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ISSN: 2365-9793

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ABSTRACT

Does Offshoring Shape Labor Market Imperfections? A Comparative Analysis of Belgian and Dutch Firms*

We study the relationship between offshoring and the prevalence and intensity of labor market imperfections at the firm level in Belgium and the Netherlands. Wage-markup pricing stemming from workers' monopoly power is more prevalent than wage-markdown pricing originating from firms' monopsony power in both countries. Offshoring benefits firms in that imports of final as well as intermediate goods are associated with a higher prevalence and intensity of wage markdowns. The widening effect of offshoring on wage markdowns arises from an increase in productivity that is only imperfectly passed through into an increase in wages. Offshoring is negatively related to the prevalence of wage markups. This also holds for the intensity of wage markups measured by workers' bargaining power in Belgium.

JEL Classification: F14, F16, J42, J50

Keywords: wage markdowns, wage markups, firm-level offshoring

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* This research has been funded by the European Union's Horizon 2020 research and innovation program, grant agreement No 822390 (MICROPROD). The contribution by Vancauteren has also been funded partly by grant agreement No 822781 (GROWINPRO). The authors are grateful to the National Bank of Belgium (NBB) and Statistics Netherlands (CBS) for providing the Belgian and Dutch non-public microdata, respectively. The authors would also like to thank Hartmut Egger and participants at seminars and conferences for insightful comments and suggestions.

1 Introduction

With the fragmentation of production and the increasing importance of outsourcing, trade in intermediate goods through offshoring has gained importance in the global economy over the past decade. Media attention to offshoring has predominantly focused on its negative aspects induced by a substitution effect. Indeed, the standard view is that rising imports of cheap low-skilled inputs substitute for domestic low-skilled workers in industrialized countries, leading to a decline in their wages and employment and increasing inequality between high- and low-skilled workers.

By now, there exist many empirical studies using firm panel data that have examined the relationship between offshoring and various firm outcomes such as total employment, the skill or occupational composition of labor demand, average wages, firm survival and innovation (see Mion and Zhu (2013) for references). The literature lacks evidence, though, on how offshoring shapes labor market imperfections arising from either firms' monopsony power or workers' monopoly power, which is the purpose of this study. Providing such evidence is particularly important as recent theoretical papers on offshoring explicitly model imperfections in the labor market through some sort of rent-sharing mechanism that generates interfirm wage dispersion (see Hummels et al. (2018) for a recent survey).[4]

We use the production function approach introduced in Dobbelaere and Mairesse (2013) for estimating jointly labor market and product market imperfections (where the latter are measured by price-cost markups). Labor market imperfections give rise to a wage-employment contract off the firm's labor demand curve. Such imperfections may either stem from firms' monopsony power enabling them to set a wage markdown, or from workers' monopoly power forcing employers to pay a wage markup. Accounting for a possible interdependence between labor and product market imperfections ensures that our estimates of wage markdowns, wage markups and price-cost markups are not contaminated.

We first document the prevalence and intensity of wage-markdown and wage-markup pricing for Belgian and Dutch employers in manufacturing, using firm panel data covering the period 2009-2017 in both countries. Thanks to highly comparable data drawn from Business registers, VAT declarations and Transaction Trade databases, we are then able to estimate how firm-level offshoring relates to firms' labor market imperfections in two small economies with a strong international focus. We are also in a position to examine different margins by distinguishing offshoring of finished goods from offshoring of intermediate goods and by considering imports from different geographical areas (neighboring countries, other OECD countries, non-OECD countries and China). In doing so, we contribute to

[4] We refer to an earlier working paper version of this study, Dobbelaere et al. (2022), for a review of the literature related to offshoring and labor market outcomes.

the empirical international trade literature. In addition, our study speaks to the growing empirical literature on the determinants of employer monopsony and worker monopoly in rent splitting and the drivers of the falling labor share in income (see Stansbury and Summers (2020), Grossman and Oberfield (2022)).

Several novel findings emerge. First, we find that labor market imperfections are the norm in both countries. These imperfections mainly arise from workers' monopoly power enabling them to push through wages above the marginal revenue product of labor. We observe such labor market setting favoring workers in about 40% (50%) of firm-year observations in Belgium (the Netherlands). For another 30% of firm-year observations in both countries, we find that labor market imperfections give rise to a labor market setting favoring employers who impose wage markdowns on workers.

Second, workers' bargaining power is higher in Belgian firms that pay wage markups, with an average value of 0.53 compared to 0.39 in Dutch counterparts. In both countries, workers obtain about 66% of their marginal product of labor in firms that set wage markdowns, pointing to considerable monopsony power.

Third, firm-level offshoring plays an important role in shaping firms' labor market imperfections. In both countries, we find that offshoring of both finished and intermediate goods is associated with a higher probability of wage-markdown pricing and a lower probability of wage-markup pricing. Hence, offshoring gives rise to a labor market setting favoring employers, which is most pronounced in the Netherlands.

Fourth, these findings at the extensive margin also hold at the intensive margin. Irrespective of the nature of imports, offshoring is accompanied with higher monopsony power of Belgian and Dutch employers. In Belgium, we also see that offshoring is negatively associated with workers' bargaining power. To solve potential endogeneity problems arising from omitted variables bias and reverse causality, we also apply an Instrumental Variables estimation method using firm-weighted exchange rates as instruments for firm-level imports (offshoring of finished and intermediate goods). Our TSLS results confirm our findings for the prevalence of wage markdowns and wage markups, and for the intensity of wage markdowns. To understand the mechanism behind the positive effect of offshoring on the intensity of wage markdowns, we empirically decompose wage markdowns into three firm-year varying components (wages, the value of the marginal product of labor and price-cost markups) and examine the effect of total imports on each component. We learn that the widening effect of offshoring on wage markdowns arises from an increase in the value of the marginal product of labor that is only imperfectly passed through into an increase in wages.

Fifth, the origin of imports seems to matter more for a labor market setting favoring Belgian employers. Imports of finished goods from non-OECD countries and imports of intermediate goods from OECD countries are positively associated with the prevalence and intensity of wage markdowns. The more global focus of Dutch companies and the more global scale of the vertical chain in which Dutch firms operate clearly shows up at the extensive margin of labor market imperfections. We find that the positive (negative) association of imports of finished as well as intermediate goods and wage markdowns (wage markups) holds irrespective of the origin of imports.

We proceed as follows. Section 2 provides some background information on institutional characteristics and international trade in Belgium and the Netherlands. Section 3 presents the main ingredients of the theoretical structural productivity model with imperfect labor and product markets. Section 4 discusses our econometric model and the estimation procedure. Section 5 presents the Belgian and Dutch firm panel data. Section 6 documents the prevalence and intensity of labor market imperfections in both countries. Section 7 investigates the relationship between firm-level offshoring and labor market imperfections. Section 8 concludes.

2 Background on institutions and international trade

In this Section, we highlight some institutional characteristics in Belgium and the Netherlands and provide some descriptive information on international trade which serves as background information for our comparative study. These characteristics might shape firms' operational environment in general and, within our context, the prevalence and intensity of labor market imperfections.

Institutional characteristics. Industrial relations in Belgium and the Netherlands share some similar wage bargaining institutional characteristics but also differ on important aspects. In both countries, there is a broadly regulated system of wage bargaining characterized by a dominance of industry-level bargaining, the existence of statutory minimum wages and extension mechanisms guaranteeing that most workers belonging to the private sector are covered by collective agreements. The wage bargaining system in Belgium is considered to be even more regulated than in the Netherlands because of state-imposed automatic wage indexation and more government interventions. Trade union density rates are also higher (Du Caju et al. (2009)). In terms of employment protection, the OECD indicators show that employment protection is significantly higher and above the OECD average in Belgium, which is due to much stricter regulation on permanent contracts, while at the OECD average in the Netherlands (Venn (2009); OECD (2013)). Both countries significantly eased the regulation on temporary contracts during the 1990s (Martin and Scarpetta (2012)).

In all EU member states, employees are represented in trade unions which are mostly organized on a industry-wide basis and which embody the traditional form of employee representation, and works councils which are organized at the company or establishment level. According to 2019 figures from the International Labor Office (ILO), trade union representation dominates in Belgium and Belgian trade unions are among the strongest in the OECD with 49.1% of employees in unions which is largely above the OECD average of 15.8% (ILO (2022)).

In Belgium, collective bargaining is highly structured. There are three levels with the industry level playing the dominant role. At the centralized level, a national agreement determines a standard for the maximum hourly increase of gross labor compensation according to the expected evolution of labor costs in the neighboring countries during the first year. This so-called "wage norm" acts as a guideline for complementary negotiations at the industry and firm levels, which are held in the subsequent year (Novella and Sissoko (2013)). Industry-level bargaining is organized around joint committees bringing together employers' and unions' representatives at the detailed industry level. It is the relevant bargaining level for about 96% of all firms in 2019. Collective labor agreements might also be concluded at the firm level with large firms having a higher probability of firm-level collective bargaining. This structure explains the very high proportion (96%) of employees covered by collective bargaining (ILO (2022)).

Automatic wage indexation, which is an exception in OECD countries, ensures that wage increases are proportional to cost of living increases in order to guarantee a constant level of purchasing power for employees and those who receive benefits.[5] Another particular characteristic of the wage bargaining system is that blue-collar and white-collar workers are represented by separate unions. Pay scales for blue-collar workers depend primarily on job descriptions while pay scales for white-collar workers are defined according to seniority. Beyond collective bargaining, the wage-setting system shows individualized characteristics with incentive pay and performance reviews determining individual wage increases or promotion.

Contrary to Belgium, employee representation at the workplace only occurs through works councils in the Netherlands. In 2019, trade union membership is low (15.4%) and below the OECD average of 15.8% (ILO (2022)). Despite low union density, a broad majority agrees with the unions' policies. Every year, collective bargaining starts at the centralized level where employer associations, trade unions and the government reach an agreement on the desirable development of wages which serves as an advice for actual negotiations on contracts and wages at the industry level. Modest wage increases have been central

[5] In particular, wages are automatically indexed according to the health price index, which is the national consumer price index excluding tobacco, motor fuels and alcoholic beverages.

in these negotiations (Hartog and Salverda (2018)).[6] At both the central and industry level, the government plays the role of moderator, ensuring that agreements are based on consensus. As such, the collective bargaining system is conducive to social stability. Collective labor agreements are concluded at the firm level in very large firms. The existence and widespread use of extension procedures for industry-level wage agreements, making these agreements binding for all employers and employees within the industry even if some employers or trade unions did not directly sign the agreement, explains the high rate of collective bargaining coverage despite low trade union density. Of all Dutch employees, 75.6% are covered by a collective contract in 2019: 75% by industry-level contracts and 25% by firm-level contracts (ILO (2022)).

International focus. Both Belgium and the Netherlands have a strong international focus, with Dutch firms having a more global status than Belgian firms. Inward and outward foreign direct investment (FDI) data for our sample of firms during the period 2006-2017 show that in Belgium there is more inward than outward FDI, most FDI is within EU-28 and China plays a minor role.[7] This is in contrast to the Netherlands where the more global scope comes from more outward FDI, more direct investments outside EU-28 and an important role played by China.

Such differences in global firm activities are confirmed by Van Cauwenberge et al. (2022) who report that Belgian listed firms mostly trade with European countries while Dutch listed firms trade more and mainly with non-European countries. More specifically, during the period 2006-2015, 70% of imports from Dutch listed firms came from outside the eurozone. In contrast, Belgian listed firms import a larger fraction from the eurozone. Dutch listed companies also export mostly to countries outside the eurozone while Belgian companies export to the euro area. Since listed firms only represent a small fraction of all internationally active firms, we use firm-level trade data on import and export destinations from Transaction Trade databases for our sample of firms during the period 2010-2017 to confirm that Dutch firms trade more with more distant countries.

3 Theoretical framework

To model a firm's product and labor market power, we follow Dobbelaere and Mairesse (2013) and nest two polar models of wage formation in imperfect labor markets in the seminal productivity model of Hall (1988) with imperfect product markets.

[6] Since 1982, wage claims by Dutch trade unions have been mostly below the EU average (Kleinknecht et al. (2006)).

[7] Inward investments refer to investments in the home country (Belgium or the Netherlands) by firms located abroad while outward investments refer to direct investments abroad by companies located either in Belgium or the Netherlands.

Each firm at any point in time produces output (Q_{it}) using labor (N_{it}), intermediate input (M_{it}) and capital (K_{it}). We assume that all producers that are active in the market are maximizing short-run profits and take the price of intermediate input as given.[8] Each firm must choose the optimal quantity of output and the optimal demand for intermediate input and labor. We assume that capital is predetermined and thus no choice variable in the short run.

The first-order condition for output yields the firm's price-cost markup $\mu_{it} = \frac{P_{it}}{(C_Q)_{it}}$ with P_{it} the output price and $(C_Q)_{it}$ the marginal cost of production. The first-order condition for intermediate input is given by setting the marginal revenue product of intermediate input equal to the price of intermediate input: $(Q_M)_{it} = \mu_{it} \frac{J_{it}}{P_{it}}$, with $(Q_M)_{it}$ the marginal product of intermediate input and J_{it} the price of intermediate input. Using this first-order condition and the first-order condition for output, we obtain an expression for firm i's price-cost markup μ_{it}:

$$\mu_{it} = \frac{(\varepsilon_M^Q)_{it}}{\alpha_{it}^M} \begin{cases} = 1 & \text{if } PMS_{it} = PMC \\ > 1 & \text{if } PMS_{it} = PMU \end{cases} \tag{1}$$

with $(\varepsilon_M^Q)_{it}$ the output elasticity with respect to intermediate input and $\alpha_{it}^M = \frac{J_{it}M_{it}}{P_{it}Q_{it}}$ the share of intermediate input expenditure ($J_{it}M_{it}$) in total revenue ($P_{it}Q_{it}$). The value of μ_{it} determines the firm's type of competition prevailing in the product market or its product market setting (denoted PMS). The product market setting is defined to be perfectly competitive if the firm engages in marginal cost pricing (PMC) and, hence, has no product market power. The product market setting is defined to be imperfectly competitive if the firm sets a price-cost markup (PMU), which is our model-consistent measure of product market power.

Firm i's wage formation process, and, hence, its optimal demand for labor depends on the prevalence and the source of labor market imperfections. The firm's type of competition prevailing in the labor market or its labor market setting (denoted LMS) is defined to be perfectly competitive if the firm engages in marginal-product pricing (WMP), that is,

[8] This assumption might be perceived as being restrictive, given recent evidence on the importance of imperfect competition in intermediate goods markets. Morlacco (2020) extends our model to account for imperfect competition in all variable input markets and uses company accounts and exhaustive records of export and import flows of French firms. Dhyne et al. (2022) rely on a model of oligopolistic competition in firm-to-firm trade and use business-to-business transactions of the universe of Belgian firms. We defend our restrictive assumption on two grounds. The first is a data reason. In line with Morlacco (2020), we could easily model imperfections in intermediate input markets as additional unit costs that create wedges between marginal costs and marginal products. However, data constraints preclude us from considering this choice. The second reason is that we prefer to focus our empirical analysis on the relationship between firm-level offshoring and employers' labor market power, abstaining from non-competitive buyer behavior in the market of intermediate inputs.

pays the marginal employee a real wage equal to her marginal product.[9] Its labor market setting is defined to be imperfectly competitive if the firm either sets a wage markdown (WMD), that is, pays the marginal employee a real wage lower than her marginal product or pays a wage markup (WMU), that is, pays the marginal employee a real wage exceeding her marginal product.

