	Average	St.dev.
Employment	3 769	77	138	2 581	35	22
Labour productivity	3 769	48 339	38 928	2 581	43 736	18 987
Monthly earnings	3 769	2 209	625	2 581	2 030	463
Profitability growth rate	3 769	-0.03	0.21	2 581	-0.03	0.18
Labour productivity growth rate	3 769	0.03	0.25	2 581	0.02	0.22
Wage growth rate	3 769	0.07	0.15	2 581	0.06	0.15
Log change in capital per labour	3 769	0.05	0.56	2 581	0.06	0.55
Share of hired, from For. MNE	3 769	0.02	0.03	2 581	0	0
Share of hired, from Dom. MNE	3 769	0.04	0.04	2 581	0	0
Share of hired, from Dom.	3 769	0.12	0.10	2 581	0.09	0.09
Share of hired, from other empl.	3 769	0.01	0.02	2 581	0.01	0.02
Share of hired, from non-empl.	3 769	0.15	0.11	2 581	0.13	0.10
Share of separated	3 769	0.27	0.16	2 581	0.23	0.14
Number of hired, from For. MNE	3 769	1.31	3.20	2 581	0	0
Number of hired, from Dom. MNE	3 769	2.39	5.72	2 581	0	0
Number of hired, from Dom.	3 769	8.48	17.00	2 581	2.92	3.06
Number of hired, from other empl.	3 769	0.50	1.28	2 581	0.24	0.58
Number of hired, from non-empl.	3 769	11.53	25.55	2 581	4.51	4.24
Separated	3 769	18.22	38.29	2 581	8.02	7.08

Note: Hired shares are shares of end-year total employment, shares of separated workers are shares of start-year employment. Labour productivity, monthly earnings and employment are end-year values

Table 4 Profitability, productivity and wage equations for local domestic firms

	Profits	Productivity	Wages
Hire, from For.MNE	-0.152	0.308**	0.424***
	(0.153)	(0.145)	(0.0967)
Hire, from Dom.MNE	0.00137	0.196	0.212***
	(0.105)	(0.127)	(0.0657)
Hire, from Dom.	-0.105***	-0.0267	0.0705**
	(0.0399)	(0.0458)	(0.0274)
Hire, from Other Emp.	-0.324*	-0.108	0.279**
	(0.185)	(0.229)	(0.136)
Hire, from Non-Emp.	0.0324	-0.178***	-0.217***
	(0.0388)	(0.0456)	(0.0304)
Separated	0.0170	-0.0878***	-0.124***
	(0.0364)	(0.0323)	(0.0205)
Observations	6350	6350	6350
R-squared	0.143	0.182	0.236

Notes:

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Table 5 Profitability, productivity and wage equations for domestic MNEs

	Profits	Productivity	Wages
Hire, from For.MNE	-0.147	0.317	0.248
	(0.473)	(0.521)	(0.194)
Hire, from Dom.MNE	0.0871	0.152	0.0822
	(0.224)	(0.264)	(0.0915)
Hire, from Dom.	-0.302	-0.441*	-0.105
	(0.207)	(0.258)	(0.147)
Hire, from Other Emp.	-1.087	-1.852	-0.811
	(1.165)	(1.278)	(0.583)
Hire, from Non-Emp.	-0.312*	-0.582**	-0.247
	(0.176)	(0.269)	(0.158)
Separated	0.296**	0.313**	0.0543
	(0.127)	(0.139)	(0.0413)
Observations	1390	1390	1390
R-squared	0.458	0.436	0.389

Notes:

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Table 6 Profitability, productivity and wage equations for foreign MNEs

	Profits	Productivity	Wages
Hire, from For.MNE	0.214	0.377	0.162
	(0.192)	(0.251)	(0.111)
Hire, from Dom.MNE	-0.481**	-0.624***	-0.0934
	(0.213)	(0.186)	(0.0916)
Hire, from Dom.	0.279	0.309	0.0914
	(0.185)	(0.211)	(0.101)
Hire, from Other Emp.	-1.280	-1.198	0.171
	(1.076)	(1.134)	(0.543)
Hire, from Non-Emp.	-0.151	-0.427**	-0.289***
	(0.176)	(0.213)	(0.104)
Separated	-0.194*	-0.220	-0.0215
	(0.105)	(0.136)	(0.0532)
Observations	1279	1279	1279
R-squared	0.559	0.545	0.223

Notes:

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Table 7 Profitability, productivity and wage equations for local domestic firms: labour flows by age/tenure group

	Profits	Productivity	Wages
Hire, from For.MNE/Young	-0.129	0.462**	0.618***
	(0.183)	(0.225)	(0.143)
Hire, from For.MNE/Old/Low Tenure	-0.408	0.0475	0.333
	(0.329)	(0.327)	(0.222)
Hire, from For.MNE/Old/High Tenure	-0.0124	0.210	0.122
	(0.384)	(0.329)	(0.164)
Hire, from Dom.MNE/Young	-0.0616	0.0191	0.119
	(0.170)	(0.198)	(0.0969)
Hire, from Dom.MNE/Old/Low Tenure	0.176	0.509**	0.301*
	(0.214)	(0.259)	(0.165)
Hire, from Dom.MNE/Old/High Tenure	-0.143	0.229	0.398**
	(0.234)	(0.298)	(0.171)
Hire, from Dom./Young	-0.0646	-0.0601	0.0138
	(0.0564)	(0.0670)	(0.0409)
Hire, from Dom./Old/Low Tenure	-0.255***	-0.158*	0.0753
	(0.0883)	(0.0947)	(0.0646)
Hire, from Dom./Old/High Tenure	-0.0610	0.218*	0.237***
	(0.126)	(0.125)	(0.0756)
Hire, from Other Emp./Young	-0.594*	-0.355	0.374*
	(0.312)	(0.371)	(0.218)
Hire, from Other Emp./Old	-0.0976	0.0647	0.140
	(0.249)	(0.296)	(0.177)
Hire, from Non-Emp./Young	0.0768	-0.199***	-0.263***
	(0.0504)	(0.0580)	(0.0411)
Hire, from Non-Emp./Old	0.00433	-0.0613	-0.107*
	(0.0753)	(0.0928)	(0.0586)
Sep., Young	-0.0189	-0.139***	-0.170***
	(0.0518)	(0.0442)	(0.0283)
Sep., Old/Low Tenure	0.0577	0.0320	-0.0130
	(0.0560)	(0.0609)	(0.0370)
Sep., Old/High Tenure	-0.00709	-0.137	-0.118**
	(0.0685)	(0.0869)	(0.0533)
Stay, Old/Low Tenure	0.0155	-0.0403	-0.0290
	(0.0413)	(0.0259)	(0.0182)
Stay, Old/High Tenure	-0.0230	-0.0325	-0.0115
	(0.0258)	(0.0300)	(0.0159)
Observations	6350	6350	6350
R-squared	0.146	0.184	0.245

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Appendix

Derivation of estimation equations with worker subgroups

When dividing all workers into M different groups $j = 1, \ldots, M$ based on individual characteristics such as age and experience, we obtain the following estimation equations[9]:

$$\frac{\Delta(Y/L)}{\overline{(Y/L)}} = \alpha_{Y/L} + \sum_e \sum_j \beta_{(Y/L),e,j,hire} HR_{ej} + \sum_j \beta_{(Y/L),j,sepa} SR_j + \sum_j^{M-1} \chi_{(Y/L),j,stay} STAYSH_j + \delta' \mathbf{Z} + \varepsilon \tag{24}$$

$$\frac{\Delta(W/L)}{\overline{(W/L)}} = \alpha_{W/L} + \sum_e \sum_j \beta_{(W/L),e,j,hire} HR_{ej} + \sum_j \beta_{(Y/L),j,sepa} SR_j + \sum_j^{M-1} \chi_{(Y/L),j,stay} STAYSH_j + \delta' \mathbf{Z} + \varepsilon \tag{25}$$

where $HR_{ej} = \frac{L_{1ej,hire}}{L_1}$ and $SR_j = \frac{L_{0,j,sepa}}{L_0}$ are the hiring and separation rates in worker groups and $STAYSH_j = \frac{L_{0,j,stay}}{\sum_j L_{0,j,stay}}$ is the share of each group of workers among staying workers.

