



# Seniority rules, worker mobility and wages: Evidence from multi-country linked employer-employee data<sup>☆</sup>

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## ABSTRACT

We construct multi-country employer-employee data to examine the consequences of last-in, first-out rules. We identify the effects by comparing worker exit rates between different units of the same firms operating in Sweden and Finland, two countries that have different seniority rules. We observe a relatively lower exit rate for more senior workers in Sweden in the shrinking firms and among the low-wage workers. These empirical patterns are consistent with last-in, first-out rules in Sweden providing protection from dismissals for the more senior workers among the worker groups to whom the rules are most relevant. Similarly, we observe a steeper seniority-wage profile in Sweden, suggesting that last-in, first-out rules may also be beneficial for more senior workers in terms of compensation.

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## 1. Introduction

Seniority rules for layoffs – sometimes denoted ‘last-in, first-out’ (LIFO) – and seniority wage premiums are important features in workplaces. In the United States, widespread use of seniority rules for lay-off decisions, especially in unionized firms, has been documented already by Abraham and Medoff (1984). Similarly, Oswald and Turnbull (1985) report that a substantial share of firms in the UK use seniority as a criterion for redundancies when firms downsize. Some countries, including Sweden and the Netherlands, even refer explicitly to seniority in employment protection legislation (EPL) as the exclusive or main criterion according to which employees should be prioritized in the event of dismissals (Bergström, 2011; World Bank, 2015). However, the adoption of seniority rules for layoffs is far from universal, with considerable differences across firms, sectors and countries.

While it seems obvious that seniority rules should reduce separation rates among the more senior workers, the effects on wage profiles are ambiguous *a priori*. On the one hand, bargaining power may explain an increasing relationship between wages and seniority. On the other

hand, compensating wage differentials could imply that LIFO rules are associated with flatter wage profiles.

This paper examines the effects of seniority rules on mobility and wages using longitudinal employer-employee data for multinational firms operating in two countries with different seniority rules. To the best of our knowledge, this is the first effort of linking personnel data for a large number of firms across national borders. We merge complete payroll records of 150 firms that operate in both Sweden and Finland. Our linked data allow us to observe the changes in employment status at the individual worker level in the matched firms over the period 2000–2011 and to compare seniority wage profiles across units of the same firm operating under different employment protection laws.

The Swedish and Finnish units of the firms that are included in our linked data operate under similar macroeconomic conditions but face different labor market regulations. The Swedish and Finnish economies are comparable with respect to aggregate unemployment, GDP per capita, general education level, union strength, the fraction of workers with temporary jobs, and industry structure. Because both countries are small export-oriented economies exporting largely to the same mar-

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kets, even the timing of the business cycle has coincided in these two countries.

Focusing on the same firms makes the operating environment of the units in different countries even more similar. The units of the same firm generally use similar production technologies and often sell identical products with the same brand names, although (with the exception of exporting firms) to different markets. These multinational firms usually have a uniform corporate culture, common personnel policies, similar job titles and the same general leadership. In most cases they have the same owners as they are publicly listed firms.

The crucial difference between units located in different countries is that the units operating in Finland are subject to Finnish labor law and the units operating in Sweden are subject to Swedish law. Overall, the two countries' employment protection rules are not very different. However, the aggregate indices mask important differences in details. In this paper, we concentrate on the effects of seniority rules that differ markedly across these two countries. In Sweden, firms must follow a strict LIFO policy, while such regulations do not exist in the Finnish labor law. Seniority rules may affect average dismissal costs and should certainly affect the choice of workers who are fired when a firm downsizes. We are particularly interested in how these rules affect the layoff risks and wages in different worker groups. Having individual-level data on all employees in the linked firms allows us to examine worker mobility and wages disaggregated by age and tenure, thereby providing reliable evidence on the heterogeneous effects of seniority rules in these important dimensions.

Our results show that the seniority rules are related to both worker mobility and wages. We find no differences in average effect of seniority on exit rates but substantial effects in the shrinking firms that reduce their employment. In these firms LIFO rules appear to be binding and tighter rules reduce exit rates of more senior workers. We also find that tighter LIFO rules reduce exit rates among more senior low-wage workers. LIFO rules are also associated with steeper seniority-wage profiles, particularly among blue-collar workers. This observation is consistent with seniority rules increasing the bargaining power of the senior workers.

A closely related empirical study is [Buhai et al. \(2014\)](#), who show that, controlling for tenure, seniority *per se* is important for both layoffs and wages in Danish and Portuguese firms. In contrast to [Buhai et al. \(2014\)](#), our analysis exploits explicit differences in labor law but our findings are generally similar. Our research setting exploiting within-firm cross-country variation can also be compared to a study by [Lafontaine and Sivadasan \(2009\)](#), who examine the effects of labor market rigidities using data on employment and sales from a single US-based fast-food chain that operates in 43 countries. Compared to their study, our two-country setting has much less variation in employment protection. However, focusing on two rather similar countries makes the operating environment much more similar in several other dimensions that affect employment than a 43-country comparison. Also, our approach should yield more generalizable results, because the linked data cover three major industries.

## 2. Literature

### 2.1. Effects on worker mobility

Economic theory predicts that more stringent EPL decreases both hiring and firing rates, while the effects on employment are ambiguous. Few studies have empirically examined the effect of seniority rules on labor market flows. A Swedish study by [von Below and Skogman-Thoursie \(2010\)](#) evaluates the effect of relaxing LIFO rules in a natural experiment setting, in which a reform in 2001 enabled small firms to exempt two workers from the seniority rules when dismissing workers for economic reasons. The results suggest that both hirings and separations increased in the small firms (with no discernible effect on net employment). Similarly, [Buhai et al. \(2014\)](#) show that the probability

of a worker leaving a firm decreases with seniority in both Denmark and Portugal, but whether there are any formal rules in the two countries requiring firms to lay off workers according to seniority is not explicitly taken into consideration.

The findings by [von Below and Skogman-Thoursie \(2010\)](#) and [Buhai et al. \(2014\)](#) are well in line with the large body of earlier literature examining broader measures of EPL based on cross-country comparisons as well as the more recent wave of within-country studies exploiting settings in which the changes in employment protection rules affect only some workers – for example workers in firms below a certain size threshold.<sup>1</sup>

A major problem in all cross-country studies concerning effects of EPL is that differences in labor market performance may be due to country-specific factors other than the stringency of regulation. Even with panel data, identification is difficult because institutions tend to change slowly. Another limitation is that cross-country comparisons typically rely on rather coarse measures of job protection, and may miss the effects of institutional details that are important for policy design.

Causal inference on the effects of job protection legislation is more straightforward in within-country studies using data from natural experiments.<sup>2</sup> While analyzing the effects of reforms within countries may be useful in obtaining causal effects, these studies may suffer from an inability to capture economy-wide general equilibrium effects that could arise if all firms were subject to tighter seniority rules.

### 2.2. Effects on wages

Theoretical predictions regarding the effect of seniority rules on wages are ambiguous, i.e., seniority-wage profiles could be steeper or flatter. In this section, we will discuss various theories and available empirical evidence.

One mechanism that may induce a positive correlation between seniority rules and a seniority wage premium is union wage discrimination. [Kuhn and Robert \(1989\)](#) construct a monopoly union model that leads to second-best employment levels that are suboptimal due to the monopoly wage markup. The LIFO arrangement enables one to set the marginal worker wage equal to the market wage, allowing wage discrimination that solves the monopoly deadweight loss problem. Thus, the seniority rules and the higher wages for more senior workers are both endogenous outcomes of a Pareto improving price-discrimination solution. It is possible that such rules are associated with stronger bargaining power of long-tenured workers compared to those with short tenures or with fixed-term contracts, because a layoff provides the threat point for a firm. This should make seniority-wage profiles steeper.<sup>3</sup> The mechanisms through which unions could achieve this may involve tariff wages and/or firm-level bargaining.

Alternative explanations for the effects of seniority rules on wages are based on compensating wage differentials, employer learning, implicit contracts and efficient bargaining. Compensating wage differentials imply that if the workers value job security, wages are, in equilibrium, lower for the better-protected older workers, implying flatter seniority-wage profiles. The predictions from learning models (see, e.g.,

<sup>1</sup> For an early example of a cross-country study based on aggregate data, see [Lazear \(1990\)](#). More recently, the focus has shifted to a more disaggregated level, enabling separate analysis and more nuanced estimates for specific sub-groups defined by gender, age, firm or industry (e.g., [Haltiwanger et al., 2006](#); [Kahn, 2007](#); [Messina and Vallanti, 2007](#)). Natural experiment approaches and within-country data have been used by, e.g., [Autor et al. \(2007\)](#), [Boeri and Jimeno \(2005\)](#), [Kugler and Pica \(2008\)](#), and [Martins \(2009\)](#). [Skedinger \(2010\)](#) and [Boeri and van Ours \(2013\)](#) provide useful surveys of this literature.

<sup>2</sup> In an ideal situation we could complement our study by also exploiting within-country reforms and using cross-country data to create additional comparison groups. However, the Swedish 2001 reform affected only small firms none of which can be found in our multinational firm data.

<sup>3</sup> It should be noted that the mechanism is not necessarily causal, since the seniority rules may reflect stronger bargaining power of unions. However, as explained in more detail in [Section 3](#), this interpretation of the mechanism seems to have little bearing in our empirical context.

Jovanovic, 1979) can go either way. On the one hand, if employers gradually accumulate more precise information about their employees so that the better-matched workers become less likely to leave the firm over time, wages will rise with seniority. On the other hand, if workers are heterogeneous in absolute productivity and learning is slow, low-productivity workers will stay with the firm, implying that seniority rules are associated with flatter seniority-wage profiles.

Alternatively, seniority rules can be interpreted as an explicit commitment device for the enforcement of implicit contracts. According to the implicit contract model, new employees are underpaid and senior employees are overpaid relative to their marginal productivity. The firm retains these implicit contracts to maintain its reputation (Lazear, 1979). Therefore, seniority rules could be interpreted as an explicit labor market rule that supports employers' commitment to implicit contracts.

