Labour Market Institutions, Skill and the (Re)Production of Wage Inequality: The Stratification Process in Comparative Perspective

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Thesis submitted for the degree of
Doctor of Philosophy in Sociology

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Thesis Abstract

This thesis is concerned with how labour market institutions and policies at the country level shape the stratification processes. Two topical questions are at the basis of the presented research: First, how do institutional frameworks impact the linkages between job positions and wage, and between individuals and jobs? Second, what do these linkages reveal about the underlying mechanisms that continue to generate wage inequality in the labour market? The interest lies in the sizes of statistical effects or associations, and in the extent of conformity to predictions based on different theorical approaches. All three of the empirical chapters in this thesis draws upon the Programme for the International Assessment of Adult Competencies (PIAAC) data from OECD. Combining data from this cross-national survey with country-level data on employment protections, union strengths and work-family policies, this thesis investigates cross-national variation in wage inequality by contract type and skill distribution, and the gender gap in skill specialization. Confirming the broad argument of new institutionalism, the thesis identifies labour market institutions as an important factor shaping the structure of wage inequality. Besides, the results suggest that the wage premium to permanent contracts compared to temporary contracts is likely to reflect employment rent by virtue of higher termination costs for the employers, rather than higher productivity due to skill specialization. Power relations crystalized in union strength may distort the market pressure for returns to both specialized and general skills. The gender gap in job-specific skills can be shaped by women's expectations of the possibility of achieving work-family balance, over and beyond the level of job interruptions.

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Chapter 1

Introduction

1.1 Wage inequality across countries

The scholarship on wage inequality has witnessed several important trends in recent decades: the rise of precarious employment which often associates with lower pay, the polarization of jobs in terms of economic compensation, and the stagnation of longstanding declines in gender earnings gap (Kalleberg, 2011; Mandel & Semyonov, 2014). It is also widely documented that the inequality patterns in terms of precarious work, wages polarization and gender wage gap vary considerably across countries (Fernández-Macías, 2012; Kalleberg, 2000; Mandel & Semyonov, 2005). While the social and economic forces such as the globalization of production, technological change, and the continued rise of the service sector have affected all high-income countries, the resulting patterns in wage inequality is mediated by the institutional structures characteristics of the specific countries.

Previous comparative research in wage inequality has primarily drawn upon institutional settings to account for the cross-national variation in the general level of economic inequality (Babones & Vonada, 2009; Hope & Martelli, 2019; Huber & Stephens, 2014; Kerrissey, 2015). However, such an approach pays little attention to the stratification processes that result in these patterns, and thus falls short to examine the underlying mechanisms driving different wage inequality patterns. From a sociological perspective, inequality in contemporary industrialized societies stems from three logically, although not temporally, distinct processes: (1) the institutional processes that define certain types of goods as valuable and desirable and differentiate positions in the division of labour from each other;

(2) the rules of allocation that distribute these goods across these various positions; and (3) the mobility mechanisms that link individuals to jobs, thereby generating unequal control over valued resources (Grusky, 2014; Weeden, 2002). It follows that the cross-national variation in stratification systems is produced by two processes: the social roles in societies are first matched to different "reward packages" of unequal value, and individual members of societies are then allocated to the positions so defined and rewarded according to varied rules.

Both the comparative research in wage inequality and the literature on stratification system are central to the field of stratification. But the former approach falls short of elucidating the stratification processes that result in the general inequality level, and the latter approach frequently overlooks the cross-national heterogeneity. By combining the two approaches, I explore how country-level institutional settings shape the stratification processes, especially with regard to how similar positions are differently rewarded, and how similar individuals are allocated into differently rewarded job positions. Do countries vary in the way that attach reward packages to job positions and the principle by which individuals are allocated into these positions? If so, what are the main factors and mechanisms driving this cross-national variation? Aiming to contribute to the understandings of the production of wage inequality, this dissertation investigates important stratification processes that contribute to wage inequality, evaluates the effects of country-level institutional arrangements, and examines the mechanisms explaining these effects.

This chapter proceeds as follows. First, I review existing studies that focus on the cross-national variation in wage inequality. Next, I discuss the different conceptualizations of skill and its role in the stratification systems. The fourth section presents the research questions.

In section five, I set out our main analytical framework and discuss the institutional settings that are expected to shape the specific stratification processes.

1.2 The cross-national variation in wage inequality

The past forty years have seen a pervasive rise in wage inequality across OECD countries (Keeley, 2015; OECD, 2011), driven primarily by technological changes, globalization and financialization (Alderson & Nielsen, 2002; Flaherty, 2019; Hope & Martelli, 2019). Despite the widespread pressure for increased income inequality, the resulting level of income inequality varies greatly across countries. In the United States, earnings of workers at the 9th decile are 4.8 times as high as those of workers at the 1st decile (the so-called D9/D1 ratio). By contrast, the D9/D1 ratio is less than 3 in the Scandinavian countries, France and Belgium (OECD, 2015b).

The comparative research on differing wage inequality levels in the United States and in Europe, despite similar pressure towards increased inequality, has led scholars to highlight the role of labour market institutional arrangements in the generation of inequality (Blau & Kahn, 1996; Hope & Martelli, 2019; Koeniger et al., 2007; Pontusson et al., 2002). They have found unionization, centralized wage setting, and employment protections to be imporatant drivers of the dispersion of wage (as measured by the D9/D1 ratio, the D9/D5 ratio/differential, the D5/D1 ratio/differential).

While we now have a good knowledge that labour market institutions shape the extent of wage inequality, it is far less clear how these institutional arrangements affect the structure of inequality, which has been a long-standing focus of sociological studies. In what ways and how much do labour market institutions boost the economic outcomes for certain clusters of positions at the expense of others? Exploring these questions are not only essential for

illustrating the mechanisms through which labour market institutions shape wage inequality, but also provide implications on how institutional changes may affect the formation and perpetuation of economic inequality.

Beyond the variation in the economic reward structure of labour market positions, countries also vary in the extent to which these positions are allocated based on ascriptive factors such as gender (Charles, 1992; Estévez-Abe, 2006). In particular, countries have adopted varied work-family policies that are consequential for a variety of gender inequality outcomes, such as employment rate, gender segregation and wage gaps (Budig et al., 2016; Mandel & Semyonov, 2006). However, the mechanisms through which work-family policies affect gender inequality are more assumed than empirically tested. Do work-family policies induce employers' discrimination against women, change women's preferences and experiences in the labour market, or shape female employees' expectations on future job success rates? It is necessary to distinguish between these potential mechanisms because they imply different policy solutions to reduce gender inequality in the labour market.

1.3 Conceptualizations and measurements of skill

Skill is widely recognized as a primary determinant of the wage level (Gallie, 2014). In the classic models of status attainment, individuals' educational attainments (in addition to ascriptive characteristics) strongly locate them in positions in the hierarchy comprising the stratification system. In the structural inequality literature, skills form the primary foundation of occupation clustering and class building, which in turn are associated with different reward packages through institutionalized market processes.

A key distinction is between an economic research focus on "individual or personal skills" and a sociological focus on "job skills", which originates from their differences in

theoretical positions in the locus and nature of wage inequality. Neoclassical economics perspectives, such as human capital theory (Becker, 1964) use market mechanisms, logics of efficiency and return on capital as the rules of valuation. The wage attainment in this perspective is conceived of as reflecting a person's productivity as measured by his/her ability and skills. On the other hand, an important sociological perspective points to the logics of power and control in determining the rewards to different social positions, of which skill level constitutes a central dimension among others. Wage inequality under this perspective reflects the distribution of economic rewards across different structural positions, which partly vary in terms of skill requirements, based on power struggles.

Another important distinction is between "general skills", which is effectively learnt by schooling, and "specialized skills", which is effectively learnt by job training. Following the human capital theory, individuals can obtain skills through both education and on-the-job training at a cost primarily in the form of earnings foregone. However, the two kinds of skills not only differ in terms of their places of acquisition, but also their investment costs. By definition of specialization, a worker is committed to accumulating a skill that has restricted applicability. Investment in specialized human capital may be even more costly and provide higher return than general human capital that requires the same amount of training time because investors of specialized human capital face an additional opportunity cost that may arise from forgone opportunities for recouping one's investment. Given this fundamental difference in general and specialized human capital, different social groups may reach different optimal mixes of general and specialized human capital (Tam, 1997).

In line with the different conceptualizations of skill in the literature, measurement strategies for assessing skill levels and skill trends have varied sharply. Researchers concerned

with individuals' skills have focused primarily on educational attainment and work experience. In contrast, those concerned with the skill content of jobs have tried to assess changes in job complexity either through changes in the structure of occupations (e.g. Oesch and Piccitto 2019), or through direct job skill measures based on self-report (e.g. Felstead et al. 2007) or expert job analysis (e.g. Liu and Grusky 2013). These different approaches have led to the emergence of major new data sets, such as the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) (OECD, 2016) surveys measuring skill as competence, as well as Eurostat's European Labour Force Survey for changes in occupational structure, Eurostat's Continuing Vocational Training Surveys, the US O*Net database of occupational descriptors, and the British Skills and Employment Surveys (Gallie, 2014).

1.4 Research questions and data-set

As shown above, there is a significant body of literature concerning how the extent of wage inequality differs across institutional settings, just as numerous authors focus on the stratification processes that attach reward packages to labour market positions and allocate individuals into different job positions. These two literatures are, unfortunately, rarely merged. In cross-national comparisons of the level of wage inequality, the stratification processes which generates inequality is often taken for granted. As a result, this literature can hardly identify the main drivers behind the observed patterns as multiple mechanisms can result in the cross-national variation in the aggregate levels of wage inequality. To fill in this gap, this thesis explores how country-level institutional contexts affect the stratification processes.

It can be difficult to directly study some of the mechanisms through which institutional context can affect the stratification processes in the labour market. The strategy of this dissertation is therefore to investigate the stratification patterns (between positions and

rewards and between individuals and positions) in research designs that include implications for which mechanisms drive these patterns. Thus, the two research questions are the following:

1) How do institutional frameworks impact the linkages between job positions and wage and between individuals and jobs?

2) What do these linkages reveal about the underlying mechanisms that continue to produce inequality in the labour market?

The following three chapters in this thesis draw upon the Programme for the International Assessment of Adult Competencies (PIAAC) dataset to provide empirical support for answering the two research questions. The Survey measures adults' proficiency in key information-processing skills - literacy, numeracy and problem solving - and gathers information and data on how adults use their skills at work (OECD, 2013a, 2013b). As a programme of assessment and analysis of adult skills, the PIAAC provides us an opportunity to disentangle the explanations for stratification processes based on market and skill differences from those based on relations and power struggles.

39 countries/economies participated in the 1st cycle of the survey, though the survey is delivered in adjacent, instead of the same, years in different countries. The survey measures adults' proficiency in key cognitive and workplace skills, as well as a broad range of other information. A representative sample of adults between 16 and 65 years of age was interviewed at home in the language of their country of residence. The survey is designed to be valid cross-culturally and internationally and to allow comparative analysis while administered in national languages in different countries[1].

[1] For more details, see https://www.oecd.org/skills/piaac/about/#d.en.481111

The survey included an assessment of cognitive skills in three domains: literacy, numeracy, and problem solving in technology-rich environments[2], which are described more completely in (OECD, 2013b). The tasks respondents had to solve were often framed as real-world problems, such as maintaining a driver's logbook (numeracy domain) or reserving a meeting room on a particular date using a reservation system (problem-solving domain).

Table 1.1 Countries participated in the PIAAC 1st Cycle

Survey time	Countries/economies
2011-2012	Australia, Austria, Belgium (Flanders), Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Russian Federation, Slovak Republic, Spain, Sweden, United Kingdom (England and Northern Ireland), United States (24)
2014-15	Chile, Greece, Indonesia, Israel, Lithuania, New Zealand, Singapore, Slovenia, Turkey (9)
2017	Ecuador, Hungary, Kazakhstan, Mexico, Peru, United States (6)

The public use file (PUF) included data for 35 countries, but the Russian Federation was not representative of the entire country as the population of the Moscow municipal area is not included (OECD 2013a). Out of the 34 countries with nationally representative data, different numbers of countries are included in the analyses for the following empirical chapters due to missing on central independent and dependent variables. In chapter 2, Canada and the United States do not provide the measures for contract type, and Hungary and Peru do not provide information on wages, resulting in a final sample of 30 countries. In chapter 3, Hungary and Peru do not provide information on wages, the country-level measures of union density are missing for Ecuador, Kazakhstan and Singapore, the measures of problem-solving domain are not available for France, Italy and Spain, and the measure for whether job is full-

[2] Participation in the problem-solving domain was optional; Cyprus, France, Italy, and Spain did not participate in this domain.

time is unavailable for Canada, resulting in a final sample of 25 countries. In chapter 4, measures on country-level family-work policies are unavailable for Ecuador, Kazakhstan, Peru, Singapore, and Turkey, and country-level control variables GINI coefficient and gender roles are unavailable for Chile, Estonia, Greece, Israel, Italy, republic of Korea, Mexico, New Zealand, and Spain, resulting in a final sample of 20 countries. Table 1.2 shows the list of countries not included in each of the three empirical chapters.

Table 1.2 Countries included and excluded (N) from the empirical analyses

Countries	Chapter 2	Chapter 3	Chapter 4
Austria			
Belgium			
Canada	N	N	
Chile			N
Czech Republic			
Denmark			
Ecuador		N	N
Estonia			N
Finland			
France			
Germany			
Greece			N
Hungary	N	N	
Ireland			
Israel			N
Italy		N	N
Japan			
Kazakhstan		N	N
Korea, Republic			N
Lithuania			
Mexico			N
Netherlands			
New Zealand			N
Norway			
Peru	N	N	N
Poland			
Singapore			N
Slovak Republic			
Slovenia			
Spain		N	N
Sweden			
Turkey			N
United Kingdom			
United States	N		

1.5 Labour market institutions and the stratification processes

This research aims to explore how country-level institutional arrangements shape the stratification processes, and consequently the structure of wage inequality across countries. In doing so, we envision an interaction between institutions at a macro level and individual behaviour at a micro level. Labour market institutions provide "enduring legal and normative frameworks that establish how the price of labour is determined" (Western, 1998: 228). Cross-national variation in employment protection, unionization and work-family policy, for example, may provide an important institutional context based on which individuals' make decisions in the process of recruitment and compensation negotiation in the labour market. These institutional settings are not entered in a horse race, as I do not argue that one institution is the most significant in shaping labour market processes. Instead, I aim to reveal the varied patterns that they contribute to the structure of inequality, while acknowledging the fact that their combined effects lead to the overall level of wage inequality. These variations are not compared in terms of their explanatory strength, but are examined in terms of the underlying mechanisms and the resulting patterns that they affect the structure of inequality.

By formulating how institutional settings shape the stratification processes in the labour market, I develop an analytical framework which combines the literature that links institutions to the cross-national variation in wage inequality with the literature that investigates why labour market positions are rewarded and allocated differently. The resulting theory has important implications for inequality research, as it explicates the potential of institutional variation in shaping the structure, in addition to the extent, of inequality. For example, if the inequality-reducing effect of strong labour market regulation mainly happens within rather than across job groups, it tends to solidify both within-group solidarity and cross-

group inequality. This form of economic clustering can strengthen the foundation for class formation and division. However, if the inequality-reducing effect of institutional settings is more across than within job groups, they may weaken class divisions and the intergenerational reproduction of inequality (Hertel & Groh-Samberg, 2019).

1.5.1 Employment protections and the Wage Gap for Temporary Workers

In the standard employment contract, workers are expected to work full-time for a particular employer at the employer's place of work, under the employer's control, with the mutual expectation of continued employment, and often progressing upward on job ladders within internal labour markets (Kalleberg, 2009, 2011). However, in a recent attempt to achieve flexibility, various types of corporate restructuring have led to a growth in nonstandard employment such as temporary work contracts, which allows the *a priori* termination of employment relationships.

The rise of temporary work in recent decades has drawn extensive attention to the question whether it brings economic penalties in addition to job insecurity. Temporary workers are found to receive lower wages than individuals with the same level of general competence working in permanent jobs in most OECD countries (OECD, 2015a). However, previous research has yet directly explored the explanations for this association. The wage premium attached to permanent contract may reflect that people develop specialized skills and thus become more productive after entering a permanent contract. It is also possible that permanent contracts can provide individuals advantages in securing employment rent than temporary contracts by virtue of higher termination costs faced by employers.

The analyses of PIAAC data of 30 countries show that around 60% of the gross association between contract type and wage among individuals with similar levels of general

skills is driven by structural and individual characteristics that affect both the adoption of a permanent/temporary contract and the wage level. Moreover, the remaining effect of contract type on wage is hardly explained by specialized skills developed at work. Furthermore, the wage gap by contract type is considerably smaller in countries with stricter employment protection for temporary work that induce higher termination costs. Finally, the wage gap by contract type hardly varies by the job occupants' gender, migration status, and cohabitation status. Together, the findings are more in support of the employment rent interpretation of the wage gap by contract type, than the productivity and compensating differentials interpretations.

1.5.2 Unions, Bargaining Power, and the Skills-Earnings Relationship across Countries

The majority of people in industrial societies obtain income and other rewards in exchange for their labour power, and skills are the central determinants of earnings. Previous research finds the skills-earnings relationship to vary considerably across countries and draws upon supply-demand relations and institutional regulations to explain this cross-national variation. However, the analyses have been confined to general skills and inadequately accounted for the role of the underlying power relations. This research builds an analytical framework based on the bargaining power theory and explores how union strength affects the returns to specialized skills as well as general skills.

