How Import Competition Affects Displaced Manufacturing Workers in the U.S.

Ivan T. Kandilov

NC State University

I. Introduction

- Effects of trade on wages and employment
  - Krueger (1980); Grossman (1987); Mann (1988)
  - Freeman and Katz (1991), Sachs and Shatz (1994)
  - Revenga (1992)
- Effect of trade/import competition, esp. from developing (low-wage, LW) countries, on displaced workers *after* job displacement: **re-employment wage** and **unemployment duration**
  - Addison et al. (1995), Kletzer (2001), Kletzer (2002)
  - 10 Displaced Worker Survey (DWS), 1984-2002
  - bilateral U.S. imports data => import competition from developing countries
  - *within*-industry variation in import penetration to assess impacts on the re-employment wage

I. Introduction

- Main Results
  - re-employment wage is sensitive to industry of displacement imports from LW countries and not overall imports
    - if industry's imports from LW countries rise by **10** percent of the industry's domestic consumption, workers displaced from that industry face about **4.8 %** decline in re-employment wages
  - higher import competition in the industry of displacement leads to longer jobless spell duration, where imports from LW countries have twice as large of an impact
    - a worker displaced from an industry with **10** percent higher import penetration from LW countries experiences about **2.7 weeks** longer jobless spell duration
  - the effect of an increase in imports from LW countries is smaller than the impact of another proxy for a decrease in product demand – the state unemployment rate
  - the effect of import competition on wages appears to be due to worker industry re-location – loss of industry specific human capital/training

I. Introduction

- Imports from LW countries
  - lower prices (unit-values) than overall imports, Schott (2002)
  - tenfold increase in imports from LW countries, 1980-2000

Table 1. Manufacturing Import Penetration (as a fraction of total domestic manufacturing consumption), 1979-2001.

Year	Manufacturing Import Penetration	Manufacturing Import Penetration from **LW Countries**	Manufacturing Import Penetration from LW Countries without China
1979	0.079	**0.003**	0.003
…	…	**…**	…
1990	0.139	**0.009**	0.005
…	…	**…**	…
2001	0.218	**0.034**	0.011

II. Theory

1. Basic continuous time version of the standard job search model

$$w^r = b + \frac{\pi}{r}\int_{w^r}^{\infty}(w - w^r)dF(w) \qquad (4)$$

w^r – equilibrium reservations wage

b – unemployment benefit

π – job offer arrival rate

r – known and constant discount rate

$F(w)$, $f(w)$ – wage offer distribution, density, with finite mean μ, and variance σ

E[T]=1/τ, where $\tau = \pi\int_{w^r}^{\infty} f(w)dw = \pi(1 - F(w^r))$

- Effects of μ on E[w|w$\geq w^r$] and E[T]

II. Theory

2. Grossman (1983), Hill and Mendez (1983)
   - extension of Ricardo-Viner (specific factors model)
   - factors (K, L) are partially mobile, i. e. instantaneously but not costlessly transferable between the two sectors, manufacturing and technology

   Conclusions: The higher the import competition in the manufacturing sector (the larger the price decline due to imports):

   a) the larger the likelihood of displacement from manufacturing and re-location to the technology sector
   b) the larger the number of workers with higher re-location costs (manufacturing specific human capital) re-located to the technology sector
   c) the lower equilibrium wage (offers) per efficiency unit of labor in both sectors

II. Theory

3. Higher import competition in the industry of displacement leads to lower wage offers for displaced workers
   - assume lower wage offers translate into a uniform leftward shift in the wage offer distribution, which only lowers its mean, μ
   - Consequences for E[w|w$\geq w^r$] and E[T] (Burdett and Ondrich (1985)) :

$$\frac{dE_w[w \mid w \geq w^r]}{d\mu} > 0 \quad (6), \text{ and } \quad \frac{dE[T]}{d\mu} < 0 \quad (7)$$

   - similar results for, π, the job offer arrival rate

III. Data

- Displaced Workers' Survey (DWS)
  - biennial supplement to the January or February CPS
  - only large-scale and nationally representative
  - first DWS instituted in January of 1984
  - 10 DWS's from 1984 to 2002
  - data on displaced workers from 1979 to 2001
  - workers displaced in the 3 (or 5) years prior to the survey
  - information on both old and new employment including previous and current wages, industry, occupation, and duration of unemployment, etc.