Intuitively, the perfectly competitive labor market setting ($LMS = WMP$) arises when the wage-employment contract lies on the firm's labor demand curve, which characterizes profit-maximizing employment levels. Analogous to the case of intermediate input, the first-order condition for labor under $LMS = WMP$ is given by setting the marginal revenue product of labor equal to the price of labor: $(Q_N)_{it} = \mu_{it} \frac{W_{it}}{P_{it}}$ with $(Q_N)_{it}$ the marginal product of labor and W_{it} the price of labor. Hence, absent labor market imperfections, there exists no wedge between the output elasticities of intermediate input and labor and their respective revenue shares. Since this wedge is derived using the first-order conditions for output, intermediate input and labor, we call this wedge the firm's joint market imperfections parameter ψ_{it}:

$$\psi_{it} = \frac{(\varepsilon_M^Q)_{it}}{\alpha_{it}^M} - \frac{(\varepsilon_N^Q)_{it}}{\alpha_{it}^N} = 0 \quad \text{if } LMS_{it} = WMP \tag{2}$$

with $(\varepsilon_N^Q)_{it}$ the output elasticity with respect to labor and $\alpha_{it}^N = \frac{W_{it}N_{it}}{P_{it}Q_{it}}$ the share of labor input expenditure ($W_{it}N_{it}$) in total revenue.

In contrast to marginal-product pricing, labor market imperfections give rise to wage-employment contracts off the firm's labor demand curve. We consider two polar sources of such imperfections. Labor market imperfections may arise from firms' monoposony power that enables them to set a wage markdown ($LMS = WMD$). There exist different underlying theoretical structural models leading to wage-employment contracts below the firm's labor demand curve. Wage-markdown pricing may, e.g., arise when workers have heterogeneous preferences over work environments of different potential employers, employers collude, or employers are active in highly concentrated labor markets (Manning (2011), Manning (2021)).[10] Considering the first –widely-used– theoretical structural

[9] Defining perfect competition in the labor market in such a way is in line with Addison et al. (2014).

[10] The simplest way to micro-found a firm-level labor supply curve in modern monopsony models derives from discrete choice modeling in Industrial Organization. More precisely, workers' heterogeneous preferences over the work environments of different potential employers is embedded in a random utility model of worker preferences that characterizes firm-specific labor supply functions. A firm's labor supply elasticity is a function of its market share and workers' responsiveness to wages in the market. Another model that is commonly used as a micro-foundation for modern monopsony models is the canonical canonical Burdett and Mortensen (1998)-model (see also Card et al. (2018)). Based on such partial equilibrium dynamic monopsony model, a firm's labor supply elasticity can be expressed as a function of the long-run elasticities of recruitment and separations. Using the argument that a separation from one firm is a recruitment in another firm in steady-state, the recruitment elasticity, and consequently also the firm's labor-supply elasticity, can simply be inferred by the separation

model, Dobbelaere and Mairesse (2013) show that the first-order condition for labor is given by: $(\varepsilon_N^Q)_{it} = \mu_{it}\alpha_{it}^N\left(1+\frac{1}{(\varepsilon_W^N)_{it}}\right)$, with $(\varepsilon_W^N)_{it} \in \mathbb{R}_+$ the wage elasticity of the labor supply of firm i, measuring the degree of wage-setting power that firm i possesses. $(\varepsilon_W^N)_{it}$ is our model-consistent measure of labor market power under $LMS = WMD$. Hence, the firm's joint market imperfections parameter ψ_{it} under $LMS = WMD$ is equal to:

$$\psi_{it} = \frac{(\varepsilon_M^Q)_{it}}{\alpha_{it}^M} - \frac{(\varepsilon_N^Q)_{it}}{\alpha_{it}^N} = -\frac{\mu_{it}}{(\varepsilon_W^N)_{it}} < 0 \quad \text{if } LMS_{it} = WMD \tag{3}$$

Labor market imperfections may also stem from workers' monopoly/bargaining power that forces employers to pay a wage markup ($LMS = WMU$). There exist different underlying theoretical structural models leading to wage-employment contracts above the firm's labor demand curve. Wage-markup pricing may, e.g., arise when a firm and its workforce negotiate simultaneously over wages and employment (McDonald and Solow (1981)), a firm bargains over wages with a workforce of declining size caused by employees gradually losing their job after bargaining breaks down (Dobbelaere and Luttens (2016)), or an employee bargains individually over wages with a firm that does not incur hiring costs (Stole and Zwiebel (1996)). Considering the first –widely-used– theoretical structural model, Dobbelaere and Mairesse (2013) show that the first-order condition for labor is given by: $(\varepsilon_N^Q)_{it} = \mu_{it}\alpha_{it}^N - \mu_{it}\gamma_{it}(1-\alpha_{it}^N-\alpha_{it}^M)$, with $\gamma_{it} = \frac{\phi_{it}}{1-\phi_{it}} \geqslant 0$ the relative extent of rent sharing and $\phi_{it} \in [0,1]$ the part of economic rents going to the workers or the degree of workers' bargaining power during worker-firm negotiations. ϕ_{it} is our model-consistent measure of labor market power under $LMS = WMU$. Hence, the firm's joint market imperfections parameter ψ_{it} under $LMS = WMU$ is equal to:

$$\psi_{it} = \frac{(\varepsilon_M^Q)_{it}}{\alpha_{it}^M} - \frac{(\varepsilon_N^Q)_{it}}{\alpha_{it}^N} = \mu_{it}\frac{\phi_{it}}{1-\phi_{it}}\left[\frac{1-\alpha_{it}^N-\alpha_{it}^M}{\alpha_{it}^N}\right] > 0 \quad \text{if } LMS_{it} = WMU \tag{4}$$

4 Econometric framework

The outlined theoretical framework allows us to determine the firm's labor market and product market setting from its production technology providing us with the output elasticities of intermediate inputs $(\varepsilon_M^Q)_{it}$ and labor $(\varepsilon_N^Q)_{it}$ and its input choices providing us with the revenue shares of intermediate inputs α_{it}^M and labor α_{it}^N. In order to obtain consistent estimates of the output elasticities, we consider production functions with a scalar Hicks-neutral productivity term which is observed by the firm but unobserved by the econometrician (denoted by ω_{it}) and common technology parameters, governing the transformation of inputs to units of output, across a set of producers (denoted by

elasticity (see e.g. Webber (2015) for an application).

the vector β). These two assumptions imply the following expression for the production function:

$$Q_{it} = F(N_{it}, M_{it}, K_{it}; \beta) \exp(\omega_{it}) \tag{5}$$

Guided by data availability in both countries, we cluster producers based on industry and consider 19 two-digit manufacturing industries. We approximate the unknown regression function $F(\cdot)$ by means of a second-order Taylor polynomial and estimate the coefficients (β) of a translog production function at the industry level. To control for unobserved productivity shocks ω_{it}, which are potentially correlated with the firm's input choices, we apply the estimation procedure proposed by Ackerberg et al. (2015) using the insight that optimal input choices hold information about unobserved productivity. We refer to Appendix B for details of the estimation routine.

The estimated production function coefficients $\widehat{\beta}$ are then used together with data on inputs to compute the output elasticities at the firm-year level. In particular, we calculate the firm-year elasticity of output with respect to labor as:

$$(\widehat{\varepsilon}_N^Q)_{it} = \widehat{\beta}_n + 2\widehat{\beta}_{nn} n_{it} + \widehat{\beta}_{nm} m_{it} + \widehat{\beta}_{nk} k_{it} \tag{6}$$

with n_{it}, m_{it} and k_{it} denoting the logs of N_{it}, M_{it} and K_{it}, respectively. Similarly, we calculate the firm-year elasticity of output with respect to intermediate inputs as:[11]

$$(\widehat{\varepsilon}_M^Q)_{it} = \widehat{\beta}_m + 2\widehat{\beta}_{mm} m_{it} + \widehat{\beta}_{mn} n_{it} + \widehat{\beta}_{mk} k_{it} \tag{7}$$

Using the shares of labor and intermediate input expenditure in total revenue, α_{it}^N and α_{it}^M, respectively, and our estimates of the output elasticities, $(\widehat{\varepsilon}_N^Q)_{it}$ and $(\widehat{\varepsilon}_M^Q)_{it}$, we are able to compute $\widehat{\mu}_{it}$ and $\widehat{\psi}_{it}$. Since the observed output $Y_{it} = Q_{it} \exp(\epsilon_{it})$ includes idiosyncratic factors including non-predictable output shocks and potential measurement error in output and inputs (ϵ_{it}), we need to correct the observed revenue shares for labor and intermediate inputs for these factors. We can recover an estimate of ϵ_{it} from the production function estimation routine and obtain adjusted revenue shares as follows:

$$\widehat{\alpha}_{it}^N = \frac{W_{it} N_{it}}{P_{it} \frac{Y_{it}}{\exp(\epsilon_{it})}} \tag{8}$$

$$\widehat{\alpha}_{it}^M = \frac{J_{it} M_{it}}{P_{it} \frac{Y_{it}}{\exp(\epsilon_{it})}} \tag{9}$$

Using Eqs. (6), (7), (8), and (9), we obtain estimates of the key parameters of our

[11] Under a Cobb-Douglas production function $(\widehat{\varepsilon}_N^Q)_{it}$ and $(\widehat{\varepsilon}_M^Q)_{it}$ would be equal to $\widehat{\beta}_n$ and $\widehat{\beta}_m$, respectively.

static productivity model, which are the price-cost markup μ_{it} and the joint market imperfections parameter ψ_{it}, as follows:

$$\widehat{\mu}_{it} = \frac{(\widehat{\varepsilon}_M^Q)_{it}}{\widehat{\alpha}_{it}^M} \tag{10}$$

$$\widehat{\psi}_{it} = \frac{(\widehat{\varepsilon}_M^Q)_{it}}{\widehat{\alpha}_{it}^M} - \frac{(\widehat{\varepsilon}_N^Q)_{it}}{\widehat{\alpha}_{it}^N} \tag{11}$$

Eq. (10) permits us to determine the product market setting as either involving marginal-cost pricing (PMC, $\widehat{\mu}_{it} = 1$) or price-cost markup pricing (PMU, $\widehat{\mu}_{it} > 1$). The sign of Eq. (11) allows us to determine the labor market setting as either one without imperfections involving marginal-product wages (WMP, $\widehat{\psi}_{it} = 0$), or as one with imperfections that result either in a wage markdown (WMD, $\widehat{\psi}_{it} < 0$) or in a wage mark-up (WMU, $\widehat{\psi}_{it} > 0$). We account for estimation uncertainty in $\widehat{\mu}_{it}$ and $\widehat{\psi}_{it}$ by using a classification procedure that relies on the the 95% two-sided confidence intervals (CIs) for μ_{it} and $gap_{it}^N = \frac{(\varepsilon_N^Q)_{it}}{\alpha_{it}^N}$:

$$[A_{\widehat{\mu}_{it}}, B_{\widehat{\mu}_{it}}] = [\widehat{\mu}_{it} - 1.96 \times \widehat{\sigma}_{\widehat{\mu}_{it}}, \widehat{\mu}_{it} + 1.96 \times \widehat{\sigma}_{\widehat{\mu}_{it}}] \tag{12}$$

$$[A_{\widehat{gap}_{it}^N}, B_{\widehat{gap}_{it}^N}] = [\widehat{gap}_{it}^N - 1.96 \times \widehat{\sigma}_{\widehat{gap}_{it}^N}, \widehat{gap}_{it}^N + 1.96 \times \widehat{\sigma}_{\widehat{gap}_{it}^N}] \tag{13}$$

with $\widehat{\sigma}_{\widehat{\mu}_{it}}$ and $\widehat{\sigma}_{\widehat{gap}_{it}^N}$ denoting the respective standard errors (estimators of the standard deviation of the sampling distribution of $\widehat{\mu}_{it}$ and $\widehat{gap}_{it}^N$, respectively) computed using the Delta method (Wooldridge (2010)).

To determine firm i's product market setting at time t, we use the 95% CI for μ_{it}. We classify the firm's product market setting as marginal-cost pricing ($PMS_{it} = PMC$) if the lower bound of the 95% CI ($A_{\widehat{\mu}_{it}}$) is lower than or equal to unity and as price-cost markup pricing ($PMS_{it} = PMU$) if $A_{\widehat{\mu}_{it}}$ exceeds unity.

To determine the firm's labor market setting at time t, we check for an overlap of the CIs for μ_{it} and gap_{it}^N which informs us whether the difference between these two (ψ_{it}) is statistically significant. If the CIs overlap, $\widehat{\mu}_{it}$ is not significantly different from $\widehat{gap}_{it}^N$, hence $\widehat{\psi}_{it} = 0$ at the 5% significance level. As such, we classify the firm's labor market setting as wage-marginal-product pricing ($LMS_{it} = WMP$). We classify the firm's labor market setting as wage-markdown pricing if $A_{\widehat{gap}_{it}^N} > B_{\widehat{\mu}_{it}}$ implying that $\widehat{\psi}_{it} < 0$ at the 5% significance level and as wage-markup pricing if $A_{\widehat{\mu}_{it}} > B_{\widehat{gap}_{it}^N}$ implying that $\widehat{\psi}_{it} > 0$ at the 5% significance level.

On top of these extensive margins, the size of the estimated μ_{it} allows us to directly infer the magnitude of product market imperfections at the intensive margin. The estimated μ_{it} and ψ_{it} permit us to recover the magnitude of labor market imperfections at the intensive margin, that is the structural parameters of labor market power for a given labor market setting. For $LMS_{it} = WMD$ or $\psi_{it} < 0$, we can recover the firm-level labor supply elasticity $(\varepsilon_W^N)_{it}$ and the wage markdown $G_{it} = W_{it}/(R_N)_{it} \leqslant 1$ using Eq. (3) together with the estimates defined in Eqs. (6)–(11) as:

$$(\widehat{\varepsilon}_W^N)_{it} = -\frac{\widehat{\mu}_{it}}{\widehat{\psi}_{it}} \tag{14}$$

$$\widehat{G}_{it} = \frac{(\widehat{\varepsilon}_W^N)_{it}}{(\widehat{\varepsilon}_W^N)_{it} + 1} \tag{15}$$

which inform us on the intensity of firm i's monopsony/wage-setting power.

