International Journal of Industrial Organization 68 (2020) 102562

Contents lists available at ScienceDirect

International Journal of Industrial Organization

journal homepage: www.elsevier.com/locate/ijio

Labor market power and the distorting effects of international trade[☆]

Matthias Mertens

Halle Institute for Economic Research (IWH) and the Competitiveness Research Network (CompNet), Kleine Märkerstraße 08, 06108 Halle, Germany

ARTICLE INFO

Article history:
Received 15 March 2019
Revised 23 September 2019
Accepted 12 November 2019
Available online 18 November 2019

JEL classification:
D24
F14
F16
J50
L13
L60

Keywords:
Labor market power
Labor market efficiency
International trade
Production function estimation

ABSTRACT

This article examines how final product trade with China shapes and interacts with labor market imperfections that create market power in labor markets and prevent an efficient market outcome. I develop a framework for measuring such labor market power distortions in monetary terms and document large degrees of these distortions in Germany's manufacturing sector. Import competition only exerts labor market disciplining effects if firms, rather than employees, possess labor market power. Otherwise, increasing export demand and import competition both fortify existing distortions, which decreases labor market efficiency. This widens the gap between potential and realized output and thus diminishes classical gains from trade.

1. Introduction

The rapid and ongoing process of globalization creates profound challenges for firms operating in the market economy. Global integration has increased the size of firms' product markets and the amount of their competitors, while global production networks and dramatically falling transportation costs redefine the nature of production activities. How firms respond to these new market conditions has fundamental implications for domestic workers, productivity levels, and living standards.[1]

☆ I thank Mareike Bauer, Eric Bartelsman, Richard Bräuer, Liuchun Deng, Sumit Deole, Sabien Dobbelaere, Marc Melitz, Steffen Müller, Georg Neuschäffer, Felix Noth, Viktor Slavtchev, Ana Soares, Zhan Qu, Jo Van Biesebroeck, Juuso Vanhala, Yuan Zi, and seminar participants at the IWH, IFO Dresden, and the annual CompNet conference 2018 for insightful discussions and comments. I would particularly like to thank Michael Rößner, Christoph Schäfer, Denise Henker, and Alexander Giebler for their invaluable support on the data. I thank the editor and two anonymous referees for excellent comments and suggestions. I am grateful to Jan K. De Loecker, Pinelopi K. Goldberg, Amit K. Khandewal, Nina Pavcnik, Amil Petrin, and James Levinsohn for sharing their stata codes.

E-mail address: matthias.mertens@iwh-halle.de

URL: https://www.iwh-halle.de/en/, https://www.comp-net.org/

[1] E.g. Biscourp and Kramarz (2007), Topalova and Khandelwal, (2011), Amiti and Davis (2012), Amiti and Khandelwal, (2013), Mion and Zhu (2013) and Edmond et al., (2015). See also the comprehensive reviews in Bernard et al. (2012) and De Loecker and Van Biesebroeck (2018)

https://doi.org/10.1016/j.ijindorg.2019.102562
0167-7187/

Traditionally, most research studying firm responses to trade exposure relies on perfectly functioning labor markets. By design, this limits the analyses to scenarios where wages are always on competitive levels and where firms do fully pass gains and losses from trade exposure through to labor expenditure adjustments. Recent work, however, has raised awareness to the role of imperfect functioning labor markets for understanding firms' responses to trade exposure: By affecting how firms adjust to changes in product and input market conditions, labor market imperfections may alter distributional outcomes from trade and may change aggregate trade gains compared to a baseline scenario with competitive labor markets (e.g. Egger and Kreickemeier, 2009; Kambourov, 2009; Dix-Carneiro, 2014). Therefore, understanding how international trade interacts with labor market imperfections has a first order priority in evaluating welfare effects and distributional impacts from trade.

In this article, I contribute to this understanding by using a simple micro-econometric partial equilibrium framework to study how final product trade causally affects and interacts with labor market power distortions in the German manufacturing sector. The production side framework of this article does not depend on specific product market demand characteristics and identifies distortions in labor markets by firm-level wedges between workers' output contributions and wages.[2] The existence of such wedges reflects market power in labor markets that affects distributional outcomes and signals market inefficiencies that decrease aggregate output compared to a scenario with competitive labor markets (Petrin and Sivadasan, 2013).

Intuitively, final product trade has the potential to affect and interact with labor market power distortions through various channels: Trade influences firms' labor demand and gives an impetus for reorganizing existing structures within firms as well as for reallocating labor between firms (Caliendo and Rossi-Hansberg, 2012; Mayer et al., 2014). On the other hand, existing labor market power distortions create adjustment barriers (e.g. employment protection agreements) and influence rent sharing processes between firms and employees. This might determine how firms adjust their labor expenses when being exposed to foreign competition and demand. Yet, how international trade influences labor market imperfections, to what extent prevalent labor market power distortions determine distributional outcomes from trade, and whether trade exposure can function as a disciplining tool for distorted labor markets remain open empirical questions that this study answers.

While doing so, this article adds two new insights to the literature. First, it presents new evidence on the causal effect of final product trade on firms' labor market power. This contributes to our understanding on how trade related changes in product market conditions influence rent sharing processes between employees and their firms. Second, this study presents first empirical results on the causal effect of final product trade on market inefficiencies emerging from imperfect labor markets. This offers insights on potential gains and losses from trade, and more generally, from changes in product market competition and demand, in terms of labor market efficiency – a topic on which our knowledge is rather limited, so far.

My main results document that an increase in export demand strengthens the labor market power of firms, whereas final product import competition increases employees' labor market power. When uncovering the mechanisms behind these effects, I find that existing structures of labor market power prevent a complete adjustment of firms' labor expenses. Firms with labor market power do not fully pass export profit gains through to workers, whereas firms facing a workforce with positive labor market power cannot fully adjust to import competition by shrinking or lowering wages. These incomplete pass-through processes increase existing labor market distortions and, therefore, decrease the efficiency of labor markets. Hence, due to imperfect labor market adjustments, final product trade can increase gaps between realized and potential output, which prevents a full realization of classical gains from trade under counterfactually competitive labor markets. In addition, I find that import competition might exert labor market disciplining effects, if firms rather than employees possess labor market power. Yet, these disciplining effects are sensitive to the empirical specification.

To conduct my analysis, I use administrative firm-product-level data for the German manufacturing sector. I exploit the eight-digit product-level information in this data to calculate exceptionally fine measures of final product import competition and export opportunities for each individual firm. Measuring trade flows at the firm rather than the industry level reduces mismeasurement in the explanatory variables, creates additional identifying variation, and accounts for multi-product firms being active in multiple industries. In line with most of the literature, the analysis of this article focuses on trade with China, whose unexpected and rapid rise to dominance in the global market constitutes an epochal shift in product market conditions for firms throughout the world (especially in the manufacturing sector) and offers an excellent playing field to study how international trade effects domestic firms and markets (Autor et al., 2016). To draw causal inferences, I instrument my trade measures in the spirit of Autor et al., (2013) and Dauth et al. (2014) by using trade flows between China and countries similar to Germany.

This study connects to the recent discussion on the prevalence and causes of high and rising market power put forward by De Loecker and Eeckhout (2018) and De Loecker et al. (2018). Much of the current discussion on the extent of firm market power focuses on product markets. In contrast, this study belongs to a fast-growing literature that investigates the extent of market power on labor markets as an alternative source of firm market power (e.g. Ashenfelter et al., (2010); Azar et al., (2017); Berger et al. 2019). There are growing concerns that labor market power creates substantial welfare losses that are comparable or even larger than welfare losses from product market power (Naidu et al., 2018; Berger et al., 2019). In response, recent research in economic law calls for extending existing antitrust regulations, which currently mostly focus on preventing excessive product market power, to address the prevalence of market power in labor markets

[2] My methodology is based on seminal work of De Loecker and Warzynski (2012) and Dobbelaere and Mairesse (2013).

(e.g. Marinescu and Posner, 2018). With this study I contribute to this young literature, by offering evidence on final product trade as a determinant of labor market power. While most of the recent work on labor market power emphasizes the presence of monopsonistic firm market power, I show that worker-side labor market power is also a key factor in shaping firm responses to changes in product competition and demand. In particular, I find that the existence of employee labor market power, similar to the existence of firm labor market power, creates efficiency losses from (trade related) changes in product market conditions.

This study also ties into the literature investigating how international trade affects wage bargaining processes. Rodrik (1997) already noted that imported products substitute domestic with foreign workers, weakening the position of the former within the firm. Moreover, Hornstein et al. (2005) provide evidence that competitive pressure may lead to deunionisation. Most closely related to this paper, Boulhol et al. (2011) find a negative impact of imports from developed countries on workers' bargaining power for the UK, while Nesta and Schiavo (2018), by focusing on the subset of firms within an efficient bargaining regime, find the same for imports from China and OECD countries in the case of France. Similarly, Ahsan and Mitra (2014) document that a reduction in output tariffs is associated with a decrease in workers' bargaining power for India. However, my study complements all mentioned contributions in several aspects. First, in contrast to this study, existing work focuses on distributional aspects and does not investigate the causal link between labor market efficiency and international trade. Second, I do not restrict my analysis to import competition. In fact, I find that labor market distortions react several times stronger to an increase in foreign demand than to an increase in import competition. Third, my results show that final product trade interacts with existing structures of labor market distortions and tends to fortify prevalent labor market power levels. This is reflected in a widening of existing positive and negative firm-level gaps between marginal products and wages and is exactly the source of losses in terms of labor market efficiency from final product trade.

Finally, this article complements recent work discussing how incomplete pass-through processes of trade related productivity gains to consumer prices give rise to output market distortions. De Loecker et al. (2016, henceforth DLGKP) find that Indian firms do not fully pass productivity gains from cheaper imported intermediate products through to consumer prices, increasing firm-markups. Arkolakis et al. (2018) show that under non-homotheticity in preferences it is unclear whether trade integration increases or decreases output market distortions. Weinberger (2017) illustrates this by incorporating a possible non-optimal market share reallocation into the Melitz (2003) model. In his model, heterogeneous output market power allows firms to heterogeneously pass productivity gains from cheaper imported inputs through to consumer prices. Through this mechanism, more productive firms increase their markups relatively more, which reallocates production to the less efficient firms, giving rise to misallocation.