The ambiguity in theoretical predictions can be resolved only with empirical work, but there is very little evidence available. Most related studies are concerned with the effect of *tenure* on wages rather than *seniority*, conditional on tenure. These studies invariably find that wages rise with tenure, but there is great variation in the magnitude of the effects.<sup>4</sup> The only previous study specifically examining the relationship between seniority rules and wages seems to be Buhai et al. (2014). They find that wage profiles increase with seniority in Denmark and Portugal.<sup>5</sup>

### 3. Context

#### 3.1. Employment protection legislation and seniority rules

In both Sweden and Finland, the basic rules regarding employment protection are stated in the labor law. These laws determine the procedures that need to be followed when firms dismiss workers. Dismissals for personal misconduct are possible in both countries, but by far the most common reasons for dismissals are 'economic and production related reasons'. For example, the Finnish labor law states that a firm may dismiss a worker when available work has 'significantly and permanently reduced', while the Swedish law stipulates that a 'lack of work' may be sufficient reason for dismissal. The labor laws establish minimum requirements for an advance notice period that increases with seniority in both countries. Discrimination based on gender, age or ethnic origin is prohibited, and some groups of workers, such as employee representatives, pregnant women, those on parental leave, and those who have lost part of their work ability while working for the same employer, are better protected. According to the most recent OECD summary indicators for 2013, both countries have EPL rules that are tighter than in Anglo-Saxon countries but more liberal than in continental Europe. In terms of ease of individual dismissals of permanent workers Finland ranks 26th and Sweden 27th among the 34 OECD countries.<sup>6</sup>

In addition to such legislation, most firms in both countries have to follow collective agreements. The union contracts are binding irrespective of whether the individual worker is a union member.<sup>7</sup> The union contracts typically extend the minimum requirements stated in the law, for example, by increasing the advance notice periods.

The crucial difference in the EPL concerns the LIFO rules. These seniority rules have been included in Swedish legislation since 1974.<sup>8</sup> The

<sup>4</sup> See, e.g., Altonji and Williams (2005), Buchinsky et al. (2010), Dustmann and Meghir (2005) and Topel (1991).

<sup>5</sup> There are also a few related studies analyzing the relationship between specific components of EPL, other than seniority rules, and wages, with mixed results. See, e.g., Centeno and Novo (2014), Leonardi and Pica (2013) and van der Wiel (2010).

<sup>6</sup> <http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm>.

<sup>7</sup> In Sweden, the contracts are binding only if the employer belongs to an employer association or has signed a local collective agreement ('hängavtal'), whereas in Finland, contracts are also binding for non-member firms if the collective agreement has been legally extended to cover such employers.

<sup>8</sup> Swedish unions are strong supporters of the LIFO rules, while employers are vehemently opposed to them. Still, it is an oversimplification to argue that the introduction

basic rule states that workers have to be laid off in inverse order of seniority when a firm downsizes for economic reasons. For workers with equal seniority, the youngest worker is laid off first. Such rules do not exist in Finnish labor law.

In practice, the differences between the two countries are somewhat smaller. The Swedish legislation on the LIFO rules specifies the group of workers and workplace units for which the rankings apply ('turordningskrets'). In addition to the establishment as the basic unit for the ranking of workers, it is usually the case that separate rankings apply depending on the negotiation area, implying that blue- and white-collar workers are treated as separate groups. The legislation also allows some latitude for the competence of the worker to be a factor when determining the relevant group of workers. The more narrowly defined the group is, the larger the scope is for the employer to retain the most valuable employees. Another important feature of Swedish legislation is the possibility to depart from the LIFO rules in local agreements ('avtalsurlista') between employers and unions, as long as the agreements are not discriminatory or otherwise improper. There is scant documentation of these agreements, and they are not recorded in our data. A survey of representatives of employers and unions in 200 firms that had to reduce production during the last two years indicates that local agreements were made in 50% of cases of downsizing for white-collar workers but that these agreements were rare occurrences for blue-collar workers (Confederation of Swedish Enterprise, 2012; Larsson et al., 2013). Thus, strict adherence to the LIFO rules is more prevalent when dismissing blue-collar workers, and some of their unions have adopted a policy of approving local agreements only in exceptional cases.

As mentioned above, Finnish labor law does not contain any reference to the layoff order. However, some union contracts, for example, the contract for the engineering industry, contain a supplement with regulations on how to choose which workers to lay off when the firm downsizes. By contrast, the collective agreements in, for example, the retail trade or hotels and restaurants contain no clauses on the layoff order. Even in engineering, the employer has a right to retain key workers who are 'crucial for the production process'. Other valid selection criteria include competency in, for example, operating specific machines. Only after mentioning these criteria does the union contract list tenure in the firm and the number of dependent children as additional factors that should affect the choice of which workers to fire. There are a few cases in the Labor Court in which the employer has been found guilty of breaking the contract, but in these cases, the employer fired a worker with a tenure of over 20 years while retaining a less competent worker with a much shorter tenure. Even in these cases, the fines have been rather small, between €2000 and €4000.

Seniority rules are part of a wider concept in EPL, namely right-to-priority (RTP) rules. RTP defines criteria according to which employees should be prioritized in the event of dismissals for economic reasons. A number of countries incorporate RTP rules in their legislation (see, e.g., Bergström, 2011, for an extensive discussion and World Bank, 2015), but very few explicitly refer to seniority as the exclusive or main criterion. In addition to Sweden, such countries include India and the Netherlands, and the details specifying how seniority should be taken into account differ somewhat among them. RTP rules in other countries, e.g. Austria, China, France, Germany and Spain, do not emphasize seniority at all or only to a limited extent. Other factors, such as the number of dependents, disability, age or status as a union representative, should be given all or equal weight relative to seniority. However, another group

of the LIFO rules and the implementation of the Employment Protection Act in 1974 were attributable to the unions being particularly powerful and influential at the time. In fact, both unions and employer organizations were initially against the Act and argued that the employment protection issues should be resolved in collective agreements (Nycander, 2010). The Social Democratic Party was the main driving force behind the legislation, which only gained the approval of the unions over time. Before the Act was introduced, the main blue-collar union even argued that seniority should be given less emphasis in the LIFO rules than stipulated in collective agreements, referring to the importance of job reallocation for structural change and growth (LO, 1971).

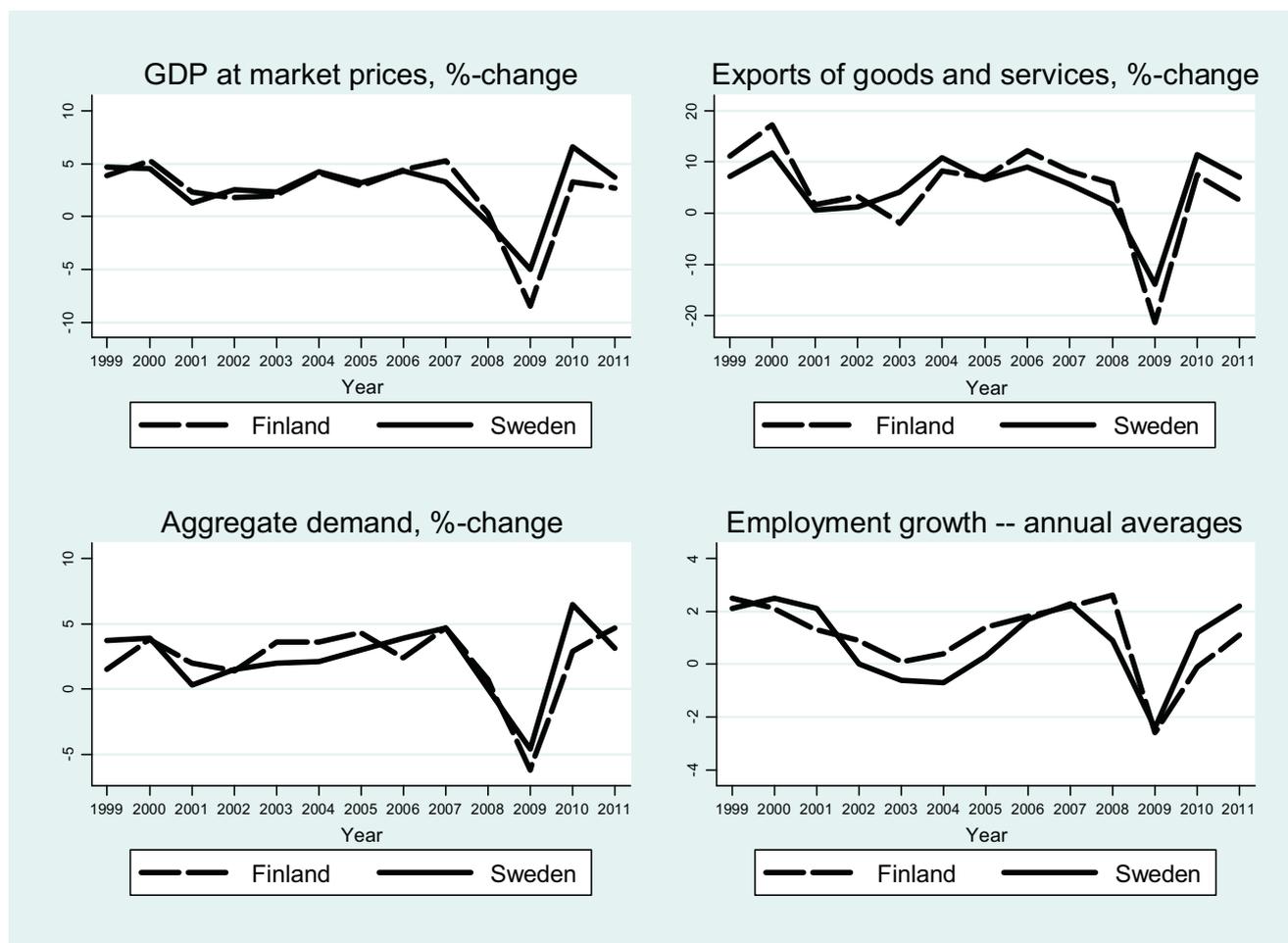


Fig. 1. Macroeconomic indicators in Finland and Sweden. Source: Eurostat.

of countries, including Belgium, Denmark, Finland, Norway, the United Kingdom and the United States, implement no RTP rules whatsoever in their EPL. Instead, legislation is limited to defining what constitutes ‘unfair’ grounds for dismissal (which is also included in legislation in countries with RTP rules). Thus, discrimination on the basis of ethnicity, gender, sexual orientation, etc., is prohibited, and certain personal circumstances, such as pregnancy, parental leave and military service, should not be cause for dismissal.

