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Differences in average wages across firms – which account for around one-half of overall wage inequality – are mainly explained by differences in firm wage premia (the part of wages that depends exclusively on characteristics of firms) rather than workforce composition. Using a new cross-country dataset of linked employer-employee data, this paper investigates the role of cross-firm dispersion in productivity in explaining dispersion in firm wage premia, as well as the factors shaping the link between productivity and wages at the firm level. The results suggest that around 15% of cross-firm differences in productivity are passed on to differences in firm wage premia. The degree of pass-through is systematically larger in countries and industries with more limited job mobility, where low-productivity firms can afford to pay lower wage premia relative to high-productivity ones without a substantial fraction of workers quitting their jobs. Stronger product market competition raises pass-through while more centralised bargaining and higher minimum wages constrain firm-level wage setting at any given level of productivity dispersion. From a policy perspective, the results suggest that the key priority should be to promote job mobility, which would reduce wage differences between firms while easing the efficient reallocation of workers across them.

JEL classification codes: E02, E25, E63, J31, J61

Keywords: Wage inequality; labour mobility; productivity dispersion; linked employer-employee data

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1. Introduction

In many OECD countries, there are large and increasing productivity differences between firms, even within narrowly defined industries (Andrews et al., 2016; Syverson, 2011). At the same time, in these countries, differences in average wages between firms have also increased, explaining more than half of the overall increases in wage inequality (Criscuolo et al., 2020[1]). To some extent, such increases in between-firm wage differences reflect the sorting of workers with higher education and more experience into firms paying higher wages. But differences in wages between firms are large even for workers with similar characteristics, suggesting the existence of firm wage premia. Recent OECD work suggests that increased dispersion in firm wage premia accounts for around two-thirds of increased between-firm wage inequality (Criscuolo et al., 2020[1]). This raises the question of the structural and policy determinants of the link between productivity and firm-level wage premia, with possibly large implications for wage inequality and the allocation of workers across firms.

A link between productivity and firm wage premia arises because workers are not perfectly mobile between firms. With limited job mobility, high-productivity firms need to pay high wages to attract workers while low-productivity firms may afford to pay low wages to workers who have limited outside job options. Job mobility, in the sense of voluntary job-to-job transitions rather than overall job churn, may be limited because there are costs for workers to search for jobs and for firms to hire workers due to labour market frictions (e.g. imperfect information on job opportunities or costs related to changing jobs), or because workers have preferences over non-wage characteristics of jobs, such as geographical location or working time flexibility (Manning, 2020[2]). At any given level of productivity dispersion, promoting job mobility would not only reduce wage premia dispersion between firms but also allow high-productivity firms to expand employment, thereby promoting the efficient allocation of labour and raising aggregate productivity.[1]

This paper analyses firm-level pass-through of productivity to wage premia for 13 OECD countries over the period 1995-2017 to better understand the challenges for labour and product market policies that aim to raise aggregate productivity growth while pursuing equity goals. First, the paper develops a conceptual framework to illustrate the channels shaping the link between productivity and wages at the firm level. Second, it analyses empirically the relevance of different channels using linked employer-employee data complemented with firm-level data. The empirical results suggest that the link between productivity and wages at the firm level is to an important extent shaped by the structure of labour and product markets, as well as wage-setting institutions:

- *Policies that promote voluntary job mobility reduce wage dispersion between firms at any given level of productivity dispersion.* Low rates of job-to-job mobility (a measure of voluntary worker transitions between jobs) and high employer concentration raise the pass-through of firm-level productivity to wages by giving firms some degree of monopsony power on wage-setting. Raising job-to-job mobility from the 20th percentile of countries covered by the analysis (corresponding roughly to Greece) to the 80th percentile (corresponding roughly to Sweden) would reduce overall wage inequality by about 15%. To put this reduction in perspective, the median increase in wage inequality across countries over the period 1995-2015 was around 10% (Criscuolo et al., 2020[1]).[2]
- *Policies that promote product market competition amplify the effect of productivity dispersion on wage dispersion between firms*. With strong product market

competition, a given difference in productivity between firms implies a larger difference in output and employment between them. At any given level of job mobility, high-productivity firms need to pay high wages relative to low-productivity firms to attain their desired level of employment. However, the upward effect of product market competition on the pass-through of productivity to wage premia may partially or fully be offset if it raises opportunities for job mobility, including through the market entry of new firms.

- More centralised collective bargaining (e.g. sector-level bargaining) and higher minimum wages reduce productivity pass-through and wage premia dispersion between firms, but risk reducing employment if wage floors are set too high. With limited job mobility, low wages in low-productivity firms may partly reflect monopsonistic wage-setting by employers so that raising wage floors through more centralised collective bargaining or higher minimum wages may not necessarily reduce employment. However, setting wage floors in excess of workers' productivity risks reducing employment. This risk could be reduced by combining centralised collective bargaining with sufficient scope for further negotiation at the firm level, and focusing minimum wage increases on areas and groups for which initial levels of wages are low.

The results in this paper have a number of implications for public policies aimed at promoting productivity growth while limiting wage inequality, especially in the wake of the COVID-19 crisis that may require significant reallocation of workers from distressed firms to those with better growth prospects (Barrero, Bloom and Davis, 2020[3]). The main implication is that policies promoting job mobility, notably by eliminating unnecessary labour market frictions, can complement policies that aim directly at closing productivity gaps between firms, including via the enhancement of skills and innovation capabilities of lagging firms (Nicoletti, von Rueden and Andrews, 2020[4]; Gal et al., 2019[5]). Promoting job mobility would reduce wage dispersion between firms at any given level of productivity dispersion while also raising the efficiency of labour allocation, and thereby productivity, average wages and employment.

Job mobility could be enhanced by reforming labour market regulation, strengthening adult learning and activation policies, as well as supporting geographical mobility and telework. Labour market regulation could be made more mobility friendly by limiting legal and contractual barriers to job mobility, such as overly restrictive occupational entry regulations (Nicoletti, Von Rueden and Bambalaite, 2020[6]), non-compete or non-poaching agreements (Krueger and Ashenfelter, 2018[7]; OECD, 2019[8]); promoting the portability of social benefits and severance pay entitlements (Kettemann, Kramarz and Zweimüller, 2017[9]). Adult learning and activation policies could be made more supportive of mobility by extending the availability of public employment services (e.g. job-search assistance, training) beyond unemployed or inactive people to workers in subsidised or non-standard forms of employment, as well as currently employed people who lack labour market-relevant skills or live in lagging regions (OECD, 2019[8]; OECD, 2020[10]). Measures strengthening geographical mobility, e.g. by reforming housing policies (Causa and Pichelmann, 2020[11]) could be complemented with measures promoting telework (OECD, 2020[12]), including by upgrading ICT infrastructure and investing in training.

The results further imply that particular care should be taken in reforming wage-setting institutions in countries where job mobility is low, such as a number of Southern European countries. In these countries, a closer alignment of productivity and wages through more decentralised collective bargaining would likely promote employment but may also raise wage dispersion between firms. The possible adverse effects on wage dispersion can be mitigated by combining sector-level bargaining with bargaining at the firm-level through

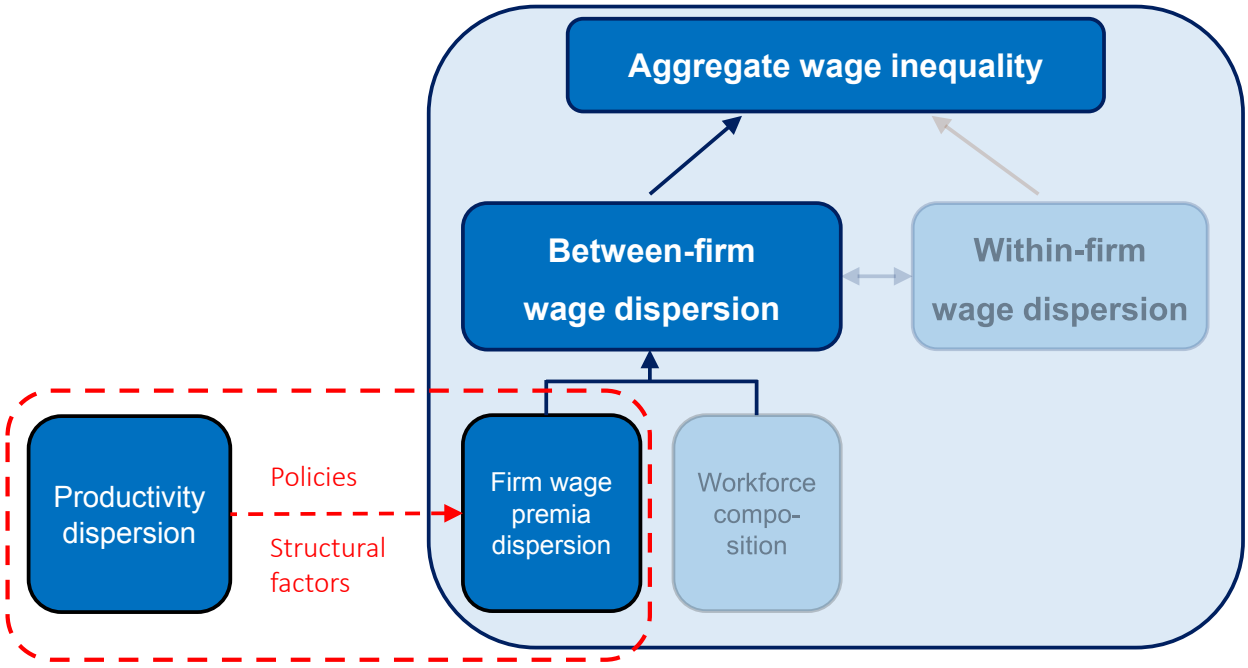
so-called organised decentralisation rather than simply replacing sector-level by firm-level bargaining (OECD, 2019[13]). For example, sector-level agreements could include opt-out clauses or leave more scope for further negotiation at the firm-level. Another way of limiting possible adverse effects of decentralisation on wage dispersion would be to complement decentralisation with increases in, or the introduction of, statutory minimum wages where they are currently low or non-existent.

The remainder of the paper is organised as follows. Section 2 provides a number of stylised facts on the dispersion of firm wage premia across countries, industries and regions. Section 3 proposes a conceptual framework to analyse the link between productivity and wages across firms and describes the empirical approach. Section 5 presents the results on firm-level productivity-wage pass-through, as well as the structural and policy factors shaping it. Section 6 concludes by drawing out the policy implications emerging from the empirical analysis.

2. Context and stylised facts on pass-through of productivity to wage premia

In order to situate the analysis in this paper in research on the drivers of wage inequality, it is useful to resort to a simple decomposition (Figure 1). Overall wage inequality can be decomposed into a between-firm and within-firm element. Within-firm wage inequality is largely determined by differences in worker characteristics such as gender, skill and experience. The between-firm element can be decomposed further into differences in workforce composition, and differences in firm wage premia that are independent of workforce composition. Firm wage premia can be obtained by estimating average firm wages while netting out the effect of average workforce characteristics, such as gender, skill and experience (Criscuolo et al., 2020[1]). This paper focuses on the link between productivity and firm wage premia, as well as the policies and structural factors shaping it, including competition in labour and product markets, as well as wage setting institutions.

Figure 1. The link between productivity dispersion and firm wage premia dispersion



Source: OECD.

2.1. Wage premia account for a substantial part of overall wage dispersion

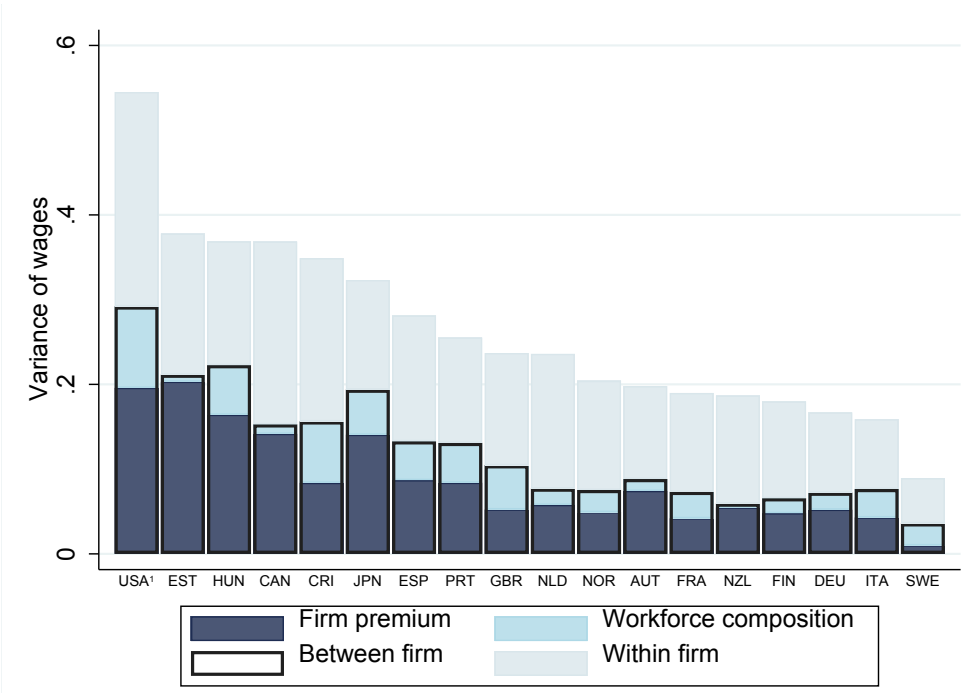
Firm wage premia, i.e. the part of wages that is determined by firms rather than workers' individual characteristics, cannot be observed directly, but can be estimated using linked employer-employee data (Annex A). Such data map workers to the firms that employ them. They typically contain information on firm-level employment, individual wages and the characteristics of individual workers (e.g. gender, age, education). In a number of countries, information on sales, value added and location of the firm is also available. The linked employer-employee data used in this paper are drawn from administrative records designed for tax or social security purposes or, in a few cases, mandatory employer surveys. This ensures high quality information, but also implies that only the formal sector of the economy is covered.[3] Firm wage premia in this paper are estimated by computing firms'

average wages, while accounting for the individual characteristics of their workers, i.e. typically occupation, education, age, gender and working-time status (Criscuolo et al., 2020[1]).[4]

In most countries, dispersion in firm wage premia accounts for around one-third of overall wage inequality, and for around two-thirds of dispersion in average wages between firms (Figure 2).[5] The remaining one-third of dispersion in average wages between firms is accounted for by differences in workforce composition, i.e. the fact that firms paying higher average wages typically also employ more highly educated and experienced workers.[6] Thus, the key to explaining differences in average wages between firms is to explain differences in wage premia rather than differences in workforce composition.

