Journal of International Economics 97 (2015) 278–294

Contents lists available at ScienceDirect

Journal of International Economics

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

Trade policy and wage inequality: A structural analysis with occupational and sectoral mobility☆

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ARTICLE INFO

Article history:
Received 18 August 2014
Received in revised form 10 June 2015
Accepted 17 June 2015
Available online 23 June 2015

JEL classification:
E24
F13
F16

Keywords:
Sectoral mobility
Occupational mobility
Trade policy

ABSTRACT

A number of authors have argued that a worker's occupation of employment is at least as important as the worker's industry of employment in determining whether the worker will be hurt or helped by international trade. We investigate the role of occupational mobility on the effects of trade shocks on wage inequality in a dynamic, structural econometric model of worker adjustment. Each worker in our specification can switch either industry, occupation, or both, paying a time-varying cost to do so in a rational-expectations optimizing environment. We also specify a novel model of offshoring based on task-by-task comparative advantage that collapses to a very simple form for simulation. We find that the costs of switching industry and occupation are both high, and of similar magnitude. In simulations we find that a worker's industry of employment is much more important than either the worker's occupation or skill class in determining whether or not she is harmed by a *trade* shock, but occupation is crucial in determining who is harmed by an *offshoring* shock.

1. Introduction

Among the key questions trade economists need to be able to answer is: when a trade shock strikes such as liberalization, trade agreement, expansion of a foreign export power, or the rise of offshoring, who benefits and who is hurt, and by how much? There are as many ways of approaching these questions as there are ways of dividing people into economically meaningful subgroups. The oldest literature divided people by what can be called 'class' lines, making a distinction between workers and the owners of physical or human capital — the Stolper–Samuelson approach. More recent approaches have divided up workers based on their industry of employment (Revenga, 1992; Pavcnik et al., 2004; Artuç et al., 2010); region of residence (Topalova, 2007; Kovak, 2013; Hakobyan and McLaren, 2010); and age (Artuç, 2012), in each case attempting to quantify how trade shocks affect people in the different groups differently.

More recently, several studies have focused on a division of workers by *occupations*, often making use of data from the US Department of Labor that breaks down the 'task' composition of a wide range of occupations in US labor data (the Dictionary of Occupational Titles data or the O*NET data; see Autor et al. (2003), for example). Authors who exploit these distinctions to look at the differential effects of trade shocks on workers with different types of occupations include Acemoglu and Autor (2011), Autor et al. (2013), Ritter (2009), Peri and Sparber (2009), Ebenstein et al. (2014), and Liu and Trefler (2011). Some of the results in Ebenstein et al. (2014), in particular, suggest that occupational distinctions may be more important than industry in identifying who loses from globalization, that it is workers in vulnerable occupations (namely, those that are the most offshorable) in affected industries who lose. If this is right, it is important information for policymakers to have to be able to target compensation programs effectively.

We take the focus on occupations in a new direction, with two innovations. (i) Building on earlier work (Artuç et al., 2010) (henceforth ACM) in which we estimated the costs to workers of switching industries in a dynamic model in order to measure the welfare effects of trade shocks on workers in different industries, we expand our framework to allow workers to change *both* their industry *and* their occupations, estimating the costs of doing so in an integrated dynamic structural econometric model. Our strategy is to specify a rational-expectations model in which industry and occupational switching is a forward-looking investment decision by long-lived workers; estimate the key structural parameters (particularly means and variances of moving costs) on worker data; and then simulate the effects of trade shocks using these estimates to analyze welfare and the time-path of the labor market's adjustment.

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http://dx.doi.org/10.1016/j.jinteco.2015.06.001
0022-1996/

(ii) We integrate this dynamic structural estimation with a novel specification of the labor-market equilibrium with offshoring, which incorporates features of models by Grossman and Rossi-Hansberg (2008), Acemoglu and Autor (2011), and Eaton and Kortum (2002) and which conveniently allows us to represent a fairly complex labor-market equilibrium as the simple minimization of cost with a CES production function. We use this specification to study the effect of a trade liberalization shock and also a drop in the cost of offshoring jobs, showing that the effects on income distribution are very different, in ways that can be understood only with a dynamic model.

This approach has a number of advantages. First, it allows us to incorporate a real dynamic analysis into the effect on different occupations. Workers can and do change occupation, but it is costly to do so, and the degree of cost will affect the wage effects of a trade shock as well as how those wage changes translate into welfare changes. Importantly, a dynamic analysis allows us to identify the role of option value, which has been shown to have a large effect on the welfare analysis of trade shocks (Artuç et al., 2010). If one's wage in one's own industry and occupation is reduced by a policy change, but wages in other occupations and industries to which one might consider switching are increased, then the positive option-value effect brought about by the latter may dominate the negative direct effect of the former. One needs a dynamic model with option value built in in order to find out what the net effect is.

