Winter 2007

Import Competition and Job Displacement: Evidence from US Manufacturing, 1981-1999

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I. INTRODUCTION

The public debate surrounding trade has become increasingly contentious and divisive and, while several studies examine the effects of import competition on net employment or job displacement, none consider variation in effects across worker types. I examine the imports-job displacement relationship using trade quantity and price data with industry-level displacement rates calculated from Displaced Worker Survey data. Potential heterogeneity in trade-related employment effects is addressed for union and non-union workers, lesser-educated and more-educated workers, and young compared to more mature workers. The analysis provides for a more informed and more fruitful debate.

Individuals favoring increased trade and those advocating protectionism transcend political party affiliation, industry, occupation, geographic locale, income level, age, and other socioeconomic and demographic factors. Supporters cite reduced prices, greater variety, and productivity gains as expected benefits. Those opposed argue that job loss, due to firm relocation or plant closure, as a reason to slow or halt liberalization. Several

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ISSN: 0885-3908 print/1521-0545 online. DOI: 10.1080/08853900601107933

polls reflect the perceived threat of trade to employment.[1] For example, a 2004 PIPA/Knowledge Networks poll reports 63 percent of respondents feel that trade leads to net job loss, while only 8 percent believe that, on net, trade creates jobs (Kull, 2004).

A second factor motivating this study is the lack of consensus in the literature regarding the employment effects of import competition. Surveying the literature, Blanchflower (2000) concludes that factors such as technology, immigration, declining unionism, and falling real minimum wages may explain observed employment effects. However, earlier surveys found imports reduce domestic employment with labor-intensive industries most affected (Belman and Lee, 1996; Baldwin, 1995; Dickens, 1988).

Two measures of import competition are used here: changes in import penetration rates and in import price indices. While the data cannot identify the impetus for increased import competition, these measures potentially capture many events that signal import competition. For example, lower tariffs may increase competition for domestic firms as product prices fall.[2] Further, tastes shifting towards imports may increase import penetration rates without a coinciding price decrease.[3] Nonetheless, use of import penetration rates is subject to an endogeneity critique and price indexes are likely to be heterogeneous within three-digit industry classifications. As a result, the relationships reported cannot be verified as causal. That said, a finding of heterogeneity with respect to the effects of import competition on displacement rates across worker types may

[1]Scheve and Slaughter (2001) review numerous such polls.

[2]Trefler (2001) reports employment decrease in Canadian industries subjected to large tariff cuts while Gaston and Trefler (1997) report Canadian non-agricultural employment decreases.

[3]Freeman and Katz (1991) find a 10 percent rise in the import penetration rate reduced U.S. manufacturing employment 5 to 6 percent. Kletzer (2000) concludes imports contribute small but significant amounts to displacement. Revenga (1997) reports reduced quota coverage led Mexican employment to fall by 2 to 3 percent.

lend greater weight to a hypothesized causal link between imports and job displacement.

II. THEORETICAL FRAMEWORK

The Heckscher-Ohlin-Samuelson model predicts that as a relatively capital-abundant country, increased trade with labor-abundant countries results in proportional reductions in U.S. labor-intensive production and increased output of capital-intensive goods. This entails a migration of labor toward capital-intensive production, with some workers voluntarily changing jobs while others suffer displacement. Displacement is a serious consequence as, typically, workers face associated earnings losses that begin prior to displacement and persist for several years once reemployed (Jacobson, LaLonde, and Sullivan, 1993; Stevens, 1997; Kletzer and Fairlie, 2003).

To analyze the import competition-displacement relationship, I use a partial equilibrium framework following Mann (1988), Freeman and Katz (1991), and Kletzer (2002). The result is two equations presenting the change in industry displacement rates as functions of industry characteristics and changes in the level and composition of sales and prices.[4]

$$(1) \quad \ln\ DISPLACEMENT\ RATE_{jt} = f\left(d\ln D_{jt}, d\left[\frac{M}{D}\right]_{jt},\ d\ln X_{jt},\ d\ln V_{jt}\right)$$

$$(2) \quad \ln\ DISPLACEMENT\ RATE_{jt} = f\left(d\ln P^{D}_{jt},\ d\ln P^{M}_{jt},\ d\ln P^{X}_{jt},\ d\ln V_{jt}\right)$$

D_{jt} represents domestic demand, the import penetration rate is given as $\left[\frac{M}{D}\right]_{jt}$, X_{jt} represents exports. P^{D}_{jt}, P^{M}_{jt}, and P^{X}_{jt} denote domestic prices, import prices, and export prices,

[4]Trade-weighted exchange rates, an instrument for real import prices, offer an alternative measure of import competition. Revenga (1992) employs U.S, manufacturing data for the years 1977–1987 and finds a 10 percent increase in trade-weighted exchange rates decreased industry employment by 2.4 to 3.9 percent.

respectively. The vector V_{jt} represents time-varying industry characteristics, while subscripts j and t indicate industry and time, respectively.