Figure 2. Firm wage premia account for around two-thirds of dispersion in wages between firms

Contribution to overall wage dispersion, latest year



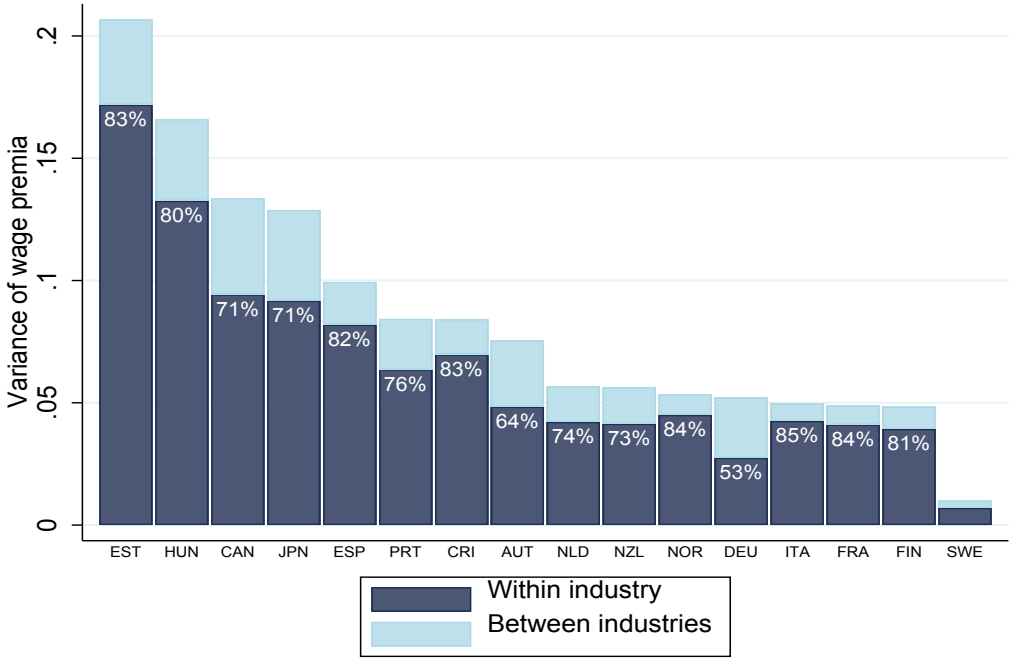
Note: The height of the bars denotes the overall level of the variance in log gross monthly earnings, including bonuses and extra payments, in the latest available year, with the shaded parts denoting the contributions of firm premia, workforce composition and within-firm wage dispersion. Earnings are full-time equivalent in Austria, Italy, Norway, Spain, Sweden, and the UK; wages for full-time workers in Germany; and total monthly earnings in Canada, Costa Rica, Estonia, Finland, France, Hungary, Japan, the Netherlands, Portugal, and New Zealand. Earnings below 90% of monthly earnings of a full-time worker at minimum wage are dropped; and those below 45% of the monthly median wage for a full-time worker if there is no minimum wage. The contribution of workforce composition is based on age, gender, part-time status and education/occupation. Education/occupation are not available in Canada, Estonia and New Zealand. Latest available year: 2011 for Hungary; 2013 for Japan; 2014 for Norway; 2015 for France, Italy and Sweden; 2016 for Canada, Germany, Netherlands and Spain; 2017 for Costa Rica, Finland, Portugal and New Zealand; 2018 for Austria, Estonia and the United Kingdom.
1. Figures for the United States are based on Barth et al. (2016[14]) and refer to the year 2007.
Source: OECD calculations.

2.2. Wage premia dispersion between firms mainly reflects within-industry differences

Wage premia differentials between industries are small relative to differentials between firms within the same industry.[7] On average across countries, around 75% of dispersion in firm wage premia is explained by wage differences between firms within the same industry (Figure 3). The role of regions appears to be even smaller. In the restricted number of countries where information on the location of the firm is available, dispersion in wage premia between regions contributes at most 10% to the within-industry dispersion of firm wage premia. In this sense, wage premia dispersion between firms does not simply reflect compensation for higher housing costs in dynamic urban areas. The small contribution of between-industry and between-region dispersion of firm wage premia relative to the within-industry and within-region component partly reflects the fairly coarse 2-digit level of industry and region disaggregations available in the LinkEED dataset.[8]

Figure 3. Between-firm wage premia dispersion mainly reflects dispersion within the same industry

Within-industry and between-industry dispersion of firm wage premia, latest available year



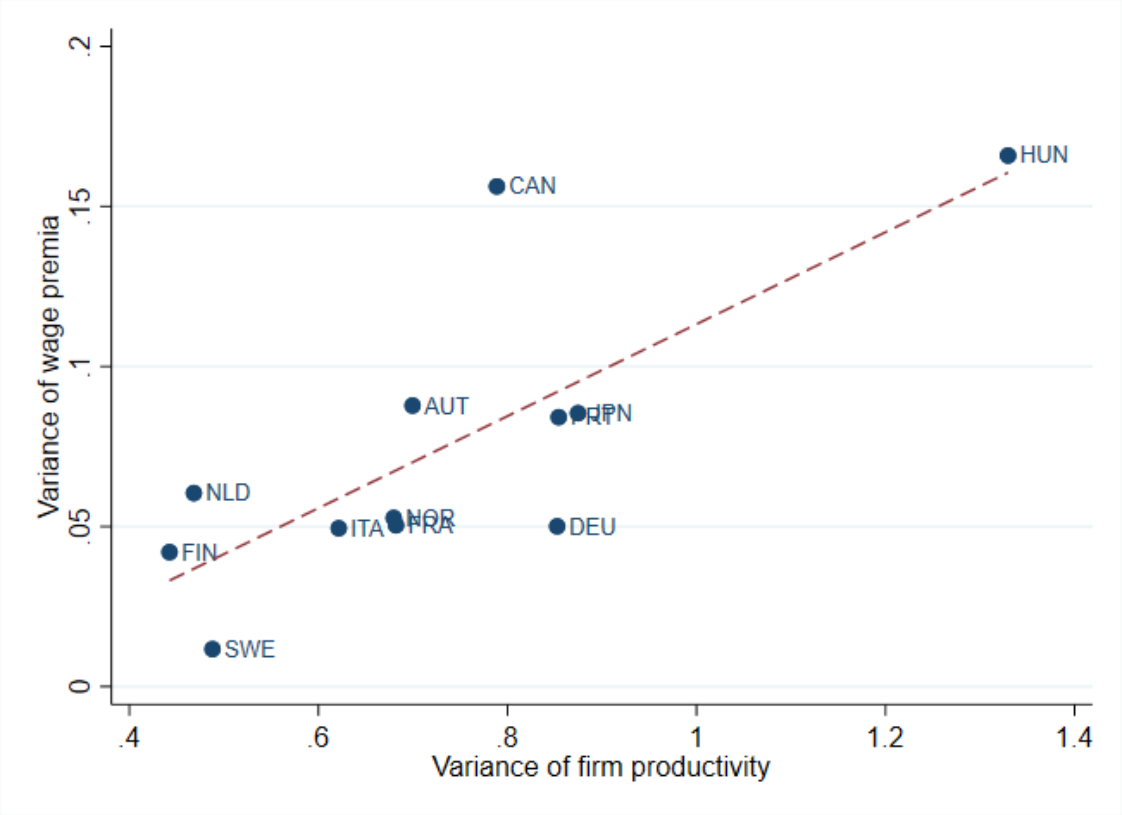
Note: The total height of the bar denotes the overall variance of wage premia in the last available year; with the height of the dark blue bar denoting the variance of wage premia within industries and the light blue bar denoting the variance of wage premia between industries and the percentage label denoting the share of within-industry wage premia variation in overall wage premia variation. Industries are defined at the two-digit level of aggregation. Latest available year: 2011 for Hungary; 2013 for Japan; 2014 for Norway; 2015 for France, Italy and Sweden; 2016 for Canada, Germany, Netherlands and Spain; 2017 for Costa Rica, Finland, Portugal and New Zealand; 2018 for Austria, Estonia. Industry-level wage premia for the United States and the United Kingdom are not available in the LinkEED database.
Source: OECD calculations.

2.3. Wage premia and productivity dispersion are positively correlated

Wage premia dispersion is typically larger in countries with larger productivity dispersion, suggesting that wage premia dispersion may at least partly be related to productivity

dispersion (Figure 4). In labour markets with frictions that limit job mobility, firms partly pass on productivity differentials to wages of workers with similar characteristics. Higher-productivity firms need to offer higher wages to attract workers from lower-productivity firms which can, in turn, offer lower wages without losing all workers. In other words, higher productivity is partly reflected in higher wages and partly in higher employment.

Figure 4. Positive association between productivity and wage premia dispersion



Note: The variance of firm productivity is the employment-weighted variance of log value added per worker from the OECD Multiprod database, and the variance of wage premia is the employment-weighted variance of firm wage premia estimated from LinkEED data. Country aggregates cover manufacturing and non-financial market services. Productivity dispersion is not available for Costa Rica, Estonia, New Zealand, Spain, the United Kingdom and the United States. Wage premia for Canada do not account for workforce composition by skills. Each data point corresponds to the latest available common year in Multiprod and LinkEED: 2011 for Hungary; 2012 for Canada, Norway, Portugal and Sweden; 2013 for Finland, Germany and Japan; 2015 for Austria, France, Italy and the Netherlands.
Source: OECD calculations.

3. Analysing productivity-wage pass-through at the firm-level

3.1. Conceptual framework

A positive link between firm-level productivity and wage premia arises as the consequence of labour market frictions, but may also depend on competition in product markets as well as institutional features of the wage-setting process (Manning, 2020[2]).

Labour market frictions are a pre-condition for firm-level productivity-wage pass-through

In perfectly competitive labour markets where workers move from a job in one firm to a job in another one as soon as there are differences in wage premia between them (i.e. there are no barriers to job mobility) productivity differences translate into differences in employment without generating wage differences. Firms adjust employment until the marginal products of labour are equalised across them and wages equal the marginal products of labour. All firms pay identical wages, i.e. they are "wage-takers", but high-productivity firms employ more workers than low-productivity ones. By contrast, in labour markets where job mobility is limited (i.e. labour supply to the firm is upward-sloping) productivity differences translate into differences in both employment and wages. High-productivity firms demand more labour than low-productivity ones but barriers to the mobility of workers prevent marginal products of labour from equalising across them. Irrespective of whether firms set wages equal to their respective marginal products of labour, or whether they exploit the wage-setting power stemming from the upward-sloping labour supply curve and set wages below marginal products, wages are higher in high-productivity firms.

Limited job mobility may reflect information frictions, pecuniary or non-pecuniary costs to job switching, or individual preferences for non-wage job characteristics (such as working conditions or commuting time). Models of labour market monopsony typically exploit one or a combination of these microeconomic drivers of limited job mobility to generate a surplus from a job match ("rent") that firms may partially share with workers. The common mechanism underlying pass-through of productivity to wages in all of these models is an upward-sloping labour supply curve to the individual firm (Manning, 2020[2]).[9] A flatter labour supply curve increases the average level of wages by limiting the scope for employers to mark down wages relative to marginal productivity, and reduces the link between productivity and wages between firms by limiting the dispersion of marginal labour productivity. In other words, higher productivity pass-through can be viewed as undesirable since it reflects barriers to job mobility and misallocation of labour across firms.

An alternative view, which does not rely on the wage-setting power of firms resulting from an upward-sloping labour supply curve, is that firms and workers bargain over the distribution of rents. In search and matching models with wage bargaining, workers and firms bargain over rents that arise from barriers to job mobility (Pissarides, 2000[15]). Importantly, these different models raise the question whether firm-level productivity-wage pass-through should be viewed as a symptom of low job mobility and a measure of misallocation of workers across firms, or as the potentially efficient sharing of rents between firms and workers (Box 1).[10]

Box 1. Productivity-wage pass-through and rent sharing

An important policy question is whether productivity-wage pass-through should be viewed as a symptom of low job mobility, or as the result of a strong bargaining position of workers. Low job mobility would imply misallocation of workers across firms, while a strong bargaining position of workers would imply the sharing of productivity-related rents between firms and workers without necessarily implying misallocation.