Drawing upon the recent Programme for the International Assessment of Adult Competencies (PIAAC) data of 25 OECD countries, this research finds stronger unions at country level to consistently reduce the economic returns to both specialized and general skills. The findings do not support the argument that skill supply-demand relations contribute to cross-national variation in skill-earnings relationship. Rather, the analyses suggest that power

relations crystalized in union strength may distort the market pressure associated with technology development for increased skill payoffs, and shape inter-class earnings inequality.

1.5.3 Parental Leave Policies and the Gender Differences in Job-Specific Skills

There is a growing concern that country-level policies targeted at reducing work-family conflicts may lead to gendered tradeoffs among different employment outcomes. This research evaluates how country-level parental leave policies affect gender differences in job specialization, which are skills effectively learned in the job. It is important to explain gender differences in job-specific skill investment because they account for most of the statistical effect of occupational sex composition on earnings (Tam, 1997) and lead to a widening gender gap in cumulative career success mobility (DiPrete & Soule, 1988).

The allocation of individuals to jobs is viewed as a choice over different tenure-reward paths, which are steeper for more specialized skills. The choice of job is made with imperfect information, especially for women about the extent to which child-rearing burdens will interrupt their career in the future. I argue that maternity/paternity leave policies can affect the gender gap in job specialization by informing women's expectations on job success rates in high-skill specialization paths. Through building formal regulation, shaping the immediate social context and providing signals related to gender equity, maternity/paternity leave policies affect women's assessments about the possibility of successfully balancing workload and family life.

Using data from 20 OECD countries, the analyses reveal males to persistently have more specialized jobs, and child-rearing related loss in work experience to explain a substantial part of the gender gap. Moreover, consonant with the predictions of the skill investment framework, generous paternity leave policy is associated with smaller gender gaps

in job specialization. The findings reveal the "social embeddedness" of individuals' skill investment decisions in the institutional context. Theoretically, the research puts forward an explanation of the effects of paternity leave policies on career choices based on women's expectations of work-family balance, instead of job interruption experiences. Finally, the research contributes to the debate of whether work–family policies are leading to trade-offs in gender equality across different labour market outcomes.

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Chapter 2

Explaining the Wage Gap for Temporary Workers: Specialized Skills or Employment Rent?

2.1 Introduction

The expectation of indefinite employment relationship was the norm in many industrial nations for much of the twentieth century. However, socio-economic changes beginning in the mid-1970s created conditions that led countries, organizations, and workers to search for – and, for the latter, oftentimes endure – greater flexibility in employment (Kalleberg, 2000). Consequently, the recent decades have witnessed a significant increase in temporary employment, which allows the *a priori* termination of employment relationships. This increase in the incidence of temporary forms of employment in Western countries has triggered a debate about the extent to which these forms of employment are inferior to permanent employment (Gash & McGinnity, 2007; Giesecke & Gross, 2003; Kalleberg et al., 2000; Watson, 2005). One consistent finding is that temporary workers receive lower wages than individuals with the same level of general competence working in permanent jobs (Gebel, 2010; Laß & Wooden, 2019; Natasha et al., 2019; OECD, 2015a).

Both structural and individual characteristics can contribute to the observed wage gap associated with contract type for similarly competent individuals. Moreover, scholars have proposed two main explanations for the remaining wage gap. Some view the wage difference as a reflection of a productivity gap. They argue that individuals in permanent contracts develop more specialized skills on the job and thus become more productive than comparable

temporary workers. Others argue that positions in social structure are relevant for how much economic rewards occupants of these positions obtain independently of the characteristics of these occupants. Certain positions in the labour market can provide rent, which represents economic returns for incumbents of these positions that are independent of the characteristics of the incumbents (Sørensen, 1996). Following this perspective, permanent workers may enjoy a wage advantage relative to comparable temporary workers because of the rent associated with an indefinite employment relationship compared with a fixed-term employment relationship.

While previous research has drawn upon the productivity and rent arguments to predict a wage gap between temporary and permanent workers, the two explanations have not been assessed directly. To what extent is the wage gap driven by structure-induced individual differences in skills, and to what extent is it driven by direct structural advantages? Besides, previous research reveals considerable cross-national heterogeneity in the size of the wage gap associated with contract type (OECD, 2015a). But there still lacks an analytical framework that explains this cross-national variation and an empirical analysis that goes beyond description.

This research develops an analytical framework that explains the direct effect of contract type on wage based on the type-of-contract segmentation theory by Polavieja (2003). Drawing upon the Programme for the International Assessment of Adult Competencies (PIAAC) data, I empirically explore the extent to which the association between employment contract type and wages for similarly competent workers (1) is driven by structural and individual characteristics, (2) can be explained by specialized skills and employment rent, and (3) is moderated by employment protection legislations. The research findings will further our

understanding on how positions in social structure are relevant for the creation of economic inequality. They also provide implications for the studies of temporary work and labour market segregation.

2.2 Temporary work and earnings gap

The growth of temporary work worldwide has been widely documented as an important feature of the recent changes in employment structure, conceptualized in previous literature as part of precarious work (Kalleberg, 2011), non-standard employment (Kalleberg et al., 2000), and contingent work (Uzzi & Barsness, 1998). Temporary jobs can be an effective way for employers to increase a firm's flexibility under the ever-increasing competition and uncertainty in global economic changes (Giesecke & Groß, 2004). Employers may use temporary jobs as probationary or screening devices toward permanent jobs, or to accommodate fluctuations in market demand. When demand for goods and services is high, employers can hire additional employees for the time they expect to need them. When the demand turns low, employers can easily adjust their number of employees by not renewing temporary contracts, thereby avoiding any firing costs.

Temporary work was often described in the "dual labour market" literature, with unstable jobs concentrated in a secondary labour market and an external labour market (for a review, see Kalleberg and Sorensen 1979). Much of the previous research on labour market dualism found that jobs cluster into good and bad segments. Jobs characterized by relatively high level of stability, such as permanent jobs compared to temporary jobs, also tend to exhibit higher earnings, as well as opportunities for on-the-job training and advancement. The type of employment contract has also been described as an important foundation of class formation (Goldthorpe, 2007). The long-term service relationship, with closer bonds to the employer, is

argued to be compensated with well-defined career opportunities and salary increments while the short-term labour contract receives wages that are calculated on a 'piece' or 'time' basis.

Despite the selection of more capable individuals into permanent compared to temporary jobs (Ortiz, 2010), recent research documents a persistent association between type of employment contract and earnings across countries even when controlling for individuals' general competencies. OECD (2015) find temporary workers to face a wage penalty, even after controlling for observable individual, family, and work characteristics. On average, a temporary contract worker receives an hourly wage that is 11% lower for men than their counterparts in standard jobs (13% lower for women). However, there is considerable cross-national variation in this wage gap. The wage penalty ranges between almost zero in Australia to 19% in Greece.

Both structural and individual characteristics can be drivers for a spurious wage gap associated with contract type for similarly competent individuals. To begin with, other structural attributes such as occupations, firms, industries, and unions may affect both the adoption of temporary contract and the level of wages. Therefore, I control for these structural variables, in addition to individual competencies, to estimate the direct effect of contract type on earning. Unfortunately, the PIAAC data we use for the current analyses does not provide information on individuals' union membership, and I cannot directly control for union status. But to the extent that unions are usually formed along the lines of occupation, firm and industry, controlling for the three variables should at least partly account for the union effects.

Individual attributes, such as gender, migration status, work experience, may also affect both the acceptance of temporary contract and the level of wages. It is possible that women, immigrants and individuals not in cohabitation with a partner are more likely to take

up temporary jobs that lack employment security (Fang & Macphail, 2008; Fuller & Vosko, 2008), and also to attain lower wages compared to similarly competent men and native workers (for a review, see Leicht 2008) and individuals with a partner (Stratton, 2002). It is also possible that new entrants into the labour market are likely to experience temporary work as 'bridges' into permanent work and that they are paid less due to their juniority. Therefore, my models also control for individual demographic variables, in addition to individual competencies, in order to get a more unbiased estimate of the direct effect of contract type on wage.

In addition to evaluating the extent to which structural and individual characteristics may contribute to the association observed between contract type and wage, this research builds an analytical framework that predicts not only a direct effect of contract type on wage, but also a cross-national variation in this relationship based on institutional settings.

2.3 Analytical framework

A distinctive approach by sociology to the study of inequality is the idea that social structure is relevant for the creation of inequality. There are two ways in which this idea can be understood. One is that structural effects reflect that people, because of their location in a social structure, change their effort and skills and thus become more or less productive. Another conception of how social structure creates inequality is that properties of positions in social structure are relevant for how much earnings occupants of these positions obtain independently of the characteristics, including economic productivity, of these occupants. This kind of positional resources that provide advantages for incumbents of social positions that are independent of the characteristics of the incumbents is defined as rent (Sørensen, 1996).

Following the two conceptions of structural inequality, this research aims at understanding how contract type can lead to a wage gap. To begin with, employers and employees under a permanent contract form mutual expectations of a lasting employment relationship. Since workers in temporary jobs have relatively short expected job tenures at time of hire, the incentive to invest in training on the job will be low for both employers and workers. Over time, this relative lack of access to, and interest in, skill development on the job is expected to lead to a productivity gap between the originally comparable temporary and permanent workers, and in turn will be reflected in wage differences. Following this argument, I propose:

Hypothesis 1. The wage gap between permanent and temporary workers, controlling for other structural and individual variables, can substantially be explained by differences in specialized skills developed on the job.

Contract type can also be relevant for earnings independently of the economic productivity of the employees. Drawing upon the theorization of employment rents (Sorensen, 2000) and the literature on labour market segmentation (e.g. Doeringer and Piore 1971), Polavieja (2003) develops the type-of-contract segmentation theory to explain how the historical deregulation of labour market in Spain has affected employees' employment rents through the 'incentive effect' and the 'buffer effect'. This research draws upon this framework to explain the direct effect of contract type on wage.

Permanent contracts can provide individuals advantages in securing employment rent relative to temporary contracts by virtue of the higher termination costs faced by employers. Workers on permanent contracts are more likely to enjoy the privileges of rigid employment security legislation, which imposes high dismissal costs for permanent employment. The *a*

priori termination of employment relationships using temporary employment allows employers to circumvent the rather costly or difficult (sometimes even impossible) dismissal of employees stemming from legal regulations and/or collective bargaining agreements. Lacking the employment security levels that dismissal costs grant permanent workers, temporary workers may be willing to accept lower wages in order to get their contracts renewed or converted into permanent ones (the incentive effect). Besides, the disparity in termination costs by type of contract may lead employers to first fire temporary workers (or simply not renew their contracts) when need goes down. Temporary workers in this way can act as a shield that protects permanent workers from unemployment, thereby giving them an advantageous position in bargaining for higher rents (the buffer effect). Following this argument, I propose:

Hypothesis 2. The wage gap between permanent and temporary workers, controlling for other structural and individual variables, can hardly be explained by specialized skills developed on the job.

Finally, institutional contexts may affect the level of rent associated with contract type by shaping the gap in termination costs. The dismissal of employees is regulated by employment protection legislations in important aspects, including procedural requirements, notice period and severance pay, the regulatory framework for unfair dismissals, and enforcement of unfair dismissal. As stronger regulations entail greater contract termination costs for employers, the gap in termination costs between permanent and temporary contract should be larger with higher level of employment protection for permanent contract and lower level of employment protection for temporary contract. A larger gap in termination costs by contract type provides higher level of job security for permanent workers, thus strengthens

both the incentive and buffer effects and leads to a larger wage gap associated with contract type. Following this argument, I propose:

Hypothesis 3a. The wage gap between permanent and temporary contract is smaller where employment protection legislation is stricter for temporary contract.

Hypothesis 3b. The wage gap between permanent and temporary contract is larger where employment protection legislation is stricter for permanent contract.

2.4 Alternative explanations

The theory of compensating wage differentials suggests that "jobs with disagreeable characteristics will command higher wages, other things equal" (Smith, 1979 p.339), while "the heterogeneity of worker tastes" (Smith, 1979 p.341) is also essential to consider when specifying whether and to what extent a job characteristic is disagreeable to certain workers. Following this argument, the wage gap associated with contract type can be interpreted as compensating differentials, depending on whether job insecurity is disagreeable to specific groups of workers. For example, if women are more home-centered, whereas men are more work-centered, women may regard a *priori* termination of job as an advantage to ensure that work is only temporary and not a commitment. It is also possible that job insecurity is less disagreeable to locally born employees, who are more willing to try different kinds of jobs before settling down, with their stronger social support as a safety net compared to migrant workers. As a result, the extent to which temporary work is disagreeable compared with permanent work may be higher for male and migrant employees than for female and local employees. Consequently, we thus may expect the compensating wage differentials for temporary work to be moderated by the job occupants' gender and migration status. To the contrary, as the structural inequality framework views the effect of contract type on earnings

to be independent of the characteristics of their occupants, we would expect the wage gap by contract type to be similar between men and women, and between immigrants and non-immigrants. This research thus further evaluates the interactive effect of contract type and gender and migration status as a robustness check.

2.5 Data and method

This research draws upon the Programme for the International Assessment of Adult Competencies (PIAAC) dataset to explore the effect of contract type on wage. For the PIAAC 1st Cycle, 39 countries/economies participated in the survey between 2011-2018, and data was collected in three different rounds. A representative sample of adults between 16 and 65 years of age was interviewed at home in the language of their country of residence. I further restrict the analysis to employees with either a permanent or temporary (fixed) contract. The public use file (PUF) included data for 35 countries, but the Russian Federation was not representative of the entire country as the population of the Moscow municipal area is not included (OECD 2013a). Canada and the United States do not provide the measures for contract type, and Hungary and Peru do not provide information on wages. The final sample thus consists of 30 countries.

Measures

Wages

The dependent variable is the natural logarithm of hourly wage adjusted by purchasing power parity (PPP), which make them comparable across countries. In the PUF, earnings data for Austria, Germany, Sweden and Turkey were reported only in deciles. Following Hanushek et al. (2015), information on the median earnings of each decile is obtained and assigned to each survey participant belonging to the respective decile of the country-specific earnings

distribution. Since the distribution of hourly earnings has a significant positive skew, the dependent variable is normalized by log transformation to better satisfy the OLS assumptions. In each country, the bottom and top one percent of the earnings distribution is trimmed to limit the influence of outliers.

Type of contract

An indefinite contract is recoded as 1, and a fixed term contract is recoded as 0. Temporary employment agency contract, an apprenticeship or other training schemes, no contract, and other types are excluded from the analysis.

Job-specific skills

Skills that are developed in the job are measured in two different approaches, addressing the outcome and the process of skill development in the job, respectively. The first directly measures the different forms of skills developed in the job, including reading, writing, numeracy, problem-solving and influencing[3]. Table 2.1 lists the items of the questionnaire on job requirements at work that are associated with each of the five specialized skill indicators. For example, the reading and writing indices are derived from a large set of questions concerning the frequency with which several types of documents (directions, instructions, memos, e-mails, articles, manuals, books, invoices, bills and forms) are read or written during one's regular work activity. PIAAC includes self-reported frequency with which workers carry out specific tasks as required by their jobs (1=never, 2= Less than once a month, 3= Less than once a week but at least once a month, 4= At least once a week but not every day, 5=every

[3] It is debatable whether task discretion, cooperation, learning at work and self-organizing, which are available in the PIAAC dataset, should also count as skills in a general sense as they are more indirect indicators. The items used to calculate the scales related to ICT skill use at work are only asked to people who report having used a computer before, thus including the ICT skill measure can be problematic as it will preclude individuals who have not used a computer from the research sample.

day). The composite variables measuring the five specialized skills is derived from these multiple task-related questions using sum scales by PIAAC.

The second measures the level of on-the-job learning and training. PIAAC includes three different indicators of the specific skill content of respondents' jobs: (1) job-specific learning time, which is measured as the time that would be required for someone with the right qualifications to learn to get the respondent's job (assessed by respondents), measured using an interval scale (1=none, 2= Less than 1 month, 3=1 to 6 months, 4= 7 to 11 months, 5=1 or 2 years, 6=3 years or more); (2) whether the respondent has attended a job skill training course in the last 12 months; and (3) the frequency with which the job involves learning new things from co-workers or supervisors, learning-by-doing from the job tasks, and keeping up to date with new products or services, measured using a five-interval scale (1=never, 2= Less than once a month, 3= Less than once a week but at least once a month, 4= At least once a week but not every day, 5=every day) for each sub indicator and calculated as the mean of the three sub indicators. Following Polavieja (2012), I have added up and averaged the standardized scores of the three different job-specific skill indicators. The result is an index measuring the average job-specific skills required in a respondent's job. The job skill specialization index (JSSi) ranges from -1.41 to 1.63.

Country level variables

To evaluate how the association between contract type and earnings is shaped by country level employment protection of temporary work, I include the Employment Protection Legislation Indicators for Regular Contracts (EPR) and Employment Protection Legislation Indicators for Temporary Contracts (EPT) from OECD, as well as the economic performance indicator, GDP (per capita, purchasing power parities: PPP) and unemployment rate.