III. DATA

Industry-level c.i.f. (cost, insurance, freight) import and f.o.b. (free on board) export data for 1981–1994 is from the NBER Trade database (Feenstra, 1996, 1997) and, for 1995, is from the U.S. International Trade Commission Trade database. Data on industry output, employment, payroll, capital stock, and capital investment for 1981–1995 is from the NBER-U.S. Census Bureau's Center for Economic Studies Manufacturing Industry database (Bartelsman and Gray, 1996). Post-1996 data is classified using the North American Industrial Classification System, which is not compatible with the 3-digit CIC level of detail. Thus, examination of the import penetration-job displacement relationship is restricted to the 1984 through 1996 Displaced Worker Surveys (DWS). Import and export price indices for 1981–1999 are from the U.S. BLS International Price Program. Creation of an SITC-to-SIC-to-CIC concordance permitted mapping of price data to the CIC classification (Office of Management and Budget, 1987; United Nations, 1986).[5]

Displacement rates are created using DWS data (U.S. Department of Commerce, 2001). A biennial supplement to the Current Population Survey (CPS), the DWS is the only survey that collects detailed information regarding displacement from a nationally-representative sample. The CPS reports respondents' age, education, union status, and industry of employment as of the survey date. When applicable,

[5]The industry concordance is available upon request from the author.

the DWS reports the industry the worker was displaced from. These industry variables permit investigation of the effects changes in industry-level variables may have on displacement rates. The DWS classifies a worker as displaced if they lost a job in the 5 years (1984–1992 DWSs) or 3 years (1994–2000 DWSs) prior to their survey date due to:

(1) plant/company closed or moved,
(2) plant/company still open, but lost job due to slack or insufficient work;
(3) plant/company still operating, but position or shift was abolished.[6]

The data cover 77 three-digit CIC manufacturing industries for each DWS conducted between 1984 and 2000.[7] To calculate displacement rates, each DWS worker observation, denoted as i, was classified as having been displaced or not during the two-years prior to their survey year. Observations were then weighted and the weighted samples merged.[8] Displacement rates were then calculated for the full sample, for union and non-union workers, four education classifications (high school dropouts; high school graduates; some college education; B.A./B.S. or more), and age categories (20–24 years of age; 25–34 years; 35–44 years; 45–54 years; 55–64 years).[9] Equation (3) illustrates.

[6]Additionally, to be classified as displaced, a worker could not have been self-employed and (for the 1994–2000 DWS supplements), as of the survey date, did not expect to be recalled to the job within 6 months.

[7]Due to missing data for Leather Tanning and Finishing, the total number of industry observations is 692.

[8]The CPS final weight was used as no Displaced Worker weight was available prior to the 1996 Survey.

[9]Workers are considered union members if members of a labor union or association or covered under a collective bargaining agreement.

$$(3) \quad DISPLACEMENT\ RATE_{jt} = \left(\frac{\sum_{i=1}^{n} DISPLACED}{\sum_{i=1}^{n} EMPLOYMENT + \sum_{i=1}^{n} DISPLACED} \right)_{ijt}$$

Given that a time lag may exist between changes in import competition and labor market adjustment, I regress the vector of displacement rates separately on two- and three-year changes in import penetration rates and import price indices.[10] As individuals are surveyed in either January of February of year t, two-year changes are differences from year t-3 to year t-1. Three-year changes are differences between years t-4 and t-1.

Bernard and Jensen (1995) and Girma, Greenaway, and Kneller (2004) report higher employment growth for exporters. As increases in exports and domestic demand correspond with lower displacement rates (Kletzer, 1998a, 2002), I include changes in domestic and foreign demand and in export price indices. Technological advances may reduce employment (Krugman and Lawrence, 1993; Lawrence and Slaughter, 1993; Berman, Bound, and Griliches, 1994; Addison, Fox, and Ruhm, 1995, 2000; Berman, Bound, and Machin, 1998; Kletzer, 1998b).[11] To control for this possibility, I create Solow Residuals from constant returns to scale Cobb-Douglas production functions with assumed constant expenditure shares (Solow, 1957). As displacement is a counter-cyclical occurrence (Carrington, 1993; Jacobson, LaLonde, and Sullivan, 1993; Fallick, 1996; Kletzer, 1998b; Farber, 2005), I include the one-year change in the sector capacity utilization rate and its one-year lagged value. Competition

[10]Four- and five-year changes were also considered; however, the estimations employing the two- and three-year changes yield the strongest relationship between import competition and displacement.