The coefficients of the hiring and separation rates are now interpreted as labour productivity effects of hiring and separating workers in each group, compared to (all) staying workers:

$$\beta_{(Y/L),e,j,hire} = \frac{(Y/L)_{1,e,j,hire} - (Y/L)_{1,stay}}{\overline{(Y/L)}} \text{ and} \tag{26}$$

[9] For derivations in a model without employer types, see Ilmakunnas and Maliranta (2007).

$$\beta_{(Y/L),j,sepa} = \frac{(Y/L)_{0,stay} - (Y/L)_{0,j,sepa}}{\overline{(Y/L)}} \quad . \tag{27}$$

and the wage equation coefficients are analogous wage effects. Now the intercept α indicates the growth rate in the reference group of stayers and the coefficients of the included $STAYSH_j$ variables (M–1 group variables) indicate differences in the growth rate in the reference group and in group j.

We further obtain the profitability change equation

$$\frac{\Delta(\Pi/L)}{\overline{(\Pi/L)}} = \alpha + \sum_e \sum_j \beta_{(Y/L),e,j,hire} HR_{ej} + \sum_j \beta_{(Y/L),j,sepa} SR_j + \sum_j^{M-1} \chi_{(Y/L),j,stay} STAYSH_j + \delta' \mathbf{Z} + \varepsilon \tag{28}$$

where the coefficient of a hiring rate is interpreted as the difference of the productivity and wage effects of the worker type in question, and similarly on the separation side.

Appendix Table 1 Firms' ownership status

		Year t			
Status in t-1	**Status in t+1**	**1998**	**2000**	**2002**	**Total**
Domestic	Domestic	4,057	4,638	4,713	13,408
Domestic MNE	Domestic MNE	456	571	664	1,691
Foreign MNE	Foreign MNE	515	589	656	1,760
Domestic	Domestic MNE	102	174	131	407
Domestic	Foreign MNE	47	52	22	121
Domestic MNE	Foreign MNE	15	21	23	59
Domestic MNE	Domestic	51	36	45	132
Foreign MNE	Domestic MNE	63	6	10	79
Foreign MNE	Domestic	40	8	11	59
Total		**5,346**	**6,095**	**6,275**	**17,716**

Appendix Table 2 Comparisons of domestic firms' productivity effects of hiring from different sources

		Comparison to hiring from				
		For. MNE	Dom. MNE	Domestic	Other Empl.	Non-Empl.
Hiring by domestic firms from	For. MNE		0.112	0.335**	0.416	0.486***
			(0.202)	(0.154)	(0.271)	(0.151)
	Dom. MNE	-0.112		0.223	0.304	0.374***
		(0.202)		(0.134)	(0.265)	(0.139)
	Domestic	-0.335**	-0.223		0.082	0.151**
		(0.154)	(0.134)		(0.237)	(0.063)
	Other Empl.	-0.416	-0.304	-0.082		0.07
		(0.271)	(0.265)	(0.237)		(0.236)
	Non-Empl.	-0.486***	-0.374***	-0.151**	-0.07	
		(0.151)	(0.139)	(0.063)	(0.236)	

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3 Profitability, productivity and wage equations for domestic MNEs: labour flows by age/tenure group

	Profits	Productivity	Wages
Hire, from For.MNE/Young	-0.142	0.425	0.535
	(0.827)	(0.892)	(0.389)
Hire, from For.MNE/Old/Low Tenure	0.307	0.573	-0.271
	(0.408)	(0.448)	(0.190)
Hire, from For.MNE/Old/High Tenure	-1.250	-0.733	0.562
	(1.722)	(1.927)	(0.479)
Hire, from Dom.MNE/Young	-0.114	-0.311	-0.118
	(0.520)	(0.654)	(0.419)
Hire, from Dom.MNE/Old/Low Tenure	0.563	0.694	0.120
	(0.397)	(0.473)	(0.155)
Hire, from Dom.MNE/Old/High Tenure	-1.106**	-0.689	0.400
	(0.447)	(0.508)	(0.257)
Hire, from Dom./Young	0.322	0.229	0.0235
	(0.325)	(0.388)	(0.212)
Hire, from Dom./Old/Low Tenure	-1.346***	-1.556***	-0.229
	(0.521)	(0.570)	(0.218)
Hire, from Dom./Old/High Tenure	-0.631	-0.871	-0.490
	(0.519)	(0.554)	(0.455)
Hire, from Other Emp./Young	-2.621	-3.765*	-1.372
	(2.040)	(2.122)	(0.860)
Hire, from Other Emp./Old	1.049	-0.114	-1.556
	(1.890)	(2.189)	(1.043)
Hire, from Non-Emp./Young	-0.344	-0.833**	-0.474**
	(0.267)	(0.394)	(0.222)
Hire, from Non-Emp./Old	-0.261	-0.351	-0.0170
	(0.494)	(0.501)	(0.171)
Sep., Young	-0.0151	0.0173	-0.100
	(0.205)	(0.218)	(0.0900)
Sep., Old/Low Tenure	0.709***	0.802***	0.262**
	(0.210)	(0.247)	(0.115)
Sep., Old/High Tenure	0.380	0.276	0.0276
	(0.358)	(0.337)	(0.102)
Stay, Old/Low Tenure	-0.132	-0.217**	-0.137***
	(0.0978)	(0.104)	(0.0370)
Stay, Old/High Tenure	-0.0296	-0.0685	-0.0997***
	(0.0979)	(0.105)	(0.0321)
Observations	1390	1390	1390
R-squared	0.474	0.453	0.415

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Appendix Table 4 Profitability, productivity and wage equations for foreign MNEs: labour flows by age/tenure group

	Profits	Productivity	Wages
Hire, from For.MNE/Young	-0.00856	0.148	0.0976
	(0.365)	(0.401)	(0.193)
Hire, from For.MNE/Old/Low Tenure	0.357	0.742	0.230
	(0.514)	(0.565)	(0.204)
Hire, from For.MNE/Old/High Tenure	0.233	0.0879	0.0275
	(0.501)	(0.569)	(0.224)
Hire, from Dom.MNE/Young	0.102	0.391	0.367*
	(0.354)	(0.409)	(0.220)
Hire, from Dom.MNE/Old/Low Tenure	-0.803	-1.292	-0.209
	(0.592)	(0.807)	(0.344)
Hire, from Dom.MNE/Old/High Tenure	-1.062**	-1.620***	-0.621**
	(0.500)	(0.507)	(0.272)
Hire, from Dom./Young	0.473*	0.545*	0.144
	(0.254)	(0.281)	(0.127)
Hire, from Dom./Old/Low Tenure	-0.113	-0.105	0.147
	(0.665)	(0.665)	(0.188)
Hire, from Dom./Old/High Tenure	-0.104	-0.360	-0.377
	(0.755)	(0.966)	(0.431)
Hire, from Other Emp./Young	-0.391	-2.192	-1.198
	(1.825)	(1.860)	(0.907)
Hire, from Other Emp./Old	-2.025	-1.672	0.308
	(1.547)	(1.667)	(0.664)
Hire, from Non-Emp./Young	-0.224	-0.677***	-0.518***
	(0.235)	(0.257)	(0.110)
Hire, from Non-Emp./Old	0.711	0.700	-0.0139
	(0.518)	(0.548)	(0.244)
Sep., Young	-0.415**	-0.551***	-0.149**
	(0.174)	(0.198)	(0.0758)
Sep., Old/Low Tenure	-0.0374	0.144	0.168**
	(0.233)	(0.254)	(0.0854)
Sep., Old/High Tenure	0.0622	0.0726	0.0626
	(0.217)	(0.288)	(0.108)
Stay, Old/Low Tenure	-0.0956	-0.143	-0.0757*
	(0.0855)	(0.0913)	(0.0386)
Stay, Old/High Tenure	-0.0550	-0.102	-0.0766*
	(0.0815)	(0.0909)	(0.0401)
Observations	1279	1279	1279
R-squared	0.565	0.556	0.261

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

International Trade and the Distribution of Wages

Pertti Haaparanta and Hanna Pesola

Abstract

We study how international trade affects both intra- and intersectoral wage distributions and unemployment. To do this we utilise the firm-worker matching model developed by Burdett and Mortensen and extend it to genuine multisector models in a standard trade theory framework. The major results we reach are as follows: a) factor price equalisation does not hold in the H-O-version of the model despite the fact that sectors are paying at least partly the same wages; b) aggregate changes like a change in the aggregate firm/job destruction rate can have implications for the sectoral allocation of factors of production (in contrast to some existing theories where only intersectoral differences matter); c) the theory is consistent with the observations that exporting firms tend to be larger firms; d) the firm heterogeneity is endogenous.