### 3.2. Stylized features of the Swedish and Finnish economies

Both Sweden and Finland are export-oriented small economies and are heavily dependent on the demand conditions in their primary export markets in Europe, the United States and Asia. Business cycle fluctuations in both countries are therefore usually due to changes in export demand. The fact that Sweden retains its own currency while Finland is part of the Economic and Monetary Union has not changed this situation. In fact, the exchange rate between the Swedish krona and euro was quite stable during the observation period, except for a brief period with a temporarily weaker Swedish krona in 2009. Also, the evolution of the Swedish and Finnish economies in the aftermath of the global financial crisis that began in 2008 was similar. The global financial crisis represented a major export shock that hit both countries, causing a drastic decline in export volume and GDP. Having a severe economic slowdown such as the Great Recession over the observation window is useful for identification, because the LIFO rules are binding (in Sweden) when the firms are forced to lay off workers. After 2009, both countries

Table 1 The number of firms and workers in the linked data.

	Sweden		Finland	
	Firms	Workers	Firms	Workers
2000	81	114,176	73	62,145
2001	75	105,141	82	63,815
2002	76	113,978	85	64,738
2003	76	105,829	88	60,125
2004	78	113,544	86	56,105
2005	85	114,624	94	59,295
2006	86	120,107	99	61,789
2007	87	125,129	109	65,786
2008	85	125,757	117	61,864
2009	98	128,546	113	60,507
2010	101	129,709	115	58,270
2011	95	131,761	120	64,262
N (obs)	1,023	1,428,301	1,181	738,701

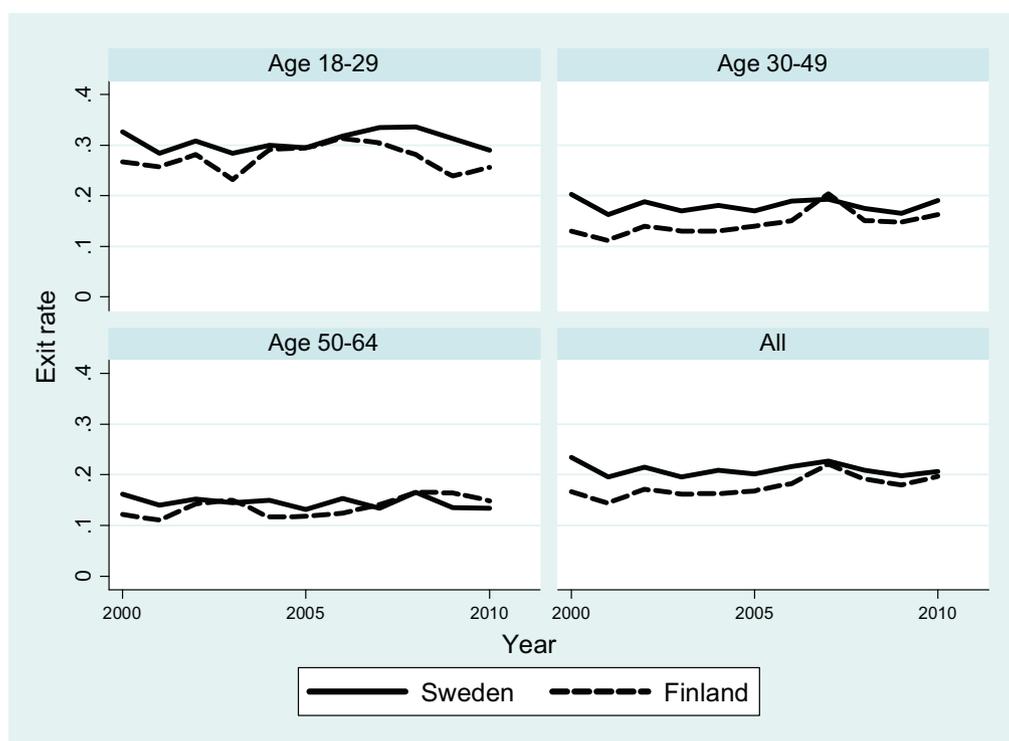
Notes: The data are unbalanced; not all firms are observed in all years in the employer association payroll data. Variation is due to entry and exit of firms, firm mergers and split-ups and failures to submit payroll data to employer associations despite reporting being mandatory.

began to recover from the shock, although the Swedish economy has grown substantially more rapidly after 2011 (a period no longer covered in our data). As shown in Fig. 1 the macroeconomic cycles were nearly identical in Sweden and Finland over the period 1999–2011 that we study.

**Table 2**  
Mean employee characteristics in the linked Finnish and Swedish firms.

	Sweden	Finland
Share of males	0.63	0.65
Share of number of white-collar workers	0.52	0.40
Average age	39.4	40.1
Age 18–24	0.12	0.10
25–34	0.25	0.26
35–44	0.29	0.26
45–54	0.20	0.24
55–64	0.14	0.14
Imputed tenure	4.3	5.5
Average hourly wage (€)	19.8	18.4
Usual weekly hours	36.2	37.2
Worker exit rate	0.21	0.17
Worker entry rate	0.21	0.16

Notes: Average wage is deflated to the year 2000 level using the consumer price index and converted into euros using the average exchange rate for each year. White-collar/blue-collar work is defined using occupational titles.



**Fig. 2.** Worker exit rates by age group.

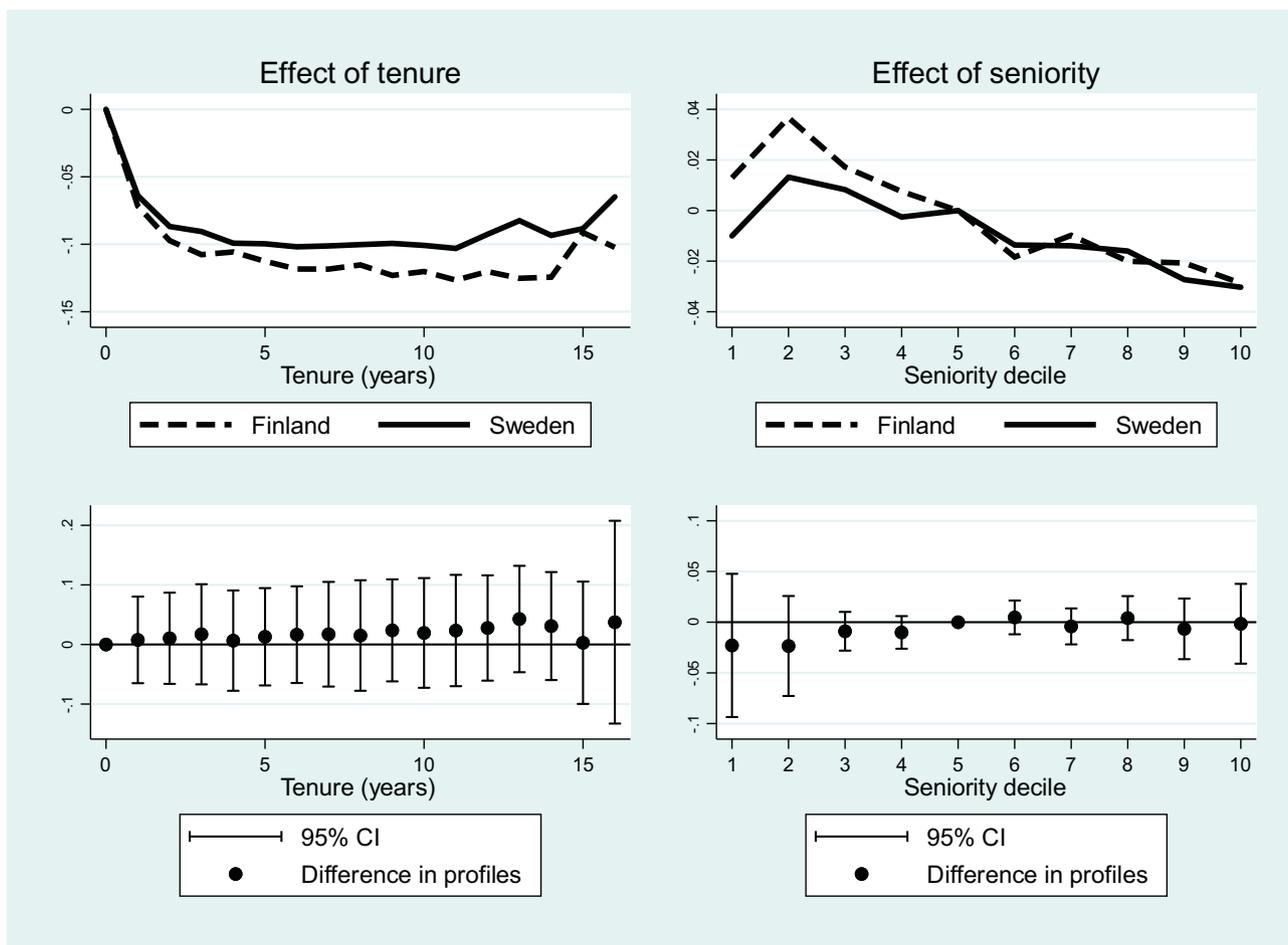
Notes: The unadjusted exit rates by age and country. Exit rates are calculated based on firm ID changes using common firm definitions in both countries. See the text for a detailed description.

The structure of the economies is also strikingly similar on relevant dimensions. For example, the average education level of the workforce is comparable. The share of the population that has completed tertiary education among 25–34 year-olds is close to 40% in both countries (OECD, 2013). The female labor force participation rate is high in both countries. Sweden has a slightly larger public sector and, consequently, a higher tax rate. According to the CESifo DICE database,<sup>9</sup> worker mobility is also rather similar between the two countries. Most workers are hired on permanent contracts. Average tenure is slightly over 10 years in both Sweden and Finland. The share of workers with tenures of 10 years or more is 22.2% in Finland and 21.9% in Sweden. During the early 2000s, the fraction of workers with temporary contracts was 16–17% of all employed persons and 14% for prime-age men in both countries.

The countries' labor market institutions and wage formation also share many similar features. Wage contracts are negotiated between industry unions and employer organizations with some co-ordination across industries. Neither Sweden nor Finland has statutory minimum wage laws. Instead, minimum wages are determined separately in each industry in the contracts between the unions and the employer organizations. The union contracts specify a set of task-specific minimum wages that may vary by region, job-complexity level and worker experience. The union density is approximately 70% in both countries. The union contracts are extended to all workers in each firm and are therefore also binding for non-union workers, with few exceptions. The coverage of collective labor agreements is consequently close to 90% in both countries.

Employees are generally well insured against income losses. Sweden and Finland both have earnings-related unemployment insurance. The replacement rate is dependent on pre-unemployment earnings and is

<sup>9</sup> <http://www.cesifo-group.de/ifoHome/facts/DICE.html>.



