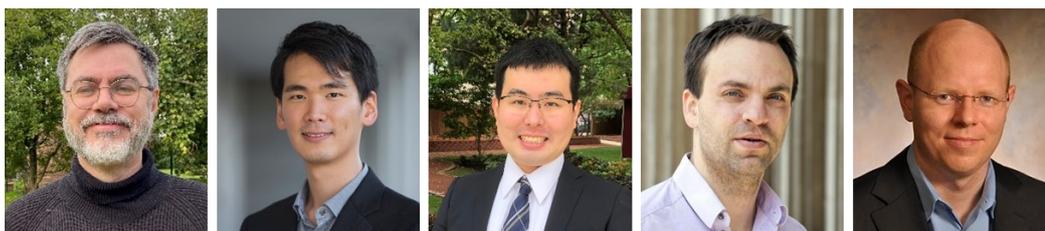


Foreign demand shocks to production networks: Firm responses and worker impacts*



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Using a very rich dataset with information on both domestic firm-to-firm sales and foreign trade transactions for the universe of Belgian firms over the 2002-2014 period, we investigate how individual firms respond to foreign demand shocks and how these shocks affect their workers. We find that firms pass on a large share of foreign demand shocks to their domestic suppliers, face upward-sloping labor supply curves, and have sizable, fixed overhead costs in labor. Motivated and guided by these findings, we develop and estimate an equilibrium model that allows us to study how idiosyncratic and aggregate changes in foreign demand propagate through a small open economy and affect firms and workers. Our results argue for a reassessment of conventional economic models, which likely grossly understate the decline in real wages due to an increase in foreign tariffs.

When most people consider foreign trade, they likely imagine direct trade among international firms, say a firm from Germany trading with a company in Spain, or a US firm trading with a Japanese company, and so on. However, international trade is not limited to direct trading among firms; rather, indirect trade also occurs, wherein smaller and often less productive firms buy and sell from domestic firms that import or export. While a lot is known about direct foreign trade, important questions remain about domestic transactions that are indirectly related to international trade.

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Most firms are indirectly exposed to foreign shocks.

Thanks to the increased availability of micro datasets with information on both domestic firm-to-firm sales and foreign trade transactions, the focus of research on international trade has been expanded to include firms that only trade indirectly by buying from or selling to domestic firms that import or export (see, e.g., Huneus, 2018, Adao et al., 2020, Demir et al., 2021, and Dhyne et al., 2021). An important insight from these data is that smaller and less productive firms often overcome the costs of entering foreign markets by selling to or buying from domestic firms that trade internationally.

This finding raises several important questions that we seek to answer in this paper: How do changes in foreign demand transmit from one firm to the next in the domestic production network? How are firms responding to and workers affected by foreign demand shocks to direct exporters and their domestic suppliers? What are the aggregate implications of foreign demand shocks for output, input costs, and real wages? We study these questions in the context of Belgium, a small open economy.

We employ a rich dataset of firms and workers from Belgium from 2002-2014, which include input factors and output, customs records, imports and exports, and a value-added tax (VAT) registry with information on domestic firm-to-firm transactions, as well as social security records and employer-employee data worker earnings, hourly wages, and work hours. This dataset allows us to determine how firms and workers are connected to foreign markets, whether directly, indirectly, or both. Using this dataset, we establish three sets of empirical facts about the Belgian economy.

First, we find that input purchases respond nearly proportionally to changes in sales, whereas, in contrast, changes in sales are associated with less than proportionate changes in labor costs. These findings are consistent with firms facing fixed overhead costs in labor inputs, whereas intermediate inputs (such as energy and materials) are predominantly variable costs in production.

Second, we build on the analysis of Dhyne et al. (2021) to show that even though direct exporters are rare, a majority of firms are indirectly exporting. This finding points to the importance of incorporating indirect export through the production network to measure firms' ultimate exposure to foreign demand.

Third, we show that firms that are more exposed to foreign markets are larger, more productive, and pay higher wages, and that these wage differentials cannot be entirely explained by observed or unobserved differences across workers. This finding suggests it is necessary to depart from the canonical model of a competitive labor market where wages depend only on the marginal product of workers and not the firm for which they work.