My study transfers these findings for output market distortions to labor markets. Closely related to this literature, I find that the underlying mechanism giving rise to labor market distorting effects from trade is based on an incomplete pass-through of firm profit changes to workforce adjustments. That final product trade has the potential to worsen the efficiency of labor markets is an alarming finding, as it implies that models assuming competitive labor markets might overestimate the gains from trade.

The remainder proceeds as follows. Section 2 describes the data and explains the construction of trade measures. Section 3 derives the framework for measuring labor market power distortions. Section 4 presents the empirical results. Section 5 concludes.

2. Data description and calculating trade measures

I use yearly administrative data on German manufacturing sector firms over the period 2000–2014 from the AFiD-database.[3] The data is supplied by the statistical offices of Germany and consists of (i) a firm-level panel for the years 2000–2014, containing, among others, data on expenditures, output, employment, and investment, and (ii) a firm-product-level panel for the period 1995–2014, supplying information on quantities and prices for firms' products.[4]

AFiD is limited to firms with at least 20 employees. To reduce administrative burden, some variables of the firm-level panel are only available for a representative and periodically rotating subsample encompassing roughly 40% of firms with at least 20 employees. Among others, this contains expenditures on intermediate inputs or employment in full time equivalents (FTE). As this subsample is stratified by size-class and industry, which are variables that I observe for all firms, I can use inverse probability weights to translate all of my regression results to the underlying population of German manufacturing sector firms (with at least 20 employees).

Bilateral trade flow data comes from the United Nations Comtrade Database (comtrade). I merge the comtrade and AFiD data at the product level. This allows me to calculate final product trade measures at the firm-product level by using information on firms' product mix.

In some cases, export values reported in comtrade exceed domestic production reported in AFiD, which could be a result of the reporting threshold of the AFiD data. Therefore, I follow Mion and Zhu (2013) and define Chinese product-level

[3] Data source: Research Data Centre of the Federal Statistical Office of Germany and the Statistical Offices of the German Länder. Names of statistics used: *"AFiD-Modul Produkte", "AFiD-Panel Industriebetriebe", "AFiD-Panel Industrieunternehmen", "Investitionserhebung im Bereich Verarbeitendes Gewerbe, Bergbau und Gewinnung von Steinen und Erden", "Panel der Kostenstrukturerhebung im Bereich Verarbeitendes Gewerbe, Bergbau und Gewinnung von Steinen und Erden".*

[4] I eliminate observations with negative value-added and outliers with respect to deflated sales over production inputs. I also purge the product data from outliers in terms of price growth and price deviations from the average product price.

import competition, $IM_{gt}^{CHN \to GER}$, as the period t share of product g imports from China to Germany, $M_{gt}^{CHN \to GER}$, in the sum of Germany's total imports and total domestic production of product g (from plants with at least 20 employees), respectively denoted by M_{gt} and Y_{gt}:

$$IM_{gt}^{CHN \to GER} = \frac{M_{gt}^{CHN \to GER}}{M_{gt} + Y_{gt}} * 100. \tag{1}$$

Complementarily, I define export opportunities for German products as:

$$EX_{gt}^{GER \to CHN} = \frac{E_{gt}^{GER \to CHN}}{M_{gt} + Y_{gt}} * 100. \tag{2}$$

where $E_{gt}^{GER \to CHN}$ denotes product g exports from Germany to China. As I discuss in my empirical section, I instrument these two measures with trade flows between China and countries similar to Germany. I aggregate all product-level trade flow measures to the firm level by using firm-specific product revenue shares in firms' total product market revenue as weights. I denote the resulting firm-level measures by IMP_{it}^{CHN} and EXP_{it}^{CHN}. I plot the evolution of my trade measures and report mean values by industry for them in the online Appendix A. To provide a better overview on the data, the online Appendix A additionally reports detailed summary statistics for key variables based on my final sample of firms.

3. A framework to estimate labor market power

This section describes the framework to estimate firm-specific labor market power parameters. Section 3.1 derives a monetary quantifiable expression for labor market power distortions. I discuss the interpretation of this parameter in Section 3.2. Section 3.3 continues with a detailed treatment of the production function estimation needed to calculate firm-specific labor market power parameters.

3.1. Deriving an expression for labor market power distortions

A firm i at period t produces output using the production function:

$$Q_{it} = Q_{it}(.) = Q_{it}(L_{it}, M_{it}, K_{it}, \omega_{it}), \tag{3}$$

where Q_{it} denotes total physical output and L_{it}, M_{it}, and K_{it} respectively are labor, intermediate, and capital inputs used in the production of Q_{it}. ω_{it} denotes total factor productivity. The only restriction on the functional form of $Q_{it}(.)$ that I impose is that it is continuous and twice differentiable with respect to its arguments. Active firms maximize short run profits and face time- and firm-specific unit input cost for any input $X = \{L, K, M\}$, denoted by V_{it}^X. Intermediate inputs are flexible and firms take intermediate input prices as given. Contrary, labor and capital markets are imperfect. Hence, these inputs markets are subject to distortions that create wedges between firms' marginal costs and marginal products. Importantly, as shown by Petrin and Sivadasan (2013), such micro-level wedges signal market inefficiencies that reduce aggregate output (see the discussion below).

As I am interested in labor market imperfections, I now focus on labor markets. I introduce labor market distortions as monetary wedges, $\delta_{it}^L \equiv f_{it}(\boldsymbol{S}_{it})$, between observed wages and marginal revenue products of labor (MRPL):

$$f_{it}(\boldsymbol{S}_{it}) = \delta_{it}^L = V_{it}^L - MRPL_{it}. \tag{4}$$

$\boldsymbol{S}_{it}$ captures the sources of labor market distortions and describes their mapping into deviations from the competitive labor market scenario ($V_{it}^L = MRPL_{it}$). As I discuss in section 3.2, I follow a large labor market literature and interpret these wedges as a sign of labor market power (see Dobbelaere and Mairesse, 2013 and the literature cited therein).

If labor market power distortions were solely resulting from firms' wage setting power (i.e. a monopsonistic labor market), observed wages would be given by $V_{it}^L = MRPL_{it} + f_{it}(\varepsilon_{it}^L)$, with $f_{it}(\boldsymbol{S}_{it}) = f_{it}(\varepsilon_{it}^L) < 0$ and ε_{it}^L denoting the supply elasticity of labor (see the online Appendix B.2). However, as labor market power distortions are an outcome of various frictions, limiting the analyses to the monopsonistic labor market model as above is restrictive. For instance, $f_{it}(\boldsymbol{S}_{it})$ may also depend on the presence of hiring and firing costs, search frictions, inflexible contracts, imperfect information, or the presence of trade unions. Therefore, I do not restrict $f_{it}(\boldsymbol{S}_{it})$ to a specific set of frictions and stay agnostic about the underlying causes of labor market power.

Consequently, my approach nests various labor market models, including models generating an outcome where $V_{it}^L > MRPL_{it}$. The latter may result from an efficient bargaining regime, where unions have some degree of bargaining power, ϕ_{it}, and wages (and employment) result from a Nash-bargaining between firms and unions: $V_{it}^L = MRPL_{it} + f_{it}(\phi_{it}, \Pi_{it})$, with Π_{it} denoting profits and $f_{it}(\phi_{it}, \Pi_{it}) > 0$ (see the online Appendix B.2).

The problem in using Eq. (4) is to recover a consistent measure of $MRPL_{it}$. To circumvent this problem, I follow Dobbelaere and Mairesse (2013) in using the intermediate input market as a competitive benchmark to express δ_{it}^L as a function of measurable variables:

$$\delta_{it}^L = V_{it}^L - \frac{\theta_{it}^L}{\theta_{it}^M} * \frac{V_{it}^M M_{it}}{L_{it}}, \tag{5}$$

where θ_{it}^X denotes the output elasticity with respect to input X. I detail the derivation in the online Appendix B.1.

Assuming competitive intermediate input markets to identify labor market distortions builds upon a large literature on estimating markups and firm productivity by control function approaches in which this assumption is key to ensure identification. In my results section, I address potential concerns about biases introduced by non-competitive intermediate input markets when estimating the impact of final product trade on δ_{it}^{L}. Besides that, I present suggestive evidence supporting the usage of intermediate input markets as competitive benchmark in the online Appendix C.

Eq. (5) can be linked to the framework of Dobbelaere and Mairesse (2013), in which labor market distortions are given by the difference between $\mu_{it}^{M} = \theta_{it}^{M} * \frac{P_{it}Q_{it}}{V_{it}^{M}M_{it}}$ and $\mu_{it}^{L} = \theta_{it}^{L} * \frac{P_{it}Q_{it}}{V_{it}^{L}L_{it}}$. Here, μ_{it}^{M} and μ_{it}^{L} respectively denote the firm's markup derived from its input decision for intermediates and labor using the framework of De Loecker and Warzynski (2012). To see the similarity between the approach in this article and the framework of Dobbelaere and Mairesse (2013), note that Eq. (5) can be rewritten as $\delta_{it}^{L} = V_{it}^{L} - \frac{\mu_{it}^{L}}{\mu_{it}^{M}} V_{it}^{L}$. Consequently, the measure of Dobbelaere and Mairesse (2013) implies the value of δ_{it}^{L} (the online Appendix B.1 provides a discussion). The advantage of the approach in this study is that I express labor market power distortions in monetary terms, which enables intuitive interpretations.

3.2. Labor market power, adjustment frictions, and market inefficiencies

δ_{it}^{L} captures the extent to which labor market imperfections, separately from product market imperfections, drive a wedge between marginal products of labor and wages. When $\delta_{it}^{L} > 0$, wages are higher than workers' output contribution. This creates an outcome in which rents are inefficiently distorted towards employees (vice versa for $\delta_{it}^{L} < 0$). Similar to Dobbelaere and Mairesse (2013), I interpret δ_{it}^{L} as an inverse measure of firms' labor market power, i.e. negative (positive) values of δ_{it}^{L} signal labor market power of the firm (firm's workforce).