1 Introduction

One of the most exciting areas of research in international trade has recently been the research on the implications of firm heterogeneity on the structure of international trade. Motivated by the empirical research on the characteristics of exporting firms vis a vis firms producing solely for the home market, theoretical research starting from Melitz (2003) and Eaton and Kortum (2002) has clarified the issue of how the firm heterogeneity in terms of (labour) productivity is transformed through self-selection to exporting status. The theory has also considered e.g. the role of trade costs in affecting the selection process. Recently, some effort has been made to explain the firm heterogeneity. Manasse and Turrini (2001) and Yeaple (2005) explain firm heterogeneity through the existence of skill differences between entrepreneurs (Manasse and Turrini) or of existence of skill differences between workers and the selection of technologies (Yeaple). Yeaple e.g. shows that firms selecting new technologies also employ the highly-skilled workers and export.

This paper provides a theory of firm heterogeneity based on imperfections in labour markets. The labour market imperfections take the form of search frictions resulting in imperfect matching and unemployment. Burdett and Mortensen (1998) was among the first studies to show that the search frictions give firms some monopsony power. Together these two effects lead to

an equilibrium where ex ante identical firms will pay different wages and are ex post heterogenous. The idea has been extended further by Acemoglu and Shimer (2000), Manning (2003), and Mortensen (2003) both in theory and empirics. We extend here the basic theory to a general equilibrium setting involving several sectors and international trade. The theory results in a theory of both intra- and intersectoral wage distributions. The main focus will be on the implications of trade for these distributions. This is done by extending the standard Heckscher-Ohlin theory of trade, for which we mostly consider only the small open economy cases.

The theory presented answers one puzzle that cannot be explained by the existing theories. There exists now quite a bit of research showing the existence of an industry wage premium even after controlling for worker skills (e.g Manning (2003), Mortensen (2003)) and that at least part of these industry skill premiums are affected by international trade: import competition reduces the skill premium while exporters pay larger premiums. This paper presents evidence on exporter wage premiums using Finnish data and then develops a simple Ricardian theory of size and both intra- and inter-industry wage distributions of firms. One of the implications of theory is that exporting firms are larger and more productive than firms competing with imports. We also examine a Heckscher-Ohlin version of the model.

The main difficulty we face in extending the Burdett-Mortensen model to a multisector economy is that without some rigidities between sectors like intersectoral labour mobility costs there will be complete specialization in production. We get around that problem by assuming the existence of mobility costs that depend on the allocation of labour between sectors e.g. due to congestion.

The major results we reach are that: a) factor price equalisation does not hold in the H-O-version of the model despite the fact that sectors are paying at least partly the same wages; b) aggregate changes like a change in the aggregate firm/job destruction rate can have implications for sectoral allocation of factors of production (in contrast to some existing theories where only intersectoral differences matter); c) the theory is consistent with the observations that exporting firms tend to be larger firms; d) the firm heterogeneity is endogenous. The next section documents differences in the wage distributions between exporters and non-exporters in Finland. We then describe our model and provide some simulation results.

2 Exporting and wages in Finland

As a background for our theoretical analysis, we use a detailed linked employer-employee data set to describe the distribution of wages in exporting and non-exporting firms. Our data consist of information on Finnish firms, plants and workers for the years 1996 to 2004. To alleviate the selection bias that will arise if the best performing firms self-select into exporting, we match exporting firms with a control group of firms that do not export and compare individual level

wages between these groups. To improve the quality of the matches, we focus on manufacturing firms with at least 20 employees. The matching procedure is described in the appendix. The data used in our analysis exhibit the stylised facts on characteristics of exporting and non-exporting firms found in previous literature: exporting firms are larger, more productive, pay higher wages and employ a more highly-educated labour force than non-exporting firms. Details of the data and descriptive statistics for the matched sample of exporting and non-exporting firms can be found in Table 1 and Table 2 in the appendix.

In order to compare wage distributions of exporting and non-exporting firms, we estimate the distribution of wages conditional on individual characteristics and industry using quantile regression and use this information to obtain the unconditional distributions for exporting and non-exporting firms.[1] We also estimate a counterfactual wage distribution for non-exporting firms assuming the same characteristics distribution as in exporting firms. Figure 1 shows the cumulative wage distributions for exporting and-non-exporting firms as well as the counterfactual wage distribution for non-exporting firms. We can see that even when controlling for the distribution of characteristics wages are slightly higher in exporting firms. The difference between the unconditional distributions is statistically significant.

To examine the impact of exporting across the wage distribution, we estimate quantile regressions controlling for a wider range of firm and worker characteristics. The results in Figure 2 show that the exporter wage premium is highest at the lower end of the wage distribution and decreases for the higher quantiles. For the highest earners, the difference in wages between exporting and non-exporting firms is not significantly different from 0.

3 The closed Ricardian economy

Consider an economy producing two goods with labour. The unit labour productivity in sector i, i = 1,2, is a_i. The goods are produced by firms, each of which employs just one worker. [2] The gross revenue of each firm in sector i is $p_i a_i$, where p_i = price of sector i good. One of the most crucial assumptions we make is that while there is a free entry of firms (subject to entry costs) we assume that once firms have entered they cannot switch between sectors. The main reason for this is that without this assumption the Burdett-Mortensen type of theory cannot account for the existence of both intra- and interindustry wage distributions, see below. Ex ante all potential firms are identical but ex post they are sector specific. Thus, the theory we build should be interpreted as a Ricardo-Viner, sector specific factor theory.

[1] Quantile regression (see e.g. Koenker and Bassett, 1978) finds the θth regression quantile, $0<\theta<1$, as a solution to the minimisation problem $\min_{\beta} \left[\sum_{i:y_i \geq x_i\beta} \theta \left| y_i - x_i\beta \right| + \sum_{i:y_i \leq x_i\beta} (1-\theta) \left| y_i - x_i\beta \right| \right]$.

[2] The theory built can be generalised to produce also a theory for the size distribution of firms.

Figure 1: Comparison of distributions

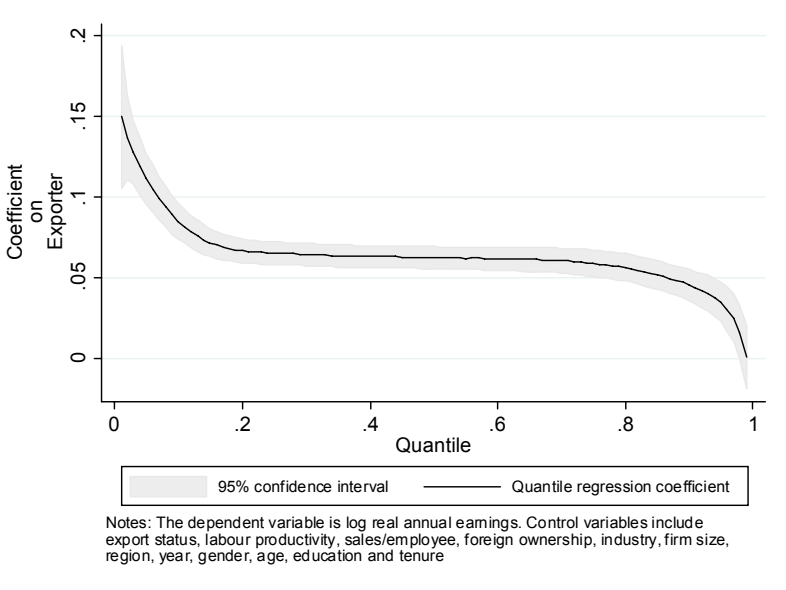


Figure 2: Exporter wage premium across the distribution

The second crucial building block of the model is the assumption that labour markets are not frictionless. Firms have to search for workers and workers have to search for firms. In this model we assume workers just to be responding to the wage offers made by firms. To facilitate the analysis and to keep in the tradition of international trade theory we assume that all the workers/consumers have identical homothetic preferences. They take as given the prices of the goods and thus their utility is linear in wages (assuming in addition that they take as given the profit income they earn). The distribution of the number of wage offers each worker receives is assumed to be a Poisson distribution with parameter λ indicating the expected number of offers received per period, λ = number of firms/number of workers. We assume that there is a continuum with mass 1 of workers and a continuum of firms with mass λ. This makes the Poisson approximation to the true (binomial) distribution good. The theory also requires the mass of potential employers to be larger than the mass of workers, $\lambda > 1$ Acemoglu and Shimer (2000). The firms maximise their expected value.

