Trade, Labor Markets and the Role of Human Capital

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Introduction

Central Question: How does an economy's openness to international trade affect its workers?

- Heckscher-Ohlin model with perfectly mobile factors:
  – Winners and losers are characterized by the factors they own: Owners of the relatively abundant (scarce) factor gain (loose)
  – Goldberg and Pavcnik (2005), Feenstra and Hanson(2002)

- Heterogeneous firm models
  – Search or matching frictions – Davidson, Matusz, and Shevchenko (2008); Cosar, Guner, and Tybout (2011); Helpman, Itskhoki, and Redding (2010) and Sethupathy (2010)
  – Efficiency or fair wages – Egger and Kreickemeier (2009); Verhoogen (2008); Amiti and Davis (2011) and Davis and Harrigan (2011)
  – Gains/losses are firm-specific and depend on trade orientation of the firm
  – Frias, Kaplan and Verhoogen (2009); Amiti and Davis (2011); Hummels, Jorgensen, Munch and Xiang (2010); Krishna, Poole and Senses (2011)

Introduction

- Models incorporating sector-specificity:

  – Short-run Ricardo-Viner model with immobile factors:

    • Owners of factors specific to the exporting (import-competing) industry gain (loose)

  – Dynamic structural models on transition dynamics under barriers to mobility (Artuc, Chadhuri and McLaren (2010), Dix-Carneiro (2010), Cosar (2011)):

    • Robust findings (Artuc et al., 2010):

      • Moving costs are high

      • Wages are not equalized across sectors either in the short run or in the long run (unlike Stolper-Samuelson predictions).

      • Whether a worker benefits from liberalization or not depends much more closely on what sector the worker is in initially than on the worker's educational class

  – Higher costs of trade related displacements for industry switchers (Kletzer (2001); Krishna and Senses (2009)); Also see the labor literature on returns to specific human capital (Neal (1995), Parent (2000), Kambourov and Manovskii (2009), Gathmann and Schoenberg, 2010)

Motivation

Goal: Analyze the mechanisms through which globalization impacts the labor market, with emphasis on the differences in the *extent* and *nature* of human capital possessed by different workers.

Specialization versus a diversified portfolio of skills

- Acquisition of specific human capital impact the level of wages by improving the productivity in current job
- Acquisition of specific human capital impact the risk of displacement and the post-displacement outcomes
  - Specific human capital investments result in costlier job to job transitions; have higher relative return compared to general human capital investments if the duration of jobs is long and the labor market is tighter. (Wasmer, 2006)
    - Trade impacts the probability of displacement and the thickness of the labor market for workers with certain skills
- Heterogeneity in costs and benefits of specific human capital investment
  - Older workers with specialized skills will suffer most in response to a negative sectoral shock as their net future benefit of developing new skills for the expanding industry is lower (Rogerson, 2005)
    - Trade-displaced workers are documented to be older relative to other displaced workers

Questions

- Are displacements from high trade exposure industries more costly than those from low trade exposure industries in terms of:
    - Immediate wage loss
    - Long-term wage path
    - Unemployment duration

- Can specificity of human capital explain the difference in outcomes? Are workers displaced from trade-exposed industries more likely to:
    - Switch industries and lose industry-specific human capital?
    - Switch occupations and lose occupation-specific human capital?
    - Move to a "further occupation" and lose more of "task-specific human capital"?

Measures of Specific Human Capital

- Human capital of varying degrees of specificity:
    - Firm-specific human capital (Becker, 1964)
    - Industry-specific human capital (Neal, 1995; Parent, 2000)
    - Occupation-specific human capital (Kambourov and Manovskiii, 2009)

- Suppose a worker switches to a new occupation at a new firm in the same industry between time t and $t+1$:
    - At the end of $t+1$ experience and industry tenure will increase by 1 year
    - Firm and occupational tenure will be zero at the beginning of $t+1$ (All firm and occupation specific human capital is lost)
    - Problem:
        - Not all human capital from the previous occupation is necessarily lost when one switches occupations
        - Occupational tenure measure does not differentiate between different types of occupational moves:
            - Move 1: Professor to Politician
            - Move 2: Professor to Chef
        - Transferability of skills between occupations matter and is not captured by the occupational tenure measure