An important precondition for the existence of labor market power is the presence of adjustment frictions that firms and employees utilize to their advantage (e.g. Manning, 2003; Naidu et al., 2018). On monopsonistic labor markets, firms exploit worker-side adjustment costs like moving costs or other local preferences to pay wages below marginal revenue products of labor. On the other hand, worker-side labor market power can only exist if firms cannot freely adjust wages and employment. The latter is a silent feature that underlies all existing bargaining models discussed in the labor market literature. For instance, in the classical efficient bargaining model, firms *are restricted* to hire workers from an organized union that coordinates its labor supply. This absence of a competitive pool of workers constitutes a hiring friction and causes wages to be higher than workers' marginal revenue products (McDonald and Solow, 1981). Similarly, any form of institutional employment protection constitutes an adjustment friction from the firm's perspective as well (e.g. contract durations, notice periods for dismissals, etc.). Intuitively, such employment protection laws (or firm-level agreements) give workers labor market power because they may protect unprofitable workers from being dismissed.[5] To give some more intuition on the interpretation of δ_{it}^{L} as a labor market power parameter, the online Appendix B.2 presents two formal labor market models showing how wedges between wages and marginal revenue products of labor translate into labor market power.

It remains an issue, however, that δ_{it}^{L} could capture adjustment frictions unrelated to labor market power. An example for such an adjustment friction could be the time span of posting a job offer after an unexpected shock. As δ_{it}^{L} is derived as a residuum, I cannot completely exclude such adjustment costs as a potential source of my labor market power parameter. In my empirical analysis I will show, however, that firms with ($\delta_{it}^{L} < 0$) and without ($\delta_{it}^{L} > 0$) labor market power differ in their reactions to (lagged) trade exposure. As I note in section 4.3, this suggests that such technical adjustment barriers faced by all firms equally are unlikely to have a significant role in driving my estimated firm responses to trade. Besides that, I also correlate δ_{it}^{L} with observed characteristics that can be related to labor market power in section 4.1. There I find evidence supporting that δ_{it}^{L} (mostly) captures labor market power.

Whereas δ_{it}^{L} reflects the distribution of market power rents between firms and employees, absolute values of δ_{it}^{L} measure firms' contribution to the total extent of labor market inefficiencies (compared to a neoclassical benchmark scenario with perfect labor markets). This is because perfect labor markets would eliminate every positive and negative gap between wages and MRPL. Petrin and Sivadasan (2013) illustrate this within an accounting framework showing that larger *levels* of absolute gaps between wages and MRPL signal a larger potential for output increasing reallocation and thus imply a larger gap between realized and potential output. Defining *levels* of $|\delta_{it}^{L}|$ as a measure of firms' contribution to total labor market inefficiencies therefore follows Petrin and Sivadasan (2013).[6] Note, however, that this also links into the above definition of labor market power: Intuitively, firms with labor market power demand too few workers, whereas workers with labor

[5] Labor hoarding models feature a similar type of labor market power. In such models it is intertemporally optimal for firms to pay wages above marginal products. Yet, the only reason for firms to do so is the existence of sunk/fixed costs in hiring or training workers. Again, this constitutes a friction that benefits temporarily unprofitable workers. In contrast, on perfect labor markets firms could freely adjust wages and workers according to their labor demand schedule (Biddle, 2014).

[6] This concept differs from Hsieh and Klenow (2009), where between-firm dispersion in such wedges is interpreted as a misallocation measure. Similar to Petrin and Sivadasan (2013), recent work by Morlacco (2018) provides a theoretical framework showing that *levels* of wedges between input costs and marginal products of inputs indicate market inefficiencies that reduce aggregate output compared to a counterfactual scenario with competitive input markets.

market power prevent firms from shrinking. From an efficiency perspective, labor market power creates distortions where too much (little) labor is allocated to firms with $\delta_{it}^{L} > 0$ ($\delta_{it}^{L} < 0$).

Before using Eq. (5), I first need to recover θ_{it}^{L} and θ_{it}^{M} by estimating a production function. As firm-level prices are regularly unobserved, researchers are often forced to assume that input and output prices equalize between firms within industries when estimating the production function. This is hardly compatible with allowing for firm-specific labor market power. As I observe firm-product-level prices, I can account for firm-specific price variation. As shown in the online Appendix D, ignoring firm price variation *increases* levels of δ_{it}^{L} in my case, leading to a higher share of firms and industries in which employees possess labor market power.

3.3. Production function estimation

I use a translog specification to define firms' production function because it allows for *time-varying* and *firm-specific* output elasticities. For estimation, I define M_{it}, K_{it}, L_{it}, and Q_{it} as a firm's intermediate inputs, capital stock, FTE, and total output, respectively.[7] The production function is given by:

$$q_{it} = \phi_{it}'\boldsymbol{\beta} + \omega_{it} + \varepsilon_{it}. \tag{6}$$

Lower-case letters indicate logs. ϕ_{it} is a vector capturing production inputs and their interactions, $\boldsymbol{\beta}$ is the associated vector of coefficients, and ε_{it} is an i.i.d. error term.[8] Hicks-neutral productivity, ω_{it}, follows a Markov process that can be influenced by firm actions and is unobserved to the econometrician. The firm knows ω_{it} before choosing its consumption of intermediate inputs. The innovation in productivity is, however, uncorrelated with the input decision for capital and labor.[9] Due to the dependence of firms' intermediate inputs on ω_{it}, estimation of Eq. (6) by OLS is inconsistent. Besides this simultaneity problem, firm-specific prices are usually unobserved. Hence, if input prices are correlated with input choices, estimating ((6) without controlling for firm price variation produces biased input coefficients.

3.3.1. Unobserved output and input prices

Due to differences in measurement units, I cannot aggregate output quantities (and prices) for multi-product firms. Therefore, I construct firm-specific output price indices from firm-product-level price information following the procedure of Eslava et al. (2004), which I describe in the online Appendix I. I purge observed firm revenue (for all firms) from output price variation by deflating it with this price index. With slightly abusing notation, I keep using q_{it} for the resulting quasi-quantities. To control for unobserved input price variation, I follow Berry (1994) and DLGKP who have shown that market shares and product dummies approximate product quality in a variety of demand models. Consequently, by assuming that producing high quality goods requires high quality inputs, one can use a quality control function based on output price information to absorb input price variation:

$$B_{it}(.) \equiv B_{it}\Big((\pi_{it},\ \boldsymbol{ms}_{it},\ G_{it},\ D_{it}) \times \phi_{it}^{c};\boldsymbol{\beta}\Big). \tag{7}$$

$\boldsymbol{ms}_{it}$ captures domestic quantity and revenue market shares, π_{it} is the firm-level price index and G_{it} and D_{it} contain dummies for headquarter location and four-digit industry affiliation. $\phi_{it}^{c} = \{1; \tilde{\phi}_{it}\}$ contains two vectors. $\tilde{\phi}_{it}$ includes the same production input terms as ϕ_{it}, either given in expenditures and deflated by an industry-level deflator or already reported in quantity terms. The tilde emphasizes that some variables in $\tilde{\phi}_{it}$ are not expressed in true quantities. The constant highlights that elements of $B(.)$ enter the price control function linearly and interacted with $\tilde{\phi}_{it}$ (which follows from using a translog production function). This specification captures unobserved input price variation that arises from variation in firms' input quality, location, and industry affiliation.

Note that while M_{it} and K_{it} enter as deflated expenditures, I use a quantity-based input measure for L_{it} (FTE). This is strictly preferable to using deflated wage bills because in this case the price control function must only absorb unobserved input price variation in M_{it} and K_{it}.[10] This is important in my framework, as I allow for labor market power being an additional shifter of wages.

Originally, DLGKP estimated product-level production functions when using product prices to control for output and input price variation between firms. I transfer their approach to the firm-level by using revenue weights to aggregate product information. This implicitly assumes that (i) such firm aggregates of product quality increase in firm aggregates of product

[7] The law of motion for capital is: $K_{it} = (1-\alpha_{jt})K_{it-1} + I_{it-1}$. I_{it} and α_{jt} respectively denote investment and the industry-specific depreciation rate. Long-term rentals are part of the capital stock. The online Appendix H describes the calculation of capital stocks.

[8] The production function is specified as: $q_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_{ll} l_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{lk} l_{it} k_{it} + \beta_{lm} l_{it} m_{it} + \beta_{km} k_{it} m_{it} + \beta_{lkm} l_{it} k_{it} m_{it} + \omega_{it} + \varepsilon_{it}$. For instance, the output elasticity of labor is given by: $\frac{\partial q_{it}}{\partial l_{it}} = \beta_l + 2\beta_{ll} l_{it} + \beta_{lm} m_{it} + \beta_{lk} k_{it} + \beta_{lkm} k_{it} m_{it}$.

[9] These timing assumptions are consistent with other studies (e.g. DLGKP for India, Valmari (2016) for Finland, and Ackerberg and Hahn (2015) for Chile). Due to the Germany's high degree of employment protection OECD, 2018), it is justified to treat labor as a quasi-fixed input.

[10] To see this, consider a Cobb–Douglas example: let $Q_{it} = L_{it}^{\alpha} K_{it}^{\beta} M_{it}^{\gamma}$ be a production function. $W_{it} = L_{it} * V_{it}^{L}$ denotes the wage bill. Assume that all input prices are unobserved and vary between firms. Assume we use W_{it} to measure the labor input. After using industry deflators, we have: $Q_{it} = (\frac{L_{it}}{P_{it}^{L}})^{\alpha} (\frac{K_{it}}{P_{it}^{K}})^{\beta} (\frac{M_{it}}{P_{it}^{M}})^{\gamma} = L_{it}^{\alpha} K_{it}^{\beta} M_{it}^{\gamma} \frac{1}{P_{it}^{L\,\alpha} P_{it}^{K\,\beta} P_{it}^{M\,\gamma}}$. P_{it}^{X} is the firm-specific price deviation from industry prices for input $X = \{M, K, L\}$. In this case, the price control function must capture unobserved variation in P_{it}^{L}, P_{it}^{K}, and P_{it}^{M}. In contrast, when using a quantity-based labor input, we directly observe $L_{it}$and have: $Q_{it} = L_{it}^{\alpha} (\frac{K_{it}}{P_{it}^{K}})^{\beta} (\frac{M_{it}}{P_{it}^{M}})^{\gamma} = L_{it}^{\alpha} K_{it}^{\beta} M_{it}^{\gamma} \frac{1}{P_{it}^{K\,\beta} P_{it}^{M\,\gamma}}$. In that case, the price control function only needs to account for variation in P_{it}^{K} and P_{it}^{M}.

prices and input quality (for inputs entering as deflated expenditures), (ii) firm-level input costs are increasing in firm-level input quality, and iii) product price elasticities are equal across the various products of a firm. These assumptions, or even stricter versions of them, are always implicitly invoked when estimating firm- instead of product-level production functions.