For $LMS_{it} = WMU$ or $\psi_{it} > 0$, we can recover workers' relative (absolute) bargaining power γ_{it} (ϕ_{it}) using Eq. (4) together with the estimates defined in Eqs. (6)–(11) as:

$$\widehat{\gamma}_{it} = \frac{\widehat{\psi}_{it}}{\widehat{\mu}_{it}} \left[\frac{\widehat{\alpha}_{it}^N}{1 - \widehat{\alpha}_{it}^N - \widehat{\alpha}_{it}^M} \right] \tag{16}$$

$$\widehat{\phi}_{it} = \frac{\widehat{\gamma}_{it}}{1 + \widehat{\gamma}_{it}} \tag{17}$$

which inform us on the intensity of workers' monopoly/bargaining power.

5 Data

Combining firm and country-level perspectives for two countries, our analysis primarily serves the purpose of examining how firm-level offshoring shapes labor market imperfections at the firm level. The selection of Belgium and the Netherlands is motivated by differences in institutional characteristics, the fact that the two economies have a strong international focus and the ability to build two highly comparable microdata sets that span the period 2009-2017. The latter ensures that our results reflect underlying economic differences which enables us to perform a reliable international comparative study.

In both countries, the unbalanced panel datasets to estimate firm-year measures of labor and product market imperfection parameters are sourced from firm annual accounts and VAT declarations. The observational unit is the firm, which can be thought of as the economic actor in the production process.[12] To harmonize datasets, we excluded small firms (that is, firms with less than 3 employees) in both countries.

For Belgium, employment (N) defined as the average number of employees in full-time equivalents over the year, the wage bill (WN) and the capital stock (to proxy K) measured

12 The Eurostat definition is as follows: an enterprise is an organizational unit producing goods or services which has a certain degree of autonomy in decision-making. An enterprise can carry out more than one economic activity and it can be situated at more than one location. An enterprise may consist of one or more legal units, see https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Enterprise.

as the stock of fixed tangible assets are reported in firms' annual accounts collected by the National Bank of Belgium. Intermediate input consumption (to proxy M) and nominal sales (to proxy Q) are taken from VAT declarations. Ultimate control of ownership to define the MNE status of a firm is provided by the Survey of Foreign Direct Investment.

For the Netherlands, firm data on value added, nominal sales (to proxy Q), the average number of employees in full-time equivalents over the year (N), the wage bill (WN), the book value of tangible assets (to proxy K) and the ultimate control of ownership (to define MNE status) are drawn from compulsory reporting of firms and income statements available in the Dutch Business Register collected by Statistics Netherlands and data from Profit and VAT tax information referred to as Baseline. Intermediate input consumption (to proxy M) is computed using firm data on value added and nominal sales.

To convert nominal values into real, inflation-adjusted data, we use two-digit industry price deflators for output, intermediate inputs and capital from the OECD STAN database for Belgium and from the National Accounts Statistics supplied by Statistics Netherlands for the Netherlands.

We relate the prevalence and intensity of firm-year labor market imperfection parameters to a number of covariates. By having access to imports at the firm level, we can distinguish between firm-specific offshoring ($IMPsh$ variables) in terms of type and origin, which are our covariates of interest. Following Biscourp and Kramarz (2007) and Mion and Zhu (2013), we measure offshoring activities based on the ratio of imports to sales and use rich information in the Transaction Trade database that reports values and volumes of international transactions, exports and imports, at the product, firm and country level. Values for exports are reported as FOB-type values and values for imports as CIF-type values.[13] Products are classified using the 8-digit CN (Combined Nomenclature) classification.

In addition to firm-level total imports, we are able to distinguish between two different types of firm-level offshoring: offshoring of finished and intermediate goods. The purpose of this distinction is to account for the different nature of imports of goods that are ready to be sold versus imports of goods that will be further processed as inputs within the firm.[14] The identification of final versus intermediate goods is based on the comparison

[13] FOB-type values include the transaction value of the goods and the value of services performed to deliver goods to the border of the exporting country. CIF-type values include the transaction value of the goods, the value of services performed to deliver goods to the border of the exporting country and the value of the services performed to deliver the goods from the border of the exporting country to the border of the importing country.

[14] This allows for a finer classification than the industry-level distinction between final and intermediate goods. For instance, when an industrial bakery imports sugar, these imports will be classified as intermediate inputs. When a sugar producer imports sugar, this will be classified as final goods imports.

between the imported product and the firm's 4-digit industry of economic activity. We convert the CN classification used for trade flows into 4-digit NACE codes, focusing on products for which a one-to-one correspondence exists, a condition that holds for the vast majority of products. We classify an imported good as final if it falls within the same 4-digit NACE industry as the firm's main activity, otherwise the good is considered as intermediate.

In addition to this final-intermediate goods distinction, we consider offshoring from various country regions (e.g. (non-)OECD, neighboring countries and China) which could also have varying effects on employers' labor market power. As such, offshoring of final goods is defined as: $IMPsh^c_{final,it} = \frac{IMP^c_{final,it}}{P_{it}Q_{it}}$, with $IMP^c_{final,it}$ equal to imports of final goods of firm i coming from country (group) c in year t. Offshoring of intermediate goods is defined as: $IMPsh^c_{int,it} = \frac{IMP^c_{int,it}}{P_{it}Q_{it}}$, with $IMP^c_{int,it}$ equal to imports of intermediate goods of firm i coming from country (group) c in year t.

As a robustness test, we clean the firm-product level trade data for re-export activities ($IMPsh\_cor$, $IMPsh\_final\_cor$, $IMPsh\_int\_cor$ and $EXPsh\_cor$ variables). Because of their central locations in Europe and thanks to the size of its main port, about one third of trade in goods in Belgium and the Netherlands can be considered as re-exports. More specifically, the volume of exported products for which an identical volume has been imported within the same year is identified as re-export and is cleaned from the data.[15]

We match trade data to Belgian and Dutch manufacturing industries in order to measure import competition at the industry level ($IMPcomp$ variables).[16] Data on international trade are sourced from the OECD STAN Bilateral Trade Database. This database consists of estimates of imports and exports of goods, broken down by reporting (or declaring)

15 Re-export activities are identified as imports of product p by firm i in year t that firm i exports within the same year. More specifically, re-export volumes are defined as $reEXP_{ipt} = min(EXP_{ipt}, IMP_{ipt})$, where EXP stands for exports and IMP for imports. Net import values are adjusted by subtracting re-export from total imports, applying the import (export) unit value aggregated across destination countries: net imports is equal to $P^{IMP}_{ipt}IMP_{ipt} - P^{IMP}_{ipt}reEXP_{ipt}$ (net exports is equal to $P^{EXP}_{ipt}EXP_{ipt} - P^{EXP}_{ipt}reEXP_{ipt}$. Note that this correction cannot be applied to trade flows by origin or destination country because it would imply (heroic) assumptions on where the re-exported flows come from and go to.

16 Similar to Mion and Zhu (2013) and unlike e.g. Caselli et al. (2021), we distinguish between import competition and offshoring. Such distinction is important as import competition relates to final goods exposure and competition within an industry while offshoring refers to imports of final goods as well as intermediate goods that are part of the firm's production process. We consider import competition as an important control variable. From the literature on heterogeneous firms and trade (e.g. Melitz and Ottaviano (2008)), we learn that import competition typically exerts competitive pressure on domestic firms (inducing e.g. lower expected profits or higher expected costs from more reliance on external financing (Bloom et al. (2016)). The theoretical prediction is that larger and more productive firms expand while small and less productive firms shrink or exit. Indirectly, such models predict that import competition reduces the rents to be shared and through this channel erodes workers' bargaining power, especially for workers employed in low-productive firms.

and partner countries[17] including all OECD member countries and a wide range of non-OECD economies. The trade flows are divided into nine categories of goods, including the three main end-use categories (capital goods, intermediate inputs and consumption) and broken down by economic activities based on Revision 4 of the ISIC classification (Zhu et al. (2011)). Similar to offshoring, we consider import competition from various country regions (e.g. (non-)OECD and China). Following Bernard et al. (2006), Mion and Zhu (2013), and Dorn et al. (2020), we define import competition as the import share of country group c of the goods produced by industry j in year t: $IMPcomp^c_{jt} = \frac{IMP^c_{jt}}{Q_{jt}+IMP_{jt}-EXP_{jt}}$, where IMP^c_{jt} and IMP_{jt} represent the value of imports from country group c and all countries, respectively, EXP_{jt} stands for the value of exports and Q_{jt} for the value of domestic production.

Additional controls include the firm's export share ($EXPsh$, defined as the exports-to-sales ratio), the firm's capital intensity ($Capint$ defined as the logarithm of the capital-to-labor ratio), firm size ($Size$, defined as the logarithm of the number of workers), the firm's revenue total factor productivity (Tfp) and the firm's workforce composition ($Shupuniv$). Firm-year varying total factor productivity estimates are obtained by estimating translog production functions separately for each of our 19 industries in both countries. For Belgium, the workers' skill type is sourced from the Social Balance Statistics which reports employment (number of employees in FTE) by education type, distinguishing between primary education ($Shprim$), secondary education ($Shsec$), upper non-university education and university degree. We aggregate the last two categories to construct the share of workers with upper education ($Shupuniv$). To define the skill type of each employee in Dutch firms, we use their education type reported in the Education database which comes from the Polis Administration and the Labour Force Survey ("Enquête BeroepsBevolking, EBB"). The Education database provides the highest level of education attained by an individual on October 1 of the year and is complete for individuals up to the age of 35. For the remaining individuals, the education type comes from the EBB using population weights. The education type is based on a 2-digit SOI-code (Dutch education classification, "Standaard Onderwijsindeling") and is converted to the ISCED classification (International Standard Classification of Education).

We first deleted firm-year observations with labor and intermediate consumption shares smaller than or equal to zero and greater than or equal to one. In order to remove outliers, we also disregarded firm-year observations with cost shares in the bottom 1% and top 1% of the respective industry-year distributions. We selected firms that survive at least three consecutive years because lagged inputs are needed to construct moment conditions in our estimation framework. For Belgium (the Netherlands), we obtain an unbalanced

[17] The origin of imports and the destination of exports.

estimation sample consisting of 52,544 (81,705) observations for 6,695 (11,379) firms over the years 2009-2017.

Tables A.1 and A.2 in Appendix A report the means of our variables for Belgium and the Netherlands, respectively. In Belgium, real firm output, labor, materials and the Solow residual (SR) or conventional total factor productivity measure have been stable over the considered period while capital has decreased at an average annual growth rate of 2.1%. In the Netherlands, real firm output, labor, materials and the Solow Residual have increased at an average annual growth rate ranging between 1.1% and 1.4% whereas capital has decreased at an average annual growth rate of 8.9%. In both countries, about 6% of firms are MNEs. The share of exporters and importers is higher in Belgium (respectively, 45% and 52% as compared to 31% and 36% in the Netherlands). In both countries, the average share of imports of final goods to sales is about the same (2.9% in Belgium and 2.7% in the Netherlands) while the average share of imports of intermediate goods is higher in Belgium (7.5% as compared to 4.9% in the Netherlands). In both countries, about 52-55% of final goods and 63-67% of intermediate goods are imported from neighboring countries.

6 Prevalence and intensity of labor and product market imperfections

6.1 Extensive margin of labor and product market imperfections

Using our panels of 6,695 Belgian firms and 11,379 Dutch firms covering the period 2009-2017, we now apply the econometric framework described in Section 4. First, we estimate translog production functions for each of the 19 two-digit industries in both countries relying on a control function approach that allows us to control for unobserved productivity shocks. We use the estimated production function coefficients together with data on firms' inputs to compute output elasticities at the firm-year level. Tables B.1 and B.2 in Appendix B present means (overall and by two-digit industries) of the estimated output elasticities of labor, intermediate inputs, and capital as well as the resulting returns to scale, i.e. the sum of the three output elasticities, for Belgium and the Netherlands, respectively. For the whole sample, average output elasticities are very similar across the two countries: about 0.25 for labor, 0.75 for intermediate inputs, and 0.03 for capital, with close to constant returns to scale. We also notice some differences in production technologies across manufacturing industries.

We now use firms' estimated output elasticities and revenue shares for labor and intermediate inputs to infer their joint market imperfections parameter and price-cost markup. This allows us to pin down firms' time-varying labor and product market settings and, hence, informs us about the extensive margin of firms' labor and product market imperfections. Recall that by considering jointly imperfections in both markets, we account for a possible interdependency between the prevalence (and the intensity) of labor and product market imperfections and by doing so, we rule out that our estimates of wage markdowns, wage markups and price-cost markups are contaminated.

In both countries, labor market imperfections are the norm rather than the exception, and give rise to a power imbalance favoring workers in most of the firms. In Belgium, 33% of observations are classified as free from labor market imperfections involving marginal-product wages, whereas for 29% of observations we find a wage markdown at the detriment of workers and for 38% a wage markup at the detriment of firms. Market imperfections are also the norm in the product market where 77% of observations show price-cost markup pricing while only 23% involve marginal-cost pricing. The overwhelming prevalence of imperfections in labor and product markets is even more so in the Netherlands. Only 17% of firm-year observations involve wage-employment outcomes on the labor demand curve (absence of labor market imperfections) whereas 33% involve wage-markdown pricing and even 50% wage-markup pricing. In the product market, up to 95% of observations involve price-cost markup pricing.

Table 1 summarizes the outcome of the classification procedure distinguishing firms according to offshoring activities in Belgium (Panel A) and the Netherlands (Panel B), respectively. In particular, we compare the prevalence of labor/product market imperfections of offshorers (that is, firms that report a positive ratio of imported goods to sales) and firms with no offshoring activities. We reveal clear differences in the prevalence of labor market imperfections across firms with and without offshoring activities. A labor market setting favoring employers (that is, wage-markdown pricing) is more frequent and a labor market setting favoring employees (that is, wage-markup pricing) is less frequent when firms engage in offshoring activities. Such differences are most pronounced in the Netherlands. In particular, 32% (41%) of offshorers in Belgium (the Netherlands) pay wages below the marginal revenue product of labor while this is only the case for about 26% of non-offshorers. In Belgium (the Netherlands), 30% (35%) of offshorers pay wages above the marginal revenue product of labor whereas this is true for 47% (59%) of Belgian (Dutch) firms without offshoring activities. These correlations suggest that engagement in offshoring activities benefits employers. In both countries, absence of labor market imperfections (that is, wage-marginal-product pricing) is about 10pp more frequent among offshorers. The prevalence of product market imperfections (that is, price-cost markup pricing) is 3.8pp higher in firms with offshoring activities in Belgium but 5.1pp less frequent for offshorers in the Netherlands.

<Insert Table 1 about here>

Exploiting the time-varying nature of our estimates of firms' joint market imperfections parameter and price-cost markup, we also examined persistence in firms' labor and product market setting by investigating one-year transition probability rates across respective states over the period, where the states are defined as $\{WMD,\ WMP,\ WMU\}$ in the case of firms' labor market setting and $\{PMC,\ PMU\}$ in the case of firms' product market setting.