[11]Advances in technology resulting from research and development expenditures may also reduce employment. The potential simultaneity problem makes separation of the displacement effects of trade and technological change difficult if not impossible.

from labor-abundant nations may increase displacement risk for domestic workers. I include capital-labor ratios given as the sum of industry plant and equipment stocks to production employment.

Table 1 presents displacement rates and descriptive statistics. For the full sample, the mean industry displacement rate is 7.6 percent. The mean rate of union workers (17.6 percent) is more than twice the non-union rate (7.9 percent). Displacement rates generally decrease with educational attainment. Workers without a high school diploma have a higher mean displacement rate (14 percent) than do college graduates (10.4 percent). Displacement rates generally decrease with age. Mean changes in both import and export price indices were positive. Average changes in exports and technology were positive with export growth being larger than average increases in domestic demand and import penetration rates.

IV. EFFECTS OF INCREASED IMPORT COMPETITION ON INDUSTRY DISPLACEMENT RATES

Applying the variables presented in Section 3 to equations (1) and (2) yields equation (4), where import competition is represented by increasing import penetration rates, and equation (5), where import price index declines represent import competition.[12]

[12]Industry-level data regarding capital-labor ratios and technology is only available through 1995, these control variables are not included in equation (5). The result is an estimation equation for the period 1981–1999. Inclusion of industry control variables would dictate reducing the sample period to 1981–1995.

Table I
Displacement Rates and Descriptive Statistics

Displacement Rates:	Mean	N	Descriptive Statistics (full sample):	Mean	N
All Workers	0.076	617	Δ ln Import Penetraton Rate (2-year Δ)	0.091	533
	(0.049)			(0.27)	
Union Workers	0.176	73	Δ ln Import Penetration Rate (3-year Δ)	0.133	533
	(0.144)			(0.336)	
Non-Union Workers	0.079	615	Δ ln Import Price Index (2-year Δ)	0.015	296
	(0.052)			(0.115)	
Skill Level:			Δ ln Import Price Index (3-year Δ)	0.025	288
				(0.161)	
< High School Diploma	0.140	329	Δ ln Exports (2-year Δ)	0.131	533
	(0.115)			(0.341)	
High School Diploma	0.114	378	Δ ln Exports (3-year Δ)	0.207	533
	(0.116)			(0.451)	
Some College	0.100	497	Δ ln Exports Price Index (2-year Δ)	0.030	235
	(0.080)			(0.086)	
B.A./B.S. or Higher	0.104	343	Δ ln Exports Price Index (3-year Δ)	0.047	225
	(0.091)			(0.117)	
Age:					
20 to 24 years of age	0.139	336	Δ ln Domestic Market (2-year Δ)	0.088	533
	(0.118)			(0.143)	
25 to 34 years of age	0.111	477	Δ ln Domestic Market (3-year Δ)	0.133	533
	(0.093)			(0.229)	
35 to 44 years of age	0.102	426	Δ ln Technology (2-year Δ)	0.091	530
	(0.078)			(0.199)	
45 to 54 years of age	0.109	374	Δ ln Technology (3-year Δ)	0.146	530
	(0.087)			(0.306)	
55 to 64 years of age	0.145	293	Δ ln Capacity Utilization Rate (1-year Δ)	0.013	692
	(0.126)			(0.037)	
			ln Capital-Labor Ratio$_{jt}$	4.145	536
				(0.726)	

Standard errors in parentheses. Displacement rates are calculated as the weighted number of observations categorized as displaced in each group divided by the total weighted number of all observations in that group. Values presented are the mean industry values for each variable. N indicates the number of industry-level observations. The reference period is 1981–1999; however, for the non-price-level industry variables the reference period is 1981–1995.