Sample: workers displaced from full-time manufacturing employment, between 21 and 65 at displacement

III. Data

- Feenstra et al. (2002) NBER trade dataset
  - disaggregate manufacturing industry-level (4-digit SIC) time series of bilateral U.S. imports from 1979 to 2001
- Data on industry output (shipments) (BEA)
- Construct 2 measures of import competition/penetration

$$IndImp_j = \frac{M_j}{Q_j - X_j + M_j}, \quad IndImp_j^{LW} = \frac{M_j^{LW}}{Q_j - X_j + M_j}$$

- Country is low-wage (LW) if its per capita GDP is 5 % or less of the U.S. per capita GDP (China, India, Indonesia, Philippines)
- Match the annual industry import competition measures to the displaced workers' industry and year of displacement in DWS
- Data on state unemployment rate (BLS)

Table 2. Summary Statistics	Displaced from Manufacturing and Re-employed			Displaced from Manufacturing		
Variable	Mean	Standard Deviation	N	Mean	Standard Deviation	N
Fraction re-employed at date of survey	1.00	-	10,013	0.76	-	13,262
Current weekly wage (constant 2003 dollars)	630.80	409.22	8,883	-	-	-
Current weekly hours	39.65	13.19	9,798	-	-	-
Lost weekly wage in (constant 2003 dollars)	685.64	413.89	8,902	666.30	404.28	11,820
Unemployment duration (two-week intervals)	10.66	12.41	8,955	11.87	13.28	12,075
Changed industry from lost to current job	0.81	-	10,013	-	-	-
Left manufacturing after job loss	0.54	-	10,013	-	-	-
Annual state unemployment rate	**0.07**	**0.02**	**10,013**	**0.07**	**0.02**	**13,262**
Industry Import Penetration	0.144	0.132	9,960	0.148	0.135	13,190
Industry Import Penetration from Low-wage Countries	**0.015**	**0.041**	**9,960**	**0.016**	**0.043**	**13,190**
Industry Import Penetration from Low-wage Countries excluding China	0.007	0.020	9,960	0.008	0.021	13,190

IV. Identification and Results 1

1. Unemployment duration

$$\ln(U_{ikjst}^{duration}) = \beta_0 + \mathbf{X}_{ikjst}\boldsymbol{\beta}_1' + \beta_2 IndImp_{jt}^{LW} + \delta_k + \lambda_j + \tau_t + \sigma_s + \varepsilon_{ikjst},$$

- interrupted (right-censored) jobless spells => Maximum Likelihood
- hazard rate (of leaving unemployment) may exhibit duration dependence

  => non-parametric base-line hazard

  => parameterize the baseline hazard, e.g. using Weibull model (monotonic hazard), whose AFT representation implies type I extreme value distribution for the error term above
- piling of durations at even weeks => group into two-week intervals
- estimated coefficients for all RHS variables when using non-parametric base-line hazard specification are nearly identical to those from a Weibull model

IV. Identification and Results 1

- Convert the unit of analysis from a displaced worker to a jobless spell interval (two-week period) at risk of leaving unemployment
- Hazard function: $\phi(t;\mathbf{Z}_i,\boldsymbol{\eta})$
- Log-likelihood: $\log L_1 = \sum_{i=1}^{N} \sum_{h=1}^{m(i)-1} \log[\alpha_h(\mathbf{Z_i},\boldsymbol{\eta})] + d_i \log[1-\alpha_{m(i)}(\mathbf{Z_i},\boldsymbol{\eta})]$ (8) ,

  where $\alpha_m(\mathbf{Z},\boldsymbol{\eta}) \equiv \exp\left[-\int_{m-1}^{m} \phi(t;\mathbf{Z},\boldsymbol{\eta})ds\right]$