To frame the issue, it is useful to view productivity-wage pass-through as being based on two possibly related mechanisms:

1. **The dispersion of marginal labour productivity between firms.** According to this view, productivity-wage pass-through is predominantly driven by the dispersion of marginal productivity at any given level of average productivity dispersion. With limited labour mobility, differences in *average* productivity between firms – e.g. due to differences in production technology or capital intensity – translate into differences in marginal productivity between them as employment adjusts only imperfectly. Consequently, productivity-wage pass-through increases with the extent of *marginal* productivity dispersion relative to average productivity dispersion.
2. **The sharing of productivity-related rents between firms and workers.** According to this view, productivity-wage pass-through is predominantly driven by the bargaining position of workers. However, so long as a stronger bargaining position of workers proportionally raises wages relative to productivity in *all* firms (e.g. because bargaining entails a proportional sharing of rents), it tends to raise average wages but does not affect wage dispersion between firms. This suggests that, on its own, the degree of firm-level productivity-wage pass-through cannot be interpreted as a measure of workers' bargaining strength. In line with this argument, the available empirical evidence suggests that search and matching models with bargaining *à la* Pissarides (2000[15]) can explain only a very small share of observed wage dispersion (Yashiv, 2007[16]).

The remainder of the paper focuses on the link between productivity dispersion and wage dispersion at the industry level. In this context, larger wage premia dispersion at any given level of productivity dispersion (and thus larger wage inequality) does not necessarily imply larger sharing of productivity-related rents with workers at the industry level.[1]

Notes: Indeed, over the past two decades, larger dispersion of firm wage premia and declining labour shares have tended to go together (Figure C.1), suggesting that the concept of firm-level productivity wage pass-through in this paper cannot be interpreted as a measure of aggregate rent sharing. The negative relation between productivity-wage pass-through and the labour share is consistent with the labour market monopsony model in which a less elastic labour supply generates both a larger markdown of wages from marginal productivity and a higher pass-through of productivity to wages across firms.

Policies and institutions shape labour market frictions and productivity pass-through

Given the importance of labour market frictions, firm-level productivity-wage pass-through is expected to be large when labour market frictions are large, which is likely to be reflected in low rates of voluntary job mobility.[11] To some extent, voluntary job mobility can be influenced by policies that reduce the cost of job switching for workers, including in the areas of occupational licensing and non-compete clauses; job-search assistance and training; as well as residential mobility and telework. A more competitive product market environment may also raise pass-through (Annex A). In such an environment, firms pass

on a large share of productivity gains to product prices and gain a larger share of the market than in an environment with more limited product market competition, which induces a larger adjustment in employment and thus a larger adjustment in wages. Finally, pass-through will tend to be larger the more wage setting takes place at the firm-level (or worker level) rather than at the industry or national levels. Wage-setting institutions such as collectively-agreed industry-level wage floors or national minimum wages may constrain firms' wage-setting choices and thereby weaken the link between firm-level wages and productivity.

Productivity-wage pass-through may vary across groups of workers

While productivity pass-through is partly determined by market-level variables such as job mobility, product market competition and wage institutions, it may vary even within the same firm. Such within-firm differences could reflect monopsonic wage discrimination as firms set lower wages for workers with fewer opportunities (e.g. women, low-skilled workers); differences in demand for different groups of workers across low- and high-productivity firms, e.g. due to complementarities between technology and skills; or differences in bargaining power.

3.2. Empirical approach

Ideally, firm-level productivity-wage pass-through is analysed empirically using worker-level linked employer-employee data. The worker-level approach relates worker-level wages to firm-level productivity (see Box 3 for the technical details). Its main advantage is that it can provide granular insights into firm-level pass-through, including differences between different groups of workers such as low-skilled and high-skilled workers or men and women. Worker-level data can also be used to construct measures of local labour market concentration to analyse the extent to which the degree of productivity-wage pass-through depends on the number of potential employers. The drawback of the individual-level approach based on worker-level data is that it is only feasible where productivity is available in linked employer-employee data, which is currently only the case in nine of the countries for which data were collected for this study, making it difficult to systematically relate the degree of pass-through to industry and country characteristics.

In the absence of matched employer-employee data with information on productivity at the firm level for a large number of countries and the impossibility of pooling the worker level information across countries due to confidentiality issues, the analysis resorts to an industry-level approach to analyse the cross-industry and cross-country pattern of productivity-wage pass-through. The industry-level approach relates between-firm dispersion in wage premia within industries to between-firm dispersion in productivity. Its main advantage is that it can be applied to countries for which productivity is not available in the linked employer-employee data by computing between-firm dispersion in productivity from external data sources, namely representative firm-level data through the OECD MultiProd database (Berlingieri et al., 2017[17]). The significant variation across countries, industries and over time makes this approach ideal for analysing the structural and institutional determinants of firm-level productivity-wage pass-through. The industry-level empirical analysis is conducted on 13 OECD countries over the period 2001-2015 and covers 22 industries for which high-quality data on productivity dispersion are available.

The empirical analysis considers structural and institutional characteristics that relate to job mobility, product market competition, as well as wage-setting institutions (Table C.1). Job mobility is proxied by the share of annual job-to-job transitions in total employment.[12] The idea is that in a near perfectly-competitive labour market without frictions the elasticity of

labour supply is high, so that employed workers can be expected to voluntarily move between jobs as soon as they receive a job offer with a marginally higher wage. The advantage of the rate of job-to-job transitions as a measure of the elasticity of labour supply is that it is likely to exclude most involuntary job transitions, which typically involve transitions into non-employment. Product market competition is proxied by import competition (defined as the share of imported value added in domestic demand) which, in contrast to indicators of product market regulation, is available at the country-industry level of disaggregation, and is unlikely to be correlated with labour market competition. The role of collective bargaining is analysed by focusing on the level of decentralisation in collective bargaining systems, i.e. largely decentralised systems based on firm-level bargaining or more centralised systems with a stronger emphasis on sector or national level bargaining (OECD, 2019[13]).[13] The minimum wage is expressed by the ratio of the statutory minimum wage to the median wage of full-time workers.

Box 2. Estimating firm-level productivity-wage pass-through

Country-by-country estimation based on worker-level data ("individual-level approach")

When productivity is available in linked employer-employee data, productivity-wage pass-through at the firm-level can be estimated in a single stage using worker-level data:

$$\ln w_{ijst} = \beta x_{it} + \rho \ln\ y_{jt}\ + \delta_s + \delta_t + \varepsilon_{ijst} \qquad (1a)$$

where w_{ijst} denotes the wage of worker i, firm j, sector s and year t; x_{it} denotes individual worker characteristics such as occupation, education, age, gender and working-time status; y_{jt} log labour productivity; ρ the estimated pass-through parameter; δ_s and δ_t industry and year fixed effects; and ε_{ijst} the error term. Labour productivity is either measured as value added per worker or, if information on value added is not available, as sales per worker.[1] This procedure can be used to estimate productivity pass-through for different groups of workers by interacting productivity with indicator variables for each group (e.g. men and women).[2]

Specification (1a) effectively uses variation in wage premia and productivity within firms over time as well as between firms at any given point in time (and in a given industry) to estimate pass-through. The advantage of using cross-sectional variation on top of the within-firm variation is that the estimated pass-through directly addresses the question of the long-term relation between the dispersion in firm wage premia and dispersion in productivity rather than the short-term response of wage premia to productivity shocks.

Equation (1a) is estimated separately for each country where productivity is available in linked employer-employee data, as well as separately for different groups of workers within these countries (by skills and gender). So far, estimates are available for Canada, Costa Rica, Finland, France, Germany, Hungary, Japan, Netherlands and Portugal.

Cross-country estimation using industry-level data ("industry-level approach")

Defining $p_{ijst} \equiv \ln w_{ijst} - x_{it}\beta$ and taking the firm-level average $\bar{p}_{jst}$, equation (1a) can be re-written as:

$$\bar{p}_{jst} = \rho \ln y_{jt} + \delta_s + \delta_t + \varepsilon_{jst} \quad (1b)$$

where $\bar{p}_{jst}$ denotes the firm wage premium in firm j and year t.[2] So long as equation (1b) is estimated using employment weights, the two approaches yield identical estimates of productivity pass-through.

Assuming non-zero productivity-wage pass-through, taking the variance of equation (1b) and pooling across countries provides an alternative empirical model to estimate productivity-pass through at the firm-level while accounting for its cross-country and cross-industry pattern:

$$Var(\bar{p}_{jst})_{sct} = \rho^2 \, Var(\ln \ y_{jt})_{sct} + \delta_c + \delta_s + \delta_t + \nu_{sct} \quad (2)$$

where Var denotes the employment-weighted variance; ρ^2 denotes the squared pass-through elasticity; δ_c, δ_s and δ_t denote country, industry and time fixed effects; and ν_{sct} denotes the error term.

To identify factors associated with productivity wage pass-through, the coefficient on productivity dispersion is allowed to vary according to structural and institutional characteristics:

$$\begin{aligned} Var(\mathrm{z}_{jt})_{sct} = {} & \gamma_0 Var(\ln \ y_{jt})_{sct} + \gamma_1 Z_{sct} \\ & + \gamma_2 \, Var(\ln \ y_{jt})_{sct} \cdot Z_{sct} + \delta_c + \delta_s + \delta_t \\ & + \nu_{sct} \end{aligned} \quad (3)$$

where the parameter γ_1 captures the association between wage premia dispersion and the structural and institutional characteristics Z_{sct}, while the parameter γ_2 on the interaction term between the structural and institutional characteristics Z_{sct} and the variance of firm productivity $Var(\ln \ y_{jt})_{sct}$ captures the association with the squared pass-through elasticity. The structural and institutional characteristics are measured using dummy variables to limit the role of outliers.[3]

Notes: Estimates of productivity pass-through should be unaffected when replacing value added per worker by sales per worker so long as the share of intermediate inputs costs in sales is constant (Card et al., 2018[18]). If the share of intermediate inputs in sales is positively correlated with the value of sales, e.g. because firms pass on fluctuations in intermediate input costs to prices, pass-through estimates based on sales per worker will be lower than estimates based on value added per worker.

A more demanding approach would be to control for worker-fixed effects on top of observable time-varying worker characteristics, which would remove any correlation between productivity and wages due to unobservable workforce composition. However, this approach is only feasible in the subset of countries where workers can be followed over time, and would thus further reduce the country sample included in the empirical analysis.

More specifically, if the underlying variable is continuous, it is set to one when its value exceeds the sample median and zero otherwise. Results using continuous variables yield very similar results (see Table C.4).

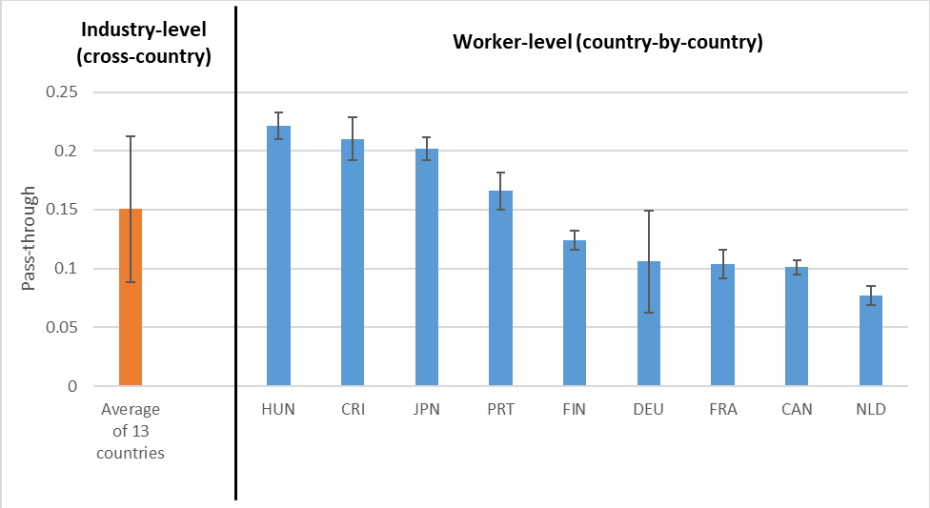
4. The size and the drivers of firm-level productivity-wage pass-through

Around one-sixth of productivity differences between firms are passed on to wage premia, contributing to wage dispersion between firms

Using the industry-level approach, the elasticity of firm-level wage premia to productivity is estimated to be around 0.15 on average across countries (Figure 5). This is in the range of estimates of firm-level productivity-wage pass-through in previous research (Card et al., 2018[18]). The country-by-country estimates based on the individual-level approach suggest that there is significant variation in pass-through across countries, with the pass-through elasticity ranging from 0.08 in the Netherlands to 0.22 in Hungary. Thus the average estimate of productivity pass-through across countries is likely to depend on country composition.

Figure 1. Firm-level productivity-wage pass-through

Industry- and worker-level approach, 2000-2015



Note: The cross-country model is based on equation (2) and estimated for 13 countries. The country-by-country model is based on equation (1a) and is estimated for a subset of countries where firm productivity is available in the linked employer-employee micro data. Error bars denote 95% confidence intervals based on cluster-robust standard errors. Countries included in the cross-country analysis are as follows: Austria (2008-2015), Canada (2001-2012), Finland (2000-2012), France (2002-2015), Germany (2003-2013), Hungary (2003-2011), Italy (2001-2015), Japan (1995-2013), Netherlands (2001-2015), New Zealand (2001-2011), Norway (2004-2012), Portugal (2004-2012) and Sweden (2002-2012). Sample periods for the country-by-country analysis are as follows: Canada (2001-2016), Costa Rica (2006-2017), Finland (2000-2017), France (2002-2015), Germany (2000-2016), Hungary (2003-2011), Japan (1995-2013), Netherlands (2001-2016), Portugal (2002-2017).
Source: OECD calculations.