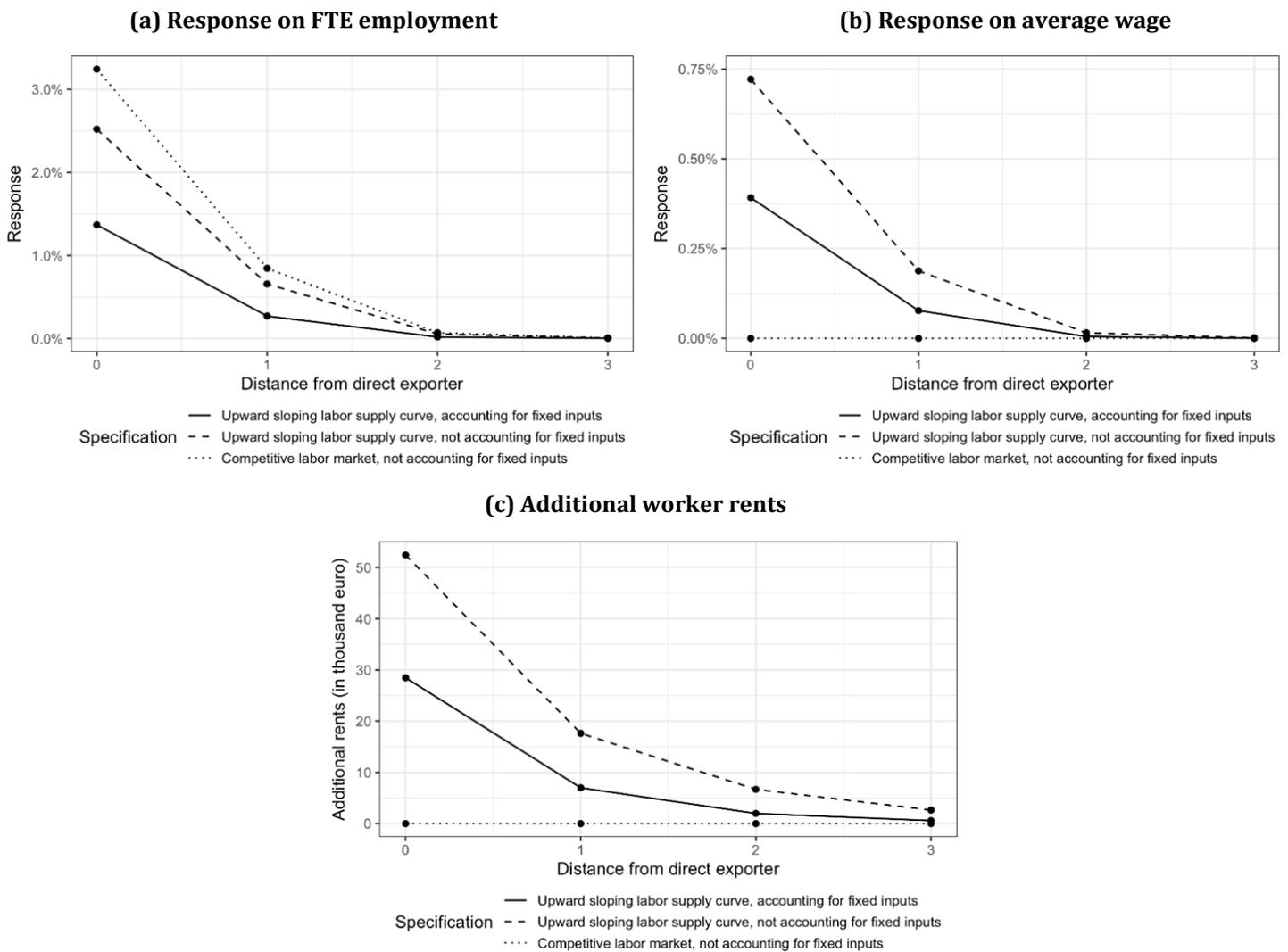
Motivated and guided by these empirical facts, we develop a small open economy model allowing for imperfect competition, in the form of monopsonistic competition in the labor market and monopolistic competition in the product market. Our model also allows the production of goods to depend on both fixed and variable costs of labor and intermediate goods. Fixed labor costs may reflect tasks such as administration, worker management, facility maintenance and any other work that does not translate directly into production and revenue. Examples of fixed intermediate input costs include waste management, accounting services, and electricity payments that occur irrespective of sales.

We take the model to the data with the goal of quantifying and explaining the firm responses and worker impacts of changes in firm sales that are induced by changes in foreign demand. Our estimates of firm responses suggest that Belgian firms pass on a large share of a foreign demand shock to their domestic suppliers, face upward-sloping labor supply curves and, thus, have wage-setting power, and have sizable fixed overhead costs in labor.

Foreign demand shocks cascade through the production network and decreasingly affects employment and wages at each stage of the domestic network.

We find that, on average, a direct exporter raises employment by 1.4 percent and the wages it pays by 0.4 percent in response to a foreign demand shock that increases the firm's direct export by 10 percent. This shock cascades through the production network as the direct exporters buy more inputs both directly from their own suppliers and indirectly from the suppliers' (direct and indirect) suppliers. These indirect demand effects increase, on average, the employment and wages of the direct exporter's key supplier by 0.3 and 0.08 percent, respectively. In other words, a key supplier experiences one-fifth of the percentage increases in wages and employment of the direct exporter.