- Piece-wise constant proportional hazard: $\phi(t;\mathbf{Z}_i,\boldsymbol{\eta}) = \exp(\mathbf{Z}_i\boldsymbol{\eta})\phi_m$ (9) , for m =1, 2, …, 79, and $m\text{-}1 \le t < m$

  with $\boldsymbol{Z_i} = [\mathbf{X}_{ikjst} | IndImp_{jt}^{LW} | U_{st}^{RATE} | \delta_k | \lambda_j | \sigma_s | \tau_t]$

IV. Identification and Results 1

- Alternatively, Weibull specification: $\phi(t;\mathbf{Z}_i,\boldsymbol{\eta}) = \exp(\mathbf{Z}_i\boldsymbol{\eta})\varphi t^{\varphi-1}$ (10)

- Log-likelihood: $\log L_2 = \sum_{i=1}^{N}\left\{d_i \log[f(t_i|\mathbf{Z}_i,\boldsymbol{\eta})] + (1-d_i)\log[1-F(t_i|\mathbf{Z}_i,\boldsymbol{\eta})]\right\}$ (11)

  where $f(t_i|\mathbf{Z}_i;\boldsymbol{\eta}) = \exp(\mathbf{Z}_i\boldsymbol{\eta})\varphi t^{\varphi-1}\exp[-\exp(\mathbf{Z}_i\boldsymbol{\eta})t^{\varphi}]$

Table 4. Panel A: Dependent Variable – Hazard rate of leaving unemployment. All specifications include industry of displacement, lost job occupation, state, year of displacement, and year of the survey dummies. Additional controls include education (6 categories), age, age squared, lost job tenure, the natural logarithm of the lost weekly wage, gender, race, marital status, and metropolitan residence status. Covariates are suppressed.

Variable	4.1	4.2	4.3	4.4	4.5	4.6
$IndImp_{jt}$	- 0.55*** (0.21)	-	- 0.29 (0.27)	- 0.56** (0.23)	-	- 0.26 (0.30)
$IndImp_{jt}^{LW}$	-	- 1.03*** (0.28)	- 0.71* (0.40)	-	- 1.09*** (0.32)	- 0.79* (0.44)
U_{st}^{RATE}	- 8.69*** (1.03)	- 8.73*** (1.05)	- 8.69*** (1.03)	- 9.02*** (1.06)	- 9.06*** (1.08)	- 9.02*** (1.07)
$\hat{\varphi}$	-	-	-	0.95*** (0.01)	0.95*** (0.01)	0.95*** (0.01)
Log Likelihood	- 29,282	- 29,282	- 29,281	- 16,351	- 16,350	- 16,349
N	10,736	10,736	10,736	10,736	10,736	10,736

Table 4. Panel B: Dependent Variable – Unemployment Duration. AFT representation from the Weibull model (11). All specifications include industry of displacement, lost job occupation, state, year of displacement, and year of the survey dummies. Additional controls include education (6 categories), age, age squared, lost job tenure, the natural logarithm of the lost weekly wage, gender, race, marital status, and metropolitan residence status. Covariates are suppressed.

Variable	4.7	4.8	4.9	4.14
$IndImp_{jt}$	0.59**	-	0.28	-
	(0.24)		(0.31)	
$IndImp_{jt}^{LW}$	-	1.14***	0.83	1.00***
		(0.33)	(0.46)	(0.33)
U_{st}^{RATE}	9.46***	9.50***	9.45***	10.75***
	(1.09)	(1.11)	(1.09)	(1.22)
$\hat{\varphi}$	0.95***	0.95***	0.95***	1.30***
	(0.01)	(0.01)	(0.01)	(0.03)
$1/\theta$	-	-	-	0.75***
				(0.06)
Log Likelihood	- 16,351	- 16,350	- 16,349	- 16,155
N	10,736	10,736	10,736	10,736

IV. Identification and Results 2

2. Re-employment wage regression

$$\ln(w_{ikjst}^{re-employment}) = \beta_0 + \boldsymbol{X}_{ikjst}\boldsymbol{\beta}_1' + \beta_2 IndImp_{jt}^{LW} + \beta_3 U_{st}^{RATE} + \delta_k + \lambda_j + \sigma_s + \tau_t + \varepsilon_{ikjst},$$

