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International sourcing, domestic labour costs and producer prices

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International sourcing, domestic labour costs and producer prices
by Sotiris Blanas and Maurizio Zanardi



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Abstract

Using a representative sample of firms in Belgian manufacturing over 2001Q1–2017Q4, we study the effects of their international sourcing activities and domestic wages on their domestic output prices, as well as the effects of international sourcing on (relative) domestic wages. Controlling for firm size and other factors, we find that higher shares of imported intermediates, especially when they originate from lower-income countries, result in lower domestic output prices. This is consistent with the cost-saving aspect of international sourcing. For high-tech products, however, we also find that higher shares of imported intermediates from high-or lower-income countries lead to higher domestic prices. This is consistent with the input quality-enhancing aspect of international sourcing, but also its cost-saving aspect allowing for the re-allocation of domestic resources towards innovation and technology-intensive activities. In addition, we find that the share of imported intermediates from high-income countries is differentially negatively associated with the wage bill share and relative wage for white-collar workers in high-tech firms. Taken together, we view these results as suggestive evidence of firms combining higher-quality foreign inputs and domestic labour—especially blue-collar workers—in order to service the domestic market with higher-quality outputs at higher prices.

Keywords: International sourcing; importing; intermediates; wages; producer prices.

JEL Codes: F10, F14, E31.

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Non-technical summary

How do international sourcing activities of firms and their domestic labour costs affect the prices that they charge for the outputs they sell in the domestic market? And how do their international sourcing activities relate to domestic labour utilization and costs? We investigate these intertwined questions using a representative sample of firms in the Belgian manufacturing sector over 2001Q1 – 2017Q4, after combining information on domestic producer prices at the firm- product level with firm-level information on imports, average domestic wages, and other variables. These questions are relevant and timely, given the fast-paced fragmentation of firms' production processes across countries in recent decades and the re-allocation of domestic resources, including labour, that this phenomenon implies.

The findings of our econometric analysis indicate that international sourcing of intermediates and domestic wages play an important role in determining domestic output prices, conditional on firm size and product-year, product-quarter, and industry fixed effects. In particular, firms that import intermediates charge lower domestic output prices than non-importing firms. Lower domestic output prices are also charged by firms that have higher shares of imported intermediates, especially when these originate from lower-income countries. This evidence highlights the cost-saving aspect of international sourcing.

However, we also find that firms with higher shares of imported intermediates, including from all source countries available or from high- or lower-income source countries, charge higher prices for their high-tech outputs sold domestically. These differential effects, particularly that of the share of imports from high-income countries, point to the input quality-enhancing aspect of international sourcing. The differential effect of the share of imports from lower-income countries may also point to the cost-saving aspect of international sourcing, which subsequently allows firms to shift domestic resources to innovation- and technology-intensive activities. The identified effects of the extensive and intensive margins of importing of intermediates on prices are sizeable and robust to a battery of robustness checks. In contrast to imports of intermediates, we find no evidence of a role for international sourcing of final goods in determining domestic prices, except for a positive differential effect of the share of imported final goods from lower- income countries on domestic prices charged by firms in high-tech manufacturing. Similarly to intermediate inputs, this differential effect points to the output quality-enhancing aspect of international sourcing.

Regarding domestic wages, we confirm that these are positively associated with domestic output prices. In addition, we show that the share of imported intermediates from high-income countries is differentially negatively associated with the (relative) wage and wage bill share of white-collar workers in high-tech firms and differentially positively associated with the wage for blue-collar workers in such firms. In conjunction with the first group of findings, these associations point to the utilization by high-tech firms of higher-quality labour—especially, blue-collar workers—along with higher-quality inputs sourced from high-income countries aiming at the production of higher-quality outputs, which are sold in the domestic market at higher prices.

Overall, our analysis allows us to derive valuable insights about the implications of international sourcing for firms, workers, and consumers. How these insights will be amended if recent developments in the global economy—most notably, the rise in trade protectionism and disruptions in GVCs due to the COVID-19 pandemic outbreak and geopolitical tensions— eventually induce firms to revise substantially their international sourcing strategies is a promising avenue for future research.

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1 Introduction

In recent decades, multilateral trade and investment liberalization episodes along with technological advancements, such as containerization and ICT, have facilitated the engagement of firms in international sourcing activities. Taking advantage of cross-country differences in factor endowments and specialization, firms have typically engaged in international sourcing in order to access cheaper material and service inputs and final outputs (De Loecker et al., 2016; Blaum et al., 2018) or more costly inputs and outputs of higher quality (Manova & Zhang, 2012; Hallak & Sivadasan, 2013; Bastos et al., 2018). As firms’ choices over international sourcing go hand-in-hand with choices over optimal utilization of their domestic labour force, among other production-related adjustments, international sourcing and domestic labour costs may determine their price-setting behaviour in domestic and export markets.

Motivated by this rationale, our goal in this paper is to conduct an in-depth empirical investigation of how the engagement of firms in international sourcing (extensive margin), the intensity with which they engage in such activities (intensive margin), and the average wages that they pay to their domestic workers impact the (producer) prices that they charge for their products sold in the domestic market. We also aim at conducting an empirical investigation of how the intensive margin of international sourcing relates to the white-collar composition of labour demand and (relative) wages paid to white-collar and blue-collar workers. Taking advantage of cross-industry variation in the scope for vertical differentiation is central in our analysis, allowing us to study the inter-connection between input quality, labour quality, and output quality (Kugler & Verhoogen, 2012; Fieler et al., 2018). Equally importantly, our analysis is particularly timely, given that a series of recent shocks—most notably, trade protectionism, COVID-19, geopolitical tensions and conflicts—have brought to the forefront the potential trade-off facing firms between efficiency-seeking international sourcing and production resilience.

To conduct the analysis, we utilize a representative sample of firms operating in the Belgian manufacturing sector during 2001Q1–2017Q4, combining very detailed firm-level information from five different data sources that have been made available to us by the National Bank of Belgium (NBB). The first data source is the PPI Database and comprises product-level information on quarterly producer prices charged by firms domestically. With the unique firm tax identifier, we merge this information with other firm-level information. In particular,

by recovering each firm’s main 4-digit (NACE) industry from the Crossroad Bank of Enterprises Database, we restrict the sample to products that pertain to the core competences of firms over the period examined. In addition, we extract data from the International Trade Database on quarterly imports, including total, by trade partner, and based on whether they meet directly final demand (final goods) or are used as inputs in production (intermediate goods). Data on quarterly labour variables such as the wage bill and employment (number of workers), including total, by occupation (blue- and white-collar), and by contract type (full- and part-time), come from the National Social Security Office. Information on other quarterly production-related variables (e.g. total purchases of goods and services) are extracted from the VAT declarations.

Using the import data, we create variables for the engagement of firms in importing (extensive margin) and share of total imports in total purchases of goods and services (intensive margin). We also define variables for the two margins of importing while distinguishing between intermediate and final goods in order to capture different international sourcing strategies of firms (Biscourp & Kramarz, 2007; Mion & Zhu, 2013). In a similar vein, we distinguish between imports, especially of intermediates, from high-income and lower-income countries in order to proxy for internationally sourced inputs of relatively high and relatively low, respectively, quality and cost. The underlying rationale is that the per-capita income level of countries reflects their comparative advantage in producing and exporting inputs of a certain level of sophistication (Schott, 2004).¹ Our main firm-level measure of domestic labour costs is the average wage, which is calculated as the ratio of the total wage bill to total employment. Considering heterogeneous labour, we also use the wages for white- and blue-collar workers and the relative wage and wage bill share of white-collar workers.

Equipped with this rich set of data, we investigate the potential role of international sourcing activities of firms in determining domestic output prices. We regress the log of producer price by firm-product-year-quarter combination on the extensive or intensive margin of importing of the corresponding firm-year-quarter triplet. In all estimations, we control for firm size with the inclusion of the log of total employment, and for quarterly and annual price variations of products and industry effects with the inclusion of product-quarter, product-year, and industry dummies, respectively. By using these controls, the effects on producer prices are

¹To classify each source country in one of the two groups, we use the World Bank’s Historical Country Classification by Income. Importantly, although we acknowledge that it is not uncommon for high-quality inputs to enter lower-income countries and be processed further before they are exported, we also stress that this issue is more relevant to final goods than intermediates.

identified based on within-product comparisons between importing and non-importing firms or between firms with different import shares. Importantly, we also identify differential effects of the share of imported intermediates by interacting it with a dummy variable indicating whether a product is high-tech (i.e. R&D-intensive) or lower-tech according to the relevant Eurostat classification. These specifications are unlikely to suffer from a simultaneity bias, as international sourcing can determine prices, but price levels are not informative about sales, revenues, or other firm performance indicators that can indeed impact the extensive and intensive margins of importing. Furthermore, the set of control variables in the specifications account for various possible sources of omitted variable bias. For this reason, we estimate the specifications by ordinary least squares (OLS) and interpret the estimated coefficients of the import variables as their effects on domestic output prices.

To investigate the potential role of domestic labour costs in determining domestic output prices, we augment the baseline specification with the log of the average wage and additional variables controlling for the white-collar and full-time composition of employment. In contrast to the import variables, levels of wages and prices may be simultaneously determined and we thus interpret the coefficient estimates of the log of the average wage as its conditional correlation with domestic output prices.² Importantly, we complement this analysis by identifying the relationships of the intensive margin of international sourcing with the wage bill share of white-collar workers, the logs of wages for white- and blue-collar workers, and the log of the relative wage for white-collar workers.

The findings of our econometric analysis indicate that international sourcing of intermediates and domestic wages play an important role in determining domestic output prices, conditional on firm size and the three sets of fixed effects. In particular, firms that import intermediates charge lower domestic output prices than non-importing firms. Lower domestic output prices are also charged by firms that have higher shares of imported intermediates, especially when these originate from lower-income countries. This evidence highlights the cost-saving aspect of international sourcing. However, we also find that firms with higher shares of imported intermediates, including from all source countries available or from high- or lower-income source countries, charge higher prices for their high-tech outputs sold domestically. These differential effects, particularly that of the share of imports from high-income countries, point to the input quality-enhancing aspect of international sourcing. The differen-

²We mitigate the possible simultaneity bias by instrumenting the log of the average wage with its fourth-lagged values (i.e. values in the previous year).

tial effect of the share of imports from lower-income countries may also point to the cost-saving aspect of international sourcing, which subsequently allows firms to shift domestic resources to innovation- and technology-intensive activities. The identified effects of the extensive and intensive margins of importing of intermediates on prices are sizeable and robust to a battery of robustness checks. In contrast to imports of intermediates, we find no evidence of a role for international sourcing of final goods in determining domestic prices, except for a positive differential effect of the share of imported final goods from lower-income countries on domestic prices charged by firms in high-tech manufacturing. Similarly to intermediate inputs, this differential effect points to the output quality-enhancing aspect of international sourcing.

Regarding domestic wages, we confirm that these are positively associated with domestic output prices. In addition, we show that the share of imported intermediates from high-income countries is differentially negatively associated with the (relative) wage and wage bill share of white-collar workers in high-tech firms and differentially positively associated with the wage for blue-collar workers in such firms. In conjunction with the first group of findings, these associations point to the utilization by high-tech firms of higher-quality labour—especially, blue-collar workers—along with higher-quality inputs sourced from high-income countries aiming at the production of higher-quality outputs, which are sold in the domestic market at higher prices.

Related literature The broad set of evidence that we derive relates directly or indirectly to different streams of literature. However, what distinguishes this paper from the vast majority of related papers is that we provide in a single analysis evidence suggesting that input quality and cost, labour quality and cost, and output quality and prices are tightly intertwined. In this regard, our paper is closely related to seminal theoretical and empirical contributions on the links between labour and output quality (Verhoogen, 2008) and input and output quality (Kugler & Verhoogen, 2009, 2012), as well as more recent contributions on the interconnections of trade, quality, technology, and the demand for skills (Fieler et al., 2018) and management practices, quality capacity, and export performance (Bloom et al., 2021).

Our evidence on the extensive and intensive margins of international sourcing of inputs leading to lower output prices charged by firms in the domestic market is consistent with De Loecker et al. (2016) and Blaum et al. (2018). The first study shows that access to cheaper inputs from abroad by firms in India, following the country’s trade liberalization reform in the early 1990s, led to lower output prices and marginal costs. The second study

shows that importing of inputs led to 27% lower consumer prices of manufacturing products in France.

In addition, our evidence on international sourcing of inputs inducing firms to charge higher prices for their high-tech outputs sold domestically matches the existing evidence on larger firms paying higher prices for their inputs and charging higher prices for their outputs. Kugler & Verhoogen (2009) find that importing plants in Colombian manufacturing are larger and more productive than non-importing plants and pay higher prices for their inputs. In a follow-up study using the same data, the authors show that the size of firms is positively associated with both input and output prices (Kugler & Verhoogen, 2012). In the same vein, Atkin et al. (2015) find that larger soccer-ball producers in Pakistan incorporate more costly, higher-quality inputs in production.

The same evidence that we provide is also consistent with a group of studies establishing a (causal) link between prices of internationally sourced inputs and prices of outputs sold in export markets. Using Chinese customs data, Manova & Zhang (2012) find that firms that charge higher export prices also pay higher prices for their imports. Two more studies employ Chinese customs data to provide similar evidence. Bas & Strauss-Kahn (2015) show that firms that sell their outputs at higher prices in high-income markets source more expensive inputs from high-income countries. Fan et al. (2015) demonstrate that input tariff reductions induce firms to raise export prices and quality in industries where the scope for vertical differentiation is large, and decrease export prices and quality in industries where the scope for vertical differentiation is small. Hallak & Sivadasan (2013) also provide similar evidence on a sample of manufacturing firms in India, the US, Chile, and Colombia, while also controlling for their size. In addition, Bastos et al. (2018) find that firms in Portugal that service high-income markets source inputs of higher quality and raise the average quality of their outputs.

As we control for firm size and other critical factors determining prices, the differential positive effects on prices of high-tech outputs that we identify may suggest that high-tech producers combine their greater capabilities with internationally sourced inputs of higher quality in order to produce higher-quality outputs and sell them in a high-income market like Belgium at higher prices. The complementarity between firm capabilities and input quality is a key feature in the theoretical frameworks of Kugler & Verhoogen (2012), Fieler et al. (2018), and Blaum et al. (2019). In this light, our evidence also relates to empirical evidence on the positive link between imports of inputs and firm productivity (Amiti & Konings, 2007; Goldberg

et al., 2010; Topalova & Khandelwal, 2011; Halpern et al., 2015; Blaum et al., 2018). Another, yet non-mutually-exclusive, interpretation for the differential effects that we identify is that efficiency gains through sourcing of inputs from high- and lower-income countries allows high-tech producers to invest more intensively domestically in R&D, technology, and human capital, and subsequently, upgrade the quality of their products (Bloom et al., 2016; Fort et al., 2018; Fort, 2023; Bloom et al., 2019; Bernard et al., 2020). Efficiency gains and the ensuing reallocation of domestic resources towards innovation-, technology-, and skill-intensive activities may also provide a context for the differential positive effects of international sourcing of final goods from lower-income countries on high-tech output prices.

Furthermore, our suggestive evidence on the complementarity between high-tech firms’ imports of higher-quality inputs from high-income countries and higher-quality domestic labour—especially, blue-collar workers—relates to existing evidence on the link between international sourcing from lower-income countries and skill upgrading in developed countries (Feenstra & Hanson, 1996; Biscourp & Kramarz, 2007; Mion & Zhu, 2013; Bloom et al., 2016; Bernard et al., 2020) and the positive link between input quality and skill upgrading (Bas & Paunov, 2021). The same evidence along with the positive association between domestic wages and output prices that we identify in this paper also relate to existing evidence on the positive association between firm size and wages (Moore, 1911; Brown & Medoff, 1989; Oi & Idson, 1999; Bloom et al., 2018).

The remainder of the paper is structured as follows. In Section 2, we describe the data and present descriptive statistics for the variables used in the main econometric analysis. We then describe the econometric model and identification strategy in Section 3, and present the main results and robustness checks in Section 4. In Section 5, we provide concluding remarks.

2 Data and descriptive statistics

In this section, we first describe the data sources and construction of main variables. Then, we present descriptive statistics in order to provide some preliminary context for the analysis.

2.1 Data and variables

The empirical analysis relies on very rich information that is retrieved from five different databases made available to us by the National Bank of Belgium (NBB). The databases are merged together using the Value-Added Tax (VAT) number of firms, which acts as a unique firm identifier. The first source is the PPI Database that includes product-level information on producer prices (PPI) charged by a representative sample of firms in the manufacturing sector of Belgium.³ This information is collected regularly through a survey by the National Statistics Office of Belgium. The bulk of the extant literature has relied on unit values (i.e. value of product sales to product quantities), which are, however, imperfect proxies for domestic or export prices, as they may be determined by changes in the composition of products within an even highly disaggregated (e.g. 8-digit) product code or by measurement error in product quantities. By contrast, the producer prices that we observe directly represent out-of-factory prices and are thus less subject, if at all, to such biases.

Producer prices are available in each month from January 2001 until December 2017 and for products sold in three different markets: Belgium, Euro Area, and non-Euro Area.⁴ We abstract from conducting the analysis for the Euro Area or non-Euro Area for two main reasons. First, information on prices charged in these two markets is limited. Second, the two export markets are too broadly defined, implying a salient heterogeneity across countries within each group in key determinants of the price-setting behaviour of firms (e.g. income level, consumer preferences, geographic distance from Belgium) that would make hard the interpretation of econometric results. To match the PPI data with the quarterly firm-level information of the other databases, we convert these prices from monthly to quarterly frequency. We calculate quarterly prices as the unweighted average of prices across months within a quarter for each firm-product-year combination. Then, we eliminate a handful of observations which correspond to “unusual” quarterly price changes, that is, firm-product prices that are at least five times larger or smaller than they were in the previous quarter (as in e.g. Klenow & Kryvtsov,

³As we explain below, there is some information on product-level prices charged by firms outside of the manufacturing sector, but we exclude it from the sample because it is very limited and, more importantly, because import activities undertaken by firms in wholesale and retail sectors, where most excluded firms pertain to, are not necessarily consistent with the standard definition of international sourcing adopted by our study and the related literature (e.g. Amiti et al., 2014).