Figure 1: Simulation results of foreign demand shock transmission along the supply chain



Note: For each panel, we report the simulation results of the transmission of foreign demand shocks along the supply chain (see the discussion in the text for how the simulation is done). The first two panels present the employment and wage response at the direct exporter, the direct exporter's key supplier, the key supplier of the exporter's key supplier, and so on. The bottom panel aggregates the rents to the workers in firms that direct export, to workers in their direct suppliers, to workers in their suppliers' suppliers, and so on (up to three links). Please see working paper for more details.

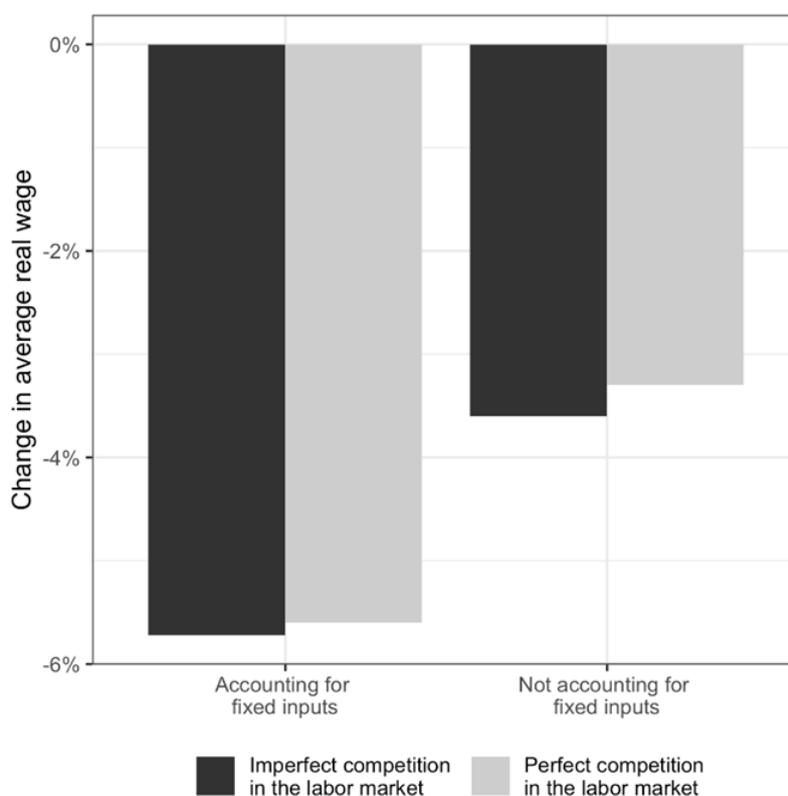
These indirect demand effects decay quickly with the distance to direct exporters in the supply chain. In fact, the foreign demand shock has little if any impact on the employment and wages of the key suppliers of an exporter's key supplier.

An implication of the direct and indirect effects on wages and employment is that workers in the production network will get surplus or rents due to the foreign demand shock. On average, workers in the directly exporting firms get 75 percent of these rents. The remaining rents are shared among the other workers in the production network, with most of them going to the workers of the direct suppliers.

Firms face significant fixed overhead costs, which leads to higher real wage losses in response to increases in foreign tariffs.

We finally analyze the aggregate effects of a five percent increase in foreign tariffs on all Belgian exports. Our results suggest that the increase in foreign tariffs produces a substantial 5.7 percent fall in the average real wage. By comparison, the reduction in real wages would be predicted to be as low as 3.3 percent if we assume the economy had no fixed costs and perfectly elastic labor. Our estimates of fixed overhead costs—that we infer from firm responses to demand shocks—are broadly comparable to the findings of De Loecker et al. (2020) based on accounting data for publicly listed US firms.

Figure 2: Changes in average real wage in response to a 5 percent increase in foreign tariffs



Note: This figure presents the estimates of how the increase in foreign tariffs on Belgian exports would affect the average real wage for each counterfactual economy. This figure illustrates the changes in average real wage due to a uniform 5 percent increase in foreign tariffs on Belgian exports. Please see working paper for more details.

In order to explain these findings, it is useful to note that, in general equilibrium, a five percent increase in foreign tariffs is equivalent to a five percent increase in tax on imports. An increase in the cost of imports has a larger impact on the firms' total variable costs, and, in turn, on output and real wages, if the economy has sizable, fixed overhead costs in labor while imported inputs are predominately variable costs. Furthermore, in an economy in which the firms face upward-sloping labor supply curves, they pay lower wages than they otherwise would by hiring fewer workers, which effectively amplifies the share of labor costs that is fixed.

As a conclusion, the way in which the labor market is typically modeled in existing research on foreign demand shocks—with no fixed costs and perfectly elastic labor supply—may grossly understate the decline in real wages due to an increase in foreign tariffs. □

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