Firms make offers which the workers who receive the offers either accept or reject. We assume that firms employ all the workers that accept their offers. Let $F(w)$ denote the distribution of wage offers, i.e. $F(w)$ is the number (mass) of firms offering at most a wage w. It can be shown (see e.g. Burdett and Mortensen (1998), Manning (2003) and Mortensen (2003) section 1.2.1.) that there does not exist any pure strategy equilibrium with each firm offering the same wage. Hence, F is non-degenerate. Also, the economy wide equilibrium distribution of wage offers must be continuous (e.g. Mortensen (2003) section 1.2.1). Also, firms with higher productivity offer wages at least as high as firms with lower productivity (see e.g. Mortensen (2003) section 1.2.3.). Finally, with free entry, the expected profits of all firms must be equalised. This requirement ties together the wage distributions of firms facing different productivities.

Once a firm and workers have been matched they remain matched as long as the firm runs. We assume that the all the firms face a random shock, distributed independently across firms, of having to close down. The probability of being hit by the shock is Poisson distributed with parameter δ indicating the firm/job destruction rate. The unit value of the firm/job, after the match, is, in sector i, for a firm having offered wage w

$$V_i(w) = \frac{p_i a_i - w}{r + \delta + \lambda(1 - F(w))} \tag{1}$$

where r = rate of interest. The value equals the discounted present value of future profits from the match with discount factor reflecting also the probability of the match being broken either by an exogenous shock or by the worker receiving a better wage offer.

If $h(w)$ denotes the probability of the wage offer being accepted the expected value of the firm is $h(w) V(w)$. The acceptance probability is

$$h(w) = u + (1 - u) G(w) \tag{2}$$

where u = rate of unemployment and $G(w)$ = fraction of the employed accepting an offer less than w. The idea here is that all unemployed workers and those

workers whose current wage is below the wage offer accept the offer. We will concentrate only on the steady state distributions. It can be shown that in the steady state

$$G(w) = \frac{\delta F(w)}{\delta + \lambda [1 - F(w)]} \tag{3}$$

To understand this, the dynamics of the unemployment rate is given by the differential equation

$$\dot{u} = \delta (1 - u) - \lambda u$$

and the dynamics of people employed at or below the wage w, $E(w)$

$$\dot{E(w)} = \lambda F(w) u - [\delta + \lambda (1 - F(w))] E(w)$$

The steady state solution is

$$\frac{u}{1 - u} = \frac{\delta}{\lambda} \tag{4}$$

and

$$E(w) = (1 - u) \left(\frac{\delta F(w)}{\delta + \lambda [1 - F(w)]} \right)$$

Since $E(w) = (1 - u) G(w)$, (3) is obvious. Thus, the steady state expected present value of the firm is, using (3) and (4)

$$PV_i(w) = \left(\frac{\delta}{\delta + \lambda (1 - F(w))} \right) \left[\frac{p_i a_i - w}{r + \delta + \lambda (1 - F(w))} \right] \tag{5}$$

To simplify the model we assume that there is no possibility for intertemporal trade, or rather that the only saving technology available is one with $r = 0$. This gives

$$PV_i(w) = \frac{\delta (p_i a_i - w)}{(\delta + \lambda (1 - F(w)))^2} \tag{6}$$

Consider now the entry of firms. We assume that once the firms have made the decision in which sector to enter they cannot switch the sector. Let the entry cost be c in terms of the numeraire good. Assume good 2 to be the numeraire. When making the decision of entry they naturally choose the sector in which the expected profit is highest. As we assume consumer preferences to be homothetic, both goods will be produced in the closed economy equilibrium. This means that, in equilibrium, the expected profits must be equal across sectors and across firms in each sector. Furthermore, in equilibrium also $p_1 a_1 = p_2 a_2 \Leftrightarrow p a_1 = a_2$, with $\mathrm{p} \equiv \frac{p_1}{p_2}$. This is, since, as shown in Burdett and Mortensen (1998), the firms with lower gross revenue would be paying lower wages than the firms in the other sector. The wage distributions would have one common wage, the lowest wage offered by the sector with the highest gross revenue and the highest wage offered by the low gross revenue sector must be the same. Given that the equilibrium distribution of wage offers, $F(w)$, must be continuous, this equality cannot hold unless $p a_1 = a_2$. This has two crucial implications for the closed economy equilibrium: a) The equilibrium goods pricing is identical to

the standard Ricardian pricing, and b) In the closed economy equilibrium there will only be intrasectoral variation of wages but no intersectoral differences in wage distributions. To get to both of these, one way would be to extend the model with consumer search to induce price distributions, an endeavour we leave for future papers. Another way would be to assume that the number of firms in each sector is exogenously given. This is the avenue we take in the case of open economy equilibrium in the barebones model of the next section: we assume that the number of firms in each sector is given by the closed economy equilibrium. Without this assumption there would be intersectoral variation in the global economy; but, since the equilibrium would be such that only one sector is active in each economy, there would by definition be only intrasectoral variation of wages in each economy. A third way is to introduce a sector specific factor explicitly, and we follow this idea in the general model of the paper.

To close the model, we assume that the unemployed workers have access to a technology producing the numeraire good, each unemployed worker can produce b units of the good 2. Naturally $b < a_2$. The lowest wage offered will be equal to b: it can be shown that at the lowest wage offered the firm offering that wage cannot affect the number of workers contacting it by changing the wage offer marginally Burdett and Mortensen (1998). This is obvious from (6) as at the lowest wage $F(w) = 0$. Thus, the optimal choice of wage is b.

Since entry is free, the equilibrium wage distribution is a solution to the equation

$$\frac{\delta(a-w)}{(\delta+\lambda(1-F(w)))^2} = \frac{\delta(a-b)}{(\delta+\lambda)^2} \tag{7}$$

where $a \equiv pa_1 = a_2$. The solution is

$$F(w) = \left(\frac{\delta+\lambda}{\lambda}\right)\left[1-\left(\frac{a-w}{a-b}\right)^{\frac{1}{2}}\right] \tag{8}$$

This is the equilibrium distribution as profits for all firms offering the wage within the support of the distribution are equalised, while a firm offering a wage below b would not attract any workers and its profits would be 0, and given the entry cost, it would be losing money. The firm offering a wage above the maximum wage in the support would certainly attract workers but then a deviation by other firms to offer a wage slightly above that wage would be optimal etc, but these firms would make less money than the firm offering the lowest wage.