Pooling all firms and focusing on the three labor market settings, wage markdowns are the most persistent: 85% (91%) of Belgian (Dutch) companies characterized by wage-markdown pricing also impose a wage markdown in the subsequent year. In terms of persistence, wage markups come next: for 83% (86%) of Belgian (Dutch) firms with a wage markup at time t, we also observe a wage markup at $t+1$. In both countries, switches from wage-markdown towards wage-markup pricing (or the other way around) are rarely observed. Paying workers real wages according to their marginal product is the least persistent labor market setting: 71% (57%) of Belgian (Dutch) firms with marginal-product wages stay in this setting in the subsequent year. In both countries, firms with no labor market power are equally likely to switch either to a labor market setting favoring employers (i.e. imposing a wage markdown) or to a labor market setting favoring employees (that is, paying a wage markup) in the next year.

Pooling all firms and focusing on the two product market settings, price-cost markups are the most persistent: 92% (99%) of Belgian (Dutch) firms characterized by price-cost markup pricing also charge prices above marginal costs in the subsequent year. Finally, 68% (58%) of Belgian (Dutch) firms characterized by price-marginal cost pricing at time t continue to have no market power in the product market at $t+1$.

Tables C.1 and C.2 in Appendix C report transition matrices across firms that differ in terms of offshoring activities. For both subsets of firms, we find the same ranking of persistence in labor/product market settings as for the full set of firms in both countries. Persistence in terms of having no labor market power (wage-marginal-product pricing) appears to be 14.5pp (8.5pp) higher among offshorers as compared to non-offshorers in Belgium (the Netherlands) while persistence in terms of wage-markup pricing is 7.9pp lower among offshorers in the Netherlands. In both countries, offshorers that pay marginal-product wages are more likely to switch to wage-markdown pricing than to wage-markup pricing while the opposite holds for firms without offshoring activities. Persistence in terms of price-marginal cost pricing is 5.8pp (10.4pp) higher among offshorers in Belgium (the Netherlands). In both countries, offshorers with no labor market power tend to switch more towards wage-markdown pricing in the next year while non-offshorers with no labor market appear to change more towards wage-markup pricing.

6.2 Intensive margin of labor and product market imperfections

So far, we have documented the prevalence of labor and product market imperfections, that is, we have focused on the extensive margin. To recover the magnitude of labor and product market imperfections at the intensive margin, we rely on standard models of imperfect competition. Consistent with two widely-used models of imperfect competition in the labor market, we measure the magnitude of labor market imperfections either by the wage elasticity of a firm's labor supply curve $(\varepsilon_W^N)_{it}$ which informs us about the size of the wage markdown, or the workers' absolute bargaining power ϕ_{it} which informs us about the size of the wage markup (see Section 3). A higher $(\varepsilon_W^N)_{it}$, that is, less employer monopsony power, implies a narrower wage markdown. A higher ϕ_{it}, that is, more worker monopoly power, implies a higher wage markup. Consistent with standard models of imperfect competition in the product market, we measure the magnitude of product market imperfections by a firm's price-cost markup μ_{it}.

In Table 2, we document average values of the intensity of wage markdowns, wage markups and price-cost markups for all firms, the subset of offshorers and the subset of firms without offshoring activities in the relevant labor/product market setting in Belgium (left part) and the Netherlands (right part), respectively.

Conditional on a labor market setting favoring employers, we observe that firms' monopsony power is roughly at par in Belgium and the Netherlands. More specifically, for the 29% (33%) of Belgian (Dutch) firm-year observations involving wage-markdown pricing, we find that the average labor supply elasticity in Belgian (Dutch) firms amounts to 3.06 (3.13), which is close to mean values of advanced countries reported in other studies (see Sokolova and Sorensen (2021)). Assuming that firms can use all of their monopsony power, this implies that workers are paid about 66% of their marginal product in both countries (that is, the average wage markdown is about 0.66).

Conditional on a labor market setting favoring employees, we find that workers' monopoly power is higher in Belgium. More specifically, for the 38% (50%) of Belgian (Dutch) firm-year observations involving wage-markup pricing, the average value of workers' absolute bargaining power amounts to 0.53 in Belgium and 0.39 in the Netherlands.

Conditional on exercising product market power, the magnitude of price-cost markups is larger in the Netherlands: Belgian (Dutch) firms charge prices that are on average 16% (37%) above marginal costs. These estimates lie within the range of recent estimates for European countries as reported in Soares (2019).

At the extensive margin, we documented that engagement in offshoring activities is associated with a higher prevalence of wage-markdown and a lower prevalence of wage-markup pricing in both countries, and a higher (lower) prevalence of price-cost markup pricing in Belgium (the Netherlands). When it comes to wage-markdown and price-cost markup pricing, our descriptive results at the extensive margin also hold at the intensive margin. More specifically, firms engaging in offshoring activities appear to have larger monopsony power than non-offshorers in both countries and offshorers seem to set higher (lower) price-cost markups in Belgium (the Netherlands). However, the picture is less clear for wage-markup pricing: on average, Belgian firms with offshoring activities tend to share more rents with their workers whereas workers' bargaining power does not seem to differ across offshoring status in Dutch firms. Such rather mixed picture could, however, be driven by confounding factors that differ across firms with and without offshoring activities and by not having distinguished between firm-level offshoring of final versus intermediate goods. In the next section, we therefore infer partial correlations from estimating regressions.

<Insert Table 2 about here>

7 Does offshoring shape labor market imperfections?

A number of theoretical papers model explicitly the impact of offshoring on labor market outcomes in a context of heterogeneous firms and imperfect labor markets. Imperfect competition in the labor market is usually modeled through a rent-sharing mechanism (see e.g. Ranjan (2013), Sethupathy (2013)). From these models, we learn that the relationship between offshoring and workers' bargaining power is a priori unclear, which is reflected in available empirical evidence.[18] It depends on which of the two forces, the productivity-augmenting effect of offshoring increasing rent sharing versus the negative effect of offshoring on workers' bargaining power through replacing domestic employment, dominates. From the little theory that models the impact of trade on the monopsony/oligopsony power of firms in the labor market, we learn that the relationship between offshoring and firm's monoponsony power is expected to be positive, if any (Egger et al. (2022)). As far as we know, empirical papers that explicitly focus on the impact of offshoring on firms' wage-setting (monopsony power) are non-existent, except for Caselli et al. (2021).[19]

The purpose of this Section is to investigate whether firm-level offshoring matters for firm-level labor market imperfections arising from either firms' monopsony power or workers' monopoly power based on regression analysis. In addition, we study the channels through

[18] For example, Kramarz (2008) and Carluccio et al. (2015) show that union wages and bargaining are strengthened by offshoring while Dumont et al. (2006), Moreno and Rodríguez (2011) and Caselli et al. (2021) provide evidence for a negative effect of offshoring on wage bargaining.

[19] While the focus of Caselli et al. (2021) is on import competition, they show a relationship between offshoring and labor market power: offshoring and importing intermediates from China increases firms' monopsony power.

which the offshoring effect operates. We accomplish this by decomposing the reduced-form measure of firm-level labor market imperfections (defined as the ratio of the average wage paid by the firm to the equilibrium marginal revenue product of labor) into four fundamental dimensions (wages, the marginal product of labor, the price-cost markup and output prices) and by investigating the impact of offshoring on each component. Such approach is analogous to the one used in Caselli et al. (2021) to understand the mechanism through which Chinese import competition affects labor market imperfections in France.

Does offshoring matter for the prevalence of labor market imperfections? To examine whether firm-level offshoring shapes the extensive margin of labor market imperfections, we run multinomial logit regressions for the labor market setting being either one favoring employers who set wage markdowns or one favoring workers who receive wage markups. The baseline is a labor market setting in which workers obtain the marginal product of wages. As such, we specify the following model:

$$\begin{aligned} LMS_m^* &= \mathbf{x}_m \beta_m + \epsilon_m, \qquad m = 1,2 \\ LMS_m &= I(LMS_m^* > 0), \quad m = 1,2 \\ \epsilon &= (\epsilon_1, \epsilon_2)\prime \sim N(0, \Sigma) \end{aligned} \tag{18}$$

where $LMS_1 = \Pr(\text{LMS=WMD}|\mathbf{x})$ and $LMS_2 = \Pr(\text{LMS=WMU}|\mathbf{x})$. The baseline category is LMS=WMP. The vector x includes firm observables, such as offshoring measures (split by type and source country group), the export-to-sales ratio, firm size (number of employees), capital intensity, the share of employees with upper education and total factor productivity, and industry observables such as import competition measures (split by source country group).[20] Since contemporaneous values of the observables are likely to be endogenous, we use one-year lagged values for all variables (e.g. $LIMPsh$ stands for the 1-year lagged value of the share of total imports at the firm level). We also include a full set of industry and year fixed effects. Firm i's labor market setting at time t might also depend on unobservable factors ϵ_m such as managerial ability and its corporate culture.

We ran three model specifications. In each specification, we consider the offshoring variables as our variables of interest and the remaining observables as control variables. In

[20] Following the work of e.g. Goldschmidt and Schmieder (2017), Dhyne et al. (2021) and Bilal and Lhuillier (2021), domestic outsourcing can also correlate with firms' labor market setting. For instance, Goldschmidt and Schmieder (2017) find that wages in outsourcing jobs fell by approximately 1-15% compared to similar jobs that were not outsourced. Given the focus of our research, we did not integrate domestic outsourcing in the analysis. To address possible omitted variable bias, we note that total factor productivity captures, among other factors, firm-level efficiency as a result of outsourced work.

specification 1, we include the firm-level total import share ($LIMPsh$).[21] In specification 2, we distinguish two different types of firm-level offshoring: offshoring of finished goods ($LIMPsh\_final$) and intermediate goods ($LIMPsh\_int$). In specification 3, we examine even more margins by differentiating between the origin of firm-level imports. More specifically, we categorize countries into four mutually exclusive groups: neighboring countries, OECD countries excluding neighboring countries, non-OECD countries excluding China and China ($LIMPsh\_X\_neig$, $LIMPsh\_X\_OECDexclneig$, $LIMPsh\_X\_nonOECDexclChina$ and $LIMPsh\_X\_China$, where $X \in \{final, int\}$). As control variables, we also refine industry-level imports by country of origin. More specifically, we classify countries into three groups to define import competition: OECD countries, non-OECD countries exclusive China and China ($LIMPcomp\_OECD$, $LIMPcomp\_nonOECDexclChina$ and $LIMPcomp\_China$).

Table 3 presents the marginal effects of the regressors of interest for the probability of a wage markdown from multinomial logit regressions in Belgium (left part) and the Netherlands (right part), respectively.[22] From specification 1, we learn that offshoring as an aggregate activity is associated with an increase in the conditional probability of a wage markdown in both countries. More specifically, an increase in the 1-year lagged total import share by 0.1 is accompanied with an average rise in the probability of a wage markdown of 2pp in Belgium (see column (1a)) and 6pp in the Netherlands (see column (4a)). Offshoring might substitute for domestic labor. As such, offshoring activities are likely to increase intra-firm labor replacement and to decrease firm's labor demand in the domestic market, giving employers monopsony power. Recent evidence for Belgium by Merlevede and Michel (2020) shows indeed a negative impact of downstream offshoring on employment in upstream manufacturing firms.

Capturing the different facets of offshoring in specification (2) shows that offshoring of finished and intermediate goods seems to be of equal importance in terms of increasing the likelihood of wage-markdown pricing in Belgium (see column (2)) while imports of intermediate goods play a larger role in Dutch firms (see column (5)). Differentiating between the origin of imports (specification (3)) reveals similarities and differences in partial correlations (see columns (3) and (6) for Belgium and the Netherlands, respectively). First, offshoring of finished goods from non-OECD countries matters most

[21] In unreported results, we considered an alternative definition of offshoring for the Netherlands using data on foreign affiliates coming from the Foreign Affiliated Trade Statistics (FATS) for the period 2010-2017. We obtain similar results at the extensive as well as at the intensive (see infra) margin. This data is compiled at the consolidated firm level and since our unit of observation is the firm, we therefore assume that a firm is engaged in offshoring if it belongs to the enterprise group with affiliates in a foreign country (and with actual foreign employment). Because the latest (2019) Eurostat outsourcing survey reveals a dominance of within enterprise group outsourcing, the assumption on the measurement of this alternative offshoring measure seems to be plausible.

[22] In all Tables, we only present the estimated coefficients on our variables of interest. The estimated coefficients on our control variables are available upon request.

for wage-markdown pricing in both countries. Second, the large positive association between offshoring of intermediate goods and the probability of a labor setting favoring employers in the Netherlands holds for all country source groups while importing intermediate goods from neighboring and other OECD countries seems to drive the positive association between offshoring of intermediate goods and firms' wage-setting power in Belgian companies. Such differences could be explained by Dutch firms having a more global focus with the different stages of production processes being located across different countries.

<Insert Table 3 about here>

Table 4 reports the marginal effects of the regressors of interest for the probability of a wage markup in Belgium (left part) and the Netherlands (right part), respectively. Overall, our results provide evidence of offshoring being associated with a lower probability of paying wage markups. More specifically, an increase in the 1-year lagged total import share by 0.1 is accompanied with an average drop in the probability of a wage markup of 3.9pp in Belgium (see column (1a)) and 8.8pp in the Netherlands (see column (4a)). Evidence from an Eurostat survey on a set of EU countries including Belgium and the Netherlands shows that firms primarily engage in offshoring to reduce costs, which is in line with theoretical predictions as e.g. in Antras and Helpman (2004).[23] In the absence of a complete pass-through of these cost reductions to domestic wage increases, increased offshoring might dampen wage bargaining, which is consistent with our findings. From specification (2), we learn that the negative relationship between offshoring activities and the likelihood of wage-markup pricing does not hinge on the nature of firm-level imports (see columns (2) and (5) for Belgium and the Netherlands, respectively). Again, the negative correlation, both in the case of offshoring of finished and intermediate goods, is much stronger in absolute value in the Netherlands. Distinguishing across source country groups shows that offshoring of final goods originating from neighboring countries as well as non-OECD countries is driving the negative correlations in both countries (see columns (3) and (6) for Belgium and the Netherlands, respectively). Offshoring intermediate goods from OECD countries and from China seems to prevent workers in Belgian firms from exercising their bargaining power while the origin of imported intermediate goods does not matter for workers in Dutch firms. In the latter, offshoring from non-OECD countries and China appears to decrease the likelihood of a wage markup even more than offshoring from OECD countries. Again, these findings may reflect the global scale in which Dutch firms as compared to Belgian firms operate.

[23] See outsourcing survey data results at `https://ec.europa.eu/eurostat/web/economic-globalisation/globalisation-in-business-statistics/global-value-chains`.