$$
\begin{aligned}
\ln DISPLACEMENT\ RATE_{jt} &= \alpha_0 \\
&+ \beta_1 \ln CAPITAL - LABOR\ RATIO_{jt} \\
&+ \beta_2 \Delta \ln CAPACITY\ UTILIZATION\ RATE_t \\
&+ \beta_3 \Delta \ln CAPACITY\ UTILIZATION\ RATE_{t-1} \\
&+ \beta_4 \Delta \ln TECHNOLOGY_{jt} + \beta_5 \Delta \ln DOMESTIC_{jt} \\
&+ \beta_6 \Delta \ln EXPORTS_{jt} \\
&+ \beta_7 \Delta \ln IMPORT\ SHARE_{jt} + \varepsilon_{jt}
\end{aligned} \tag{4}
$$

$$
\begin{aligned}
\ln DISPLACEMENT\ RATE_{jt} &= \alpha_0 \\
&+ \beta_1 \Delta \ln CAPACITY\ UTILIZATION\ RATE_t \\
&+ \beta_2 \Delta \ln CAPACITY\ UTILIZATION\ RATE_{t-1} \\
&+ \beta_3 \Delta \ln EXPORT\ PRICE_{jt} \\
&+ \beta_4 \Delta \ln IMPORT\ PRICE_{jt} + \varepsilon_{jt}
\end{aligned} \tag{5}
$$

Table II reports the estimation results for the full sample.[13] Column (1) contains the coefficient representing the effect of a two-year change in import penetration rates. A one percent increase leads to a 0.38 percent increase in the industry displacement rate. Column (2) reports the effects of the three-year change in import penetration rate: The industry displacement rate rises by 0.23 percent due to a one percent increase in import competition. Columns (3) and (4) report coefficients for two- and three-year import price index changes: A one percent decrease in the import price index over a two-year span increases industry displacement rates by 1.31 percent increase. Similarly, one percent changes in the import price index over a three-year period increase displacement rates by 1.48 percent. These values are similar to

[13]Industry and DWS-specific fixed effects are allowed for. An F-test determined if a fixed effects or common intercept specification was appropriate.

Table II
All Workers (Dependent Variable: ln Displacement Rate$_{jt}$)

	Quantity Estimations		*Price Estimations*	
Variable	(1)	(2)	(3)	(4)
Δ ln Import Penetration Rate$_{jt}$ (2-year Δ)	0.384**			
	(0.097)			
Δ ln Exports$_{jt}$ (2-year Δ)	−0.197*			
	(0.088)			
Δ ln Import Penetration Rate$_{jt}$ (3-year Δ)		0.23**		
		(0.007)		
Δ ln Exports$_{jt}$ (3-year Δ)		−0.077		
		(0.067)		
Δ ln Import Price Index$_{jt}$ (2-year Δ)			−1.311*	
			(0.551)	
Δ ln Import Price Index$_{jt}$ (2-year Δ)			0.181	
			(0.728)	
Δ ln Import Price Index$_{jt}$ (3-year Δ)				−1.483**
				(0.362)
Δ ln Import Price Index$_{jt}$ (3-year Δ)				0.832
				(0.527)
Δ ln Domestic Market$_{jt}$ (2-year Δ)	−0.435#			
	(0.226)			
Δ ln Domestic Market$_{jt}$ (3-year Δ)		−0.358*		
		(0.171)		
Δ ln Technology$_{jt}$ (2-year Δ)	0.345#			
	(0.182)			
Δ ln Technology$_{jt}$ (3-year Δ)		0.335*		
		(0.136)		
Δ ln Capacity Utilization Rate$_{t}$ (1-year Δ)	−1.236	−0.878	1.519	0.451
	(0.941)	(0.943)	(1.934)	(1.762)
Δ ln Capacity Utilization Rate$_{t-1}$ (Lagged 1-year Δ)	−4.325**	−4.572**	−0.914	0.445
	(0.857)	(0.873)	(1.678)	(1.636)
ln Capital-Labor Ratio$_{jt}$	0.193	0.216		
	(0.226)	(0.234)		
Constant			−2.844**	−2.867**
			(0.048)	(0.046)
N	473	473	175	162
Adjusted R^2	0.26	0.25	0.05	0.07

Heteroskedasticity-consistent robust standard errors in parentheses. "**," "*," and "#" denote statistical significance at the 1%, 5%, and 10% levels, respectively.

those of Haveman (1998) who reports annual 1 percent decreases in import prices increase industry displacement rates by 1.6 percent.

The remaining coefficients provide interesting results. The coefficients on both the two- and three-year changes in the technology variable are positive and significant, implying that technology may be labor displacing. Business cycle downturns appear to coincide with increased displacement rates. Similarly, the coefficients on the changes in exports and domestic market size variables are generally significant and negative as expected with the coefficients on the domestic market variables the larger of the two.