Productivity pass-through is higher for skilled workers and men, contributing to wage dispersion within firms

Across firms within the same industry, productivity-wage pass-through tends to be higher for high-skilled workers than low-skilled workers and higher for men than women (Figure 6). Differences in pass-through across different groups of workers imply that productivity-wage pass-through affects both wage inequality between firms and inequality within them. With homogeneous pass-through across different groups of workers, larger productivity dispersion only raises between-firm wage inequality. It may additionally raise within-firm wage inequality if pass-through is larger for high-skilled workers and men who typically

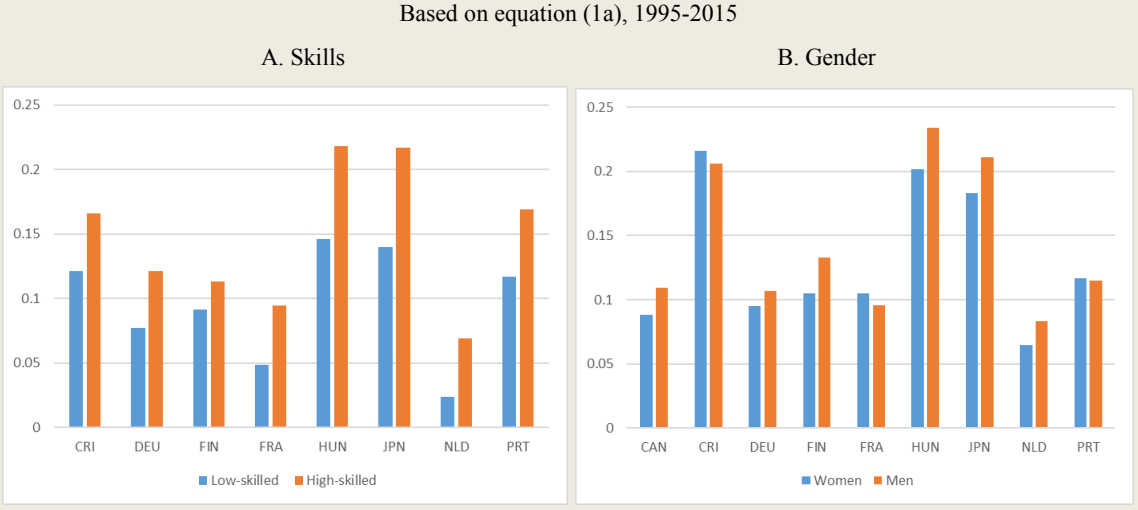
earn higher wages to begin with. In other words, larger pass-through for high-skilled workers and men provides an explanation for the empirical fact documented in Criscuolo et al. (Criscuolo et al., 2020[1])that within-firm and between-firm wage inequality tend to go together.

Box 1. Productivity-wage pass-through across different groups of workers

Estimating equation (1a) for high-skilled and low-skilled workers as well as men vs women separately suggests that pass-through is typically larger for high-skilled workers and men (Figure 6). This may partly reflect differences in labour demand and labour supply elasticities. For instance, a number of empirical studies suggest that the firm-level labour supply elasticity is particularly high for low-skilled workers (Matsudaira, 2014[19]). But higher pass-through for skilled workers could also reflect technology-skill complementarities that give rise to higher relative demand for skilled workers in more productive firms. As a result, a given productivity difference between firms may result in larger differences in the demand for skilled labour than for the demand for less skilled labour, raising productivity-wage pass-through for high-skilled workers relative to low-skilled workers. A related explanation could be that higher-skilled workers have a stronger bargaining position and may be able to negotiate higher wages in high-productivity firms. In the case of gender, worker-firm complementarities may also explain the larger pass-through for men as higher-productivity firms may disproportionately reward worker flexibility. For instance, recent evidence suggests that the gender wage gap tends to be larger in exporting firms (which tend to be more productive) than in non-exporting ones (Bøler, Javorcik and Ulltveit-Moe, 2018[20]). The opposite pattern in Costa Rica, France and Portugal could reflect monopsonic wage discrimination by profit-maximising firms based on differences between men and women in opportunities for job mobility (i.e. less elastic labour supply for women). These issues will be explored in more detail in future work of the LinkEED project.

Figure 2. Higher pass-through for high-skilled workers and men

Based on equation (1a), 1995-2015



Note: Productivity pass-through is estimated using a modified version of equation (1a) where productivity is interacted with the worker characteristic. Separate regression models are estimated for each country. Skills are measured by education (tertiary, secondary and less than secondary) where available, otherwise by occupation. Each regression controls for industry fixed effects so that the coefficients can be interpreted as within-industry pass-through for different types of workers. Education and occupation not available for Canada. Sample periods for each country: Canada (2001-2016), Costa Rica (2006-2017), Finland (2000-2017), France (2002-2015), Germany (2000-2016), Hungary (2003-2011), Japan (1995-2013), Netherlands (2001-2016), Portugal (1991-2009).
Source: OECD calculations.

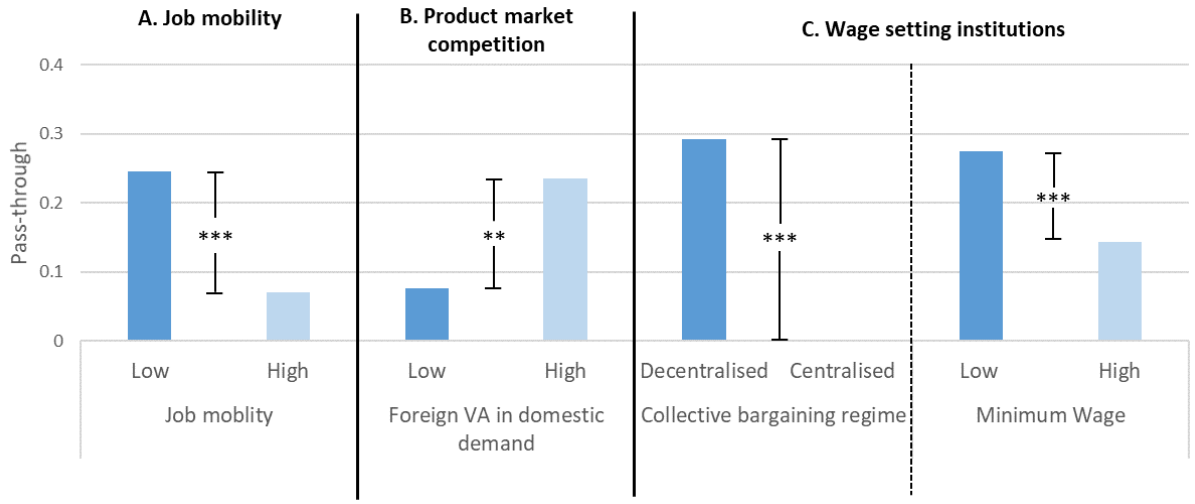
Labour market frictions are a key driver of productivity-wage pass-through at the firm level

The role of labour market frictions is analysed by relating productivity-wage pass-through to (i) the share of job-to-job transitions in employment as a proxy of voluntary job mobility, or (ii) to local labour market concentration as a proxy of employers' wage-setting power (monopsony). The results suggest that productivity-wage pass-through increases with the degree of labour market frictions as measured by a low rate of job-to-job transitions (Figure 7, Panel A). As workers do not easily move from one job to another, low-productivity employers can afford paying low wages relative to high-productivity ones. Conversely, high-productivity employers need to raise wages well above low-productivity ones to poach workers from them. The negative relation between job mobility and productivity pass-through is robust to the use of alternative measures of job mobility (Table C.3, Column 6), as well as to controlling for interactions of productivity with trade in value added and collective bargaining (Table C.2, Column 10).[14] The effect of raising job mobility on overall wage inequality through the pass-through channel is quantitatively significant: raising job mobility from the average of countries with low job mobility to the average of those with high mobility – roughly equivalent to an increase from the 20th percentile of job mobility (Greece) to the 80th percentile (Sweden) – would reduce overall wage inequality by about 15%. To put this reduction in perspective, the median increase in wage inequality across countries over the period 1995-2015 was around 10% (Criscuolo et al., 2020[1]).[15]

The importance of job mobility for productivity pass-through is confirmed in a variety of sensitivity checks (Table C.3). A first issue with the rate of job-to-job transitions as a measure of job mobility is that it may be positively correlated with the business cycle so that it may pick up the effects of low unemployment rather than job-to-job mobility. However, while the estimated coefficient on the interaction between productivity and unemployment is indeed highly significant, the rate of job-to-job transitions continues to be negatively related to productivity pass-through (Table C.3, Column 2). Similarly, controlling for the employment rate does not significantly change the estimated pass-through coefficient (Table C.3, Column 3). Another issue with the rate of job-to-job transitions is that it may be endogenous to the wage structure. For a given level of productivity dispersion, a more compressed wage structure may reduce incentives for job-to-job mobility. To reduce the risk of endogeneity, an alternative mobility measure is constructed as the product of average job mobility in all other industries in the same country and average job mobility in the same industry in all other countries. The advantage of this measure is that it can reasonably be considered as exogenous to wage-setting in a specific industry and country. The negative relation between industry labour market frictions and productivity pass-through at the firm level is robust to using this transformed variable as an instrument (Table C.3, Column 5).[16]

Figure 3. The structural and policy drivers of productivity-wage pass-through

Based on equation (3), 1995-2015



Note: Job mobility is measured by the industry-level share of job-to-job transitions in employment. Foreign value added content is defined as the industry-level share of direct and indirect foreign value added in total domestic demand. The minimum wage is incidence is measured by the ratio of the statutory minimum wage to the median wage of full-time workers. These variables are denoted high when their value exceeds the sample median, and zero otherwise. Collective bargaining regimes are differentiated only at the country level. The taxonomy of collective bargaining regimes follows (OECD, 2018[21]), where "largely or fully decentralised" countries are classed as decentralised, otherwise centralised. Country coverage: Austria (2008-2015), Canada (2001-2012), Finland (2000-2012), France (2002-2015), Germany (2003-2013), Hungary (2003-2011), Italy (2001-2015), Japan (1995-2013), Netherlands (2001-2015), New Zealand (2001-2011), Norway (2004-2012), Portugal (2004-2012) and Sweden (2002-2012).. *, ** and *** denote a statistically significant difference across the groups at the 10%, 5% and 1% levels. See Annex Table C.2 for the full results.
Source: OECD calculations.

Evidence from Portuguese LinkEED data with information on firm-productivity suggests that wages are lower and the degree of wage-productivity pass-through is generally higher in local labour markets where employment is highly concentrated in a small number of employers than elsewhere (Box 5). This is consistent with previous studies suggesting that local labour market concentration reduces the elasticity of labour supply as job opportunities in other firms decline (Azar, Marinescu and Steinbaum, 2019[22]). On average, as described in Figure 8, the empirical model suggests that wage premia are about 6% lower in firms in highly-concentrated labour markets (i.e. at the 75th percentile of the distribution of local labour market concentration) than in less concentrated ones (i.e. those at the 25th percentile). Importantly, however, while wage premia appear to be lower, productivity-wage pass-through appears to be significantly larger in highly concentrated labour markets. The most productive firms pay about 55% higher wage premia than the least productive firms in highly concentrated labour markets. By comparison, in less concentrated labour markets, this pay difference is significantly lower at around 45%. This is likely to reflect the fact that when workers have limited job options outside of their current employer, as is the case in highly concentrated labour markets, low-productivity firms can afford paying lower wages relative to high-productivity ones and nonetheless attract (or retain) a sufficient number of workers. The results account for the role of unobserved factors that affect wages and local labour market concentration and are robust to different definitions of local labour market concentration. In future work of the OECD LinkEED project, this analysis will be extended to a number of other countries for which the necessary data are available.

Box 2. The effect of local labour market concentration on firm-level productivity pass-through

This box relates local labour market concentration to firm-level productivity-wage pass-through using country-specific linked employer-employee data. The analysis is conducted for Portugal over the period 1991-2009.

