Trade dynamics with sector-specific human capital ☆

Adam Guren [a], David Hémous [b,c], Morten Olsen [d,*]

[a] Boston University, United States
[b] INSEAD, France
[c] CEPR, United Kingdom
[d] IESE Business School, University of Navarra, Spain

ARTICLE INFO

ABSTRACT

This paper develops a dynamic Heckscher Ohlin Samuelson model with sector-specific human capital and over-lapping generations to characterize the dynamics and welfare implications of gradual labor market adjustment to trade. Our model is tractable enough to yield sharp analytic results, that complement and clarify an emerging empirical literature on labor market adjustment to trade. Existing generations that have accumulated specific human capital in one sector can switch sectors when the economy is hit by a trade shock. Nonetheless, the shock induces few workers to switch, generating a protracted adjustment that operates largely through the entry of new generations. This results in wages being tied to the sector of employment in the short-run but to the skill type in the long-run. Relative to a world with general human capital, welfare is improved for the skill group whose type-intensive sector shrinks. We extend the model to include physical capital and show that the transition is longer when capital is mobile. We also introduce nonpecuniary sector preferences and show that larger gross flows are associated with a longer transition.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

The growth of North–south trade over the last 15 years—particularly due to the emergence of China—has sparked renewed interest in the consequences of inter-industry trade and its effects on labor reallocation and income inequality (Krugman, 2008; Autor et al., 2013, and Haskel et al., 2012). In addition to the effects of trade on relative factor rewards, concern has been raised over the welfare costs of protracted labor reallocation and of the idle/lost expertise for workers whose sector is hit by import competition. More generally, the dynamics of an economy's adjustment to trade shocks are critical to understanding the benefits and distributional consequences of both trade liberalizations and trade shocks.

Yet, most models assume perfect factor mobility or complete immobility even though, empirical results suggest that—owing to short- and

medium-run adjustment costs—both assumptions are too extreme for analyzing the impact of trade shocks on the labor market. To address this issue, Matsuyama (1992) analyzes labor reallocation following a trade shock in an overlapping generations model, assuming that workers can only choose their sector once in their lives. This implies that all reallocations occur through the entry of new generations. In contrast, we allow for labor mobility in a Heckscher Ohlin Samuelson (HOS) model augmented with sector-specific human capital. This endogenously generates little immediate reallocation of labor in response to a trade shock and leads to a protracted transition, providing a better fit with the empirical findings. This more general framework allows us to investigate additional outcomes of trade shocks, such as the share of reallocation that happens on impact and the distributional consequences of trade for workers of different cohorts.

The model is an overlapping generations HOS model in which new workers of both low- and high-skill types enter the economy each period as old generations die. Both skill types are essential in both sectors, but the sectors differ in their skill intensities. Workers accumulate human capital that is specific to the sector of their employment. The empirical relevance of sector-specific human capital has been demonstrated most notably by Neal (1995), Parent (2000), and Kletzer (2001). Because our focus is on sector-specific human capital and sectoral reallocation we keep the neoclassical assumption of perfectly competitive markets and we consider an economy with homogeneous

firms. This makes our analysis complementary with recent work emphasizing within-industry reallocation, such as Helpman et al. (2010).

In steady state, workers never switch sectors and the model replicates the standard HOS model. Yet when prices and wages adjust in response to a trade shock, sector-specific human capital generates endogenous rigidities. Although all workers have the opportunity to switch sectors, not all do so and wages do not immediately equilibrate across sectors. Young workers with little accumulated sector-specific human capital find the higher relative wages of the expanding sector attractive enough to switch, whereas older workers with more accumulated human capital find it optimal to stay.

Our main finding is that most of the adjustment occurs not through immediate labor reallocation but rather through the entry of new generations of workers. Intuitively, the wage benefits of relocating to the expanding sector diminish as the economy adjusts to its new steady state, while human capital accumulated in the sector of previous employment is permanently idled if a worker switches. Consequently, even workers with a relatively small amount of accumulated specific human capital in the shrinking sector find it optimal not to switch. Technically, we use approximation methods to prove that the number of people who switch in response to a shock is second order in the price change whereas the length of adjustment is first order in the price change. Perhaps surprisingly, we show that the transition can be slower when human capital accumulates faster. Given the small amount of labor reallocation that occurs upon impact, the immediate effect of a trade shock on factor rewards is tied to sector of employment and not (as in the standard HOS model) to skill type. As the economy moves toward the new steady state, the standard Stolper–Samuelson result emerges whereby real wage changes are tied to skill type.

To relate our model to the current debate over the consequences of imports of low-skill labor-intensive products, we consider a shock that lowers the price of goods produced by the low-skill-intensive sector. First, although sector specificity prevents some individual low-skill workers in the shrinking sector from taking advantage of the higher wages in the expanding sector, overall the slower adjustment benefits low-skill workers because factors of production are kept longer in the low-skill-intensive sector. Second, a policy, financed by high-skill workers, which subsidizes workers of both types who switch sectors reduces the welfare of some of the low-skill workers who do not move by accelerating the transition.[1] This general equilibrium impact can be large enough to decrease the aggregate lifetime income of all low-skill workers alive at the time of the shock. This result continues to hold if one considers a retraining program that allows workers to keep part of their sector-specific human capital when switching sectors. Finally, there are distributional consequences across generations. For instance, low-skill workers in the high-skill intensive-sector who are old enough benefit from the decrease in the price of the low-skill-intensive good.