**Fig. 3.** Effect of tenure and seniority on exit rates in stable and expanding firms.  
*Notes:* Expanding firms include firms where employment increases by more than 20%, and stable firms are those where employment change is between +/- 20%, as described in more detail in the text. Upper panels display average exit rates by tenure and seniority; lower panels display difference between Sweden and Finland. Standard errors are clustered at the common firm identifier level. The 95% confidence intervals are indicated.

relatively similar in these countries. For example, the average net replacement rate for those who have been unemployed for six months was 64% of pre-employment earnings in Finland and 69% in Sweden in 2009. Earnings-related unemployment insurance is based on voluntary membership in mostly union-run unemployment insurance funds. This system, whereby the unions administer government-subsidized unemployment insurance funds, is known as the Ghent system. Both countries also have earnings-related pensions and guaranteed minimum pensions. The expected effective retirement age is higher in Sweden than in Finland but early retirement schemes are mostly relevant for those who are aged 60 or over (Tuominen, 2013).

**4. Data**

Our primary data originate from the payroll records of the Swedish and Finnish central employers’ organizations. Employers’ organizational structures in Sweden and Finland are quite similar, with a large central federation in both countries that is composed of several industry-wide member organizations.<sup>10</sup> The central federation in each country maintains the payroll records, but access to the data is more cumbersome in

<sup>10</sup> Finland formerly had two different employer federations that merged in 2005. Currently, most large employers belong to the Confederation of Finnish Industries (EK), which is also the organization that kindly provided us with data on both its members and the members of the previous employer organizations.

Sweden because both the central federation and each member organization have to approve access to data on their member firms. We gained access to data from three large industries: engineering, retail trade, and hotels and restaurants. For Finland, our data contain the entire private sector. Originally, the Finnish data for the hourly paid blue-collar and monthly paid white-collar workers were collected separately, but we have included both in the data linked to Swedish firms.

The payroll record data cover all workers in all firms that are members of the employers’ organizations in the respective countries. Nearly all large firms are members of the employers’ organizations, but not all small firms are included. On the one hand, this implies that the data provided by the employers’ organizations are not representative of the overall economy. On the other hand, most large multinational firms are members of the employers’ organizations and, hence, are included in the payroll data.

Information in the payroll data comes directly from the firms’ pay systems. These data were originally gathered to monitor wage growth after a union contract had been agreed upon, and consequently, they are used as a basis for ongoing negotiations over collective labor agreements. The statistical authorities also use these data to construct official measures of earnings growth. Thus, these data are highly accurate and contain minimal measurement error, which is common in wage surveys. These data have been frequently used in research both in Sweden and in Finland but thus far always in anonymized form whereby person and

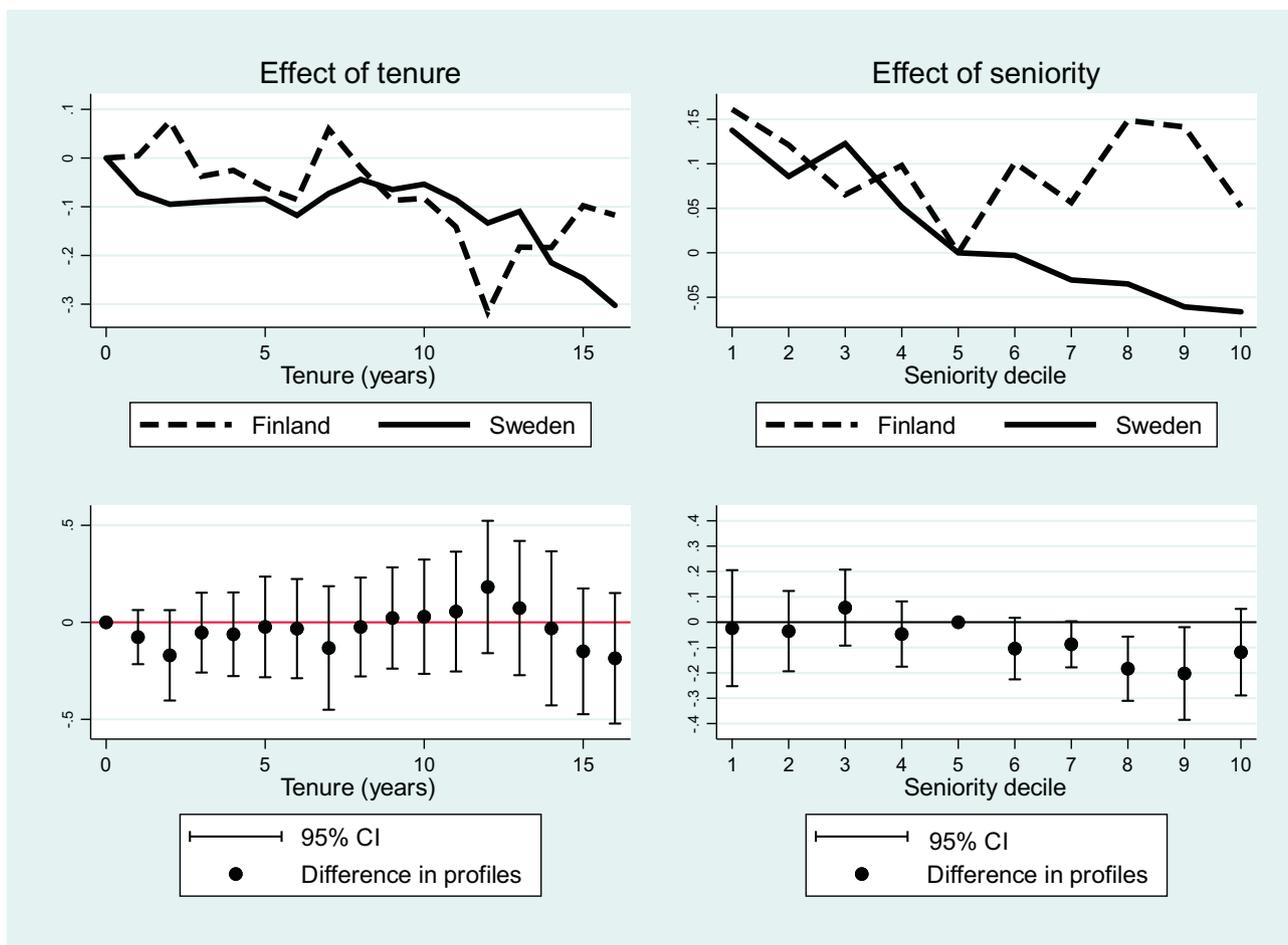


Fig. 4. Effect of tenure and seniority on exit rates in shrinking firms. Notes: Shrinking firms include firms where employment declines by more than 20%, as described in the text. Upper panels display average exit rates by tenure and seniority; lower panels display difference between Sweden and Finland. Standard errors are clustered at the common firm identifier level. The 95% confidence intervals are indicated.

firm identifiers are removed so that individual firms and workers cannot be identified from the data. For our linking purposes, it was necessary to obtain the true firm IDs and firm names, for which we obtained permission from the respective employer organizations in both countries.

The payroll data contain records on each worker employed by the member firms at the end of each year, and they can be used to calculate various measures of employment in firms. They also contain a large amount of useful information on the individual workers, including age, gender, wage, working hours, occupation, pay period, collective agreement and, in Finland, tenure in the firm.

The payroll data in both Sweden and Finland contain unique identifiers for both firms and workers that are consistent over time. For this study, we use data covering the period 2000–2011. The data cover a full business cycle from peak to trough in both countries. To identify the effects, it is useful for the data period to capture the recent global financial crisis, which caused a major exogenous demand shock for the firms in our data and induced them to adjust their workforce.

We create a multi-country linked employer-employee panel by linking Swedish and Finnish records by firm names and name variations. In this way, we matched not only firms that operate under identical names but also firms that use slightly different names (often abbreviations) in the two countries. Finally, we manually checked all records and in uncertain cases checked the firms’ websites to ensure that we were indeed capturing correct matches. We also manually verified that we included in the data all parts of the firm in cases in which the firm reports its

wages separately in different units (e.g., R&D, sales, maintenance) or in different plants. We then created a new firm ID that is shared by all units of the same firm in both countries and use this new firm ID as a definition of the firm in our empirical analyses.

The firms operate both in Sweden and Finland for several reasons. For firms in retail trade, the two countries are simply two markets. For example, one firm in our sample is a multinational firm that sells exactly identical ready-to-assemble furniture in both countries. In other cases, a multinational firm has been created by a merger of Finnish and Swedish firms.<sup>11</sup>

Table 1 reports the number of observations for both firms and employees in the linked data for each year over the period 2000–2011. In total, we have 150 multinational firms in the linked data that operate in both Sweden and Finland. The panel is unbalanced; not all firms are observed in all years. This is due to mergers or firm entry during the observation period and partly due to non-response. The total number of firms is slightly larger in the Finnish data. Because most of the multinational firms are large as measured by the number of employees, the total number of employee observations in the linked firms exceeds two million over the period 2000–2011.

The number of workers in the Swedish units is nearly double that in the Finnish units (Table 1). This pattern reflects both the absolute

<sup>11</sup> The data do not contain information on the products that different subsidiaries of the multinational firms produce. The linked data do not contain plant codes.