The results also permit examination of the effects exports have on displacement. In 11 of the 13 estimations, coefficients on the two-year change in exports are negative while in 8 of the 13 estimations coefficients on the three-year change in exports are negative. Frequently, coefficients are significant. Comparing magnitudes of significant coefficients on the two- and three-year changes in the import penetration rate variable to coefficients on the two- and three-year changes in the exports variable, the former are greater than the latter by a factor of 1.9 times, on average, in the "two-year change" case and 1.7 times in the "three-year change" case. This suggests equal proportional increases in import penetration rates and exports may generate a net displacement rate increase.

Relative effects of domestic demand increases can also be analyzed. Coefficients are negative in 22 of 26 estimations and significant in nearly one-half of the cases, implying domestic demand increases correspond to decreases in displacement rates. When the magnitude of significant coefficients on two- and three-year changes in domestic demand are compared to coefficients on two- and three-year change in import penetration rate, the former exceed the latter by an average factor of 1.6 in the "two-year change" case and 2.5 in the "three-year change" case. Thus, equal proportional domestic demand and import penetration

rate increases may be associated with a net decrease in displacement.

Educational attainment serves to proxy for skill. Tables III and IV present associated results. Effects are strongest on displacement rates of high school graduates; where one percent increases in two- and three-year import penetration rates increase displacement rates by 0.83 and 0.68 percent, respectively. For workers who have completed some college the coefficient, 0.25, is marginally significant. Considering the effect of changes in import price indices, the coefficients on the three-year change in the import price variable for workers with a high school diploma imply a one percent decrease in import prices is associated with a 2.06 percent increase in the displacement rate. The coefficient of workers who have completed some college, −1.16, is significant but of lesser magnitude.

Surprisingly, displacement rates for neither the high school dropouts nor college graduates increase with import competition. For college graduates, this may be due to such workers more likely employed in non-production positions. A second explanation is that these workers may be sufficiently productive relative to their wage to avoid competition from lower-wage foreign workers. The absence of employment effects for high school dropouts may result from concentration of such workers in industries that have been afforded protection from imports. The correlation coefficients between average industry education and two- and three-year changes in import penetration rates are 0.14 and 0.18, respectively. An alternative explanation is that wage differentials between U.S. high school dropouts and workers employed in comparable production abroad may be too low for foreign production to compete effectively.

Table V presents the effects of imports by union affiliation. For non-union workers, the coefficients on both import penetration rate variables are positive but insignificant. Due to data constraints, associated samples are small and larger samples may

Table III
All Workers, by Education Level, 1981–1995 (Quantity Measures of Import Competition) (Dependent Variable: ln Displacement $Rate_{jt}$ [OLS Estimations])

Education Level:	Less Than High School Diploma	High School Diploma	Some College	B.A./B.S. or Higher	Less Than High School Diploma	High School Diploma	Some College	B.A./B.S. or Higher
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ ln Import Penetration	0.043	0.829**	0.249#	0.195				
$Rate_{jt}$ (2-year Δ)	(0.157)	(0.19)	(0.14)	(0.192)				
Δ ln $Exports_{jt}$ (2-year Δ)	−0.003	−0.204	−0.01	−0.037				
	(0.133)	(0.149)	(0.096)	(0.168)				
Δ ln Import Penetration					−0.037	0.681**	0.129	0.276
$Rate_{jt}$ (3-year Δ)					(0.139)	(0.171)	(0.112)	(0.177)
Δ ln $Exports_{jt}$ (3-year Δ)					−0.012	−0.397**	−0.015	0.016
					(0.11)	(0.134)	(0.079)	(0.128)
Δ ln $Domestic\ Market_{jt}$	−0.205	−0.162	−0.338	−0.466				
(2-year Δ)	(0.418)	(0.664)	(0.276)	(0.423)				
Δ ln $Domestic\ Market_{jt}$					−0.356	−0.065	−0.424#	−0.252
(3-year Δ)					(0.356)	(0.584)	(0.224)	(0.339)
Δ ln $Technology_{jt}$	0.656	−0.011	0.089	0.48				
(2-year Δ)	(0.507)	(0.354)	(0.237)	(0.299)				
Δ ln $Technology_{jt}$					0.79*	0.096	0.097	0.374
(3-year Δ)					(0.392)	(0.33)	(0.198)	(0.259)
Δ ln Capacity Utilization	1.128	5.414**	−1.664	−1.485	0.906	3.873*	−1.475	−1.198
$Rate_t$ (1-year Δ)	(1.663)	(1.531)	(1.317)	(1.75)	(1.649)	(1.568)	(1.328)	(1.702)
Δ ln Capacity Utilization	−1.051	−0.878	−3.206*	0.787	−1.056	−2.287	−3.126*	0.395
$Rate_{t-1}$ (Lagged 1-year Δ)	(1.624)	(1.735)	(1.386)	(1.805)	(1.543)	(1.528)	(1.415)	(1.801)
ln $Capital\text{-}Labor\ Ratio_{jt}$	−1.484**	−1.381*	0.137	−0.71#	−1.487**	−1.611*	0.032	−0.552
	(0.493)	(0.608)	(0.304)	(0.418)	(0.5)	(0.659)	(0.312)	(0.417)
N	249	267	390	264	250	267	390	264
Adjusted R^2	0.25	0.24	0.15	0.14	0.26	0.21	0.15	0.14

See Table 2 for notes.