The analysis closely follows the empirical approach developed in previous research analysing the effect of local labour market concentration on wages but focuses on differential productivity-wage pass-through across local labour markets with different levels of employment concentration.1 The basic estimating equation is as follows:

$$\ln w_{iojsrt} = \beta_1 x_{it} + \rho_1 \ln y_{jt} + \beta_2 \ln C_{l(o,r)t} + \rho_2 \ln y_{jt} \times \ln C_{l(o,r)t} + \delta_o + \delta_r + \delta_t + \delta_s + \varepsilon_{iojsrt} \quad (4)$$

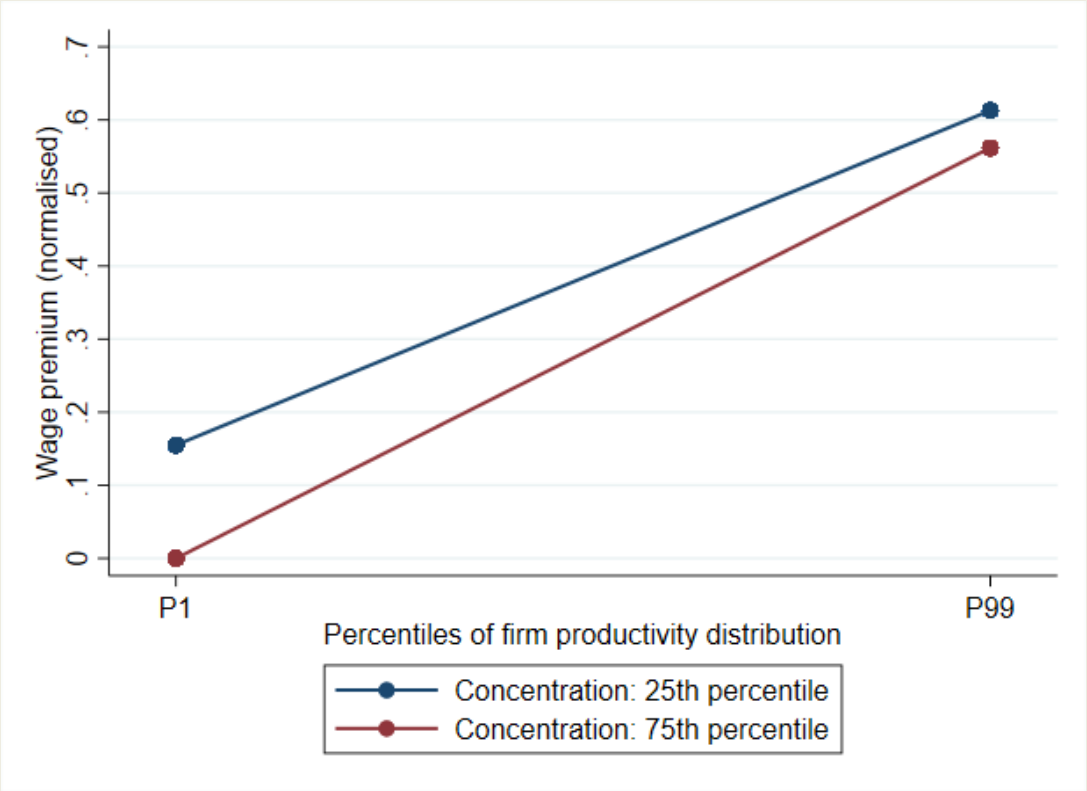
where w_{iojsrt} denotes the wage of worker i in occupation o working in firm j, sector s, region r and year t; x_{it} denotes individual worker characteristics such as gender, age and skill; (demeaned) productivity y is measured as sales per worker, C denotes (demeaned) local labour market concentration in market l, defined as an occupation-region (o-r) pair at time t, ρ_1 is the estimated average productivity pass-through parameter, β_2 is the direct effect of concentration on firm wage premia levels, ρ_2 measures the sensitivity of productivity pass-through to local labour market concentration, and δ is a set of fixed effects based on occupation, region, industry (s) and time.

Local labour market concentration is measured by the Hirschman-Herfindahl Index (HHI) for hiring in local labour markets defined in terms of regions and occupations (120 occupations by 29 regions). HHI is the sum of the squared hiring shares of firms in the local labour market. It can take values between zero (perfect competition) and one (perfect monopsony). It is preferable to other measures of concentration, as it is easy to interpret, uses information about all firms in the local labour market, and has a clear relation to policy (e.g. the Department of Justice in the United States has published guidelines on horizontal mergers based on the HHI).[2] Following the literature, labour market concentration is instrumented by average concentration across all other regions within the same occupation in order to address potential endogeneity (e.g. due to omitted labour supply or demand shocks that simultaneously affect wages and concentration).

The results suggest that local labour market concentration is associated with lower wage premia on average and higher pass-through of productivity to wages at the firm-level (Figure 8). Higher labour market concentration directly reduces wage premia as firms mark down wages by more. At the same time, the firm-level pass-through of productivity to wage premia is larger in more concentrated local labour markets, with the least productive firms able to pay significantly lower wages than the most productive ones without losing all their workers. Both results are consistent with the view that the labour supply facing individual firms is less responsive to changes in wages in highly concentrated local labour markets.

Figure 4. Labour market concentration reduces wages but raises productivity-wage pass-through

Based on equation (4), Portugal, 1991-2009



Note: The graph shows predicted values of log wage premia for different points in the firm productivity and labour market concentration distributions in Portugal. Predicted values are obtained from estimated coefficients on productivity, concentration, and their interaction; as well as the quantiles of the corresponding distributions in the regression sample. To ease interpretation, predicted values are normalised, such that the values on the y-axis correspond to log point differences with respect to the lowest wage premium. Productivity is measured as sales per worker, concentration is measured as the log of the Hirschman-Herfindahl index (HHI) for hiring. Labour market concentration is instrumented by average concentration across all other regions within the same occupation
Source: OECD calculation.

Notes: A number of recent studies analyse the effect of local labour market concentration on wages. The basic setup of these studies is to relate individual-level wages to measures of local labour market concentration while controlling for individual worker and firm characteristics. These studies typically find that firms mark down wages in highly concentrated labour market relative to less concentrated ones (Azar, Marinescu and Steinbaum, 2017[23]), for the United States; (Martins, 2018[24]), for Portugal; and (Marinescu, Ouss and Pape, 2020[25]), and (Bassanini, Batut and Caroli, 2019[26]), for France).
In robustness checks, alternative measures of concentration are used, such as the HHI defined in terms of employment instead of hires. The HHI based on hires is typically higher than the HHI based on employment as only a subset of firms hire at a given time. The hiring HHI might give a more accurate picture of local labour market concentration than the employment HHI if aggregate job mobility is low. If it is relatively easy to switch jobs, then the employment HHI might be more accurate because a firm could still be a potential employer even if it does not hire in a given year.

Product market competition raises productivity pass-through

Pass-through of productivity to wage premia is larger in industries that face stronger import competition as measured by the share of imported value added in final domestic demand (Figure 7, Panel B). In a competitive environment, a given change in productivity induces a larger adjustment in employment and thus a larger adjustment in wages, as firms passing

on the productivity gain to product prices gain a larger share of the market than in an environment with limited product market competition. According to the empirical estimates, productivity pass-through at the firm-level is about 13 percentage points larger in countries and industries with an above-median share of imported value added in final domestic demand than in those with a below-median share (22% compared with 9%). Measures that proxy domestic competition, such as industry concentration, are generally not statistically significant, which could reflect the fact that stronger product market competition may also raise competition for workers, including through the market entry of new firms (Table C.2).[17]

Wage-setting institutions can constrain productivity pass-through at the firm-level

The decentralisation of collective bargaining tends to increase the pass-through of firm-level productivity to wages (Figure 7, Panel C).[18] Collective bargaining systems characterised by a predominance of industry-level bargaining (labelled "centralised") focus on industry-wide productivity in wage setting, whereas systems based on a predominance of firm-level bargaining (labelled "fully or largely decentralised") allow for larger differentiation of wages according to firm-specific productivity. [19] Country-specific evidence on decentralisation of collective bargaining in Germany supports the cross-country evidence on the positive link between decentralisation and productivity-wage pass-through at the firm-level. In Germany, there has been a tendency towards more flexibility in wage setting at the firm-level over the past three decades, partly driven by the increased scope for within sector-level agreements in bargaining at the firm-level and partly by declining collective bargaining coverage, which has tended to raise the pass-through of firm-level productivity to wages (Box 6).

Box 3. The decentralisation of collective bargaining in Germany and the pass-through of firm-specific productivity performance to wages

In countries where collective bargaining takes place predominantly at the industry level, including in Germany, concerns about the flexibility of firms to adjust wages in line with productivity have given rise to calls for the decentralisation of collective bargaining. The introduction of flexibility in such systems is typically considered as requiring a shift from sector to firm-level bargaining. While such a shift would indeed provide more flexibility to firms, it would also tend to reduce collective bargaining coverage. A number of countries have therefore sought to introduce more flexibility at the firm-level within the broader framework of industry-level bargaining through a process of "organised decentralisation".

In Germany, there has been a strong shift towards decentralised collective bargaining since the 1990s. The process shares elements of organised decentralisation, such as the introduction of opting-out clauses in industry-level collective agreements. At the same time, state support for industry-level collective bargaining has tended to weaken, notably through the reduced use of administrative extensions. This process of decentralisation has been associated with one of the strongest declines in collective bargaining coverage in the OECD, with collective bargaining coverage declining from about 85% in 1990 to less than 60% in 2015. The decline in coverage may in turn have undermined the effectiveness of wage coordination across industries in which the metal industry sets a wage norm for subsequent collective wage negotiations in other industries.

This process of decentralisation in Germany could potentially have had important implications for the pass-through of productivity to wages. The introduction of opt-out clauses in industry-level agreements is likely to allow for wage differentiation between firms according to their productivity, but reduce the pass-through of industry-wide productivity performance. There is indeed some evidence that suggests that firm-level productivity pass-through is stronger among firms not covered by collective bargaining (Gürtzgen, 2009[27]) and that the rise in between-firm wage dispersion is related to the tendency of new firms to opt out of sectoral collective bargaining (Card, Heining and Kline, 2013[28]).

New evidence for Germany suggests that the pass-through of both firm-specific and industry-level productivity has tended to increase since the late 1990s/early 2000s (Table 1). The rise in the pass-through of firm-specific productivity gains is consistent with the trend towards greater decentralisation of collective bargaining. The increase in the pass-through of industry-wide productivity gains suggests that there has also been an increasing pass-through of wages and productivity at the industry level. In principle, this could indicate that the system of wage coordination across sectors has weakened over time, possibly as a result of the decline in collective bargaining coverage.[1] The increase in pass-through at the industry and firm levels contributed to increasing wage dispersion between firms, both within and between industries.

Table 1. Firm-specific and industry-level productivity-wage pass-through in Germany

	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled		1995-2005		2006-2015	
Pass-through	Firm	Industry	Firm	Industry	Firm	Industry
Overall	0.10***	0.23***	0.07***	0.06	0.14***	0.19***
	(0.02)	(0.04)	(0.02)	(0.05)	(0.01)	(0.05)
Manufacture	0.09***	0.31***	0.06**	0.14*	0.16***	0.22***
	(0.02)	(0.07)	(0.03)	(0.08)	(0.01)	(0.07)
Services	0.11***	0.08	0.11***	0.04	0.11***	0.04
	(0.01)	(0.06)	(0.01)	(0.08)	(0.01)	(0.08)

Note: The table shows the estimated elasticity of firm-level productivity, measured as sales per worker, and industry-level productivity measured as value added per worker, on gross monthly earnings. The estimates control for gender, a third power polynomial of age, the interaction between age profiles and gender, as well as year and industry fixed effects. The total sample consists of 11,301,867 observations; of which 8,153,583 are in manufacturing and 3,148,284 in services. *, ** and ** denote statistical significance at the 10%, 5% and 1% levels.
Source: OECD calculations

Notes: The pass-through of industry-wide productivity gains is much larger than the pass-through of firm-specific productivity gains, which is consistent with previous studies (Carlsson, Messina and Skans, 2016[29])

Statutory minimum wages (relative to the median wage) also tend to reduce productivity pass through at the firm-level (Figure 7, Panel C). A key argument for the use of minimum wage is to contain the wage-setting power of employers in imperfectly competitive labour markets and ensure fair wages for workers, particularly those with limited skills or a weak bargaining position.[20] The results suggests that the impact of minimum wages on overall wage dispersion, as documented for example in OECD (2018[30]), is partly driven by a reduction in wage dispersion between firms for a given level of productivity dispersion. The compression of the wage distribution may have adverse effects on the efficiency of labour allocation but recent evidence for Germany and Israel suggests that this may not necessarily be the case. Higher minimum wages may force low-productivity firms to raise productivity or exit the market, thereby reducing productivity dispersion (Drucker, Mazirov and Neumark, 2019[31]; Dustmann et al., 2020[32]).

5. Policy implications and concluding remarks

While wage differences between firms originating from productivity-wage pass-through provide incentives for workers to move from lower-productivity to higher-productivity firms, they also raise overall wage inequality and have been a major factor in rising overall wage inequality in many OECD countries (Criscuolo et al., 2020[1]). The results in this paper suggest that the extent of firm-level productivity-wage pass-through is shaped by the degree of competition in labour and product markets, as well as the nature of wage-setting institutions. Conditional on productivity dispersion, wage dispersion between firms increases with frictions in the labour market and is amplified by strong product market competition and decentralised collective bargaining. The key policy question raised by these empirical results is how to promote productivity-enhancing reallocation without widening pay differences between firms, especially in a context of potentially large shifts in labour demand across firms and industries in the wake of the COVID-19 crisis.

The main policy implication emerging from this paper is that facilitating voluntary job mobility of workers would not only raise productivity growth by easing reallocation from low to high-productivity firms but may also limit wage dispersion between firms by weakening the link with productivity dispersion. In the absence of complementary measures to facilitate job mobility and strengthen competition in labour markets, trade and competition-friendly product market reforms as well as the gradual decentralisation of collective bargaining in countries with a strong tradition of sector-level bargaining risk raising overall inequality by raising wage dispersion between firms. Policies that would facilitate job mobility and strengthen competition in labour markets include:

- Limiting legal and contractual barriers to job mobility can promote competition between employers for workers and strengthen worker incentives for taking up new opportunities. Opportunities for job mobility tend to be more limited in more concentrated local labour markets (Naidu, Posner and Weyl, 2018[33]; OECD, 2019[8]) and where the importance of non-compete clauses, no-poaching agreements, and occupational licensing requirements is greater (Nicoletti, Von Rueden and Bambalaite, 2020[6]; Kleiner and Xu, 2020[34]; Lipsitz and Starr, 2019[35]).
- Strengthening adult learning and taking a more comprehensive approach to activation that goes beyond promoting access to employment would help workers find better jobs in other firms. For instance, public employment services in the form of job-search assistance, training and career counselling could be made available to workers in jobs that are supported by job retention schemes that were used on a massive scale in most OECD countries to curb job losses as a result of the COVID-19 crisis (OECD, 2020[10]; OECD, 2020[36]). More generally, public employment services could be made available to all workers who would like to progress in their careers but face significant barriers in moving to better jobs, including people in non-standard forms of work, as well as people who are currently employed but lack relevant skills or live in lagging regions. This would require a more active role of public employment services in advising workers on adult learning opportunities, as well as collecting information on skill requirements of prospective employers.
- Mobility across geographical areas could be fostered by reforming housing policies, including by redesigning land-use and planning policies that raise house price differences across locations, reducing transaction taxes on selling and buying a home, and relaxing overly strict rental regulations (Causa and Pichelmann,

2020[11]). Social cash and in-kind expenditure on housing could also support residential mobility by raising the affordability of housing for low-income households, especially if such expenditure is designed in such a way that benefits are fully portable across geographical areas.