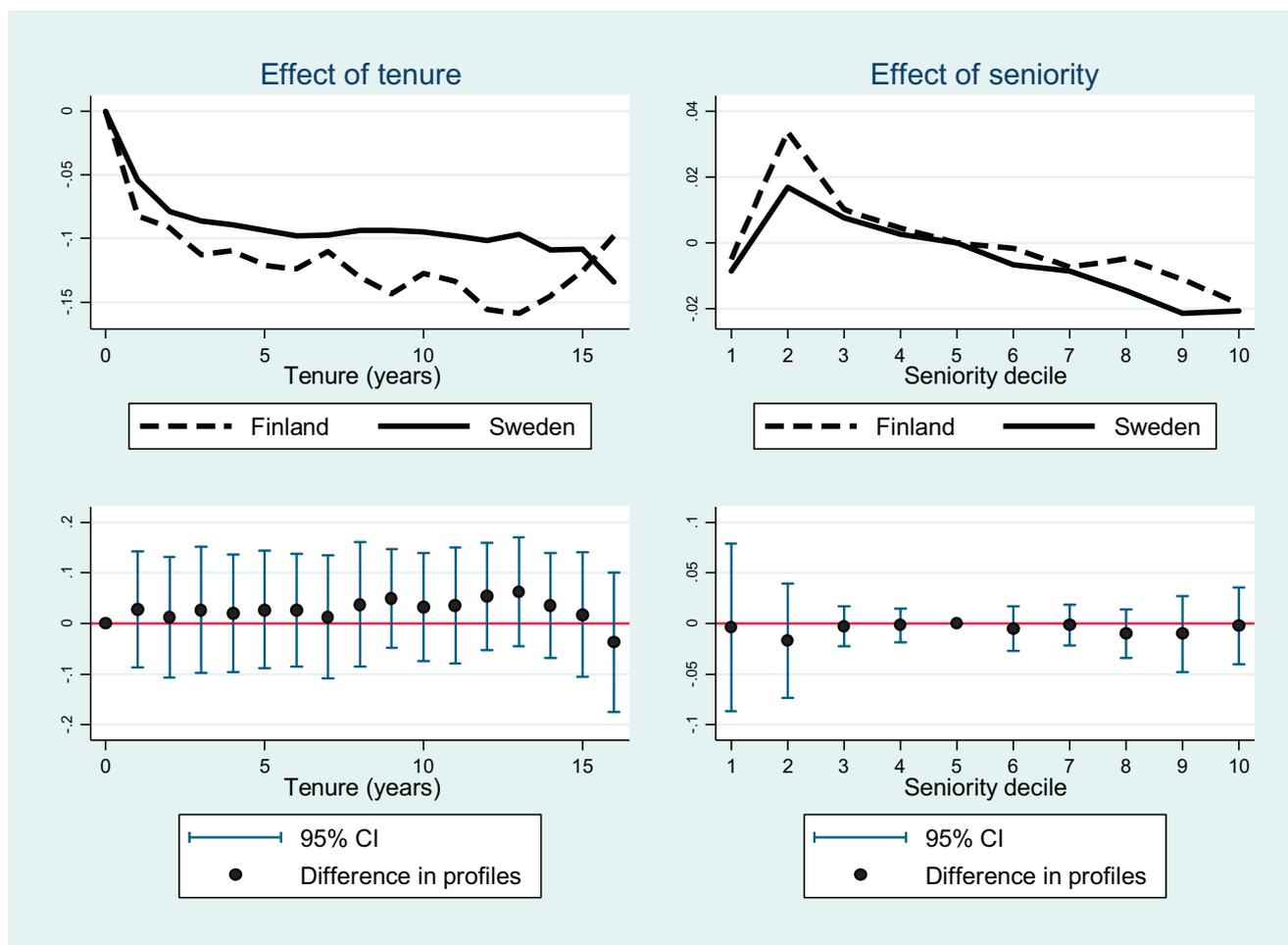


Fig. 5. Effect of tenure and seniority on exit rates for high-wage workers.

Notes: High-wage workers defined as having above median residuals from a regression of wages on gender, age, experience and blue/white-collar status. Upper panels display average exit rates by tenure and seniority; lower panels display difference between Sweden and Finland. Standard errors are clustered at the common firm identifier level. The 95% confidence intervals are indicated.

size difference of the countries and that many of the firms in the linked data are large Swedish-based multinational firms that subsequently entered the Finnish market. The total number of employees in the linked Swedish firms has risen over the period. In contrast, in the Finnish data, there is no notable trend in the total number of employees in the linked firms.

Table 2 documents the fact that the key employee characteristics typically do not differ substantially across the linked Finnish and Swedish units. For example, the average age of employees and the age structure are comparable in the Swedish and Finnish units. However, the share of white-collar workers among all employees is larger in the Swedish units, possibly reflecting the headquarters locations of Swedish multinational firms in the linked data. The turnover rate is slightly higher in Sweden than in Finland, possibly for structural reasons. However, aggregate figures like these say little about the impact of seniority rules, as we shall see in the regressions.

The final linked data set that is used in the analyses covers three major industries because of the more restrictive data access policy on the Swedish side. Employment growth in the linked Swedish and Finnish units is comparable (Appendix Fig. A1). The distribution of employment growth is also not notably different between these countries.

We standardized the information content of the variables in the linked data. Thus, the variables are comparable in content across both firms and industries within countries and across countries. For example,

we adjusted wages to make them comparable, both in terms of the reporting period and in various wage components (overtime pay, Sunday bonuses, performance bonuses, etc.) and converted all monthly wages (typically received by white-collar workers) to hourly wages using the explicit formulas from collective labor agreements.

Worker mobility measures are calculated based on changes in firm codes in the linked data. A worker who disappears from the data while the firm is still present in the following year is classified as an exit, and a worker who appears in the data for the first time while the firm existed in the previous year is classified as a new entrant. If a worker is observed in the data in two consecutive years under different firm codes, we classify her/him as an exit from the first firm and an entrant in the second. Because our data do not contain the entire population (the Finnish data lack the public sector and small firms; the Swedish data contain only engineering, retail trade and hotels and restaurants), we cannot reliably distinguish between job-to-job movements and entry from or exit into unemployment. Thus, we do not distinguish movements of workers between firms and out of the data. Nor can we distinguish between layoffs and voluntary quits, as it is typical with observational data. In the analyses we estimate separate models for shrinking firms where more of the separations are likely to be involuntary. For the same purpose, we also examine the effects separately for low- and high-wage workers.

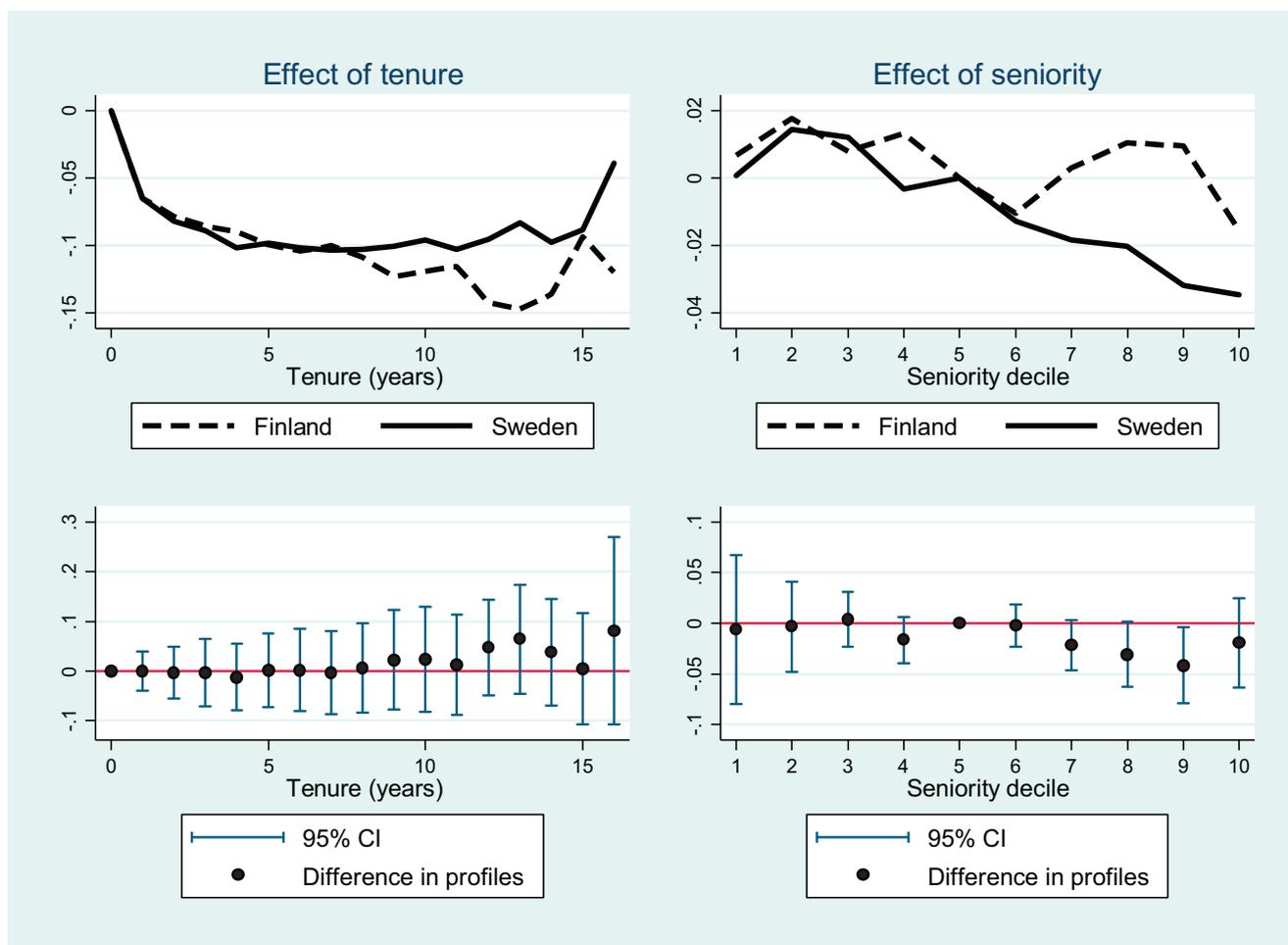


Fig. 6. Effect of tenure and seniority on exit rates for low-wage workers.

Notes: Low-wage workers defined as having below median residuals from a regression of wages on gender, age, experience and blue/white-collar status. Upper panels display average exit rates by tenure and seniority; lower panels display difference between Sweden and Finland. Standard errors are clustered at the common firm identifier level. The 95% confidence intervals are indicated.

Table 3  
Determinants of worker exits at the individual level.