Finally, note that the inclusion of a price control function as above would still be preferable to omitting it, even if some of the above assumptions do not hold. This is because including the price control function can still help to absorb some of the unobserved price variation and does not demand that input prices vary between firms with respect to all elements of $B_{it}(.)$. The estimation can regularly result in coefficients implying that there is no price variation at all. The attractiveness of a price control function lies in its agnostic view about existence and degree of input price variation.

3.3.2. Unobserved productivity and identifying moments

To address the dependence of firms' flexible input decision on unobserved productivity, I employ a control function approach in the spirit of Olley and Pakes (1996). I base my control function on firms' consumption of energy and raw materials, e_{it}, which are components of total intermediate inputs. Inverting the demand function for e_{it} gives an expression for productivity:

$$\omega_{it} \equiv g_{it}(.) = g_{it}(e_{it},\; k_{it},\; l_{it}, \boldsymbol{z}_{it}), \tag{8}$$

where, in addition to k_{it} and l_{it}, $\boldsymbol{z}_{it}$ captures other state variables of the firm. Ideally, $\boldsymbol{z}_{it}$ should include a broad set of variables affecting productivity and demand for e_{it}. Therefore, I include dummy variables for export (EX_{it}) as well as research and development (RD_{it}) activities, firm-level import competition (as defined in section 2), the number of products a firm produces ($NumP_{it}$) and the average wage it pays into $\boldsymbol{z}_{it}$.[11] The latter absorbs unobserved quality and price differences that shift demand for e_{it}, which accounts for the criticism of Gandhi et al. (2017) (De Loecker and Scott, 2016).

I assume that productivity follows a first order Markov process that can be shifted by firm-specific actions: $\omega_{it} = h_{it}(\omega_{it-1}, \boldsymbol{T}_{it-1}) + \xi_{it} = h_{it}(.) + \xi_{it}$, where ξ_{it} denotes the innovation in productivity and $\boldsymbol{T}_{it} = (EX_{it}, RD_{it}, IMP_{it}^{CHN}, NumP_{it})$ reflects that I allow for learning and competition effects from export market participation, import competition, and research activities as well as for (dis)economies of scope to influence firm productivity. Plugging (7), (8) and the law of motion for productivity into (6) gives:

$$q_{it} = \tilde{\phi}_{it}'\boldsymbol{\beta} + B_{it}(.) + h_{it}(.) + \varepsilon_{it} + \xi_{it}, \tag{9}$$

which constitutes the basis of my estimation.[12] I estimate (9) separately for every two-digit industry by using a one-step estimator in the spirit of Wooldridge (2009). I jointly form identifying moments on $\varepsilon_{it} + \xi_{it}$:

$$E((\varepsilon_{it} + \xi_{it})\mathrm{Y}_{it}) = 0, \tag{10}$$

where $\mathbf{Y}_{it}$ includes lagged interactions of intermediate inputs with capital and labor, contemporary interactions of capital and labor, lagged elements of $g_{it}(.)$, contemporary location and industry dummies, the lagged output price index, lagged market shares, as well as lagged interactions of the output price index with production inputs. By relying on these moments, I assume that output prices can react to productivity shocks but are correlated over time. Contrary, decisions about location, product mix, and exit and entry into export and research activities are quasi-fixed variables. This allows for the existence of sunk costs when entering export markets, building new plants, or designing new blueprints.

I report output elasticities derived from the production function estimation in the online Appendix A. Across all industries, median output elasticities for labor, capital, and intermediates respectively equal 0.28, 0.10, and 0.63 (means are similar).

4. Empirical results

This chapter presents the empirical results. Section 4.1 discusses descriptive evidence on the degree of labor market power distortions within the German manufacturing sector. Section 4.2 presents the main findings of this article, documenting how final product trade affects labor market power distortions. Section 4.3 continues by analyzing the mechanisms underlying these results.

4.1. Labor market power in the German manufacturing sector

From the estimated output elasticities, I calculate labor market power parameters using Eq. (5). As a first sanity check, I investigate whether δ_{it}^{L} captures relevant dimensions of labor market power by running OLS regressions of the form:

$$\delta_{it}^{L} = \gamma_0 + \boldsymbol{c}_{it}'\boldsymbol{\gamma} + \upsilon_j + \upsilon_t, \tag{11}$$

[11] I use an export dummy as it is the simplest way of capturing firms' export activities. My results are robust to using my export opportunity measure instead of the export dummy.

[12] I approximate $h_{it}(.)$ with a third order polynomial in all of its elements, except for the variables in $\boldsymbol{z}_{it}$ and $\boldsymbol{T}_{it}$. Those I add linearly. $B_{it}(.)$ is approximated with a flexible polynomial where I interact the output price index with elements in $\tilde{\phi}_{it}$ and add the vector of market shares, the output price index, as well as location and industry dummies linearly. This implementation is similar to the one in DLGKP.

Table 1
Labor market power parameter and observed characteristics related to labor market power.

	$\delta_{it}^{L}(1)$	$\delta_{it}^{L}(2)$	$\delta_{it}^{L}(3)$	$\delta_{it}^{L}(4)$	$\delta_{it}^{L}(5)$	$\delta_{it}^{L}(6)$	$\delta_{it}^{L}(7)$
Employment (FTE)	−10,834***	−8999***	−8992***	−9.263***	−9.753***		−9.345***
	(141.70)	(147.10)	(147.00)	(146.90)	(260.20)		(549.10)
Average wages	23.301***						
	(362.80)						
Capital over labor	−4503***	−1807***	−1813***	−1.628***	−2.052***		−3.534***
	(115.30)	(126.00)	(126.10)	(123.10)	(220.80)		(709.10)
Labor share		5.131***	5138***	4.864***	3.507***		6738***
		(344.80)	(344.8)	(338.10)	(671.90)		(2352)
Labor market concentration			−337.00**	−274.90*	72.62		−1138
			(151.20)	(147.80)	(320.10)		(815.10)
West-Germany (dummy)				7658***	7255***		5615***
				(255.60)	(389.50)		(1273)
Outsourcing rate					−486.60***		−625.60*
					(118.40)		(363.60)
Worker share covered by industry-wide wage standards						3089*	−1511
						(1614)	(1790)
Industry FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
Observations	146.209	146.133	146.133	146.133	84,510	3025	2184
R-squared	0.470	0.367	0.367	0.390	0.406	0.135	0.469
Number of firms	31,930	31,916	31,916	31,916	21,282	2716	1931

The table reports results from estimating Eq. (11) by OLS using different control variables. The dependent variables in columns 1–7 is the labor market power parameter. All regressions include time and industry fixed effects and are weighted using population weights. Standard errors are clustered at the firm level. The top and bottom one percent of observations with respect to the distribution of the labor market power parameter are excluded. Significance: *10%, **5%, ***1%.

where $\boldsymbol{c}_{it}$ is a vector of (mostly) firm-specific variables of interest and υ_j and υ_t capture industry and time fixed effects.

Table 1 presents the several specifications I estimated. Sample sizes differ due to data availability and I do not claim any causality here. In the first column, I include firms' FTE, average wages, and capital over labor ratios (all in logs) into the regression model. I find that higher levels of firm labor market power ($\delta_{it}^{L} < 0$) are associated with a larger firm size, lower wages, and a higher capital intensity. This is already reassuring. Intuitively, firms possessing labor market power should be able to depress wages for a given firm size. The negative coefficient on the capital over labor ratio indicates that firms being less dependent on labor inputs possess more labor market power over their workforce. Column 2 replaces average wages with the value-added labor share and finds that firms with higher labor market power levels are also characterized by smaller labor shares.

Column 3 adds a local labor market concentration measure, defined as the log of the sum of firms' squared employment shares in a given region (i.e. the HHI at the regional level), where I use the 300 German Landkreise as regional unit. The literature documents a positive relationship between local concentration measures and estimates of labor supply elasticities – an alternative measure of firms' labor market power (e.g. Azar et al., 2017). I also find that firms' labor market power is higher in concentrated labor markets. Column 4 adds a dummy for being located in West-Germany. Existing work on German industrial relations shows that West-Germany is characterized by a higher union coverage rate and a higher rate of collective wage agreements (Schnabel and Wagner, 2007; Oberfichtner and Schnabel, 2019). This should promote a better bargaining position for workers in West-German firms compared to workers employed in East-German firms. I find that δ_{it}^{L} can reliably capture this dimension of labor market power. Note, however, that the statistical significance of the labor market concentration measure declines in column 4. Column 5 includes firm's logged outsourcing rate defined as costs for temporary agency workers over total costs for temporary agency and permanently employed workers into the regression model. As expected, firms with higher outsourcing rates have more labor market power over their workforce.

Finally, I run two more regressions where I control for the log of the firm's employment share working in plants being covered by collectively bargained minimum wage standards (the bargaining is conducted at the industry-level). This information is only available for a small randomly drawn subset of plants and must therefore be treated with caution (not all plants of a firm are necessarily drawn). Consequently, I do not put too much emphasize on the results in columns 6 and 7. As shown in column (6), firms with more workers covered by collectively bargained wage standards possess less labor market power. The coefficient is, however, only statistically significant at the 10 percent level and becomes insignificant after conditioning on the other variables.

Overall, results in Table 1 are reassuring and indicate that δ_{it}^{L} captures relevant dimensions of labor market power. Although this does not entirely rule out that variation in δ_{it}^{L} might be partly resulting from factors unrelated to labor market power, my results provide evidence that variation in firms' labor market power is a main driver of variation in δ_{it}^{L}. In

Table 2
Sample medians for labor market power distortions and firm wages, by sector.