Table IV
All Workers, by Education Level, 1981–1999 (Price Measures of Import Competition) (Dependent Variable: ln Displacement Rate$_{jt}$ [OLS Estimations])

Education Level:	Less Than High School Diploma	High School Diploma	Some College	B.A./B.S. or Higher	Less Than High School Diploma	High School Diploma	Some College	B.A./B.S. or Higher
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ ln Import Price Index$_{jt}$ (2-year Δ)	−0.741	−1.489	−0.797	−0.9				
	(1.17)	(1.6)	(0.514)	(0.903)				
Δ ln Export Price Index$_{jt}$ (2-year Δ)	−0.914	1.122	−0.063	0.901				
	(1.681)	(2.002)	(0.86)	(1.351)				
Δ ln Export Price Index$_{jt}$ (3-year Δ)					0.626	1.947	0.973	0.186
					(1.45)	(1.267)	(0.609)	(0.935)
Δ ln Import Price Index$_{jt}$ (3-year Δ)					−1.576	−2.055#	−1.164**	−0.865
					(1.168)	(1.234)	(0.382)	(0.74)
Δ ln Capacity Utilization Rate$_{1}$ (1-year Δ)	3.25	2.913	−0.389	6.989*	0.871	−0.318	−2.158	5.339#
	(4.161)	(3.801)	(2.013)	(2.984)	(4.122)	(4.15)	(1.974)	(3.09)
Δ ln Capacity Utilization Rate$_{t-1}$ (Lagged 1-year Δ)	1.199	−1.128	−1.862	4.545#	1.875	0.384	−0.65	4.527
	(3.776)	(3.061)	(2.004)	(2.635)	(4.524)	(3.016)	(2.047)	(2.791)
Constant	−2.436**	−2.832**	−2.631**	−2.778**	−2.462**	−2.885**	−2.658**	−2.783
	(0.097)	(0.087)	(0.056)	(0.076)	(0.116)	(0.881)	(0.572)	(0.782)
N	104	130	154	119	97	121	141	112
Adjusted R^2	−0.01	−0.001	0.01	0.03	−0.002	0.01	0.02	0.02

Note: See Table II for notes.

Table V
Union/Non-Union Worker Comparisons, 1981–1999 (Quantity and Price Measures of Import Competition)
(Dependent Variable: ln Displacement Rate_{jt} [OLS Estimation])

	Union Workers		*Non-Union Workers*		*Union Workers*		*Non-Union Workers*	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ ln Import Penetration	0.391		0.39**					
Rate_{jt} (2-year Δ)	(0.279)		(0.099)					
Δ ln Exports_{jt} (2-year Δ)	−1.374**		−0.18*					
	(0.4)		(0.089)					
Δ ln Import Penetration		0.385		0.227**				
Rate_{jt} (3-year Δ)		(0.367)		(0.079)				
Δ ln Exports_{jt} (3-year Δ)		0.238		−0.058				
		(0.362)		(0.068)				
Δ ln Import Price Index_{jt}					−3.492		−1.113#	
(2-year Δ)					(3.709)		(0.586)	
Δ ln Export Price Index_{jt}					3.804		−0.188	
(2-year Δ)					(2.85)		(0.809)	
Δ ln Import Price Index_{jt}						0.04		−1.386**
(3-year Δ)						(2.206)		(0.387)
Δ ln Export Price Index_{jt}						0.222		0.622
(3-year Δ)						(1.79)		(0.573)
Δ ln Domestic Market_{jt}	0.516		−0.502*					
(2-year Δ)	(1.9)		(0.254)					
Δ ln Domestic Market_{jt}		1.368*		−0.365*				
(3-year Δ)		(0.606)		(0.183)				
Δ ln Technology_{jt}	1.602		0.358#					
(2-year Δ)	(2.272)		(0.182)					
Δ ln Technology_{jt}		−1.196		0.338*				
(3-year Δ)		(0.754)		(0.137)				
Δ ln Capacity Utilization	1.633	5.227	−1.402	−0.991	−1.051	−0.714	1.293	0.212
Rate_t (1-year Δ)	(3.208)	(5.613)	(0.958)	(0.958)	(8.324)	(1..688)	(2.066)	(1.946)
Δ ln Capacity Utilization	−6.156	0.433	−4.322**	−4.577**	0.473	−1.484	−0.994	0.409
Rate_{t-1} (Lagged 1-year Δ)	(3.872)	(5.502)	(0.876)	(0.882)	(6.152)	(6.889)	(1.688)	(1.65)
ln Capital-Labor Ratio_{jt}	−0.816	0.12	0.169	0.214				
	(1.177)	(0.246)	(0.239)	(0.249)				
Constant		−2.678*			−2.205**	−2.092**	−2.801**	−2.825**
		(1.024)			(0.229)	(0.194)	(0.047)	(0.045)
N	59	59	472	472	26	24	174	161
Adjusted R^2	0.52	0.16	0.26	0.25	−0.11	−0.21	0.04	0.06