The largest wage paid, $w^{\max}$ can be solved from the equation with the solution

$$\left(\frac{\delta+\lambda}{\lambda}\right)\left[1-\left(\frac{a-w^{\max}}{a-b}\right)^{\frac{1}{2}}\right] = 1 \tag{9}$$

$$w^{\max} = a - \left(\frac{\delta}{\delta+\lambda}\right)^2 (a-b) \tag{10}$$

The wage distribution, as measured by the difference between maximum and minimum wages offered, is the more dispersed, ceteris paribus, the higher the level of productivity, as measured by a, the lower the income while unemployed, and the lower the unemployment rate, $\frac{\delta}{\delta+\lambda}$. The unemployment rate, however, is endogenous, as the match frequency λ is endogenous and the solution to

$$\frac{\delta\left(a-b\right)}{\left(\delta+\lambda\right)^{2}}=c \tag{11}$$

giving

$$\lambda=\left[\frac{\delta\left(a-b\right)}{c}\right]^{\frac{1}{2}}-\delta \tag{12}$$

giving the equilibrium unemployment rate as

$$u=\frac{\delta}{\delta+\lambda}=\left(\frac{c\delta}{a-b}\right)^{\frac{1}{2}} \tag{13}$$

and the maximum wage as

$$w^{\max}=a-c\delta \tag{14}$$

The allocation of firms and employment to sectors must be such that employment in each sector is able to produce the output demanded at the given price. Assuming Cobb-Douglas preferences with α as the share of good 1 in aggregate expenditure, the equilibrium condition for market for good 1 is

$$\alpha\left[\left(1-u\right)\int_{b}^{w^{\max}}wg\left(w\right)dw+ub+\lambda c\right]=\frac{a_{2}}{a_{1}}Q_{1} \tag{15}$$

where $g=G'$, the density of wages paid. The last term equals, with the free entry condition, aggregate profits in the economy, as λ is the measure of firms in the economy. Using (3) and (8) one can calculate

$$G\left(w\right)=\frac{\delta}{\lambda}\left[\left(\frac{a-b}{a-w}\right)^{\frac{1}{2}}-1\right] \tag{16}$$

which can be used with integration by-parts to get

$$\int_{b}^{w^{\max}}wg\left(w\right)dw= \tag{17}$$
$$2w^{\max}-b-\frac{\delta}{2\lambda}\left[\left(a-b\right)^{\frac{1}{2}}\left(\left(a-b\right)^{\frac{1}{2}}-\left(a-w^{\max}\right)^{\frac{1}{2}}\right)\right]$$

as the average wage in the economy. With expressions for the mass of firms and unemployment rate and the maximum wage, (15) gives the aggregate output of good 1 in the economy.

Since in the closed economy equilibrium firms in both sectors are similar (except for producing different goods) the share of firms in each sector is given by their share of employment. Thus, the share of firms in sector i is

$$\sigma_i = \frac{\frac{Q_i}{a_i}}{\frac{Q_1}{a_1} + \frac{Q_2}{a_2}} \tag{18}$$

To complete the characterisation of the closed economy equilibrium, it can be noted that firms paying higher wages are also larger in terms of their labour force. This is as the average size of firms paying wage w is

$$\lim_{\varepsilon \to 0} \frac{G(w) - G(w-\varepsilon)}{F(w) - F(w-\varepsilon)} = \frac{g(w)}{f(w)} = \frac{\delta(a-b)}{(\delta+\lambda)(a-w)} \tag{19}$$

which is increasing in the wage rate.

4 Small open Ricardian economy

To show the basic idea and mechanics of the model let us consider first how one can generate wage and firm size distributions in an otherwise standard Ricardian model. Consider now the equilibrium in a small open economy facing world market price ratio p^w. Assume, for definiteness, that $p^w > \frac{a_2}{a_1}$, i.e. the world market price of good 1 exceeds the closed economy equilibrium price. If the firms can move freely between sectors, it is clear that we get the same result as in the standard Ricardian model: the economy will be completely specialised, in this case in production of good 1. This is as now $p^w a_1 > a_2$ and the equalisation of profits cannot take place for any continuous wage offer distribution.

But this is still an interesting case and gives some first ideas of the impacts of international trade on wage distributions and unemployment rate. By substituting $p^w a_1$ for a in (13) one sees that trade reduces unemployment rate (since all the previous formulas still apply, there is just one sector in the economy): trade opening is equivalent to an economy wide productivity increase. Similarly, (14) implies that the trade increases the largest wage offer made, implying higher wage inequality in the sense that the difference between the highest and lowest wages in the economy increases.

Broadly similar conclusions hold when the model is extended by assuming that once firms/workers have entered a sector they cannot switch between sectors, i.e. there is a very high mobility cost. Accordingly, assume now that the the number (mass) of firms is fixed and their distribution across sectors is given by (18). Then it is known that the open economy equilibrium is characterised by a distribution of wages that is a combination of sectoral wage distributions. Sector 2 firms will offer, in equilibrium lower wages than sector 1 firms. As the wage distribution must have a connected support there exists a threshold level of wage, the highest wage offered by sector 2 firms and lowest wage offered by

sector 1 firms. The distribution of wages in sector 2 is now determined by the equation

$$\frac{\delta\left(a_2-w\right)}{\left(\delta+\lambda\left(1-F_2\left(w\right)\right)\right)^2}=\frac{\delta\left(a_2-b\right)}{\left(\delta+\lambda\right)^2} \tag{20}$$

with the highest wage paid by the sector satisfying the equation

$$F_2\left(\underline{w}\right)=\sigma_2 \tag{21}$$

The solutions are

$$F_2\left(w\right)=\left(\frac{\delta+\lambda}{\lambda}\right)\left[1-\left(\frac{a-w}{a-b}\right)^{\frac{1}{2}}\right] \tag{22}$$

and

$$\underline{w}=a_2-\left[\frac{\delta+\lambda(1-\sigma_2)}{\delta+\lambda}\right]^2\left(a_2-b\right) \tag{23}$$

The wage distribution in sector 1 can be solved from the equation

$$\frac{\delta\left(p^w a_1-w\right)}{\left(\delta+\lambda\left(1-F_1\left(w\right)\right)\right)^2}=\frac{\delta\left(p^w a_1-\underline{w}\right)}{\left(\delta+\lambda\left(1-F_1\left(\underline{w}\right)\right)\right)^2} \tag{24}$$

with the solution

$$F_1\left(w\right)=\left(\frac{\delta+\lambda}{\lambda}\right)\left[1-\left(\frac{a-w}{a-\underline{w}}\right)^{\frac{1}{2}}\right] \tag{25}$$

and the overall wage distribution is given by

$$F\left(w\right)=F_2\left(w\right)+F_1\left(w\right) \tag{26}$$

The highest wage paid in the economy is given as the solution to

$$F_1\left(w^{\max}\right)=1 \tag{27}$$

The solution is

$$w^{\max}=p^w a_1-\left(\frac{\delta}{\delta+\lambda}\right)^2\left(p^w a_1-\underline{w}\right) \tag{28}$$

Exporting firms are more profitable than firms competing with imports, and they also are on average larger (as measured by the number of employed persons) than the firms competing with imports. Export sector firms also grow in size compared to what they were in the closed economy equilibrium. Exporting firms also pay higher wages than firms in the other sector. The highest wage paid is higher in the open economy than it is in the closed economy. In this sense, the opening of trade increases wage dispersion.

5 General model: Wage distributions in a small open economy Heckscher-Ohlin model

The model can be extended also into a Heckscher-Ohlin type of framework with an imperfectly intersectorally mobile factor (capital) in addition to labour. As is usual the key assumption to be made is that capital intensities differ between sectors. With this, the solution can be obtained in steps analogous to those in the previous section. Among the results one can easily show that factor price equalisation does not any more hold. The intuition is clear: due to the labour market imperfection one cannot anymore talk about a single wage and also firms are earning rents (which naturally will be competed away but still there is no necessary relationship between unit price and unit cost). This section also extends the model to allow firms in both sectors to offer the same wages at least for a range of wages. This is necessary, as we saw above that that is the relevant empirical case. The analogous extension can be applied to the models previously presented.

5.1 Basics

There are two-sectors in the economy, 1 and 2. In both sectors two intersectorally mobile factors of production, capital (or land) and labour, are used. As above, let us consider capital to be general capital: it can be used in another employment relationship if the current use comes to an end. The capital is acquired before the firms make their wage offers. Let us assume that labour productivity in sector i is given by

$$f_i(k_i), f_i' > 0, f_i" < 0 \tag{29}$$

Then the value of an existing employment relationship to the firm paying wage w, $J(p_i f_i(k_i), w)$, is given by the Bellman-equation

$$\begin{aligned} rJ(p_i f_i(k_i), w) = p_i f_i(k_i) - w - \delta J(p_i f_i(k_i), w) + \\ \lambda(1 - F(w))[V(p_i f_i(k_i), w) - J(p_i f_i(k_i), w)] \end{aligned} \tag{30}$$

Here $V(p_i f_i(k_i), w)$ = value of a vacant job. Similarly, the value of a vacant job satisfies the Bellman-equation

$$\begin{aligned} rV(p_i f_i(k_i), w) = h(w)[J(p_i f_i(k_i), w) - V(p_i f_i(k_i), w)] - \\ c - \delta V(p_i f_i(k_i), w) \end{aligned} \tag{31}$$

where the probability that the firm's wage offer is accepted $h_i(w)$ is, like above

$$h_i(w) = \frac{\delta}{\delta + \lambda(1 - F(w))}$$

At the time the firm is making its decision on how much capital to acquire its profits are, assuming again that the world rate of interest = 0

$$\pi_i(w) = \delta[V(p_i f_i(k_i), w) - r_k k_i] \tag{32}$$

By solving the value of a vacant job from (30) and (31) this can be rewritten as

$$\pi_i(w) = \frac{h(w)[p_i f_i(k_i) - w] - d(w)c}{h(w) + d(w)} - \delta r_k k_i \tag{33}$$

where, like above, $d(w) = \delta + \lambda(1 - F(w)) =$ probability that the offer is declined. The first order condition for the choice of the capital stock is

$$\frac{h(w)}{h(w) + d(w)} p_i f_i'(k_i) = \delta r_k \tag{34}$$

giving the optimum choice as

$$k_i = k_i\left(\frac{p_i}{\delta r_k} z(w)\right), k_i' > 0 \tag{35}$$

where $z(w) \equiv \frac{h(w)}{h(w)+d(w)}$. The direct implication here is that the firms offering higher wages also have larger capital stock.