	(1)	(2)	(3)	(4)
Country indicator (Sweden)	0.039*** (0.014)	0.053*** (0.019)	..	..
Age group (18–29)	0.171*** (0.010)	0.163*** (0.010)	0.156*** (0.010)	0.155*** (0.010)
Age group (50–64)	0.011** (0.005)	0.014*** (0.005)	0.015*** (0.004)	–0.006 (0.004)
Sweden × age group (18–29)	0.020 (0.016)	–0.010 (0.013)	–0.006 (0.015)	–0.008 (0.015)
Sweden × age group (50–64)	–0.025** (0.011)	–0.028*** (0.009)	–0.028*** (0.009)	–0.028*** (0.008)
Year effects	X	X	X	X
Common firm effects		X		
Country × (national) firm effects			X	X
Excluding those who are 60+				X
N	1,918,300	1,918,300	1,918,300	1,837,676

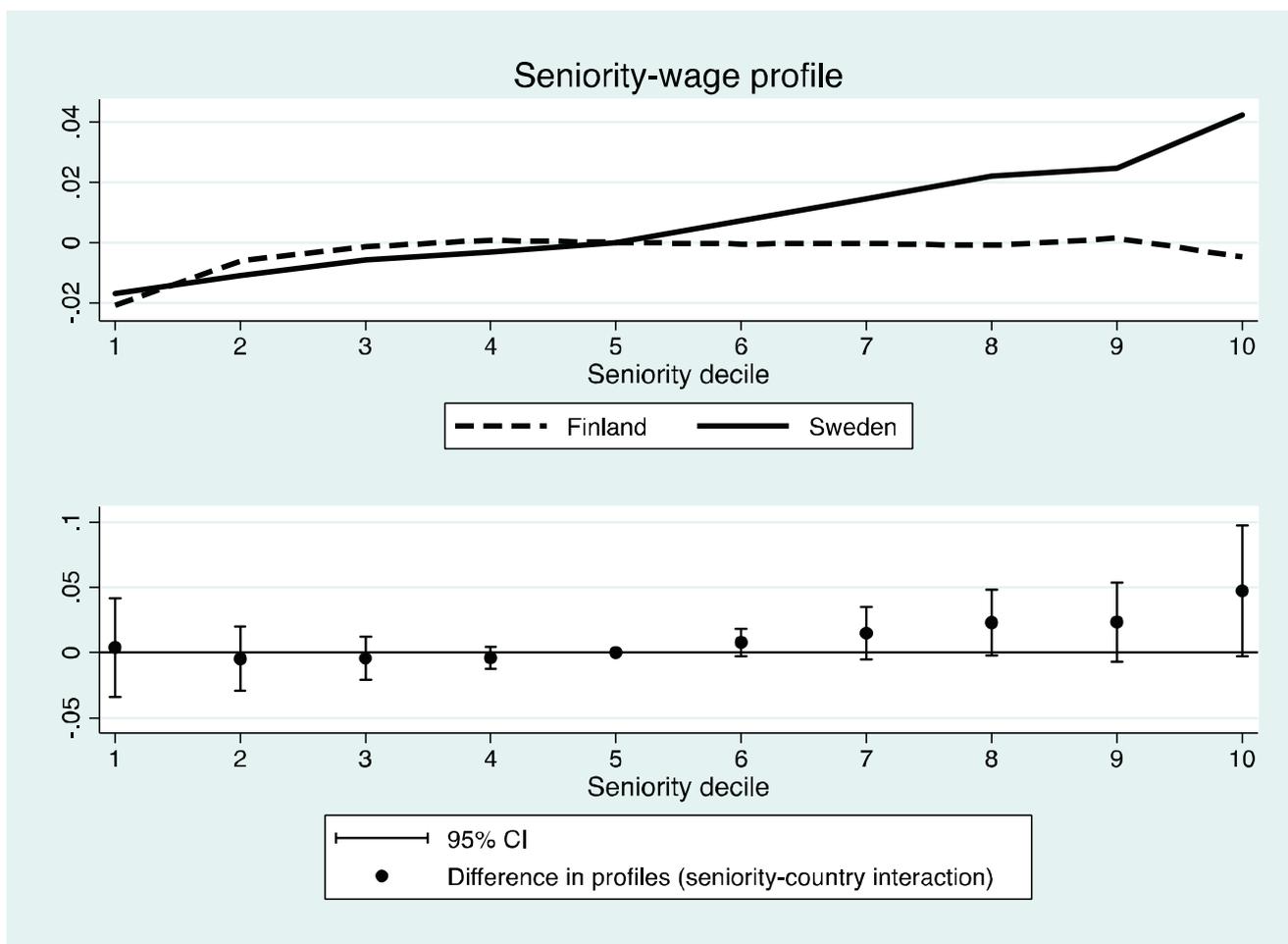
Notes: The dependent variable is an indicator of whether the individual worker leaves the firm. Estimation period 2000–2010. Reference age group is 30–49. Standard errors are clustered at the common firm identifier level. Statistical significance: \*\*\* $p < .01$ , \*\* $p < .05$ , and \* $p < .1$ .

Mobility measures are corrected for artificial firm code changes that are caused by, e.g., mergers and acquisitions or ownership or name

changes leading to new firm ID codes. To detect artificial code changes, we implemented identical procedures for both the Swedish and Finnish data. The correction procedure involves reclassifying cases in which the common firm code changes in the same way for more than 70% of the workers initially employed in the same firm.

In the empirical specifications, we use age, imputed tenure, and seniority (tenure rank within the firm).<sup>12</sup> Creating comparable measures of tenure was challenging. The Finnish data contain a date of entry into the current firm that can be used for calculating tenure, but such a measure does not exist in the Swedish data. Thus, we imputed tenure in both countries using the panel dimension of the data. We are able to follow the workers consistently in both countries back to 1995, and we impute tenure based on the number of consecutive observations in the same firm. We allow one- or two-year gaps in the data if a person is observed in the firm before and after the gap. The cumulative number of gaps is added to the imputed tenure. The measure of imputed tenure is also corrected for artificial firm code changes. Because comparable data only extend to 1995, our tenure measures are severely censored, particularly in the earlier years of the observation period. However, for the seniority rules, the key measure is the worker’s tenure compared to the other employees in the same firm in a given year. This can be

<sup>12</sup> For each year, we rank the workers within each firm (separately in the Finnish and Swedish units) according to their tenure in the firm and scale this variable so that it takes a value of zero for the most recent entrant and a value of one for the most senior worker in the firm.



**Fig. 7.** Regression-adjusted seniority-wage profiles for all workers.  
 Notes: The upper panel plots coefficients of seniority decile dummies from a regression that includes age, tenure and seniority, all interacted with country, and worker by firm (employment spell) fixed effects. Lower panel contains differences in these coefficients across countries and the confidence intervals of these differences. Standard errors are clustered at the common firm identifier level. The 95% confidence intervals are indicated.

reasonably well calculated from the data, although it is naturally impossible to distinguish between two long tenure workers. A comparison between the imputed and actual tenure reported in the Finnish data shows that the imputation procedure works reasonably well. The Spearman’s rank correlation coefficient between the imputed and observed tenure in the Finnish data is 0.8 when calculated using all years. The correlation between imputed tenure and observed tenure is particularly strong for observed tenure up to 10 years (Appendix Fig. A2).

## 5. Results

### 5.1. Worker exits by age

Fig. 2 illustrates the worker exit rates using the 1-year mobility measures. Worker exit covers both worker movements from the firm to other firms included in the data and transitions out of the linked data.

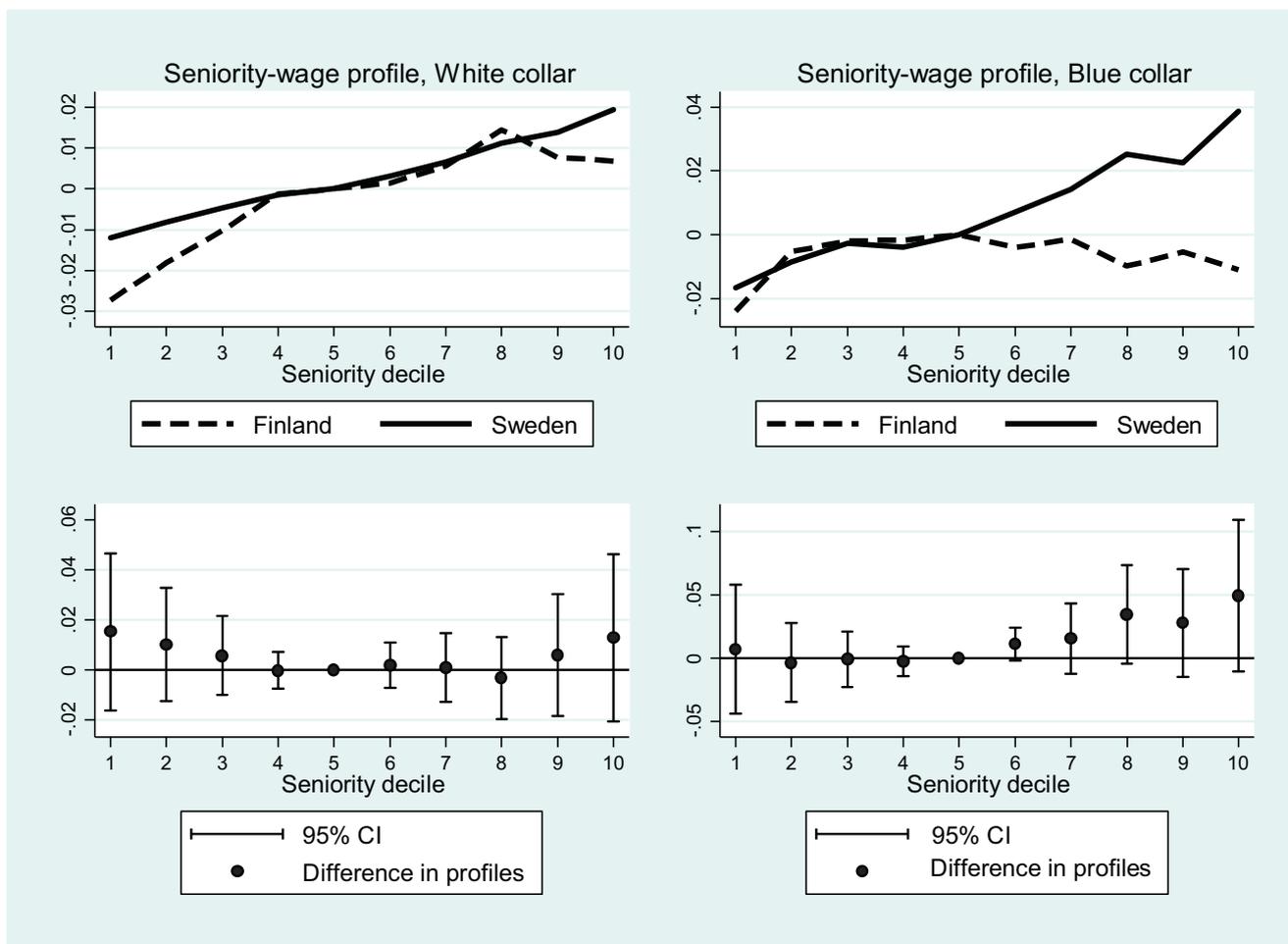
Two patterns stand out from Fig. 2. First, the average worker exit rate for all workers has been at approximately the same level in the Swedish and Finnish units but the rate was somewhat higher in Sweden during the earlier part of the period. Second, the high mobility among the youngest workers is consistent with the stylized empirical facts of worker turnover.