Note: See Table II for notes.

produce significant coefficients. Baldwin (2003) finds imports have led to declining unionization within manufacturing. If so, the results reported here suggest union status may only delay exposure to import competition. If union status affords protection from import competition, then as unionization declines workers will face import competition and, for non-union workers, considerable effects of import competition are found (see columns (3) and (4)). One percent increases in import penetration rates over two- and three-year horizons increase displacement rates by 0.39 and 0.23 percent, respectively. Similarly, when import price indices represent import competition, significant effects are found only for non-union workers. One percent decreases in the two- and three-year import price variables increase displacement rates by 1.11 and 1.39 percent, respectively.

Following Kletzer (2001), I stratify the sample by age. Tables VI and VII present results. Using two- or three-year changes in import penetration, significant effects are found for workers age 44 and below. This suggests "last-in, first-out" labor shedding where more-tenured workers are retained. Workers aged 20–24 years face the largest effects with the coefficient on the two-year change in the import penetration rate equal to 0.53. For those 25–34 years of age, the coefficient is 0.38 while for workers 35–44 years of age the coefficient is 0.42. Similar effects, albeit lesser in magnitude, are found for three-year changes in import penetration. A one percent decrease in the import price index over two-years for workers aged 20–24 years increase displacement rates by 1.86 percent. A one percent decrease in import prices over a three-year period increases displacement rates for 20–24 year olds and 25–34 year olds by 1.42 percent and 1.53 percent, respectively.

V. CONCLUSION

Two import competition measures quantify the import competition-displacement relationship for the full sample and a variety

Table VI
All Workers, by Age, 1981–1995 (Quantity Measures of Import Competition) Dependent Variable: ln Displacement Rate_{jt} [OLS Estimation])

Age Category:	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ ln Import Penetration	0.53**	0.379**	0.419**	−0.249	0.051					
Rate_{jt} (2-year Δ)	(0.2)	(0.135)	(0.105)	(0.186)	(0.21)					
Δ ln Exports_{jt} (2-year Δ)	−0.016	−0.181#	−0.073	0.23*	0.279#					
	(0.144)	(0.101)	(0.101)	(0.101)	(0.161)					
Δ ln Import Penetration						0.315#	0.286*	0.311**	−0.013	0.085
Rate_{jt} (3-year Δ)						(0.182)	(0.124)	(0.088)	(0.161)	(0.186)
Δ ln Exports_{jt} (3-year Δ)						0.004	−0.103	−0.042	0.111	0.061
						(0.121)	(0.081)	(0.088)	(0.088)	(0.136)
Δ ln Domestic Market_{jt}	−0.283	−0.291	−0.646#	−0.026	−0.362					
(2-year Δ)	(0.315)	(0.278)	(0.361)	(0.284)	(0.595)					
Δ ln Domestic Market_{jt}						−0.128	−0.128	−0.762*	0.087	0.325
(3-year Δ)						(0.325)	(0.216)	(0.326)	(0.235)	(0.386)
Δ ln Technology_{jt}	−0.365	0.304	−0.011	0.361	−0.197					
(2-year Δ)	(0.274)	(0.253)	(0.325)	(0.258)	(0.394)					
Δ ln Technology_{jt}						0.008	0.272	0.146	0.137	−0.086
(3-year Δ)						(0.221)	(0.201)	(0.278)	(0.18)	(0.26)
Δ ln Capacity Utilization	−0.964	−1.078	0.5	1.241	6.472**	−1.506	−0.852	−0.339	1.186	4.988**
Rate_t (1-year Δ)	(0.161)	(1.228)	(1.309)	(1.458)	(1.875)	(1.655)	(1.251)	(1.299)	(1.473)	(1.758)
Δ ln Capacity Utilization Rate_{t-1}	−2.886#	−3.519**	−2.196#	−1.643	4.578**	−3.363*	−3.904**	−2.352#	−1.731	3.832*
(Lagged 1-year Δ)	(1.66)	(1.287)	(1.294)	(1.304)	(1.701)	(1.686)	(1.301)	(1.274)	(1.326)	(1.611)
ln Capital-Labor Ratio_{jt}	0.056	−0.162	−0.294	−0.623#	0.235	0.037	−0.075	−0.498	−0.473	0.552
	(0.312)	(0.319)	(0.321)	(0.344)	(0.484)	(0.337)	(0.306)	(0.329)	(0.341)	(0.481)
N	272	379	326	279	217	271	379	326	279	217
Adjusted R^2	0.21	0.24	0.29	0.26	0.07	0.20	0.24	0.30	0.25	0.08