To specify the equilibrium, assume that good 2 is used as the numeraire and that the recruitment requires as costs c units of sector 2 goods. In equilibrium, since firms are free to choose the sector in which they operate, they must have the same expected profits. Also, all the firms must have equal expected profits regardless of the wage offers they make. To specify the equilibrium, the last equilibrium means that the wage offer distribution equalising profits within each sector $F_i(w)$ must satisfy the equation, using (33) and (35)

$$\frac{h_i(w)\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right)\right) - w\right] - d_i(w)c}{h_i(w) + d_i(w)} - \delta r_k k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right) = \underline{\pi} \tag{36}$$

Here $\underline{\pi} =$ the expected profits of a firm actually offering wage b. The sector in which the firm is producing will be determined in equilibrium. But (36) determines the wage distribution for each sector. The actual wage distribution observed in the economy is determined by the conditions requiring profits to be equalised across sectors. To get there, one must understand the properties of the sectoral distributions. Thus, rewrite (36) as

$$z_i(w)\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right)\right) - w\right] - (1 - z_i(w))c - \delta r_k k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right) = \underline{\pi} \tag{37}$$

This equation can be solved for $z_i(w)$ and it can then in turn be used to solve for the wage offer distribution. Now use the envelope theorem in (37) and take total differentials

$$\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right)\right) - w + c\right] dz_i = \tag{38}$$
$$z_i dw + (1 - z_i) dc + k_i d(\delta r_k) - f_i(k_i) dp_i + d\underline{\pi}$$

From (38) we get an expression for the change in the probability of having a wage offer accepted as a a function of the wage rate

$$z_i'(w) = \frac{z_i}{p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right)\right) - w + c} \,(>0) \tag{39}$$

The second derivative is

$$z_i"(w) = \tag{40}$$
$$\frac{z_i'(w)\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right)\right) - w + c\right] - z_i(w)\left[\frac{f_i'}{\delta r_k} - 1\right]}{\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k} z_i(w)\right)\right) - w + c\right]^2} =$$
$$-z_i(w)\frac{f_i'}{\delta r_k} < 0$$

using (39).

Using the definitions of $h(w)$, $d(w)$ and $z(w)$ we have

$$z_i(w) = \frac{\delta}{\delta + [\lambda + (1 - F_i(w))]^2}$$

which gives

$$F_i(w) = 1 + \lambda - \delta^{\frac{1}{2}}\left(\frac{1}{z_i(w)} - 1\right)^{\frac{1}{2}} \tag{41}$$

From this we get the properties of the wage offer distribution for sector i:

$$F_i'(w) = \frac{\delta^{\frac{1}{2}}}{2}\frac{z_i'}{z_i^2}\left(\frac{1}{z_i(w)} - 1\right)^{-\frac{1}{2}} \,(>0) \tag{42}$$

and, crucial for the density of wage offers,

$$F_i"(w) = \frac{\delta^{\frac{1}{2}}}{2}\left(\frac{1}{z_i(w)} - 1\right)^{-\frac{3}{2}} \times \tag{43}$$
$$\left\{\frac{z_i" z_i - 2z_i'}{z_i^3}\left(\frac{1}{z_i} - 1\right) + \frac{(z_i')^2}{2z_i^4}\right\}$$

This shows, that depending on the model parameters and productivity functions, the wage offer distribution can have any shape, and the shape can even vary.

We have not yet completely determined the aggregate equilibrium. What is lacking is the equilibrium in the market for capital. The equilibrium condition is

$$(1-x)\int_b^{\overline{w}_2} k_2\left(\frac{1}{\delta r_k} z_2(w)\right) dF_2(w) + x\int_b^{\overline{w}_1} k_1\left(\frac{p_1}{\delta r_k} z_1(w)\right) dF_1(w) = K \tag{44}$$

where K = supply of capital and x= share of workers in sector 1 (see below). This immediately showsthat the capital rental rate depends on the supply of capital. This then means that the factor price equalisation does not hold: countries with different endowments of capital have different capital rentals and thus, also different wage offer distributions.

The profits of a firm offering wage b are

$$\frac{\delta}{\delta+\lambda^2}\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k}\frac{\delta}{\delta+\lambda^2}\right)\right)-b+c\right]-c-\delta r_k k_i\left(\frac{p_i}{\delta r_k}\frac{\delta}{\delta+\lambda^2}\right) \quad (45)$$

With free entry the profits should whither and the matching rate is determined by

$$\frac{\delta}{\delta+\lambda^2}\left[p_i f_i\left(k_i\left(\frac{p_i}{\delta r_k}\frac{\delta}{\delta+\lambda^2}\right)\right)-b+c\right]-c-\delta r_k k_i\left(\frac{p_i}{\delta r_k}\frac{\delta}{\delta+\lambda^2}\right)=0 \quad (46)$$

The interesting feature of (46) is that the capital rental plays a crucial role in the determination of the matching rate and unemployment. E.g. if the firm paying the lowest wage is from sector 2, the numeraire sector, then changes in prices, e.g. due to trade policy changes, come only through the capital rental. With a higher price in sector 1, the capital intensive sector, capital rental increases. The marginal firm's profits decline and it becomes profitable only, if λ falls, i.e. it becomes easier to find workers who accept low wages. To make this happen, the unemployment rate increases, due to the exit of firms and the decline in the demand for labour at the low end of wages.

5.2 Worker decisions

To finally fully complete the model we still need a way to analyse how workers get allocated to the sectors. Assume that workers have to decide in which sector to search for a job. Assume further that once the decision is made they stay in the sector until they get unemployed again. Assume first that unemployed workers can costlessly search for a jobs in both of the sectors regardless of their previous employment. With these assumptions it is natural to require that in equilibrium the expected discounted incomes an unemployed person can get must be equalised between the sectors. This condition determines the allocation of workers between sectors.

The first implication of the change is that both sectors have their own wage distributions with sector specific maximum wages and matching intensities. We retain the assumption that the workers have the same outside opportunity b. Thus, now we have

$$F_i\left(w_i\right), w_i^{\max}, \lambda_i$$

Given this the analysis for each sector for given sectoral allocation of labour is as in the previous subsection. The only difference comes from the behaviour of the workers. In sector i the employed at wage w_i and unemployed workers'

expected incomes are given as solutions to the asset valuation equations

$$\begin{aligned} rV_i(w_i) &= w_i + \delta U_i + \lambda_i \left[\int_b^{w_i^{\max}} \max\{V_i(w_i), V_i(x)\} dF_i(x) - V_i(w_i) \right] \quad (47) \\ rU_i &= b + \lambda_i \left[\int_b^{w_i^{\max}} \max\{U_i, V_i(x)\} dF_i(x) - U_i \right] \end{aligned}$$

Here $V_i(w_i)$ = the expected lifetime income of a sector i employed earning currently wage w_i, and U_i = expected lifetime income of a currently employed worker who has decided to search for a job in sector i. We have here retained the assumption that both the unemployed and employed workers receive employment-wage offers with equal intensity. This implies that the reservation wage, the wage that equates the currently employed worker's utility with the unemployed worker's utility, equals the outside opportunity. This fact has been used in these equations. Obviously $V_i(w_i) \geq U_i$ and $V_i'(w_i) \geq 0$.