Table 3 reports the estimates for the determinants of worker exit at the individual level. The models for worker exit at the individual level include a full set of indicators for three age groups (with prime-age workers as the reference group), the year effects and a country indica-

tor for Sweden. We use Finland as the base category. The coefficients of interest are the interactions between the country indicator for Sweden and the three age groups. In Column 2, the model also accounts for the firm effects (i.e., firm IDs that are the same for all units of the multinational firm in both countries).<sup>13</sup> The difference in the exit rate between the oldest age group and the prime age group is 2.8 percentage points larger in Sweden (Column 2 of Table 3).<sup>14</sup> A specification that accounts for a full set of country-firm fixed effects effectively also controls for the firm size differences between the countries (Column 3). The pattern remains intact.

<sup>13</sup> Our linked data are organized by country, firm, and person, with several observations per each person, several persons per firm and several firms per country. In principle, observations split by any of these levels may be correlated within clusters, and treating the observations as independent would understate the standard errors and, consequently, overstate the significance of the estimates. Bertrand et al. (2004) suggest clustering standard errors at the level of variation in the policy variable which in our case could imply clustering by country. This approach is infeasible in our setting, because we only have two countries in our analyses. We report for all specifications standard errors that are clustered at the firm level, allowing for arbitrary correlation of the error term across workers within firms.

<sup>14</sup> We have also estimated a set of models that add some key individual-level controls such as gender to the vector of explanatory variables. Their addition only has a marginal effect on the point estimates of interest (not reported). A potential concern is that the age difference may reflect the differences in early retirement schemes between the two countries (cf. Appendix Fig. A3). For this reason, in Column 4, we have excluded those who are older than 60 from the estimation sample. The pattern remains intact.



**Fig. 8.** Regression-adjusted seniority-wage profiles for white- and blue-collar workers.  
 Notes: The upper panel plots coefficients of seniority decile dummies from regressions that include age, tenure and seniority, all interacted with country, and worker by firm (employment spell) fixed effects. Lower panels contain differences in these coefficients across countries and the confidence intervals of these differences. Standard errors are clustered at the common firm identifier level. The 95% confidence intervals are indicated.

5.2. Worker exits by tenure and seniority

The observed differences in the worker exit rates across age groups between countries cannot be interpreted as the effects of seniority rules. For instance, actual opportunities in the labor market may be different in the two countries for younger and for older workers. To account for (unobserved) country characteristics that affect younger and older workers differently, we estimate models in which we focus explicitly on the effects of seniority on worker flows.

We introduce firm effects in all specifications. Provided that firms are in the same industries in both countries, the set of firm indicators also captures prevailing industry differences. Note that we define the firm effects by creating firm indicators that are common for the units of the same multinational firm that operates in different countries, thereby exploiting within-firm cross-country variation in identifying the effects of EPL.

Table 4 reports the results when we use either imputed tenure or both imputed tenure and seniority as explanatory variables. Worker exit is less likely for those who have a long (imputed) tenure (Column 1) and for workers with higher seniority within a firm (Column 2). The age difference between countries remains intact. The interaction terms between tenure/seniority and the country indicator for Sweden are not statistically significant. Because we do not observe significant average differences in the effects of seniority between the countries, we focus

next on the specific groups of workers to whom the LIFO rules are most relevant.

5.3. Worker exits by tenure and seniority in expanding vs. shrinking firms

The LIFO rules relate most closely to involuntary separations or firings. To identify the effects of seniority rules, we proceed to examine more closely worker groups for which the observed turnover is most likely involuntary. First, we investigate worker exits separately in expanding or stable firms and in shrinking firms. Firms may be able to adjust employment without resorting to dismissals when the adjustment needs are relatively small. Thus, this setting is relevant because seniority rules should have more ‘bite’ in firms that need to reduce the number of workers. We classify firms as shrinking if their employment decreases by more than 20% compared to the previous year.<sup>15</sup>

In Figs. 3 and 4, we report the effects of tenure and seniority on the exit rates. The estimates plotted in the figure are based on a linear regression model where the exit rates are explained by the firm effects

<sup>15</sup> We have estimated the models also by defining shrinking firms as those where employment declines by more than 10% and by more than 15%. As expected, the pattern is more pronounced when defining the shrinking firms more tightly. We have also estimated the exit models separately for blue- and white-collar workers but found no clear differences. Further splitting the blue-collar or white-collar data to shrinking vs. growing firms reduces the statistical power and increases the standard errors so that any effects are hard to detect.

**Table 4**  
Determinants of worker exits at the individual level.

	(1)	(2)	(3)	(4)
Tenure (years)	-0.016*** (0.002)	-0.004 (0.004)	-0.002 (0.003)	-0.003 (0.004)
Tenure (years)×Sweden	-0.002 (0.003)	0.001 (0.005)	0.001 (0.004)	0.002 (0.004)
Seniority		-0.182*** (0.052)	-0.142*** (0.049)	-0.148*** (0.050)
<b>Seniority × Sweden</b>		<b>-0.009 (0.071)</b>	<b>-0.017 (0.067)</b>	<b>-0.020 (0.067)</b>
Sweden × age group (18–29)			0.004 (0.009)	0.006 (0.009)
Sweden × age group (50–64)			-0.029** (0.013)	-0.029*** (0.012)
Common firm effects	X	X	X	X
Country indicator (Sweden) × year effects	X	X	X	X
Excluding those who are 60+				X
N	1,918,300	1,918,300	1,918,300	1,837,676

Notes: The dependent variable is an indicator of whether the individual worker leaves the firm or not. Estimation period 2000–2010. Reference age group is 30–49 in Columns 3–4. Standard errors are clustered at the common firm identifier level. Statistical significance: \*\*\* $p < .01$ , \*\* $p < .05$ , and \* $p < .1$ .

**Table 5**  
The effect of tenure and seniority on wages.

	(1) All	(2) Blue-collar	(3) White-collar
Country indicator (Sweden)	..	..	..
Tenure (years)	-0.006 (0.004)	0.005* (0.003)	0.003 (0.003)
Tenure (years)×Sweden	-0.012 (0.009)	-0.009*** (0.003)	-0.003 (0.003)
Seniority	0.113*** (0.045)	0.049* (0.026)	-0.006 (0.036)
<b>Seniority×Sweden</b>	<b>0.083 (0.095)</b>	<b>0.065** (0.029)</b>	<b>0.018 (0.040)</b>
Age group (18–29)	-0.176*** (0.012)	-0.085*** (0.009)	-0.230*** (0.009)
Age group (50–64)	-0.007 (0.007)	-0.012** (0.005)	0.010 (0.008)
Sweden×age group (18–29)	-0.006 (0.012)	0.054*** (0.010)	-0.013 (0.011)
Sweden×age group (50–64)	0.024*** (0.009)	-0.006 (0.005)	0.015 (0.012)
Year effects	X	X	X
Country×year effects	X	X	X
Country×(national) firm effects	X	X	X
N	1,868,641	879,073	989,568

Notes: The dependent variable is the logarithm of wages at the individual level. Reference age group is 30–49. Standard errors are clustered at the common firm identifier level. Statistical significance: \*\*\* $p < .01$ , \*\* $p < .05$ , and \* $p < .1$ .

and year, age, tenure and seniority – all interacted with the country effect. Age effects are controlled by using indicators for ten-year age intervals, allowing nonlinear patterns (cf. Appendix Fig. A3). The effects of tenure and seniority on the worker exit rates are also unlikely to be linear. For this reason, we use indicators for each possible level of tenure and model the effect of seniority by adding indicators for each decile of within-firm seniority. To facilitate interpretation of the seniority profiles, the estimates are normalized to median seniority in the figures. The upper panels of Figs. 3–4 show the estimated profiles, and the lower panels document the differences in the profiles between the Swedish and Finnish units.

The worker exit rates are generally much lower for those workers with longer tenure and higher seniority (Figs. 3–4). In the growing or stable firms the relationship between tenure or seniority and the exit rates is similar in Sweden and Finland. Cross-country differences are nowhere near of being statistically significant. However, in the shrinking

firms, seniority rules affect the exit rates (Fig. 4). Increasing seniority has a monotonously decreasing effect on the exit rates in Sweden, while in Finland, the pattern is somewhat U-shaped so that the workers with the highest seniority are relatively more likely to exit. In the shrinking firms these cross-country differences are also statistically significant at 5% level.

#### 5.4. Worker exits by tenure and seniority for low- vs. high-wage workers

We also examine worker mobility using samples split based on key worker characteristics. In Figs. 5 and 6 we present separate effects for low- and high-wage workers. The groups are defined based on the sign of residuals from a regression of wages on gender, age, total work experience and blue/white-collar status. For the high-wage workers we find no significant differences between countries. However, seniority seems to have different relationship to exist among the low wage workers. In Sweden exits of low-wage workers monotonously decline with seniority but in Finland seniority seems to increase exits of low-wage workers. The differences are significant at 5% level in 9th decile and close to it in 7th and 8th deciles.

#### 5.5. Effects on seniority–wage profile

To examine the effects of seniority rules on wage formation, we estimate a set of regression models where we explain log hourly wages by age, tenure, seniority and year – all interacted with country indicators. The results are reported in Table 5. The specification is similar to the exit regressions in Table 4 and contains the country-specific firm effects. We have dropped the observations outside the 1st and 99th percentiles of the wage distribution as well as part-time workers with less than 30 weekly working hours. In Column 1, we report the results for all workers, in Column 2 the results for blue-collar workers and in Column 3 the results for white-collar workers.

According to the regression results in Table 5, more seniority increases wages and this increase is larger in the Swedish firms. However, this cross-country difference in the seniority premium is significant only for blue-collar workers. For white-collar workers seniority premium is close to zero in both countries and the difference across countries is not statistically significant.

In Fig. 7 we present the coefficients of tenure and seniority from a more flexible model that includes indicators for each possible level of tenure and decile of seniority, one-year age dummies, and the year of observation – all these interacted with country effects. We also add worker by firm (employment spell) fixed effects and thereby control for any worker- and firm-specific time-invariant factors.<sup>16</sup> Note that the effect of seniority is identified even after controlling for the effects of tenure and including spell-specific fixed effects because seniority is also affected by the tenure distribution among other workers in the firm (see Buhai et al., 2014).

