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Costly labor adjustments to trade shocks in CGE analysis

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Abstract

Gains from international trade depend on the ability of factors of production to reallocate across sectors. International trade analyses based on computable general equilibrium (CGE) frameworks typically model the reallocation of aggregate factors of production: e.g., capital, skilled labor, and unskilled labor. These factors are often modeled as perfectly and costlessly mobile across sectors. This paper explores the influence of labor reallocation across sectors subject to explicit adjustment costs as an economy adjusts to several types of trade shocks. The paper compares the results of this analysis to analyses obtained under the assumption of perfectly and costless labor mobility across sectors and with models of imperfect capital mobility across sectors.

Keywords: Labor adjustment costs, GTAP Model

JEL codes: C68, D58, F16

Costly labor adjustments to trade shocks in CGE analysis

Gains from international trade depend on the ability of factors of production to reallocate across sectors. International trade analyses based on computable general equilibrium (CGE) frameworks typically model the reallocation of aggregate factors of production: e.g., capital, skilled labor, and unskilled labor. These factors are often modeled as perfectly and costlessly mobile across sectors.

Focusing on labor, when moving between sectors, workers face certain costs. Specific costs documented in the literature include reduced future employment opportunities with lower wages (Davis and von Wachter, 2011; Jacobson et al., 1993). Earnings losses can persist for decades, are even more severe for workers displaced during a recession, and for those in the lower tail of the income distribution (Eliason and Storrie, 2006; Huttunen et al., 2011). The econometric literature finds that industry, occupation, and task-specific human capital are significant determinants of earnings and that human capital is not fully transferable across sectors. A recent literature review is in Riker and Swanson (2016).

These issues have been recognized by modelers. Some early efforts are Adelman (1966), Bowles (1970), Manne (1973), and Dixon, Parmenter, Ryland, and Sutton (1977). These authors modeled several types of labor and utilized various degrees of substitution between categories of labor at the sector level. In more recent work, Babiker and Eckaus (2007) distinguish mobile labor from sector-specific labor to model labor market rigidities in CGE models.

Lofgren and Cicowiez (2017) use a proximity-based approach to model labor mobility across sectors. Labor can switch sectors subject to costs that depend on how far apart skill requirements are across sectors reflected as a proximity score and measures efficient employment losses. The authors compare simulations after an increase in food export price. They start with sector-specific labor (very low proximities scores) and then increase the magnitude of the proximity scores in each subsequent simulation, ending with perfect labor mobility in which proximity scores are all equal to one.

Hafstead, Williams III, and Chen (2018) compare a full-employment CGE model to one that incorporates search frictions from Hafstead and Williams III (2018). Search frictions are modelled using a matching function with recruitment costs. They find that estimated changes in the aggregate quantity of labor are similar across the full-employment vs matching CGE models. However, they find that the matching CGE model shows that sector specific job losses are smaller in sectors shedding workers and have larger increases in sectors gaining workers.

Castellanos and Heutel (2019) model labor market frictions by using an exogenously parameterized wage curve, in which the levels of unemployment affect wages at the sector level. While their model does not allow for degrees of mobility, it analyzes perfect mobility vs perfect immobility. Following Blanchflower and Oswald (1995), the authors fix the total stock of labor for each sector and the labor force for each sector is calculated to match sectoral unemployment rates. For the perfectly mobile labor assumption, unemployment rates across sectors are identical, so each sector's labor supply is a function of that sector's total labor stock and the economy-wide unemployment rate.

This paper explores the influence of labor reallocation across sectors subject to explicit adjustment costs as an economy adjusts to several types of trade shocks. The paper compares the results of this analysis to analyses obtained (1) under the assumption of perfectly and costless labor mobility across sectors and (2) with models of imperfect capital mobility.

Labor adjustment costs in the GTAP model

A modified version of the GTAP model (Hertel, 1997 and Corong et al., 2017) is employed to run the trade scenarios.

The GTAP model data used in this work are for the year 2014 and they were obtained from the GTAP Database Version 10 (Aguiar et al., 2019).