⁴Producer prices are also available at the plant-product level, but not for the whole time period. In any case, an analysis at this level would not be feasible as information in the other databases that we rely on is available only at the firm level. For the relatively few cases in which product-specific prices are observed for at least two plants belonging to the same firm, we calculate the unweighted average of prices across plants by firm-product-year-month-market combination.

2008).

Products are uniquely identified by their 8-digit PRODCOM codes. The first four digits of these codes indicate the corresponding industries according to the NACE classification (i.e. the European industry standard classification system). Due to the revision of this classification in 2008, we harmonize the 2-digit industry codes according to NACE Rev. 1.1 (in use until 2007) with those according to NACE Rev. 2 (in use as of January 2008).⁵ We then use only the 2-digit industry codes according to the first version throughout the empirical analysis. Given the small numbers of firm-year-quarter combinations for products pertaining to non-manufacturing industries (i.e. mining and quarrying; recycling; electricity, gas and water supply), we keep only products pertaining to the manufacturing sector, that is, products for which the first two digits of their PRODCOM codes correspond to NACE Rev. 1.1 codes 15–36. Within manufacturing, we further eliminate product categories comprising low numbers of firm-year-quarter combinations (i.e. NACE codes: 16, 19, 30, 32 and 35), which correspond to only 986 observations in total (i.e. 3% loss of information).

In order to focus on the price setting of products that pertain to the core competences of firms, we keep only products of firms for which the first four digits of their PRODCOM codes match in *every* year-quarter pair that appear in the data with the corresponding 4-digit codes of the main industries of firms, as these are recorded in the Crossroad Bank of Enterprises Database.⁶ A key advantage of this approach is that it removes mismatches that might have occurred due to product switches, industry switches, or reporting by firms of producer prices for different products at different points in time. This approach also allows for a tighter link between the intermediates and final goods sourced internationally and the products whose prices we observe. The final PPI dataset comprises information on producer prices charged in the Belgian market for 47,463 firm-product-year-quarter combinations.⁷ The manufacturing industries in which firms operate are listed in Table A1 of the Appendix. In the dataset, the average firm-product pair appears in 48 year-quarters, the average firm-product-quarter

⁵There is an one-to-one mapping of industries between the two NACE versions at the 2-digit industry level, which we focus on in the empirical analysis.

⁶In other words, when a product code does not match with the main industry of a firm in *at least one* year-quarter combination, we drop this firm-product combination for that and all other year-quarter pairs in which it appears. This results in the elimination of 21,387 observations. The Crossroad Bank of Enterprises Database contains information on the main industry each firm belongs to according to its annual declaration. Industries in this database are identified by 5-digit codes, whose first four digits correspond to NACE, thereby making comparisons with product codes straightforward.

⁷This is the upper bound of observations in the estimating samples utilized after merging firm-product-level information on producer prices with other firm-level information.

triplet in 12 years, and the average firm-product-year triplet in 4 quarters. Firms sell, on average, 2 products per year-quarter and a given product is sold, on average, by 5 firms per year-quarter.⁸

Relying on Eurostat’s classification of industries by R&D intensity, we distinguish firms operating in high-tech manufacturing industries from those operating in lower-tech industries. Of the industries examined, “Pharmaceuticals, medicinal chemicals and botanical products” (NACE 25.3) and “Medical, precision, and optical instruments” (NACE 33) are classified as high-tech.⁹ Given that the dataset includes products that always match the respective industries of firms, we essentially identify firms selling high-tech versus lower-tech products, or equivalently, products with greater versus smaller scope for vertical differentiation, which could potentially play a role in shaping the price-setting behaviour of firms in the Belgian market (Kugler & Verhoogen, 2009, 2012; Mion & Zhu, 2013; Fan et al., 2015; Bloom et al., 2016; Fort, 2023; Bloom et al., 2019; Bernard et al., 2020).

Having constructed the PPI dataset, we then match it with firm-level information from three additional sources. From the VAT declarations, we collect information on total purchases of goods and services (in current Euro prices). From the International Trade Database, we collect information on the total value of imports, but also distinguish by good type (i.e. intermediate or final), source country, and by both good type and source country. Import variables are also in current Euro prices. The distinction between imported intermediate and final goods is based on the comparison between a firm’s main 4-digit (NACE) industry and the 4-digit (NACE) code of the sourced good.¹⁰ For instance, tyres are recorded as intermediate goods when imported by car producers and as final goods when imported by tyre producers. In this way, we are able to distinguish between the case in which firms source foreign inputs in order to produce new inputs or final goods and the case in which firms source a product in its final form to meet final demand. This approach is quite common in the related literature (e.g. Feenstra & Hanson, 1996, 1997; Biscourp & Kramarz, 2007; and Mion & Zhu, 2013), given the complexity of international sourcing strategies implemented by firms which makes

⁸The maximum values for these statistics are 68, 17, 4, 8, and 22, respectively. Also, note that the 48 year-quarters in which the average firm-product pair appears are not necessarily consecutive.

⁹“Office machinery and computers” (NACE 30), “Radio, television and communication equipment and apparatus” (NACE 32), and “Aircraft and spacecraft” (NACE 35.2) also qualify as high-tech, but, as stated earlier, we have excluded them from the dataset because of the very few firm-product-year-quarter combinations that they contain.

¹⁰As imported goods per firm are classified according to the Combined Nomenclature (CN8), these have first been mapped to 4-digit NACE codes. There has been an one-to-one correspondence in 99% of cases. The unmatched cases have been eliminated.

tracking of entire value-added chains a notoriously difficult task for empirical researchers.¹¹ Relatedly, given Belgium’s “trade hub” status, we exclude imports that are exported without value being added domestically (Bernard et al., 2019). This brings us closer to the original notion of international sourcing (Johnson & Noguera, 2012; Johnson, 2018). The trade data allow us to do this for total imports and imports by type of good, but not for imports by source country.

Given the import data at our disposal, we create a dummy variable indicating whether a firm has a positive total value of imports (in a given year-quarter), which captures the extensive margin of importing. Similarly, we create dummy variables capturing the extensive margins of imported intermediate and final goods based on whether a firm has a positive total value of imports of the respective type of goods (in a given year-quarter). To create variables for the intensive margins of total imports and imports by type of goods, we calculate the shares of the total value of imports, the value of imported intermediate goods, and the value of imported final goods in the total value of purchased goods and services.¹² We perceive these variables, especially those capturing the intensive margin of importing, as (imperfect) measures of the foreign component of the marginal cost of a firm (Amiti et al., 2014).

Emulating studies of the related literature (e.g. Bernard et al., 2006; Bas & Strauss-Kahn, 2015), we also create these variables after distinguishing source countries by their income status. For the latter, we label a source country as high-income or lower-income (i.e. upper-middle-, lower-middle-, or low-income) according to the World Bank’s Historical Country Classification by Income based on its gross national product in at least half of the years in our sample. Making this distinction is important as the per-capita income level of a country reflects the relative abundance of its factor endowments and, in turn, the levels of complexity and cost of intermediate and final goods that it has a comparative advantage

¹¹For firms selling more than one products, we do not know whether their imported intermediates and final goods are used for the production of or correspond to the products whose prices we observe. This, however, should not be a major issue, as we consider only core products of firms and it is hard to imagine that international sourcing was used exclusively for non-core products. Even in the latter case, international sourcing could exert indirect effects on domestic prices, as decisions made by firms over the pricing of their products are part of a single profit maximization problem. To address any remaining concerns about this issue, we show in a robustness check that the main results remain unchanged when we eliminate from the sample all firms that have declared prices for more than one product in at least one year-quarter pair.

¹²These calculations yield some outliers (i.e. shares above 1). To deal with these, we assign the 99th percentile value to import shares greater than 1 but smaller than 2, and a missing value to shares that are equal to or above 2. Such outliers may be the result of reporting errors and collection of different pieces of information from different sources. In fact, data on trade of Belgian firms with non-EU countries (extra-EU) are collected by the Belgian customs, data on their trade with EU countries (intra-EU) are collected through a survey (Intrastat Inquiry), and data on their sales are collected by the Belgian VAT administration.

in producing and exporting (Schott, 2004). This rationale is more applicable to imports of intermediates than imports of final goods and total imports and implies that, by and large, intermediates imported from high-income countries are considered to be of relatively high quality and cost, while intermediates imported from lower-income countries are considered to be of relatively low quality and cost.¹³

The final database that we rely on contains firm-level information on labour variables, as originally collected by the National Social Security Office of Belgium. In particular, we have information on the total wage bill and total number of workers per firm, the wage bill and number of workers by broad occupation category (i.e. blue-collar or white-collar), the number of workers by contract type (i.e. full-time or part-time), and the number of workers by broad occupation category and contract type. We use the total number of workers as a measure of firm size. Calculating the ratio of the total wage bill to total employment yields the average wage paid by a firm per year-quarter, which is our measure of domestic labour costs or the domestic component of the marginal cost of a firm (Amiti et al., 2014). Similarly, we calculate the average wages for blue- and white-collar workers as ratios of their wage bills to their total employment. To capture the relative cost of the two worker groups, we calculate the ratio of the wage for white-collar workers to the wage for blue-collar workers and the share of the wage bill of white-collar workers in the total wage bill. In addition, we calculate the shares of white-collar and full-time employment in total employment in order to capture the white-collar and full-time composition of a firm’s workforce, and the shares of full-time blue- and white-collar workers in the total number of blue- and white-collar workers, respectively, in order to capture the full-time composition of employment per occupation group.

2.2 Descriptive statistics

Having described the main features of the dataset and the construction of the main variables, we now present some summary statistics in Table 1.¹⁴ Regarding the extensive margin

¹³Things are more complicated for imports of final goods and total imports, as it is common practice for firms in lower-income countries to distribute high-quality final goods in domestic and export markets by undertaking domestically mostly, if not exclusively, low-value-added activities, such as final assembly of inputs and components. As a result, such countries also export highly complex and pricy final goods, which are not justified by their comparative advantages (Schott, 2008). This issue becomes even more severe considering also that imports by source country cannot be corrected for re-exports, as it may not be uncommon for high-quality final goods that are imported into Belgium from lower-income countries to be exported to third countries.

¹⁴The statistics for each variable are produced on the estimating sample that is formed when the corresponding variable is included as a regressor. The small variation in the number of observations of import shares is because of the treatment of outlier values, as explained in the previous section.

of importing, Table 1 conveys three main messages. First, engagement in importing is a common activity of firms, as positive total values of imports correspond to almost 80% of the firm-product-year-quarter combinations. Distinguishing by type of good, importing of intermediates is much more common than importing of final goods (71% versus 38% of firm-product-year-quarter combinations), while there is an almost even split in terms of occurrences between importing of both intermediate and final goods and importing of intermediates only (38% and 33%, respectively). Instead, importing of final goods only corresponds to very few observations (i.e. less than 1%). Regarding the distinction between high- and lower-income source countries, importing from the first group is much more common (i.e. 78% versus 37%), and this also holds when we distinguish simultaneously by type of goods and type of source countries.

Turning to the variables for the intensive margin of importing, the summary statistics illustrate a more nuanced picture of firms' import activities. Although imports of the average firm account for roughly 41% of their total purchases of goods and services, the import share of firms below the 5th percentile is zero and imports of firms above the 95th percentile account for almost the entirety of their total purchases of goods and services. This is also evident from the standard deviation of the import share being almost as high as the mean value. Variation across firms in the other import share variables is also quite significant. Some patterns, however, can be detected that are similar to those for the extensive margins of importing. The average share of imported intermediates is larger than the average share of imported final goods and the average share of imports from high-income countries is larger than the average share of imports from lower-income countries. These patterns also hold when we distinguish by both type of goods and source country income group.

In addition to import shares, firms in the sample are highly heterogeneous in various labour market dimensions, including total employment, white-collar and full-time composition of employment, full-time composition of white- and blue-collar employment, average wage, wages for blue- and white-collar workers, and the wage bill share of white-collar workers. For instance, while the average firm employs roughly 200 workers, there exist firms in the sample that have less than 10 employees and others that have more than 800 employees. Again, some clear patterns also emerge that are intuitive. Full-time workers account for relatively high fractions of total, blue-, and white-collar employment, while some firms employ workers only full-time. By contrast, white-collar workers account, on average, for relatively low fractions

Table 1: Summary statistics

	Observations	Mean	St. dev.	5 th pct.	95 th pct.
Importer	47,463	0.794	0.404	0	1
Importer of intermediates	47,463	0.708	0.455	0	1
Importer of final goods	47,463	0.384	0.486	0	1
Importer of both intermediates and final goods	47,463	0.376	0.484	0	1
Importer of intermediates only	47,463	0.332	0.471	0	1
Importer of final goods only	47,463	0.008	0.087	0	0
Importer from HI	47,463	0.780	0.414	0	1
Importer from LMI	47,463	0.366	0.482	0	1
Importer of intermediates from HI	47,463	0.696	0.460	0	1
Importer of intermediates from LMI	47,463	0.281	0.450	0	1
Importer of final goods from HI	47,463	0.438	0.496	0	1
Importer of final goods from LMI	47,463	0.149	0.356	0	1
Share of imports	36,728	0.406	0.395	0	0.974
Share of imports of intermediates	39,859	0.279	0.353	0	0.960
Share of imports of final goods	39,859	0.059	0.178	0	0.534
Share of imports from HI	35,202	0.411	0.403	0	0.973
Share of imports from LMI	38,886	0.047	0.153	0	0.345
Share of imports of intermediates from HI	39,859	0.284	0.358	0	0.961
Share of imports of intermediates from LMI	39,859	0.023	0.096	0	0.125
Share of imports of final goods from HI	38,695	0.084	0.217	0	0.777
Share of imports of final goods from LMI	39,640	0.017	0.089	0	0.052
Employment	47,463	209	484	9	825
Share of full-time workers in total employment	37,973	0.869	0.116	0.653	1
Share of white-collar workers in total employment	37,973	0.288	0.201	0.000	0.667
Share of white-collar workers in total wage bill	37,973	0.370	0.216	0.000	0.740
Share of full-time white-collar workers in total number of white-collar workers	35,670	0.807	0.200	0.429	1
Share of full-time blue-collar workers in total number of blue-collar workers	37,564	0.890	0.125	0.659	1
Average wage	37,973	7373.82	10788.88	3694.15	12412.30
Average wage of white-collar workers	35,670	10022.79	6418.11	4938.38	16288.07
Average wage of blue-collar workers	37,564	6955.69	48171.31	3246.41	10123.23

Notes: The statistics for the import dummies are produced on the estimating sample of Table 2. The statistics for the import shares are produced on the estimating sample of Table 3. The statistics for labour variables are produced on the estimating sample of Table 5, except for total employment whose statistics are produced on the estimating sample of Table 2. A source country is defined as high-income (HI) or lower-income (LMI) if it is classified as such in at least half of the years in our sample (i.e. 2001–2017) by the World Bank’s Historical Country Classification by Income. The lower-income category includes upper-middle, lower-middle and low-income countries.

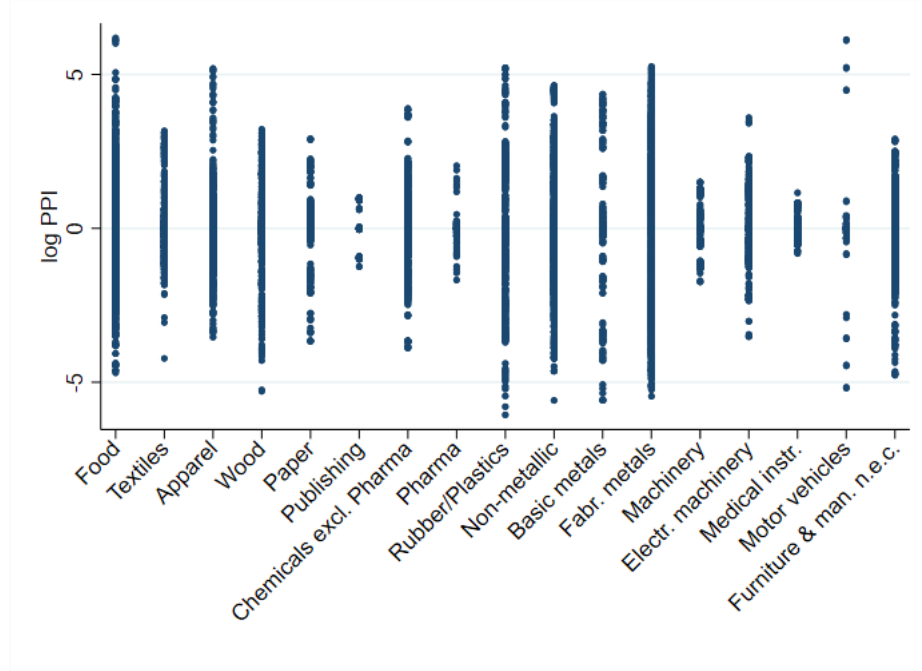
Source: Authors’ calculations based on data from the NBB Trade Database, the VAT declarations, the National Social Security Database, and the World Bank’s Historical Country Classification by Income.

of total employment and the total wage bill. Also, the wage paid to white-collar workers by the average firm is higher than the wage paid to blue-collar workers and this also holds for firms paying wages that lie in the low and high ends of the respective distributions.