- An expansion of telework could partly compensate for limited geographical mobility. A significant fraction of jobs can potentially be conducted remotely – between one-quarter and one-third of all jobs according to some estimates (Dingel and Neiman, 2020[37]; Boeri, Caiumi and Paccagnella, 2020[38]; OECD, 2020[12]) – potentially raising job opportunities for workers and reducing costs to move from one job to another. Promoting telework will require strengthening digital infrastructure to increase network access and speed for all workers as well as digital adoption by firms; enhancing workers' ICT skills through training; as well as raising employers' management capabilities through the diffusion of managerial best practices (Nicoletti, von Rueden and Andrews, 2020[4]; OECD, 2020[12]).

A significant degree of barriers to job mobility are likely to remain even after addressing policy distortions that contribute to labour market frictions. Workers differ in their preferences for jobs in different firms, industries and geographical areas as well as their ability to perform them, and firms differ in terms of non-wage working conditions and skill requirements, which creates inherent barriers to job mobility. Moreover, raising job mobility may not be the most effective policy to address within-firm wage inequality, which is likely to mainly reflect differences in individual worker characteristics such as skills or gender. Skills policies that allow all workers to acquire and update relevant skills over the life cycle and policies that raise women's opportunities to work in high-productivity firms, including through flexible work schedules and telework, will need to complement policies to raise job mobility. Tax and benefit systems can also prevent workers who have limited job opportunities despite measures to promote mobility, skills and working time flexibility from experiencing poverty and financial hardship.

In principle, wage-setting institutions in the form of minimum wages and collective bargaining could help to contain the wage-setting power of firms in labour markets with limited job mobility, thereby reducing pay differences between them. In areas and occupations where wages are well below workers' productivity, this could even raise employment by raising labour market participation among people who are unwilling to work at current wages. However, there is a risk that wage floors are set at levels in excess of workers' productivity, which would reduce employment. This risk could be reduced by combining centralised collective bargaining with sufficient scope for further negotiation at the firm level, and focusing minimum wage increases on areas and groups for which initial levels of wages are low. Ongoing research based on a comparison between Norway and the United States further suggests that wage compression between firms does not necessarily reduce the efficiency of labour allocation between firms (Hijzen, Lillehagen and Zwysen, 2021[39]). The key to achieve high productivity through an efficient allocation of labour is to complement wage-setting institutions that constrain the ability of firms to pay different wages for similar workers with measures that promote innovation in low productivity firms and strengthen job mobility.

Endnotes

[1] Weakening the firm-level link between productivity and wage premia should not viewed as a policy objective *per se* but as the consequence of policies that reduce job-mobility reducing distortions in the economy.

[2] To the extent that job mobility may have direct effects on productivity dispersion between firms, the overall downward effect of higher job mobility on wage inequality may be larger or smaller. It may be larger if higher job mobility forces low-productivity firms out of business but it may be smaller if increased sorting of high-skilled worker into high-technology firms raises productivity in the technologically most advanced firms.

[3] Self-employed workers without employees and public sector employees are excluded from the analysis.

[4] In formal terms, firm premia are recovered as the estimated firm effects in the equation $\ln w_{ijt} = x_{it}\beta + z_{jt} + \varepsilon_{ijt}$, where w_{ijt} denotes the wage of worker i in firm j at time t; x_{it} denotes a vector of observable worker characteristics; β denotes the estimated return to these characteristics; z_{jt} denotes firm fixed effects of firm j in year t; and ε_{ijt} denotes the error term (Barth et al., 2016[14]).

[5] Criscuolo et al. (2020[1]) show that the level and evolution of overall wage inequality in these datasets generally line up well with comparable statistics based on the OECD Earnings Distribution Database.

[6] Criscuolo et al. (2020[1]) show for selected countries for which this is possible that accounting for unobservable differences in workforce composition between firms related slightly reduces the contribution of firm wage premia to the overall *level* of wage dispersion, but has no systematic impact on their contribution to *changes* in overall wage dispersion.

[7] A large body of evidence has documented significant and persistent inter-industry wage differentials (Abowd et al., 2012[43]; Jean and Nicoletti, 2015[46]).

[8] The empirical analysis reported below focuses on explaining wage premium dispersion within 2-digit industries, which accounts for the major part of wage premia dispersion between firms. Evidence for the United States suggests that at a higher level of industry disaggregation the contribution of the between-industry component may account for a significantly higher share of overall wage premia dispersion (Haltiwanger and Spletzer, 2020[40]).

[9] This mechanism is illustrated in more detail using the simple static monopsony model in Annex A. In static and dynamic monopsony models, high-productivity firms unilaterally post high wages to attract workers who are imperfectly mobile. Wage setting in the static monopsony model is analysed in Robinson (1933[44]), Manning (2003[42]), Card et al. (2018[18]) and Lamadon et al. (2020), while analyses of the dynamic monopsony model include Burdett and Mortensen (1998[45]) and Manning (2011[41]). Another alternative micro-foundation for an upward-sloping labour supply curve are efficiency wage models in which the effective labour input that firms receive rises with the wage because higher-paid workers exert more effort (Manning, 1995[48]).

[10] In the static monopsony model, wages of all firms are marked down by a constant factor relative to their marginal products of labour but firm-level wages are proportional to firm-level productivities.

[11] Job mobility is also determined by worker preferences over non-wage characteristics of jobs (Manning, 2003).

[12] The measure is calculated at the country-industry level from the European Labour Force Survey over the period 2000-17 (Causa and Luu, 2020[47]).

[13] The distinction between decentralised and more centralised collective bargaining systems in based on the OECD taxonomy of collective bargaining systems which consists of three main building blocks (OECD, 2019): i) the level of bargaining at which collective agreements are negotiated (e.g. firm level, sector level or even national level); ii) the role of wage co-ordination between sector-level (or firm-level) agreements to take account of macroeconomic conditions; iii) the degree of flexibility for firms to modify the terms set by higher-level agreements.

[14] The results are qualitatively unchanged when using a measure of job-to-job mobility that accounts for transitions from other industries in addition to within-industry transitions.

[15] Average pass-through when job mobility is low is 25% versus 7% when job mobility is high (Figure 7). At the median value of productivity dispersion (corresponding to France for where the variance of log productivity was 0.68 in the last year) this translates into a 0.037 log-point difference in overall wage variance, which is about 15% of the median overall wage variance across countries in the last available year. The average annual rate of job-to-job transitions is about 5.8% when job mobility is low (roughly corresponding to the value for Greece, Figure C.2), while it is around 10% when job mobility is high (roughly corresponding to the value for Sweden).

[16] The negative relation between job mobility and pass-through is also robust to a more flexible fixed effects structure (Table C.5) and replacing discrete explanatory variables with continuous variables (Table C.4).

[17] A complementary explanation may be that measures of industry concentration may not be meaningful indicators of competitive pressures in highly globalised economies, especially in manufacturing industries. Additionally, industry concentration could partly reflect large economies of scale or scope that do not necessarily imply a lack of product market competition so long as market entry is contestable. Unreported results suggest that more competition-friendly product market regulation reduces pass-through, but product market regulation indicators are not available at the country-industry level, and the effect on pass-through is thus identified through cross-country variation and variation over time only.

[18] The associations are effectively based on comparisons of the average degree of productivity pass-through within sectors across groups of countries with different collective bargaining systems. Since collective bargaining systems tend to be deeply embedded in a countries' broader institutional set-up, it is difficult to isolate the impact of specific collective bargaining systems in the present framework.

[19] For the purposes of the econometric analysis underlying Figure 7, "centralised" and "organised decentralised" collective bargaining systems are grouped together. Centralised countries include France, Italy and Portugal; organised decentralised countries include Austria, Germany, Netherlands, Norway and Sweden, and largely or fully decentralised countries include Canada, Costa Rica, Hungary, Japan and New Zealand.

[20] The use of minimum wages has also been justified based on arguments i) to promote work incentives by making work pay; ii) boost tax revenue and/or tax compliance by limiting the scope of wage under-reporting; and iii) anchoring wage bargaining.

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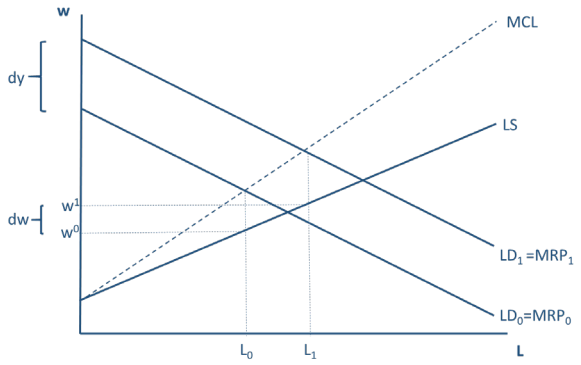
Annex A. Firm-level productivity-wage pass-through: The static monopsony model

In a perfectly-competitive labour market, there are no frictions related to the costs of finding and changing jobs that limit workers' job options outside of their firms. In such a setting, all firms pay the single market wage irrespective of their productivity since no worker would accept a lower wage and paying a higher wage would reduce firms' profits. In formal terms, this implies that firms are price-takers in labour markets, with the labour supply curve being flat ("perfectly elastic"). Workers receive a wage equal to the market wage, which is in turn equal to workers' marginal product. Importantly, the market wage is independent of the productivity of the firm for which they work.

In imperfectly-competitive labour markets with frictions related to the cost of finding and changing jobs, or preferences over jobs' non-wage characteristics, workers' job options outside of their firms are limited. Consequently, not all workers quit when paid less than their marginal product and individual firms face an upward-sloping labour supply curve, which describes reservation wages of marginal workers (Figure A.1).1 Assuming that firms are unable to observe the outside options of individual workers (i.e. they cannot price discriminate between them), the cost of attracting additional workers (i.e. the marginal cost of labour) typically exceeds their reservation wage.2 Firms set wages so that labour supply to the firm corresponds to the profit-maximising employment levels, i.e. where the marginal revenue product of labour (MRP) and the marginal cost of labour (MCL) are the same.3

As productivity increases, at each level of employment the more productive firm is in principle willing to pay a higher wage (i.e. labour demand shifts outwards), since higher productivity allows it to absorb higher labour costs. Thus, firm-level wages co-move with productivity even for workers with identical earnings characteristics. Labour demand of the high-productivity firm (firm 1) is above that of the low-productivity firm (firm 0), resulting in a positive wage gap between the high-productivity and the low-productivity firm (w1 - w0). In other words, there is positive pass-through of productivity to wages at the firm level, leading to dispersion in wages that is proportional to productivity dispersion. By contrast, in perfectly competitive labour markets with perfectly elastic labour supply, firms have no wage-setting power and productivity dispersion does not translate into wage dispersion between firms.

Figure A.1. Firm-level productivity-wage pass-through in imperfectly competitive labour markets



Note: w: wage; dw: wage dispersion; dy: labour productivity dispersion; L: employment; LS: (inverse) labour supply curve; LD: (inverse) labour demand curve; MRP: marginal revenue product of labour; MCL: marginal cost of labour.
Source: OECD.

The degree of productivity pass-through (i) declines with the elasticity of labour supply; (ii) increases with the elasticity of labour demand; and (iii) declines with the level of institutional wage floors (Annex A).

I. A decline in the elasticity of labour supply rotates the labour supply curve anti-clockwise, so that a given productivity difference between firms translates into a larger equilibrium wage difference. The elasticity of labour supply increases with job mobility, which is in turn partly determined by labour market frictions (Figure A.2, Panel A).

II. An increase in the labour demand elasticity rotates the labour demand curve anti-clockwise, so that a given productivity difference between firms – as measured by the vertical distance in the labour demand curve – translates into a larger difference in firm wage premia (Figure A.2., Panel B). The elasticity of labour demand increases with competition in product markets.

III. Collectively- agreed wage floors at the industry level or statutory minimum wages may raise wages of low-productivity firms above their profit-maximising levels, which would reduce wage differences between firms at any given productivity difference.

Notes: Firm-level and aggregate labour elasticities are fundamentally different concepts. Firm-level elasticities capture the degree of competition between firms for workers (or opportunities of workers outside of the firm) whereas aggregate elasticities capture the decision to participate in the labour market.
The inability or unwillingness of firms to price discriminate between workers implies that existing workers are paid the same wage as newly hired workers. This means that labour costs increase more quickly when expanding employment than is suggested by the labour supply curve. If firms could perfectly observe workers' reservation wages, the marginal cost of labour and the labour supply curve would coincide.
Note that the wage set by the firm is below the marginal revenue product of labour (i.e. wages are "marked down") in inverse proportion to the elasticity of labour supply to the firm. If firms could perfectly observe workers' reservation wages, equilibrium wages would be equal to the marginal revenue product of labour but, since marginal revenue products are not equalised across firms, wages would nonetheless be proportional to the firm's average productivity. In other words, firm-level productivity-wage pass-through does not hinge on the assumption of unobservable reservation wages and marked down wages, but on an upward sloping labour supply curve.