(47) are valid value equations for workers' welfare assuming that workers' preferences are homothetic, as for given goods prices these equations are the value functions for expected income and also value functions for welfare when expected income is deflated by the proper consumer price index.

In equilibrium

$$U_1 = U_2 \quad (48)$$

must hold to make unemployed workers indifferent between sectors in their search for jobs. To fully close the model assume that the aggregate mass of workers in the economy equals unity. Let x = the share of workers employed in sector 1. Then we know that

$$\lambda_1 = \frac{m_1}{x}, \lambda_2 = \frac{m_2}{1-x}$$

where m_i = mass of firms in sector i.These can, for given allocation of labour be substituted in the sectoral free entry (0-profit) conditions to determine the number of firms in each sector. Then (48) can be used to determine the allocation of labour between sectors.

It is easy to see that with these assumptions when prices are fixed the economy will be, in general, completely specialised. This is so as the 0-profit conditions fix the mass of firms in each sector. Then the sector with a larger number of firms relative to workers, with higher λ, will attract all the workers and the reallocation of workers does not at all affect the matching intensities.

To get around this we assume that the workforce has in the past been allocated to both sectors. E.g. in the autarky equilibrium both sectors will produce with homothetic preferences. Assume now that if there is a change, e.g. trade liberalisation, changing the relative welfare levels of the unemployed, and there is an incentive to search for a job in a different sector there is a cost attached in moving to the other sector. We assume this cost to be increasing and convex in the number of workers in the sector attracting new job applicants relative to the number of workers staying where they are. This specification captures e.g.

the difficulties in finding housing in the area where the production facilities of the sector attracting workers are located. The mobility cost function is

$$M = M\left(\frac{x}{1-x}\right), M', M" > 0$$

if workers are moving from sector 2 to sector 1 and

$$M\left(\frac{1-x}{x}\right), M', " > 0$$

if they are moving from sector 1 to sector 2.

5.3 Simulation results

It is very hard to get any analytic results from the model. Thus, we have constructed a numerical version of the model where the sectors have CES-production functions with different elasticities of substitution etc. We have used it for some experiments reported next.

We choose the parameters of the model to fit some aspects of Finnish data. The job destruction rate is initially set at 8% to equal the estimated job destruction rate for the manufacturing sector in 2005 (Ilmakunnas and Maliranta (2008)). The interest rate is set at 2% and the capital share in the CES production function is set at 0.45 in sector 1 and 0.35 in sector 2. In 2005, the capital share of value added in manufacturing in Finland ranged from 0.14 in the manufacture of motor vehicles to 0.54 in the manufacture of electrical equipment. The elasticity of substitution parameters are set at -0.25 and -0.20 for sectors 1 and 2 respectively. Total factor productivity in sector 1 is set 5% higher than in sector 2. The minimum wage is treated as exogenous in these simulations and is set at 15 500e annually in sector 1 and 13 000e annually in sector 2. These are in line with our data set. The recruiting cost is set at 17% of the annual wage, in line with the average recruiting cost reported e.g. in the technical fibre products industry (see Tamfelt (2007)).

Figure 3 shows simulated sectoral wage distributions based on our model. The resulting distributions have a shape reasonably close to reality and we can see that the distribution of sector 1, the more productive sector, stochastically dominates the distribution of sector 2. The employment share of the more productive sector is initially 56%, and the unemployment rates are 0.96% and 1.03% in sectors 1 and 2 respectively. Figure 4 shows the result of an experiment where the job destruction rate falls from 14% (as in Finland in 1993) to 8% (Finland 2005). We can see that the fall in the job destruction rate shifts the cumulative distributions down slightly in both sectors implying higher wages in both sectors. The highest wage paid increases in both sectors, and with a fixed minimum wage, this also implies an increase in wage dispersion in the economy. The fall in the job destruction rate decreases unemployment in both sectors, with the low initial values in this case implying changes that are small in absolute terms. Interestingly, such an aggregate shock also implies a small

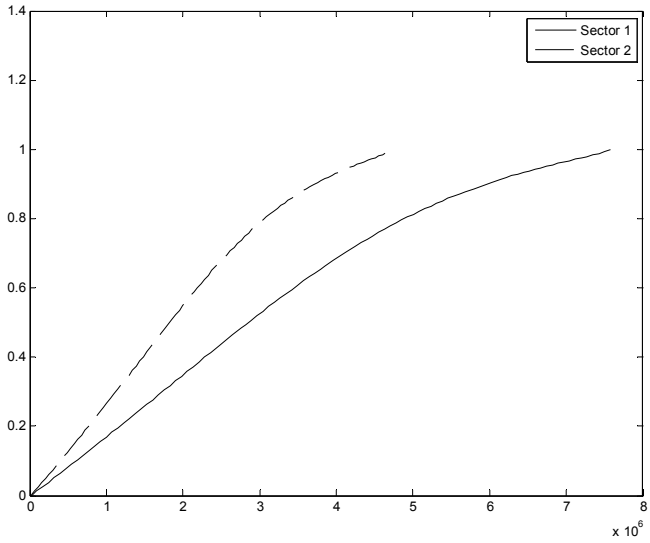


Figure 3: Sectoral wage distributions

shift in the allocation of labour between sectors, with the employment share of sector 2 increasing slightly. This is in contrast to some existing theories where only intersectoral differences matter.

Figure 5 depicts the impact of a 10% increase in both sectors' total factor productivity. This results in a shift in the wage distributions of both sectors similar to that following a fall in the job destruction rate, albeit larger in magnitude. Wage dispersion thus increases following the change. The unemployment rate also falls again in both sectors. The allocation of workers between sectors does not change.

We also experimented with some sector specific changes. A 10% increase in TFP in one of the sectors leads to a shift in the wage distribution of that sector implying higher wages. The wage distribution in the other sector remains unchanged. The employment share of the sector experiencing the TFP increase rises in both cases while the unemployment rate in that sector falls. The unemployment rate in the other sector remains practically unchanged.

Sector specific changes in the job destruction rate have somewhat asymmetric effects. An increase in the job destruction rate of the more productive sector decreases the employment share of that sector slightly and increases the unem-

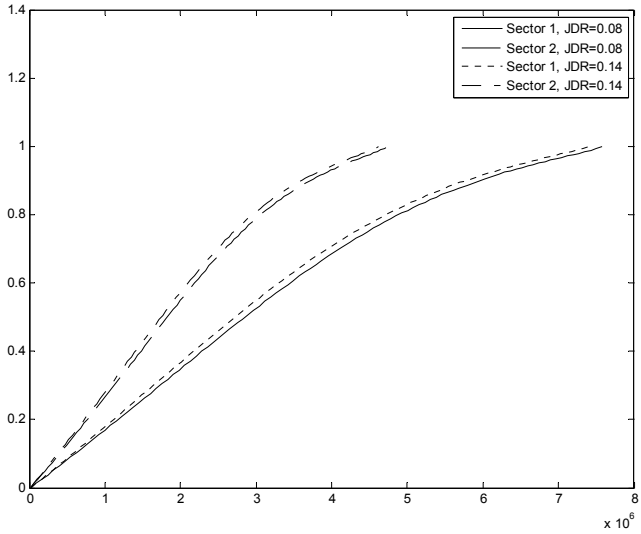


Figure 4: Wage distributions following change in job destruction rate

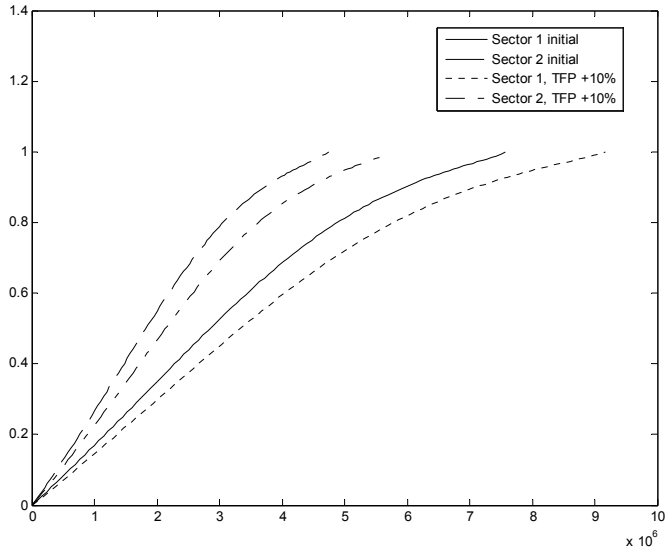


Figure 5: Wage distributions following change in TFP

ployment rate in both sectors. Interestingly, the increase in the unemployment rate is actually more pronounced in the less productive sector where the job destruction rate remains unchanged. These changes are accompanied by shifts in the wage distributions that imply slightly higher wages in the less productive sector and slightly lower wages in the more productive sector compared to the situation before the change.