After controlling for other factors, there is a systematic pattern according to which wages grow with seniority in Sweden but less so in Finland (Fig. 7). The differences in the seniority profiles have  $p$ -values in deciles 8 to 10 ranging from 6 to 12%. As we show in Fig. 8 the differences in the seniority profiles are due to blue-collar workers. For white-collar workers the seniority wage profiles do not really differ. For blue-collar workers the differences are marginally significant in this flexible specification. Thus,  $p$ -values are below 10% in deciles 6, 8 and 10.

## 6. Conclusions

Analyzing the effects of labor market institutions with standard cross-country data is challenging, because it is difficult to make coun-

<sup>16</sup> Buhai et al. (2014) also estimate models that account for spell-specific fixed effects. In cross-country data, this is particularly useful because coding of e.g. education and industry in a fully comparable way is difficult.

tries fully comparable. Nor is it straightforward to identify the effects of institutions by using single-country data, because there is typically little variation in relevant institutions within countries.

We contribute to the literature by examining the effects of labor market institutions based on a newly assembled multi-country linked employer-employee data set with firms matched across countries. The data contain information on all workers in matched firms operating in Finland and Sweden. A key novelty of our approach is that we identify workers in the respective countries who share a common employer. A weakness is that we observe the variation in the LIFO rules only at the country level, because there are two countries in our linked data, which limits our ability to identify causal effects. While our research focused on the specific effects of seniority rules, the new type of multi-country linked employer-employee data that we constructed also holds promise for studies examining other key labor market institutions and their impacts.

Seniority rules, which are firmly specified by law in Sweden but not in Finland, stipulate that employees be laid off in inverse order of seniority when firms dismiss workers for economic reasons. Seniority rules

protect the oldest workers against dismissals. Our results suggest that seniority rules are related to both worker mobility and wages. We observe strongly heterogeneous effects, i.e. the impacts of seniority rules on worker exit are observed in shrinking firms and among low-wage workers. These findings are consistent with the strict LIFO rules in Sweden protecting older, more senior workers among the specific groups of workers to whom the LIFO rules are most relevant. We also document the fact that seniority rules are associated with steeper seniority-wage profiles for blue-collar workers, which is consistent with increased bargaining power for those who have stayed with the same firm for longer.

We share several findings with the closely related study by [Buhai et al. \(2014\)](#), who report that more senior workers face a smaller job separation hazard and earn a higher wage. The estimated effects are larger in Portugal than Denmark, and [Buhai et al. \(2014\)](#) attribute this to EPL being more stringent in the former country. However, neither Portugal nor Denmark incorporates LIFO rules in their legislation and it is unclear what components of EPL, if any, contribute to the differences in estimated effects. By contrast, our study on LIFO rules should inform the policy debate by focusing on a specific component of EPL.

### Appendix

[Figs. A1 –A3](#)

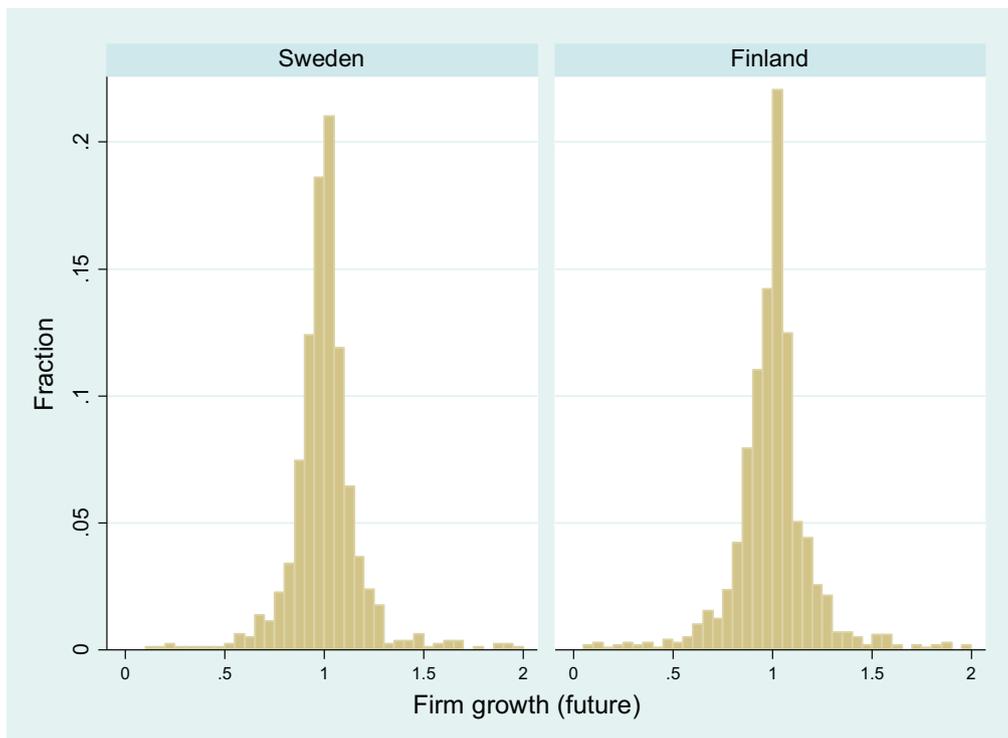
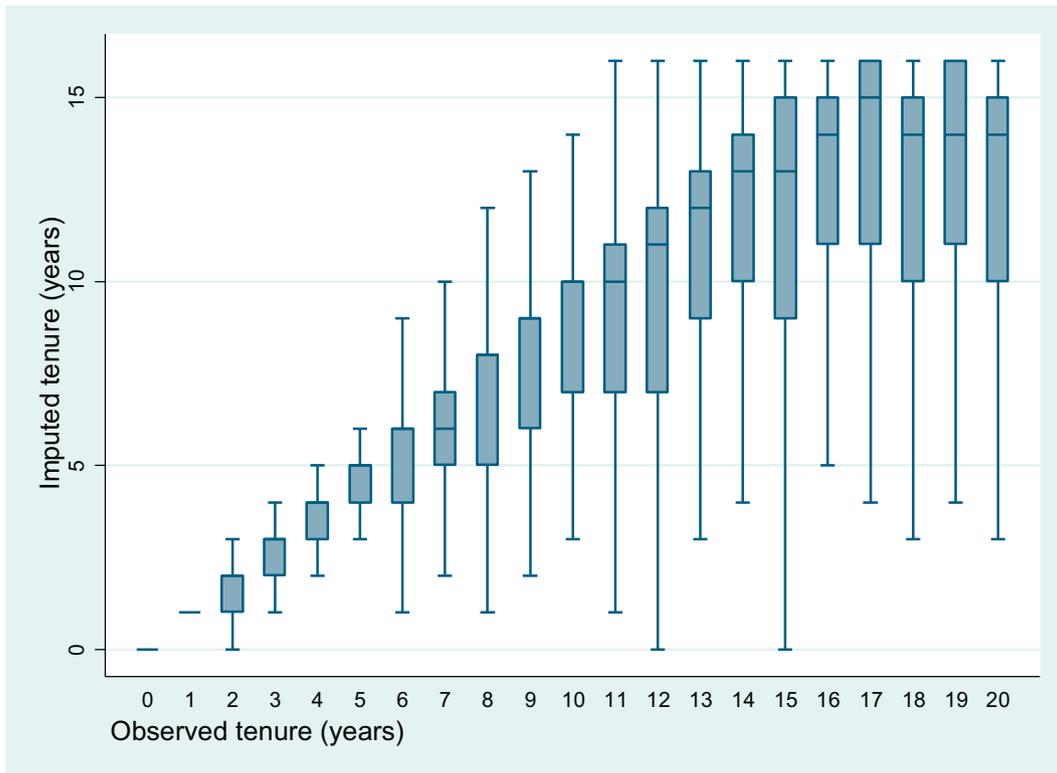
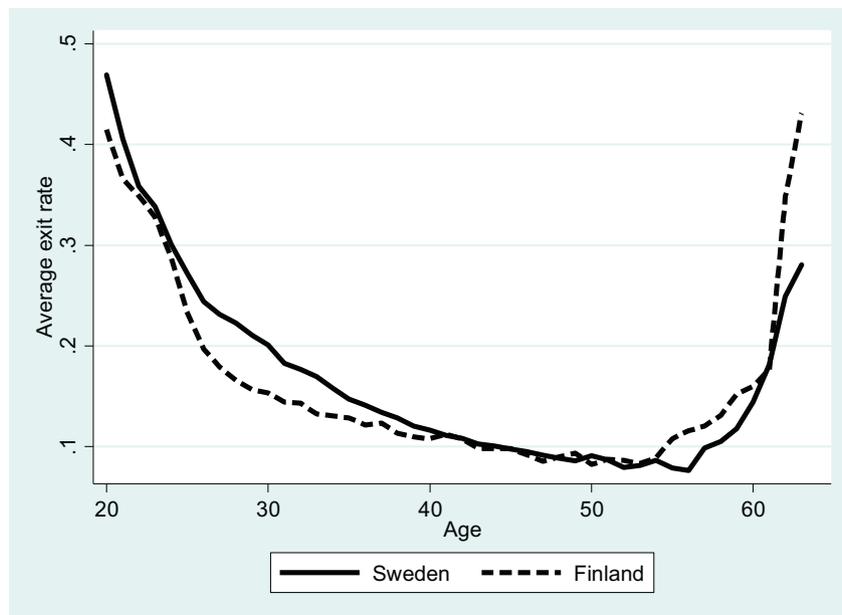


Fig. A1. Firm growth in the linked data.

Notes: Definition of firm growth: number of workers in firm in year  $t + 1$  / number of workers in year  $t$ .



**Fig. A2.** The correlation between imputed tenure and observed tenure in the Finnish data.  
*Notes:* Figure displays the minimum, lower quartile, median, upper quartile and maximum imputed tenure by observed tenure. Observed tenure is calculated as the difference between the current year and the entry year. We use the last year of the data in the figure. Imputed tenure is the number of consecutive observations of a worker in the same firm counting back to the year 1995. While the correlation between the measures is high, there are some differences due to changes in firm codes not detected by our procedures due to workers not being employed during the month when the payroll data are reported to employer organizations and due to workers having entered the firm before 1995.



**Fig. A3.** The worker exit rates by age.  
*Notes:* The average unadjusted exit rates in one-year age groups, all years pooled.

**Supplementary materials**

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.labeco.2017.11.006](https://doi.org/10.1016/j.labeco.2017.11.006).

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