Sector	δ^L_{it} (1)	$\lvert\delta^L_{it}\rvert$ (2)	V^L_{it} (3)	$\mu^M_{it} - \mu^L_{it}$ (4)	Observations (5)
15 food products and beverages	12478.74	12494.25	24438.17	0.50	17952
17 textiles	11.18	8851.34	31649.82	0.00	5776
18 apparel, dressing, and dyeing of fur	4764.42	8821.64	29988.74	0.19	1766
19 leather and leather products	8864.06	9793.86	26980.73	0.37	985
20 wood and wood products	1340.86	6620.14	31518.65	0.04	4738
21 pulp, paper, and paper products	−6820.93	12525.87	38609.97	−0.20	4107
22 Publishing and PRINTING	−8117.07	22099.81	37544.19	−0.17	1457
24 chemicals and chemical products	−1907.02	11392.41	46002.31	−0.05	11481
25 rubber and plastic products	5667.30	6890.19	34613.06	0.18	11205
26 other non-metallic mineral products	−2790.46	9657.55	36854.24	−0.09	8952
27 basic metals	−3900.85	12394.92	40964.20	−0.10	5900
28 fabricated metal products	5395.26	11042.79	36121.34	0.18	23658
29 machinery and equipment	1718.68	12603.35	42266.89	0.05	27796
30 electrical and optical equipment	−140.97	17395.81	41148.26	0.00	804
31 electrical machinery and apparatus	1324.07	12755.07	37307.54	0.04	10106
32 radio, television, and communication	3856.67	16173.84	35583.26	0.14	2385
33 medical and precision instruments	13723.91	16962.16	38148.14	0.47	7480
34 motor vehicles and trailers	−996.72	20240.15	37439.54	−0.03	5394
35 transport equipment	6247.36	17066.75	38471.99	0.19	2007
36 furniture manufacturing	6398.20	7698.22	30342.60	0.24	5724
Across all industries	4367.01	11442.93	36519.27	0.14	159673

The table reports sample medians of labor market power distortions for every NACE rev. 1.1 2-digit industry. Column 1–4 respectively report medians for the labor market power parameter, its absolute value, average yearly wages, and differences between De Loecker-Warzynski (2012) markups based on firms' intermediate and labor input decision. Column 5 reports the number of observations used to calculate the respective variables. The top and bottom one percent of observations with respect to the distribution of the labor market power parameter are excluded.

particular, it seems unlikely that frictions unrelated to labor market power differ that clearly along the firm characteristics displayed in Table 1.

Table 2 documents industry-specific median values for δ^L_{it}, its absolute value, average yearly wages per FTE, and the difference between markup expressions calculated from firms' intermediate (μ^M_{it}) and labor (μ^L_{it}) input decision using the approach of De Loecker and Warzynski (2012).[13] The latter difference is included as it is a frequently used measure of labor market power in the literature that implies the value of δ^L_{it} (see Dobbelaere and Mairesse, 2013 and subsequent work). Throughout this study, I express monetary variables in euros of 2000. Across all industries, the median firm pays a wage that, given its employment decision, is 4400 euros above the output contribution of its employees (column 1). Relating this figure to observed wages, one finds that median labor market power distortions equal to $\frac{4,367*100}{36,519} \approx 12\%$ of paid wages. Across industries, labor market power levels vary enormously. Intuitively, one would expect that industries characterized by high wages and which manufacture technologically sophisticated products feature a strong workforce. Whereas this intuition holds for several industries (e.g. medical and precision instruments), high values of δ^L_{it} are not always associated with high wages (e.g. food products and beverages). This illustrates how employee-side labor market power can also emerge from a low output contribution given paid wages. In that case, employees' labor market power could result from adjustment barriers protecting unproductive workers from being dismissed (e.g. long-term contracts). Column 2 shows absolute values of δ^L_{it} which reflect the total extent of labor market inefficiencies. Whereas the publishing and printing industry displays the largest absolute distortions, the wood and wood products industry is characterized by the smallest level of labor market inefficiencies. However, even there, median distorted rents equal to 6600 euros per full-time worker.

In some industries, the implied distortions are equivalent to 30–50% of overall wages. A substantial number that is concealed in existing measures based on subtracting μ^M_{it} and μ^L_{it} from each other. Notably, the differences between μ^M_{it} and μ^L_{it} that I estimate are smaller than documented in the literature.[14] Consequently, the monetary labor market power distortions reported in Table 2 are *small* compared to existing estimates. An interesting insight from Table 2 is that judging from the pure magnitude of the estimated wage gaps, models featuring a bargaining over wages subsequent to a perfectly flexible labor quantity decision of the firm cannot explain these massive distortions.

In my empirical exercise I run separate regressions for firms with ($\delta^L_{it} < 0$) and without ($\delta^L_{it} > 0$) labor market power, as the prevalence of labor market power might determine the pass-through of firm profit gains and losses to wage and employment adjustments. Table 3 shows the sample percentages of firms characterized by $\delta^L_{it} > 0$ and $\delta^L_{it} < 0$, which I respectively denote as positively distorted (PD) and negatively distorted (ND) firms. Thirteen out of twenty industries host a majority of

[13] Recap the formulas for μ^M_{it} and μ^L_{it}: $\mu^M_{it} = \theta^M_{it} * \frac{P_{it}Q_{it}}{V^M_{it}M_{it}}$ and $\mu^L_{it} = \theta^L_{it} * \frac{P_{it}Q_{it}}{V^L_{it}L_{it}}$. I do not use the error correction formula of De Loecker and Warzynski (2012), as this decreases my observation count and leads to similar differences.

[14] See Dobbelaere et al. (2015) finding values between −0.69 and 0.91, −0.29 and 0.76, and −2.57 and 0.91 respectively for France, Japan, and The Netherlands, Dobbelaere et al. (2016) finding values between −2.25 and 1.93 and −0.23 and 1.05 respectively for Chile and France, and Dobbelaere and Mairesse (2013) finding values between −1.10 and 0.50 for France.

Table 3
Sample percentage of firms with positive and negative labor market power parameters, by sector.

Sector	Percentage of firm-year observations with $\delta^L_{it} > 0$ (PD-firms) (1)	Percentage of firm-year observations with $\delta^L_{it} < 0$ (ND-firms) (2)	Number of firm-year observations (3)
15 food products and beverages	96.37	3.63	18,432
17 textiles	50.12	49.88	5782
18 apparel, dressing, and dyeing of fur	69.16	30.84	1767
19 leather and leather products	80.91	19.09	985
20 wood and wood products	55.48	44.52	4755
21 pulp, paper, and paper products	33.60	66.40	4217
22 publishing and printing	39.11	60.89	1667
24 chemicals and chemical products	45.53	54.47	11,575
25 rubber and plastic products	76.83	23.17	11,274
26 other non-metallic mineral products	42.46	57.54	8968
27 basic metals	41.16	58.84	5965
28 fabricated metal products	64.85	35.15	23,795
29 machinery and equipment	53.59	46.41	28,209
30 electrical and optical equipment	47.52	52.48	909
31 electrical machinery and apparatus	52.81	47.19	10,242
32 radio, television, and communication	55.67	44.33	2680
33 medical and precision instruments	78.40	21.60	7745
34 motor vehicles and trailers	44.37	55.63	6094
35 transport equipment	58.41	41.59	2104
36 furniture manufacturing	76.85	23.15	5766
Across all industries	61.31	38.69	162,931

The table reports sample percentages PD-firms and ND-firms for every NACE rev. 1.1 two-digit industry. Columns 1 and 2 respectively report the sample percentages of PD-firms and ND-firms for each two-digit industry. Column 3 reports the associated number of sample observations per industry.

PD-firms, whereas the other seven are dominated by ND-firms. In total, I classify 61.3 (38.7) percent of my firm-year observations as PD-firms (ND-firms).[15] Notably, within firms, the classification into PD- and ND-firms is stable across time. Only 7.7% of all observations switch between both categories. In the online Appendix J, I run several regressions to show how PD- and ND-firms differ in their characteristics. The results are consistent with the estimates in Table 1. On average, PD-firms pay higher wages, are smaller, both in terms of labor force and produced output, have higher product market power and lower labor shares, display a lower labor productivity, and have lower capital to labor ratios.

4.2. Chinese trade exposure and labor market power distortions

To infer on the effects of Chinese trade exposure on labor market power distortions, I consider the following specification:

$$y_{it} = \gamma_{IMP} IMP^{CHN}_{it-1} + \gamma_{EXP} EXP^{CHN}_{it-1} + \boldsymbol{C}'_{it-1}\boldsymbol{\gamma} + \upsilon_{ij} + \upsilon_t. \tag{12}$$

EXP^{CHN}_{it} and IMP^{CHN}_{it} measure firm-level export opportunities to and import competition from China. Consistent with the production model described in section 3, I rely on lagged trade measures to allow for a timeframe in which adjustment processes can be realized. The vector $\boldsymbol{C}$ introduces control variables. υ_t and υ_{ij} capture time and firm-industry fixed effects, whereas $y_{it} = \{\delta^L_{it},\ |\delta^L_{it}|\}$.[16] Estimating the model in levels while controlling for firm-industry and year fixed effects uses the same identifying variation as a first difference model but avoids a disproportional loss of observations when working with an unbalanced panel (as I do).

4.2.1. Baseline results

Table 4 displays results from estimating Eq. (12). OLS regressions (columns 1–4) imply that exposure to import competition *decreases* firms' labor market power (δ^L_{it} rises). Simultaneously, they show an increase in labor market efficiency from import competition ($|\delta^L_{it}|$ falls). According to OLS, export opportunities do not affect labor market power distortions.

For identifying the effects of international trade on labor market distortions, it is important that the competitiveness of intermediate inputs markets does not itself react to trade exposure. I account for this concern by controlling for contemporaneous values of $\mu^M_{it} = \theta^M_{it} * \frac{P_{it}Q_{it}}{V^M_{it}M_{it}}$. As μ^M_{it} captures any form of intermediate input market imperfection, controlling for

[15] I abstain from using statistical tests for my classification as this involves arbitrary decisions on when to classify a distortion as being compatible with perfect competition. Yet, even when I define a comparably large interval of $\delta^L_{it} \in [1500€, -1500€]$ as indicating perfect labor markets, the scheme of my classification results remains unchanged (i.e. 57.8% PD-firms vs. 35.5% ND-firms). My empirical results are unaffected when using this alternative classification scheme.

[16] I control for firms' worker outsourcing rate, labor productivity (log of value-added over FTE), share of researchers in FTE, market share (a revenue weighted aggregation of firms' domestic product market shares), and FTE. Controlling for firm-industry fixed effects avoids statistical jumps due to firms switching industries as I estimated the production function separately for two-digit industries. Yet, only 1% of observations switch two-digit industries.

Table 4
Labor market distortions and Chinese trade exposure.