<Insert Table 4 about here>

Our results presented so far could potentially suffer from endogeneity problems arising from omitted variable bias. For example, changes in the global value chain as a result of quality-adjusted innovation, changes in the mix of products within an industry and trade liberalization are all factors that might jointly affect firms' labor market setting and offshoring decision. Reverse causality could be another concern since offshoring activities could also be affected by firms' labor market setting. In both cases, the offshoring variables might be endogenous.

To solve such potential threats to internal validity of our analysis and to learn about a potential mechanism through which offshoring might affect labor market imperfections, we rely on Instrumental Variables (IV) estimation. To construct country group-firm-year-specific instruments for our aggregate offshoring variable, we follow Mion and Zhu (2013) and Goel (2017) and use firm-level import shares as weights to construct a weighted geometric mean of exchange rates for each country group-firm-year triple. We consider countries belonging to three country groups: OECD countries (excluding neighboring countries), China and the rest of the world. This IV strategy is meant to capture exchange rate risk, which can be interpreted as a proxy for changes in the international market and can have an impact on firms. Such risk may vary across firms depending on their product mix, international structure including offshoring and employment.[24] The data on exchange rates are obtained from the IMF International Financial Statistics. One important caveat here is that they only apply to transactions that are outside the euro zone. For example, both Belgian and Dutch firms typically have EU countries as main trading partners. As such, in most of the cases there will be no exchange rate (Euro area trade only) or the British pound only. At the firm-level, it will be equal to zero for firms that have no export outside the Euro area. This may concern a large fraction of exporters, which explains a large drop in the number of observations when applying such IV approach, especially in Belgium which is characterized by a stronger exposure to Euro area markets.[25]

In the first stage of our TSLS estimation, we relate our potential endogenous variable of interest, the firm-level total import share, to our three country group-firm-year-specific instruments and include the one-year lagged values of exports, firm size, capital intensity,

[24] We refer to Fraser and Pantzalis (2004), Ekholm et al. (2012), Dai and Xu (2017) and Van Cauwenberge et al. (2022) for the motivation and construction of firm-level exchange rate variables.

[25] We have also considered another instrumental variable addressing the potential endogeneity problem by looking at supply shocks from the rest of the world. This approach is meant to capture the exogenous, supply-driven components of rising firm-level offshoring, determined by for instance, know-how, lowering trade barriers and increases in productivity growth. The construction of this instrument is based on industry-level exports and production. These instruments appeared to be invalid which could be explained by the industry-level aggregation. We refer to Hummels et al. (2018) for further details on the measurement of this instrument.

share of employees wih upper education, total factor productivity (all defined at the firm level), industry-level import competition, and industry and year fixed effects as control variables. The second-stage regression relates the dependent variable to the predicted value from the first-stage regression and the same set of control variables. The dependent variable is a binary variable taking a value of 1 if the labor market setting is wage-markdown pricing (wage-markup pricing) and 0 otherwise in Table 3 (Table 4).

Our TSLS estimates, which we consider as a robustness check, are presented in columns (1b) and (4b) of Tables 3 and 4 for Belgium and the Netherlands, respectively. Since the credibility of TSLS estimates hinges on instrument validity conditions, we report the first-stage F-statistic for the joint significance of the instruments and the p-value of the Sargan test statistic for the joint validity of the overidentifying restrictions. From the former, we learn that our instruments are relevant. The latter indicates that the null of instrument exogeneity cannot be rejected in the IV regressions for the probability of a wage markdown in both countries (see columns (1b) and (4b) in Table 3) and for the probability of a wage markup in the Netherlands (see column (4b) in Table 4). The Sargan test rejects, however, the null of instrument exogeneity in the IV regression for the probability of a wage markup in Belgium (see column (1b) in Table 4), rendering our instrumentation strategy invalid in this case. Estimating these linear probability models leads to similar conclusions as estimating the logit models discussed above: firms with a higher total import share are more likely to impose a wage markdown on workers and less likely to pay a wage markup. More precisely, an increase in the 1-year lagged total import share by 0.1 increases the conditional probability of a wage markdown by 7.5pp in Belgium and even by 15pp in the Netherlands (see columns (1b) and (4b) in Table 3) but decreases the conditional probability of a wage markup by 6.7pp in Belgium and even by 19pp in the Netherlands (see columns (1b) and (4b) in Table 4).[26]

Does offshoring matter for the intensity of labor market imperfections? Let us now turn to the intensive margin and examine whether firm-level offshoring shapes the intensity of labor market imperfections. We correct for censoring by fitting type II Tobit models, in which the first-stage probit participation equation for $\psi_{it} < 0$ (in the case of a wage markdown) and $\psi_{it} > 0$ (in the case of a wage markup), respectively, and the second-stage outcome equation for the respective labor market imperfection parameter (firm-level labor supply elasticity $(\varepsilon_W^N)_{it}$ under wage-markdown pricing and workers' relative bargaining power γ_{it} under wage-markup pricing) include the same regressors which are allowed to have different coefficients in the two equations, though (see e.g. Cameron and Trivedi (2005)).[27] Since the labor market imperfection parameters (dependent variables)

[26] The marginal effects from the multinomial logit regressions relying on the IV subsample are qualitatively similar to those of the full sample (results not reported but available upon request).

[27] Rather than estimating such type II Tobit models, we could run OLS regressions on restricted

are in logarithms, the coefficient on the offshoring variables can be interpreted as the percentage change in the dependent variable given a one-unit increase in the independent variable. We use the same set of regressors and the same three model specifications as in the extensive-margin analysis.

Table 5 reports the results for the second-stage output equation for the intensity of wage-markdown pricing measured by the firm's labor supply elasticity in Belgium (left part) and the Netherlands (right part), respectively. For Belgium, it follows that the patterns for firm-level offshoring that showed up at the extensive margin also hold at the intensive margin. More specifically, given a wage markdown, firms importing finished as well as intermediate goods display lower labor supply elasticities, that is, such firms have higher monopsony/wage-setting power. The regression coefficient on offshoring as an aggregate activity indicates that a 0.1 unit increase in the 1-year lagged total import share is associated with a 5.8% lower labor supply elasticity (see column (1a)). Again, the nature of imports does not play a role (though the effect of final goods offshoring is larger than that of offshoring intermediate goods in Belgium, see column (2)) but the country of origin comes into play (see column (3)). Similar to the extensive-margin results, the country of origin matters for firm-level offshoring of intermediate goods. More precisely, the positive correlation between imported intermediate goods and firms' monopsony power is primarily due to imports from OECD countries. Unlike the extensive-margin results, the positive association between imported final goods and firms' monopsony power holds for all country source groups.

From column (4a), we learn that the positive association between offshoring as an aggregate activity and firms' wage-setting power is even larger in the Netherlands: a 0.1 unit increase in the 1-year lagged total import share is associated with a 8.1% lower labor supply elasticity. While the country of origin does not matter for the extensive-margin results of offshoring in the Netherlands, it does so at the intensive margin (see column (5)). The negative association between imported final goods and firms' labor supply elasticity is driven by such imports from neighboring countries. Imports of intermediate goods from OECD countries and China fortify the wage-setting power of Dutch firms, as shown by the negative correlation between such imports and firms' labor supply elasticity.

<Insert Table 5 about here>

Table 6 presents the results for the second-stage output equation for the intensity of wage-markup pricing measured by the magnitude of workers' relative bargaining power in Belgium (left part) and the Netherlands (right part), respectively. For Belgium,

estimation samples. We did so in a check of robustness and obtained very similar results (results not reported but available upon request).

our findings at the intensive margin are very much in line with the extensive-margin results. In firms where workers are paid above their marginal revenue product, firm-level offshoring of both finished and intermediate inputs is negatively associated with workers' bargaining power (see column (2)). The regression coefficient on offshoring of finished (intermediate) goods indicates that a 0.1 unit increase in the 1-year lagged import share of final (intermediate) goods is associated with a decrease in workers' relative bargaining power of 7.3% (7.7%). In the case of offshoring of finished goods, such negative correlation is driven by imports from non-OECD countries (see column (3)), which could be rationalized by labor cost reductions. In the case of offshoring of intermediate goods, imports from neighboring countries and China seem responsible for dampening workers' monopoly/bargaining power during negotiations (see column (3)).

Unlike the results for Belgium and unlike the Dutch results at the extensive margin of workers' bargaining power (that is, wage-markup pricing), firm-level offshoring does not play a large role in shaping the intensity of workers' bargaining power in Dutch firms that pay wage markups (see right panel). Only offshoring of intermediate goods correlates negatively with workers' bargaining power and this is true irrespective of the country of origin, except for imports from neighboring countries (see column (6)).

<Insert Table 6 about here>

Similar to the extensive-margin analysis, one could be worried about the validity of the intensive-margin analysis presented so far due to potential endogeneity problems. Using again firm-weighted exchange rates vis-a-vis the euro as instruments for aggregate firm-level offshoring, we present our TSLS estimates as a robustness check in columns (1b) and (4b) of Tables 5 and 6 for Belgium and the Netherlands, respectively. From the first-stage F-statistic for the joint significance of the instruments, we learn that at least one of our instruments is useful for predicting aggregate offshoring activity, that is, the instrument relevance condition is satisfied. Similar to the IV regressions at the extensive margin, we conclude from the p-value of the Sargan test statistic that the instruments are exogenous in the IV regressions for the intensity of wage-markdown pricing in both countries (see columns (1b) and (4b) in Table 5) and for the intensity of wage-markup pricing in the Netherlands (see column (4b) in Table 6). However, the instrument exogeneity condition fails in the IV regression for the intensity of wage-markup pricing in Belgium (see column (1b) in Table 6).

The TSLS estimates confirm the estimates of the type II Tobit regressions for the intensity of wage-markdown pricing. In particular, we find that offshoring increases firms' monopsony power in both countries. More precisely, a 0.1 unit increase in the 1-year lagged total import share decreases the labor supply elasticity of Belgian (Dutch) firms by 26.6% (22.9%) (see columns (1b) and (4b) in Table 5 for Belgium and the Netherlands, respectively).[28] Similar to the type II Tobit regression estimates, our TSLS findings point to a negative impact of aggregate offshoring activity on workers' bargaining power in Belgian firms, though this effect is not statistically significant and our instrumentation strategy appears to be invalid (see column (1b) in Table 6). The TSLS coefficient of aggregate firm-level imports on workers' bargaining power in Dutch firms switches sign but is not statistically significant (see column (4b) in Table 6). Such insignificant TSLS estimates could be due to restricted IV subsamples (only 13% and 22% of the Tobit regression samples in Belgium and the Netherlands, respectively).

We checked and confirmed the robustness of our main results at the extensive and intensive margin to using firm-product level trade data corrected for re-export activities. [29]

How does offshoring affect the intensity of labor market imperfections? To examine the channels through which offshoring shapes labor market imperfections, we derive a reduced-form representation of firm-level labor market imperfections consistent with our theoretical framework and the modeling convention in the misallocation literature (Hsieh and Klenow (2009), Liu (2019)). More precisely, we represent labor market imperfections (G_{it}) by the ratio of the average wage paid by the firm (W_{it}) to the equilibrium marginal revenue product of labor ($(R_N)_{it}$). Recall that in our theoretical framework, labor market imperfections give rise to wage-employment contracts off the firm's labor demand curve and, hence, cause G_{it} to be different from unity. Labor market imperfections arising from firms' monopsony power lead to wage-employment contracts below the firms' labor demand curve (wage-markdown pricing, G_{it} below unity). Labor market imperfections arising from workers' monopoly power lead to wage-employment contracts above the firms' labor demand curve (wage-markup pricing, G_{it} above unity). Given that in equilibrium, the marginal revenue equals the marginal cost of production ($(R_N)_{it} = (C_Q)_{it}$) and that solving the firm's profit maximization problem yields the standard result that the firm's price is a markup over its marginal cost of production ($\mu_{it} = \frac{P_{it}}{(C_Q)_{it}}$), it can be show that G_{it} can be decomposed into four fundamental dimensions: the average wage paid by the firm (W_{it}), the marginal product of labor ($(Q_N)_{it}$), the price-cost markup (μ_{it}) and the output price (P_{it}):[30]

$$G_{it} = \frac{W_{it}}{(R_N)_{it}} = \frac{W_{it}\mu_{it}}{(Q_N)_{it}P_{it}} \tag{19}$$

Multiplying the numerator and denominator of the right-hand side of Eq. (19) by $\frac{N_{it}}{Q_{it}}$ and rearranging, it is straightforward to show that G_{it} can also be written as the ratio of the gap between the output elasticity with respect to labor and the share of labor

[28] The type II Tobit regression estimates relying on the IV subsample are are qualitatively similar to those of the full sample (results not reported but available upon request).

[29] These results are not reported but available upon request.

[30] We refer to Caselli et al. (2021) for details of the derivation.

input expenditure in total revenue to the gap between the output elasticity with respect to intermediate input and the share of intermediate input expenditure in total revenue:

$$G_{it} = \frac{\frac{(\varepsilon^Q_M)_{it}}{\alpha^M_{it}}}{\frac{(\varepsilon^Q_N)_{it}}{\alpha^N_{it}}} = \frac{\mu_{it}}{gap^N_{it}} \tag{20}$$

Comparing this expression to our expression for the firm's joint market imperfections parameter, $\psi_{it} = \frac{(\varepsilon^Q_M)_{it}}{\alpha^M_{it}} - \frac{(\varepsilon^Q_N)_{it}}{\alpha^N_{it}}$ shows indeed that $\psi_{it} < 0$ ($LMS_{it} = WMD$) corresponds to $G_{it} < 1$ and $\psi_{it} > 0$ ($LMS_{it} = WMU$) corresponds to $G_{it} > 1$.

To empirically decompose G_{it} into its building blocks, we follow Caselli et al. (2021) and deflate total revenue by the two-digit industry deflator (P_{jt}) for output to proxy for physical output since our data does not contain firm-level prices and quantities. This implies that we can't include the output price (P_{it}) and productivity ($(Q_N)_{it}$) as separate components. Defining the value of the marginal product of labor (VMP^N_{it}) as $(\varepsilon^Q_N)_{it}\frac{Q_{it}}{N_{it}}\frac{P_{it}}{P_{jt}} = \frac{(Q_N)_{it}P_{it}}{P_{jt}}$ and substituting this expression in Eq. (19) leads to a decomposition of G_{it} into measurable components:

$$G_{it} = \frac{W_{it}\mu_{it}}{VMP^N_{it}P_{jt}} \tag{21}$$

Taking the logarithmic version of Eq. (21) decomposes the log of G_{it} into four additive terms.

We are now in a position to examine the channels through which the effect of firm-level total imports on labor market imperfections operates. Consistent with the intensive-margin analysis, we estimate type II Tobit models, in which the first-stage probit participation equation for $\psi_{it} < 0$ (in the case of a wage markdown) and $\psi_{it} > 0$ (in the case of a wage markup), respectively, and the second-stage outcome equation for the reduced-form labor market imperfection parameter and its four components include the same regressors which are allowed to have different coefficients in the two equations. We use the same set of regressors as in the intensive-margin analysis.