Table 1 does not display summary statistics for domestic producer prices so that we avoid lumping together prices of very different products. To make meaningful comparisons of producer prices, we instead plot in Figure 1 the log(PPI) of firm-product-year-quarter combinations by 2-digit industry after demeaning it by product-year and by product-quarter pair in order to account for product-specific quarterly and annual trends. The figure illustrates the extent of variation of prices within industries: price variation is relatively high in the food,

apparel, rubber/plastics, and fabricated metals industries, and relatively low in publishing, machinery, and the two high-tech (i.e. pharmaceuticals and medical instruments) industries.¹⁵

Figure 1: Domestic producer prices of 8-digit products by 2-digit NACE industry



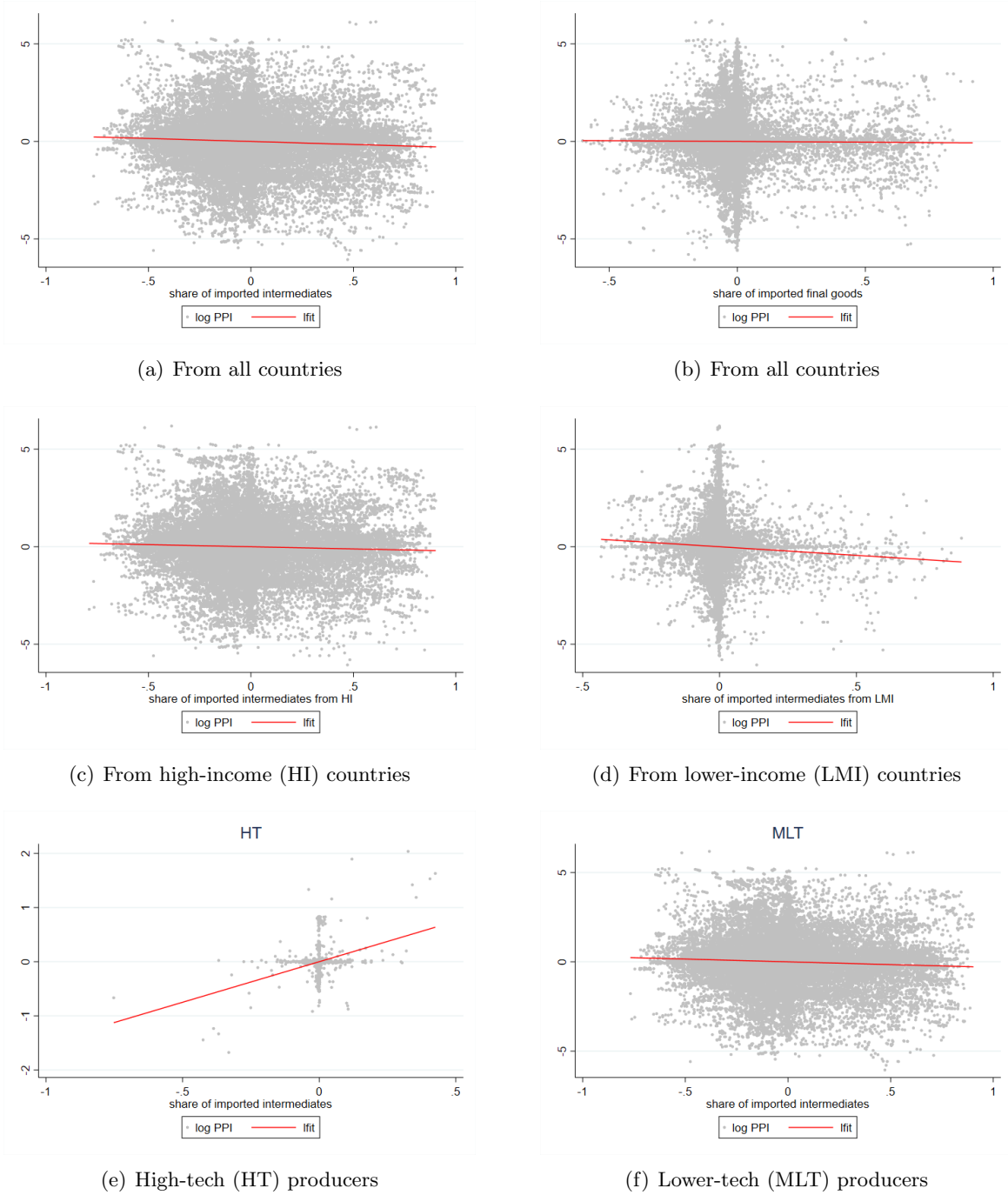
Notes: log PPI: log of prices charged in the Belgian market by firms for 8-digit NACE products over the period examined. The variable is demeaned by product-year and product-quarter. Industries on the horizontal axis are classified according to the 2-digit NACE. The figure is produced on the estimating sample of Table 3.

Source: Authors' calculations based on data from the NBB PPI Database.

Before moving to the econometric analysis, it is useful to visualize how import shares relate to producer prices. To this end, we plot in Figure 2 the $\log(\text{PPI})$ of firm-product-year-quarter combinations, demeaned by product-year and by product-quarter, against shares of imported intermediate or final goods (Panels (a) and (b)), and shares of imported intermediates after distinguishing by source country income group (Panels (c) and (d)) or the technology intensity of firms' products (Panels (e) and (f)). While the first panel shows a weak negative correlation between the share of imported intermediates and domestic producer prices, the second panel suggests that there is no correlation between the share of imported final goods and producer prices. Shedding more light on the correlation of the first panel, Panel (c) points to a very weak negative correlation between the share of imported intermediates from high-income countries and domestic prices, while Panel (d) points to a stronger negative correlation between the

¹⁵The figure also provides a graphic illustration of available observations by industry (e.g. much fewer for the motor vehicles than the fabricated metals industry). For the precise number of observations per industry, see Table A1.

Figure 2: Correlations of import shares with domestic producer prices



Notes: log PPI: log of producer price charged in the Belgian market; import shares are calculated as ratios of the corresponding import value to the value of total purchases of goods and services. The variables are demeaned by product-year and product-quarter. For the definition of source countries by income level, see Table 1. Panel (e) includes firms that sell high-tech manufacturing (HTM) products, while panel (f) includes firms that sell medium- or low-tech manufacturing (MLT) products, according to the Eurostat classification of manufacturing industries by R&D intensity. The figures are produced on the estimating sample of Table 3.

Source: Raw correlations based on data from the PPI Database, the Trade Database, and the VAT declarations.

share of imported intermediates from lower-income countries and producer prices. In a similar vein, the panels in the bottom row show that distinguishing by the technology intensity

of products does matter: while high-tech producers' shares of imported intermediates are strongly positively correlated with domestic prices, the correlation between the two variables is weakly negative for lower-tech producers.¹⁶

In sum, according to Panels (a) and (b) of Figure 2, while the share of imported final goods may not be correlated with domestic producer prices, the relationship between the share of imported intermediates and domestic producer prices may be negative and significant, pointing to international input sourcing as a cost-saving strategy of firms. The latter may be particularly relevant when inputs are sourced from lower-income countries, rather than high-income countries, as suggested by Panels (d) and (c). However, the contrast between Panels (e) and (f) may also point to international input sourcing as an input quality-enhancing strategy of firms—in particular, those that are innovation- and technology-intensive and produce more vertically differentiated products. With these insights in mind, the econometric analysis that follows aims at investigating whether and how international sourcing determines prices charged by manufacturing firms in the Belgian market.

3 Econometric methodology

To identify how international sourcing activities of firms impact their pricing decisions, we estimate the following specification:¹⁷

$$\log(PPI_{fpqy}) = D_{pq} + D_{py} + D_i + \beta_S \cdot \log(S_{fqy}) + \beta_M \cdot M_{fqy} + \epsilon_{fpqy}, \quad (1)$$

where $\log(PPI_{fpqy})$ is the log of the producer price charged by firm f (in industry i) for its 8-digit product p sold in the Belgian market in quarter q of year y . M_{fqy} is a vector comprising the main regressors of interest, capturing the extensive or intensive margin of importing of firm f in quarter q of year y . In either case, the vector includes variables for total imports, their breakdown by type of goods (i.e. intermediate or final), their breakdown by source

¹⁶Panel (a) of Figure A1 shows that the share of total imports is weakly correlated with domestic producer prices, which may be explained by the fact that imports of intermediates account for the bulk of total imports. Distinguishing imports by source country income group and technology intensity of products yields positive correlations of high-tech producers' shares of imported intermediates from high- and lower-income countries with domestic prices, but the second correlation is stronger (Panels (b)–(c) of the same figure). By contrast, the correlations of lower-tech producers' shares of imported intermediates from high- and lower-income countries with domestic prices are negative, with the second correlation being stronger (Panels (d)–(e) of Figure A1).

¹⁷This specification is very similar to the empirical analogs of the equations derived by Kugler & Verhoogen (2012) in the two versions of their Melitz-type framework linking input and output prices to firm size, and the equations derived by Fan et al. (2015) in their framework of endogenous input and output quality choice.

income country group (i.e. high-income or lower-income), or the breakdown by both type of goods and source country income group.

The log of total employment, $\log(S_{fqq})$, acts as a measure of firm size.¹⁸ Controlling for firm size is crucial as there is evidence showing that it is strongly positively associated with input and output prices (Kugler & Verhoogen, 2009, 2012). It also ensures that the effects of importing on output prices that we aim at identifying are not confounded with the effects of firm size, as there exists evidence on positive associations of the latter variable with the extensive and intensive margins of importing (Bernard et al., 2007).¹⁹ Similarly to direct importing, firm size controls for the possibility of firms in our sample, including those identified as non-importers, of importing indirectly (i.e. through intermediaries).²⁰

In addition, firm size is associated with a host of other factors that could potentially impact producer prices. In particular, larger firms typically have better capabilities, utilize higher-quality labour, material and service inputs and technological equipment, engage more intensively in innovation-related (e.g. R&D) activities, and have better management practices (Kugler & Verhoogen, 2012; Atkin et al. (2015); Blaum et al. (2019); Bloom et al., 2018; Song et al., 2019; Boler et al., 2015; Bloom & Van Reenen, 2007), allowing them to produce higher-quality outputs and sell them at higher prices. Firm size is also strongly positively associated with wages, which tend to reflect average labour quality (Moore, 1911; Brown & Medoff, 1989; Oi & Idson, 1999; Bloom et al., 2018; Song et al., 2019). Size may also capture the bargaining power of firms vis-à-vis their suppliers (Halpern et al., 2015). In its capacity to account for such factors, firm size may thus be viewed as an imperfect measure of a firm’s marginal cost. On top of that, firm size is strongly correlated with market shares and may act as an imperfect measure of a firm’s markup (Amiti et al., 2014).²¹ Hence, to the extent that the log of employment captures variability of a firm’s marginal cost and markups, it will

¹⁸The log of sales, on which we have information, could also act as a measure of firm size. We use this variable only in a robustness check, as it is more prone to measurement error than the log of employment and likely endogenous with producer prices (Kugler & Verhoogen, 2012).

¹⁹The positive associations of firm size with the two margins of importing typically reflect self-selection of firms into this type of activity (Antràs et al., 2017). In other words, larger firms find it less costly to become importers (extensive margin) and increase the intensity of their imports (intensive margin). In accord with this intuition and past evidence, we show in tables that are available upon request that importing firms in our sample differ from non-importing firms along various dimensions, including employment, in each two-digit industry examined.

²⁰In a similar spirit to the Melitz-type framework of self-selection of firms into direct or indirect exporting and associated evidence (Ahn et al., 2011), the average relatively small firm may find it profitable to engage only in indirect importing, while large firms may engage in direct importing or in both direct and indirect importing.

²¹N. Berman et al. (2012) use productivity as an imperfect measure of a firm’s markup. We consider using this variable in robustness exercises.

also reflect market power.

In addition to the firm size control, three sets of fixed effects define our identification strategy by addressing other sources of omitted variable bias. Product-quarter dummies (D_{pq}) account for quarterly price variation of a given (8-digit) product due to seasonal demand (e.g. gloves) or institutional factors such as sales (e.g. apparel and footwear). Product-year dummies (D_{py}) account for annual price variation of a given product induced by changes in technological characteristics (e.g. new features of smartphones), among other factors. Given our focus on the identification of the effects of international sourcing on domestic output prices, it is noteworthy that these two sets of fixed effects control for import competition, which may be another driver of the price-setting behaviour of firms in the Belgian market. The same sets of fixed effects also act as deflators when the specification includes monetary variables in nominal terms. As price variation may be determined by time-invariant industry-specific institutional factors, such as wage bargaining, the specifications also include 5-digit industry dummies (D_i). Given this set of controls, the coefficients in β_M are identified based on the comparison between importing and non-importing firms selling the same 8-digit product in a given year-quarter, when M_{fgy} comprises variables for the extensive margin of importing. When this vector comprises variables for the intensive margin of importing, the identification of the coefficients in β_M is based on the comparison between firms with different import shares within an 8-digit product in a given year-quarter.

The baseline specification in (1) is estimated by OLS. Standard errors are always clustered at the firm level so that we allow for possible correlations across the products sold by a firm (Kugler & Verhoogen, 2012). Although the engagement of firms in importing and their import shares are expected to impact output prices through a cost-saving or quality-enhancing strategy, the reverse is unlikely to be true. In fact, either margin of importing could be impacted by the sales and revenue that firms realize and their overall performance and efficiency. However, output prices do not convey information about any of the aforementioned variables. For instance, a lower (higher) price charged by a firm in the Belgian market due to international sourcing does not necessarily imply higher (lower) sales and revenue that could potentially feedback into international sourcing activities. In short, we argue that the specification is unlikely to suffer from a simultaneity bias. And as discussed earlier, we include a broad set of controls that address various sources of omitted variable bias.²² For this reason, we interpret

²²Another potential source of endogeneity is measurement error in key variables, but the associated bias is unlikely to be significant. As stressed in Section 2.1, measurement error in producer prices, unlike unit values,

statistically significant estimates of the coefficients in β_M as the *effects* of the engagement of firms in importing or their shares of imports on the prices that they charge in the domestic market.

4 Empirical results

We can now present the results of the econometric analysis. We first identify the effects of international sourcing on domestic output prices, confirm their robustness to a battery of checks, and quantify them. Then, we add the domestic labour cost dimension in order to identify the relationship between domestic wages and domestic output prices and confirm that this addition does not alter the effects of international sourcing on domestic output prices. To investigate in depth the role of domestic labour utilization in production when firms have the opportunity to source inputs and final goods from abroad, we then study the effects of international sourcing on the wages paid to white- and blue-collar workers and the wage bill share and relative wage of white-collar workers.

4.1 International sourcing and domestic prices

4.1.1 Extensive margin of international sourcing and domestic prices

We begin by studying the effects of the extensive margin of international sourcing on domestic producer prices. Table 2 shows the results for the baseline specification in (1) when we use as key regressor(s) the dummy for the import status of firms (column (1)) or dummies for their import status broken down by type of goods (columns (2) and (3)). The common finding in this table is the positive and statistically significant effect (at 5% level) of the log of employment on producer prices. All else equal, the employment (firm size) elasticities of output prices that we obtain in the three columns suggest that a rise in a firm's total employment by 1% leads to a rise in the price that it charges for a given product in the domestic market by around 13%.

tends to be rather small or non-existent. In addition, the conversion of import data from monthly to quarterly frequency is expected to mitigate a possible measurement error in these. Even if a measurement error exists, the dummy variables for the import status of firms that we have created are less likely to be subject to it. In the same spirit, in a robustness exercise we use as key regressors dummy variables for import share ranges, which are expected to mitigate a possible measurement error in import shares. Total employment, measured as the total number of employees, is also less likely to be subject to an error, especially compared to alternative firm size measures, such as the total number of hours worked or total value of sales.

Table 2: Import status and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)
$\text{Log}(\text{employment}_{fpy})$	0.135** [0.061]	0.132** [0.060]	0.129** [0.061]
Importer_{fpy}	-0.361** [0.159]		
$\text{Importer of intermediates}_{fpy}$		-0.350** [0.140]	
$\text{Importer of final goods only}_{fpy}$		0.555 [0.424]	0.565 [0.424]
$\text{Importer of both intermediate and final goods}_{fpy}$			-0.319** [0.155]
$\text{Importer of intermediates only}_{fpy}$			-0.366** [0.143]
Product-quarter fixed effects	yes	yes	yes
Product-year fixed effects	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes
Observations	47,463	47,463	47,463
Clusters (firms)	958	1,007	1,007
R^2	0.800	0.801	0.801

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

The negative and significant coefficient estimate of the dummy variable for the engagement of firms in importing in column (1) indicates that importing firms charge lower output prices in the domestic market compared to non-importing firms. It is worth emphasizing that we identify this difference between importing and non-importing firms while controlling for their size, industry trends, and the quarterly and annual price variations of their (8-digit) products. The magnitude of the coefficient estimate indicates that the effect is economically significant: importing firms charge approximately 30% lower prices for a given product sold in the Belgian market compared to their non-importing counterparts.²³

In column (2), the key regressors are the dummy variables for the engagement of firms in imports of intermediates and imports of final goods only. In column (3), we decompose imports of intermediates further by using as the key regressors the dummy variables for the engagement of firms in imports of intermediates only, imports of final goods only, and imports of both intermediate and final goods. In line with the scatterplots depicted in Panels (a) and (b) of Figure 2, the coefficient estimates in these columns clearly indicate that the effect of international sourcing on output prices identified in column (1) is driven by importing of intermediates and regardless of it taking place along with importing of final goods or not.

²³This is calculated as: $100 * (\exp(-0.361) - 1) = 30.3\%$. We provide a comprehensive assessment of the economic significance of the estimates in Section 4.1.4.

Instead, the engagement of firms in imports of final goods exerts no statistically significant effect on prices.