The Employment Protection Legislation (EPL) indicators[4] evaluate the regulations on the dismissal of workers on regular contracts and the hiring and dismissal of workers on temporary contracts, considering both individual and collective dismissals. The EPR indicator ranges from 0 to 6 and a larger value indicates stronger protection. It considers four broad aspects of dismissal regulation: (1) procedural requirements, (2) notice period and severance pay, (3) the regulatory framework for unfair dismissals and (4) enforcement of unfair dismissal regulation.

The EPT indicator also ranges from 0 to 6 and considers, with equal weights, both a broad category of hiring regulation on fixed-term and temporary work agency contracts, and a broad category specific to the termination of fixed-term contracts. Hiring regulation include (1) valid cases for use of fixed-term contracts, (2) maximum number of successive fixed-term contracts, and (3) maximum cumulated duration of successive fixed-term contracts. Termination regulation includes the same aspects as EPR but evaluates in equal shares the regulation both before and at the end date of fixed-term contracts.

Individual characteristics

I control for individual-level variables including gender (1=male), migrant status (1=migrant), work experience, educational attainment (1= Lower secondary or less, 2= Upper secondary, 3= Post-secondary, 4= Professional degree, 5= Bachelor's degree or above), and literacy and numeracy[5] defined as[6]:

[4] For details of how the indicators are constructed, see https://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm

[5] PIAAC also provides information on problem-solving skills, but France, Italy, and Spain did not participate in the problem-solving domain, which was optional. The models including a control of problem-solving skill present similar results and are available upon request.

[6] Please see appendix for detailed measures of literacy and numeracy skills.

1. Literacy: the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential;

2. Numeracy: the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life.

Structural characteristics

Structural characteristics that may affect both the type of contract and earnings are controlled in the analyses, including occupation (8 dummy variables), firm size (4 dummy variables), industry (19 dummy variables) and sector (public/private sector)[7].

Table 2.1 Descriptive statistics

Variable	Mean	SD	Min	Max	Variable	Percentage
Log hourly earnings (PPP)	2.67	0.63	-1.59	5.05	Infinite contract	86.77
Reading	2.34	0.82	-0.96	7.02	Educational attainment	
Writing	2.25	0.95	0.06	5.80	Lower secondary or less	8.29
Numeracy (work)	2.11	1.01	-0.09	6.05	Upper secondary	34.44
Complex-problem solving	3.11	1.18	1.00	5.00	Post-secondary	5.47
Influencing skill	2.22	0.97	0.06	5.58	Tertiary professional	15.5
JSSi	0.32	0.61	-1.41	1.63	University or post-university	36.31
Literacy	284.58	43.33	74.18	446.45	Male	49.62
Numeracy (general)	284.39	47.07	30.91	448.68	Immigrant	8.77
Experience	18.15	11.51	0.00	47.00	Cohabitation	76.35
N=42,549						

Table 2.2 Country level variable

Country	Sample size	Permanent contract	EPR	EPT
Austria	1548	0.93	2.29	1.31
Belgium	1538	0.95	1.88	2.25
Chile	987	0.83	2.67	3.00
Czech Republic	1375	0.83	3.38	1.31
Denmark	2798	0.92	1.53	1.38
Ecuador	470	0.80	1.76	3.88

[7] Please see appendix for the detailed categories of each structural variables.

Estonia	2001	0.91	1.81	1.88
Finland	2196	0.88	2.08	1.56
France	1792	0.93	2.50	3.13
Germany	1652	0.90	2.60	1.00
Greece	385	0.85	2.45	2.25
Ireland	1354	0.84	1.10	0.63
Israel	834	0.89	2.37	0.88
Italy	804	0.90	3.02	2.00
Japan	2133	0.82	1.37	0.88
Kazakhstan	757	0.69	3.32	Missing
Korea, Republic	1320	0.78	2.42	2.13
Lithuania	959	0.94	2.63	2.38
Mexico	799	0.87	2.03	2.06
Netherlands	1743	0.86	3.24	0.94
New Zealand	1897	0.91	1.64	1.00
Norway	1950	0.92	2.33	3.00
Poland	1747	0.60	2.33	1.63
Singapore	1561	0.77	Missing	Missing
Slovak Republic	1193	0.90	2.89	1.75
Slovenia	1202	0.89	2.08	1.50
Spain	1128	0.87	2.21	2.56
Sweden	1634	0.92	2.45	0.81
Turkey	469	0.83	2.98	4.88
United Kingdom	2323	0.89	1.51	0.38
Total	42549			

Method

I use linear regression models to estimate the average wage gap by contract type. To estimate the effect of contract type on earnings, I regress the natural logarithm of hourly wage adjusted by PPP on contract type, and then control for individual and structural variables. Further, to explore the extent to which this effect can be explained by individual differences in specialized skills developed on the job, I add two sets of specialized skills measures separately into the model to see how the coefficient of contract type changes.

Country fixed effects are used to account for all relevant country differences. Because we include country fixed effects, we are not able to estimate the main effects of our two country-level variables (employment protection for regular and temporary worker). But this is not a problem, as we are only interested in the moderating effect of the two country level variables, and these can be estimated irrespective of the country-level main effects. For a similar approach, see Bol et al. 2014. Thus, I further add interaction terms between contract type and country level of employment protection for regular and temporary job into the country fixed effects models.

To provide a robustness check for the compensating wage differentials argument, I explore whether the wage gap associated with contract type varies by gender, migration status and cohabitation status. In the analyses, I use the sampling weights that are provided by the PIAAC survey, scaled in such a way that each country contributes equally to the analyses.

2.6 Results

Table 2.3 provides estimates of the relationship between contract type and earnings with different groups of control variables. Model (1) shows the gross coefficient of contract type controlling only for general skills. Model (2) and model (3) further control for structural characteristics and individual demographic variables. Model (4) and model (5) add two different groups of specialized skills as measured by specific tasks carried out at work and by the time spent learning and training at work.

Comparing model (1) and model (2), the coefficient of contract type drops by around 20 percent, suggesting that certain occupations, firms, industries and sectors provide job positions that both have permanent contract and higher levels of wage. Comparing model (1) and (3), the coefficient of contract type further drops about half its size, suggesting that work

experience, as well as gender, migration status, and cohabitation, affect both the chances of receiving a permanent contract and wages. Comparing model (1) with (4) and (5), the coefficient of contract type barely changes. Permanent contract pays around 5.5% more than temporary contract, controlling for other variables. This suggests that the wage gap by contract type can hardly be explained by individuals' difference in specialized skills. Thus hypothesis 1 is not supported. Hypothesis 2, that a wage gap between permanent and temporary workers remains even after controlling for specialized skills developed on the job, is instead supported.

Table 2.3 Regression of logged hourly earnings on contract type

	(1)	(2)	(3)	(4)	(5)
Permanent contract	0.155***	0.124***	0.057***	0.055***	0.055***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Occupation	N	Y	Y	Y	Y
Firm size	N	Y	Y	Y	Y
Industry	N	Y	Y	Y	Y
Sector	N	Y	Y	Y	Y
Gender [a]			0.109***	0.096***	0.104***
			(0.006)	(0.007)	(0.006)
Immigrant [b]			-0.040***	-0.036***	-0.038***
			(0.009)	(0.009)	(0.009)
Cohabitation status [c]			0.066***	0.062***	0.065***
			(0.008)	(0.008)	(0.008)
Experience			0.019***	0.018***	0.018***
			(0.001)	(0.001)	(0.001)
Experience2			-0.256***	-0.241***	-0.241***
			(0.021)	(0.021)	(0.021)
Specialized skills (1)					
Reading				0.037***	
				(0.005)	
Writing				0.004	
				(0.004)	
Numeracy				0.005	
				(0.003)	
Problem-solving				0.009*	
				(0.004)	
Influencing				0.021***	
				(0.004)	
Specialized skills (2)					
JSSi					0.045***
					(0.004)
General skills					
Literacy	-0.044***	-0.039***	0.002	0.002	0.000

	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Numeracy	0.139***	0.094***	0.060***	0.059***	0.061***
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Educational attainment [d]					
Upper secondary	0.090***	0.070***	0.089***	0.076***	0.082***
	(0.013)	(0.013)	(0.012)	(0.012)	(0.012)
Post-secondary	0.148***	0.090***	0.106***	0.088***	0.098***
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
Professional degree	0.240***	0.133***	0.164***	0.143***	0.153***
	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
Bachelor's degree or above	0.437***	0.244***	0.304***	0.275***	0.291***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Constant	2.428***	2.662***	2.261***	2.266***	2.266***
	(0.018)	(0.039)	(0.039)	(0.039)	(0.039)
Country fixed effects	Y	Y	Y	Y	Y
Observations	42,549	42,549	42,549	42,549	42,549

Note: Standard errors in parentheses. [a] Reference group = female; [b] Reference group = non-migrant; [c] Reference group= not living with spouse or partner; [d] Reference group= Lower secondary or less; * P<0.05, ** P<0.01, ***P<0.001.

Table 2.4 provides estimates of how the relationship between contract type and wages varies by the country level of employment protection, controlling for both individual characteristics (such as general skills, specialized skills and demographic variables), and structural characteristics (such as occupation, firm size, industry and sector). Model (1) and (2), using two different sets of job-specific skill measures as control variables, consistently show the coefficient of the interaction term between employment protection for temporary work and permanent contract to be negative. This finding suggests that the level of employment protection legislation for temporary contract is negatively associated with the wage premium to permanent work. Individuals in countries with one-unit higher level of employment protection for temporary work (e.g. the difference between France and Germany is around 2 units) have around 30% (0.05/0.156) lower wage gap by contract type. Therefore, hypothesis 3a, that this wage gap is smaller in countries with stricter employment protection for temporary contract, is supported. In model (3) and (4), the coefficients of the interaction terms between contract type and country-level employment protection for regular contract are

both in the opposite direction than expected and statistically insignificant. Therefore, hypothesis 3b is not supported.

Table 2.4 Regression of logged hourly earnings on contract type, by level of employment protection

	(1)	(2)	(3)	(4)
Permanent contract*EPT	-0.050***	-0.050***		
	(0.015)	(0.015)		
Permanent contract*EPR			-0.016	-0.015
			(0.015)	(0.015)
Permanent contract	0.156***	0.155***	0.095**	0.093**
	(0.024)	(0.024)	(0.034)	(0.034)
Occupation	N	Y	Y	Y
Firm size	N	Y	Y	Y
Industry	N	Y	Y	Y
Sector	N	Y	Y	Y
Specialized skills (1)				
Reading	0.036***		0.036***	
	(0.005)		(0.005)	
Writing	0.009*		0.005	
	(0.004)		(0.004)	
Numeracy	0.005		0.005	
	(0.003)		(0.003)	
Problem-solving	0.008*		0.010*	
	(0.004)		(0.004)	
Influencing	0.018***		0.021***	
	(0.004)		(0.004)	
Specialized skills (2)				
JSSi		0.044***		0.045***
		(0.004)		(0.004)
Male	0.097***	0.104***	0.099***	0.107***
	(0.007)	(0.007)	(0.007)	(0.007)
Migrant	-0.050***	-0.052***	-0.051***	-0.053***
	(0.009)	(0.010)	(0.009)	(0.009)
Cohabitation status	0.059***	0.062***	0.059***	0.062***
	(0.008)	(0.008)	(0.008)	(0.008)
Experience	0.019***	0.019***	0.018***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)
Experience^2	-0.255***	-0.256***	-0.230***	-0.231***
	(0.022)	(0.022)	(0.022)	(0.022)
General skills				
Literacy	0.006	0.004	0.003	0.001
	(0.008)	(0.008)	(0.008)	(0.008)
Numeracy	0.052***	0.054***	0.053***	0.056***
	(0.008)	(0.008)	(0.008)	(0.008)
Educational attainment [d]				
Upper secondary	0.074***	0.080***	0.075***	0.081***
	(0.013)	(0.012)	(0.012)	(0.012)

Post-secondary	0.092***	0.102***	0.093***	0.104***
	(0.016)	(0.016)	(0.016)	(0.016)
Professional degree	0.141***	0.151***	0.144***	0.155***
	(0.014)	(0.014)	(0.014)	(0.014)
Bachelor's degree or above	0.269***	0.286***	0.272***	0.289***
	(0.014)	(0.014)	(0.014)	(0.014)
Constant	2.169***	2.169***	2.223***	2.223***
	(0.045)	(0.045)	(0.050)	(0.050)
Country fixed effects	Y	Y	Y	Y
Observations	40,231	40,231	40,988	40,988

Note: Standard errors in parentheses. [a] Reference group = female; [b] Reference group = non-migrant; [c] Reference group= not living with spouse or partner; [d] Reference group= Lower secondary or less. The EPT indicator is missing for Kazakhstan and Singapore, and the EPR indicator is missing for Singapore, which leads to the smaller sample size in the bottom panel of the table compared to the pooled analyses. For the full table with coefficients for the control variables, see appendix. * P<0.05, ** P<0.01, ***P<0.001.

Table 2.5 provides estimates of how the relationship between contract type and wages varies by gender, migration status and cohabitation status, controlling for individual and structural characteristics. No coefficients for the interaction terms is statistically significant, suggesting that the wage gap by contract type is similar across gender, migration status and cohabitation status. Therefore, the findings do not support the interpretation based on compensating differentials of the wage premium to permanent contract.

Table 2.5 Regression of logged hourly earnings on contract type, by demographic variables

	(1)	(2)	(3)	(4)	(5)	(6)
Permanent contract*Male	0.033	0.033				
	(0.019)	(0.019)				
Permanent contract*Migration status			-0.035	-0.039		
			(0.025)	(0.025)		
Permanent contract* Cohabitation status					0.017	0.020
					(0.021)	(0.021)
Permanent contract	0.039**	0.039**	0.058***	0.059***	0.044*	0.042*
	(0.012)	(0.012)	(0.011)	(0.011)	(0.018)	(0.018)
Male	0.068***	0.076***	0.096***	0.104***	0.096***	0.104***
	(0.018)	(0.018)	(0.007)	(0.006)	(0.007)	(0.006)
Migrant	-0.036***	-0.038***	-0.005	-0.004	-0.036***	-0.038***
	(0.009)	(0.009)	(0.023)	(0.023)	(0.009)	(0.009)
Cohabitation status	0.062***	0.065***	0.062***	0.065***	0.048*	0.048*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.020)	(0.020)

Experience	0.018***	0.018***	0.018***	0.018***	0.018***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Experience^2	-0.241***	-0.242***	-0.240***	-0.241***	-0.242***	-0.242***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Specialized skills (1)						
Reading	0.037***		0.037***		0.037***	
	(0.005)		(0.005)		(0.005)	
Writing	0.004		0.004		0.004	
	(0.004)		(0.004)		(0.004)	
Numeracy	0.005		0.005		0.005	
	(0.003)		(0.003)		(0.003)	
Problem-solving	0.009*		0.009*		0.009*	
	(0.004)		(0.004)		(0.004)	
Influencing	0.020***		0.021***		0.021***	
	(0.004)		(0.004)		(0.004)	
Specialized skills (2)						
JSSi		0.045***		0.045***		0.045***
		(0.004)		(0.004)		(0.004)
General skills						
Literacy	0.002	0.001	0.002	0.001	0.002	0.000
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Numeracy	0.059***	0.060***	0.059***	0.061***	0.059***	0.061***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Educational attainment [d]						
Upper secondary	0.076***	0.081***	0.076***	0.082***	0.076***	0.082***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Post-secondary	0.088***	0.098***	0.088***	0.098***	0.088***	0.098***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Professional degree	0.143***	0.153***	0.143***	0.154***	0.143***	0.153***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Bachelor's degree or above	0.275***	0.291***	0.275***	0.291***	0.275***	0.291***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Occupation	Y	Y	Y	Y	Y	Y
Firm size	Y	Y	Y	Y	Y	Y
Industry	Y	Y	Y	Y	Y	Y
Sector	Y	Y	Y	Y	Y	Y
Constant	2.280***	2.280***	2.264***	2.263***	2.275***	2.276***
	(0.040)	(0.040)	(0.039)	(0.039)	(0.040)	(0.040)
Country fixed effects	Y	Y	Y	Y	Y	Y
Observations	42,549	42,549	42,549	42,549	42,549	42,549

Note: Standard errors in parentheses. [a] Reference group = female; [b] Reference group = non-migrant; [c] Reference group= not living with spouse or partner; [d] Reference group= Lower secondary or less; * P<0.05, ** P<0.01, ***P<0.001.

2.7 Conclusion and discussion

Scholars recently observe that temporary workers receive lower wages than individuals with the same level of general competence working in permanent jobs. This wage gap associated

with contract type can partly be a spurious correlation. Certain individual and structural characteristics can be consequential for both the adoption of a temporary/permanent contract for a job and the level of economic compensation attached to it. More importantly, contract type may directly affect wages by inducing differences in productivity and in termination costs that grant employees advantages in securing employment rent. This research builds an analytical framework based on Polavieja's (2003) type-of-contract segmentation theory and explain the net association between contract type and wage through the 'incentive effect' and the 'buffer effect'. But given the difficulties in directly measuring employment rent, some scholars may interpret the remaining wage penalty associated with temporary employment as a preference-based tradeoff for other job amenities.