Note: See Table II for notes.

Table VII
All Workers, by Age, 1981–1999 (Price Measures of Import Competition) Dependent Variable: ln Displacement Rate_{jt} [OLS Estimation])

Age Category:	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ ln Import Price Index$_{jt}$ (2-year Δ)	−1.863*	−0.914	−2.233	−1.027	−0.67*					
	(0.866)	(0.657)	(0.701)	(0.822)	(0.98)					
Δ ln Export Price Index$_{jt}$ (3-year Δ)	3.842**	0.609	0.806	−0.188	−2.401#					
	(1.292)	(0.912)	(1.134)	(0.951)	(1.311)					
Δ ln Import Price Index$_{jt}$ (3-year Δ)						−1.423*	−1.53**	−0.712	−0.517	−0.689
						(0.582)	(0.475)	(0.589)	(0.721)	(0.742)
Δ ln Export Price Index$_{jt}$ (3-year Δ)						2.077*	1.301*	1.465	−0.436	−1.203
						(0.833)	(0.655)	(0.923)	(0.811)	(0.867)
Δ ln Capacity Utilization Rate$_{t}$ (1-year Δ)	3.305	1.874	5.393*	−1.841	6.287#	1.543	−0.412	2.724	−2.537	6.109
	(2.547)	(2.368)	(2.381)	(2.934)	(3.212)	(2.872)	(2.13)	(2.556)	(3.127)	(3.728)
Δ ln Capacity Utilization Rate$_{t-1}$ (Lagged 1-year Δ)	2.427	−1.992	0.316	−3.386	4.215	3.178	−1.087	1.656	−2.981	4.743#
	(2.504)	(2.367)	(2.354)	(2.314)	(2.652)	(2.526)	(2.294)	(2.307)	(2.363)	(2.794)
Constant	−2.547**	−2.745**	−2.812**	−2.67**	−2.386**	−2.543**	−2.787**	−2.864**	−2.669**	−2.401**
	(0.078)	(0.067)	(0.071)	(0.066)	(0.087)	(0.077)	(0.065)	(0.076)	(0.065)	(0.087)
N	111	145	144	132	100	103	135	135	124	95
Adjusted R^2	0.06	0.02	0.02	0.02	0.09	0.02	0.04	0.01	0.01	0.08

Note: See Table II for notes.

of worker types. For all workers, displacement rates increase with import competition regardless of whether import competition is measured as an increase in import penetration or a decrease in import prices. Increased exports, positive domestic demand shifts and business cycle upturns create jobs, tempering the effects of import competition. Labor-intensive industries have higher displacement rates and improvements in industry-level technology are positively associated with increased displacement rates.

Considerable heterogeneity is reported in the effects of import competition on displacement across worker types. Displacement rates of high school graduates increase significantly in response to increased import competition, but displacement rates for high school dropouts and college graduates appear unaffected. Similarly, import competition increases displacement rates of non-union workers, while displacement rates for union workers appear unaffected. We also see displacement rates for workers age 44 and below increase as import competition rises, yet more mature workers are generally unaffected.

While a cleavage persists in public sentiment regarding the domestic labor market effects of trade, the hypothesized domestic labor market effects attributable to trade have yet to be fully understood. The positive relationship documented here between import competition and displacement provides rationale for the existence of policies to assist trade-displaced workers. The finding of heterogeneity across worker types provides a more detailed characterization of who is, and who is not, adversely affected by imports. While a causal relationship is not verified, information is provided that may permit a more enlightened public debate and assist formulation of future public policy.

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