In the case of an increase in the job destruction rate only in the less productive sector, the employment share of the more productive sector increases as would be expected. There is a marked drop in the unemployment rate of the less productive sector, while the unemployment rate in the sector not experiencing a change in the job destruction rate increases slightly. This somewhat counterintuitive result is, however, accompanied by a substantial shift in the wage distribution of the less productive sector which implies significantly lower wages across the whole distribution and will be related to more hiring. In the more productive sector with no change in the sector's own job destruction rate the wage distribution remains unchanged.

Some of these results may be affected by the fact that the minimum wage in each sector is currently exogenous. This issue will be addressed in further work. The simulations are also quite sensitive to changes in the elasticity of substitution which limits the range of feasible values.

6 Conclusions

We have here modelled endogenous firm and wage heterogeneity by applying the Burdett-Mortensen model and its extensions to multisector trade models. These models have been then used to study how e.g. trade liberalisation affects wage and firm heterogeneity and the unemployment rate. The mileage one gets from these models is seen by looking at the results: a) factor price equalisation does not hold in the H-O-version of the model; b) aggregate changes like a change in the aggregate firm/job destruction rate can have implications for sectoral allocation of factors of production (in contrast to some existing theories where only intersectoral differences matter); c) the theory is consistent with the observations that exporting firms tend to be larger firms; d) the firm heterogeneity is endogenous and the firm heterogeneity in the exporting sector increases when trade is liberalised; e) unemployment is affected by trade policies, unemployment can either go up or down with trade liberalization.

References

Acemoglu, D. and Shimer, R. (2000) "Wage and Technology Dispersion". Review of Economic Studies, 67, 585-607.

Burdett, K. and Mortensen, D.T. (1998) "Equilbrium Wage Differentials and Employer Size". International Economic Review, 39, 257-274.

Eaton, J. and Kortum, S. (2002) "Technology, Geography, and Trade". Econometrica, 70, 1741–79.

Iacus, S.M., King, G. and Porro, G. (2009) "Causal Inference Without Balance Checking: Coarsened Exact Matching", mimeo, Institute for Quantitative Social Science, Harvard University.

Ilmakunnas, P. and Maliranta, M. (2005) "Työpaikka- ja työntekijävirrat yrityssektorilla vuosina 1991–2005", Prime Minister's Office Reports (Valtioneuvoston kanslian raportteja) 2/2008.

Koenker, R. and Bassett, G. Jr. (1978) "Regression Quantiles". Econometrica, 46, 33-51.

Manning, A. (2003) Monopsony in Motion. Princeton University Press, Princeton NJ.

Manasse, P. and Turrini, A. (2001) "Trade, wages, and 'superstars'". Journal of International Economics, 54, 97-117.

Mortensen, D.T. (2003) Wage Dispersion: Why Are Similar Workers Paid Differently. MIT Press, Cambridge MA.

Melitz, M. J. (2003) "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity". Econometrica, 71, 1695-1725.

Tamfelt Annual Report 2007.

Yeaple, S.R. (2005) "A Simple Model of Firm Heterogeneity, International Trade and Wages". Journal of International Economics, 65, 1-20.

A Data

This study uses an extensive panel data set from Statistics Finland that links information on employers, that is, firms and plants, and their employees. The data set is formed by linking data from various Statistics Finland databases: Finnish Longitudinal Employer-Employee Data, Business Register, Industrial Statistics and Financial Statements Statistics. The data set is based on a 1/3 sample of individuals who were 16 to 69 years old in 1990. These individuals were followed until 2004, and the sample was extended each year by adding a 1/3 sample of 16-year-old persons. The data set contains extensive information on individuals' characteristics including details on their education, family, labour market situation, income etc. The firm- and plant-level variables include information on industry, ownership, economic activity etc. Information on the employer is linked to each individual based on the employer at the end of the year. These data are collected for all available years on all firms and plants that

employ at least one individual in the sample. We use data for the years 1996 to 2004 in order to have consistent information on key control variables. We also restrict our analysis to the manufacturing sector, which enables us to better control for plant productivity. Table 1 shows descriptions of the variables used in the analysis.

The analysis of wages paid by exporting and non-exporting firms is hindered by the potential selection bias caused by better performing firms self-selecting into exporting. To tackle this, we match each exporting firm to a similar non-exporting firm using the "Coarsened Exact Matching" method proposed by Iacus et al. (2009). The matching is done year by year using lagged values of productivity, foreign ownership, firm size, industry and region. The quality of matches is greatly improved when the sample is restricted to firms with at least 20 employees, so we focus on this group in our analysis. We also exclude firms that fail during our observation period and thus do not use this information for matching purposes. [3] The matched sample of firms is then linked to the data on their employees resulting in a data set with 152 041 person-year observations. Table 2 displays descriptive statistics for the matched sample used in the analysis. The data display many of the stylized facts on exporters and non-exporters: exporters tend to be more productive, larger and pay higher wages. Exporting firms also have a slightly more educated workforce, although the difference is not as pronounced as in some previous studies.

[3] Matching results are available on request.

Variable	Definition / Measurement
Individual characteristics	
Age	Age in years
Tenure	Tenure at current employer in years
Education	3 indicators for education level: comprehensive school, secondary education, university education
Wages	Logarithm of real annual earnings in euros (2004)
Gender	Indicator for female employees
Plant[1] *level characteristics*	
Exporter	Indicator for plants with exports > 0
Sales per employee	Plant sales per employee in euros
Labour productivity	Value added per hours worked
Industry	15 industry dummies
Region	6 region dummies (NUTS2)
Firm[1] *level characteristics*	
Firm size	4 indicators for firm size classes: 20 to 49 employees, 50 to 99 employees, 100 to 299 employees, more than 300 employees
Foreign ownership	Defined on the basis of ultimate beneficiary owner (UBO) with a 20 % threshold used in classifying a plant as foreign owned.
Other	
Years	9 year dummies

Notes

1. Plant refers to the physical location of a certain economic activity. Firms may consist of many plants.

Table 1: Variable descriptions

Variable	Exporters	Non-exporters
Log annual earnings	10.19	10.09
	(0.44)	(0.53)
P90/P10	1.09	1.11
P90/P50	1.04	1.05
P50/P10	1.04	1.06
Sales/employee	204 465	127 665
	(207 287)	(175 020)
Labour productivity	35.17	25.65
	(20.82)	(27.70)
Age	40.12	40.28
	(10.80)	(11.20)
Tenure (years)	11.13	10.66
	(10.04)	(9.95)
Female %	0.35	0.46
Comprehensive school %	0.28	0.28
Secondary education %	0.61	0.63
University education %	0.11	0.09
Foreign owned %	0.10	0.06
Firm size 20-49 employees (%)	0.07	0.14
Firm size 50-99 employees (%)	0.11	0.12
Firm size 100-299 employees (%)	0.19	0.19
Firm size > 300 employees (%)	0.63	0.54
Observations	129 390	22 651

Standard deviations in parentheses

Table 2: Descriptive statistics

Aalto-DD 12/2011

ISBN: 978-952-60-4036-3 (pdf)
ISBN: 978-952-60-4035-6
ISSN-L: 1799-4934
ISSN: 1799-4942 (pdf)
ISSN: 1799-4934

Aalto University
School of Economics
Department of Economics
aalto.fi

BUSINESS +
ECONOMY

ART +
DESIGN +
ARCHITECTURE

SCIENCE +
TECHNOLOGY

CROSSOVER

DOCTORAL
DISSERTATIONS