Occupational Distance

- Each occupation can be described as a 3-dimensional vector of task intensity $q_o=(q_{01},q_{02},q_{03})$ where q_{0j} denotes the intensities of each task used in a given occupation averaged across all sampled individuals in occupation j
  - 3 tasks are manual, interactive, analytical
  - For example, an occupation that is completely manual would be (1, 0, 0) and an occupation that uses each task at equal intensity would be (0.33, 0.33, 0.33)

- Define the closeness between two occupations *(o, o')* as the cosine angle between their positions in vector space:

$$AngSep_{oo'} = \frac{q_o * q_{o'}}{||q_o|| * ||q_{o'}||} = Closeness_{oo'}$$

- Define the distance between the two occupations as: $Dis_{oo'} = 1 - Closeness_{oo'}$

  - Varies between zero (identical task requirements) and one (orthogonal task requirements)
  - We have conducted robustness using:
    - Euclidian distance
    - 17 dimensional task vector instead of 3 dimensional task vector

Task-Specific Human Capital

- Captures the idea that some skills are transferable between occupations (Gathmann and Schoenberg, 2010; Poletaev and Robinson, 2008; Nedelkoska and Neffke, 2011)

- Definition:
  – Weighted sum of time spent in all previous occupations where the weights are the occupational "closeness" between current and all past occupations. (Gathmann and Schoenberg, 2006)
  – Moving to a "closer" occupation will preserve more specific human capital compared to moving to a more "distant" occupation
    - Move 1: Professor to Politician
    - Move 2: Professor to Chef

- Properties of Task Tenure:
  – Task tenure should never be greater than experience
    - Will be equal to experience for workers who never switched occupations
  – Task tenure should never be less than occupational tenure
  – If a worker remains in the same occupation, then task tenure, occupational tenure, and experience should all increase by the duration of the spell

Data

- Worker data – Sample of Integrated Labor Market Biographies (SIAB) from the Federal Employment Agency in Germany
    - 2% random sample of individuals (who were either employed or received unemployment benefits or who were registered as job-seekers); approximately 100,000 individuals
    - Main advantage: trace workers over time and across firms and job spells
    - Data is organized by spells. A new spell is recorded if:
        - individual separated from their job
        - individual experienced a pay change
        - end of the year
    - Employed individuals in this sample can be linked to limited firm information (location, number of employees and industry)
    - Worker data includes firm, occupation, daily wages, gender, education, nationality, unemployment duration and benefits
    - From 1975-2008
        - Sample Restriction: Dropped workers who entered the dataset in 1990-92:
            - We do not know whether the worker is actually entering the labor force or entering the dataset from East Germany which will confound human capital calculations

Data

- Task data – German Federal Institute for Vocational Education and Training (BIBB)
  - Employment Surveys of 1979, 1986, 1992, 1999, **2006**
  - Random sample of German labor force; repeated cross-sections; 20-30,000 individuals
  - 17 tasks for each occupation (242 occupations in sample)
    - Manufacturing of goods
    - Operating, controlling machine
    - Purchasing, selling
    - Promoting, marketing, public relations
    - Research, development
    - Gathering information, documenting
    - Entertaining, preparing food
    - Guarding, controlling traffic
    - Cleaning, waste disposal
    - Measuring, testing, quality control
    - Repairing
    - Transporting, storing, shipping
    - Organizing, making plans
    - Teaching, training
    - Consulting, advising
    - Taking care, healing
    - Working with computers

- Trade data – OECD
  - Data on import penetration for 17 industries from 1991 onwards