The GTAP data for the shares of less skilled labor and more skilled labor employed by each of the 57 GTAP sectors in the United States were revised based on data developed by Carrico and Tsigas.

This paper considers the implications of labor adjustment costs in comparative static and long run trade scenarios. The long-run scenarios are recursive dynamic scenarios.

It is necessary to include a baseline scenario because costly labor reallocations occur as economies approach a long-run equilibrium even in the absence of trade shocks.

The trade shocks studied in this work are caused by changes in import tariffs or other exogenous changes in the rest of the world.

Expansion of MVH exports, Comparative static scenarios

This draft discusses the comparative static effects of an expansion in U.S. exports of the MVH sector, which represents motor vehicles and parts. The export expansion is caused by a hypothetical reduction in tariffs imposed by importers of U.S. motor vehicles and parts. In particular, the importing economies/regions lower their MVH tariffs on imports from the United States to the level of tariffs the United States imposes on their exports of MVH to the United States.

The first column in Table 1 shows simulated effects under standard CGE assumptions: there are no labor adjustment costs and capital is freely mobile across sectors. The effects in the second column are based on the assumption that labor lowers the productivity of workers that reallocate from one sector to another sector by 10 percent. The effects reported in the third column are based on the assumptions of not only costly labor adjustments but also imperfect capital mobility.

Under standard CGE assumptions, the tariff reduction for MVH imports causes a 6.554 percent expansion in U.S. production and a 6.562 percent in the sector’s employment. Among other sectors, fabricated metal products (MFP) and iron and steel (I_S) also increase their production; other manufactures (OMF) and other financial services (OFI) experience a decline in production.

The wage rate paid by the MVH sector increases by 0.448 percent, while the average U.S. wage rate increases by 0.426. The sector-specific wage increase is different from the U.S. wage rate because of differences in the shares of low- high-skill workers.

The effects in the second column show that in the presence of labor adjustment costs, the MVH sector expands by 6.299 while its employment expands by 6.797 percent. The MVH sector compensates to some degree for the 10 percent loss in the productivity of new workers by hiring more of them. However, the employment expansion is not enough to achieve the

Table 1. Comparative static effects of an expansion in U.S. exports of MVH under different assumptions about labor adjustment costs and capital mobility

U.S. indicators		Perfect capital mobility across sectors: Without labor adjustment costs	Perfect capital mobility across sectors: 10% labor adjustment costs	Imperfect capital mobility across U.S. sectors: Without labor adjustment costs	Imperfect capital mobility across U.S. sectors: 10% labor adjustment costs
Indicators for MVH sector					
Volume of exports	% change	29.108	28.591	28.065	27.435
Volume of production	% change	6.554	6.299	6.08	5.771
Employment	% change	6.562	6.797	7.238	7.548
Effective cost of labor	% change	0.448	1.063	0.459	1.135
Wage	% change	0.448	0.425	0.459	0.431
Output price	% change	0.314	0.432	0.539	0.685
Volume of production for selected sectors					
FMP	% change	0.474	0.432	0.391	0.345
I_S	% change	0.041	0.032	-0.013	-0.022
OMF	% change	-1.428	-1.366	-1.261	-1.195
OFI	% change	-0.047	-0.052	-0.048	-0.052
Welfare effects					
Terms of trade	million $	10,147	9,931	10,164	9,907
Allocative efficiency	million $	1,016	884	994	854
Labor adjustments	million $	0	-1,222	0	-1,304
Total welfare (EV)	million $	11,163	9,593	11,158	9,457
Real GDP	% change	0.006	-0.002	0.006	-0.003
Real GDP	million $	1,016	-338	994	-450
Economy-wide wage	% change	0.426	0.403	0.436	0.408
Economy-wide effective cost of labor	% change	0.426	0.414	0.436	0.420

same output expansion as under no costs of adjustment. The GTAP model variable $afeall_{i,j,USA}$, for $i \in$ Labor and $j \in$ PROD_COMM, is endogenized in this scenario to reflect the assumption that the productivity of new workers to a sector would be 10 percent lower than the productivity of existing workers. While the effective labor cost for the MVH sector rises by 1.063 percent, the wage received by workers rises by 0.425 percent.