	OLS				IV			
	δ^L_{it}(1)	$\lvert\delta^L_{it}\rvert$(2)	δ^L_{it}(3)	$\lvert\delta^L_{it}\rvert$(4)	δ^L_{it}(5)	$\lvert\delta^L_{it}\rvert$(6)	δ^L_{it}(7)	$\lvert\delta^L_{it}\rvert$(8)
IMP^{CHN}_{it-1}	96.68***	−38.24**	83.87***	−40.36**	220.20***	−40.32	187.40***	−45.69
	(26.19)	(18.57)	(23.74)	(18.42)	(61.92)	(43.89)	(54.09)	(44.35)
EXP^{CHN}_{it-1}	−19.81	30.74	−31.74	28.77	−428.00***	278.20***	−391.90***	284.20***
	(23.70)	(20.94)	(22.31)	(20.94)	(130.50)	(100.90)	(116.30)	(101.00)
μ^M_{it}	–	–	21,564***	3559***	–	–	21,580***	3538***
			(714.80)	(644.00)			(715.90)	(644.40)
Firm-industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	108,776	108,776	108,776	108,776	108,776	108,776	108,776	108,776
R-squared	0.921	0.864	0.930	0.865	0.920	0.864	0.930	0.864
First-stage *F*-test	–	–	–	–	108.3	108.3	108.4	108.4
Number of firms	24,304	24,304	24,304	24,304	24,304	24,304	24,304	24,304

The table reports results from estimating Eq. (12) by OLS and IV using the full sample of firms. OLS results are reported in columns 1–4. IV results are reported in columns 5–8. The dependent variable in columns 1, 3, 5, and 7 is the labor market power parameter, δ^L_{it}, whereas in columns 2, 4, 6, and 8 it is the absolute value of the labor market power parameter, $|\delta^L_{it}|$. All regressions include time and firm-industry fixed effects and controls for firms' size, worker outsourcing rate, share of researchers in the workforce, market share, and labor productivity. All regressions are weighted using population weights. Standard errors are clustered at the firm level. The top and bottom one percent of observations with respect to the distribution of the labor market power parameter are excluded. Significance: *10%, **5%, ***1%.

it isolates responses of δ^L_{it} and $|\delta^L_{it}|$ from reactions of firms' market power in intermediate input markets and thus ensures that the estimated effects are not caused by changes in the competitive benchmark (see also the online Appendix C.1). Controlling for μ^M_{it}, however, also absorbs the part of the effect from international trade on δ^L_{it} which works through changes in firms' product market power. As such changes could itself influence rent sharing processes (Nickell, 1999), I focus my interpretations on specifications excluding μ^M_{it} and consider regressions including μ^M_{it} as robustness checks. Yet, controlling for μ^M_{it} leaves the results unchanged.

As OLS regressions might suffer from an endogeneity bias, we cannot draw causal inference from them. The main concern is that unobserved product demand and supply shocks simultaneously affect trade flows and domestic firms' labor demand. To address this identification problem, I apply an IV approach using trade flows between China and countries similar to Germany as instruments for IMP^{CHN}_{it} and EXP^{CHN}_{it}. I define instruments in the following way: For every product, I calculate the share of imports (exports) flowing from China (instrument group countries) to instrument group countries (China) in total imports (exports) flowing from the world (instrument group countries) to the instrument group countries (world).[17] Identical to the construction of IMP^{CHN}_{it} and EXP^{CHN}_{it}, I aggregate these product-level trade flows to the firm level by using product revenue shares in firms' total product market revenue.

Using trade flows to other countries as instruments for local trade flows exploits that China's rise induces demand and supply shocks also for other trade partners. When defining instruments, I only use countries that are neither direct neighbors of Germany nor share the same currency. This minimizes concerns about correlated unobserved demand and supply shocks between Germany and countries included in the instrument group that would invalidate my identification (Dauth et al., 2014).[18] The online Appendix G reports the first stage regressions for the following main IV results.

Using IV estimators increases the magnitude of my coefficients.[19] According to column 5, a unit increase in import competition raises the share of rents that every full-time worker captures from its firm relative to its output contribution by 220 euros, whereas a unit increase in export opportunities decreases this share by 428 euros. To put this into perspective: Using weights, I calculate that throughout my observation period Chinese import competition and export demand increased by 0.8 and 1.0 points, respectively. Furthermore, I calculate that each year roughly 5 million full-time workers are active in German manufacturing sector firms with at least 20 employees. Hence, the estimates in column 5 suggest that the increase in export demand (import competition) from China raised rents that firms (workers) can capture, relative to their employees (firms) by 2.14 billion (880 million) euros.

[17] The product-level instruments for export opportunities and import competition are defined as: $EX^{INS}_{gt} = \frac{E^{INS\to CHN}_{gt}}{E^{INS\to WORLD}_{gt}} * 100$ and $IM^{INS}_{gt} = \frac{M^{CHN\to INS}_{gt}}{M^{WORLD\to INS}_{gt}} * 100$.

[18] The instrument country group includes Australia, New Zealand, Sweden, Norway, Japan, Great Britain, Canada, and Singapore (results are robust to different specifications).

[19] There are several mechanisms that can cause endogeneity problems in my OLS regressions that are in line with my results. For instance, an unobserved positive domestic product supply shock, e.g. through government subsidies or new production technologies, could simultaneously lead to an increase in domestic firms' labor demand (which might increase δ^L_{it}), a decrease in imports, and an increase in the capabilities of domestic firms to export (vice versa for negative supply shocks). In that case, OLS coefficients for the effect of IMP^{CHN}_{it-1} and EXP^{CHN}_{it-1} on δ^L_{it} are respectively negatively and positively biased. Moreover, unobserved demand shocks for certain German products that are correlated with German export opportunities to China could bias the OLS coefficient on EXP^{CHN}_{it-1} upwards. Additionally, one expects a downward bias in the coefficient on IMP^{CHN}_{it-1}, if the government protects domestic firms/industries in which employees output contribution is below their wage from foreign imports. Besides that, OLS estimates are biased towards zero, if there is measurement error in the endogenous variable. For more discussion, please see Dauth et al. (2014) and related work.

The increase of δ_{it}^{L} from import competition is not associated with a statistically significant effect on labor market efficiency, whereas a rise in export demand decreases labor market efficiency (column 6).[20]

4.2.2. PD- vs. ND-firms

At first glance, my results seem counterintuitive. One could expect that a rise in import competition would decrease δ_{it}^{L} by lowering employees' bargaining power due to a replacement of domestic production by foreign firms (Rodrik, 1997). Reversely, one could expect an increase of δ_{it}^{L} from new export opportunities. However, there is a simple mechanism working against this logic: Final product trade may increase or decrease firms' profits stronger than their labor expenditures. Intuitively, the degree of pass-through of profit changes to workforce adjustment may be determined by existing labor market power structures that prevent smooth workforce adjustments.[21]

To shed light on that, I investigate whether firms with (ND-firms) and without (PD-firms) labor market power respond heterogeneously to final product trade. ND-firms could exploit their labor market power to prevent export market profit gains from being shared with their workforce, decreasing δ_{it}^{L} for these firms. Oppositely, employees with positive labor market power might prevent output losses from import competition from being transferred to them.

Table 5 runs the regressions from Table 4 again on firms grouped according to their $t-1$ regime-type. Within PD-firms, a one unit increase in import competition increases the share of rents that workers can gain relative to their firm by 136 euros (column 5). For ND-firms, this coefficient is larger (230 euros). Consistent with these findings, labor market efficiency decreases (increases) from import competition targeted at PD-firms (ND-firms). For ND-firms, controlling for μ_{it}^{M} reduces the significance of these results to the 10-percent level (column 7 and 8).

Concerning the effects of foreign demand, I find that a unit increase in export opportunities increases firms' rents, relative to their workers, by 637 euros (column 5). This translates into a huge loss in labor market efficiency that amounts to 5 percent of the median (absolute) labor market distortion across all industries (Table 2). Interestingly, there is no effect of export opportunities on labor market power within PD-firms. Thus, an increase in foreign demand tends to raise inequality in labor market power between workers employed in PD- and ND-firms. I investigate this further in the online Appendix E and indeed find a positive causal relationship between industry-level dispersion in δ_{it}^{L} and industry-level export opportunities. Again, IV-estimates are much larger in terms of magnitude than OLS-estimates in Table 5 (see footnote 19 above).

Table 5 confirms that existing labor market power structures are relevant for determining how international trade influences labor market distortions. As export opportunities (import competition) might increase existing labor market distortions if firms (employees) possess labor market power, trade can widen gaps between potential and realized output. Import competition can, however, exert a disciplining effect by decreasing ND-firms' labor market power. Consequently, it depends on existing domestic labor market power structures whether final product trade can improve or worsen labor market efficiency. This constitutes a novel margin for gains (losses) from trade. Although I cannot quantify such additional gains and losses in my analysis, my findings highlight that models abstracting from such interdependencies might misjudge distributional outcomes and welfare gains from trade and, more generally, from product market competition and demand shocks.

I present several robustness checks in the online Appendix F. First, I use the BRICS country group (Brazil, Russia, India, China, and South Africa) instead of China as Germany's trade partner. This generalizes my analysis to a broader set of countries and addresses concerns about measurement errors in my trade measures for products that do not have China as their main import origin or export destination. Second, to address concerns about splitting firms into PD- and ND-samples based on a time-varying lagged outcome variable, I run three additional sets of regressions where I i) control for a dummy being one if firms switched their classification into PD- and ND-firms between t and $t-1$, ii) exclude firms that changed their classification into PD- and ND-firms at some point in time, and iii) split my firm sample on the basis of time-invariant regional measures of labor market power. Third, I re-run my entire estimation procedure without correcting for unobserved firm price variation showing that the effects of final product trade on labor market power do not depend on the complicated estimation approach described in section 3.3. Fourth, I address concerns of endogeneity with respect to my instruments by constructing new instruments that exclusively rely on firms' first observed product portfolio when aggregating product-level trade flows to the firm level (i.e. I use fixed weights for aggregation). While I find that the labor market disciplining effect of import competition on ND-firms is sensitive to the choice of the empirical specification, most of my other results are extremely robust to these different specifications.

4.3. Firm adjustments to Chinese trade exposure

Wedges between workers' output contribution and wages change in response to increasing trade exposure, if labor expenditure adjustments do not concord with changes in profits. This creates room for labor market disciplining and distorting

[20] Only exporting firms are affected by new export opportunities (results are available on request).