The findings show that structural characteristics and individual demographic characteristics explain around 60% of the gross association between contract type and wage among individuals with similar levels of general skills. But the remaining effect of contract type on wage – of around 5,5% – is hardly explained by productivity differences based on specialized skills developed at work. This suggests that the advantages with a permanent contract may be direct, instead of indirect through improving the productivity of employees on such contracts. The results are in line with an explanation in terms of positional advantages, for example by employment rent, although as a residual effect, other mechanisms cannot be ruled out. Also in accordance with the employment rent argument is the finding that the wage penalty for temporary work is considerably smaller in countries with stricter employment protection for temporary work that induce higher termination costs. Finally, the wage gap by contract type does not vary by the job occupants' gender, migration status, and cohabitation status, while they are likely to structure individual preferences for different amenities strongly.

Together, the findings are more in support of the employment rent interpretation of the remaining wage gap by contract type, than the productivity and compensating differentials interpretations.

The findings have several implications. To begin with, new entrants to the workforce, as well as female, immigrants and individuals not in cohabitation with a partner, are doubly disadvantaged in the labour market. They are not only more likely to accept temporary contracts that provide less job security, but also paid less than their similarly competent counterparts, creating a substantial spurious association between contract type and wage. While much previous research has studied how seniority, gender, migration status and cohabitation status are translated into wage gaps, less attention has been paid to the question how they may also affect the acceptance of a temporary instead of a permanent contract. Further research on this topic will deepen our understanding of the different dimensions of social inequality based on demographic characteristics.

Besides, the rise of temporary work may lead to the further deepening of labour market segmentation. The findings suggest that temporary contract not only has innate the element of instability in employment, but also brings an economic disadvantage to employees. In this way, it shows the tendency of increased crystallization, where different dimensions of job amenities covary with each other, creating the segmentation between good and bad jobs (Kalleberg, 2011). To further scrutinize this, it is also fruitful to analyze life-course careers, in order to study to what extent individuals are stuck in temporary employment, and to what extent this is just a phase in their job careers.

Further, this research provides empirical evidence to distinguish between two conceptions of the structural inequality based on contract type. While the need of specialized

skills in production forms an important reason for an employer to adopt permanent contracts, this research suggests that specialized skills hardly explain the association between contract type and earnings net of individual and structural characteristics. Instead, it suggests that the effect of contract structure is relevant for individuals' earnings occupants independently of their characteristics, including economic productivity. In this sense, contract type may be an important source of the creation of rent, which has been seen as the basis for the formation of classes (Sørensen, 1996).

Finally, while the wage penalty to temporary contract has been widely documented, its variation across countries has received relatively less attention. The findings above suggest the employment protection for temporary contract to be a noteworthy factor in shaping the level of wage penalty associated with temporary contract. A policy implication for reducing the economic disadvantage faced by temporary workers is thus to strengthen the regulation of dismissals both during and at the end of temporary contracts.

Some limitations of this research should be acknowledged. While this research provides support to an employment rent argument over the specialized skills explanation for the wage gap by contract type, it cannot not directly measure employment rent which is conceptualized as an advantage inherent in certain structural positions such as permanent jobs. Rather, it interprets as employment rent the remaining association between contract type and wage after controlling for individual and structural characteristics and specialized skills. Despite an extensive measure of the control variables, it is still possible that unmeasured individual/structural characteristics or specialized skills is behind this remaining association. Similarly, despite a robustness check of the compensating differentials interpretation for the wage gap by contract type, it does not test this argument by directly measuring different

dimensions of job quality. Further research which allows more comprehensive measures of the alternative explanations will help further scrutinize this argument.

Chapter 3

Unions, Bargaining Power, and the Skills-Earnings Relationship across Countries

3.1 Introduction

Skill is a central determinant of earnings in modern industrialized nations. In the dominant model of wage determination proposed by neoclassical economists, individual earnings are a function of their labour market skills (human capital). Wages rise in proportion to skills as skills can be deployed to produce superior productivity. Similarly, the functionalist theory of stratification (Davis and Moore, 1945) argues that the hierarchy of rewards is primarily a consequence of the technical division of labour. Society must reward the occupations that require higher level of skills to motivate people to undergo the necessary training with all its attendant sacrifices and miseries.

The extent to which skills are rewarded economically in the labour market can be explained by the supply-demand relations of skills (Acemoglu and Autor, 2011; Liu and Grusky, 2013) and the institutional contexts shaping the wage-setting processes (Carbonaro, 2006; Kim and Sakamoto, 2010). The market approach argues that the economic rewards to skills are higher when there is an increase in demand relative to supply for them. The institutional approach, on the other hand, argues that stronger institutional regulation limits employers' discretion in setting differential pay rates according to skills and consequently weakens the skills-earnings relationship.

Previous research on the skills-earnings relationship has primarily conceptualized skill as general skills formed at school and measured it by schooling and cognitive skills such as

literacy and numeracy. However, the emerging literature on returns to specialized skills, which are formed in the workplace, suggests that they have experienced a precipitous increase in the wage payoff during recent decades, while the direct returns to general skills have increased comparatively slowly (Liu and Grusky, 2013). It is thus essential to further look into the economic returns to specialized skills across countries and explore the extent to which market and institutional drivers shape this skills-earnings relationship.

Moreover, previous research has primarily focused on describing the empirical patterns of the skill-earnings relationship associated with specific institutional contexts, with limited theoretical justifications. Instead of fixed social contexts which shape the exchange of skilled labour for economic rewards, labour market institutions themselves can represent the ongoing struggles between different groups of social actors crystalized in a specific institutional form (Western, 1998). The focus on how specific rules of regulation would limit employers' discretion in rewarding skills and thus affect the skill-earnings relationship neglects the active role of another important group of labour market actors, the employees. As a result, it falls short of revealing the underlying power relations that shape the exchanges in the labour market.

This research takes the approach that rests on the distinction between the general skills formed at school and the specialized skills formed in the workplace (e.g. Carbonaro 2005; Liu and Grusky 2013). Drawing upon the bargaining power theory, I build an analytical framework to explain how union strength, which constitutes a major source of worker power, affects the skills-earnings relationship across countries. As a robustness check, I also evaluate whether the supply-demand relations of skills provide an alternative explanation for the cross-national variation in skill-earnings relationship. Drawing upon the PIAAC dataset collected

between 2011 and 2017, I conduct multi-level analyses of 25 countries, analysing how the economic returns to general and specialized skills are shaped by country-level union strength, as well as the supply-demand relations of skills. The analyses advance previous research by (1) building an analytical framework based on power relations to explain the cross-national variation in the outcomes of wage-setting processes; (2) estimating the market and institutional effects on economic returns to specialized skills in addition to general skills.

3.2 Explaining the variation in skills-earnings relationship across countries

The skills-earnings relationship varies dramatically across countries (Blau & Kahn, 2005; Devroye & Freeman, 2001). In the 2010s, a one-standard-deviation increase in numeracy skills was associated with between 12 and 15 percent wage increase in Nordic countries, but with a 28 percent wage increase in the United States (Hanushek et al., 2015). There are two main lines of explanation for this cross-national difference in the returns to skills: the country-level variation in (a) supply-demand relations of skills and in (b) the institutional regulations of labour market such as unions, employment protections, minimum wages and so on.

Under the supply-demand framework, the greater the supply of skilled labour relative to the demand, the lower the wage rate. There is an extensive literature that supports the effect of supply-demand relations on returns to skills over time within countries (e.g. Card and Lemieux 2001; Katz and Murphy 1992; Manacorda, Sanchez-Paramo, and Schady 2010; Perugini and Pompei 2009). But only a few studies explore whether supply-demand relations contribute to the cross-national variation in skills-earnings relationship. Blau and Kahn (1996) find the cross-national variation in returns to skills, as measured by schooling, to be inconsistent with the predictions of the supply-demand relations. But Leuven, Oosterbeek, and Van Ophem (2004) replace education with a direct cognitive skill measure and find that

about one third of the variation in relative wages between skill groups across countries can be explained by national differences in the supply-demand relations of skills.

There is an extensive literature documenting the inequality-reducing effects of strong labour market institutions over time and across countries (e.g. Hope and Martelli 2019; Koeniger, Leonardi, and Nunziata 2007; Pontusson, Rueda, and Way 2002). Researchers also find strong labour market institutions to have varied effects on the earnings of different skill groups, making distinctions between managers and workers (Rosenfeld, 2006; Shin, 2014) and focusing on unskilled workers (Forth and Millward, 2001; Krashinsky, 2008; Brady, Baker and Finnigan, 2013). Further, there is a line of research documenting that strong labour market institutions reduce the returns to skills (Blau and Kahn, 1996; Carbonaro, 2006; Peng and Kang, 2013; Hanushek et al., 2015), using education and cognitive skills to measure skill.

In previous literature that explains the cross-national variation in skill-earnings relationship, skill has been operationalized as general skills formed at school. But the limited research on returns to specialized skills, which are formed in the workplace, suggest that they have experienced a more dramatic wage increase than general skills in the recent wave of technological development (Liu and Grusky, 2013). Yet no previous research has explored whether supply-demand relations and labour market institutions drive cross-national differences in the returns to specialized skills. Moreover, the main rationale underlying the analyses of multiple labour market institutions has been that institutional regulations are likely to restrict employers' discretion in the extent to which skills can be rewarded (Carbonaro, 2006; Hanushek et al., 2015). But such an approach that focuses on specific rules of regulation leaves out in its analysis a central group of actors, the employees, and falls short of considering the employees' and their organization's active role in shaping the wage-setting processes.

3.3 Bargaining power and the skills-earnings relationship

In social exchanges, relative bargaining power stems from the dependence of one of the parties on the other party to obtain needed resources, and in turn determines the outcomes from an exchange relationship (Emerson, 1962; Blau, 1964). When one party is more dependent than the other party, it has less bargaining power and therefore weaker ability to realize its interests (Dencker, 2009). In the labour market, employees exchange their labour for wages with the employers. A distinctive structural feature of this exchange is the asymmetric dependency of sellers (labourers) on buyers (employers), creating a power relationship in addition to the market relationship (Western, 1998).

While workers' livelihoods are intimately related to maintaining an employment relationship with their employer, employers are generally less dependent on any particular worker. If a worker leaves a firm, the firm will continue to generate revenue because of the contributions of the employer and other workers. Therefore, there exists a power relationship in which workers generally depend more on individual employers than employers depend on individual workers, while the extent of dependency is likely to vary across skill levels. As workers with little skills are more replaceable, employers are less dependent on them than on workers with high general skills that are scarce to recruit and specialized skills that are costly to lose. In extreme cases of top executive managers, the dependency relation may even reverse and favor the employee bargaining power over the employer (Shin, 2014).

In the face of unbalanced power relations between employees and employers, the collectivization of labour is the most common balancing operation to reduce the power advantage of employers (Emerson, 1962). This is because that employers' dependency on employees' collective labour is much larger than on any single employee. Employees can

negotiate collectively through unions with the employer over wages and working conditions and use strikes to achieve their goals. To enhance organizational unity and solidarity, unions seek single pay rates for workers in similar working conditions (Freeman and Medoff, 1984). As a result, countries with a higher level of unionization may restrict the allocation of economic rewards based on individual productivity as measured in general skills in similar jobs.

Unions can be organized within occupations (craft unions) or industries (industrial unions), and the negotiation of wage agreements between unions and employers can take place predominantly at firm, industry, or centralized at country level (Wallerstein, 1999). In decentralized bargaining systems, unions negotiate independently with employers at the firm or industry level. In this case, unions should increase the bargaining power more for employees with little specialized skills than for those with occupation- and industry-specific skills, as the latter would have better outside options than unskilled workers in individual bargaining (Peng and Kang, 2013). In highly centralized bargaining systems, craft unions and industrial unions can further combine into encompassing trade unions, and such peak level labour and employer associations typically negotiate a frame agreement on wages nationwide. Due to cooperative considerations of maximization of the welfare of labour as a whole (Wallerstein, 1990) and reduction in aggregate unemployment (Barth, Zweimüller and Zweimuller, 1995), the centralization of wage setting tends to reduce the relative wages between jobs with different levels of specialized skills. As a result, higher level of unionization may be expected to reduce the economic returns to specialized skills.

3.4 Data and method

Sample

This research adopts a multilevel model strategy using country-level data from OECD and Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS, version 6.1) in conjunction with individual data from the Programme for the International Assessment of Adult Competencies (PIAAC). Developed by the OECD and collected between 2011 and 2017, the PIAAC is a large-scale international survey of adults aged 16 to 65, and it is designed to obtain a nationally representative sample in each participating country. This article restricts the analysis to respondents who were employees at the time of survey. For the PIAAC 1st Cycle, 39 countries/economies participated in the survey and the public use file (PUF) included data for 35 countries. Russia is excluded from the analysis as the data is not representative of the entire country. After excluding countries for which country-level data is not available, the final research sample is of 25 countries.

Dependent variable

The dependent variable is the natural logarithm of the hourly earnings (PPP adjusted). In the PUF, earnings data for Austria, Germany, Sweden, Turkey and the United States were reported only in deciles. Following Hanushek et al. (2015), information on the median earnings of each decile is obtained and assigned to each survey participant belonging to the respective decile of the country-specific earnings distribution. In each country, the bottom and top one percent of the earnings distribution is trimmed to limit the influence of outliers. Since the distribution of hourly earnings has a significant positive skew, the dependent variable is normalized by log transformation to better satisfy the OLS assumptions.

Key independent variables

The key independent variables measure general and specialized skills. Given the ongoing debate in the interpretation of educational earnings effects (e.g. see Araki 2020), this

research follows Hanushek et al. (2015) and uses cognitive scores as measures of general skills. For easier interpretation, I standardize skill measures in the subsequent regression analyses to have a within-country mean of zero and a within-country standard deviation of one. The three domains of general skills are defined as:

Literacy: the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential;

Numeracy: the ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life;

Problem solving in technology-rich environments: the ability to use digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks.

The tasks include 52 items for literacy and numeracy, and 14 items for problem-solving in technology-rich environments, and are often framed as real-world problems, such as reading preschool rules (literacy domain), calculating temperature change (numeracy domain), or accessing and evaluating information relating to job search in simulated web environment (problem-solving domain) . All three domains are measured on a 500-point scale. The cognitive test design for PIAAC was based on a variant of matrix sampling (using different sets of items, multistage adaptive testing, and different assessment modes) where each respondent was administered a subset of items from the total item pool (OECD, 2013). To correct for the uncertainty in measurement that is a result of using a subset, the OECD provides plausible values which require special estimations whenever they are used as a dependent variable. Since literacy, numeracy and problem-solving skills are only used as

independent variables in this analysis, I opt for the first plausible values of the PIAAC scores in each domain, as did by Esping-Andersen and Cimentada (2018) and Hanushek et al. (2015).

Specialized skills are measured by the self-reported frequency with which workers carry out specific tasks as required by their jobs. Borelli (2016) provides evidence of the validity of the PIAAC dataset to describe the task content of occupations by comparing to O*NET, which has also been used to assess the economic returns to specialized skills (e.g. Liu and Grusky 2013). This analysis include reading, writing, numeracy, complex problem-solving and influencing skills. Table 3.1 lists the items of the questionnaire associated with each of the five specialized skill indicators. For example, the reading and writing indices are derived from a large set of questions concerning the frequency with which several types of documents (directions, instructions, memos, e-mails, articles, manuals, books, invoices, bills and forms) are read or written during one's regular work activity. A value of 1 indicates that the worker never uses that specific skill at work while a value of 5 indicates that the corresponding skill is used every day or all the time. The composite variables measuring the five specialized skills is derived from these multiple task-related questions using sum scales by PIAAC.

Table 3.1 Indicators of specialized skills

Indicator	Group of tasks
Reading	Reading documents (directions, instructions, letters, memos, e-mails, articles, books, manuals, diagrams, maps)
Writing	Writing documents (letters, memos, e-mails, reports, forms)
Numeracy	Calculating costs or budgets; use or calculate fractions or percentages; use a calculator, prepare charts, graphs or tables; use simple algebra or formulas, use advanced math or statistics
Problem-solving	Facing hard problems (at least 30 minutes of thinking to find a solution)
Influencing skills	Instructing, teaching or training people; making speeches or presentations; advising people; planning others' activities; persuading or influencing others, negotiations

The key country-level predictors measuring union strength are represented in three dimensions: union density, collective bargaining coverage, and bargaining centralization. The former two indicators come from OECD statistics, and the last indicator comes from the ICTWSS database. For the three indicators (as well as the control variable GDP per capita), the reference years are 2011 for round 1 PIAAC countries, 2014 for round 2 PIAAC countries and 2017 for round 3 PIAAC countries. Union density measures the percentage of employees who are union members and can vary between 0 to 100. Collective bargaining coverage measures the percentage of employees covered by collective wage bargaining agreements as a proportion of wage and salary earners and can vary between 0 to 100. Bargaining centralization measures the predominant level at which wage bargaining takes place while accounting for three additional elements and is a continuous measure that can vary from 0 to 5. Table 3.2 shows specific countries, their numbers of sample and union strength levels.