Summary Statistics

	All Industries		Manufacturing	
	Mean	Std. Dev.	Mean	Std. Dev.
Industry Tenure	4.93	5.77	5.14	6.03
Occupation Tenure	5.28	5.89	5.40	6.00
Firm Tenure	3.78	5.06	4.30	5.56
Task Tenure	8.03	6.81	8.70	7.12
Experience	8.21	6.92	8.90	7.24
Share of Female	48.25		36.96	
Share of College Graduates	10.16		10.20	

Empirical Specification – Wages and Specific Human Capital

$$w_{it} = \alpha_1 X_{it} + \alpha_2 Ind\_tenure_{it} + \alpha_3 Occ\_tenure_{it} + \alpha_4 Firm\_tenure_{it} + \alpha_5 Task\_tenure_{it} + Fixed\_Effects + \varepsilon_{it}$$

$Fixed\_Effects$: Industry, Year, Occupation, Firm-state (and Worker) fixed effects

X_{it} : (Gender), Experience, Nationality, Education

Empirical Specification – Wages and Specific Human Capital

	All industries		Manufacturing	
	OLS	FE	OLS	FE
Industry Tenure	0.005 ***	0.005 ***	0.004 ***	0.002 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Occupation Tenure	0.008 ***	0.007 ***	0.007 ***	0.004 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm Tenure	0.003 ***	0.001 ***	0.002 ***	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Task Tenure	0.081 ***	0.063 ***	0.069 ***	0.036 ***
	(0.001)	(0.002)	(0.001)	(0.003)
Experience	0.006 ***	0.047 ***	0.006 ***	0.070 ***
	(0.000)	(0.002)	(0.001)	(0.003)
Experience2	-0.002 ***	-0.002 ***	-0.002 ***	-0.002 ***
	(0.001)	(0.00)	(0.000)	(0.000)
Female	-0.254 ***		-0.276 ***	
	(0.001)		(0.001)	
Worker Fixed Effects	No	Yes	No	Yes
Other Fixed Effects	Yes	Yes	Yes	Yes
N	5,240,849	5,240,849	1,915,155	1,915,155

Involuntary Job Separation

- If the separation was followed by a period of unemployment of at least 90 days

- We focus on only one job to one job separations (for now):
  - Approximately 90% of job separations
  - Omit from the sample workers who switched from one job to more than one job, from more than one job to one job and between multiple jobs.

- Share of workers who experienced a separation

	All Sectors	All Manuf.	Net Exporters	Net Importers	Low import	High import
Any Seperation	8.06	7.53	7.5	7.66	7.36	7.69
Involuntary Seperations	3.02	2.82	2.74	3.12	2.65	2.97

Involuntary Job Separation- Worker Composition

	All Industries				Manufacturing			
	All Workers (N=5,240,849)		Involuntary Switchers (N=303,050)		All Workers (N=1,915,155)		Involuntary Switchers (N=109,064)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Industry Tenure	4.93	5.77	2.41	3.49	5.14	6.03	2.16	3.35
Occupation Tenure	5.28	5.89	2.66	3.74	5.40	6.00	2.46	3.66
Firm Tenure	3.78	5.06	1.74	2.73	4.30	5.56	1.69	2.84
Task Tenure	8.03	6.81	4.59	4.86	8.70	7.12	4.60	4.96
Experience	8.21	6.92	4.74	4.99	8.90	7.24	4.75	5.09
Share of Female	48.25		46.27		36.96		40.15	
Share of College Graduates	10.16		5.75		10.20		4.03	

Involuntary Job Separation- Change in Real Wages

	All Separations	No industry Switch	Industry Switch	No Occup. Switch	Occup. Switch
			Change in log real wages		
All Industries	-0.029	0.024	-0.055	0.018	-0.055
Manufacturing	-0.087	0.012	-0.131	0.003	-0.130
Above mean import pen.	-0.172	-0.001	-0.239	-0.020	-0.252
Below mean import pen.	0.034	0.030	0.036	0.030	0.036