[21] Note that I focus on final product import competition and study firms' responses to changes in product market conditions. Intermediate input imports should exert different effects on labor market power. While both, final product and intermediate input imports substitute domestic workers with foreign ones, intermediate input imports should have a positive affect on firm profits. The response of the labor market power parameter then depends on how firms adjust their workforce and on how firms share rents from cheaper foreign inputs. As workers' bargaining power should be reduced by the substitution of workers with foreign intermediates and as I find that firms in response to new export opportunities do not fully share profit gains (see below), I expect that intermediate input imports have a negative affect on workers' labor market power (this would be in line with Rodrik, 1997). I leave a detailed examination of this issue for future research.

Table 5
Labor market distortions and Chinese trade exposure, PD-firms vs. ND-firms.

Panel A: PD-firms	PD-firms							
	OLS				IV			
	δ^L_{it}(1)	$\lvert\delta^L_{it}\rvert$(2)	δ^L_{it}(3)	$\lvert\delta^L_{it}\rvert$(4)	δ^L_{it}(5)	$\lvert\delta^L_{it}\rvert$(6)	δ^L_{it}(7)	$\lvert\delta^L_{it}\rvert$(8)
IMP^{CHN}_{it-1}	52.71**	43.87**	35.58*	29.74*	136.00***	104.90**	96.30**	72.09**
	(21.06)	(19.40)	(19.27)	(17.87)	(46.13)	(39.64)	(41.75)	(36.06)
EXP^{CHN}_{it-1}	−13.70	−14.55	−15.30	−15.86	−38.21	30.60	−65.08	8.432
	(25.95)	(22.01)	(23.08)	(19.72)	(123.60)	(98.26)	(113.70)	(89.99)
μ^M_{it}	–	–	15,320***	12,638***	–	–	15,307***	12,628***
			(405.50)	(362.00)			(405.50)	(362.10)
Firm-industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	63,183	63,183	63,183	63,183	63,183	63,183	63,183	63,183
R-squared	0.835	0.846	0.859	0.865	0.835	0.846	0.859	0.865
First-stage F-test	–	–	–	–	71.65	71.65	71.63	71.63
number of firms	16,481	16,481	16,481	16,481	16,481	16,481	16,481	16,481
Panel B: ND-firms	**ND-firms**							
	OLS				IV			
	δ^L_{it}(1)	$\lvert\delta^L_{it}\rvert$(2)	δ^L_{it}(3)	$\lvert\delta^L_{it}\rvert$(4)	δ^L_{it}(5)	$\lvert\delta^L_{it}\rvert$(6)	δ^L_{it}(7)	$\lvert\delta^L_{it}\rvert$(8)
IMP^{CHN}_{it-1}	174.70***	−155.90***	174.80***	−156.00***	230.80**	−217.70**	172.60*	−174.80*
	(49.51)	(47.97)	(48.03)	(48.78)	(116.30)	(105.80)	(102.10)	(98.83)
EXP^{CHN}_{it-1}	−42.71	49.85	−80.54*	77.71*	−637.40**	617.10***	−453.70**	481.60***
	(48.62)	(45.70)	(43.06)	(41.86)	(247.30)	(203.30)	(214.20)	(185.00)
μ^M_{it}	–	–	38,700***	−28,502***	–	–	38,793***	−28,602***
			(1793)	(1773)			(1792)	(1776)
Firm-industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-level controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	41,263	41,263	41,263	41,263	41,263	41,263	41,263	41,263
R-squared	0.876	0.888	0.894	0.898	0.875	0.887	0.894	0.898
First-stage *F*-test	–	–	–	–	34.50	34.50	34.58	34.58
Number of firms	8717	8717	8717	8717	8717	8717	8717	8717

The table reports results from estimating Eq. (12) by OLS and IV using separate samples for $t-1$ PD-firms (Panel A) and ND-firms (Panel B). OLS results are reported in columns 1–4. IV results are reported in columns 5–8. The dependent variable in columns 1, 3, 5, and 7 is the labor market power parameter, δ^L_{it}, whereas in columns 2, 4, 6, and 8 it is the absolute value of the labor market power parameter, $\lvert\delta^L_{it}\rvert$. All regressions include time and firm-industry fixed effects and controls for firms' size, worker outsourcing rate, share of researchers in the workforce, market share, and labor productivity. Regressions are weighted using population weights. Standard errors are clustered at the firm level. The top and bottom one percent of observations with respect to the distribution of the labor market power parameter are excluded. Significance: *10%, **5%, ***1%.

effects from trade. My findings suggest a domination of the latter in the case of Germany. Interestingly, incomplete adjustment processes on labor markets bear a close analogy to recent findings on an incomplete pass-through of trade related cost savings and exchange rate shocks to consumer prices (e.g. Amiti et al., 2014; DLGKP). Recent work highlights such incomplete pass-through processes in output markets as a source of distorting effects from international trade (e.g. Weinberger, 2017; Arkolakis et al., 2018). Similar to this literature on product market distortions, an incomplete pass-through of firm profit changes to labor input adjustments could introduce distortions on labor markets, explaining the previous section's results.

To investigate this further, Table 6 reports IV regression results for the responses of firms' revenue deflated by an industry-level deflator (r_{it}), FTE (l_{it}), average wages (υ^L_{it}), and ratio of intermediate to labor input expenditures (χ_{it}) – all in logs – to trade exposure. Results are separately reported for PD- (Panel A) and ND-firms (Panel B).

Table 6 suggests that trade related profit changes do not perfectly translate into labor adjustments. Note, however, that the mechanism behind the effect of import competition on ND-firms cannot be identified. This is unsurprising as the associated response of δ^L_{it} within ND-firms is imprecisely estimated and sensitive to the empirical specification. In contrast, I find a clear negative effect of import competition on revenues and employment for PD-firms. Yet, PD-firms decrease intermediate input expenditures stronger than labor expenditures in response to import competition (column 4). This creates a wedge between the adjustments of flexible commodities and labor inputs and (holding technology constant) implies that, although employees in PD-firms suffer from adverse competition shocks, PD-firms cannot completely pass the revenue losses from import competition through to workforce adjustments. As consequence, δ^L_{it} increases for these firms. Hence, labor market power on the employee side protects workers from adverse shocks, which creates labor market inefficiencies (i.e. PD-firms cannot shrink sufficiently). Yet, whether the inability of PD-firms to adjust their labor input downwards emerges from fixed contract durations, important firm specific worker skills, or other frictions cannot be differentiated in my empirical analysis.

Table 6
Firm adjustments and Chinese trade exposure, PD-firms vs. ND-firms.

Panel A: PD-firms	PD-firms			
	r_{it}(1)	l_{it}(2)	v^L_{it}(3)	χ_{it}(4)
IMP^{CHN}_{it-1}	−0.0104***	−0.00813***	−0.000650	−0.00557***
	(0.00250)	(0.00206)	(0.000854)	(0.00194)
EXP^{CHN}_{it-1}	0.0258***	0.00899**	0.00969***	0.00611
	(0.00627)	(0.00438)	(0.00237)	(0.00463)
Firm * industry FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Observations	63,183	63,183	63,183	63,183
R-squared	0.982	0.981	0.939	0.940
First-stage F-test	71.73	71.73	71.73	71.73
Number of firms	16,481	16,481	16,481	16,481
Panel B: ND-firms	**ND-firms**			
	r_{it}(1)	l_{it}(2)	v^L_{it}(3)	χ_{it}(4)
IMP^{CHN}_{it-1}	0.00383	0.00190	0.00106	−0.00313
	(0.00430)	(0.00319)	(0.00212)	(0.00361)
EXP^{CHN}_{it-1}	0.0212***	0.00240	0.00237	0.0239***
	(0.00717)	(0.00576)	(0.00363)	(0.00733)
Firm * Industry FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
Observations	41,263	41,263	41,263	41,263
R-squared	0.986	0.986	0.955	0.926
First-stage *F*-test	34.44	34.44	34.44	34.44
Number of firms	8717	8717	8717	8717

The table reports results from estimating Eq. (12) without any control variables by IV using separate samples for $t-1$ PD-firms (Panel A) and ND-firms (Panel B). The dependent variables in columns 1, 2, 3, and 4 respectively are logs of firms' revenue deflated with an industry specific price index, FTE, average wages, and ratio between intermediate and labor input expenditures. All regressions include time and firm-industry fixed effects and are weighted using population weights. Standard errors are clustered at the firm level. The top and bottom one percent of observations with respect to the distribution of the labor market power parameter are excluded. Significance: *10%, **5%, ***1%.

Within PD-firms, new rents from export market participation are passed on to positive workforce adjustments. This explains the insignificant effects from export opportunities on δ^L_{it} and $|\delta^L_{it}|$ within PD-firms. Interestingly, while ND-firms can increase their output in response to an increase in export demand, I find no statistically significant adjustment in their labor expenditures (also the point estimates are low compared to changes in revenue). Yet, ND-firms increase their intermediate input expenditures which causes a wedge between adjustments in flexible commodities and labor input expenditures implying an incomplete pass-through of export profit gains to adjustments in labor expenses. This ND-firm-specific mechanism gives rise to labor market distorting effects from export opportunities (again, compared to a model with perfect labor markets).

The results in Table 6 suggest that ND-firms do not share rents from increasing foreign demand with their workforce and instead try to substitute labor for intermediates. Firms on monopsonistic labor markets have strong incentives to do so: If labor and intermediates are substitutes, and if firms have labor market power, we expect that firms, in response to rising product demand, increase their demand for inputs bought on competitive input markets relative to labor. This is because increasing the amount of labor becomes increasingly costly for monopsonistic firms, while input prices are exogenously fixed on competitive input markets. Notably, a substitution of workers with intermediates might additionally fortify ND-firms labor market power by lowering the bargaining power of their workers (i.e. ND-firms become less dependent on labor).[22]

Finally, note that rising foreign demand leads to an increase in wages and employment within PD-firms, while both variables are unaffected within ND-firms. This implies that the decrease in δ^L_{it} and the associated decrease in labor market efficiency from an increase in export opportunities for ND-firms are unlikely to be caused by institutional barriers or short run adjustment frictions preventing upward wage and employment adjustments.

5. Conclusion

This article examines how final product trade with China shapes and interacts with labor markets power distortions in the German manufacturing sector by using a simple econometric partial equilibrium approach. I estimate labor market power distortions by calculating monetary wedges between workers' output contribution and received compensation that prevent the competitive labor market outcome.

[22] A labor market model that captures all discussed mechanisms can, for instance, be derived by combining the efficient bargaining and monopsonistic labor market models discussed in the online Appendix B.2. For an example of such a model see Falch and Strøm (2007).