Productivity pass-through declines with the elasticity of labour supply

A reduction in the elasticity of labour supply rotates the labour-supply curve anti-clockwise, giving rise to an upward-sloping labour-supply curve (Figure A.2, Panel A). The productivity difference between a less productive firm 0 and a more productive firm 1 – as reflected by the vertical distance between their labour demand curves, LD0 and LD1

– translates into a difference in firm wage premia (w1(B)-w0(B)). The pass-through of productivity to wages (and wage dispersion at any given level of productivity dispersion) declines with the elasticity of labour supply, i.e. the flatter the labour supply curve. At the same time, wages are marked down relative to marginal labour productivity, implying that workers earn less on average in the imperfectly-competitive equilibrium than in the perfectly competitive one.

The elasticity of labour supply to the individual firm is partly determined by job mobility, which in turn depends, among other things, on local labour market concentration; the number of job vacancies per firm; hiring and firing costs (e.g. employment protection); the availability of easily accessible information on job opportunities (e.g. on-line platforms, public employment services); and regulatory barriers to mobility such as occupational licensing or distortions in the housing market (e.g. high taxes on housing transactions). In some cases, job mobility may also be held back by tacit agreements between firms not to hire workers from each other (no-poaching agreements) or contract clauses that prevent workers from moving to competing firms during a certain period (non-compete clauses).

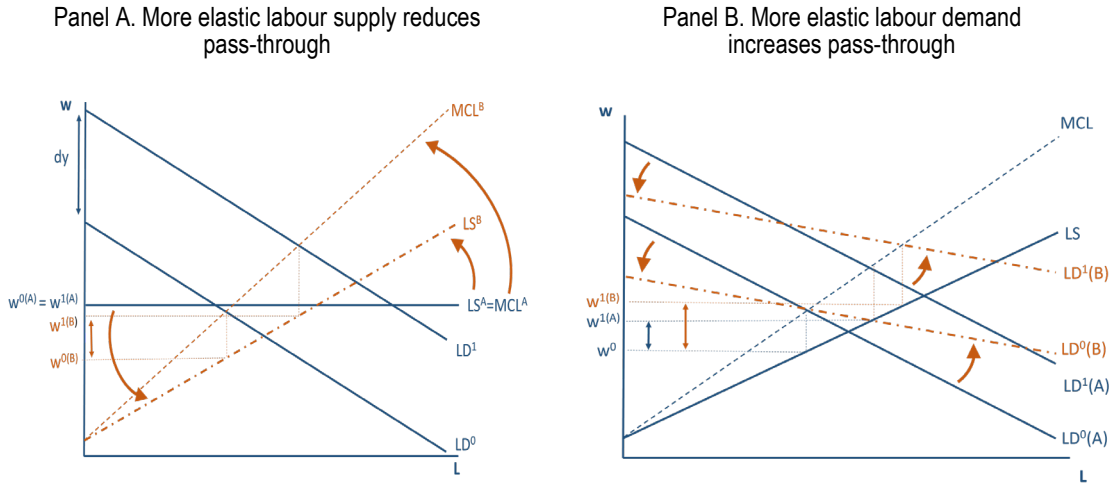
Productivity pass-through increases with the elasticity of labour demand

An increase in the elasticity of labour demand rotates the labour-demand curve anti-clockwise, making the labour-demand curve flatter (Figure A.2, Panel B). The productivity difference between two firms, as reflected by the vertical distance in the labour demand curve, translates into a larger difference in firm wage premia the higher the elasticity of labour demand (w1(B)-w0 compared with w1(A)-w0). The wage-elasticity of labour demand increases with the price-elasticity of final demand (product market competition) and the elasticity of substitution between labour and other factors of production, such as capital or services (automation, outsourcing and offshoring).

A pro-competitive environment in product markets, which could for instance reflect domestic product market policies or trade policies, tends to raise the price-elasticity of final demand and thereby the wage-elasticity of labour demand. In such an environment, a change in productivity induces a larger response of output and employment at any given level of wages (a larger horizontal shift in labour demand). Given an upward sloping labour supply curve, wages need to adjust by more to accommodate the shift in labour demand.

Technology also shapes the transmission of productivity to wages, but is likely to be less relevant in practice. Automation and offshoring increase the ease with which labour can be substituted by capital or imported intermediate inputs and hence increases the sensitivity of firm employment to wages. In imperfectly competitive labour markets this has a tendency to mitigate the effects of productivity dispersion on wage dispersion by reducing the labour intensity of production in more productive firms. Given the second-order role of technology via this channel in the present framework this will not be analysed empirically.

Figure A.2. Labour demand and supply elasticities determine firm-level productivity-wage pass-through



Note: w: wage; L: employment; LS: Inverse labour supply curve; LD: Inverse labour demand curve. In Panel A, initially labour supply LSA is perfectly elastic and equals the marginal cost of labour MCLA. Then labour supply rotates clockwise to LSB (less elastic) and a wedge opens up with the marginal cost of labour MCLB that tilts even more. In Panel B, initially labour demand of firms 0 and 1 is at LD0(A) and LD1(A). Then labour demand of both firms rotates counter-clockwise to LD0(B) and LD1(B), respectively (more elastic).
Source: OECD.

Wage-setting institutions constrain productivity pass-through at the firm level

Collectively agreed wage floors at the industry level or statutory minimum wages may raise wages of low-productivity firms above their profit-maximising levels (w^0 in Figure A.1). This would reduce wage premia dispersion between firms at any given level of productivity dispersion, i.e. it would weaken the degree of firm-level productivity-wage pass-through. The coordination of collective bargaining outcomes across sectors by means of wage norms or wage ceilings would also tend to reduce wage premia differences but mainly between industries rather than between firms (OECD, 2019[13]). By contrast, the decentralisation of collective bargaining from the industry to the firm level is likely to increase firm-level productivity-wage pass-through with respect to either industry-level or national-level collective bargaining.

Annex B. LinkEED database

Table B.1. Overview of Data Sources

		Coverage	Employer	Sample structure	Longitudinal	Earnings data	Working time	Worker skills	Productivity data
Austria	AMS-BMASK Arbeitsmarktdaten-bank	All private sector employees 1972-2016 (current sample period in LinkEED: 2008-2015)	Firm	Universe	Yes	Gross monthly earnings	Days worked (but no information on hours or part-time status)	Occupation	No information
Canada	Longitudinal Worker Files (LWF)	Salaried and self-employed in administrative tax records: 1989-2016 (current sample period in LinkEED: 1991-2016)	Firm	Universe	Yes	Annual earnings	No information	No information	No information
	Canadian Employer-Employee Dynamics Database (CEEDD)	Salaried and self-employed in administrative tax records: 2001-2015	Firm	Universe	Only for workers	Annual earnings	No information	No information	Yes, revenue and value added from business registry and corporate tax records
Costa Rica	Sistema Centralizado de Recaudación (SICERE) from CCSS	All workers affiliated to social security fund, 2006-2017	Firm	Universe	Yes	Gross monthly earnings	No information	Occupation	Yes, sales and value added through link with REVEC (Ministry of Finance)
Estonia	Data from the Tax and Customs Board Register	All workers (sample period used in LinkEED: 2002-2018)	Firm	Universe	Yes	Taxable annual income (inc. bonuses)	Number of months	No information	No information
France	Déclaration annuelle des données sociales unifiée (DADS) Panel	Private sector employees 1976-2015 (sample period used in LinkEED: 2002-2015)	Firm (aggregated from establishment level)	Random worker sample (1/25th before 2002; 1/12th after)	Yes	Annual gross salary	Days worked; hours, and part-time coefficient.	Occupation.	Yes, for universe of firms through link with FARE/FICUS
Finland	FOLK employment data from Statistics Finland, Employer Payroll Report from Tax Administration	Full population of employees including paid employees and the self-employed 1999-2017 (sample period used in LinkEED: 2000-2017)	Firm	Universe	Yes	Annual gross earnings including cash benefits and bonuses	Days worked (but no information on hours or part-time status)	Education	Yes, for universe through link with Business Register data and Financial Statement Statistics (FSS)
Germany	LIAB (also available from previous rounds: integrierte Erwerbsbiographien)	Private sector employees: 1975-2017 (East Germany from 1993) (sample period used in LinkEED: 1996-2016)	Establishment	Universe of workers that are matched with employer that is included in the Betriebspanel (6.4% of all workers)	Yes	Taxable payroll earnings.	Days worked. Indicator for part-time work, but no information on hours.	Education and Occupation	Yes, sales from IAB Betriebspanel (around 16,000 establishments)

		Coverage	Employer	Sample structure	Longitudinal	Earnings data	Working time	Worker skills	Productivity data
Hungary	ADMIN II - Panel of administrative data (OEP, ONYF, NAV, NMH, OH)	Full population, including employees and self-employed, are observed with payment records and transfers, 2003-2011	Firm	50% random sample of population, taken in 2003	Yes	Gross monthly wage.	Days worked in month (but no information on hours)	Occupation	Yes, for link to corporate income tax balance sheet data
Italy	Longitudinal Sample social security INPS (LoSai)	All salaried workers, 1985-2015	Firm (social security reporting unit)	1/15th random sample of workers	Yes	Daily pay.	Days worked. Part-time indicator and coefficient	Limited measure of occupation	No
Japan	Basic Survey of Wage structure	Employees working in larger than 50 employee firms (sample period used in LinkEED: 2005-2013)	Establishment	Sampling prefecture by industry	yes at the establishment level, no at the individual level	Earnings in January, annual bonuses in previous year	Hours worked in June	Years of education	Yes
	Basic Survey of Japanese Business Strcture and Activities	Employees working in larger than 50 employees firms and over 10M JPY capital stock	Firm	Census	No				Yes
Netherlands	Basisadministratie Persoonsgegevens (GBA), Algemeen Bedrijven Register (ABR) and Hoogsteopltab.	All salaried workers: 2006-2016	Enterprise (bedrijfs-eenheid): More aggregate than establishment	Universe	Yes	Gross taxable wage, including bonuses and subsidies	Hours worked. Indicator for part-time workers	Education (for about half the sample, with sample weights)	Yes, information on productivity for firms with at least 10 workers.
	Baanmerkenbus and Baanpersonenbus, GBA, ABR	All salaried workers: 1999-2016 (sample period used in LinkEED: 2001-2016)					Days worked. Part-time indicator and coefficient		
New Zealand	Integrated Data Infrastructure (IDI) – Inland Revenue (IR) & Business Register data	Universe, 1999-2017 (monthly) (sample period used in LinkEED: 2000-2017)	Firm	Universe	Yes	Gross monthly earnings	No information	Cross-sectional data from linked Census 2013 on occupation/educatio n	For around 70% of firms. Coverage increasing with firm size (currently not available in LinkEED)
Norway	Earnings data (Tax Register), augmented with employment history (National Education database)	All workers in tax records, 2004-2014 (sample period used in LinkEED: 2004-2014)	Firm	Universe	Yes	Total annual earnings	Days worked per year, hours worked per week, indicator for part time	Education and Occupation	For a subset of firms (currently not available in LinkEED)

		Coverage	Employer	Sample structure	Longitudinal	Earnings data	Working time	Worker skills	Productivity data
Portugal	Quadros de Pessoal	Private sector employees, 1994-2017 (sample period used in LinkEED: 2002-2017)	Firm	Universe	Yes	Earnings in the reference month (generally October)	Hours worked. Part-time indicator	Education, occupation and job title	Sales
Spain	Muestra Continua de Vidas Laborales con Datos Fiscales (MCVL-CDF)	Everyone affiliated to general social security system, 1980-2016 (sample period used in LinkEED: 1996-2016)	Establishment and firm	Random 4% sample of people	Yes, including retro-spectively from 1980	Annual earnings.	Hours worked. Indicator for part-time and coefficient.	Education and occupation	No
Sweden	SES	All employees employed in November, 1997-2014 (sample period used in LinkEED: 1999-2015)	Firm and establishment	100% of the public sector; stratified sample covering 50% of all private sector firms	Yes (if they remain in the same firm)	Annual earnings	Hours worked	Education if trained in Sweden	Yes, for all private sector firms (currently not available in LinkEED)
United Kingdom	Annual Survey of Hours and Earnings (ASHE)	1998-2018 (sample period used in LinkEED: 1998-2018)	Firm	1% random sample of national insurance records	Yes	Weekly baseline pay; overtime pay and incentive pay	Basic hours and total hours	Occupation	Yes, through link with business structure database, BDS (currently not available in LinkEED)

Annex C. Supplementary tables and figures

Table C.1. Explanatory variables

Variables included in the regression analysis

	Variable	Definition	Variation	Source
Labour supply elasticity	Rate of industry job-to-job transitions	Annual job-to-job transitions within the industry as a share of total employment in the industry	Country-sector-year	Causa and Luu (2020) based on EU-LFS
Labour demand elasticity	Foreign value added in domestic final demand	Share of foreign value added (direct or via intermediate inputs) in domestic final demand of an industry	Country-sector-year	OECD TiVA database
	Import share	Imports over value added of an industry	Country-sector-year	OECD TiVA database
	Industry concentration	Share of 8 largest business group in the sales of each industry (CR8)	Country-sector-year	Bajgar, Criscuolo and Timmis (2019)
Wage-setting insitutions	Collective bargaining (CB)	Decentralised CB includes countries with largely or fully decentralized CB systems in the OECD taxonomy	Country-year	OECD (2019)
	Minimum Wage incidence (Kaitz index)	Ratio of statutory minimum wage to median wage of full-time employees	Country-year	OECD earnings database

Note: Continuous variables are transformed into binary variables in the regression analysis, by means of a split among the median into high and low values of the variable.