In sum, the analysis in Table 2 first confirms the positive relationship between firm size and output prices that has already been identified in the literature (e.g. Kugler & Verhoogen, 2009, 2012). As already stressed in Section 3, this positive association may suggest that larger firms sell in the domestic market higher-quality products at higher prices thanks to their greater capabilities, utilization of higher-quality labour, material and service inputs, and technological equipment, greater innovation capacity, better management practices, or combination of these (Kugler & Verhoogen, 2012; Atkin et al. (2015); Blaum et al. (2019); Bloom et al., 2018; Song et al., 2019; Boler et al., 2015; Bloom & Van Reenen, 2007). More importantly, the analysis in Table 2 reveals that, conditional on their size and the aforementioned factors possibly impacting prices, firms that engage in importing, especially of intermediates, charge lower prices for their outputs sold in the domestic market. We view these results as evidence of firms with access to cheaper inputs from abroad being in a position to charge lower output prices in the domestic market. Similar evidence is provided by De Loecker et al. (2016) and Blaum et al. (2018).

Considering the import status of firms has led to very useful preliminary insights, but it does not convey information about the intensity with which firms engage in international sourcing. And as documented in Section 2.2, firms differ substantially in the latter dimension. To this end, we proceed in our investigation by considering the intensive margin of international sourcing.

4.1.2 Intensive margin of international sourcing and domestic prices

Table 3 displays the results obtained when employing import share variables as the key regressors. In all columns, we consider imports by type of good, as the previous table has clearly illustrated that making this distinction is crucial.²⁴ The results in the first column are consistent with those obtained in the previous section, in that while the share of imported final goods exerts no statistically significant effect on domestic output prices, the share of imported intermediates exerts a negative and significant effect. The latter effect suggests that firms likely source inputs from abroad more cheaply and the higher the fraction of these inputs

²⁴When discussing the robustness checks, we present results without such distinction. Also, note that the lower number of observations in this table compared to Table 2 is due to the treatment of outliers of import shares, as discussed in Section 2.1.

in their total purchases of goods and services is, the lower is the price that they charge for a given product sold in the domestic market. By contrast, the coefficient estimate of the log of employment continues to be positive, but becomes statistically insignificant and smaller in size once we switch from import dummies to import shares, and these remarks also hold in the rest of the columns of the table.

Table 3: Import shares and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpy})$	0.089 [0.063]	0.089 [0.063]	0.087 [0.063]	0.087 [0.063]
Share of imports of intermediates $_{fpy}$	-0.356** [0.162]	-0.360** [0.163]		
Share of imports of final goods $_{fpy}$	0.048 [0.233]	0.051 [0.233]	0.064 [0.230]	0.069 [0.229]
Share of imports of intermediates $_{fpy}$ * High-tech $_p$		1.742*** [0.569]		
Share of imports of intermediates from HI $_{fpy}$			-0.244 [0.165]	-0.248 [0.165]
Share of imports of intermediates from LMI $_{fpy}$			-0.866** [0.407]	-0.888** [0.408]
Share of imports of intermediates from HI $_{fpy}$ * High-tech $_p$				1.108*** [0.418]
Share of imports of intermediates from LMI $_{fpy}$ * High-tech $_p$				3.621*** [1.080]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	39,859	39,859	39,859	39,859
Clusters (firms)	936	936	936	936
R^2	0.796	0.796	0.796	0.796
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.012		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.026
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.006

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

The results obtained so far point to the cost-saving aspect of international sourcing. In the next columns of the table, we expand the analysis in three important ways focusing on the imports of intermediates, which have consistently been found to impact prices. In column (2) of Table 3, we consider the potential role of technological sophistication of products sold by firms. We do so by interacting the share of imported intermediates with the dummy variable indicating whether a firm operates in a high-tech industry, or equivalently, whether a product sold by a firm is high-tech.²⁵ In a similar spirit, we distinguish in column (3) between

²⁵Recall that we consider in the analysis only core products of firms, after dropping those that do not match with the main industries in which firms operate. Hence, the expressions “high-tech industry” and “high-tech

high-income (HI) and lower-income (LMI) countries from which intermediates are imported. As mentioned in Section 2.1, this distinction allows us to proxy for the sophistication and cost differences between inputs sourced from countries in the two groups (Schott, 2004; Bas & Strauss-Kahn, 2015). That is, we consider inputs sourced from high-income countries to be of relatively high quality and cost while inputs sourced from lower-income countries to be, by and large, of relatively lower quality and cost. In column (4), we consider jointly the technological content of products and source country of inputs by interacting the shares of imported intermediates from high- and lower-income countries with the dummy variable for high- or lower-tech products.

Similarly to column (1), the coefficient estimate of the share of imported intermediates remains negative and significant in column (2). Interestingly, the positive and significant coefficient estimate of the interaction term in that column demonstrates that there is a positive differential effect of the share of imported intermediates on prices charged by firms for high-tech outputs sold in the domestic market relative to firms selling lower-tech outputs and all non-importing firms. On top of that, the overall effect of the share of imported intermediates on domestic prices of high-tech outputs is positive and highly statistically significant, as shown by the F-test at the bottom of the table (i.e. the sum of the respective coefficients $(-0.360 + 1.742)$ is positive and statistically different from zero at 5% level). In short, while international sourcing of intermediates induces lower-tech firms to charge *lower* prices for their goods sold in the domestic market, it induces high-tech firms to charge *higher* domestic output prices.

The results in column (2) suggest that only lower-tech firms view international sourcing as a purely cost-effective strategy. High-tech firms, instead, likely source material and service inputs of relatively high quality and cost from abroad, allowing them to sell higher-quality outputs in a high-income market, like that of Belgium, for which they charge higher prices. Similar evidence has been provided by several related studies (Kugler & Verhoogen, 2009, 2012; Manova & Zhang, 2012; Hallak & Sivadasan, 2013; Bas & Strauss-Kahn, 2015; Atkin et al., 2015; Bastos et al., 2018). Another possible explanation is that high-tech firms source foreign inputs at lower costs, and in doing so, they find it easier to allocate more resources domestically towards innovation- and technology-intensive activities, with the aim to produce outputs of higher quality. This rationale has also been provided by other related studies

product” can be used interchangeably.

(Bloom et al., 2016; Bloom et al., 2019; Bernard et al., 2020).

The results in the last two columns of Table 2 lend extra support to the interpretations that we have provided for the results in the first two columns. While the share of imported intermediates from high-income countries in column (3) shows no statistically significant effect on domestic output prices, the share of imported intermediates from lower-income countries exerts a negative and statistically significant effect. In line with the effect in column (1) and the view that inputs originating from lower-income countries are mostly of relatively low quality and cost, the latter effect points to the cost-saving aspect of international sourcing. The coefficient estimates of these two key regressors in column (4) are qualitatively and quantitatively very similar. However, the coefficient estimates of the respective interaction terms are positive and highly statistically significant, pointing to positive differential effects on prices of high-tech products sold in the domestic market. Also, as indicated by the relevant F-tests at the bottom of the table, the overall effects of the shares of imported intermediates from high- and lower-income countries on domestic prices of high-tech products are positive and statistically significant (i.e. $-0.248 + 1.108$ is statistically different from zero at 5% level and $-0.888 + 3.621$ is statistically different from zero at 1% level). Hence, international sourcing of higher-quality inputs, particularly from high-income countries, likely leads to the production of higher-quality domestic outputs for which higher prices are charged. The latter is also likely achieved through international sourcing of cheaper inputs from lower-income countries and the ensuing reallocation of domestic resources towards innovation- and technology-intensive activities.²⁶

We derive an additional insight, which is consistent with the interpretations of the differential effects, by re-estimating the specification in column (4) after adding to it the shares of imported final goods from high- and lower-income countries and their interactions with the dummy variable indicating firms selling high- or lower-tech products. Although the share of imported final goods from high-income countries exerts no statistically significant effect on domestic prices charged by high- or lower-tech firms, there are positive and significant dif-

²⁶Estimating the specifications in columns (1) and (3) separately on the samples of firms in high- and lower-tech manufacturing instead of using interaction terms, we derive consistent results (available upon request). For high-tech firms, their shares of total imports of intermediates and shares of imported intermediates from high- and lower-income countries exert positive and significant effects on output prices that they charge in the domestic market. By contrast, the share of total imports of intermediates and share of imported intermediates from lower-income countries exert negative and significant effects on domestic output prices charged by lower-tech firms. These effects are also very similar in magnitude to the corresponding effects in columns (2) and (4).

ferential and overall effects of the share of imported final goods from lower-income countries on domestic prices charged by high-tech firms (column (4) of Table A2). The latter effects likely suggest that high-tech firms source higher-quality goods from lower-income countries for which they charge higher prices in the domestic market. As stressed in Section 2.1, although sourcing of high-quality goods from lower-income countries may not be in line with their comparative advantages, it is quite common for different high-quality components and intermediates to be gathered and assembled in lower-income countries and then be shipped to high-income countries like Belgium in the form of final goods in order to meet final demand (Schott, 2004, 2008).²⁷

4.1.3 Robustness checks

To verify their robustness, we now engage in a battery of checks on the results presented in Table 3. To save on space, the tables are reported in the Appendix or made available upon request.

No distinction of imports by type of good The results of the previous section have clearly indicated that the effects of the intensive margin of importing on domestic prices are statistically significant only for intermediates except for one case in which they are significant for both intermediate and final goods. The results that we obtain from the first check highlight the importance of this distinction. Re-estimating the specifications without distinguishing imports by type of goods yields coefficient estimates of the share of total imports and share of imports from lower-income countries that are still negative but statistically insignificant (columns (1) and (3), respectively, of Table A3). The positive and significant differential effects of the same key regressors are consistent with the respective effects of the shares of imported intermediates (columns (2) and (4) of the same table). However, while the overall effect of the second regressor is positive and significant at 1%, the overall effect of the first regressor is positive and significant only at 10%, as indicated by the p-values of the relevant

²⁷In contrast to these significant effects, we find no significant (differential) effect of the share of imported final goods for lower-tech (high-tech) firms when we do not distinguish between high- and lower-income source countries (column (2) of Table A2) and weakly or no significant effects of the shares of imported final goods from high- and lower-income source countries when we do not distinguish between high- and lower-tech firms (column (3) of the same table). The effect of the share of imported final goods when we do not distinguish between high- and lower-tech firms and between high- and lower-income source countries is also insignificant (column (1) of the same table). The coefficient estimates of the share(s) of imported intermediates and their interactions are very similar qualitatively to the corresponding estimates in Table 3 but mostly of larger size. In addition, the estimates of the log of employment are positive and insignificant, which is in line with the respective estimates in Table 3, but of slightly smaller size.

F-test at the bottom of the table. Also in contrast to the main results, the differential effect of imports from high-income countries is statistically insignificant and so is the relevant overall effect (column (4) of the same table).²⁸

Import share bins In the second robustness exercise, we keep the distinction between intermediate and final goods of the main analysis, but now use as the key regressors dummy variables for ranges of shares of imported intermediates. In doing so, we account for the possibility that the effects are non-linear and mitigate a possible bias in the estimates in case of measurement error in the import data. Considering firms with zero shares as the reference group, we create these variables using as thresholds their 50th and 75th percentile values, calculated on the whole sample. Re-estimating the specifications using these dummy variables reveals that only firms with high and upper-middle shares of imported intermediates charge lower domestic prices relative to non-importers and the effect is stronger the higher is the import share bin (column (1) of Table A4). Also, the effects of the different import share bins on domestic prices are insignificant or significant only at 10% when distinguishing between high- and lower-income source countries (columns (3) of the same table). The differential and overall effects of the import share bins are positive and significant, but the effects are stronger for higher import share bins (columns (2) and (4) of the same table).

Product-year-quarter fixed effects In the baseline specifications, we always include product-year and product-quarter fixed effects to absorb annual and quarterly variation of domestic producer prices. As quarterly variation of prices may also occur within years, we re-estimate the specifications after replacing these two sets of fixed effects with product-year-quarter fixed effects. The loss of roughly 10,000 observations explains why this set of fixed effects is not part of our baseline specification.²⁹ Still, apart from the lower significance of the positive differential effect of the share of imported intermediates from lower-income countries and its insignificant overall effect, the results bear a very close resemblance to the main ones (Table A5).

Log of sales as a measure of firm size In an additional robustness exercise, we re-estimate the specifications using the log of sales as an alternative to the log of employment.³⁰ As sales are the product between prices and quantities, they are likely to be endogenous. For this

²⁸Recall from Section 2.2 that we have detected and dropped some outliers for the share of total imports, which explains why the estimating sample in this exercise contains approximately 5,500 fewer observations.

²⁹These observations are eliminated due to little or no variation across product-year-quarter combinations per firm. This may not be surprising, given that the PPI data are collected through a survey.

³⁰Information on nominal sales is retrieved from the VAT declarations.

reason, we produce not only OLS results but also 2SLS results after instrumenting the log of sales with the log of total employment, as has been done by Kugler & Verhoogen (2012). Although the results obtained from OLS and 2SLS estimations are largely similar to the main ones, some notable differences have been detected (Panels A and B, respectively, of Table A6). The coefficient estimates of the non-interacted and interacted import shares are larger. Also, the OLS estimates of the log of sales have very similar magnitudes to the respective estimates of the log of employment and remain insignificant, but the 2SLS estimates are significant at 10% and of larger size. These quantitative differences are consistent with a possible attenuation bias in the OLS estimates due to measurement error in the data.³¹

Export status of firms A well-known stylized fact in the trade literature is that firms that import also tend to export and vice versa (Bernard et al., 2007), while there is also evidence on causal links between firms' imports of intermediates and expansion of the volume and scope of their exports (Feng et al., 2016). In addition, firm expansion to foreign markets typically requires output quality upgrading (Verhoogen, 2008). If the latter implies an increase in average output quality, it will likely also lead to domestic output quality upgrading and higher producer prices. On the other hand, in case firms discriminate against the domestic market, foreign market expansion may degrade domestic output quality and reduce producer prices. Hence, by incorporating the dummy for the export status of firms, we aim at ensuring that the effects of the share of imported intermediates are not confounded with those of exporting. Indeed, the results obtained bear a very close resemblance qualitatively and quantitatively to the main ones (Table A7).

Multinational status of firms As the bulk of international trade is conducted by multinational firms (Antràs & Yeaple, 2014), the effects of the shares of imported intermediates may be confounded with effects of multinational activity and intra-firm transactions (Amiti et al., 2014). To address these concerns, we eliminate multinational firms from the sample (Table A8). In a second check, which controls for multinational activity but not necessarily for intra-firm trade, we estimate the specifications on the benchmark sample while controlling for a dummy variable indicating the multinational status of firms. Reassuringly, the results remain largely unchanged in either case, while, in the second check, the coefficient estimate of the additional control is always positive but statistically insignificant (results available upon

³¹Note that using the log of sales in the specifications as a measure of firm size yields an estimating sample that comprises roughly 2,000 fewer observations than the sample on which the main results are produced.

request).³²

Labour productivity and capital intensity of firms In addition to employment, exporting, and multinational status, import activities tend to be strongly correlated with other notable firm characteristics, such as labour productivity and capital intensity. For instance, there is evidence on productivity premia of importers over non-importers (Bernard et al., 2007) and positive effects of importing on firm efficiency (Halpern et al., 2015). Equally importantly, employment, productivity, and market shares tend to be strongly correlated (Amiti et al., 2014), while labour productivity can act as an imperfect measure of markups (N. Berman et al., 2012). Relatedly, there is evidence showing that industries have been increasingly dominated by larger, more productive firms with high market shares and markups (Autor et al., 2017, 2020). In other words, employment, labour productivity, and capital intensity could individually or collectively capture firms’ market power, which could be an alternative interpretation for the positive differential effects that we have identified in the main analysis.

These variables may also capture bargaining power of firms over their input suppliers, or equivalently, the market power that input suppliers may exercise at the expense of the firms examined (Halpern et al., 2015). This is important for the interpretation of the identified effects driven by high- and lower-income source countries. As explained earlier, intermediates sourced from lower-income countries tend to be of relatively low quality and thus, it is less likely, if not unlikely, that the identified effects that are driven by this group of source countries reflect market power of foreign input suppliers or relatively low bargaining of the firms examined over their input suppliers from such countries. By contrast, the identified effects that are driven by high-income source countries may reflect market power, as these inputs are typically of relatively high quality and can be produced by a relatively limited number of suppliers.

To this end, we re-estimate the specifications and add to the benchmark set of control variables the log of labour productivity, calculated as the ratio of nominal value added to total employment, and the log of capital intensity, calculated as the ratio of nominal capital investment to total employment. The effects of the import shares are very similar qualitatively to the main ones, but of larger size (Table A9). Also, unlike the main results, there is a

³²Information on the multinational status of firms in 2001–2017 is retrieved from the NBB’s Foreign Direct Investment (FDI) Database. We identify a firm as multinational if it has at least one subsidiary abroad (outward FDI) or is itself a subsidiary of a firm based in a foreign country (inward FDI).

negative effect of the share of imported intermediates from high-income countries on domestic prices, but it is significant only at 10% (columns (3) and (4) of the same table). Given that the inclusion of the two additional controls leads to a loss of more than 10,000 observations, we ensure that the results obtained from this exercise are not driven by sample selection by estimating the main specifications on this restricted sample (results available upon request).³³

Interactions of firm size or productivity with industry-level R&D intensity In relation to the previous check, considering that employment and labour productivity may be related to both quality upgrading and higher market shares and power, we estimate the main specifications in columns (2) and (4) of Table 3 after adding the interaction between the log of employment or labour productivity and the dummy for firms in high- or lower-tech manufacturing (columns (1)–(2) and (5)–(6), respectively, of Table A10). As an alternative to the log of employment, we also use a dummy variable in the newly-added interaction term indicating whether a firm is relatively large or small (columns (3)–(4) of Table A10). We construct this dummy variable based on whether the total employment of a firm is at least equal to or smaller than the sample mean of total employment reported in Table 1.