In studying the impact of final product trade on labor market power in the German manufacturing sector, I find that firms possessing labor market power prevent an optimal pass-through of export profit gains to labor input expenditures. This raises their profit shares relative to their workers' labor shares. On the other hand, firms facing a workforce with positive labor market power cannot fully pass losses from import competition through to efficient wage and employment adjustments. Both effects distort rents towards firms and employees with labor market power and decrease total labor market efficiency. In contrast, evidence for labor market disciplining effects is extremely sensitive to the employed empirical specification.

The relevance of existing heterogeneous structures of labor market distortions in shaping distributional and efficiency related outcomes is an aspect that is widely unconsidered in the theoretical literature. Yet, the result that trade related changes in product market competition and demand can fortify prevalent labor market power distortions is of clear importance for designing industrial and trade policy. Although trade may still be welfare increasing, an increase in labor market distortions diminishes total trade gains compared to the first best allocative efficient scenario, which is usually considered in most theoretical models of trade.

An important aspect that this article emphasizes is the role of labor market power as an alternative source of firm market power. While most existing IO-studies neglect this dimension of firm market power, incorporating imperfect labor markets into the analysis might offer new insights on currently intensively debated questions concerning firm market power. For instance, the existence of labor market power might be important for understanding how firm market power has changed over the past decades and how potentially rising firm market power has contributed to several macroeconomic trends like falling labor shares, rising inequality, and declining business dynamism. I therefore believe that investigating the determinants and importance of labor market power constitutes a promising field for future research and hope that this article encourages fruitful discussions on this topic.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijindorg.2019.102562.

References

Ackerberg, D., & Hahn, J. (2015). Some non-parametric identification results using timing and information set assumptions. Working paper.
Ahsan, R.N., Mitra, D., 2014. Trade liberalization and labor's slice of the pie: evidence from Indian firms. J. Dev. Econ. 108 (C), 1–16.
Arkolakis, C., Costinot, A., Donaldson, D., Rodríguez-clare, A., 2018. The elusive pro-competitive effects of trade. Rev. Econ. Stud. 86 (1), 46–80.
Ashenfelter, O.C., Farber, H., Ransom, M.R., 2010. Labor market monopsony. J. Labor Econ. 28 (2), 203–210.
Autor, D.H., Dorn, D., Hanson, G.H., 2013. The china syndrome: local labor market effects of import competition in the united states. Am. Econ. Rev. 103 (6), 2121–2168.
Autor, D.H., Dorn, D., Hanson, G.H., 2016. The china shock: learning from labor-market adjustment to large changes in trade. Annu. Rev. Econo. 8 (1), 205–240.
Amiti, M., Davis, D., 2012. Firms, trade, and wages: theory and evidence. Rev. Econ. Stud. 79 (1), 1–36.
Amiti, M., Khandelwal, A.K., 2013. Import competition and quality upgrading. Rev. Econ. Stat. 95 (2), 476–490.
Amiti, M., Itskhoki, O., Konings, J., 2014. Importers, exporters, and exchange rate disconnect. Am. Econ. Rev. 104 (7), 1942–1978.
Azar, J., Marinescu, I., Steinbaum, M.I., 2017. Labor Market Concentration. National Bureau of Economic Research (No. w24147).
Berger, D.W., Herkenhoff, K.F., Mongey, S., 2019. Labor Market Power. National Bureau of Economic Research (No. w25719).
Bernard, A.B., Jensen, J.B., Redding, S.J., Schott, P.K., 2012. The empirics of firm heterogeneity and international trade. Annu. Rev. Econ. 4 (1), 283–313.
Berry, S.T., 1994. Estimating discrete-choice models of product differentiation. Rand. J. Econ. 25 (2), 242–262.
Biddle, J.E., 2014. Retrospectives: the cyclical behavior of labor productivity and the emergence of the labor hoarding concept. J. Econ. Perspect. 28 (2), 197–212.
Biscourp, P., Kramarz, F., 2007. Employment, skill structure and international trade: firm-level evidence for France. J. Int. Econ. 72 (1), 22–51.
Boulhol, H., Dobbelaere, S., Maioli, S., 2011. Imports as product and labour market discipline. Br. J. Indust. Relat. 49 (2), 331–361.
Caliendo, L., Rossi-hansberg, E., 2012. The impact of trade on organization and productivity. Q. J. Econ. 127 (3), 1393–1467.
Dauth, W., Findeisen, S., Südekum, J., 2014. The rise of the east and the far east: German labor markets and trade integration. J Eur Econ Assoc 12 (6), 1643–1675.
De Loecker, J., Goldberg, P.K., Khandelwal, A.K., Pavcnik, N., 2016. Prices, markups, and trade reform. Econometrica 84 (2), 445–510.
De Loecker, J., Scott, P.T., 2016. Estimating Market Power Evidence from the US Brewing Industry. National Bureau of Economic Research (No. w22957).
De Loecker, J., van Biesebroeck, J., 2018. Effect of international competition on firm productivity and market power. In: Grifell-Tatjé, E., Knox Lovell, C.A., Sickles, R.C. (Eds.). In: The Oxford Handbook of Productivity Analysis, Vol. 1. Oxford University Press, New York, pp. 463–491.
De Loecker, J., Eeckhout, J., 2018. Global Market Power. National Bureau of Economic Research (No. w24768).
De Loecker, J., & Eeckhout, J., Unger, G. (2018). The rise of market power and the macroeconomic implications. Working paper.
De Loecker, J., WARZYNSKI, F., 2012. Markups and firm level export status. Am. Econ. Rev. 102 (6), 2437–2471.
Dix-carneiro, R., 2014. Trade liberalization and labor market dynamics. Econometrica 82 (3), 825–885.
Dobbelaere, S., Kiyota, K., Mairesse, J., 2015. Product and labor market imperfections and scale economies: micro-evidence on france, japan and the netherlands. J. Comp. Econ. 43 (2), 290–322.
Dobbelaere, S., Lauterbach, R., Mairesse, J., 2016. Micro-evidence on product and labor market regime differences between chile and france. Int. J. Manpow. 37 (2), 229–252.
Dobbelaere, S., Mairesse, J., 2013. Panel data estimates of the production function and product and labor market imperfections. J. Appl. Econometr. 28 (1), 1–46.
Edmond, C., Midrigan, V., Xu, D.Y., 2015. Competition, markups, and the gains from international trade. Am. Econ. Rev. 105 (10), 3183–3221.
Egger, H., Kreickemeier, U., 2009. Firm heterogeneity and the labor market effects of trade liberalization. Int. Econ. Rev. (Philadelphia) 50 (1), 187–216.
Eslava, M., Haltiwanger, J., Kugler, A., Kugler, M., 2004. The effects of structural reforms on productivity and profitability enhancing reallocation: evidence from Colombia. J. Dev. Econ. 75 (2), 333–371.
Falch, T., Strøm, B., 2007. Wage bargaining and monopsony. Econ. Lett. 94 (2), 202–207.
Gandhi, A., Navarro, S., & Rivers, D.A. (2017). On the identification of production functions. Working paper.

Hornstein, A., Krusell, P., Violante, G.L., 2005. The effects of technical change on labor market inequalities. In: Aghion, P., Durlauf, S.N. (Eds.). In: Handbook of Economic Growth, Vol. 1. North-Holland, Amsterdam, pp. 1275–1370.
Hsieh, C.-T., Klenow, P., 2009. Misallocation and manufacturing TFP in China and India. Q. J. Econ. 124 (4), 1403–1448.
Kambourov, G., 2009. Labour market regulations and the sectoral reallocation of workers: the case of trade reforms. Rev. Econ. Stud. 76 (4), 1321–1358.
Manning, A., 2003. Monopsony in Motion: Imperfect Competition in Labor Markets. Princeton University Press, Princeton.
Marinescu, I., Posner, E.A., 2018. A Proposal to Enhance Antitrust Protection Against Labor Market Monopsony. Roosevelt Institute Working Paper.
Mayer, T., Melitz, M.J., Ottaviano, G.I., 2014. Market size, competition, and the product mix of exporters. Am. Econ. Rev. 104 (2), 495–536.
Mcdonald, I.M., Solow, R.M., 1981. Wage bargaining and employment. Am. Econ. Rev. 71 (5), 896–908.
Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71 (6), 1695–1725.
Mion, G., Zhu, L., 2013. Import competition from and offshoring to china: a curse or blessing for firms? J. Int. Econ. 89 (1), 202–215.
Morlacco, M. (2018). Market power in input markets: theory and evidence from French manufacturing. Working paper.
Naidu, S., Posner, E.A., Weyl, G., 2018. Antitrust remedies for labor market power. Harv. Law Rev. 132 (2), 536–601.
Nesta, L., & Schiavo, S. (2018). International competition and rent sharing in French manufacturing. Sciences PO OFCE Working Paper n° 14.
Nickell, S., 1999. Product markets and labour markets. Labour Econ. 6 (1), 1–20.
Oberfichtner, M., Schnabel, C., 2019. The german model of industrial relations:(Where) does it still exist? Jahrbücher für Nationalökonomie und Statistik 239 (1), 5–37.
OECD (2018). OECD indicators of employment protection. http://www.oecd.org.
Olley, S., Pakes, A., 1996. The dynamics of productivity in the telecommunications equipment industry. Econometrica 64 (6), 1263–1297.
Petrin, A., Sivadasan, J., 2013. Estimating lost output from allocative inefficiency, with an application to chile and firing costs. Review of Econ. Stat. 95 (1), 286–301.
Rodrik, D., 1997. Has globalization gone too far? Calif. Manage Rev. 39 (3), 29–53.
Schnabel, C., Wagner, J., 2007. The persistent decline in unionization in western and eastern Germany, 1980–2004: what can we learn from a decomposition analysis? Indust. Beziehungen German J. Indust. Relat. 14 (2), 118–132.
Topalova, P., KHANDELWAL, A., 2011. Trade liberalization and firm productivity: the case of India. Rev. Econ. Stat. 93 (3), 995–1009.
Valmari, N., 2016. Estimating Production Functions of Multiproduct Firms. ETLA Working Papers (No. 37).
Weinberger, A. (2017). Markups and misallocation with evidence from an exchange rate appreciation. Working paper.
Wooldridge, J.M., 2009. On estimating firm level production functions using proxy variables to control for unobservables. Econ. Lett. 104 (3), 112–114.