Table 3.2 Target Countries and the Number of Samples

Country	Samples count	Union density (percentage)	Collective bargaining coverage (percentage)	Bargaining centralization
Austria	1408	28.3	98	2.2
Belgium	1513	55.1	96	3.6
Chile	888	15.3	18.1	1
Czech	1159	15.4	33.9	1.8
Denmark	2525	67.8	76.3	2.3
Estonia	1577	7	23	1
Finland	1888	69.5	89.7	3.4
Germany	1511	18.4	58.9	2.2
Greece	410	23.1	21.9	0.8
Ireland	1263	32.7	40.5	1
Israel	992	22.8	26.1	1.5
Japan	1591	18	17.8	1
Korea, Republic	1444	9.8	13	1
Lithuania	884	8.1	7.1	1
Mexico	639	13.8	13.8	1
Netherlands	1660	19.3	87.2	2.2
New Zealand	1980	18.5	15.3	1
Norway	2070	49.3	73.1	2.4
Poland	1378	17	18.1	0.9
Slovak Republic	989	14.1	35	1.9
Slovenia	1131	26.4	69.2	2.5

Sweden	1566	68.3	89	2.4
Turkey	463	6.9	6.6	1
United Kingdom	2411	26.5	31.2	1
United States	1396	11.3	12.5	1
Total	34,736			

Control variables

I control for individual-level variables that may affect both skills and wages, and thus confound the skills-earnings relationship. Logged hourly wages is modeled as a function of gender (1=male), cohabitation status (1= living with spouse or partner), migrant status (1=migrant), work experience, educational attainment (1= Lower secondary or less, 2= Upper secondary, 3= Post-secondary, non-tertiary, 4= Professional degree, 5= Tertiary degree), sector (1=public sector), and employment status (1=full-time), in addition to skill measures (Liu and Grusky, 2013). To better estimate the effect of union strength on the skill-earnings relationship, I also include the economic performance indicator, GDP (per capita, purchasing power parities: PPP), which is an important driver of the economic returns to skills. While previous research on labour market institutions and the skills-earnings relationship also includes institutional attributes such as employment protection, minimum wage and public employment, the current analysis deliberately does not control for them as they represent specific rules of regulation that are often advocated by unions (see Hall and Soskice 2001; Kahn 2008; Western and Rosenfeld 2011), and thus are potentially endogenous to union strength.

To evaluate whether the supply-demand relations of skills shape the cross-national variation in skills-earnings relationship, I use country-level skill net supply measures from the OECD's Skills for Jobs Indicators. Positive values indicate skill shortage while negative values point to skill surplus. The larger the absolute value, the larger the imbalance. Results

are presented on a scale that ranges between -1 and +1 and takes any value at one decimal point . Considering that the PIAAC data was collected between 2011 and 2017 and the skill net supply variables are of the year of 2015, there should be a reasonably good match in historical period between the two datasets. I use the indicators that match the specialized skill measures at the individual level. Descriptive statistics for all variables used in the analyses are provided in table 3.3.

Table 3.3 Descriptive statistics

Variables	Mean	SD	Min	Max
Individual level				
Log hourly earnings (PPP)	2.73	0.61	-1.59	5.05
Specialized skills				
Reading	2.39	0.79	-0.96	7.02
Writing	2.30	0.93	0.06	5.80
Numeracy	2.14	1.00	-0.09	6.05
Complex problem solving	3.16	1.16	1	5
Influencing skill	2.27	0.97	0.06	5.58
General skills				
Literacy	287.80	41.61	84.34	445.15
Numeracy	288.44	45.23	71.92	470.25
Problem-solving	287.65	41.97	63.48	487.41
Gender	0.50	0.50	0	1
Migration status	0.08	0.27	0	1
Cohabitation status	0.77	0.42	0	1
Employment status	0.84	0.36	0	1
Educational attainment	3.44	1.44	1	5
Work experience	18.24	11.44	0	47
Sector	0.32	0.47	0	1
Country level				
Union density	30.40	20.96	6.9	69.5
Collective bargaining coverage	48.17	31.52	6.6	98
Bargaining centralization	1.75	0.83	0.8	3.6
GDP per capita	40218.81	10345.78	18981.09	58631.42
Net skill supply				
Reading comprehension	0.25	0.18	-0.17	0.70
Writing	0.23	0.16	-0.153	0.6
Mathematics skills	0.14	0.12	-0.119	0.49
Complex problem solving	0.19	0.14	-0.135	0.498
Social skills	0.13	0.12	-0.152	0.372
Observations	Individuals=34,736, Countries=25			

Method

Drawing upon the PIAAC dataset and country-level data, I use multilevel linear regression to show how the relationships between skills and earnings are moderated by the country level of union strength. In Model 1, only individual-level predictors are used to examine the main effects of skills on the logarithm of PPP adjusted hourly earnings:

$$\ln(w_{ij}) = \beta_{0j} + \beta_1 GS_{ij} + \beta_2 SS_{ij} + \boldsymbol{\gamma X_{ij}} + \varepsilon_{ij} \quad (1)$$

Where i = level one (individual), j = level two (country), GS_{ij}represents general skills, SS_{ij} represents specialized skills, $\boldsymbol{X_{ij}}$ contains individual-level control variables: gender, cohabitation status, migrant status, work experience, educational attainment, sector, and employment status.

To examine how country-level union strength affects the skills-earnings relationships, model 2 to model 4 represent the intercept of model (1) as a function of a country-level union indicator, GDP per capita (G_j), and country dependent deviation (μ_{0j}). Equation 2 to 4 are in turn substituted into Equation 1, and interaction terms are generated by multiplying country-level union strength as measured by union density (UD), collective bargaining coverage (CBC), and bargaining centralization (BC) respectively and the individual-level general and specialized skill measures.

$$\beta_{0j}(in\ Equation\ 1) = \gamma_{00} + \gamma_{01} UD_j + \gamma_{02} G_j + \mu_{0j} \ (2)$$

$$\beta_{0j}(in\ Equation\ 1) = \gamma_{00} + \gamma_{01} CBC_j + \gamma_{02} G_j + \mu_{0j} \ (3)$$

$$\beta_{0j}(in\ Equation\ 1) = \gamma_{00} + \gamma_{01} BC_j + \gamma_{02} G_j + \mu_{0j} \ (4)$$

Considering the extensive literature on gender differences in the labour market process (e.g. Cohen and Huffman 2003; Kaufman 2010), I further run the analyses separately for male

and female subsamples. To explore whether the supply-demand relations of skills contribute to the cross-national variation in skills-earnings relationship, I also add cross-level interaction terms between country-level skill net supply and the individual-level skill variables of the same kind.

3.5 Results

Table 3.4 summarizes the skills-earnings relationships and how they are shaped by union strength. Model 1 includes only specialized and general skills and individual-level control variables. It shows that both specialized skills and general skills are positively related to earnings ($p< 0.001$). The coefficients of control variables also appear in the predicted directions. Controlling for other variables, there is an earnings advantage associated with male, non-migrant, individuals in cohabitation with a spouses or partner, higher educational attainment, longer work experience and full-time employment. The distinction between public and private sector does not have a statistically significant effect on earnings in the pooled data.

Model 2 to model 4 shows that the effects of skills on earnings are moderated by country-level union strength. The interaction terms between union strength, as measured by union density, collective bargaining coverage and bargaining centralization, and specialized skills and general skills are predominantly negative, while the magnitude varies across skill types and around half of the coefficients are statistically significant.

Specifically, the negative effect of union density on the skills-earnings relationship is statistically significant for specialized reading and influencing skills, and general numeracy skills. An increase of 10 percent in union density is associated with 13% (0.0088/0.0679), 12% (0.0027/0.0222), and 11% (0.0092/0.0799) decrease in wage returns to specialized reading, influencing and general numeracy skills respectively. The negative effect of collective

bargaining coverage on the skills-earnings relationship is statistically significant for specialized reading, problem-solving and influencing skills, and general numeracy skills. An increase of 10 percent in collective bargaining coverage is on average associated with 7% (0.0043/0.0624), 5% (0.0019/0.0397), 9% (0.0022/0.0243) and 8% (0.0065/0.0823) decrease in wage returns to specialized reading, problem-solving, influencing, and general numeracy skills respectively. Finally, the negative effect of centralized bargaining on the skills-earnings relationship is statistically significant for specialized reading, problem-solving and influencing skills, and general numeracy skills. One level higher centralized bargaining (e.g. from bargaining predominantly takes place at the local or company level to intermediate or alternating between sector and company bargaining) is associated with 24% (0.0172/0.0721), 15% (0.0065/0.0419), 29% (0.0083/0.0284), 23% (0.0204/0.0870) decrease in wage returns to specialized reading, problem-solving, influencing, and general numeracy skills respectively. The general negative association between union strength and returns to skills support the argument that unions reduce economic returns to specialized skills as well as that to general skills.

Table 3.5 (in Appendix) summarizes how the skills-earnings relationships are shaped by country-level supply-demand relations of skills. Model 5 to model 9 include interactions between net skill supplies and individual skills of the same kind. However, the interaction terms are negative for all skill measures. As higher value of net skill supplies indicates more shortage of this form of skill, the results from model 5 actually suggest that countries with more shortage of skills appear to exhibit lower returns to these skills. These findings thus do not support the argument that the supply-demand relations of skills explain the variation in skills-earnings relationship across countries.

Table 3.4 Multilevel Linear Regression of Logged Hourly Earnings, Model 1 to 4

Specialized skills	(1)		(2)		(3)		(4)	
Reading	0.0458***	(0.0034)	0.0679***	(0.0057)	0.0624***	(0.0056)	0.0721***	(0.0074)
Writing	0.0191***	(0.0027)	0.0114*	(0.0047)	0.0099*	(0.0047)	0.0082	(0.0062)
Numeracy	0.0126***	(0.0024)	0.0109**	(0.0041)	0.0175***	(0.0043)	0.0176**	(0.0055)
Problem-solving	0.0303***	(0.0027)	0.0381***	(0.0047)	0.0397***	(0.0048)	0.0419***	(0.0062)
Influencing	0.0138***	(0.0025)	0.0222***	(0.0044)	0.0243***	(0.0045)	0.0284***	(0.0058)
General skills								
Literacy	0.0292***	(0.0055)	0.0326***	(0.0094)	0.0287**	(0.0096)	0.0321**	(0.0123)
Numeracy	0.0523***	(0.0054)	0.0799***	(0.0091)	0.0823***	(0.0092)	0.0870***	(0.0119)
Problem-solving	0.0151***	(0.0037)	0.0210***	(0.0063)	0.0246***	(0.0062)	0.0273***	(0.0082)
Union density/10*skills								
UD*Reading			-0.0088***	(0.0017)				
UD*Writing			0.0026	(0.0014)				
UD*Numeracy			0.0010	(0.0012)				
UD*Problem-solving			-0.0025	(0.0013)				
UD*Influencing			-0.0027*	(0.0012)				
UD*Literacy			-0.0010	(0.0026)				
UD*Numeracy			-0.0092***	(0.0025)				
UD*Problem-solving			-0.0023	(0.0019)				
Collective bargaining coverage/10*skills								
CBC*Reading					-0.0043***	(0.0011)		
CBC*Writing					0.0020*	(0.0009)		
CBC *Numeracy					-0.0007	(0.0008)		
CBC *Problem-solving					-0.0019*	(0.0009)		
CBC *Influencing					-0.0022**	(0.0008)		
CBC *Literacy					0.0005	(0.0017)		
CBC *Numeracy					-0.0065***	(0.0016)		
CBC *Problem-solving					-0.0025*	(0.0012)		
Bargaining centralization*skills								
BC*Reading							-0.0172***	(0.0042)
BC*Writing							0.0064	(0.0034)

BC *Numeracy							-0.0022	(0.0029)
BC *Problem-solving							-0.0065*	(0.0033)
BC *Influencing							-0.0083**	(0.0031)
BC *Literacy							-0.0011	(0.0065)
BC *Numeracy							-0.0204***	(0.0062)
BC *Problem-solving							-0.0078	(0.0045)
Gender [a]	0.1247***	(0.0046)	0.1251***	(0.0046)	0.1257***	(0.0046)	0.1255***	(0.0046)
Migrant [b]	-0.0416***	(0.0081)	-0.0447***	(0.0081)	-0.0456***	(0.0081)	-0.0448***	(0.0081)
Cohabitation [c]	0.1072***	(0.0054)	0.1074***	(0.0054)	0.1071***	(0.0054)	0.1066***	(0.0054)
Educational attainment [d]								
Upper secondary	0.0616***	(0.0091)	0.0624***	(0.0091)	0.0624***	(0.0091)	0.0602***	(0.0091)
Post-secondary	0.1036***	(0.0123)	0.1065***	(0.0123)	0.1096***	(0.0123)	0.1068***	(0.0123)
Professional degree	0.1739***	(0.0102)	0.1783***	(0.0101)	0.1798***	(0.0101)	0.1777***	(0.0101)
Tertiary degree	0.3424***	(0.0097)	0.3442***	(0.0097)	0.3452***	(0.0097)	0.3434***	(0.0097)
Work experience	0.1374***	(0.0028)	0.1358***	(0.0028)	0.1350***	(0.0028)	0.1355***	(0.0028)
Public	0.0015	(0.0050)	0.0009	(0.0050)	0.0008	(0.0050)	0.0009	(0.0050)
Full-time	0.0358***	(0.0062)	0.0385***	(0.0062)	0.0384***	(0.0062)	0.0368***	(0.0062)
Union density/10			0.0346*	(0.0163)				
Collective bargaining coverage/10					-0.0007	(0.0127)		
Bargaining centralization							0.0496	(0.0339)
GDP per capita/10000			0.2632***	(0.0315)	0.3200***	(0.0366)	0.3004***	(0.0342)
Constant	2.1968***	(0.0739)	1.1106***	(0.1132)	0.9896***	(0.1205)	0.9812***	(0.1263)
Observations	34,736		34,736		34,736		34,736	
Number of groups	25		25		25		25	

Note: [a] Reference group = female; [b] Reference group = non-migrant; [c] Reference group= not living with spouse or partner; [d] Reference group= Lower secondary or less; * P<0.05, ** P<0.01, ***P<0.001.

Finally, table 3.6 and 3.7 (in Appendix) estimate whether the patterns by which union strength moderates the skills-earnings relationship vary between male and female subsamples. The results generally show negative associations between union strength and the economic returns to skills, but no systematic gender differences. The pattern is more significant for specialized reading skills and influencing skills and general literacy skills for women, and it is more prominent for specialized reading skills and general numeracy skills for men. These patterns may partly reflect the fact that women and men tend to be segregated into jobs that require different kinds of skills.

3.6 Conclusion and discussion

Previous research has primarily explained the cross-national variation in skills-earnings relationship either by market forces or institutional regulations. However, they have focused the analyses narrowly to general skills, despite that specialized skills are increasingly important in determining the allocation of economic rewards along with the technological change. Moreover, the main rationale underlying the institutional analysis views labour market regulations as contexts that restrict employers' discretion in the extent to which skills can be rewarded. Such an approach falls short to illustrate the power relations between labour and capital, and thus overlooks the active role of employees in the wage-bargaining processes. Against such a background, this research draws upon the bargaining power theory to explain how union strength shapes economic returns to both general and specific skills and tests the predictions with the PIAAC dataset. The findings contribute to the theoretical explanation of economic inequality based on power relations, in addition to market relations, and to the empirical studies of cross-national variation in earnings inequality.

The results of multilevel linear regression analyses show that stronger unions generally reduce the economic returns to skills. This pattern is quite consistent across the three measures of union strengths (union density, collective bargaining coverage and bargaining centralization). The effects are especially prominent for specialized skills formed in the workplace in terms of reading, complex problem-solving (except for union density), and influencing and general skills in terms of numeracy. Union strength affects the returns to specialized skills and the returns to general skills to a similar extent, while the effect size is relatively larger for union density and bargaining centralization than for collective bargaining coverage. Further analyses on male and female subsamples also suggest that stronger unions reduce the economic returns to specialized and general skills for both men and women.

Besides, the analyses suggest that market forces are not important drivers for cross-national variation in economic returns to skills, as countries where skills are more in shortage turn out to have lower returns to these skills. While this finding contradicts the prediction of neoclassical economics, the same pattern has been documented in previous literature (e.g. Blau and Kahn 1996). A comprehensive explanation of this pattern is beyond the scope of this research, but one possible explanation is that free competition, which is an essential element of the supply-demand framework of wage determination, does not always hold in the real world. The supply and demand relations of skills can only determine the wage rate if workers and employers are allowed to freely search for matchings that maximize their economic gains in the market. If strong labour market regulations restrict wage fluctuations in case of either a shortage or a surplus of skill, we may expect the lower paid skills to attract an even smaller supply and thus a shortage of this skill, and the higher paid skills to stimulate a larger supply and thus a surplus of skill.

This research further provides two important implications for the literature on unions and inequality. Firstly, Acemoglu and Autor (2011) argue that technological change in the past decades increased the demand for skilled occupations and decreased that for unskilled ones in developed countries. As a result, this accelerating technical change has raised the payoff to skill, and thereby generated rising earnings inequality. However, the findings of this research suggest that through balancing the power relations between labour of different skill levels and capital, countries with different levels of union strength may have distorted to varying degree the market pressure for upward wage trends for high-skill workers. In this sense, the decreasing organization in unions over the past decades may have also contributed to the trend of rising skill payoffs.