	Change in log Real Wages
All workers	-0.087
Above mean industry tenure	-0.207
Below mean industry tenure	0.035
Above mean occup. tenure	-0.211
Below mean occup. tenure	0.036
Above mean firm tenure	-0.206
Below mean firm tenure	0.034
Above mean task tenure	-0.238
Below mean task tenure	0.041

Involuntary Job Separation- Distance and Change in Task Tenure

	Distance	Change in Task Tenure
Occup. Switch	0.09	-1.50
No industry Switch	0.01	-0.03
Industry Switch	0.08	-0.14

- Greater wage losses following involuntary job separation:
  - Workers with above average levels of specific human capital
  - Less educated workers
  - Workers who moved across industries or switched occupations
  - Workers displaced from high import penetration industries (or net-importing industries)

- 'Further' occupational move after involuntary separation for workers who moved across industries

Empirical Specification – Change in Real Wages Following an Involuntary Separation

$$\Delta w_{it} = \beta_1 X_{it-1} + \beta_2 Ind\_tenure_{it-1} + \beta_3 Occ\_tenure_{it-1} + \beta_4 Firm\_tenure_{it-1} + \beta_5 Task\_tenure_{it-1}$$
$$+ \beta_6 Imp\_Pen_{it-1} + Fixed\_Effects + \varepsilon_{it}$$

$Fixed\_Effects$: Industry, Year, Occupation, Firm-state (and Worker) fixed effects

X_{it} : Experience, Gender, Nationality, Education

Sample: Involuntary separations originating from the manufacturing sector

Empirical Specification – Change in Real Wages Following an Involuntary Separation

	Manufacturing	
	OLS	FE
Industry Tenure	-0.010 ***	-0.009 **
	(0.002)	(0.004)
Occupation Tenure	-0.013 ***	-0.007 **
	(0.001)	(0.003)
Firm Tenure	-0.007 ***	0.001
	(0.002)	(0.004)
Task Tenure	-0.022 ***	-0.081 ***
	(0.007)	(0.021)
Experience	0.011	-0.002
	(0.007)	(0.021)
Experience^2	0.000 ***	0.001 ***
	(0.000)	(0.000)
Female	-0.129 ***	
	(0.006)	
Import Penetration	-0.001 *	0.003
	(0.001)	(0.003)
Worker Fixed Effects	No	Yes
Other Fixed Effects	Yes	Yes
N	109,064	109,064

Empirical Specification – Change in Real Wages Following an Involuntary Separation

$$\Delta w_{it} = \beta_1 X_{it-1} + \beta_2 Ind\_switch_{it} + \beta_3 Occ\_switch_{it} + \beta_4 Ind\_tenure_{it-1} + \beta_5 Occ\_tenure_{it-1} + \beta_6 Firm\_tenure_{it-1}$$

$$+ \beta_7 Task\_tenure_{it-1} + \beta_8 \operatorname{Im}p\_Pen_{it-1} + \beta_9 Ind\_switch_{it} * \operatorname{Im}p\_Pen_{it-1} + \beta_{10} Occ\_switch_{it} * \operatorname{Im}p\_Pen_{it-1}$$

$$+ Fixed\_Effects + \varepsilon_{it}$$

$Fixed\_Effects$: Industry, Year, Occupation, Firm-state (and Worker) fixed effects

X_{it} : Experience, Gender, Nationality, Education

Sample: Involuntary separations originating from the manufacturing sector

Empirical Specification – Change in Real Wages Following an Involuntary Separation