Second, a full account of occupational choice can have a significant effect on the whole pattern of gains and losses from trade shocks. Take a simple thought experiment as an example. If it is very easy to switch industries but impossible to switch occupations, then workers in a given occupation will receive the same income in each industry. A trade shock that lowers the price received by one industry will affect every worker in a given occupation in the same way; to know whether a given worker gains or loses, all one needs to know is that worker's occupation. The industry of employment is superfluous, even though it is an industry-specific shock. On the other hand, if it is easy to switch occupation but not industry, wages will be equated across occupations within each industry. In this case, to learn who is hurt by the trade shock, the occupation of employment is superfluous. The point is that these outcomes depend crucially on the relative costs of switching industry and switching occupation, which is an empirical matter, and is what we have set out to estimate.

To anticipate results, we find that both inter-sectoral and inter-occupational switching costs are large, and that they are similar in magnitude. Nonetheless, idiosyncratic shocks to the switching decision are also large, so that a non-negligible fraction of US workers switch along both dimensions every year. We also find that these costs are sub-additive, in the sense that the cost of switching both sector and occupation is much less than the cost of switching only industry plus the cost of switching only occupation. Finally, from the simulations, we find: (i) despite the extremely high costs of switching occupation, the main determinant of whether a worker benefits from *trade liberalization* or not is that worker's industry. In our simulations, one's occupation of employment makes almost no difference to the direction of welfare effect once industry has been taken into account. (ii) By stark contrast, who benefits from an *offshoring shock* in an industry turns crucially on occupation within that industry, and although the shock directly affects only a narrow class of workers in manufacturing, the dynamic general equilibrium welfare effects harm most less-educated workers and benefit most college-educated workers.

These results complement findings in the reduced-form literature; for example, as with Ebenstein et al. (2014), we find a drop in wages for blue-collar workers in offshorable occupations when offshoring increases (in stark contrast to predictions of the Grossman and Rossi-Hansberg (2008) model). However, unlike that study, we compute an implied effect, not just on wages, but on lifetime utility taking into account the transition path; and we also find that the pattern of effects is very different for trade shocks. Hummels et al. (2014), working with Danish matched firm-worker data, find that wages of high-skill workers within a firm tend to rise when the firm increases offshoring, while wages of low-skill workers drop, particularly in routine occupations. Autor et al. (2014) examine US worker-level data and find that the impact of rising imports from China varies greatly with the skill level of affected worker, as does inter-sectoral mobility.

Aside from our previous efforts in ACM, this equilibrium approach is related to some other work on the relationship between occupational choice and income distribution. Liu and Trefler (2011) use an equilibrium Roy-type model with endogenous matching of workers to occupations to interpret patterns of occupational adjustment in tradeable services occupations in response to international offshoring. They show that increased competition with foreign workers tends to lead to increased switching to lower-wage occupations for some workers and to higher-wage occupations for others. Crucially, if one allows for unobserved heterogeneity in worker productivity the welfare losses to a worker from a trade-induced downward occupational switch are greatly diminished. Kambourov and Manovskii (2009) use a general-equilibrium model with optimal dynamic occupational choice to show that rises in the volatility of occupation-specific productivity can help explain increases in income inequality in the data. Cortes and Gallipoli (2014) model occupational switching with a specification analogous to a gravity equation and find that differences in task content of occupations are an important constraint in switching.

In addition, we are adding to the developing literature on dynamic general-equilibrium adjustment to trade shocks. Cosar (2010) studies a model with costly adjustment due to search frictions, calibrated to Brazilian data. Kondo (2013) also analyzes the interaction between search frictions and trade but using a model calibrated with US data. Ritter (2009) calibrates a model to US data that has both search frictions and occupation-specific human capital, which serves as a cost to switching occupation. Dix-Carneiro (2014) estimates a structural model of dynamic labor-market response with costly adjustment and sector-specific human capital, again using Brazilian data. Each of these studies pursues similar themes but emphasizes different aspects of adjustment. Mitra and Ranjan (2010) study the income-distribution and employment effects of offshoring in a model with both search frictions and idiosyncratic moving costs.

The next section lays out our model and estimation method. The following section shows the data and estimations, and the last section details the simulation results.

2. Model

Each worker chooses her sector i and occupation k jointly in each period in order to maximize her expected present discounted utility. Assume that there are I industries (sectors) and K occupations. There are two skill groups, indexed by s: College-educated workers, indicated by $s = c$, and non-college educated workers, indicated by $s = n$. Assume that workers cannot change their skill status.[1]

For the moment, we take wages as exogenously given, because it simplifies the discussion of the empirics. However, in Section 4 we will endogenize wages in each sector by specifying a spot market for labor in each sector that clears in each period (and of course the endogenous effect of trade shocks on wages is a major focus of this inquiry). Each period t, the wage w_t^{iks} for each sector i, occupation k and skill class s is realized and observed by all. Each worker understands the distribution of future wages and optimizes accordingly.

In order to accommodate the fact that workers who appear identical to the econometrician often do different things, we introduce idiosyncratic shocks to workers' preferences. If worker z in skill class s spends period t working in occupation k in sector i, her instantaneous utility is $w_t^{iks} + \eta_t^{iks} + \epsilon_t^{zik}$, where ϵ_t^{zik} is a cell-specific iid utility shock with

[1] It would be of interest to allow for endogenous schooling decisions as in Lee and Wolpin (2006), which would likely reduce the gap in welfare effects between college-educated and non-college educated workers. This is beyond the scope of this paper.