Secondly, unions have been widely acknowledged as the major form of working-class organization in the struggle between capital and labour which generally increases the labour's share of national income (Wallace, Leicht and Raffalovich, 1999; Wright, 2000; Kristal, 2010). However, it is not clear how unions economically affect the national status of the 'middle-class', such as managers and professionals in firms who can either be amalgamated into the capitalist class by virtue of their ownership of stock and command of production process or be regarded as part of the 'working class' as employees (Wright, 2000). While a scrupulous examination of this question is beyond the scope of the current research, the findings of this research provide a tentative answer. As country-level union strength reduces returns to specialized skills, which is at least partly occupation-specific, country-level unionization may tend to reduce the wage gaps across occupation-based classes.

Some limitations of this research should be acknowledged. To begin with, while it includes multiple dimensions of specialized skills, it is necessary to keep in mind when

interpreting the coefficients of skills that many forms of skills (such as ICT, creative and nurturing skills etc.) are not included in the model. Future research with more comprehensive measures of specialized skills will further advance this line of research. Besides, due to data availability, this research focuses on pre-tax earnings, while unions may further reduce earnings inequality by supporting country-level redistributive policies. The current research thus does not fully capture the inequality-reducing effect of unions but focuses solely on its role in the wage-setting process.

Appendix

Table 3.5 Multilevel Linear Regression of Logged Hourly Earnings, Model 5 to 9

	(5)		(6)		(7)		(8)		(9)	
Specialized skills										
Reading	0.059***	(0.005)	0.042***	(0.004)	0.043***	(0.004)	0.043***	(0.004)	0.043***	(0.004)
Writing	0.026***	(0.003)	0.034***	(0.004)	0.026***	(0.003)	0.026***	(0.003)	0.026***	(0.003)
Numeracy	0.013***	(0.002)	0.013***	(0.002)	0.015***	(0.003)	0.013***	(0.002)	0.013***	(0.002)
Complex Problem-solving	0.031***	(0.003)	0.031***	(0.003)	0.031***	(0.003)	0.035***	(0.004)	0.030***	(0.003)
Influencing	0.011***	(0.003)	0.011***	(0.003)	0.011***	(0.003)	0.011***	(0.003)	0.013***	(0.004)
General skills										
Literacy	0.057***	(0.007)	0.061***	(0.007)	0.030***	(0.006)	0.032***	(0.006)	0.030***	(0.006)
Numeracy	0.049***	(0.005)	0.049***	(0.005)	0.066***	(0.006)	0.050***	(0.005)	0.050***	(0.005)
Problem-solving	0.017***	(0.004)	0.017***	(0.004)	0.017***	(0.004)	0.037***	(0.005)	0.017***	(0.004)
Skill net supply*skill										
Reading comprehension*reading	-0.078***	(0.016)								
Reading comprehension*literacy	-0.109***	(0.016)								
Writing* writing			-0.039**	(0.015)						
Writing* literacy			-0.133***	(0.017)						
Mathematic skills*numeracy (specialized)					-0.018	(0.018)				
Mathematic skills*numeracy (general)					-0.123***	(0.024)				
Complex problem-solving*problem-solving (specialized)							-0.024	(0.018)		
Complex problem-solving*problem-solving(general)							-0.127***	(0.017)		
Social skills*influencing									-0.017	(0.019)
Reading comprehension	0.206*	(0.086)								
Writing			-0.024	(0.262)						
Mathematics skills					-0.535	(0.453)				
Complex problem-solving							-0.052	(0.305)		
Social skills									0.048	(0.348)
Gender [a]	0.120***	(0.005)	0.120***	(0.005)	0.120***	(0.005)	0.120***	(0.005)	0.120***	(0.005)
Migrant [b]	-0.049***	(0.008)	-0.049***	(0.008)	-0.048***	(0.008)	-0.048***	(0.008)	-0.047***	(0.008)
Cohabitation [c]	0.096***	(0.006)	0.096***	(0.006)	0.095***	(0.006)	0.096***	(0.006)	0.095***	(0.006)
Educational attainment [d]										
Upper secondary	0.060***	(0.009)	0.061***	(0.009)	0.061***	(0.009)	0.062***	(0.009)	0.062***	(0.009)

Post-secondary	0.103***	(0.012)	0.103***	(0.012)	0.103***	(0.012)	0.103***	(0.012)	0.104***	(0.012)
Professional degree	0.174***	(0.010)	0.174***	(0.010)	0.175***	(0.010)	0.175***	(0.010)	0.176***	(0.010)
Tertiary degree	0.337***	(0.010)	0.337***	(0.010)	0.337***	(0.010)	0.338***	(0.010)	0.338***	(0.010)
Work experience	0.125***	(0.003)	0.124***	(0.003)	0.125***	(0.003)	0.124***	(0.003)	0.126***	(0.003)
Sector	0.003	(0.005)	0.003	(0.005)	0.002	(0.005)	0.003	(0.005)	0.003	(0.005)
Full-time	0.023***	(0.006)	0.022***	(0.006)	0.023***	(0.006)	0.023***	(0.006)	0.022***	(0.006)
GDP per capita/10000	0.312***	(0.036)	0.306***	(0.038)	0.326***	(0.034)	0.306***	(0.039)	0.299***	(0.036)
Constant	0.988***	(0.178)	1.071***	(0.129)	1.024***	(0.118)	1.073***	(0.130)	1.082***	(0.127)
Observations	30,709		30,709		30,709		30,709		30,709	
Number of groups	22		22		22		22		22	

Note: [a] Reference group = female; [b] Reference group = non-migrant; [c] Reference group= not living with spouse or partner; [d] Reference group= Lower secondary or less; * P<0.05, ** P<0.01, ***P<0.001.

Table 3.6 Multilevel Linear Regression of Logged Hourly Earnings, Model 1 to 4, female subsample

	(1)		(2)		(3)		(4)	
Specialized skills								
Reading	0.049***	(0.005)	0.069***	(0.008)	0.063***	(0.008)	0.078***	(0.010)
Writing	0.021***	(0.004)	0.020**	(0.006)	0.012	(0.006)	0.011	(0.009)
Numeracy	0.010**	(0.003)	0.001	(0.006)	0.011	(0.006)	0.010	(0.008)
Complex Problem-solving	0.026***	(0.004)	0.038***	(0.006)	0.037***	(0.006)	0.038***	(0.008)
Influencing	0.009**	(0.003)	0.018**	(0.006)	0.024***	(0.006)	0.026***	(0.008)
General skills								
Literacy	0.039***	(0.008)	0.063***	(0.013)	0.064***	(0.013)	0.079***	(0.017)
Numeracy	0.043***	(0.007)	0.048***	(0.013)	0.048***	(0.013)	0.041*	(0.017)
Problem-solving	0.015**	(0.005)	0.020*	(0.009)	0.025**	(0.009)	0.024*	(0.011)
Union density/10*skills								
UD*Reading			-0.008***	(0.002)				
UD*Writing			0.0005	(0.002)				
UD*Numeracy			0.004*	(0.002)				
UD*Complex Problem-solving			-0.004*	(0.002)				
UD*Influencing			-0.003	(0.002)				
UD*Literacy			-0.008*	(0.004)				
UD*Numeracy			-0.001	(0.004)				

UD*Problem-solving			-0.002	(0.003)				
Collective bargaining coverage/10*skills								
CBC*Reading					-0.004*	(0.002)		
CBC*Writing					0.002	(0.001)		
CBC *Numeracy					0.00003	(0.001)		
CBC *Complex Problem-solving					-0.002	(0.001)		
CBC *Influencing					-0.003**	(0.001)		
CBC *Literacy					-0.005*	(0.002)		
CBC *Numeracy					-0.001	(0.002)		
CBC*Problem-solving					-0.002	(0.002)		
Bargaining centralization/10*skills								
BC*Reading							-0.020***	(0.006)
BC*Writing							0.006	(0.005)
BC *Numeracy							0.001	(0.004)
BC *Complex Problem-solving							-0.007	(0.004)
BC *Influencing							-0.010*	(0.004)
BC *Literacy							-0.023*	(0.009)
BC *Numeracy							0.001	(0.009)
BC*Problem-solving							-0.006	(0.006)
Migrant [a]	-0.028**	(0.011)	-0.031**	(0.011)	-0.031**	(0.011)	-0.030**	(0.011)
Cohabitation [b]	0.071***	(0.007)	0.072***	(0.007)	0.071***	(0.007)	0.071***	(0.007)
Educational attainment [c]	0.047***	(0.013)	0.049***	(0.013)	0.048***	(0.013)	0.046***	(0.013)
Upper secondary	0.091***	(0.018)	0.095***	(0.018)	0.098***	(0.018)	0.095***	(0.018)
Post-secondary	0.189***	(0.014)	0.193***	(0.014)	0.195***	(0.014)	0.192***	(0.014)
Professional degree	0.346***	(0.014)	0.349***	(0.014)	0.350***	(0.014)	0.348***	(0.014)
Tertiary degree	0.135***	(0.004)	0.134***	(0.004)	0.133***	(0.004)	0.133***	(0.004)
Work experience	0.024***	(0.006)	0.024***	(0.006)	0.024***	(0.006)	0.024***	(0.006)
Public	0.025***	(0.007)	0.028***	(0.007)	0.028***	(0.007)	0.026***	(0.007)
Full-time			0.036	(0.021)				
Union density/10					0.003	(0.014)		
Collective bargaining coverage/10							0.050	(0.041)
Bargaining centralization			0.267***	(0.035)	0.320***	(0.041)	0.308***	(0.038)
GDP per capita/10000								
Constant	2.229***	(0.078)	1.125***	(0.126)	1.002***	(0.138)	0.973***	(0.145)

Observations	17,394	17,394	17,394	17,394
Number of groups	25	25	25	25

Note: [a] Reference group = non-migrant; [b] Reference group = not living with spouse or partner; [c] Reference group= Lower secondary or less; * P<0.05, ** P<0.01, ***P<0.001.

Table 3.7 Multilevel Linear Regression of Logged Hourly Earnings, Model 1 to 4, male subsample

	(1)		(2)		(3)		(4)	
Specialized skills								
Reading	0.044***	(0.005)	0.066***	(0.008)	0.062***	(0.008)	0.067***	(0.011)
Writing	0.017***	(0.004)	0.006	(0.007)	0.011	(0.007)	0.009	(0.009)
Numeracy	0.018***	(0.004)	0.020***	(0.006)	0.020**	(0.006)	0.024**	(0.008)
Complex Problem-solving	0.031***	(0.004)	0.030***	(0.007)	0.034***	(0.007)	0.037***	(0.009)
Influencing	0.016***	(0.004)	0.021**	(0.007)	0.018**	(0.007)	0.023**	(0.009)
General skills								
Literacy	0.023**	(0.008)	0.021	(0.013)	0.013	(0.014)	0.008	(0.018)
Numeracy	0.059***	(0.008)	0.089***	(0.013)	0.092***	(0.013)	0.104***	(0.017)
Problem-solving	0.014**	(0.005)	0.020*	(0.009)	0.024**	(0.009)	0.029*	(0.012)
Union density/10*skills								
UD*Reading			-0.009***	(0.002)				
UD*Writing			0.004	(0.002)				
UD*Numeracy			-0.001	(0.002)				
UD*Complex Problem-solving			0.001	(0.002)				
UD*Influencing			-0.001	(0.002)				
UD*Literacy			0.001	(0.004)				
UD*Numeracy			-0.010**	(0.004)				
UD*Problem-solving			-0.002	(0.003)				
Collective bargaining coverage/10*skills								
CBC*Reading					-0.004**	(0.001)		
CBC*Writing					0.001	(0.001)		
CBC *Numeracy					-0.0003	(0.001)		
CBC *Complex Problem-solving					-0.001	(0.001)		
CBC *Influencing					-0.0003	(0.001)		

CBC *Literacy					0.003	(0.002)		
CBC *Numeracy					-0.007**	(0.002)		
CBC*Problem-solving					-0.002	(0.002)		
Bargaining centralization/10*skills								
BC*Reading							-0.015**	(0.006)
BC*Writing							0.004	(0.005)
BC *Numeracy							-0.003	(0.004)
BC *Complex Problem-solving							-0.003	(0.005)
BC *Influencing							-0.004	(0.005)
BC *Literacy							0.009	(0.009)
BC *Numeracy							-0.026**	(0.009)
BC*Problem-solving							-0.009	(0.006)
Migrant [b]	-0.052***	(0.012)	-0.054***	(0.012)	-0.056***	(0.012)	-0.055***	(0.012)
Cohabitation [c]	0.141***	(0.008)	0.142***	(0.008)	0.142***	(0.008)	0.141***	(0.008)
Educational attainment [d]								
Upper secondary	0.073***	(0.012)	0.073***	(0.012)	0.073***	(0.012)	0.071***	(0.012)
Post-secondary	0.114***	(0.017)	0.115***	(0.017)	0.118***	(0.017)	0.116***	(0.017)
Professional degree	0.156***	(0.014)	0.161***	(0.014)	0.161***	(0.014)	0.161***	(0.014)
Tertiary degree	0.337***	(0.013)	0.338***	(0.013)	0.338***	(0.013)	0.337***	(0.013)
Work experience	0.139***	(0.004)	0.137***	(0.004)	0.137***	(0.004)	0.137***	(0.004)
Public	-0.026***	(0.008)	-0.026***	(0.008)	-0.026***	(0.008)	-0.026***	(0.008)
Full-time	0.098***	(0.013)	0.099***	(0.013)	0.097***	(0.013)	0.097***	(0.013)
Union density/10			0.033*	(0.014)				
Collective bargaining coverage/10					-0.005	(0.012)		
Bargaining centralization							0.079***	(0.023)
GDP per capita/10000			0.248***	(0.028)	0.312***	(0.035)	0.290***	(0.032)
Constant	2.242***	(0.072)	1.216***	(0.105)	1.089***	(0.114)	0.996***	(0.129)
Observations	17,342		17,342		17,342		17,342	
Number of groups	25		25		25		25	

Note: [a] Reference group = non-migrant; [b] Reference group = not living with spouse or partner; [c] Reference group= Lower secondary or less; * P<0.05, ** P<0.01, ***P<0.001.

Chapter 4

Maternity Leave, Paternity Leave and the Gender Differences in Job-Specific Skills

4.1 Introduction

Despite the decline and eventual reversal of the gender gap in skill investment through schooling across the member countries of the Organization for Economic Cooperation and Development (OECD, 2018), women continue to be disadvantaged in post-schooling skill investments (Boye & Grönlund, 2018; Evertsson, 2004; Felstead et al., 2007; Grönlund, 2012; Knoke & Ishio, 1998). As these skills are effectively learned on the job, they are referred to as job-specific or specialized skills. This gender difference in job-specific skills contributes significantly to the gender wage gap (Tam, 1997; Tomaskovic-Devey & Skaggs, 2002), and lead to accumulative gender inequality in promotion opportunities within firms as well as in upward job mobility experiences (DiPrete & Soule, 1988).

Countries have, to a varied extent, developed work-family policies that aim at addressing gendered economic inequalities. However, there is a growing concern that work–family policies may facilitate women's attachment to the labour force at the expense of increased gender inequality in terms of occupational segregation and earnings gap (Budig et al., 2016; Mandel & Semyonov, 2006; Pettit & Hook, 2009). Previous research has primarily built their predictions based on policy-induced changes in job interruptions and employer discrimination for women. While these explanations underscore how work-family policies can affect women's employment outcome by shaping their labour market opportunities, they overlook the agency of female employees. When

faced with different work-family policies, how do women adjust their career choices in the labour market that are consequential for the socioeconomic attainment?

This research explores how work-family policies affect the gender gap in job-specific skills, which are both consequential for gender economic inequality and free from the country-specific wage-setting dynamics. I build an explanatory framework based on the socially embedded investment argument. Under uncertainty and information constraints, individuals are likely to draw on any social signal that facilitates career forecasting to make skill investment decisions (Polavieja, 2012). As specialized skill investment decisions often precede family formation, women have to foretell under severe information constraints the extent to which motherhood would put a curb to their labour supply in the future. By building formal regulations, shaping the immediate social context and providing signals related to gender equity, country-level work-family policies can provide important information for women upon which to draw to make investment decisions on job specific skills.

Specifically, this research focuses on maternity and paternity leave policies, which are meant to support temporary caregiving while allowing parents, especially women, to return to the same or equivalent job. Generous leave policies may affect women's investment in specialized skills by shaping their expectation on the possibility of involuntary job termination, workplace discrimination and unbearable workload, and consequently on the likelihood to successfully balance work with family life. The analyses draw upon the PIAAC dataset between 2011 and 2017 on a representative sample of 38,627 individuals in 20 countries to test this argument. Drawing upon the "social embeddedness" of investment decisions approach, this research elucidates an overlooked mechanism through which work-family policies affect the gender gap in opportunities

for skill advancement. It also provides policy implications on how to further improve women's labour market outcomes.

4.2 The gender gap in job-specific skills

Contrary to the view of the labour market as a free and universal market matching the supply of and the demand for labour in orthodox economics, the dual labour market theory asserts that the labour market is sharply divided between good jobs and bad jobs (or primary and secondary-jobs) (Doeringer & Piore, 1971). A central characteristic featuring this division is the existence of an internal labour market, which provides both employment stability and chances of advancement, and consequently chances for on-the-job training. While jobs in internal labour market are likely to provide varied levels of training in addition to practical work experience, jobs in external labour market are more likely to be picked up through brief orientation and informal practice sessions.