In two extensions we include physical capital and nonpecuniary sector preferences. For both extensions, most of the adjustment still occurs through the entry of new generations. We show that the transition is slower when physical capital is general instead of sector-specific. We also show that larger gross flows (generated by nonpecuniary sector preferences) further delay the transition to the new steady state but cause more reallocation upon the shock's impact.

To illustrate the workings of our model, we calibrate two versions of the model to data from the United States. We divide US manufacturing into two sectors of similar size according to their skill intensity. First, to stay as close as possible to the theoretical setting, we ignore capital and simulate a trade shock that reduces the price of the low-skill sector's product by 1%. The numerical results show a relatively long transition: it takes 2.11 years for low-skill wages and 7.41 years for high-skill wages to be equalized again. Moreover, the number of workers switching sectors in response to the trade shock is very small: only low-skill (resp. high-skill) workers with experience less than 0.04 years (resp. 0.27 years)

switch sectors. Yet, since the difference in skill intensity across sectors is small, the reallocation predicted in this Heckscher–Ohlin model for such a small price change seems counterfactually large. Therefore, we also calibrate the model with sector-specific capital. This allows us to study large price changes and we find that, in this case, even for a 20% price change, the initial reallocation of workers represent less than a quarter of the steady-state reallocation.

Our results relate to a large empirical literature, typically based on the HOS-model, on the distributional consequences of exposure to international trade, both in developing and developed countries. For developed countries, Slaughter (2000) surveys an extensive literature of the 1990s on the role of international trade in explaining rising US inequality by correlating changes in the relative producer prices of low-skill intensive goods with relative wages of low-skilled workers as predicted by the Stolper–Samuelson theorem. He documents a limited support for the Stolper–Samuelson predictions especially in the 1970s, but argues that the methodology used is too limited to make firm conclusions. Yet, other authors find that trade played a more substantial role in the increase in inequality in developed countries, and Wood (1995) argues that methodology choices in computing the factor content of trade considerably affect the estimated impact of trade on inequality. Goldberg and Pavcnik (2007) survey the literature on developing countries and document that in general labor market adjustments are sluggish and trade liberalizations have not led to the reductions in income inequality predicted by factor endowment trade models. Though the limited labor mobility seems to contradict the central tenets of HOS theory and to undermine the empirical relevance of the HOS theory, our model suggests that a lack of labor reallocation and the presence of sector wage premia on impact are fully consistent with a HOS framework that incorporates rigidities. In fact, Robertson (2004) shows that the Stolper–Samuelson predictions emerge starting 3–5 years after a trade shock in Mexico.[2] Similarly, Gonzaga et al. (2006) find Stolper–Samuelson effects in Brazil.[3] Mayda and Rodrik (2005) show that both in developed and developing countries preferences over trade policy are in line with HOS theory, another indication that in the long-run the Stolper–Samuelson theorem holds. Our model provides some guidance for evaluating the time horizon at which Stolper–Samuelson effects might become important.

The model presented here also relates to a literature that examines the short-run dynamics of trade adjustment (Matsuyama, 1992, as mentioned, and Mayer, 1974; Mussa, 1978, and Neary, 1978, who analyze limited capital mobility). Yet only recently have efforts been made to incorporate sluggish labor adjustment into theoretical trade models. Most of these efforts – some of which include sector-specific human capital – focus on structurally estimated or calibrated models. For instance, Artuç et al. (2010) structurally estimate a dynamic rational expectations model of labor adjustment in which nonpecuniary idiosyncratic shocks in moving costs are the sole source of rigidities. Their model does not feature entering generations and sector-specific human capital, which (as we show) can endogenously generate rigidities for pecuniary reasons. Kambourov (2009) shows in a calibrated model that, in the presence of sector-specific human capital, firing costs reduce the benefits from trade liberalization. Closer to our work, Coşar (2013) calibrates a model with overlapping generations, sector-specific human capital, and job search, and Dix-Carneiro (2014) estimates a structural model with overlapping generations, sector-specific human capital, and switching costs.[4] To complement this literature,

---

[1] Because there are no inefficiencies in the economy, such a subsidy also reduces output.

[2] In addition, Robertson uses industry-specific tariff reductions. This addresses a potential bias in the estimation of wage effects from trade liberalizations as tariff reductions are often larger for low-skill intensive industries.

[3] Helpman et al. (2012), however, demonstrate that within occupations inequality (for which the HOS framework is silent) increased in Brazil after trade liberalization.

[4] Dix-Carneiro and Kovak (2015) provide empirical evidence on the slow adjustment of labor markets in Brazil following trade liberalization. Their work focuses on labor reallocation across regions and between the formal and informal sectors, instead of labor reallocation across tradeable sectors. Yet, their results are consistent with a model where factors are initially sector-specific and adjust slowly.