Using either measure of firm size yields results that are very similar to the main ones. Interestingly, the effects of log of employment on domestic output prices continue to be statistically insignificant, but the respective effects of the dummy for relatively large firms are positive, significant at 1%, and much larger in size. The latter effects are consistent with both quality upgrading in relatively large firms and with exercise of market power by these firms in the domestic market. The differential and overall effects of the firm size measures are statistically insignificant. Equally interestingly, when the log of productivity is part of the additional interaction term, the (differential) effects of the shares of imported intermediates are, by and large, qualitatively similar to the main ones, but mostly of larger magnitude. The overall effects of the same variables are also very similar to the main ones. Two exceptions are worth mentioning: the share of imported intermediates from high-income countries exerts a negative effect on domestic output prices, which is significant at 5%, and the log of employment exerts a positive effect on domestic output prices, albeit this is significant only at 10%. As for the differential and overall effects of the log of labour productivity, these are

³³The quite large decline in the number of observations is due to missing information on capital investment. The conclusions drawn from this exercise hold if we incorporate the additional controls individually (results available upon request). Also, the results remain largely unchanged when labour productivity is calculated as the ratio of aggregate sales to aggregate employment or the ratio of value added or aggregate sales to full-time employment (results available upon request).

statistically insignificant.

Industry concentration As the expansion of larger, more productive firms with high market shares and markups has contributed to rising industry concentration since the 1980s (Autor et al., 2017, 2020), we also estimate the main specifications in columns (2) and (4) of Table 3 after adding the interaction of the share of imported intermediates with the cumulative change of an industry concentration measure between 2000 and 2014 (columns (7)–(8) of Table A10). For the latter, we rely on Bajgar et al. (2023), who have created an industry concentration measure (CR8) for the EU using data on 64 two-digit industries, including ours, in several EU countries, including Belgium. The main effects remain largely unchanged, except for those of the share of total imports of intermediates and share of imported intermediates from lower-income countries that turn insignificant. As for the differential and overall effects based on cross-industry differences in concentration, these are negative but mostly statistically insignificant. The only exception is the differential and overall effects of the share of imported intermediates from lower-income countries, which are significant at 10% and 5%, respectively. A possible explanation for latter effects is that firms that source cheaper inputs more intensively from lower-income countries charge lower prices as a response to higher domestic concentration.³⁴

Horizontal product differentiation Using the high-tech product dummy in interaction terms has allowed us to identify positive differential and overall effects on domestic prices charged by high-tech firms, which likely point to differences between these firms and lower-tech firms in the quality of internationally sourced inputs and quality of products sold in the domestic market. As it is possible that this variable may be capturing both horizontal and vertical differentiation, we re-estimate the specifications in columns (2) and (4) of Table 3 after adding interactions of the share of imported intermediates with measures of horizontal differentiation (Kugler & Verhoogen, 2012).³⁵ In relation to previous robustness exercises, the additional interaction term may also capture firms’ market power stemming from horizontal product differentiation.

The measures of horizontal differentiation that we rely on are those of Gollop & Monahan

³⁴As the cumulative change of the industry concentration measure corresponds to 2000–2014, these estimations are made for the sample period 2001–2014. For this reason, we also ensure that the results remain largely unchanged when we estimate the main specifications in columns (2) and (4) of Table 3 for the shorter period (results available upon request).

³⁵The effects of horizontal differentiation on domestic product prices that are common to all firms per product examined are already captured by product-year and industry fixed effects. Instead, with the additional interaction term, we aim at capturing differential effects on prices charged by firms selling products with different degrees of horizontal differentiation in the domestic market (Kugler & Verhoogen, 2012).

(1991) and Nunn (2007). The latter has built upon the relevant methodology of Rauch (1999). The first measure was originally constructed to capture the dissimilarity of input mixes across establishments of multi-establishment firms. Given the level of aggregation of our data, we use the version of the shipments-weighted or shipments-unweighted measure that captures input mix differences across firms within a (2-digit SIC) industry in 1982 (Syverson, 2004; Kugler & Verhoogen, 2012).³⁶ According to the original measure of Rauch (1999), differentiated products are defined as those that cannot be sold on an organized exchange, nor can they be reference priced. A looser definition, which we also consider in this exercise, is that differentiated products are only those that cannot be sold on an organized exchange. Combining information on this measure with industry-level information from US input-output tables for 1997, Nunn (2007) calculates the liberal and conservative versions of Rauch (1999)’s measures at the industry (3-digit SIC Rev. 2) level as fractions of differentiated inputs in the total value of inputs used. We use these industry-level measures after assigning the corresponding NACE code to each industry.³⁷

Going to the results, although the coefficient estimates of the non-interacted shares of imported intermediates lose their significance, the differential effects are very similar to the main ones (Tables A11 and A12). The overall effects, however, are statistically insignificant or only marginally significant. As for the coefficient estimates of the newly-added interaction terms, these are insignificant, regardless of using the shipments-weighted or shipments-unweighted measure of Gollop & Monahan (1991) or the liberal Nunn-Rauch measures based on the main and alternative definitions of product differentiation. We draw the same conclusions using the conservative Nunn-Rauch measures based on the main and alternative definitions (results available upon request).

Multiple firm-product combinations per year-quarter As stressed in Section 3, the domestic prices that we observe correspond to core products and it is thus unlikely that international sourcing activities of multi-product firms in our sample were related exclusively

³⁶The values of the shipments-weighted and shipments-unweighted measures by industry for 1982 are available upon request. We have chosen the values for 1982 because this is the most proximate year to the start year of our sample for which information on this measure is available. Relying on the titles of the industries listed in Gollop & Monahan (1991), it is straightforward to assign manually to each industry the corresponding NACE code (concordance table available upon request).

³⁷The concordance between 3-digit SIC and NACE industry codes and the liberal and conservative estimates by industry are available upon request. For NACE codes that correspond to more than one 3-digit SIC industry, we first sum the values of differentiated inputs and total values of inputs over 3-digit SIC industries by the corresponding NACE industry, and then calculate the fraction of differentiated inputs in the total value of inputs used by NACE industry. Also, note that by using these measures, we assume that the input use of industries in Belgium is the same as that of the corresponding industries in the US in 1997.

to their non-core products. To further mitigate a possible bias in our results due to partial or full allocation of imported intermediates to products other than those for which firms in our sample have reported producer prices, we re-estimate the specifications after excluding from the sample firms that declare producer prices for more than one product per year-quarter.³⁸ The effects of the shares of imported intermediates from high- and lower-income countries and the differential and overall effects of all import shares are very similar to the main ones (columns (3)–(4) of Table A13), but the effect of the share of imported intermediates from all source countries, albeit still negative, turns insignificant (columns (1) and (2) of the same table).

4.1.4 Quantification exercise

Taking stock of the analyses in Tables 2 and 3, we have shown that the extensive and intensive margins of international sourcing of intermediates do play a role in determining domestic output prices. At the same time, either margin of international sourcing of final goods plays no role in this regard, apart from the intensive margin of international sourcing of final goods by high-tech firms from lower-income countries according to a supplementary exercise. Having also confirmed the robustness of the results in Table 3, it is now useful to investigate their economic significance.

To this end, we rely on the coefficient estimates of the shares of imported intermediates in columns (1)–(4) of Table 3 and assume that the log price of a given product sold by a firm with zero share of imported intermediates is equal to 1. Column (1) of Table 4, based on the most parsimonious specification, shows that firms whose imported intermediates account for 10%, 50% or 90% of the total value of purchased goods and services charge, respectively, 3.5%, 16%, and 27% lower domestic prices than firms that do not import intermediates.³⁹ By contrast, column (2) shows that high-tech producers with the same shares of imported intermediates charge 15%, 99.5%, and 247% higher prices compared to firms that do not

³⁸Note that if such a bias exists, this exercise mitigates it but does not eliminate it, as there may be firms which have allocated imported intermediates to products for which they have not declared producer prices in any of the year-quarter combinations that we observe.

³⁹The percentage differences in prices in column (1) are calculated by multiplying the coefficient estimate of the share of imported intermediates in column (1) of Table 3 by the respective import share and then subtract this product from 1 (i.e. the log of price charged by firms with zero share of imported intermediates). The rest of the percentage differences in prices reported in this table are calculated similarly. The share of imported final goods is omitted from this and the other columns of this table as its effects are statistically insignificant. Regarding imported intermediates, recall from Section 2.2 that shares as high as 90% are observed in our sample. For instance, the 95th percentile value is equal to 96% (Table 1).

import intermediates (i.e. the quantified effects with interaction terms include the base level).

Taking into account the origin of imports in column (3) reveals that firms with a 50% share of imported intermediates from high- and lower-income countries charge 11% and 35% lower prices, respectively, than firms with zero share of imported intermediates. It is noteworthy that the first price difference is 5 percentage points smaller and the second price difference is 19 percentage points larger than the price difference reported in column (1), where there is no distinction of source countries by income. According to column (4), where we distinguish both by income status of source countries and technological sophistication of products, high-tech firms whose imported intermediates from high-income countries account for 10%, 50%, or 90% of the total value of purchased goods and services charge, respectively, 9%, 54%, and 117% higher prices than firms with zero share of imported intermediates. Also, high-tech firms whose imported intermediates from lower-income countries account for 10% or 50% of the total value of purchased goods and services charge, respectively, 31% and 292% higher prices than firms with no imports of intermediates, but the differential effect when the import share is set at 90% is statistically insignificant. Note that price differences based on imports from high-income countries are smaller and those based on imports from lower-income countries are larger than those reported in column (2), where we consider only the technological sophistication of products.

Overall, we conclude from the quantification exercise that the intensity with which firms of Belgian manufacturing engage in international sourcing of intermediates exerts both statistically and economically significant effects on the prices that they charge for products sold in the domestic market.

4.1.5 International sourcing, domestic wages, and domestic prices

When firms implement international sourcing strategies, they adjust accordingly their domestic labour costs, which is a key domestic component of their marginal costs, through optimal utilization of this production factor. Hence, it is highly relevant to examine the relationships of international sourcing and domestic wages with domestic output prices.

To do this, we augment the baseline specification in column (1) of Table 3 with the log of average wage, which is calculated as the ratio of a firm's total wage bill to its total employment. This is followed by the inclusion of additional controls and the change in one of the sets of

Table 4: Quantification of import share effects

	(1)	(2)	(3)	(4)
Share of imports of intermediates $_{fqq}$:				
share 0.10	0.965***	0.965***		
share 0.50	0.837***	0.835***		
share 0.90	0.726***	0.723***		
Share of imports of intermediates $_{fqq}$ * High-tech $_p$:				
share 0.10		1.148***		
share 0.50		1.995***		
share 0.90		3.468**		
Share of imports of intermediates from HI $_{fqq}$:				
share 0.10			0.976***	0.976***
share 0.50			0.885***	0.884***
share 0.90			0.803***	0.800***
Share of imports of intermediates from LMI $_{fqq}$:				
share 0.10			0.917***	0.915***
share 0.50			0.648***	0.641***
share 0.90			0.459***	0.450***
Share of imports of intermediates from HI $_{fqq}$ * High-tech $_p$:				
share 0.10				1.090***
share 0.50				1.537***
share 0.90				2.169***
Share of imports of intermediates from LMI $_{fqq}$ * High-tech $_p$:				
share 0.10				1.314***
share 0.50				3.922**
share 0.90				11.704

Notes: Calculations based on the specifications in the equivalent columns of Table 3; quantification of interaction terms include the base level. Significance is based on the quantified effects being statistically equal to 1. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

fixed effects. In particular, we further add to the specification the shares of white-collar employment and full-time employment to account for changes in the average wage paid by a firm due to changes in these variables.⁴⁰ Regarding the change of fixed effects, it is important to bear in mind that wage bargaining in Belgium takes place at a highly disaggregated industry level, in addition to bargaining at the national level. This implies that wage variation may be absorbed by the 5-digit industry fixed effects, thereby not allowing its coefficient to be precisely estimated. For this reason, we replace 5-digit with 2-digit industry fixed effects in the augmented version of the specification.

In contrast to the coefficient estimates of international sourcing variables capturing their effects on domestic prices, the coefficient estimate of the log of average wage is viewed as capturing the conditional correlation of this variable with domestic prices. In fact, the latter

⁴⁰As shown in Table 1, white-collar and full-time employees are paid, on average, higher wages than the blue-collar and part-time employees, respectively. Hence, all else equal, changes in the white-collar or full-time composition of employment will induce changes in the average wage. Besides, there is evidence showing that changes in the workforce composition have contributed significantly to changes in the average wages paid by firms and determined the relationship between firm size and wages (Bloom et al., 2018).

estimate is likely to be subject to the simultaneity bias, as firms are likely to make decisions over the setting of wages and output prices concurrently. Also, in relation to the discussion in Section 3, the inclusion of the log of average wage in the baseline specification implies that we control for the wage premia of importing and larger firms.

The augmented version of the specification is estimated on a slightly smaller sample (by roughly 2,000 observations) than that of Table 3 due to missing information on the wage bill and white-collar and full-time employment. For this reason, we ensure in column (1) of Table 5 that the main results remain largely unchanged qualitatively and quantitatively when we estimate the baseline specification with 5-digit industry dummies on the smaller sample. Due to the change in the fixed effects in the augmented version of the specification, we also estimate the baseline specification with 2-digit industry dummies on this smaller sample. The estimates obtained are reported in column (2) and bear a very close resemblance to those in column (1), while R^2 drops only marginally.

Reassured that these changes do not alter the main results, we show in column (3) the results obtained from the estimation of the augmented version of the specification. The coefficient estimate of the log of the average wage is positive but significant only at 10%. Instrumenting this variable in column (4) using its fourth-lagged values to mitigate a possible simultaneity bias yields a coefficient estimate that remains positive, but is now significant at 5% and more than twice as large. The larger size of the 2SLS estimate suggests that the OLS estimate may be subject to an attenuation bias due to measurement error in the data. The unreported first-stage results and first-stage statistics shown at the bottom of the table reveal that the instrument performs well. The OLS and 2SLS estimates suggest that a 1% rise in the average wage paid by firms in Belgian manufacturing is associated with a 31% and 79%, respectively, rise in the prices that they charge for their outputs sold domestically. Replacing the log of the average wage with dummy variables for wage bins in column (5) reveals that it is the top-wage firms (i.e. those paying wages above the 90th percentile value), but not the upper-middle-wage firms (i.e. those paying wages above the 50th percentile value and up to the 90th percentile value) that charge higher domestic output prices compared to the lower-paying firms (i.e. those paying wages no higher than the 50th percentile value).

The coefficient estimates of the share of imported intermediates in columns (3)–(5) remain negative and significant at 5% and their magnitudes are very similar to those in the first two columns and those reported in Table 3. The coefficient estimates of the log of employment in

Table 5: Import shares, domestic wages and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)	(5)
$\text{Log}(\text{employment}_{fpy})$	0.079 [0.064]	0.072 [0.062]	0.057 [0.061]	0.016 [0.066]	0.064 [0.060]
Share of imports of intermediates $_{fpy}$	-0.326** [0.162]	-0.338** [0.165]	-0.341** [0.163]	-0.348** [0.170]	-0.335** [0.162]
Share of imports of final goods $_{fpy}$	-0.004 [0.239]	-0.095 [0.254]	-0.087 [0.251]	-0.045 [0.252]	-0.086 [0.251]
$\text{Log}(\text{average wage}_{fpy})$			0.308* [0.184]	0.794** [0.375]	
Average wage in (50 th pct.,90 th pct.) $_{fpy}$					0.138 [0.092]
Average wage in (90 th pct.,100 th pct.) $_{fpy}$					0.342** [0.163]
Share of white-collar employment $_{fpy}$			-0.747* [0.421]	-1.159** [0.498]	-0.706* [0.390]
Share of full-time employment $_{fpy}$			-0.476 [0.462]	-0.829 [0.513]	-0.402 [0.450]
Product-quarter fixed effects	yes	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	no	no	no	no
Industry (2-digit NACE) fixed effects	no	yes	yes	yes	yes
Observations	37,973	37,973	37,973	33,784	37,973
R^2	0.800	0.774	0.775	0.008	0.775
Kleibergen-Paap rk LM				85.400	
Kleibergen-Paap rk LM (p-value)				0.000	
Kleibergen-Paap Wald rk F				71.979	

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns but column (4). Two-stage Least Squares (2SLS) estimations with standard errors clustered at the firm level in square brackets in column (4). Log average wage in the equation of column (4) is instrumented with its fourth lag. The results in all columns are produced on the estimating sample of column (3). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

columns (3)–(5) are smaller, especially when we instrument for the log of wage, but remain positive and insignificant. As for the additional control variables, the coefficient estimate of the full-time employment share is always negative and insignificant, while the coefficient estimate of the white-collar employment share is always negative and significant at 10% or 5%. Given the broad occupational coverage in the groups of white- and blue-collar workers, the negative association of the white-collar employment share with domestic prices does not have a straightforward interpretation, while the multi-collinearity issue cannot be excluded.⁴¹

As stressed above, firm size, international sourcing and the white-collar and full-time composition of employment control for important factors that likely affect both wages and

⁴¹The relationship between domestic wages and domestic prices is insensitive to the replacement of import shares with the dummy for importing (Table A14) or the dummies for importing by type of goods (Table A15), while the estimates of the extensive margins of importing bear a very close resemblance to the corresponding estimates in Table 2.

output prices. Hence, the positive association between average wages and output prices that we identify while controlling for these factors likely reflects unobserved differences across firms in key labour characteristics (e.g. education, training, experience, know-how) and/or differences in their occupational composition of employment, with occupations being defined at a more disaggregated level than that at our disposal.⁴² Either interpretation prompts us to view this result as suggestive evidence on the positive link between labour quality and output quality. In the next section, we investigate further the role of sourcing of foreign inputs and utilization of domestic labour in production by studying the relationships between firms' international sourcing activities and the (relative) costs of their domestically employed white- and blue-collar workers.