Table 7 reports the results for the second-stage output equation for the log of G_{it} and its three firm-year varying components (the log of W_{it}, VMP^N_{it} and μ_{it}) in Belgium (Panel A) and the Netherlands (Panel B), respectively. The decomposition analysis for wage-markdown firms is shown in the left part and the one for wage-markup firms in the right part.

The results show for both countries a negative relationship between the 1-year lagged total import share and the reduced-form labor market imperfection parameter that is only significant for the subsample of wage-markdown firms. The effects are similar in both countries: an increase in the 1-year lagged total import share by 0.1 widens the gap between the wage paid by the firm and the marginal revenue product of labor by 19.3% in Belgium and 16.8% in the Netherlands (see column (1) in Panel A and B, respectively). The widening effect of offshoring on wage markdowns is consistent with the increase in the wage-setting power of firms as show in columns (1a) and (4a) of Table 5 for Belgium and the Netherlands, respectively.[31] We learn that this offshoring effect operates via an increase in the value of the marginal product of labor that is imperfectly passed through into increased wages in both countries (see columns (3) and (2) in Panels A and B) and also via a decrease in the price-cost markup of Dutch firms (see column (4) in Panel B). In Belgium (the Netherlands), an increase in the 1-year lagged total import share by 0.1 is associated with a 41% (49%) higher productivity and 15% (35%) higher wage. Such imperfect productivity-wage pass-through is most pronounced in Belgium and can be explained by wage rigidity (see e.g. Dhyne and Druant (2010) and Fuss and Wintr (2012))[32]. The positive association between offshoring and both productivity and wages can be reconciled with empirical evidence on offshoring enabling firms to import either high-quality intermediates in order to increase efficiency, or cheap intermediate inputs in order to concentrate on core, high productive, high-skill tasks (see e.g. Bernard et al. (2020)). In addition, these productivity and wage augmenting effects are consistent with labor restructuring (see e.g. Mion and Zhu (2013) for evidence on offshoring inducing skill upgrading and productivity increases in Belgian firms). The finding that an increase in the 1-year lagged total import share by 0.1 is associated with a 11% lower price-cost markup of Dutch firms can partially be explained by increases in domestic wages leaving less room for profits or can be interpreted as suggestive evidence of Dutch firms using offshoring to stay competitive in the local market.

The non-significant offshoring effect on the reduced-form labor market imperfection parameter for wage-markup firms in the Netherlands (see column (5) in Panel B) is consistent with the null estimate on workers' bargaining power in the Netherlands (see column (4a) of Table 6).[33] Compared to wage-markdown firms, the positive association between offshoring and the value of the marginal product of labor is much smaller in

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31 This is in line with expectations given that there exists a one-to-one relationship between the reduced-form labor market imperfection parameter G_{it} and the structural labor market imperfection parameter $(\varepsilon^N_W)_{it}$. This is because a firm's labor supply elasticity $(\varepsilon^N_W)_{it}$, measuring the degree of wage-setting power that a firm possesses, is a direct transformation of a firm's wage markdown $G_{it} = \frac{(\varepsilon^N_W)_{it}}{(\varepsilon^N_W)_{it}+1}$.

32 Both studies document that firm-level wage bill variation is predominantly associated with firm-level labor fluctuations. In addition, Fuss and Wintr (2012) show that firm-level wages respond far less to firm-level shocks than to industry-level shocks in Belgium which is characterized by a centralized bargaining structure.

33 Note that the structural labor market imperfection parameter γ_{it} is an indirect transformation of

wage-markup firms and only significantly so (at the 10% level) in Dutch firms. In these firms, an increase in the 1-year lagged total import share by 0.1 is associated with a 16% higher productivity (see column (7) in Panel B). Offshoring increases wages by 42% and 15% in Belgium and the Netherlands, respectively (see column (6) in Panels A and B, respectively). As such, offshoring induces workers in Dutch firms that pay wage markups to obtain wage increases that are of the same order of magnitude as increases in the value of the marginal product of labor whereas offshoring gives rise to wage increases that highly exceed productivity increases for workers in Belgian firms that pay wage markups.

<Insert Table 7 about here>

8 Conclusion

The acceleration of technological progress, the reduction in transport and communication costs and the fragmentation of production has profoundly affected international trade patterns in recent decades. Empirical studies using firm panel data have investigated the impact of increased offshoring on various firm outcomes such as total employment, the composition of labor demand in terms of skill or occupation types, average wages, firm survival and innovation. Against the concern that firms' monopsony power has been on the rise in recent years, this paper examines how different facets of firm-level offshoring relate to the prevalence and intensity of firms' labor market power. As such, our analysis complements research analyzing the reduced-form effects of offshoring on end points (wages and employment).

Our empirical analysis is based on firm-level data sourced from firm annual accounts and VAT declarations complemented with information on international transactions at the country, firm and product level sourced from the Transaction Trade database. Having access to such rich data for Belgian as well as Dutch firms over the period 2009-2017 allows us to compare the interplay between firm-level offshoring and firms' labor market power in two small open economies that differ in terms of global focus. We use the production function approach introduced by Dobbelaere and Mairesse (2013) to measure the prevalence and intensity of firms' labor market power. At the extensive margin, firms either impose a wage markdown on workers or pay a wage markup to workers. The magnitude of firms' labor supply elasticity informs us on the intensity of wage markdowns and the magnitude of workers' bargaining power informs us on the intensity of wage markups.

the reduced-form labor market imperfection parameter G_{it}: $G_{it} = \frac{1}{1-\gamma_{it}\frac{1-\alpha_{it}^N-\alpha_{it}^M}{\alpha_{it}^N}}$, hence, a higher workers' relative bargaining power γ_{it} implies a higher firm's wage markup G_{it}.

Our core result is that offshoring shapes employers' labor market power, irrespective of the nature of imports. Firm-level offshoring of finished as well as intermediate goods favors employers as firms with offshoring activities are more likely to impose wage markdowns and less likely to pay wage markups. These findings at the extensive margin also show up at the intensive margin. Offshoring is associated with higher monopsony power (wider wage markdowns) in Belgian and Dutch firms while accompanied with lower workers' bargaining power (lower wage markups) in Belgian firms. In both countries, the widening effect of offshoring on wage markdowns arises from an increase in productivity that is only imperfectly passed through into an increase in wages. In the Netherlands, the results at the extensive margin are stronger than at the intensive margin and the size effects are larger than in Belgium. Contrary to the nature of imports (finished versus intermediate goods), the origin of imports matters for the prevalence of Belgian firms' labor market power. This is far less so for Dutch companies which could be explained by their more global focus and the more global scale of the vertical chain in which they operate.

Tables

Table 1: The prevalence of labor and product market imperfections of offshorers (non-offshorers) in percentages

Panel A: Belgium

Labor market setting	Product market setting: Price marginal cost	Product market setting: Price-cost markup	$\sum$
Wage markdown	10.4 (9.0)	21.5 (16.8)	31.9 (25.8)
Wage marginal product	7.5 (6.4)	30.6 (20.9)	38.1 (27.3)
Wage markup	3.3 (9.6)	26.7 (37.3)	30.0 (46.9)
$\sum$	21.2 (25.0)	78.8 (75.0)	

Panel B: the Netherlands

Labor market setting	Product market setting: Price marginal cost	Product market setting: Price-cost markup	$\sum$
Wage markdown	5.9 (1.9)	35.6 (25.6)	41.5 (27.4)
Wage marginal product	2.1 (0.8)	21.3 (12.9)	23.4 (13.7)
Wage markup	0.4 (0.6)	34.7 (58.2)	35.0 (58.8)
$\sum$	8.4 (3.3)	91.6 (96.7)	

Notes: 6,534 (11,296) firms in Belgium (the Netherlands) covering the period 2010–2017. Percentages of 39,758 (66,126) firm-year observations in Belgium (the Netherlands). Offshorers are defined as firms reporting a positive ratio of imported goods to sales. Based on the estimates of the joint market imperfections parameter ($\widehat{\psi}$) and the price-cost mark-up ($\widehat{\mu}$), we classify observations into labor market settings using Eqs. (3)–(4) and into product market settings using Eq. (1).

Table 2: The intensity of labor and product market imperfections (means)

Market imperfection intensity	Belgium			the Netherlands		
	All	Offshorer		All	Offshorer	
		Yes	No		Yes	No
Joint market imperfections parameter (ψ_{it})	–0.018	–0.091	0.056	0.022	–0.185	0.140
… when wage markdown ($\psi_{it} < 0$)	–0.669	–0.810	–0.491	–0.804	–0.850	-0.765
… when wage markup ($\psi_{it} > 0$)	0.473	0.599	0.391	0.570	0.497	0.595
Given wage markdown ($\psi_{it} < 0$) …						
Firm-level labor supply elasticity ($(\varepsilon_w^N)_{it}$)	3.063	2.742	3.466	3.127	2.699	3.497
Wage markdown (G_{it})	0.673	0.646	0.706	0.657	0.636	0.675
Given wage markup ($\psi_{it} > 0$) …						
Workers' absolute bargaining power (ϕ_{it})	0.529	0.576	0.498	0.394	0.390	0.396
Workers' relative bargaining power (γ_{it})	4.556	6.163	3.513	3.156	2.315	3.441
Price-cost markup (μ_{it})	1.115	1.129	1.102	1.346	1.250	1.400
… when markup pricing ($\mu_{it} > 1$)	1.162	1.171	1.153	1.366	1.275	1.415

Notes: Based on the estimates of the joint market imperfections parameter ($\widehat{\psi}$) and the price-cost mark-up ($\widehat{\mu}$), we classify observations into labor market settings using Eqs. (3)–(4) and into product market settings using Eq. (1). Conditional on a labor market setting, the structural labor market imperfection parameters are recovered using Eqs. (14)–(17). Conditional on a product market setting, the structural product market imperfection parameter is recovered using Eq. (10).

Table 3: Average marginal effects from multinomial logit regressions and average effects from an IV regression for the probability of a wage markdown

	Belgium				the Netherlands			
	(1a)	(1b)	(2)	(3)	(4a)	(4b)	(5)	(6)
LIMPsh	0.207***	0.748***			0.641***	1.489***		
	(0.033)	(0.277)			(0.063)	(0.332)		
LIMPsh_final			0.235***				0.414***	
			(0.056)				(0.096)	
LIMPsh_final_neig				0.139				0.476***
				(0.088)				(0.085)
LIMPsh_final_OECDexclneig				0.152*				0.046
				(0.080)				(0.250)
LIMPsh_final_nonOECDexclChina				0.713***				0.904***
				(0.264)				(0.312)
LIMPsh_final_China				0.773***				0.531***
				(0.288)				(0.204)
LIMPsh_int			0.205***				0.816***	
			(0.040)				(0.085)	
LIMPsh_int_neig				0.162***				0.784***
				(0.050)				(0.106)
LIMPsh_int_OECDexclneig				0.247***				0.567***
				(0.079)				(0.161)
LIMPsh_int_nonOECDexclChina				0.143				0.874***
				(0.200)				(0.287)
LIMPsh_int_China				0.272				0.874***
				(0.177)				(0.215)
Log likelihood	–30,012.1		–30,025.6	–29,950.6	–48,512.9		–48,452.6	–48,348.8
First-stage F-statistic		18.60				1,878		
Sargan Test p-value		0.131				0.759		
Number of observations	32,188	10,067	32,188	32,188	52,433	19,360	52,433	52,433

Notes: Reported numbers in columns (1a), (2), (3), (4a), (5) and (6) are average marginal effects from multinomial logit regressions for the probability of a wage markdown. In these regressions, the dependent variable is a categorical variable for the classification of the labor market setting as involving either a wage markdown, marginal-product wages or a wage markup. Reported numbers in columns (1b) and (4b) are average effects from an IV regression for the probability of a wage markdown. In this regression, the dependent variable is a binary variable taking a value of 1 if the labor market setting is wage-markdown pricing and 0 otherwise. Standard errors are clustered at the firm level and are reported in parentheses. ***/**/* denotes statistical significance at the 1%/5%/10% level. Control variables included in all specifications are firm observables, such as the export-to-sales ratio, firm size (number of employees), capital intensity, the share of employees with upper education and total factor productivity, and industry observables such as import competition measures (split by source country group) and industry and year fixed effects.

Table 4: Average marginal effects from multinomial logit regressions and average effects from an IV regression for the probability of a wage markup

	Belgium				the Netherlands			
	(1a)	(1b)	(2)	(3)	(4a)	(4b)	(5)	(6)
LIMPsh	-0.388***	-0.666***			-0.879***	-1.870***		
	(0.041)	(0.240)			(0.090)	(0.352)		
LIMPsh_final			-0.343***				-0.614***	
			(0.082)				(0.144)	
LIMPsh_final_neig				-0.254**				-0.619***
				(0.112)				(0.108)
LIMPsh_final_OECDexclneig				-0.167				-0.011
				(0.146)				(0.363)
LIMPsh_final_nonOECDexclChina				-1.424***				-1.220***
				(0.436)				(0.433)
LIMPsh_final_China				-0.803*				-0.833***
				(0.449)				(0.302)
LIMPsh_int			-0.395***				-1.045***	
			(0.049)				(0.111)	
LIMPsh_int_neig				-0.436***				-0.984***
				(0.064)				(0.136)
LIMPsh_int_OECDexclneig				-0.341***				-0.754***
				(0.099)				(0.210)
LIMPsh_int_nonOECDexclChina				0.076				-1.191***
				(0.268)				(0.390)
LIMPsh_int_China				-0.814***				-1.188***
				(0.254)				(0.273)
Log likelihood	–30,012.1		–30,025.6	–29,950.6	–48,512.9		–48,452.6	–48,348.8
First-stage F-statistic		18.60				1,878		
Sargan Test p-value		0.000				0.527		
Number of observations	32,188	10,067	32,188	32,188	52,443	19,360	52,443	52,443

Notes: Reported numbers in columns (1a), (2), (3), (4a), (5) and (6) are average marginal effects from multinomial logit regressions for the probability of a wage markup. In these regressions, the dependent variable is a categorical variable for the classification of the labor market setting as involving either a wage markdown, marginal-product wages or a wage markup. Reported numbers in columns (1b) and (4b) are average effects from an IV regression for the probability of a wage markup. In this regression, the dependent variable is a binary variable taking a value of 1 if the labor market setting is wage-markup pricing and 0 otherwise. Standard errors are clustered at the firm level and are reported in parentheses. ***/**/* denotes statistical significance at the 1%/5%/10% level. Control variables included in all specifications are firm observables, such as the export-to-sales ratio, firm size (number of employees), capital intensity, the share of employees with upper education and total factor productivity, and industry observables such as import competition measures (split by source country group) and industry and year fixed effects.