	OLS		FE	
Industry Switch	-0.073 ***	-0.050 ***	-0.077 ***	-0.048 ***
	(0.006)	(0.007)	(0.013)	(0.015)
Ind_Switch*Imp_Pen		-0.002 ***		-0.002 ***
		(0.000)		(0.001)
Occupation Switch	-0.110 ***	-0.063 ***	-0.071 ***	-0.038 **
	(0.006)	(0.007)	(0.012)	(0.015)
Occ_Switch*Imp_Pen		-0.003 ***		-0.002 ***
		(0.000)		(0.001)
Industry Tenure	-0.012 ***	-0.012 ***	-0.007 *	-0.007 *
	(0.002)	(0.002)	(0.004)	(0.004)
Occupation Tenure	-0.015 ***	-0.016 ***	-0.007 **	-0.006 *
	(0.001)	(0.001)	(0.003)	(0.003)
Firm Tenure	-0.006 ***	-0.006 ***	0.001	0.001
	(0.002)	(0.002)	(0.004)	(0.004)
Task Tenure	-0.027 ***	-0.026 ***	-0.082 ***	-0.082 ***
	(0.007)	(0.007)	(0.021)	(0.021)
Experience	0.016 **	0.015 **	-0.002	-0.002
	(0.007)	(0.007)	(0.021)	(0.021)
Experience^2	0.000 ***	0.000 ***	0.001 ***	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.127 ***	-0.127 ***		
	(0.006)	(0.006)		
Import Penetration	-0.001 *	0.002 ***	0.000	0.004 ***
	(0.001)	(0.001)	(0.002)	(0.002)
Worker Fixed Effects	No	No	Yes	Yes
Other Fixed Effects	Yes	Yes	Yes	Yes
N	5,240,849	5,240,849	109,029	109,029

Empirical Specification – Change in Tenure following an Involuntary Separation

$$\Delta Industry\_tenure_{it} = \gamma_1 X_{it} + \gamma_2 Ind\_tenure_{it-1} + \gamma_3 Occ\_tenure_{it-1} + \gamma_4 Firm\_tenure_{it-1} + \gamma_5 Task\_tenure_{it-1}$$
$$+ \gamma_6 \operatorname{Im}port\_Penetration_{it-1} + Fixed\_Effects + \varepsilon_{it}$$

$$\Delta Occupation\_tenure_{it} = \gamma_1 X_{it} + \gamma_2 Ind\_tenure_{it-1} + \gamma_3 Occ\_tenure_{it-1} + \gamma_4 Firm\_tenure_{it-1} + \gamma_5 Task\_tenure_{it-1}$$
$$+ \gamma_6 \operatorname{Im}port\_Penetration_{it-1} + Fixed\_Effects + \varepsilon_{it}$$

$$\Delta Task\_tenure_{it} = \gamma_1 X_{it} + \gamma_2 Ind\_tenure_{it-1} + \gamma_3 Occ\_tenure_{it-1} + \gamma_4 Firm\_tenure_{it-1} + \gamma_5 Task\_tenure_{it-1}$$
$$+ \gamma_6 \operatorname{Im}port\_Penetration_{it-1} + Fixed\_Effects + \varepsilon_{it}$$

$Fixed\_Effects$: Industry, Year, Occupation, Firm-state (and Worker) fixed effects

X_{it} : Experience, Gender, Nationality, Education

Empirical Specification – Change in Tenure following an Involuntary Separation

	Change in Industry Tenure		Change in Occupation Tenure		Change in Task Tenure	
Industry Tenure	-0.633 ***	-1.076 ***	0.041 ***	0.005	0.001	-0.006
	(0.011)	(0.027)	(0.012)	(0.023)	(0.002)	(0.006)
Occupation Tenure	0.033 ***	0.053 ***	-0.643 ***	-1.124 ***	-0.003 *	0.004
	(0.007)	(0.015)	(0.009)	(0.019)	(0.002)	(0.004)
Firm Tenure	-0.135 ***	0.103 ***	-0.112 ***	0.146 ***	-0.011 ***	0.019 ***
	(0.012)	(0.028)	(0.012)	(0.027)	(0.002)	(0.005)
Task Tenure	-0.010	-0.064	0.125 ***	0.142 *	-0.524 ***	-1.110 ***
	(0.032)	(0.070)	(0.038)	(0.084)	(0.015)	(0.048)
Experience	0.105 ***	0.322 ***	0.005	0.172 **	0.487 ***	1.075 ***
	(0.030)	(0.074)	(0.035)	(0.087)	(0.014)	(0.047)
Experience2	-0.002 ***	-0.004 **	-0.001 **	-0.003 *	0.000 *	-0.001 ***
	(0.000)	(0.002)	(0.001)	(0.002)	(0.000)	(0.000)
Female	-0.019		0.139 ***		-0.045 ***	
	(0.014)		(0.015)		(0.004)	
Import Penetration	0.003	-0.018 ***	0.000	-0.009 **	-0.001 **	-0.004 ***
	(0.002)	(0.004)	(0.002)	(0.005)	(0.001)	(0.001)
Worker Fixed Effects	No	Yes	No	Yes	No	Yes
Other Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	116,257	116,257	117,113	117,113	113,018	113,018