4.2 International sourcing and domestic labour outcomes

In this section, we identify how firms' international sourcing activities relate to the wage bill share of their white-collar workers, the wages that they pay to their white- and blue-collar workers, and the wage gap between the two worker groups. To this end, we estimate the following specification:

$$L_{fqq} = D_f + D_{yq} + \beta_C \cdot C_{fqq} + \beta_M \cdot M_{fqq} + \epsilon_{fqq}, \quad (2)$$

where L can assume different definitions: the wage bill share of white-collar workers of firm f in quarter q of year y , the log of the wage for white-collar or blue-collar workers, or the log of the relative wage for white-collar workers, calculated as the log of the ratio of the wage for white-collar workers to the wage for blue-collar workers. M_{fqq} is a vector comprising the two key regressors, namely, the share of imported intermediates and share of imported final goods. As we are interested in identifying relationships within firms, we include in the specification firm-specific fixed effects (D_f). We also incorporate year-quarter fixed effects (D_{yq}) in order to control for time-varying shocks common to all firms, such as the business cycle and other macroeconomic trends.

Following the related empirical literature, we include the log of value added, controlling for firm size, and the log of capital intensity, calculated as the ratio of capital investment

⁴²Workers in some white-collar occupations (e.g. managerial) are, on average, more skilled and better paid than workers in other white-collar occupations (e.g. administrative/clerical). Hence, differences across firms in the occupational composition of employment will reflect differences in the average levels of human and knowledge capital stocks and in the average wage.

to value added, in vector C_{fqq} (E. Berman et al., 1994; Feenstra & Hanson, 1996).⁴³ As discussed in Section 4.1.5, changes in workforce composition tend to induce wage changes and therefore, vector C_{fqq} also comprises the share of white-collar workers and share of full-time white-collar (blue-collar) employment in total white-collar (blue-collar) employment when the dependent variable is the log of wage for white-collar (blue-collar) workers or the share of full-time employment in total employment when the dependent variable is the log of the relative wage for white-collar workers.⁴⁴

For consistency with the first part of our analysis, we estimate the wage bill share and log of (relative) wage specifications on the sample of Table 3. Standard errors are clustered at the firm level and 2-digit industry level (Mion & Zhu, 2013).⁴⁵ In addition, we estimate the specifications after augmenting these with the interaction between the share of imported intermediates and the dummy for high- or lower-tech products, while breaking down the share of imported intermediates by source country income group, or while considering the shares of imported intermediates from high- and lower-income countries and interacting these with the dummy for high- or lower-tech products. Results from OLS estimations of all four versions of the wage bill share specifications are displayed in Table 6, while results from OLS estimations of the last two versions of the log of (relative) wage specifications are displayed in Table 7.⁴⁶

Based on the two tables, there are no statistically significant associations of the shares of imported intermediates and final goods with the wage bill share of white-collar workers (columns (1)–(4) of Table 6), the log of wage for white-collar workers (columns (1)–(2) of Table 7), the log of wage for blue-collar workers (columns (3)–(4) of the same table), and the log of the relative wage for white-collar workers (columns (5)–(6) of the same table). By contrast, there are negative and significant differential and overall associations of the share of imported intermediates with the wage bill share of white-collar workers in high-tech firms

⁴³Information on nominal investment is retrieved from the VAT declarations. Value-added is not readily available and we thus calculate it ourselves by subtracting total purchases of goods and services from sales.

⁴⁴As the wage bill shares of the white- and blue-collar workers add up to 1, it is sufficient to estimate the specification with that dependent variable for only one of the two worker groups. As common in the literature, this specification is derived from a translog cost function where it is assumed that capital is a quasi-fixed factor and thus adjusts only partially in the short run. Assuming further that the cost function exhibits constant returns to scale implies that factor prices are linearly homogeneous and thus the summations of the coefficient estimates of each regressor across the specifications for the wage bill shares of the white- and blue-collar workers are equal to zero.

⁴⁵Clustering at a relatively high level of industry aggregation is motivated by wage bargaining in Belgium taking place at a finely-disaggregated industry level, in addition to wage bargaining at the national level (see relevant discussion in Section 4.1.5).

⁴⁶The lower numbers of observations in the tables of this section are due to missing information on labour-related variables and other controls that are incorporated in the specifications.

Table 6: Import shares and the wage bill share of white-collar workers

Dep. var: Wsh_{fqq}^{White}	(1)	(2)	(3)	(4)
$\text{Log}(\text{value added}_{fqq})$	-0.005*** [0.001]	-0.005*** [0.001]	-0.005*** [0.001]	-0.005*** [0.001]
$\text{Log}(\text{capital intensity}_{fqq})$	-0.000 [0.000]	-0.000 [0.000]	-0.000 [0.000]	-0.000 [0.000]
Share of imports of intermediates $_{fqq}$	-0.005 [0.005]	-0.005 [0.005]		
Share of imports of final goods $_{fqq}$	0.003 [0.009]	0.003 [0.009]	0.002 [0.009]	0.002 [0.009]
Share of imports of intermediates $_{fqq}$ * High-tech $_p$		-0.017** [0.007]		
Share of imports of intermediates from HI $_{fqq}$			-0.006 [0.006]	-0.006 [0.006]
Share of imports of intermediates from LMI $_{fqq}$			0.021 [0.015]	0.021 [0.015]
Share of imports of intermediates from HI $_{fqq}$ * High-tech $_p$				-0.025** [0.010]
Share of imports of intermediates from LMI $_{fqq}$ * High-tech $_p$				0.010 [0.037]
Firm fixed effects	yes	yes	yes	yes
Year-quarter fixed effects	yes	yes	yes	yes
Observations	20,183	20,183	20,183	20,183
R^2	0.910	0.910	0.910	0.910
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.001		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.004
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.388

Notes: OLS estimations with standard errors clustered at the firm level and 2-digit industry level in square brackets in all columns. The estimations are made on the sample of Table 3. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

(column (2) of Table 6), which are driven by imports from high-income countries (column (4) of the same table). Similarly, there are negative and significant differential and overall associations of the share of imported intermediates from high-income countries with the log of the (relative) wage paid by high-tech firms to white-collar workers (columns (2) and (6) of Table 7), and positive and significant differential and overall associations of the share of imported intermediates from high-income countries with the log of the wage paid by high-tech firms to blue-collar workers (column (4) of the same table). Although the latter differential association is positive only at 10%, the corresponding overall association is significant at 5% (see p-values of F-tests at the bottom of the table).⁴⁷

⁴⁷Interestingly, we find no significant differential or overall associations of the shares of imported intermediates with the employment share of white-collar workers in high-tech firms. Comparing these results to those obtained from estimations of wage bill share specifications suggests that adjustments due to sourcing from high-income countries occur through wages, rather than employment, in high-tech firms. By contrast, adjustments in lower-tech firms likely occur through employment, as indicated by the negative and significant association of the share of imported intermediates with the employment share of white-collar workers, which is driven by imports from high-income countries (Table A16). In addition, we identify very similar differential and overall associations to those in Table 7 when we do not distinguish imported intermediates by source country income group (Table A17). In fact, the positive differential and overall associations of the share of imported intermediates with the log of wage for blue-collar workers are more significant than before (at 5%

Table 7: Shares of imports from high- and lower-income countries and domestic wages

Dep. var:	(1) Log(W_{fgy}^{White})	(2) Log(W_{fgy}^{White})	(3) Log(W_{fgy}^{Blue})	(4) Log(W_{fgy}^{Blue})	(5) Log($W_{fgy}^{White} / W_{fgy}^{Blue}$)	(6) Log($W_{fgy}^{White} / W_{fgy}^{Blue}$)
Log(value added $_{fgy}$)	0.003 [0.002]	0.003 [0.002]	0.018*** [0.002]	0.018*** [0.002]	-0.013*** [0.004]	-0.013*** [0.004]
Log(capital intensity $_{fgy}$)	-0.000 [0.001]	-0.000 [0.001]	-0.001 [0.001]	-0.001 [0.001]	0.002 [0.002]	0.002 [0.002]
Share of imports of intermediates from HI $_{fgy}$	0.005 [0.008]	0.006 [0.008]	0.010 [0.011]	0.010 [0.011]	-0.002 [0.016]	-0.001 [0.016]
Share of imports of intermediates from LMI $_{fgy}$	-0.005 [0.044]	-0.007 [0.044]	0.020 [0.031]	0.019 [0.031]	-0.038 [0.057]	-0.039 [0.058]
Share of imports of final goods $_{fgy}$	0.003 [0.008]	0.003 [0.008]	0.006 [0.018]	0.006 [0.018]	-0.009 [0.019]	-0.008 [0.019]
Share of imports of intermediates from HI $_{fgy}$ * High-tech $_i$		-0.059*** [0.006]		0.041* [0.024]		-0.103*** [0.026]
Share of imports of intermediates from LMI $_{fgy}$ * High-tech $_i$		0.212 [0.138]		0.084 [0.057]		0.149 [0.145]
Share of white-collar employment $_{fgy}$	-0.212*** [0.051]	-0.213*** [0.051]	0.593*** [0.119]	0.594*** [0.119]	-0.801*** [0.126]	-0.801*** [0.126]
Share of full-time white-collar employment $_{fgy}$	0.462*** [0.033]	0.462*** [0.033]				
Share of full-time blue-collar employment $_{fgy}$			0.253** [0.099]	0.253** [0.099]		
Share of full-time employment $_{fgy}$					0.113 [0.073]	0.113 [0.073]
Firm fixed effects	yes	yes	yes	yes	yes	yes
Year-quarter fixed effects	yes	yes	yes	yes	yes	yes
Observations	19,025	19,025	19,025	19,025	19,025	19,025
R^2	0.829	0.829	0.745	0.745	0.646	0.646
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$		0.000				
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$		0.131				
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.033		
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.078		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$						0.000
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$						0.421

Notes: OLS estimations with standard errors clustered at the firm level and 2-digit industry level in square brackets in all columns. The estimations are made on the sample of Table 3. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

In sum, results suggest that sourcing of higher-quality inputs from high-income countries likely substitutes for domestic white-collar workers and complements domestic blue-collar workers in high-tech firms. By contrast, we find no evidence for imports of intermediates from lower-income countries being associated with labour costs in high- or lower-tech firms. In conjunction with the results of the previous section, we conclude that high-tech firms combine higher-quality inputs sourced from high-income countries with higher-quality domestic labour, especially blue-collar workers, in order to produce higher-quality outputs, which they sell in the Belgian market at higher prices.

Regarding the control variables, the log of value added is negatively associated with the wage bill share of white-collar workers and the log of the relative wage for the same worker group, and positively associated with the log of the wage for blue-collar workers. These associations suggest that the expansion of firm output is biased towards domestic blue-collar and 1%, respectively).

workers. By contrast, there are no statistically significant associations of the log of capital intensity with the labour outcome variables examined. Intuitively, a higher white-collar employment share is associated with a lower log of (relative) wage for white-collar workers and a higher log of wage for blue-collar workers, while a higher share of full-time white-collar (blue-collar) workers is associated with a higher log of wage for white-collar (blue-collar) workers.⁴⁸

5 Conclusion

How do international sourcing activities of firms and their domestic labour costs affect the prices that they charge for the outputs they sell in the domestic market? And how do their international sourcing activities relate to domestic labour utilization and costs? We investigate these intertwined questions using a representative sample of firms in the Belgian manufacturing sector over 2001Q1–2017Q4, after combining information on domestic producer prices at the firm-product level with firm-level information on imports, average domestic wages, and other control variables. These questions are relevant and timely, given the fast-paced fragmentation of firms’ production processes across countries in recent decades and the re-allocation of domestic resources, including labour, that this phenomenon implies. On top of that, developments in the global economy over the last few years—most notably, the rise in trade protectionism and disruptions in GVCs due to the COVID-19 pandemic outbreak and geopolitical tensions—have prompted firms to re-consider and possibly revise their international sourcing strategies by re-shuffling production across countries.

Controlling for firm size and other factors, we first provide evidence highlighting the cost-saving aspect of international sourcing. In particular, we find that higher shares of imported intermediates, especially when these originate from lower-income countries, allow firms to charge lower domestic output prices. However, by exploiting differences in the technology intensity of products, we also find that higher shares of imported intermediates, originating

⁴⁸In an additional exercise, we estimate the specifications in columns (1) and (3) of Table 6 and columns (1), (3), and (5) of Table 7 separately on the samples of firms in high- and lower-tech manufacturing, as opposed to adding interaction terms. The results that we obtain are consistent with the results reported in this section and available upon request. For high-tech firms, their share of total imports of intermediates and share of imported intermediates from high-income countries exert negative and significant effects on the wage bill share of white-collar workers and their relative wage, while the second import share variable also exerts a positive and significant effect on the average wage paid to blue-collar workers. Their share of imported intermediates from lower-income countries exerts no statistically significant effects on the wage bill share or relative wage of white-collar workers or the average wage paid to white- or blue-collar workers. For lower-tech firms, the effects of the three import share variables on the labour outcome variables are always statistically insignificant.

from high- or lower-income countries, induce firms to charge higher prices for high-tech products that they sell domestically. This evidence points to international sourcing as an input quality-enhancing strategy, but also as a cost-saving strategy allowing high-tech producers to shift domestic resources towards innovation- and technology-intensive activities. In addition to their statistical significance, the (differential) effects of the shares of imported intermediates on domestic prices are sizeable. By contrast, we find no evidence for the role of imports of final goods in determining domestic output prices, apart from a positive differential effect of the share of imported final goods from lower-income countries on domestic prices charged by high-tech firms. This effect likely suggests that final assembly of higher-quality goods takes place in lower-income countries, which are then sourced by high-tech firms in Belgium and sold domestically at higher prices.

In addition, we find a positive association between firms' average domestic wages and domestic output prices, while controlling for key factors impacting both variables. We also show that the share of imported intermediates from high-income countries is differentially negatively associated with the (relative) wage and wage bill share of white-collar workers in high-tech firms and positively associated with the wage for blue-collar workers in these firms. Taken together, we view these findings as reflecting the employment of higher-quality domestic labour in high-tech firms, particularly of blue-collar workers, which are combined with higher-quality inputs sourced from high-income countries for the production of higher-quality outputs that are sold domestically at higher prices.

Thinking forward, an interesting extension of our analysis with the use of more appropriate data would be to make the multi-product status of firms central. In fact, there is evidence showing that multi-product firms tend to optimize their product portfolios by re-directing resources to their most efficient uses (Bernard et al., 2010; Eckel et al., 2015), and international sourcing has an important role to play in this regard (Bernard et al., 2020). In turn, this could potentially impact not only output prices, but also the number of varieties and products that are sold in a given market (Krugman, 1979, 1980; Broda & Weinstein, 2006; Eckel & Neary, 2010; Goldberg et al., 2010).

Finally, recent contributions to the literature have made attempts at understanding the implications of the recent rise in trade protectionism—particularly between US and China—for firms and consumers (Amiti et al., 2019; Fajgelbaum et al., 2019; Fajgelbaum & Khandelwal, 2022). Our analysis complements this body of research by deriving valuable insights about the

implications of international sourcing for firms, workers, and consumers. From the perspective of firms operating in Belgian manufacturing, international sourcing of inputs is part of their strategic decision to service the domestic market by competing on cost or quality. Combining higher-quality domestic labour—especially blue-collar workers—with higher-quality inputs sourced from high-income countries is also part of the strategic decision of firms to compete on quality. Obviously, the utilization of higher-quality labour is beneficial for domestic workers, but this is observed only in firms operating in highly innovative industries of Belgian manufacturing. The two strategic decisions of firms have important benefits for domestic consumers as well. Lower prices of products sold domestically due to sourcing of cheaper inputs from lower-income countries imply higher purchasing power for consumers, at least those who do not lose out in terms of income from this type of sourcing. However, given that Belgium is a high-income country whose average consumer has a high propensity to pay for quality, the role played by the sourcing of higher-quality inputs from other high-income countries in the production of higher-quality domestic output and the sourcing of higher-quality final goods by high-tech firms from lower-income countries is also crucial. How these conclusions will be amended if recent developments in the global economy eventually induce firms to revise substantially their international sourcing strategies is a promising avenue for future research.

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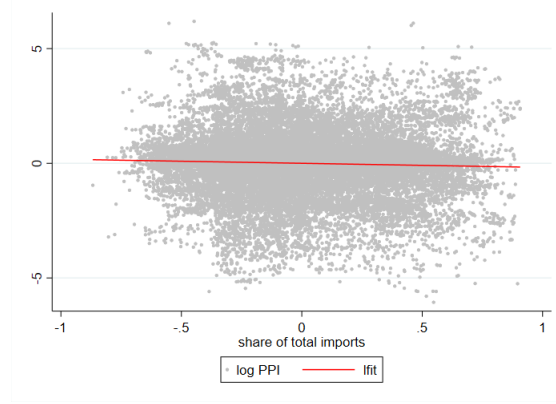
Appendix

Table A1: NACE (Rev. 1.1) industries

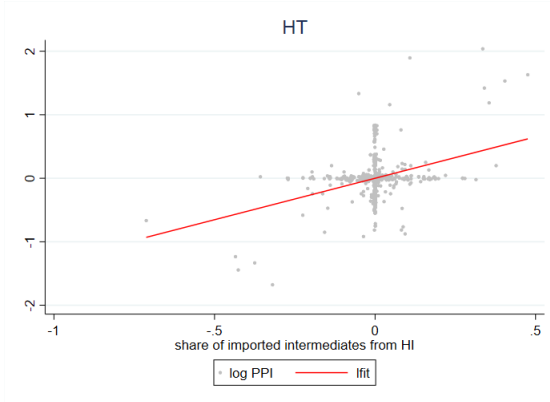
Industry (NACE Rev. 1.1) code	Industry title	Observations	%
15	Food products	15755	33.19
17	Textiles	1768	3.73
18	Apparel	2557	5.39
20	Wood	1753	3.69
21	Paper	1047	2.21
22	Publishing and printing	180	0.38
24	Chemicals	3941	8.30
25	Rubber and plastic products	1596	3.36
26	Other non-metallic mineral products	5349	11.27
27	Basic metals	1119	2.36
28	Fabricated metal products	5148	10.85
29	Machinery and equipment n.e.c	1348	2.84
31	Electrical machinery and apparatus n.e.c.	1126	2.37
33	Medical, precision and optical instruments	797	1.68
34	Motor vehicles	381	0.80
36	Furniture and manufacturing n.e.c.	3598	7.58
Total		47,463	100.00

Notes: Each observation corresponds to a firm-product-year-quarter combination.
Source: Authors' calculations based on the estimating sample of Table 2.