The effects in the third column show that in the presence of labor adjustment costs and sluggish capital mobility across sectors, the MVH sector expands by 5.771 while its employment expands by 7.548 percent. To attract the required amount of capital the MVH sector needs to offer a higher rent for capital, which changes the wage/rental ratio in the favor of labor.

Expansion of MVH exports, Long-run scenarios

Table 2. Long-run effects of an expansion in U.S. exports of MVH under different assumptions about labor adjustment costs and capital mobility, percentage point difference from corresponding baseline

	Perfect capital mobility across sectors		Imperfect capital mobility across U.S. sectors	
U.S. indicators	Without labor adjustment costs	With 10% labor adjustment costs	Without labor adjustment costs	With 10% labor adjustment costs
Indicators for MVH sector				
Volume of exports	33.969	33.196	32.124	31.211
Volume of production	7.581	7.250	6.863	6.469
Employment	6.968	7.174	7.604	7.870
Effective cost of labor	0.436	1.095	0.452	1.173
Wage	0.436	0.424	0.452	0.437
Output price	0.262	0.382	0.500	0.647
Real GDP	0.022	0.012	0.015	0.004
Economy-wide wage	0.415	0.403	0.429	0.414

Influence of labor adjustment costs in other hypothetical scenarios

Table 3. Comparative static effects of sector specific, output augmenting technical change in either the United States or the rest of the world under different assumptions about labor adjustment (with perfect capital mobility across sectors)

Sector experiencing technical change	U.S. indicator			Sector specific, output augmenting technical change: in the United States, Without labor adjust. costs	in the United States, With 10% labor adjust. costs	in the rest of the world, Without labor adjust. costs	in the rest of the world, With 10% labor adjust. costs
TEX: Textiles	TEX exports		% change	83.450	81.620	-54.640	-54.560
	TEX imports		% change	-26.560	-26.240	43.150	43.040
	Welfare (EV)		million $	26,061	24,609	17,754	16,722
	Labor adjustment costs						
		All sectors	million $	0	1,121	0	1,352
		TEX sector	million $	0	356	0	0
	Real GDP		% change	0.115	0.108	0.017	0.008
	Wage rate		% change	0.427	0.409	-0.417	-0.448
WAP: Wearing apparel	WAP exports		% change	114.340	108.570	-47.370	-47.310
	WAP imports		% change	-15.680	-15.130	22.630	22.590
	Welfare (EV)		million $	17,754	16,722	8,768	7,822
	Labor adjustment costs						
		All sectors	million $	0	788	0	708
		WAP sector	million $	0	485	0	0
	Real GDP		% change	0.076	0.071	0.016	0.012
	Wage rate		% change	0.226	0.214	-0.174	-0.189
MVH: Motor vehicles & parts	MVH exports		% change	36.870	36.490	-33.150	-33.060
	MVH imports		% change	-10.620	-10.640	21.840	21.720
	Welfare (EV)		million $	94,080	88,475	12,623	9,133
	Labor adjustment costs						
		All sectors	million $	0	4,437	0	2,651
		MVH sector	million $	0	958	0	0
	Real GDP		% change	0.438	0.410	-0.002	-0.018
	Wage rate		% change	1.683	1.612	-0.909	-0.961
ELE: Electronic equipment	ELE exports		% change	99.420	97.030	-58.710	-58.470
	ELE imports		% change	-14.930	-14.830	21.290	21.070
	Welfare (EV)		million $	135,248	124,508	5,971	319
	Labor adjustment costs						
		All sectors	million $	0	8,240	0	4,141
		ELE sector	million $	0	1,939	0	0
	Real GDP		% change	0.494	0.442	-0.024	-0.050
	Wage rate		% change	3.554	3.395	-1.529	-1.623

Conclusions

The results reported in this draft were obtained using the GEMPACK economic modelling software (Horridge et al. (2018), and Harrison and Pearson (1996)).

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