Table 5: Estimates of the second-stage output equation of type II Tobit regressions and of an IV regression for the intensity of wage-markdown pricing measured by the magnitude of firms' labor supply elasticity

	Belgium				the Netherlands			
	(1a)	(1b)	(2)	(3)	(4a)	(4b)	(5)	(6)
LIMPsh	-0.584***	-2.656***			-0.811***	-2.292***		
	(0.089)	(0.733)			(0.093)	(0.761)		
LIMPsh_final			-0.688***				-0.657***	
			(0.154)				(0.128)	
LIMPsh_final_neig				-0.461**				-0.708***
				(0.232)				(0.154)
LIMPsh_final_OECDexclneig				-0.775***				-0.448
				(0.280)				(0.302)
LIMPsh_final_nonOECDexclChina				-1.037*				-0.966*
				(0.618)				(0.497)
LIMPsh_final_China				-1.214***				0.213
				(0.417)				(0.302)
LIMPsh_int			-0.370***				-0.918***	
			(0.101)				(0.115)	
LIMPsh_int_neig				-0.570***				-0.802***
				(0.140)				(0.124)
LIMPsh_int_OECDexclneig				-0.500**				-1.149***
				(0.198)				(0.191)
LIMPsh_int_nonOECDexclChina				-1.093*				-0.610
				(0.577)				(0.435)
LIMPsh_int_China				-0.327				-0.679**
				(0.381)				(0.293)
Log likelihood	–17,773.8		–17,804.3	–17,733.3	–30,811.1		–30,800.7	–30,779.8
First-stage F-statistic		12.44				16,727		
Sargan Test p-value		0.190				0.245		
Number of observations	14,861	5,943	14,861	14,861	21,785	10,529	21,785	21,785

Notes: Reported numbers in columns (1a), (2), (3), (4a), (5) and (6) are coefficients from the outcome equation of type II Tobit regressions and reported numbers in columns (1b) and (4b) are IV estimates with standard errors clustered at the firm level in parentheses. ***/**/* denotes statistical significance at the 1%/5%/10% level. Control variables included in all specifications are firm observables, such as the export-to-sales ratio, firm size (number of employees), capital intensity, the share of employees with upper education and total factor productivity, and industry observables such as import competition measures (split by source country group) and industry and year fixed effects.

Table 6: Estimates of the second-stage output equation of type II Tobit regressions and of an IV regression for the intensity of wage-markup pricing measured by the magnitude of workers' relative bargaining power

	Belgium				the Netherlands			
	(1a)	(1b)	(2)	(3)	(4a)	(4b)	(5)	(6)
LIMPsh	-0.789***	-1.174			-0.120	1.303		
	(0.180)	(2.009)			(0.074)	(1.082)		
LIMPsh_final			-0.728***				-0.058	
			(0.369)				(0.096)	
LIMPsh_final_neig				-0.589				-0.515*
				(0.533)				(0.296)
LIMPsh_final_OECDexclneig				-0.697				0.138
				(0.553)				(0.116)
LIMPsh_final_nonOECDexclChina				-4.074**				0.423
				(2.015)				(1.654)
LIMPsh_final_China				-0.424				-1.955*
				(1.761)				(1.175)
LIMPsh_int			-0.774***				-0.151	
			(0.210)				(0.106)	
LIMPsh_int_neig				-0.928***				-0.247
				(0.309)				(0.196)
LIMPsh_int_OECDexclneig				-0.424				-0.938**
				(0.440)				(0.391)
LIMPsh_int_nonOECDexclChina				-0.339				-2.682**
				(1.027)				(1.267)
LIMPsh_int_China				-2.739***				-1.684**
				(0.965)				(0.703)
Log likelihood	–26,283.2		–26,283.3	–26,205.4	–50,938.2		–50,937.8	–50,429.0
First-stage F-statistic		11.64				17.71		
Sargan Test p-value		0.019				0.554		
Number of observations	17,203	3,823	17,203	17,203	30,658	8,794	30,658	30,658

Notes: Reported numbers in columns (1a), (2), (3), (4a), (5) and (6)) are coefficients from the outcome equation of type II Tobit regressions and reported numbers in columns (1b) and (4b) are IV estimates with standard errors clustered at the firm level in parentheses. ***/**/* denotes statistical significance at the 1%/5%/10% level. Control variables included in all specifications are firm observables, such as the export-to-sales ratio, firm size (number of employees), capital intensity, the share of employees with upper education and total factor productivity, and industry observables such as import competition measures (split by source country group) and industry and year fixed effects.

Table 7: Estimates of the second-stage output equation of type II Tobit regressions for the reduced-form labor market imperfections parameter and its three firm-year varying components (the average wage paid by the firm, the value of the marginal product of labor and the firm-level price-cost markup)

Panel A: Belgium

	Wage-markdown firms				Wage-markup firms			
	Log of...				Log of...			
	reduced-form labor market imperfection parameter G_{it}	average wage paid by the firm W_{it}	value of marginal product of labor VMP_{it}^N	firm-level price-cost markup μ_{it}	reduced-form labor market imperfection parameter G_{it}	average wage paid by the firm W_{it}	value of marginal product of labor VMP_{it}^N	firm-level price-cost markup μ_{it}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LIMPsh	-0.193***	0.154***	0.413***	0.010	-0.028	0.423***	0.100	-0.169***
	(0.040)	(0.035)	(0.049)	(0.011)	(0.096)	(0.040)	(0.105)	(0.018)
Log likelihood	–6,732.3	–9,117.6	–11,318.6	–259.31	–10,754.49	–5,892.4	-12,313.6	3,223.51
Number of observations	14,861				16,740			

Panel B: the Netherlands

	Wage-markdown firms				Wage-markup firms			
	Log of...				Log of...			
	reduced-form labor market imperfection parameter G_{it}	average wage paid by the firm W_{it}	value of marginal product of labor VMP_{it}^N	firm-level price-cost markup μ_{it}	reduced-form labor market imperfection parameter G_{it}	average wage paid by the firm W_{it}	value of marginal product of labor VMP_{it}^N	firm-level price-cost markup μ_{it}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LIMPsh	-0.168***	0.353***	0.492***	-0.113***	-0.098	0.151**	0.165*	-0.051*
	(0.035)	(0.049)	(0.047)	(0.012)	(0.067)	(0.071)	(0.092)	(0.029)
Log likelihood	–10,286.8	–20,634.7	–17,547.1	2,938.0	–12,760.71	–18,806.6	–19,484.4	10,848.8
Number of observations	21,753				30,554			

Notes: The dependent variable is the logarithm of the reduced-form labor market imperfections parameter (log of the ratio of the average wage paid by the firm to the marginal revenue product of labor), the average wage paid by the firm, the value of the marginal product of labor and the firm-level price-cost markup and. Reported numbers are coeffcients from the outcome equation of type II Tobit regressions with standard errors clustered at the firm level in parentheses. ***/**/* denotes statistical significance at the 1%/5%/10% level. Control variables included in all specifications are firm observables, such as the export-to-sales ratio, firm size (number of employees), capital intensity, the share of employees with upper education and total factor productivity, and industry observables such as import competition measures (split by source country group) and industry and year fixed effects.

A Descriptive statistics

Table A.1: Descriptive statistics for Belgium, 2009-2017

	Mean	Sd	p25	p50	p75	
Real firm output growth rate (Δq_{it})	-0.006	0.219	-0.089	0.001	0.090	52,543
Labor growth rate (Δn_{it})	0.002	0.146	-0.053	0.000	0.056	52,544
Intermediate inputs growth rate (Δm_{it})	-0.007	0.257	-0.109	0.001	0.108	52,544
Capital growth rate (Δk_{it})	-0.021	0.427	-0.175	-0.075	0.068	45,800
Revenue share of labor (α_{it}^N)	0.253	0.130	0.158	0.237	0.329	52,544
Revenue share of intermediate inputs (α_{it}^M)	0.670	0.161	0.558	0.681	0.792	52,544
1-(α_{it}^N)-(α_{it}^M)	0.078	0.132	0.007	0.075	0.153	52,544
ln(wagebill$_{it}$	13.656	1.387	12.622	13.413	14.413	52,544
ln(output$_{it}$)	10.546	1.551	9.408	10.281	11.388	52,544
ln(employment$_{it}$)	2.956	1.210	2.041	2.728	3.622	52,544
ln(intermediate inputs$_{it}$)	10.098	1.691	8.877	9.868	11.075	52,544
ln(capital$_{it}$)	8.570	1.859	7.439	8.585	9.681	52,544
ln(real output per worker) (ln($\frac{Q}{N}$)$_{it}$)	7.590	0.720	7.102	7.508	7.984	52,544
ln(real value added per worker) (ln($\frac{Q-M}{N}$)$_{it}$)	6.469	0.519	6.174	6.445	6.747	52,443
Capital intensity ($Capint_{it}$)	5.614	1.330	4.895	5.775	6.506	52,544
Solow Residual (SR_{it})	0.001	0.150	-0.059	0.003	0.064	45,799
Share of workers with primary education	0.131	0.256	0.000	0.000	0.120	52,544
Share of workers with secondary education	0.395	0.361	0.000	0.370	0.723	52,544
Share of workers with upper education	0.065	0.136	0.000	0.000	0.078	52,544
IMP	0.518	0.500	0.000	1.000	1.000	52,544
IMPsh	0.113	0.190	0.000	0.000	0.189	52,544
IMPsh_cor	0.029	0.085	0.000	0.000	0.000	52,544
IMPsh_final	0.029	0.096	0.000	0.000	0.001	52,544
IMPsh_final_cor	0.009	0.046	0.000	0.000	0.000	52,544
IMPsh_final_neig	0.015	0.061	0.000	0.000	0.000	52,544
IMPsh_final_OECDexclneig	0.010	0.062	0.000	0.000	0.000	52,544
IMPsh_final_nonOECDexclChina	0.002	0.019	0.000	0.000	0.000	52,544
IMPsh_final_China	0.002	0.022	0.000	0.000	0.000	52,544
IMPsh_int	0.075	0.143	0.000	0.000	0.092	52,544
IMPsh_int_cor	0.018	0.061	0.000	0.000	0.000	52,544
IMPsh_int_neig	0.050	0.108	0.000	0.000	0.048	52,544
IMPsh_int_OECDexclneig	0.024	0.072	0.000	0.000	0.007	52,544
IMPsh_int_nonOECDexclChina	0.002	0.021	0.000	0.000	0.000	52,544
IMPsh_int_China	0.004	0.024	0.000	0.000	0.000	52,544
EXPxIMP	0.385	0.487	0.000	0.000	1.000	52,544
EXP	0.448	0.497	0.000	0.000	1.000	52,544
EXPsh	0.183	0.327	0.000	0.000	0.286	52,544
EXPsh_cor	0.084	0.211	0.000	0.000	0.001	52,544
MNE	0.063	0.243	0.000	0.000	0.000	52,544
IVEXCHSH_OECDexclneig	0.430	0.868	0.000	0.073	0.412	24,894
IVEXCHSH_ROW	0.808	1.639	0.000	0.000	0.691	24,894
IVEXCHSH_China	0.616	0.952	0.000	0.000	1.992	24,894
IMPcomp	1.540	1.980	0.522	0.633	2.061	52,553
IMPcomp_OECD	0.964	1.045	0.347	0.379	1.495	52,553
IMPcomp_nonOECDexclChina	0.436	0.735	0.121	0.250	0.394	52,553
IMPcomp_China	0.140	0.343	0.007	0.055	0.136	52,553
Firms			6,695			

Note: $SR_{it} = \Delta q_{it} - \alpha_{it}^N \Delta n_{it} - \alpha_{it}^M \Delta m_{it} - (1 - \alpha_{it}^N - \alpha_{it}^M)\Delta k_{it}$.

Table A.2: Descriptive statistics for the Netherlands, 2009-2017

	Mean	Sd	p25	p50	p75	
Real firm output growth rate (Δq_{it})	0.013	0.315	-0.088	0.009	0.107	79,875
Labor growth rate (Δn_{it})	0.011	0.156	-0.052	0.000	0.070	79,875
Intermediate inputs growth rate (Δm_{it})	0.014	0.427	-0.104	0.006	0.122	79,857
Capital growth rate (Δk_{it})	-0.089	2.539	-0.158	-0.044	0.082	79,301
Revenue share of labor (α_{it}^{N})	0.235	0.106	0.155	0.228	0.304	81,705
Revenue share of intermediate inputs (α_{it}^{M})	0.582	0.147	0.474	0.578	0.686	81,705
1-(α_{it}^{N})-(α_{it}^{M})	0.183	0.115	0.110	0.174	0.248	81,705
ln(wagebill$_{it}$	6.058	1.341	5.204	6.009	6.880	81,601
ln(output$_{it}$)	7.598	1.410	6.552	7.437	8.464	81,705
ln(employment$_{it}$)	2.748	1.001	1.990	2.615	3.331	81,705
ln(intermediate inputs$_{it}$)	7.017	1.544	5.867	6.851	7.979	81,705
ln(capital$_{it}$)	5.459	2.355	4.461	5.809	6.926	81,705
ln(real output per worker) (ln($\frac{Q}{N}$)$_{it}$)	4.850	0.765	4.390	4.839	5.288	81,705
ln(real value added per worker) (ln($\frac{Q-M}{N}$)$_{it}$)	3.931	0.637	3.592	3.982	4.310	81,635
Capital intensity ($Capint_{it}$)	2.711	2.229	2.063	3.200	4.056	81,705
Solow Residual (SR_{it})	0.016	0.504	-0.063	0.007	0.074	79,295
Share of workers with primary education	0.156	0.150	0.042	0.125	0.222	81,495
Share of workers with secondary education	0.265	0.179	0.146	0.250	0.361	81,495
Share of workers with upper education	0.145	0.215	0.000	0.063	0.222	81,495
IMP	0.363	0.481	0.000	0.000	1.000	81,705
IMPsh	0.076	2.617	0.000	0.000	0.007	81,705
IMPsh_cor	0.064	2.174	0.000	0.000	0.005	81,705
IMPsh_final	0.027	1.617	0.000	0.000	0.000	81,705
IMPsh_final_cor	0.023	1.352	0.000	0.000	0.000	81,705
IMPsh_final_neig	0.015	0.266	0.000	0.000	0.000	81,705
IMPsh_final_OECDexclneig	0.003	0.055	0.000	0.000	0.000	81,705
IMPsh_final_nonOECDexclChina	0.001	0.019	0.000	0.000	0.000	81,705
IMPsh_final_China	0.009	1.378	0.000	0.000	0.000	81,705
IMPsh_int	0.049	1.715	0.000	0.000	0.003	81,705
IMPsh_int_cor	0.040	1.429	0.000	0.000	0.001	81,705
IMPsh_int_neig	0.031	0.339	0.000	0.000	0.000	81,705
IMPsh_int_OECDexclneig	0.008	0.319	0.000	0.000	0.000	81,705
IMPsh_int_nonOECDexclChina	0.002	0.020	0.000	0.000	0.000	81,705
IMPsh_int_China	0.011	1.164	0.000	0.000	0.000	81,705
EXPxIMP	0.256	0.436	0.000	0.000	1.000	81,705
EXP	0.315	0.464	0.000	0.000	1.000	81,705
EXPsh	0.151	6.022	0.000	0.000	0.007	81,705
EXPsh_cor	0.139	5.403	0.000	0.000	0.005	81,705
MNE	0.060	0.238	0.000	0.000	0.000	81,705
IVEXCHSH_OECDexclneig	0.358	0.982	0.000	0.000	0.216	29,599
IVEXCHSH_ROW	0.314	1.216	0.000	0.000	0.000	29,599
IVEXCHSH_China	0.148	0.534	0.000	0.000	0.000	29,599
IMPcomp	1.104	2.457	0.414	0.577	1.067	81,705
IMPcomp_OECD	0.773	1.326	0.327	0.463	0.849	81,705
IMPcomp_nonOECDexclChina	0.171	0.601	0.033	0.088	0.147	81,705
IMPcomp_China	0.160	0.575	0.011	0.055	0.102	81,705
Firms			11,379			

Note: $SR_{it} = \Delta q_{it} - \alpha_{it}^{N}\Delta n_{it} - \alpha_{it}^{M}\Delta m_{it} - (1 - \alpha_{it}^{N} - \alpha_{it}^{M})\Delta k_{it}$.