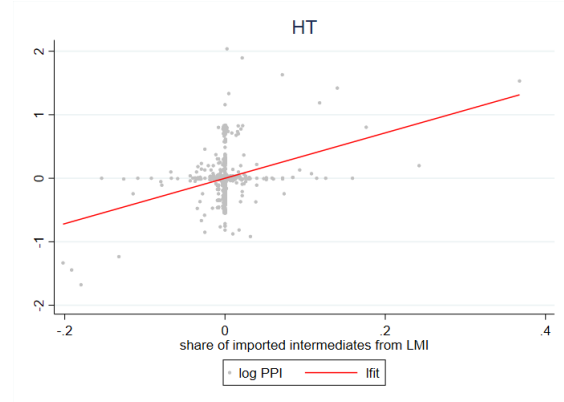
Figure A1: Correlations of import shares with domestic producer prices, additional plots



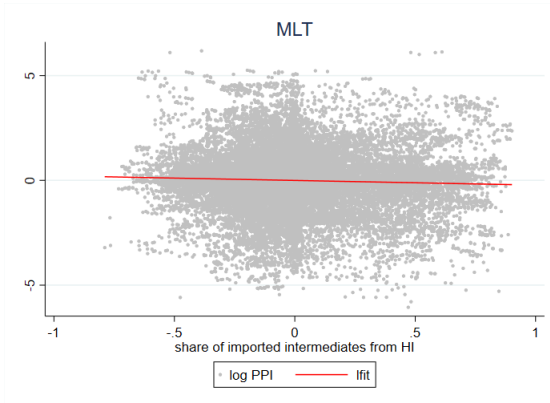
(a) From all countries



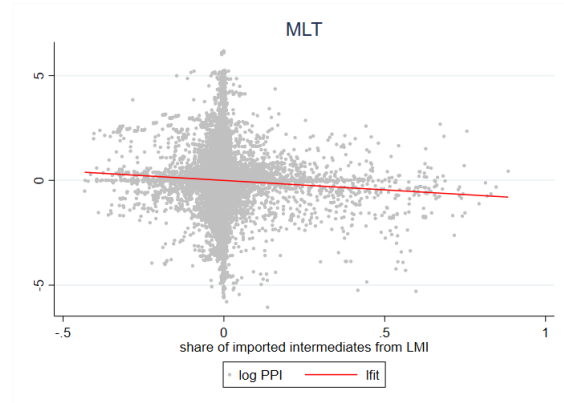
(b) High-tech (HT) producers' imports from high-income (HI) countries



(c) High-tech (HT) producers' imports from lower-income (LMI) countries



(d) Lower-tech (MLT) producers' imports from high-income (HI) countries



(e) Lower-tech (MLT) producers' imports from lower-income (LMI) countries

Notes: log PPI: log of producer price charged in the Belgian market; import shares are calculated as ratios of the corresponding import value to the value of total purchases of goods and services. The variables are demeaned by product-year and product-quarter. For the definition of high-income (HI) and lower-income (LMI) source countries, see Table 1. Panels (b) and (c) include firms that sell high-tech manufacturing (HTM) products, while panels (d) and (e) include firms that sell medium- or low-tech manufacturing (MLT) products, according to the Eurostat classification of manufacturing industries by R&D intensity. The figures are produced on the estimating sample of Table 3.

Source: Raw correlations based on data from the PPI Database, the Trade Database, and the VAT declarations.

Table A2: Shares of imported intermediate and final goods and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpyy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpyy})$	0.071 [0.062]	0.071 [0.062]	0.065 [0.063]	0.065 [0.063]
Share of imports of intermediates $_{fpyy}$	-0.397** [0.160]	-0.400** [0.160]		
Share of imports of final goods $_{fpyy}$	-0.151 [0.229]	-0.157 [0.231]		
Share of imports of intermediates $_{fpyy}$ * High-tech $_p$		2.396*** [0.717]		
Share of imports of final goods $_{fpyy}$ * High-tech $_p$		1.287 [0.928]		
Share of imports of intermediates from HI $_{fpyy}$			-0.305* [0.164]	-0.308* [0.165]
Share of imports of intermediates from LMI $_{fpyy}$			-0.597 [0.393]	-0.613 [0.394]
Share of imports of final goods from HI $_{fpyy}$			0.123 [0.216]	0.131 [0.217]
Share of imports of final goods from LMI $_{fpyy}$			-0.538 [0.433]	-0.579 [0.433]
Share of imports of intermediates from HI $_{fpyy}$ * High-tech $_p$				1.667*** [0.460]
Share of imports of intermediates from LMI $_{fpyy}$ * High-tech $_p$				3.206*** [0.932]
Share of imports of final goods from HI $_{fpyy}$ * High-tech $_p$				-0.056 [0.536]
Share of imports of final goods from LMI $_{fpyy}$ * High-tech $_p$				5.923*** [0.818]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	38,547	38,547	38,547	38,547
R^2	0.795	0.796	0.795	0.796
F-test (p-value): $\beta_{M_INT} + \beta_{M_INT,HT} = 0$		0.005		
F-test (p-value): $\beta_{M_FIN} + \beta_{M_FIN,HT} = 0$		0.209		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.002
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.002
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.878
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.000

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). M_INT (M_FIN) at the bottom of the table stands for the share of imports of intermediate (final) goods. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A3: Share of total imports and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpqy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fqy})$	0.032 [0.064]	0.031 [0.064]	0.025 [0.065]	0.025 [0.065]
Share of imports $_{fqy}$	-0.230 [0.162]	-0.234 [0.162]		
Share of imports $_{fqy}$ * High-tech $_p$		1.244** [0.616]		
Share of imports from HI $_{fqy}$			-0.090 [0.165]	-0.090 [0.165]
Share of imports from LMI $_{fqy}$			-0.631 [0.393]	-0.665* [0.394]
Share of imports from HI $_{fqy}$ * High-tech $_p$				0.441 [0.444]
Share of imports from LMI $_{fqy}$ * High-tech $_p$				5.536*** [0.981]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	34,450	34,450	34,450	34,450
R^2	0.797	0.797	0.797	0.797
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.091		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.402
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.000

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A4: Import share bins and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpy})$	0.093 [0.063]	0.094 [0.063]	0.097 [0.063]	0.097 [0.063]
Share of imports of intermediates in $(0, 50^{th} \text{pct.}]_{fpy}$	-0.134 [0.133]	-0.139 [0.135]		
Share of imports of intermediates in $(50^{th} \text{pct.}, 75^{th} \text{pct.}]_{fpy}$	-0.282* [0.144]	-0.287** [0.145]		
Share of imports of intermediates in $(75^{th} \text{pct.}, 1]_{fpy}$	-0.351** [0.172]	-0.359** [0.173]		
Share of imports of intermediates in $(0, 50^{th} \text{pct.}]_{fpy} * \text{High-tech}_p$		0.576** [0.229]		
Share of imports of intermediates in $(50^{th} \text{pct.}, 75^{th} \text{pct.}]_{fpy} * \text{High-tech}_p$		0.897*** [0.276]		
Share of imports of intermediates in $(75^{th} \text{pct.}, 1]_{fpy} * \text{High-tech}_p$		1.703*** [0.511]		
Share of imports of intermediates from HI in $(0, 50^{th} \text{pct.}]_{fpy}$			-0.187 [0.135]	-0.188 [0.136]
Share of imports of intermediates from HI in $(50^{th} \text{pct.}, 75^{th} \text{pct.}]_{fpy}$			-0.256* [0.148]	-0.257* [0.148]
Share of imports of intermediates from HI in $(75^{th} \text{pct.}, 1]_{fpy}$			-0.267 [0.177]	-0.271 [0.178]
Share of imports of intermediates from LMI in $(0, 50^{th} \text{pct.}]_{fpy}$			-0.016 [0.087]	-0.022 [0.088]
Share of imports of intermediates from LMI in $(50^{th} \text{pct.}, 75^{th} \text{pct.}]_{fpy}$			-0.073 [0.134]	-0.078 [0.135]
Share of imports of intermediates from LMI in $(75^{th} \text{pct.}, 1]_{fpy}$			-0.375* [0.216]	-0.391* [0.217]
Share of imports of intermediates from HI in $(0, 50^{th} \text{pct.}]_{fpy} * \text{High-tech}_p$				0.351* [0.183]
Share of imports of intermediates from HI in $(50^{th} \text{pct.}, 75^{th} \text{pct.}]_{fpy} * \text{High-tech}_p$				0.542** [0.211]
Share of imports of intermediates from HI in $(75^{th} \text{pct.}, 1]_{fpy} * \text{High-tech}_p$				1.153*** [0.337]
Share of imports of intermediates from LMI in $(0, 50^{th} \text{pct.}]_{fpy} * \text{High-tech}_p$				0.464** [0.226]
Share of imports of intermediates from LMI in $(50^{th} \text{pct.}, 75^{th} \text{pct.}]_{fpy} * \text{High-tech}_p$				0.468** [0.227]
Share of imports of intermediates from LMI in $(75^{th} \text{pct.}, 1]_{fpy} * \text{High-tech}_p$				1.756*** [0.487]
Share of imports of final goods $_{fpy}$	0.070 [0.239]	0.072 [0.239]	0.099 [0.238]	0.104 [0.238]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	39,859	39,859	39,859	39,859
R^2	0.796	0.796	0.796	0.796
F-test (p-value): $\beta_{M_PCT1} + \beta_{M_PCT1,HT} = 0$		0.020		
F-test (p-value): $\beta_{M_PCT1,HI} + \beta_{M_PCT1,HI,HT} = 0$				0.191
F-test (p-value): $\beta_{M_PCT1,LMI} + \beta_{M_PCT1,LMI,HT} = 0$				0.034
F-test (p-value): $\beta_{M_PCT2} + \beta_{M_PCT2,HT} = 0$		0.010		
F-test (p-value): $\beta_{M_PCT2,HI} + \beta_{M_PCT2,HI,HT} = 0$				0.062
F-test (p-value): $\beta_{M_PCT2,LMI} + \beta_{M_PCT2,LMI,HT} = 0$				0.032
F-test (p-value): $\beta_{M_PCT3} + \beta_{M_PCT3,HT} = 0$		0.005		
F-test (p-value): $\beta_{M_PCT3,HI} + \beta_{M_PCT3,HI,HT} = 0$				0.003
F-test (p-value): $\beta_{M_PCT3,LMI} + \beta_{M_PCT3,LMI,HT} = 0$				0.002

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). M_PCT1 , M_PCT2 , M_PCT3 at the bottom of the table stand for the shares of imports of intermediates in $(0, 50^{th} \text{pct.}]$, $(50^{th} \text{pct.}, 75^{th} \text{pct.}]$, and $(75^{th} \text{pct.}, 1]$, respectively. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A5: Import shares and domestic producer prices, product-year-quarter fixed effects controlled for

Dep. var: $\text{Log}(\text{PPI}_{fpyqy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpyqy})$	0.089 [0.067]	0.088 [0.067]	0.088 [0.067]	0.088 [0.067]
Share of imports of intermediates $_{fpyqy}$	-0.375** [0.184]	-0.378** [0.184]		
Share of imports of final goods $_{fpyqy}$	0.056 [0.277]	0.065 [0.277]	0.081 [0.273]	0.091 [0.273]
Share of imports of intermediates $_{fpyqy}$ * High-tech $_p$		4.356*** [0.402]		
Share of imports of intermediates from HI $_{fpyqy}$			-0.250 [0.186]	-0.253 [0.186]
Share of imports of intermediates from LMI $_{fpyqy}$			-1.157** [0.536]	-1.184** [0.536]
Share of imports of intermediates from HI $_{fpyqy}$ * High-tech $_p$				3.184*** [0.805]
Share of imports of intermediates from LMI $_{fpyqy}$ * High-tech $_p$				3.187* [1.842]
Product-quarter-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	29,113	29,113	29,113	29,113
R^2	0.698	0.698	0.698	0.698
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.000		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.000
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.252

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A6: Import shares and domestic producer prices, log of sales in lieu of log of employment

Panel A: Ordinary least squares				
Dep. var: $\text{Log}(\text{PPI}_{fpyqy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{sales}_{fpyqy})$	0.083 [0.055]	0.083 [0.055]	0.082 [0.055]	0.082 [0.055]
Share of imports of intermediates $_{fpyqy}$	-0.480*** [0.167]	-0.484*** [0.167]		
Share of imports of final goods $_{fpyqy}$	0.024 [0.237]	0.027 [0.236]	0.045 [0.233]	0.050 [0.233]
Share of imports of intermediates $_{fpyqy}$ * High-tech $_p$		1.885*** [0.574]		
Share of imports of intermediates from HI $_{fpyqy}$			-0.364** [0.172]	-0.369** [0.172]
Share of imports of intermediates from LMI $_{fpyqy}$			-0.924** [0.413]	-0.947** [0.414]
Share of imports of intermediates from HI $_{fpyqy}$ * High-tech $_p$				1.243*** [0.420]
Share of imports of intermediates from LMI $_{fpyqy}$ * High-tech $_p$				3.689*** [1.097]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	37,702	37,702	37,702	37,702
R^2	0.792	0.792	0.792	0.792
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.011		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.024
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.007
Panel B: Two-stage least squares				
Dep. var: $\text{Log}(\text{PPI}_{fpyqy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{sales}_{fpyqy})$	0.118* [0.068]	0.118* [0.068]	0.115* [0.068]	0.116* [0.068]
Share of imports of intermediates $_{fpyqy}$	-0.525*** [0.169]	-0.529*** [0.170]		
Share of imports of final goods $_{fpyqy}$	-0.004 [0.242]	-0.001 [0.242]	0.020 [0.238]	0.025 [0.238]
Share of imports of intermediates $_{fpyqy}$ * High-tech $_p$		1.894*** [0.565]		
Share of imports of intermediates from HI $_{fpyqy}$			-0.406** [0.173]	-0.411** [0.174]
Share of imports of intermediates from LMI $_{fpyqy}$			-0.977** [0.427]	-1.000** [0.428]
Share of imports of intermediates from HI $_{fpyqy}$ * High-tech $_p$				1.254*** [0.406]
Share of imports of intermediates from LMI $_{fpyqy}$ * High-tech $_p$				3.741*** [1.100]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	37,702	37,702	37,702	37,702
R^2	0.792	0.792	0.792	0.792
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.012		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.024
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.007

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A7: Import shares and domestic producer prices, export status controlled for

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpy})$	0.121*	0.121*	0.120*	0.120*
	[0.063]	[0.063]	[0.063]	[0.063]
Share of imports of intermediates $_{fpy}$	-0.307*	-0.310*		
	[0.161]	[0.162]		
Share of imports of final goods $_{fpy}$	0.084	0.087	0.101	0.106
	[0.232]	[0.231]	[0.229]	[0.229]
Share of imports of intermediates $_{fpy}$ * High-tech $_p$		1.677***		
		[0.565]		
Share of imports of intermediates from HI $_{fpy}$			-0.190	-0.194
			[0.163]	[0.163]
Share of imports of intermediates from LMI $_{fpy}$			-0.846**	-0.868**
			[0.404]	[0.405]
Share of imports of intermediates from HI $_{fpy}$ * High-tech $_p$				1.019**
				[0.406]
Share of imports of intermediates from LMI $_{fpy}$ * High-tech $_p$				3.678***
				[1.060]
Exporter $_{fpy}$	-0.238	-0.237	-0.245	-0.245
	[0.154]	[0.154]	[0.154]	[0.154]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	39,859	39,859	39,859	39,859
R^2	0.796	0.796	0.796	0.797
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.012		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.028
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.004

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A8: Import shares and domestic producer prices, multinational firms excluded

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpy})$	0.003 [0.075]	0.003 [0.075]	-0.002 [0.075]	-0.002 [0.075]
Share of imports of intermediates $_{fpy}$	-0.436** [0.184]	-0.441** [0.184]		
Share of imports of final goods $_{fpy}$	-0.016 [0.268]	-0.009 [0.268]	-0.013 [0.264]	-0.002 [0.264]
Share of imports of intermediates $_{fpy}$ * High-tech $_p$		2.215*** [0.760]		
Share of imports of intermediates from HI_{fpy}			-0.318* [0.189]	-0.322* [0.189]
Share of imports of intermediates from LMI_{fpy}			-0.598 [0.482]	-0.627 [0.483]
Share of imports of intermediates from HI_{fpy} * High-tech $_p$				1.539*** [0.538]
Share of imports of intermediates from LMI_{fpy} * High-tech $_p$				3.658*** [1.136]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	31,526	31,526	31,526	31,526
R^2	0.791	0.791	0.790	0.790
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.016		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.015
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.003

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A9: Import shares and domestic producer prices, labour productivity and aggregate capital intensity controlled for

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpy})$	0.138** [0.069]	0.138** [0.069]	0.135* [0.070]	0.135* [0.070]
$\text{Log}(\text{labour productivity}_{fpy})$	0.017 [0.038]	0.017 [0.038]	0.016 [0.038]	0.017 [0.038]
$\text{Log}(\text{capital intensity}_{fpy})$	0.020 [0.018]	0.021 [0.018]	0.020 [0.018]	0.020 [0.018]
Share of imports of intermediates $_{fpy}$	-0.427** [0.175]	-0.431** [0.175]		
Share of imports of final goods $_{fpy}$	-0.023 [0.249]	-0.020 [0.249]	-0.011 [0.246]	-0.005 [0.245]
Share of imports of intermediates $_{fpy}$ * High-tech $_p$		2.011*** [0.671]		
Share of imports of intermediates from HI $_{fpy}$			-0.318* [0.180]	-0.322* [0.181]
Share of imports of intermediates from LMI $_{fpy}$			-0.800** [0.391]	-0.826** [0.391]
Share of imports of intermediates from HI $_{fpy}$ * High-tech $_p$				1.194*** [0.420]
Share of imports of intermediates from LMI $_{fpy}$ * High-tech $_p$				3.918*** [1.081]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	28,713	28,713	28,713	28,713
R^2	0.803	0.803	0.803	0.803
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.015		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.022
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.002