Job-specific skills (JSS) capture all the new skills that are learned on the job, with a varied level of transferability across jobs, occupations, firms and industries. JSS are therefore directly linked to job complexity[8]. From the standpoint of on-the-job training opportunities, jobs can be viewed as "training slots" and "skill packages" (Thurow, 1975). Both formal and informal training schemes provided by the firm or simply via learning by doing can provide workers with JSS. The matching of workers to jobs can be viewed as a mechanism whereby workers are located to different JSS investment paths. High JSS investment paths often take the form of a job ladder in which the bulk of JSS investments are concentrated to the first slots and job complexity increases as workers move up the ladder (Polavieja, 2012). Compared with similarly capable individuals located in low JSS investment paths, workers in high JSS investment paths receive reduced wages

[8] See Appendix for the correlation matrix between JSS and the complexity of job skill requirements.

during the training period and increased wages as workers accumulate tenure. The mechanisms driving steep tenure-earning profiles for high JSS investment paths can reflect either losses and gains in workers' productivity due to human capital investment (Becker, 1964) or employers' strategies to minimize skill-related contractual hazard such as incentives to shirk and worker turnover (Flabbi & Ichino, 2001).

Previous research has documented the male advantage in JSS investment in countries such as Sweden (Boye & Grönlund, 2018; Evertsson, 2004; Grönlund, 2012), the United Kingdom (Felstead et al., 2007) and the United States (Knoke & Ishio, 1998). The major explanations are based on individual preferences of both employees and employers. On the supply-side, traditional socialization patterns may lead to the cultural transmission of sex-specific values, norms, and orientations, and consequently sphere specialization in the labour market by sex (Corrigall & Konrad, 2007; Crompton & Harris, 1998; Okamoto & England, 1999). On the demand side, the more powerful male actors who control the access to different job paths (i.e., male employers and male supervisors) may prefer the status-alike individuals (i.e., men) and actively exclude the status inferiors (i.e., women) from the best and most desired jobs, which tend to be those requiring specific training (Tomaskovic-Devey & Skaggs, 2002). As these studies are country-specific, we still know little about the cross-national patterns of the gender gap in JSS.

4.3 Work-family policies and women's employment

One of the main causes of job disruptions and reduced work supply for women remains to be the unequal distribution of family responsibilities (Gustafson, 2006; Han & Moen, 1999; Kan, 2007; Laurijssen & Glorieux, 2013; Maume, 2006, 2008). Specifically targeted at this issue, countries have, to a varied extent, developed policies that mitigate the conflicts between motherhood and paid employment. The state implements and activates a variety of support systems and provides

services and benefits targeted mostly at families with children. For example, paid maternity leave can last for an entire year in Sweden and Estonia (as of 2015), and can be extended with reduced compensation for up to two years and even longer in many other places such as Austria, France, Germany, and Denmark (Nelson et al., 2020). Such programs and benefits, often referred to in the literature as "work-family policies", provide women with the necessary conditions to combine work with family responsibilities, and thus strengthen women's ties to the labour market (Gornick & Meyers, 2003; OECD, 2001).

However, an increasing number of comparative researchers have raised concerns over the potential adverse effects of family policies on female employment in dimensions other than labour force participation. Although paid maternity leave serves as a device that protects women's employment rights, a long absence from employment – irrespective of whether this is economically compensated or not – may also economically harm women by inducing forgone work experience and employer discrimination against long-absent workers. Previous research focusing on occupational segregation and earnings suggests that work-family policies may either ameliorate or exacerbate the degree of gender inequality (Budig et al., 2016; Korpi et al., 2013; Mandel, 2009; Pettit & Hook, 2009).

The work-family policies apply to women's experiences, relative to men, in balancing motherhood with paid employment in the labour market, and only indirectly to the gender distribution across occupations and gender gap in wages. Occupations and wages are separate outcomes subject to cultural, institutional and market forces, such as perceptions of gendered ability (Robinson & McIlwee, 1991), union power (Western & Rosenfeld, 2011), and returns to working in a specific industry (Lin & Tomaskovic-Devey, 2013). To further evaluate the family policy tradeoffs, this research focuses on the gender gap in job-specific skills, which is both a

direct result of labour market experiences affected by work-family policies and a significant contributor to occupational gender segregation and gender wage gap.

Some recent research has also begun to investigate the influences of paternity leave, which aims to encourage fathers' involvement in childrearing. Previous research finds paternity leave policy to contribute to more equally shared family responsibilities during and after the leave (Almqvist & Duvander, 2014; Bünning, 2015; Kotsadam & Finseraas, 2011; Petts & Knoester, 2018; Wray, 2020), and to reduced gender wage gaps in the workplace (Andersen, 2018; Cools & Strøm, 2016; Misra & Strader, 2013). But it remains unclear how paternity leave policy would affect women's behavior in the labour market and whether it shapes the gender gap in job-specific skills.

4.4 Analytical framework

This research models the matching between workers to jobs as individual choices in different skill investment paths. Compared to the paths with low JSS investments, high JSS investments produce steep tenure-earning profiles, which combines below-productivity wages during the training period at the beginning of careers with above-productivity wages at the end (Brown, 1989; Topel, 1991). Tenure-reward profiles define the opportunity structure that employees face when pondering different job investment options. An individual will choose jobs that require high JSS investments over jobs that require low JSS investments if his or her expected returns over the tenure are greater in the former than in the latter jobs. Given the steeper tenure-earnings profiles in high JSS investment paths, employees will only choose high JSS investment if they expect their tenure to be long enough that the wages increment in the ending phase will offset or surpass the wages loss in the beginning period. As a result, employees' investment choices will be crucially

dependent on their expected duration in the firm. A question of "will I stay long enough in the firm for my JSS investment to pay off?" will thus dominate the investment decision.

The expectation of job tenure length is thus central in individuals' decisions on JSS investment. Job length expectations in turn encompass individuals' assessments about the possibility of involuntary job termination or interruption, the likelihood to work long or unsociable hours, and the risks of facing uncooperative or openly discriminatory working environments (Polavieja, 2012). One important source that brings uncertainty to these assessments, especially for women, lies in family formation and the accompanying possibilities of child-rearing. As JSS investment decisions often precede family formation, women have to foretell under severe information constraints the extent to which motherhood would entail job termination, make the employment workload unbearable, and induce workplace discrimination.

Under these uncertainty and information constraints, individuals' JSS investment decisions are likely to be influenced by any social signal that facilitates career forecasting (Polavieja, 2012). Maternity/paternity leave policies can provide important contextual signals that facilitate women's assessment of childrearing-related job interruption risks and thus their investment decisions. On the one hand, generous maternity leave policies increase women's expected chances of staying in the firm instead of job termination after childbirth. This is because leave policies support temporary caregiving while allowing women to return to the same or equivalent job, and longer maternity leave can increase women's expected success in balancing motherhood and paid employment during the child's early years of life. By increasing women's ties especially to the same employer and by balancing the workload with family life, maternity leave policies may encourage women's investment in JSS. On the other hand, it is also possible that very generous maternity leave increase women's expectation of employer discrimination and reduced time in

gainful employment, and in turn discourage JSS investment. The effect of maternity leave regulation on the gender gap in JSS can thus be mixed and depend on specific leave rules. It is quite possible that the effect of maternal leave time has an inverted U-shape, or at least is substantially reduced with longer spells out of the labour market.

Paternity leave policy is likely to reduce the gender gap in JSS investment by increasing women's expectations on the likelihood of successfully balancing work and family life. Generous paternity leave not only allows fathers time to household tasks and childcare, but also contribute to more equally share of these family responsibilities after the leave (Almqvist & Duvander, 2014; Bünning, 2015; Kotsadam & Finseraas, 2011; Petts & Knoester, 2018; Wray, 2020). Fathers' participation in domestic labour and early experience of child-care can at least to some extent free women of family responsibilities to allocate more of their time to participating in the labour force. The adoption of paternity leave policies also accompanies reduced gender gaps in the workplace (Andersen, 2018; Cools & Strøm, 2016; Misra & Strader, 2013). Women may learn these policy effects from their immediate social context by observing higher level of father engagement and lower level of workplace gender inequality. Besides, offering family policies not only to women but also to men breaks with the traditional division of roles, which may signal to women a collective commitment to more gender equality (Van der Lippe et al., 2019). If women expect less workplace discrimination and more equal division of family burdens by gender when they perceive the society to be more gender equal, they may have higher level of work commitment (Spoor & Hoye, 2014; Triana et al., 2019). Thus, through both real-life effects and signal interpretation, generous paternity leave may increase women's expectations on job success and encourage their JSS investment, and consequently reduce the gender gap in JSS.

In sum, I expect an inverse U-shape correlation between maternal leave and a reduction of the male advantage in JSS, and a positive correlation between both paternal leave and a reduction of the male advantage in JSS. But if prolonged terms off work and employer discrimination are the main mechanisms through which family policies affect women's JSS investment, I expect longer maternity leave to correlate with higher levels of gender gap in JSS investment, and longer paternity leaves to have only limited effects.

There are other theoretical explanations for a positive association between maternity/paternity leave legislation and the JSS gender difference, and my analyses will only be suggestive when it comes to any causal claim. Perhaps the most plausible alternative interpretation would be country differences in culture. A substantial body of feminist literature recognizes the important influence of gender ideologies on welfare state policies, of which generous work-family policies constitute an important element (Koven & Michel, 1993; Kremer, 2006; Lewis, 1992; Mink, 1995). For example, Kremer (2006) suggests that certain "ideals of care", which define good care and good caregivers, promote welfare states. Following this line of argument, preexisting cultural expectations concerning the appropriateness of mothers' employment may shape the JSS gender gap through policy formation. In my models, I aim at taking this into account by controlling for nation specific gender-role attitudes.

4.5 Data and method

Sample

This study uses data from multiple sources. Individual-level data comes from the Programme for the International Assessment of Adult Competencies (PIAAC). The PIAAC is an excellent source of secondary survey data on workplace skills and provides cross-national microdata for comparing across OECD countries. The data was collected between 2011-2018 with

a design to obtain a nationally representative sample in each participating country. The sample for all countries is restricted to adults aged 16 to 65, and this research further restricts the sample to individuals who are employed, but not self-employed or in the military. For the PIAAC 1st Cycle, 39 countries/economies participated in the survey and the public use file (PUF) included data for 35 countries. Russia is excluded from the analysis as the data is not representative of the entire country. After excluding countries for which country-level policies on maternity/paternity leaves are not available, the research sample consists of 20 countries. The total individual-level sample size is 38,627 with country samples varying between 408 in the Slovenia dataset to 4,679 in the data from Canada. I present sample sizes in each country in table 4.1.

The dependent variable is the job-specific skills (JSS) calculated following Polavieja (2012). PIAAC includes three different indicators of the specific skill content of respondents' jobs (assessed by respondents): (1) job-specific learning time, which is measured as the time that would be required for someone with the right qualifications to learn to get the respondent's job using an interval scale (1=none, 2= Less than 1 month, 3=1 to 6 months, 4= 7 to 11 months, 5=1 or 2 years, 6=3 years or more); (2) whether the respondent has attended a job skill training course in the last 12 months; and (3) the frequency with which the job involves learning new things from co-workers or supervisors, learning-by-doing from the job tasks, and keeping up to date with new products or services, measured using a five-interval scale ranging from 1 (never) to 5 (every day) for each sub indicator and calculated as the mean of the three sub indicators. I have added up and averaged the standardized scores of the three different job-specific skill indicators. The result is an index (JSSi), ranging from -1.79 to 1.63, measuring the average job-specific skills required in a respondent's job. For easier interpretation, I z-standardize this index again in regression models.

The primary independent variables are country level maternity/paternity leaves policies. I use leave measures from the Parental Leave Benefit (PLB) dataset of the Social Policy Indicators (SPIN) database (Nelson et al., 2020). The PLB module is designed to facilitate internationally comparative analyses of work-family policy institutions. The maternity and paternity leaves are measured as all weeks of leave taken at the highest benefit rate, ranging from earnings-related to flat-rate benefits, excluding any flexibility options that may increase the length of leave at reduced wage replacement rates. These policy measures capture only access to federal leaves as our focus is at the country level. Workplace policies are thus not covered by the data.

To ensure that the effects of other country characteristics, especially cultural attitudes toward gender roles, are not mistakenly attributed to family policies, I also include in the analysis a series of country-level control variables. Country level gender-role attitudes are calculated based on the International Social Survey Programme (ISSP) 2012 module 'Family and Changing Gender Roles IV', which measures gender-role attitudes by a battery of items regarding beliefs and orientations toward the role of women (and partly of men) in paid work, care, and household tasks (stated as follows).

To what extent do you agree or disagree…?

1. A working mother can establish just as warm and secure a relationship with her children as a mother who does not work.

2. A preschool child is likely to suffer if his or her mother works

3. All in all, family life suffers when the woman has a full-time job.

4. A job is all right, but what most women really want is a home and children

5. Being a housewife is just as fulfilling as working for pay.

6. Both the man and woman should contribute to the household income

7. A man's job is to earn money; a woman's job is to look after the home and family.

Respondents could respond with (1) 'strongly agree,' (2) 'agree,' (3) 'neither agree nor disagree' (4) 'disagree,' and (5) 'strongly disagree.' I reversely coded items 1 and 6 so that a higher score on each of the seven items denotes a more modern-oriented, egalitarian gender-role attitude. The final gender-role attitude measure is constructed by computing the mean over the seven items (alpha value=0.76), and then aggregating the mean at the country-level.

I also include country-level control variables that were used in previous comparative studies on related topics (i.e., gender occupational segregation, female labour force participation and wage inequality; see, e.g., Budig et al., 2012; Charles, 1992; Mandel & Semyonov, 2006). These variables are economic development (measured by GDP per capita), unemployment rate, and income inequality (measured by the Gini index). The country-level control variables enable us to examine whether and to what extent these variables could be driving relationships between the work-family policies and the gender gap in JSS investment. I present country-level measures for each country in table 4.1.

Table 4.1 Target Countries and the Number of Samples

Country	Sample size	Country-level variables averaged over years					
		Leave type (week)		GDP	Unemployment rate	GINI	Gender-role
		Maternity	Paternity				
Austria	1556	16.00	0.00	44740.38	4.42	29.86	3.22
Belgium	1765	22.25	1.02	39116.78	8.05	28.87	3.24
Canada	4679	15.00	0.00	42112.49	7.65	33.63	3.49
Czech Republic	1896	28.00	0.00	26374.61	7.06	26.50	3.24
Denmark	2450	18.00	2.00	42930.62	6.71	24.91	3.88
Finland	1835	17.50	2.38	36610.58	8.99	25.73	3.50
France	2226	16.00	0.72	35936.37	8.92	31.86	3.53
Germany	1978	14.00	0.00	39789.39	7.53	29.90	3.71
Hungary	877	52.00	1.00	23735.17	9.23	32.01	2.98
Ireland	2500	16.39	0.00	40722.32	9.40	34.81	3.36
Japan	719	14.00	0.00	38133.42	4.73	33.32	3.28
Lithuania	544	18.00	1.95	20979.07	12.58	34.53	3.09
Netherlands	1911	15.11	0.13	42965.38	5.71	29.21	3.37
Norway	2055	7.02	0.00	51760.19	4.27	26.66	3.66
Poland	3721	20.64	0.66	21262.37	12.36	34.09	3.14
Slovak Republic	813	28.00	0.00	23326.56	15.39	28.40	3.18
Slovenia	408	15.00	3.00	29728.58	6.70	24.69	3.51

Sweden	1489	4.97	2.00	38606.35	6.49		26.31	3.75
United Kingdom	3330	23.82	0.42	35216.15	6.71		36.00	3.34
United States	1875	0.00	0.00	47525.15	6.26		39.81	3.30
Total	38627							

Note: the country-level variables are averaged across 5-year intervals from 1990 to 2010.

Following the analytical framework, individuals' JSS investment decisions are shaped by the maternity/paternity leave policies that were in effect near their entry into the labour market, instead of the policies of the year they were interviewed. Similarly, the country-level control variables should be measured in the similar time to that of the maternity/paternity leave policies. Thus, I have compiled measures of all the country level variables varying from 1990 to 2010 in five years interval (due to data availability) and matched them with age groups. I use the country-year measure that corresponds to the time when an individual was 20-24, except that the age group 16-19 at the time of interview is matched with measures in the year 2010. For example, an individual aged 40-44 at the time of interview (approximately 2010) is matched with the country measures in the year 1990, and age group 35-39 is matched with country measures in the year 1995 (see table 4.2).

Table 4.2 The matching between individual age groups and the year of country-level variables

Age group	Maternity leave	Paternity leave	GDP per capita	Unemployment rate	GINI	Gender role attitudes
16-19	2010	2010	2010	2010	2010	2012
20-24	2010	2010	2010	2010	2010	2012
25-29	2005	2005	2005	2005	2005	2012
30-34	2000	2000	2000	2000	2000	2002
35-39	1995	1995	1995	1995	1995	2002
40-44	1990	1990	1990	1990	1990	2002

In addition to the key independent variable gender (men=1), individual-level control variables include age (in groups), migration status (migrant=1), family composition (number of children top-coded at 4 and relationship status with married or cohabiting =1) and educational

attainment (1= Lower secondary or less, 2= Upper secondary, 3= Post-secondary, non-tertiary, 4= Professional degree, 5= Tertiary degree). They reflect both early life experiences (e.g., schooling) and adult life events (e.g., family formation) that are highly consequential for job specialization. I also control for the size and the industry of activity of respondents' firms as they are expected to capture much of the historical and organizational variation in workplace discrimination practices that are central to demand-side approaches to explain the gender gap in JSS investment (Tomaskovic-Devey & Skaggs, 2002). Descriptive statistics of the variables are presented in table 4.3.