B Estimating firms' production function

In order to obtain consistent estimates of the output elasticities $(\varepsilon_N^Q)_{it}$ and $(\varepsilon_M^Q)_{it}$, we consider production functions with a scalar Hicks-neutral productivity term (denoted by ω_{it}) and common technology parameters across producers within a manufacturing industry (denoted by the vector β). These two assumptions imply the following expression for the production function:

$$Q_{it} = F(N_{it}, M_{it}, K_{it}; \beta)\exp(\omega_{it})\,. \tag{B.1}$$

To control for productivity shocks ω_{it} which are observed by the firm when making optimal input choices but unobserved by the econometrician, we follow standard practice in the extant literature. We employ a semi-parametric structural control function approach and use the insight that optimal intermediate input demand holds information about unobserved productivity. We apply the estimation procedure proposed by Ackerberg et al. (2015). We denote the logs of Q_{it}, N_{it}, M_{it} and K_{it} by q_{it}, n_{it}, m_{it} and k_{it}, respectively.

We impose the following timing assumptions. Capital k_{it} is assumed to be decided a period ahead (at $t-1$) because of planning and installation lags. Labor is "less variable" than material. More precisely, n_{it} is chosen by firm i at time $t-b$ $(0 < b < 1)$, after k_{it} being chosen at $t-1$ but prior to m_{it} being chosen at t. This assumption is consistent with e.g. firms needing time to train new workers.

We assume that productivity (ω_{it}) evolves according to an endogenous first-order Markov process. In particular, we allow a firm's decision to engage in foreign direct investment (denoted MNE_{it-1}) to endogenously affect future productivity, which is supported by evidence in international economics applications (see e.g. Blomström and Kokko (1997), Helpman et al. (2004), Girma et al. (2005), Greenaway and Kneller (2007)). As such, we can decompose ω_{it} into its conditional expectation given the information known by the firm in $t-1$ (denoted I_{it-1}) and a random innovation to productivity (denoted ξ_{it}):

$$\omega_{it} = \mathbb{E}[\omega_{it}|I_{it-1}] + \xi_{it} = \mathbb{E}[\omega_{it}|\omega_{it-1}, MNE_{it-1}] + \xi_{it} = g(\omega_{it-1}, MNE_{it-1}) + \xi_{it} \tag{B.2}$$

with $g(\cdot)$ a general function. ξ_{it} is assumed to be mean independent of the firm's information set at $t-1$.

Given these timing assumptions, firm i's intermediate input demand at t depends directly on n_{it} chosen prior to m_{it}, i.e. the input demand function for m_{it} is conditional on n_{it}:

$$m_{it} = m_t(n_{it}, k_{it}, MNE_{it}, \omega_{it}) \tag{B.3}$$

Eq. (B.3) shows that ω_{it} is the only unobservable entering the intermediate input demand function. This scalar unobservable assumption together with the assumption that $m_t(\cdot)$ is strictly increasing in ω_{it} conditional on n_{it}, k_{it} and MNE_{it} (strict monotonicity assumption), allow to invert ω_{it} as a function of observables:

$$\omega_{it} = m_t^{-1}(m_{it}, n_{it}, k_{it}, MNE_{it}) \,. \tag{B.4}$$

Considering the logarithmic version of Eq. (B.1) and allowing for an idiosyncratic error term including non-predictable output shocks and potential measurement error in output and inputs (ϵ_{it}) gives:

$$y_{it} = f(n_{it}, m_{it}, k_{it}; \beta) + \omega_{it} + \epsilon_{it} \tag{B.5}$$

where $y_{it} = q_{it} + \epsilon_{it}$ with ϵ_{it} assumed to be mean independent of current and past input choices.[34]

We approximate $f(\cdot)$ by a second-order polynomial where all logged inputs, logged inputs squared and interaction terms between logged inputs are included (translog production function):

$$\begin{aligned} y_{it} = \beta_0 + \beta_n n_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_{nn} n_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{kk} k_{it}^2 \\ + \beta_{nm} n_{it} m_{it} + \beta_{nk} n_{it} k_{it} + \beta_{mk} m_{it} k_{it} + \omega_{it} + \epsilon_{it} \end{aligned} \tag{B.6}$$

where β_0 has to be interpreted as the mean efficiency level across firms.

Substituting Eq. (B.4) in Eq. (B.6) results in a first-stage equation of the form:

$$y_{it} = f_{it} + m_t^{-1}(m_{it}, n_{it}, k_{it}, MNE_{it}) + \epsilon_{it} = \varphi_t(n_{it}, m_{it}, k_{it}, MNE_{it}) + \epsilon_{it} \tag{B.7}$$

which has the purpose of separating ω_{it} from ϵ_{it}, i.e. eliminating the portion of output y_{it} determined by unanticipated shocks at time t, measurement error or any other random noise (ϵ_{it}).

Hence, the first stage involves using Eq. (B.7) and the moment condition $\mathbb{E}[\epsilon_{it}|I_{it}] = 0$ to obtain an estimate $\widehat{\varphi}_{it}$ of the composite term $\varphi_t(n_{it}, m_{it}, k_{it}, MNE_{it}) = f_{it} + m_t^{-1}(m_{it}, n_{it}, k_{it}, MNE_{it})$, which represents output net of ϵ_{it}. In our application, estimation of Eq. (B.7) is implemented by regressing output on a second-order polynomial series expansion where all logged inputs, logged inputs squared and interaction terms between logged inputs are included. To allow for time variation in φ_t, these polynomial terms are interacted with a time trend.

[34] Note that $(\varepsilon_N^Q)_{it} = \frac{\partial f(\cdot)}{\partial n_{it}}$ and $(\varepsilon_M^Q)_{it} = \frac{\partial f(\cdot)}{\partial m_{it}}$. These output elasticities are by definition independent of a firm's productivity shock.

Given a particular set of parameters β, we can compute (up to a scalar constant) an estimate of ω_{it}:

$$\begin{aligned} \widehat{\omega}_{it}(\beta) &= \widehat{m}_t^{-1}(m_{it}, n_{it}, k_{it}, MNE_{it}) \\ &= \widehat{\varphi}_{it} - \beta_0 - \beta_n n_{it} - \beta_m m_{it} - \beta_k k_{it} - \beta_{nn} n_{it}^2 - \beta_{mm} m_{it}^2 - \beta_{kk} k_{it}^2 \\ &\quad - \beta_{nm} n_{it} m_{it} - \beta_{nk} n_{it} k_{it} - \beta_{mk} m_{it} k_{it} \end{aligned} \tag{B.8}$$

In order to implement the second stage and to identify the production function coefficients, we need to recover the innovation to productivity (ξ_{it}) to form moments on. Using Eq. (B.8), a consistent (non-parametric) approximation to $\mathbb{E}[\omega_{it}|\omega_{it-1}, MNE_{it-1}]$ is given by the predicted values from regressing nonparametrically $\widehat{\omega}_{it}(\beta)$ on $\widehat{\omega}_{it-1}(\beta)$ and MNE_{it-1}. The residual from this regression provides us with an estimate of ξ_{it}.

Given the timing assumptions on input use, the following population moment conditions can be defined: $\mathbb{E}[\xi_{it}(\beta)d] = 0$ where the set of instruments is:

$$d_{it} = \left\{n_{it-1}, m_{it-1}, k_{it}, n_{it-1}^2, m_{it-1}^2, k_{it}^2, n_{it-1}m_{it-1}, n_{it-1}k_{it}, m_{it-1}k_{it}\right\} \tag{B.9}$$

Exploiting these moment conditions, we can now estimate the production function coefficients β using standard GMM and rely on block bootstrapping for the standard errors. The estimated production function coefficients $\widehat{\beta}$ are then used together with data on inputs to compute the output elasticities at the firm-year level (see Eqs. (6) and (7) in the main text).

Table B.1: Estimated output elasticities by two-digit industry in Belgium (means)

Industry (NACE2)		Output elasticity of... labor	inter-mediate inputs	capital	Returns to scale	Obs.	Firms
Food products	(10)	0.260	0.729	0.031	1.020	7,829	1,213
Beverages	(11)	0.200	0.749	0.073	1.021	544	78
Textiles	(13)	0.253	0.757	0.019	1.029	1,749	271
Wearing apparel, leather	(14–15)	0.187	0.831	0.014	1.033	824	125
Wood and wood products	(16)	0.258	0.755	0.049	1.062	1,835	285
Paper and paper products	(17)	0.243	0.791	0.045	1.079	907	132
Printing and recorded media	(18)	0.292	0.754	0.046	1.092	2407	379
Chemicals and petroleum products	(19–20)	0.172	0.798	0.042	1.012	1,902	290
Basic pharmaceutical products	(21)	0.298	0.792	-0.063	1.027	406	61
Rubber and plastic products	(22)	0.169	0.787	0.040	0.996	2,130	324
Non-metallic mineral products	(23)	0.184	0.749	0.046	0.979	3,121	466
Basic metals	(24)	0.356	0.778	0.032	1.166	579	86
Fabricated metal products	(25)	0.262	0.678	0.023	0.963	9,899	1,519
Machinery and equipment	(28)	0.302	0.762	0.040	1.104	3,214	493
Computer and electronic products	(26)	0.385	0.757	0.028	1.170	832	128
Electrical equipment	(27)	0.263	0.725	0.020	1.008	1,044	155
Motor vehicles and trailers	(29)	0.258	0.801	0.050	1.109	595	88
Furniture	(31)	0.209	0.735	0.026	0.971	2,227	337
Other manufacturing	(32)	0.237	0.698	0.041	0.976	1,737	265
All		0.249	0.736	0.033	1.018	43,781	6,695

Table B.2: Estimated output elasticities by two-digit industry in the Netherlands (means)

Industry (NACE2)		Output elasticity of... labor	intermediate inputs	capital	Returns to scale	Obs.	Firms
Food products	(10)	0.211	0.870	0.054	1.136	12,392	2,131
Beverages	(11)	0.214	0.849	0.000	1.064	192	36
Textiles	(13)	0.314	0.758	0.034	1.106	1,709	279
Wearing apparel, leather	(14–15)	0.226	0.756	0.022	1.004	1,091	199
Wood and wood products	(16)	0.233	0.762	0.028	1.022	2,466	417
Paper and paper products	(17)	0.224	0.755	0.030	1.009	921	159
Printing and recorded media	(18)	0.294	0.703	0.032	1.030	4,768	824
Chemicals and petroleum products	(19–20)	0.220	0.782	0.036	1.038	1,725	309
Basic pharmaceutical products	(21)	0.216	0.740	0.049	1.006	351	68
Rubber and plastic products	(22)	0.231	0.760	0.026	1.017	3,052	521
Non-metallic mineral products	(23)	0.221	0.755	0.032	1.008	2,173	378
Basic metals	(24)	0.200	0.762	0.037	0.999	740	126
Fabricated metal products	(25)	0.301	0.678	0.039	1.018	14,596	2,392
Machinery and equipment	(28)	0.266	0.724	0.019	1.010	6,654	1,165
Computer and electronic products	(26)	0.235	0.818	0.018	1.071	1,891	343
Electrical equipment	(27)	0.225	0.770	0.028	1.023	1,831	313
Motor vehicles and trailers	(29)	0.246	0.766	0.027	1.039	1,399	252
Furniture	(31)	0.316	0.783	0.024	1.123	3,813	669
Other manufacturing	(32)	0.308	0.655	0.037	0.999	4,544	798
All		0.262	0.752	0.035	1.049	66,308	11,379

C Labor and product market setting switches

Table C.1: Transition matrix for the labor market setting of offshorers (non-offshorers)

Panel A: Belgium

Labor market setting in t	Labor market setting in $t+1$		
	Wage markdown	Marginal-product wages	Wage markup
Wage markdown	85.2 (82.1)	13.6 (15.7)	1.2 (2.1)
Marginal-product wages	13.3 (16.1)	77.8 (63.3)	9.0 (20.6)
Wage markup	1.7 (2.2)	14.8 (11.9)	83.4 (86.0)

Panel B: the Netherlands

Labor market setting in t	Labor market setting in $t+1$		
	Wage markdown	Marginal-product wages	Wage markup
Wage markdown	86.1 (85.8)	11.4 (10.5)	2.5 (3.8)
Marginal-product wages	22.1 (21.7)	61.5 (53.0)	16.4 (25.3)
Wage markup	3.6 (2.1)	11.9 (5.4)	84.6 (92.5)

Notes: 6,534 (11,296) firms in Belgium (the Netherlands) covering the period 2010–2017. Percentages of 39,758 (66,126) firm-year observations in Belgium (the Netherlands). Offshorers are defined as firms reporting a positive ratio of imported goods to sales. Based on the estimates of the joint market imperfections parameter ($\widehat{\psi}$), we classify observations into labor market settings using Eqs. (3)–(4).

Table C.2: Transition matrix for the product market setting of offshorers (non-offshorers)

Panel A: Belgium

Product market setting in t	Product market setting in $t+1$	
	Marginal cost	Price-cost markup
Marginal cost	71.2 (65.4)	28.8 (34.6)
Price-cost markup	6.9 (9.1)	93.1 (90.9)

Panel B: the Netherlands

Product market setting in t	Product market setting in $t+1$	
	Marginal cost	Price-cost markup
Marginal cost	62.5 (52.1)	37.5 (47.9)
Price-cost markup	2.3 (0.7)	97.7 (99.3)

Notes: 6,534 (11,296) firms in Belgium (the Netherlands) covering the period 2010–2017. Percentages of 39,758 (66,126) firm-year observations in Belgium (the Netherlands). Offshorers are defined as firms reporting a positive ratio of imported goods to sales. Based on the estimates of the price-cost mark-up ($\widehat{\mu}$), we classify observations into product market settings using Eq. (1).

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