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A10: Import shares and domestic producer prices, measures of market power and industry concentration controlled for

Dep. var: $\text{Log}(\text{PPI}_{fpyy})$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Log}(\text{employment}_{fpyy})$	0.089 [0.063]	0.087 [0.063]			0.117* [0.066]	0.114* [0.066]	0.100 [0.063]	0.098 [0.063]
Large firms $_{fpyy}$			0.582*** [0.152]	0.586*** [0.150]				
$\text{Log}(\text{labour productivity}_{fpyy})$					-0.011 [0.029]	-0.012 [0.030]		
Share of imports of intermediates $_{fpyy}$	-0.360** [0.163]		-0.343** [0.164]		-0.475*** [0.165]		-0.296 [0.212]	
Share of imports of final goods $_{fpyy}$	0.050 [0.233]	0.069 [0.229]	0.033 [0.231]	0.053 [0.228]	-0.020 [0.244]	-0.003 [0.240]	0.039 [0.242]	0.074 [0.237]
Share of imports of intermediates $_{fpyy}$ * High-tech $_p$	1.692*** [0.573]		1.805*** [0.654]		2.052*** [0.657]		1.794*** [0.567]	
Share of imports of intermediates from HI $_{fpyy}$		-0.247 [0.165]		-0.233 [0.166]		-0.355** [0.169]		-0.242 [0.205]
Share of imports of intermediates from LMI $_{fpyy}$		-0.887** [0.408]		-0.911** [0.406]		-0.958** [0.438]		0.605 [0.913]
Share of imports of intermediates from HI $_{fpyy}$ * High-tech $_p$		1.056** [0.416]		1.135** [0.506]		1.265*** [0.418]		1.069** [0.415]
Share of imports of intermediates from LMI $_{fpyy}$ * High-tech $_p$		3.620*** [1.070]		3.704*** [1.076]		3.950*** [0.988]		2.788** [1.313]
$\text{Log}(\text{employment}_{fpyy})$ * High-tech $_p$	0.053 [0.125]	0.056 [0.125]						
Large firms $_{fpyy}$ * High-tech $_p$			-0.567 [0.684]	-0.409 [0.701]				
$\text{Log}(\text{labour productivity}_{fpyy})$ * High-tech $_p$					-0.008 [0.084]	-0.006 [0.084]		
Share of imports of intermediates * EU CR8 $_i$							-0.102 [0.329]	
Share of imports of intermediates from HI * EU CR8 $_i$								-0.006 [0.329]
Share of imports of intermediates from LMI * EU CR8 $_i$								-1.749* [1.019]
Product-quarter fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	39,859	39,859	40,114	40,114	33,953	33,953	35,546	35,546
R^2	0.796	0.796	0.796	0.796	0.793	0.793	0.789	0.789
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$	0.015		0.021		0.014		0.006	
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.060		0.019		0.043
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$		0.034		0.005		0.001		0.002
F-test (p-value): $\beta_M + \beta_{M,CR8} = 0$		0.006					0.103	
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,CR8} = 0$								0.326
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,CR8} = 0$								0.010
F-test (p-value): $\beta_{EMP} + \beta_{EMP,HT} = 0$	0.190	0.186						
F-test (p-value): $\beta_{EMP} + \beta_{EMP,HT} = 0$			0.982	0.796				
F-test (p-value): $\beta_{LP} + \beta_{LP,HT} = 0$					0.804	0.826		

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. Large firms $_{fpyy}$ is a dummy variable indicating whether the total employment of a firm in a year-quarter is at least equal to or smaller than the sample mean of total employment reported in Table 1. EU CR8 $_i$ is the cumulative change between 2000 and 2014 of an industry concentration measure (CR8) for the EU, as constructed by Bajgar et al. (2023) using data on 64 two-digit industries, including ours, in several EU countries, including Belgium. EMP at the bottom of the table stand for the log of employment in columns (1) and (2) and for the dummy for relatively large firms in columns (3) and (4). LP at the bottom of the table stands for the log of labour productivity. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A11: Import shares and domestic producer prices, interactions with Gollop & Monahan (1991) measure

Dep. var: $\text{Log}(\text{PPI}_{fpyqy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpyqy})$	0.089 [0.063]	0.087 [0.063]	0.089 [0.063]	0.087 [0.063]
Share of imports of intermediates $_{fpyqy}$	-0.817 [0.723]		-0.165 [0.736]	
Share of imports of final goods $_{fpyqy}$	0.049 [0.231]	0.067 [0.226]	0.045 [0.237]	0.080 [0.229]
Share of imports of intermediates $_{fpyqy}$ * High-tech $_p$	1.540** [0.597]		1.782*** [0.582]	
Share of imports of intermediates $_{fpyqy}$ * GM (weighted) $_p$	1.247 [1.779]			
Share of imports of intermediates from HI $_{fpyqy}$		-0.787 [0.749]		-0.136 [0.742]
Share of imports of intermediates from LMI $_{fpyqy}$		-1.262 [1.302]		-1.667 [1.354]
Share of imports of intermediates from HI $_{fpyqy}$ * High-tech $_p$		0.893** [0.430]		1.109*** [0.422]
Share of imports of intermediates from LMI $_{fpyqy}$ * High-tech $_p$		3.379*** [1.196]		3.434*** [1.116]
Share of imports of intermediates from HI $_{fpyqy}$ * GM (weighted) $_p$		1.468 [1.829]		
Share of imports of intermediates from LMI $_{fpyqy}$ * GM (weighted) $_p$		1.076 [3.464]		
Share of imports of intermediates $_{fpyqy}$ * GM (unweighted) $_p$			-3.552 [12.146]	
Share of imports of intermediates from HI $_{fpyqy}$ * GM (unweighted) $_p$				-2.035 [12.166]
Share of imports of intermediates from LMI $_{fpyqy}$ * GM (unweighted) $_p$				15.170 [24.278]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	39,859	39,859	39,859	39,859
R^2	0.796	0.796	0.796	0.796
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$	0.501			
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$		0.915		
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$		0.302		
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$			0.097	
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.250
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.345

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A12: Import shares and domestic producer prices, interactions with Nunn (2007)–Rauch (1999) measure

Dep. var: $\text{Log}(\text{PPI}_{fpyqy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpyqy})$	0.089 [0.063]	0.088 [0.062]	0.089 [0.063]	0.087 [0.063]
Share of imports of intermediates $_{fpyqy}$	-0.516 [0.486]		-0.574 [0.764]	
Share of imports of final goods $_{fpyqy}$	0.051 [0.233]	0.062 [0.229]	0.050 [0.234]	0.077 [0.229]
Share of imports of intermediates $_{fpyqy}$ * High-tech $_p$	1.734*** [0.581]		1.706*** [0.601]	
Share of imports of intermediates $_{fpyqy}$ * N–R (lib 1) $_p$	0.361 [0.990]			
Share of imports of intermediates from HI $_{fpyqy}$		-0.125 [0.490]		-0.575 [0.760]
Share of imports of intermediates from LMI $_{fpyqy}$		-2.145* [1.199]		0.501 [2.627]
Share of imports of intermediates from HI $_{fpyqy}$ * High-tech $_p$		1.151*** [0.415]		1.046** [0.471]
Share of imports of intermediates from LMI $_{fpyqy}$ * High-tech $_p$		3.689*** [1.132]		3.741*** [1.095]
Share of imports of intermediates from HI $_{fpyqy}$ * N–R (lib 1) $_p$		-0.276 [1.015]		
Share of imports of intermediates from LMI $_{fpyqy}$ * N–R (lib 1) $_p$		2.484 [2.004]		
Share of imports of intermediates $_{fpyqy}$ * N–R (lib 2) $_p$			0.269 [1.018]	
Share of imports of intermediates from HI $_{fpyqy}$ * N–R (lib 2) $_p$				0.413 [1.026]
Share of imports of intermediates from LMI $_{fpyqy}$ * N–R (lib 2) $_p$				-1.613 [2.969]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	39,859	39,859	39,859	39,859
R^2	0.796	0.796	0.796	0.796
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$	0.089			
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$		0.109		
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$		0.277		
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$			0.302	
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.651
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.149

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A13: Import shares and domestic producer prices, sample of firms with a single product in all year-quarter pairs

Dep. var: $\text{Log}(\text{PPI}_{fpy})$	(1)	(2)	(3)	(4)
$\text{Log}(\text{employment}_{fpy})$	0.111 [0.106]	0.111 [0.106]	0.107 [0.106]	0.107 [0.106]
Share of imports of intermediates $_{fpy}$	-0.366 [0.245]	-0.372 [0.245]		
Share of imports of final goods $_{fpy}$	0.417 [0.296]	0.422 [0.296]	0.419 [0.295]	0.430 [0.295]
Share of imports of intermediates $_{fpy}$ * High-tech $_p$		2.057*** [0.725]		
Share of imports of intermediates from HI $_{fpy}$			-0.255 [0.247]	-0.261 [0.247]
Share of imports of intermediates from LMI $_{fpy}$			-1.052** [0.487]	-1.096** [0.488]
Share of imports of intermediates from HI $_{fpy}$ * High-tech $_p$				1.443*** [0.534]
Share of imports of intermediates from LMI $_{fpy}$ * High-tech $_p$				4.288*** [1.170]
Product-quarter fixed effects	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	yes	yes	yes
Observations	23,755	23,755	23,755	23,755
R^2	0.770	0.771	0.771	0.771
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.014		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.014
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.003

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns. The results in all columns are produced on the sample that is formed by the sequential estimation of the equations in columns (3) and (1). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A14: Import status, domestic wages and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fqy})$	(1)	(2)	(3)	(4)	(5)
$\text{Log}(\text{employment}_{fqy})$	0.130** [0.062]	0.127** [0.059]	0.106* [0.059]	0.068 [0.063]	0.111* [0.058]
Importer_{fqy}	-0.346** [0.160]	-0.370** [0.166]	-0.357** [0.164]	-0.342** [0.165]	-0.342** [0.164]
$\text{Log}(\text{average wage}_{fqy})$			0.344* [0.184]	0.782** [0.367]	
Average wage in (50 th pct.,90 th pct.) _{fqy}					0.148* [0.089]
Average wage in (90 th pct.,100 th pct.) _{fqy}					0.430*** [0.156]
Share of white-collar employment _{fqy}			-0.602 [0.408]	-1.005** [0.485]	-0.577 [0.376]
Share of full-time employment _{fqy}			-0.439 [0.449]	-0.760 [0.497]	-0.369 [0.436]
Product-quarter fixed effects	yes	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	no	no	no	no
Industry (2-digit NACE) fixed effects	no	yes	yes	yes	yes
Observations	44,094	44,094	44,094	39,287	44,094
R^2	0.802	0.778	0.779	0.010	0.779
Kleibergen-Paap rk LM				97.347	
Kleibergen-Paap rk LM (p-value)				0.000	
Kleibergen-Paap Wald rk F				86.165	

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns but column (4). 2SLS estimations with standard errors clustered at the firm level in square brackets in column (4). Log average wage in the equation of column (4) is instrumented with its fourth lag. The results in all columns are produced on the estimating sample of column (3). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A15: Import status by good type, domestic wages and domestic producer prices

Dep. var: $\text{Log}(\text{PPI}_{fpyy})$	(1)	(2)	(3)	(4)	(5)
$\text{Log}(\text{employment}_{fpy})$	0.125** [0.061]	0.122** [0.058]	0.100* [0.058]	0.063 [0.062]	0.106* [0.056]
Importer of intermediates $_{fpy}$	-0.325** [0.141]	-0.354** [0.146]	-0.341** [0.144]	-0.327** [0.146]	-0.328** [0.144]
Importer of final goods only $_{fpy}$	0.562 [0.418]	0.583 [0.422]	0.601 [0.409]	0.705* [0.398]	0.610 [0.410]
Log avg wage $_{fpy}$			0.345* [0.184]	0.794** [0.368]	
Average wage in (50 th pct.,90 th pct.) $_{fpy}$					0.151* [0.089]
Average wage in (90 th pct.,100 th pct.) $_{fpy}$					0.438*** [0.157]
Share of white-collar employment $_{fpy}$			-0.625 [0.407]	-1.039** [0.483]	-0.603 [0.374]
Share of full-time employment $_{fpy}$			-0.381 [0.447]	-0.712 [0.495]	-0.314 [0.434]
Product-quarter fixed effects	yes	yes	yes	yes	yes
Product-year fixed effects	yes	yes	yes	yes	yes
Industry (5-digit NACE) fixed effects	yes	no	no	no	no
Industry (2-digit NACE) fixed effects	no	yes	yes	yes	yes
Observations	44,094	44,094	44,094	39,287	44,094
R^2	0.802	0.779	0.780	0.012	0.780
Kleibergen-Paap rk LM				97.031	
Kleibergen-Paap rk LM (p-value)				0.000	
Kleibergen-Paap Wald rk F				85.997	

Notes: OLS estimations with standard errors clustered at the firm level in square brackets in all columns but column (4). 2SLS estimations with standard errors clustered at the firm level in square brackets in column (4). Log average wage in the equation of column (4) is instrumented with its fourth lag. The results in all columns are produced on the estimating sample of column (3). Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A16: Import shares and the employment share of white-collar workers

Dep. var: Esh_{fqq}^{White}	(1)	(2)	(3)	(4)
Log(value added $_{fqq}$)	-0.003*** [0.001]	-0.003*** [0.001]	-0.003*** [0.001]	-0.003*** [0.001]
Log(capital intensity $_{fqq}$)	-0.001* [0.000]	-0.001* [0.000]	-0.001* [0.000]	-0.001* [0.000]
Share of imports of intermediates $_{fqq}$	-0.007** [0.003]	-0.007** [0.003]		
Share of imports of final goods $_{fqq}$	0.010 [0.008]	0.010 [0.008]	0.009 [0.008]	0.009 [0.008]
Share of imports of intermediates $_{fqq}$ * High-tech $_p$		-0.002 [0.013]		
Share of imports of intermediates from HI $_{fqq}$			-0.007** [0.003]	-0.007** [0.003]
Share of imports of intermediates from LMI $_{fqq}$			0.012 [0.011]	0.012 [0.011]
Share of imports of intermediates from HI $_{fqq}$ * High-tech $_p$				-0.017 [0.024]
Share of imports of intermediates from LMI $_{fqq}$ * High-tech $_p$				0.004 [0.064]
Firm fixed effects	yes	yes	yes	yes
Year-quarter fixed effects	yes	yes	yes	yes
Observations	20,183	20,183	20,183	20,183
R^2	0.929	0.929	0.929	0.929
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.482		
F-test (p-value): $\beta_{M,HI} + \beta_{M,HI,HT} = 0$				0.338
F-test (p-value): $\beta_{M,LMI} + \beta_{M,LMI,HT} = 0$				0.797

Notes: OLS estimations with standard errors clustered at the firm level and 2-digit industry level in square brackets in all columns. The estimations are made on the sample of Table 3. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

Table A17: Import shares and domestic wages

Dep. var:	(1) Log(W_{fqq}^{White})	(2) Log(W_{fqq}^{White})	(3) Log(W_{fqq}^{Blue})	(4) Log(W_{fqq}^{Blue})	(5) Log($W_{fqq}^{White} / W_{fqq}^{Blue}$)	(6) Log($W_{fqq}^{White} / W_{fqq}^{Blue}$)
Log(value added $_{fqq}$)	0.003 [0.002]	0.003 [0.002]	0.018*** [0.002]	0.018*** [0.002]	-0.012*** [0.004]	-0.013*** [0.004]
Log(capital intensity $_{fqq}$)	-0.000 [0.001]	-0.000 [0.001]	-0.001 [0.001]	-0.001 [0.001]	0.002 [0.002]	0.002 [0.002]
Share of imports of intermediates $_{fqq}$	0.006 [0.009]	0.006 [0.010]	0.016 [0.012]	0.015 [0.012]	-0.010 [0.017]	-0.009 [0.017]
Share of imports of intermediates $_{fqq}$ * High-tech $_i$		-0.052*** [0.010]		0.064** [0.027]		-0.109*** [0.021]
Share of imports of final goods $_{fqq}$	0.002 [0.008]	0.003 [0.008]	0.006 [0.018]	0.005 [0.018]	-0.009 [0.020]	-0.008 [0.020]
Share of white-collar employment $_{fqq}$	-0.212*** [0.051]	-0.212*** [0.051]	0.595*** [0.119]	0.595*** [0.119]	-0.803*** [0.125]	-0.803*** [0.125]
Share of full-time white-collar employment $_{fqq}$	0.462*** [0.033]	0.462*** [0.033]				
Share of full-time blue-collar employment $_{fqq}$			0.253** [0.099]	0.253** [0.099]		
Share of full-time employment $_{fqq}$					0.114 [0.073]	0.114 [0.073]
Firm fixed effects	yes	yes	yes	yes	yes	yes
Year-quarter fixed effects	yes	yes	yes	yes	yes	yes
Observations	19,025	19,025	19,025	19,025	19,025	19,025
R^2	0.829	0.829	0.745	0.745	0.646	0.646
F-test (p-value): $\beta_M + \beta_{M,HT} = 0$		0.002	0.007		0.000	

Notes: OLS estimations with standard errors clustered at the firm level and 2-digit industry level in square brackets in all columns. The estimations are made on the sample of Table 3. Asterisks denote significance at 1% (***), 5% (**), and 10% (*).

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