Table 4.3 Descriptive statistics

Variable	Mean	SD	Min	Max	variable	Percentage
Individual level					Age group	
JSS	0.02	0.71	-1.79	1.63	16-19	9.75
Gender(male=1)	0.46	0.50	0.00	1.00	20-24	25.14
Migrant	0.12	0.32	0.00	1.00	25-29	24.04
Number of children	0.89	1.13	0.00	4.00	30-34	13.83
Cohabitation	0.56	0.50	0.00	1.00	35-40	14.11
Work experience	8.38	7.10	0.00	45.00	40-44	13.13
Country level						
Maternity leave	17.32	8.95	0.00	52.00	Educational attainment	
Paternity leave	0.59	0.96	0.00	4.33	Lower secondary or less	15.54
GDP	37299.49	9732.73	18247.92	59317.88	Upper secondary	43.32
Unemployment rate	7.88	3.35	1.80	17.80	Post-secondary, non-tertiary	6.87
GINI	31.21	4.31	22.90	41.00	Professional degree	9.79
Gender-role	3.42	0.24	2.98	4.06	Tertiary degree	24.47
Sample size	38,627					

Method

Many previous scholars have studied the effects of work-family policies by comparing broad welfare state regimes (Gornick & Meyers, 2003; Korpi, 2000; Stier et al., 2001) or by using an index that reflects the overall welfare state provisions for working mothers (Mandel &

Semyonov, 2005, 2006). As Budig et al. (2016) argue, a limitation of the comparative case approach is that it is difficult to disentangle policy effects with other country-level differences in, for example, culture or broader earnings inequality. The policy index approach also falls short of accounting for the diversity of the family policies summarized in such indices, given that some policies may have markedly different effects on gender inequality than other policies.

I adopt the approach that evaluate the effects of leave policies separately (e.g. Boeckmann et al., 2015; Budig et al., 2016; Mandel & Semyonov, 2005, 2006) because they may contribute differently to women's expectations on job survival probabilities and thus JSS investment decisions. I start the analysis by fitting a pooled-country OLS model with country fixed effects, estimating the average gender gap in JSS investment. To evaluate whether child-rearing affects this average JSS gender gap, I explore whether the JSS gender gap varies by the number of children. Finally, to explore the extent to which forgone work experience, resulting from both individual preferences and employer discrimination, can explain the variation in JSS gender gap by the number of children. In the analyses, I use the sampling weights that are provided by the PIAAC survey, scaled in such a way that each country contributes equally to the analyses.

In order to further estimate the effect of the maternity/paternity leave policies on the gender gap in JSS investment, I regress JSS on interactions between maternity/paternity leave policies and gender, controlling for both individual-level and country-level variables that may confound this relationship. This linear regression model uses standard errors clustered at the country level to account for the fact that individuals are nested within countries in the dataset. Following the analytical framework, the relationship between maternity leave and JSS is modelled as curvilinear. The relationship between paternity leave and JSS is modelled as linear, while the focus is to estimate the direction of the effect, instead of interpreting it as an effect size per unit increase in

paternity leaves, given the little variance in this variable. Our main interest is in the coefficient of the interaction terms between gender and maternity/paternity leave policies: a positive coefficient of the exponential term would indicate that longer maternity leave is associated with a JSS gender gap that first declines and then increases; a negative coefficient would indicate that countries with longer paternity leaves tend to have a smaller JSS gap by gender.

4.6 Results

Pooled-sample analysis

In order to evaluate whether and how having children affect the gender gap in JSS investment, I estimate a series of ordinary least squares (OLS) regression equations based on the pooled sample of 20 countries. The results are displayed in table 4.4. In model 1, the gender gap in JSS is modelled with controls for migration status, cohabitation status, age group and educational attainment. Model 2 adds to model 1 interaction terms between number of children and gender. Model 3 further adds work experience.

Model 1 shows a significant average gender gap in JSS, controlling for demographic backgrounds, as males on average have 0.245 standard deviation higher JSS than females. Model 2 shows that the gender gap in JSS varies significantly by the number of children in one's family. For individuals with no children, the gender gap in JSS is 0.144 standard deviations, while the number increases by 0.104 for an additional child. That is, taking individuals with no children as the baseline, the gender gap in JSS increases by around 70% (0.104/0.144) for individuals with one child. This suggests that having children is an important factor behind the gender gap in JSS.

Model 3 shows that after controlling for work experience, the gender gap in JSS varies across the number of children to a lesser extent. This suggests that interruptions in work-life careers is an important mechanism through which child-rearing affects the JSS gender gap. But it is also

noteworthy that the JSS gender gap still varies considerably by the number of children. This can be interpreted as differences in the labour market opportunities, beyond what is captured by the length of work experience[9], faced by men and women with different number of children. However, it can also be interpreted as individuals with different child-rearing plans choosing career paths with different levels of JSS development even when faced with similar opportunity structures.

The coefficients of the control variables in table 4.4 also provide important information about the distribution of JSS across social groups and labour market structures. Controlling for other variables, immigrants have lower levels of JSS, and people who are married or in cohabitation have higher JSS. The JSS of individuals increases with age. Individuals with higher level of educational attainment and longer work experience also have higher JSS. This provides support to the construct validity of JSS as it positively covaries with educational attainment and work experience, as expected.

Table 4.4 OLS Regressions on the Job Skill Specialization index (JSSi), Pooled sample

	(1)		(2)		(3)	
Gender [a]	0.245***	(0.014)	0.144***	(0.019)	0.140***	(0.019)
Number of children			-0.113***	(0.009)	-0.086***	(0.009)
Gender* Number of children			0.104***	(0.012)	0.062***	(0.012)
Migrant	-0.248***	(0.021)	-0.248***	(0.021)	-0.181***	(0.021)
Cohabitation status [b]	0.080***	(0.018)	0.098***	(0.018)	0.064***	(0.018)
Age group [c]						
20-24	0.089**	(0.030)	0.108***	(0.030)	0.045	(0.030)
25-29	0.126***	(0.031)	0.173***	(0.031)	-0.011	(0.033)
30-34	0.216***	(0.033)	0.306***	(0.034)	-0.018	(0.038)
35-39	0.232***	(0.033)	0.351***	(0.035)	-0.119**	(0.042)
40-44	0.260***	(0.032)	0.388***	(0.035)	-0.236***	(0.047)
Educational attainment [d]						
Upper secondary	0.318***	(0.020)	0.297***	(0.020)	0.277***	(0.020)
Post-secondary, non-tertiary	0.419***	(0.033)	0.392***	(0.033)	0.385***	(0.032)
Professional degree	0.677***	(0.029)	0.647***	(0.029)	0.641***	(0.029)
Tertiary degree	0.805***	(0.023)	0.758***	(0.024)	0.804***	(0.024)
Work experience					0.035***	(0.002)
Constant	-0.499***	(0.036)	-0.446***	(0.036)	-0.510***	(0.036)

[9] The results remain similar even when we further control for firm size and industry, which are expected to partly proxy for employer discrimination. Results are available upon request.

Observations	38,627	38,627	38,627
R-squared	0.105	0.111	0.126

Note: JSS is standardized in the regression model. Pooled specification with country-fixed effects. The observations are given sampling weights scaled in such a way that each country contributes equally to the analyses. [a] Reference group = female; [b] Reference group = not married or cohabiting; [c] Reference group=15-19; [d] Reference group= Lower secondary or less; e Reference group=1 to 10 people. SEs in parentheses. * P<0.05, ** P<0.01, ***P<0.001

Cross-national analysis

The main question in this study is whether the gender gap in JSS, conditional on controls, varies with country-level maternity/paternity leave policies. To analyze this, I estimate a series of OLS regressions with standard errors clustered at the country level. The results of this cross-national analysis are displayed in table 4.5. Model 1 estimate the curvilinear relationship between maternity leave and the gender JSS gap, with controls for individual- and country-level variables.

The coefficient for the interaction between the squared maternity leave and gender is positive and the interaction between maternity leave and gender negative, but small in magnitude (coefficient=0.00002 and -0.0005 for one additional week) and statistically insignificant. The pattern shows a very slight decrease of the JSS gender gap along the increase of maternity leave until around 13 weeks, and then a slight increase. While this pattern is in line with the predicted direction of the curvilinear relationship, it is neither statistically nor practically significant.

Model 2 shows that the coefficient for the interaction term between paternity leave and gender is negative and statistically significant with controls for both individual variables and country-level GDP per capital, unemployment rate, GINI coefficient and gender role attitudes. Controlling for other variables, one week's increase in paternity leave is associated with around 18 percent decrease in the JSS gap by gender (0.047/0.267). The findings thus support the prediction that paternity leave policy affects the JSS gender gap.

Also, the findings are more in support of the explanation of the association between maternity/paternity leave policies and JSS gender gap based on the context-informed expectations

than that based on women's experienced time off work or employer discrimination. This is because the latter explanations predict a positive and non-relationship, respectively, for maternity and paternity leaves.

Table 4.5 Multilevel Regressions on the Job Skill Specialization index (JSSi)

	(1)		(2)	
Gender*Maternity leave	-0.0005	(0.005)		
Gender*Maternity leave^2	0.00002	(0.00007)		
Gender*Paternity leave			-0.047*	(0.021)
Gender [a]	0.233***	(0.046)	0.267***	(0.026)
Maternity leave	-0.0005	(0.004)		
Maternity leave^2	0.00007	(0.00006)		
Paternity leave			0.026	(0.015)
Migrant	-0.231***	(0.027)	-0.230***	(0.027)
Age group [c]				
20-24	0.099	(0.054)	0.098	(0.055)
25-29	0.179**	(0.056)	0.172**	(0.059)
30-34	0.255**	(0.069)	0.236**	(0.073)
35-39	0.305***	(0.063)	0.281***	(0.070)
40-44	0.339***	(0.069)	0.312***	(0.075)
Number of children	-0.070***	(0.013)	-0.070***	(0.013)
Cohabitation status [b]	0.114***	(0.020)	0.113***	(0.020)
Educational attainment [d]				
Upper secondary	0.295***	(0.024)	0.288***	(0.025)
Post-secondary, non-tertiary	0.394***	(0.032)	0.400***	(0.032)
Professional degree	0.642***	(0.036)	0.634***	(0.038)
Tertiary degree	0.752***	(0.040)	0.744***	(0.041)
GDP	-0.740	(2.033)	-1.620	(1.803)
Unemployment rate	-0.001	(0.004)	-0.002	(0.004)
GINI	-0.004	(0.004)	-0.005	(0.003)
Gender roles	-0.193**	(0.064)	-0.256**	(0.075)
Constant	0.242	(0.318)	0.544	(0.346)
Observations	38,627		38,627	

Note: JSS is standardized in the regression model. [a] Reference group = female; [b] Reference group = not married or cohabiting; [c] Reference group=15-19; [d] Reference group= Lower secondary or less. Clustered SEs in parentheses. * P<0.05, ** P<0.01, ***P<0.001.

4.7 Conclusion and discussion

Despite the aim to address the gendered economic inequalities, there is an increasing concern that work-family policies lead to gendered trade-offs between different labour market outcomes. To

evaluate the gendered trade-offs argument, previous research has primarily focused on whether work-family policies lead to cross-national differences in occupational gender segregation and in the gender wage gap. However, work-family policies directly apply to individuals', especially women's, experiences when balancing motherhood with paid employment. The extent to which these experiences may translate into occupational gender segregation and gender gaps in earnings is further subject to the cross-national variation in cultural, institutional and market forces. Besides, previous research has primarily focused on how work-family policies would affect the opportunity structure faced by women in the labour market. It inadequately addresses the possibility that women actively change their career choices in face of different work-family policies.

This research draws upon a "social embeddedness" of skill investment approach and argues that work-family policies shape the gender gap in job-specific skills by affecting women's expectations on their job success in case of motherhood. As skilled jobs in the labour market often take the form of a job ladder in which the bulk of skill learning is concentrated on the first slots, we can model individuals' job-specific skills as a result of their investment decisions between low- and high-JSS paths at the beginning of their career. An individual will only take the high-JSS path if he/she expects the job tenure to be long enough that the wages increment in the later phase will offset or surpass the forgone earnings in the early phase due to investment in skills. Maternity/paternity leave policies build formal regulations, shape the immediate social context, and provide signals related to gender equity. This is consequential for childrearing related job interruptions such as involuntary job termination, workplace discrimination, and pressure on a work-life balance; and thus for women's expectations on job success.

In general, the findings support an inequality-reducing effect of paternity leave polices with regard to the gender gap in JSS. The analysis of the pooled data of 20 countries reveals a consistent

male advantage in JSS investment, and this gender gap is considerably larger for individuals with more children. This suggests that having children is an important factor behind the gender gap in JSS. While work experience partly accounts for this effect, the gender gap in JSS is still larger for individuals with more children. This suggests that interruptions in work experience cannot fully explain the JSS gender gap induced by childrearing. More importantly, the cross-national analysis shows that paternity leaves are associated with lower level of gender gap in JSS, controlling for both individual- and country-level variables. The gender gap in JSS investment is 18 percent lower in countries with one week's paternity leave than in countries with no paternity leave.

The effect of maternity leave conforms to the expected curvilinear relationship but is not statistically significant. A negative effect of maternity leave policy, as predicted by the explanation based on policy-induced prolonged terms off work and employer discrimination, is also not found. This suggests that maternity leave may have a mixed effect on the JSS gender gap through a variety of mechanisms. On the one hand, generous maternity leave can increase women's expectations on returning to the same employer after childbirth and managing to balance the workload with family life. On the other hand, it may bring women reduced time in gainful employment and employer discrimination, both in expectation and in real experience.

The findings show the "social embeddedness" of JSS investment (Polavieja, 2012) in the institutional context, which provide regulations, laws, structures and norms concerning women's work and differ across countries. Especially, paternity leave policy facilitates fathers' engagement in family responsibilities and workplace gender equality, and provide signals for the likelihood of workplace discrimination. By observing such changes in their immediate social context such as the neighborhood and workplace, women develop higher expectations of successfully balancing

workload with family life. As a result, paternity leave may reduce the gender gap in job-specific skills investment.

This research contributes to the comparative research on women's employment by extending the analysis to a measure of job specific skills that both directly responds to work-family policies and is consequential for gendered economic inequality. More importantly, it explicates an overlooked mechanism through which work-family policies shape gender inequality in the workplace: women's context-informed expectations on work-family balance, in addition to the experienced job interruptions which have been the focus of previous research. While paternity leave can be too short to impact women's time away from work, it can still send an important signal of work-family balance which is woman-friendly, especially in the presence of kids.

However, this is not to say that work experience interruptions and employer discrimination do not explain the gender gap in JSS. As is supported by the analysis of the pooled data, work experience interruptions cogently explain the effect of child-rearing on the JSS gender gap. The findings instead suggest that in addition to the experienced interruptions in the labour market due to childbirth, the expected extent of successfully balancing workload and childrearing burdens also affects women's JSS. While the experience of job interruptions is highly consequential for the JSS gender gap, the mechanism through which paternity leave policies affect the JSS gender gap is more likely to be expectations of work-family balance, rather than job interruption experiences.

This research also provides important policy implications for promoting gender equality. Previous studies on the family policy effects for female employment have primarily focused on maternity leaves, which seems to increase (within moderate length) women's labour market participation but also occupational gender segregation (Del Rey et al., 2021; Estevez-Abe, 2005; Mandel & Semyonov, 2006). One central concern for higher level of gender segregation is that

occupations with larger numbers of female workers pay less (Tam, 1997). However, my research finds little evidence that maternity leave polices increase JSS gender gap, which accounts for most of the statistical effect of occupational sex composition on earnings. In other words, even if maternity leave policies are strengthening occupational gender segregation, the effect is likely to take shape in a way that is not leading to greater wage gap by gender. My analysis further suggests the potential of paternity leave to reduce the gender gap in JSS investment. More generous paternity leave thus may contribute to greater gender equality in the division of labour both at home and at the workplace.

Some limitations need to be noted while interpreting the findings. To begin with, this research reports an association between country-level maternity/paternity leave policies and the gender gap in JSS investment, but does not establish a causal relationship between the two. Further research adopting a quasi-experimental or experimental research design would be needed to examine a causal relationship. Further, due to space limitations, the heterogeneity in the effects of maternity/paternity leave policies is inadequately addressed. While it is likely that women with more childrearing plans are more strongly affected by the present maternity/paternity leave policies, this research only reports the average effect for all women. Due to the character of the data, this research only focuses on the country-level effects, although maternity/paternity leave policies are also likely to vary within countries, partly because different workplaces or industries may have different child-leave policies. Finally, due to data availability and the research scope to differentiate between the mechanisms contributing to the work-family policy effects, this research considers the effects of family policies only in terms of maternity/paternity leave, while other work-family policies such as subsidized childcare, flexible work scheduling and parental leave for young children may both reduce women's time away from work and increase their expectations

on successfully balancing work and family life. However, this research cannot control for these other aspects of work-family policy due to data availability. From this perspective, the observed effect of paternity leave can be interpreted as part of the integrated influence of women/mother-friendly family policies aiming at facilitating women's career development.

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