Firm Organization and the Transmission of Shocks *

VERY PRELIMINARY - DO NOT CIRCULATE

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Abstract

I use matched administrative data on the universe of Danish firms and workers to investigate the aggregate and distributional effects of sector-specific trade and productivity shocks. The effect of a particular tariff change (for example) on labor demand, productivity, and welfare depends on interconnections between different industries and the patterns of substitution between labor and materials/services. Standard approaches to modeling production and input demand put very heavy restrictions on these relationships which fail to capture pertinent moments in the data. For example, a recent literature (eg. Hummels et al (2014)) has documented significant heterogeneity within skill groups in the response of wages to trade shocks. I additionally document significant firm-level heterogeneity in input mix use, task-level productivity, and outsourcing patterns. These empirical regularities are at odds with most of the recent work on the impact of tariffs and the transmission of shocks through domestic and international trade networks. In such models (eg. Carvalho et al (2016)), labor is treated as a single input which is either a substitute or compliment to traded intermediates. Thus, a trade or productivity shock will have a monolithic effect on wages and employment within a linked sector or industry, regardless of labor type. Towards reconciling these models with the latest empirical evidence, I extend existing models

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of multi-factor production and intermediate linkages to allow for task-specific complementaries between particular types of intermediates and labor. Critically, I allow for the elasticity of demand for labor with respect to a change in intermediate cost to differ across intermediate types, labor types, industries and firms.

To conduct this analysis, I build on methods from the structural IO/Trade literature to estimate a dynamic firm-level model of input-output linkages and roundabout production where firms choose whether to purchase each input from another sector, or hire task-specific labor to perform the intermediate task in-house. Wages, labor demand, profits and output are jointly determined by each firm's own vector of task-enhancing productivity terms, intra-firm wage bargaining and productivity/wages in linked sectors. I estimate this model in steps. First, I specify a generalized production function framework in which firms produce output using an endogenously chosen set of input and labor types which can vary by period and across firms. This estimation strategy can easily be extended to other settings where researchers wish to study task or occupation-specific outcomes and drivers of firm behavior. Critically, I am able to use the data on price (wage) variation and labor demand to back out unobserved input use and calculate firm-level prices and markups. I then close the model by specifying and estimating labor supply using the matched worker-firm data as well as information on firm-level non-pecuniary amenities (such as location).

My approach provides several innovations. First, I develop a new method for estimating generalized firm-specific multi-factor production functions which allow for flexible substitution patterns. A main result of my paper is developing conditions under which these production functions are identified using variations in wages and labor demand, even if prices and purchased input quantities are not observed. Second, I use these estimates to calculate aggregate labor and input demand elasticities, which I can use for partial-equilibrium estimates of the employment and welfare implications of tariffs on particular goods or industries. Third, I estimate (in progress) a full general equilibrium model of inter-firm and inter-industry trade and network linkages using data at the firm and worker level, rather than relying on macro data such as aggregate input-output tables. Ultimately, I am able to show that the welfare effect of a tariff or productivity shock depends critically on the linkages, outsourcing behavior and productivity structure of the affected industries. An industry which purchases all of an intermediate from other firms (domestic or international) will be more exposed to trade shocks than an industry which makes that same intermediate in-house. I show that this exposure has been increasing over the last 15 years. Explicitly accounting for the firm's make-or-buy decision generates significantly different estimates for the responses of output, wages and employment to a trade shock. I then provide

evidence that recent changes in firm organization are due to differential shifts in task-enhancing productivity, which I estimate as a generalization of existing concepts of labor-enhancing productivity. Finally, I develop a full framework for the analysis of sector level changes in policy (such as product-level tariffs) and productivity on welfare, both at the aggregate level, and at the firm-worker level.

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