Empirical Specification – Change in Task Tenure Following an Involuntary Separation

$$Industry\_Switch_{it} = \gamma_1 X_{it} + \gamma_2 Ind\_tenure_{it-1} + \gamma_3 Occ\_tenure_{it-1} + \gamma_4 Firm\_tenure_{it-1} + \gamma_5 Task\_tenure_{it-1}$$

$$+ \gamma_6 \operatorname{Im}port\_Penetration_{it-1} + Fixed\_Effects + \varepsilon_{it}$$

$$Occupation\_Switch_{it} = \gamma_1 X_{it} + \gamma_2 Ind\_tenure_{it-1} + \gamma_3 Occ\_tenure_{it-1} + \gamma_4 Firm\_tenure_{it-1} + \gamma_5 Task\_tenure_{it-1}$$

$$+ \gamma_6 \operatorname{Im}port\_Penetration_{it-1} + Fixed\_Effects + \varepsilon_{it}$$

$Fixed\_Effects$: Industry, Year, Occupation, Firm-state (and Worker) fixed effects

X_{it}: Experience, Gender, Nationality, Education

Empirical Specification – Industry and Occupation Switches

	Industry Switch		Occupation Switch	
Industry Tenure	-0.024 ***	0.022 ***	-0.004 ***	0.007 ***
	(0.001)	(0.002)	(0.001)	(0.002)
Occupation Tenure	-0.001	-0.002	-0.019 ***	0.009 ***
	(0.001)	(0.002)	(0.001)	(0.002)
Firm Tenure	0.007 ***	-0.007 ***	0.005 ***	-0.009 ***
	(0.001)	(0.002)	(0.001)	(0.002)
Task Tenure	-0.019 ***	0.000	-0.039 ***	-0.027 ***
	(0.004)	(0.009)	(0.004)	(0.008)
Experience	0.019 **	-0.016	0.035 ***	0.020 **
	(0.004)	(0.010)	(0.004)	(0.009)
Experience^2	0.000 ***	0.000 **	0.000 ***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.024 ***		0.000	
	(0.003)		(0.003)	
Import Penetration	0.001 *	0.003 ***	0.000	0.002 *
	(0.000)	(0.001)	(0.000)	(0.001)
Worker Fixed Effects	No	Yes	No	Yes
Other Fixed Effects	Yes	Yes	Yes	Yes
N	113,105	113,105	117,300	117,300

Summary

- Does globalization alter the net returns to specialization relative to acquisition of general human capital?
  - Duration of firm-worker match
  - Certain industries (or firms within an industry) shrink
    - Increased likelihood of loss of firm or industry specific human capital
    - Decline in bargaining power for those who stay
  - Increased risk of some tasks becoming obsolete (unpredictable)
    - Increased likelihood of loss of occupation specific human capital
    - Switches to more distant occupations

- Preliminary results indicate
  - Task tenure is important in wage determination
  - Displacements from high import penetration industries are more likely to be associated with an occupation or industry switch
  - Workers who switch industries or occupations experience a bigger wage decline following displacement and the decline in wages is higher for workers displaced from high trade exposure industries
    - One explanation for this finding: Trade-related displacements are associated with a bigger decline in industry, occupation and task tenure