Table C.2. Structural and institutional drivers of firm-level productivity pass-through

Based on equation (3), 1995-2015

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variable:	**Var(Firm Wage Premia)**								
	Var(Firm Productivity)	0.02**	0.06***	0.01	0.01	0.05**	-0.00	0.08***	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)
Labour supply elasticity	Var(Prod) x High rate of industry job-to-job transitions		-0.06***							-0.02**
			(0.01)							(0.01)
Labour demand elasticity	Var(Prod) x High share of foreign VA in domestic final demand			0.05***	0.06***					0.02*
				(0.02)	(0.02)					(0.01)
	Var(Prod) x High share of imports over value added				-0.01					
					(0.02)					
	Var(Prod) x Highly concentrated industry					0.01				
						(0.02)				
Wage-setting institutions	Var(Prod) x Decentralised collective bargaining country						0.09***		0.07***	0.07***
							(0.02)		(0.02)	(0.01)
	Var(Prod) x High minimum wage relative to median wage							-0.05***	-0.01	
								(0.02)	(0.01)	
	Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Industry fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Non-interacted determinant		YES	YES	YES	YES	YES	YES	YES	YES
	Observations	2,823	2,823	2,823	2,823	2,823	2,823	2,823	2,823	2,823
	Adjusted R^2	0.70	0.74	0.74	0.74	0.76	0.78	0.78	0.80	0.81

Note: Variances of productivity and firm wage premia within each industry-country-year cell are weighted by employment of each firm. Productivity refers to value added per worker. Each regression contains a full interaction with an indicator for any missing values on the independent variables. Standard errors clustered at the country-sector in parentheses. *, ** and ** denote statistical significance at the 10%, 5% and 1% levels. Following equation (3), implied productivity pass-through can be calculated from these coefficients as $\sqrt{\tilde{\rho}}$ for the reference group, and $\sqrt{\tilde{\rho} + \gamma_1} - \sqrt{\tilde{\rho}}$ for the difference with respect to the reference group.

Table C.3. Robustness: Job-to-job mobility

Based on equation (3), 1995-2015

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable:	**Var(Firm Wage Premia)**									
Model:	OLS	OLS	OLS	OLS	IV-2SLS	OLS	OLS	OLS	OLS	IV-2SLS
Var(Firm Productivity)	0.06***	0.06***	0.05***	0.07***	0.05***	0.05***	0.06***	0.03***	0.06***	0.03**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Var(Prod) x High rate of industry job-to-job transitions	-0.06***	-0.06**	-0.04***	-0.07***	-0.04***					
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)					
Var(Prod) x High rate of job-to-job transitions (incl. from other industries)						-0.04***	-0.04***	-0.03**	-0.05***	-0.01
						(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Var(Prod) x Unemployment rate		-0.33**					-0.30**			
		(0.16)					(0.14)			
Var(Prod) x Employment rate			-0.33***					-0.41***		
			(0.09)					(0.12)		
Country fixed effects	YES	YES	YES			YES	YES	YES		
Industry fixed effects	YES	YES	YES			YES	YES	YES		
Year fixed effects	YES	YES	YES			YES	YES	YES		
Country-year fixed effects				YES	YES				YES	YES
Sector-year fixed effects				YES	YES				YES	YES
Non-interacted determinant	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,823	2,823	2,823	2,823	2,823	2,823	2,823	2,823	2,823	2,823

Note: Variances of productivity and firm wage premia within each industry-country-year cell are weighted by employment of each firm. Productivity refers to value added per worker. Each regression contains a full interaction with an indicator for any missing values on the independent variables. Columns (1) to (5) measure job mobility by the rate of job-to-job transitions within an industry. Columns (6) to (10) alternatively express job mobility by the rate of job-to-job inflows from any industry. Columns (5) and (10) instrument job-to-job mobility of a country-sector-year observation using the average job mobility of the same industry in all other countries and the average of job mobility of the same country in all other industries. Standard errors clustered at the country-sector in parentheses. *, ** and ** denote statistical significance at the 10%, 5% and 1% levels. Following equation (3), implied productivity pass-through can be calculated from these coefficients as $\sqrt{\tilde{\rho}}$ for the reference group, and $\sqrt{\tilde{\rho}+\gamma_1}-\sqrt{\tilde{\rho}}$ for the difference with respect to the reference group.
Source: OECD calculations.

Table C.4.Robustness: Continuous explanatory variables

Based on equation (3), 1995-2015

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variable:	**Var(Firm Wage Premia)**								
	Var(Firm Productivity)	0.02**	0.03***	0.03***	0.01	0.05***	-0.00	0.06***	-0.02	-0.00
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.02)	(0.01)
Labour supply elasticity	Var(Prod) x Rate of industry job-to-job transitions		-0.01***							-0.00***
			(0.00)							(0.00)
Labour demand elasticity	Var(Prod) x Share of foreign VA in domestic final demand			0.11***	0.29***					-0.02
				(0.05)	(0.08)					(0.03)
	Var(Prod) x Share of imports over value added				-0.07***					
					(0.02)					
	Var(Prod) x Industry concentration					0.01				
						(0.04)				
Wage-setting institutions	Var(Prod) x Decentralised collective bargaining country						0.09***		0.11***	0.11***
							(0.02)		(0.03)	(0.02)
	Var(Prod) x Ratio of minimum wage relative to median wage							-0.26***	0.20*	
								(0.11)	(0.11)	
	Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Industry fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Non-interacted determinant		YES	YES	YES	YES	YES	YES	YES	YES
	Observations	2,823	2,073	2,823	2,823	2,823	2,823	2,823	2,823	2,073
	Adjusted R^2	0.70	0.73	0.74	0.74	0.76	0.78	0.78	0.80	0.83

Note: Variances of productivity and firm wage premia within each industry-country-year cell are weighted by employment of each firm. Productivity refers to value added per worker. Determinants are winsorised at top and bottom 1%. Standard errors clustered at the country-sector in parentheses. *, ** and ** denote statistical significance at the 10%, 5% and 1% levels. Following equation (3), implied productivity pass-through can be calculated from these coefficients as $\sqrt{\tilde{\rho}}$ for the reference group, and $\sqrt{\tilde{\rho}+\gamma_1}-\sqrt{\tilde{\rho}}$ for the difference with respect to the reference group.
Source: OECD calculations.

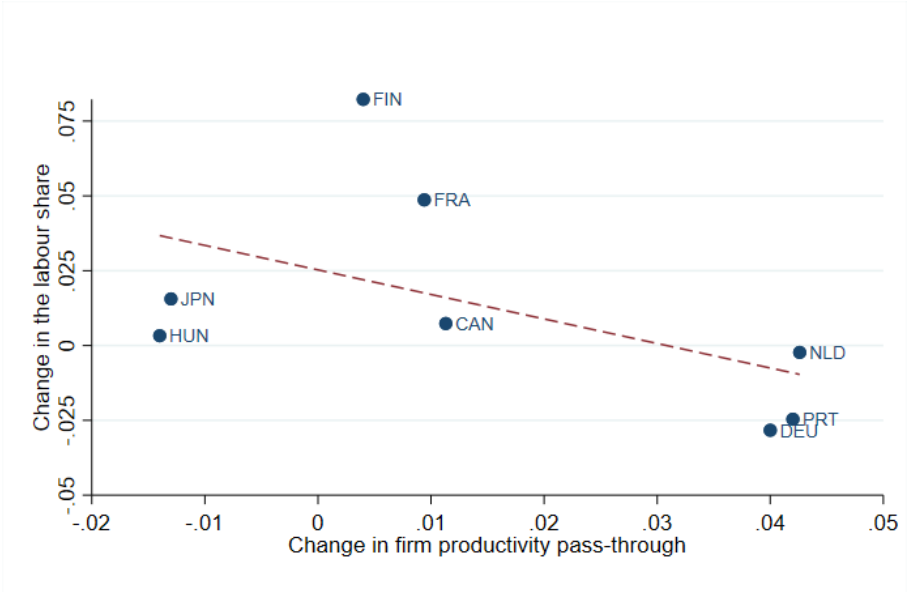
Table C.5. Robustness: More flexible fixed effects structure

Based on equation (3), 1995-2015

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variable:	**Var(Firm Wage Premia)**								
	Var(Firm Productivity)	0.02**	0.07***	0.01	0.01	0.05**	-0.00	0.08***	-0.00	0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.00)	(0.01)
Labour supply elasticity	Var(Prod) x High rate of industry job-to-job transitions		-0.07***							-0.02**
			(0.01)							(0.01)
Labour demand elasticity	Var(Prod) x High share of foreign VA in domestic final demand			0.05***	0.06**					0.01
				(0.02)	(0.02)					(0.01)
	Var(Prod) x High share of imports over value added				-0.01					
					(0.02)					
	Var(Prod) x Highly concentrated industry					0.02				
						(0.02)				
Wage-setting institutions	Var(Prod) x Decentralised collective bargaining country						0.09***		0.09***	0.07***
							(0.02)		(0.02)	(0.02)
	Var(Prod) x High minimum wage relative to median wage							-0.07***	0.01	
								(0.02)	(0.02)	
	Country-year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Industry-year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
	Non-interacted determinant		YES	YES	YES	YES	YES	YES	YES	YES
	Observations	2823	2823	2823	2823	2823	2823	2823	2823	2823
	Adjusted R^2	0.67	0.74	0.71	0.71	0.73	0.76	0.74	0.76	0.79

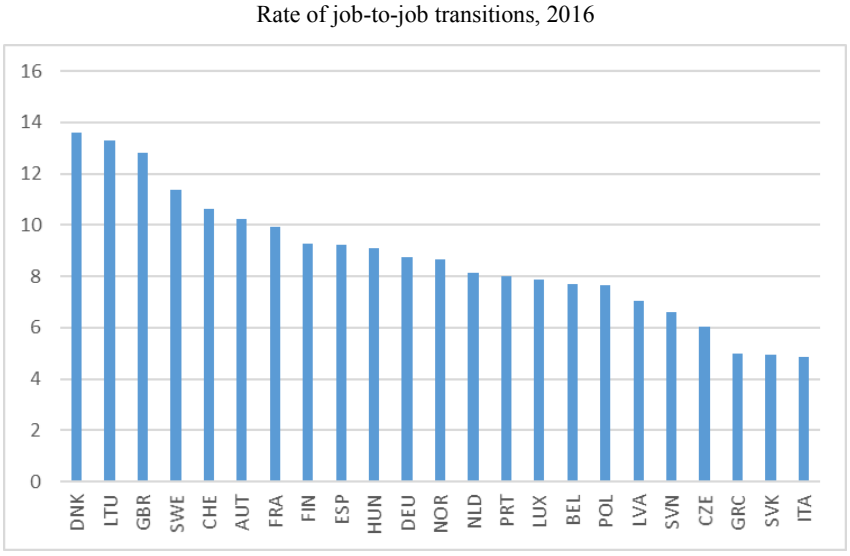
Note: Variances of productivity and firm wage premia within each industry-country-year cell are weighted by employment of each firm. Productivity refers to value added per worker. Each regression contains a full interaction with an indicator for any missing values on the independent variables. Standard errors clustered at the country-sector in parentheses. *, ** and ** denote statistical significance at the 10%, 5% and 1% levels. Following equation (3), implied productivity pass-through can be calculated from these coefficients as $\sqrt{\tilde{\rho}}$ for the reference group, and $\sqrt{\tilde{\rho} + \gamma_1} - \sqrt{\tilde{\rho}}$ for the difference with respect to the reference group.

Figure C.1. Higher firm-level productivity pass-through and lower rent sharing typically go together



Note: This figure shows that increasing firm-level productivity pass-through tends to go together with a decreasing labour share at the country level, suggesting that the concept of firm-level productivity wage pass-through in this paper cannot be interpreted as a measure of aggregate rent sharing The change in firm-level productivity pass-through is the difference in pass-through coefficients estimated from linked employer-employee micro data separately at the beginning and the end of the observation period based on equation (1a). The labour share is total labour compensation of salaried and self-employed workers as a share of value added at factor costs in the total economy excluding the housing, primary and non-market sectors. Each data point refers to the change between the following estimation periods: Canada (2001/05 and 2011/15), Finland (2001/05 and 2011/15), France (2002/05 and 2011/15), Germany (1996/2000 and 2011/15), Hungary (2003/05 and 2011), Japan (2005 and 2011/13), Netherlands (2001/05 and 2011/16), Portugal (2002/05 and 2011/16). Labour share not available for Costa Rica.

Figure C.2. Job mobility across countries



Note: The rate of job-to-job transitions is defined as the share of workers who change jobs in 2016 in total employment.
Source: OECD calculations based on EU-LFS.

Annex D. Data references and disclaimers

Japan

Ryo Kambayashi, Satoshi Tanaka, and Shintaro Yamaguchi, "Report of Changes in Wage Inequality Between and Within-Firm: Evidence from Japan 1993-2013," (9th Sep. 2019), mimeograph.

New Zealand

The results in this paper are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI), managed by Stats NZ. The opinions, findings, recommendations, and conclusions expressed in this paper are those of the author(s), not Stats NZ. Access to the anonymised data used in this study was provided by Stats NZ under the security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person, household, business, or organisation, and the results in this paper have been confidentialised to protect these groups from identification and to keep their data safe. Careful consideration has been given to the privacy, security, and confidentiality issues associated with using administrative and survey data in the IDI. Further detail can be found in the Privacy impact assessment for the Integrated Data Infrastructure available from http://www.stats.govt.nz/. The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994. This tax data must be used only for statistical purposes, and no individual information may be published or disclosed in any other form, or provided to Inland Revenue for administrative or regulatory purposes. Any person who has had access to the unit record data has certified that they have been shown, have read, and have understood section 81 of the Tax Administration Act 1994, which relates to secrecy. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

Norway

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United Kingdom

Office for National Statistics (2018). Annual Survey of Hours and Earnings, 1997-2018: Secure Access. 13th Edition. UK Data Service. SN: 6689, http://doi.org/10.5255/UKDA-SN-6689-12

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