- $\ln(w_{ikjst}^{re-employment})$ is the logarithm of the weekly re-employment wage for an individual *i* in the year of the survey *k*, displaced from an industry *j* in year *t*, and residing in state *s*
- X_{ikjst} is a vector of personal characteristics for the individual *i*
  - education (6 categories), age, age^2, tenure and occupation on the lost job, the logarithm of the lost job weekly wage rate, state unemployment rate in the year of displacement, and dummies for race, gender, marital status, and metropolitan area residence
- Compute robust standard errors clustered by industry of displacement

Table 5. Dependent Variable - $\ln(w_{ikjst}^{re-employment})$. All specification include industry of displacement, lost job occupation, state, year of displacement, and year of the survey dummies. Additional controls include education (6 categories), age, age squared, lost job tenure, the natural logarithm of the lost weekly wage, gender, race, marital status, and metropolitan residence status. Covariates are suppressed.

Variable	5.1	5.2	5.3	5.10	5.12
$IndImp_{jt}$	- 0.21** (0.09)	-	- 0.07 (0.12)	-	-
$IndImp_{jt}^{LW}$	-	- 0.48*** (0.10)	- 0.40*** (0.15)	- 0.72*** (0.18)	- 0.83* (0.47)
U_{st}^{RATE}	- 2.29*** (0.52)	- 2.28*** (0.52)	- 2.28*** (0.52)	- 2.18*** (0.57)	- 2.02*** (0.58)
Industry Trends	-	-	-	-	Yes
State Trends	-	-	-	-	Yes
R^2	0.45	0.45	0.45	0.48	0.46
N	7,781	7,781	7,781	3,925	7,781

Table 6. Industry and sector relocation upon re-employment. All regressions include industry of displacement, lost job occupation, state, year of displacement and year of the survey dummies. Additional controls include education (6 categories), age, age squared, lost job tenure, the natural logarithm of the lost weekly wage, gender, race, marital status, and metropolitan residence status. Covariates are suppressed.

Panel A: Linear probability model for leaving industry of displacement and for leaving manufacturing

Variable	6.1	6.2
	Leave pre-displacement industry	Leave manufacturing
$IndImp_{jt}^{LW}$	0.12	0.34**
	(0.19)	(0.17)
U_{st}^{RATE}	- 1.03***	- 0.44
	(0.30)	(0.39)
R^2	0.14	0.11
N	12,412	12,412

Table 9. Dependent Variable - $\ln(w_{ikjst}^{re-employment})$. All regressions include industry of displacement, lost job occupation, state, year of displacement and year of the survey dummies. All Covariates are suppressed.

Variable	6.3	6.4	6.5	6.6
	Stayed in pre-displacement industry	Left pre-displacement industry	Stayed in manufacturing	Left manufacturing
$IndImp_{jt}^{LW}$	- 0.18 (0.22)	- 0.55*** (0.15)	- 0.09 (0.14)	- 0.59*** (0.15)
U_{st}^{RATE}	0.34 (0.91)	- 2.81*** (0.54)	- 0.54*** (0.52)	- 3.21*** (0.74)
R^2	0.70	0.43	0.61	0.41
N	1,523	6,258	3,732	4,049

V. Conclusion

- Main Results
  - re-employment wage is sensitive to industry of displacement imports from LW countries and not overall imports
    - if industry's imports from LW countries rise by **10** percent of the industry's domestic consumption, workers displaced from that industry face about **4.8 %** decline in re-employment wages
  - higher import competition in the industry of displacement leads to longer jobless spell duration, where imports from LW countries have twice as large of an impact than overall imports
    - a worker displaced from an industry with **10** percent higher import penetration from LW countries experiences about **2.7 weeks** longer jobless spell duration
  - the effect of increase in imports from LW countries is smaller than the impact of another proxy for decrease in product demand – the state unemployment rate
  - the effect of import competition on wages appears to be due to worker industry re-location – loss of industry specific human capital/training