The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade

David Autor, David Dorn, and Gordon Hanson, *Annual Review of Economics*, 2016

William R. Hauk, Jr.

Darla Moore School of Business
University of South Carolina

ECON 860 – International Trade Theory
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Table of Contents

Introduction

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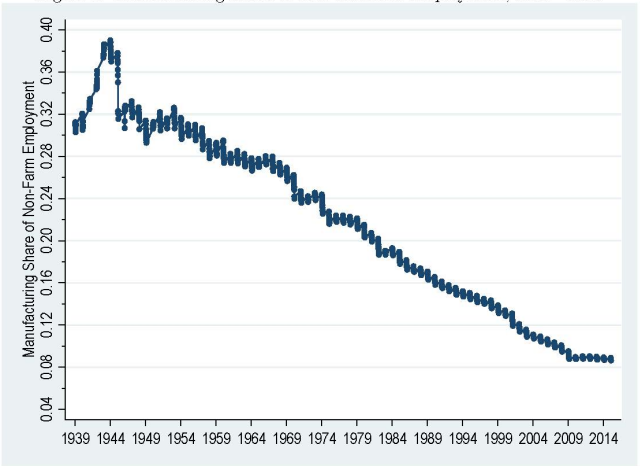
- Strong consensus in economics towards free trade. Even as evidence emerged in 1980s and 1990s of gaps between skilled and unskilled workers, this was explained empirically as more of a technology shock than a trade shock.
- Even when workers did lose their jobs due to trade, they should be able to reallocate easily to other industries. Short-to-medium run gains from trade should be positive.

Figure 1

Figure 1: Manufacturing Share of U.S. Nonfarm Employment, 1939 - 2015



Source: FRED Economic Data https://research.stlouisfed.org/fred2/graph/?g=1Gor

Table of Contents

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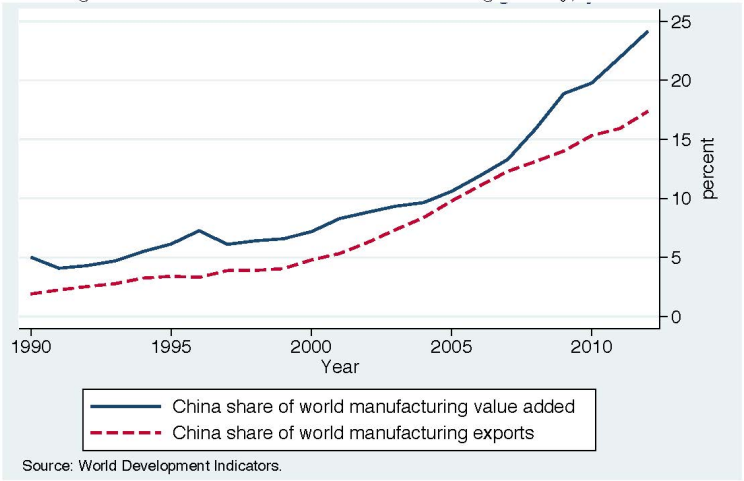
- Reformers gained upper hand in early 1990s, and manufacturing activity in China exploded, especially in Special Economic Zones on the east coast. Number of SEZs increased from 20 in 1991 to 150 in 2010.
- Chinese share of world manufacturing exports grew from 2.3% in 1991 to 18.8% in 2013.

Figure 2

Figure 2: China's Share of World Manufacturing Activity, 1990 - 2012



Source: World Development Indicators.

The China "Shock"

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- The rise of China is importance both because of its magnitude and the relative paucity of natural experiments in international trade. (E.g. NAFTA was caused by foreign investment as much as it caused foreign investment.)

Why We Should Study China

Three features of China's experience make it worthy of detailed study:

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- Unexpected nature of China's export growth caught many people by surprise.
- China's relative degree of isolation under Mao, which created a lot of opportunity for China to catch up.
- Manufacturing was at the heart of its economic turn-around, as opposed to raw materials – large positive supply shock in manufacturing and large demand shock for raw materials.

Figure 3.A

Figure 3: The Evolution of China's Imports and Exports

A. Exports Minus Imports as a Share of GDP for China

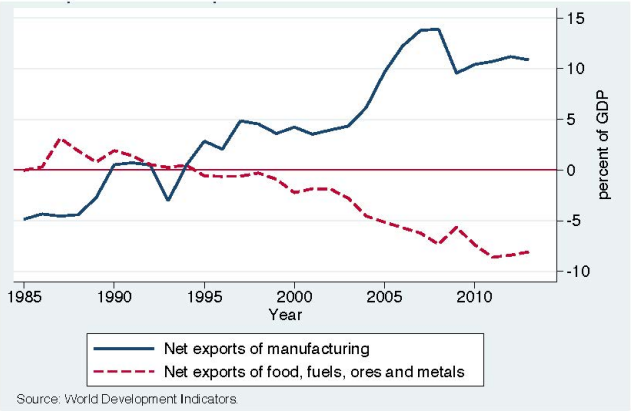
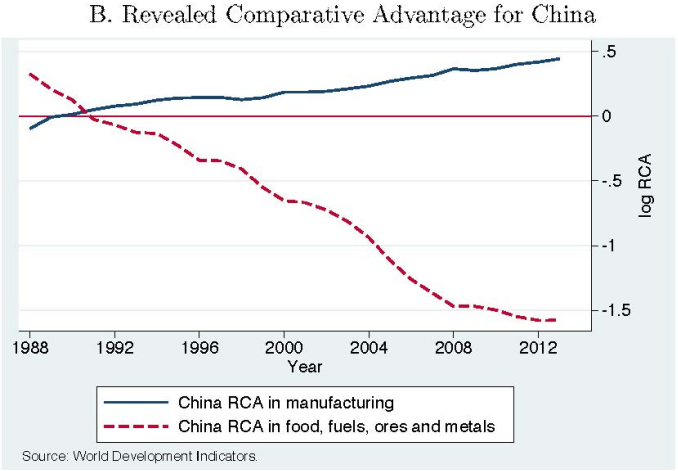


Figure 3.B


B. Revealed Comparative Advantage for China
.5
0
-.5
-1
-1.5
log RCA
1988
1992
1996
2000
2004
2008
2012
Year
China RCA in manufacturing
China RCA in food, fuels, ores and metals
Source: World Development Indicators.

The Global Factory

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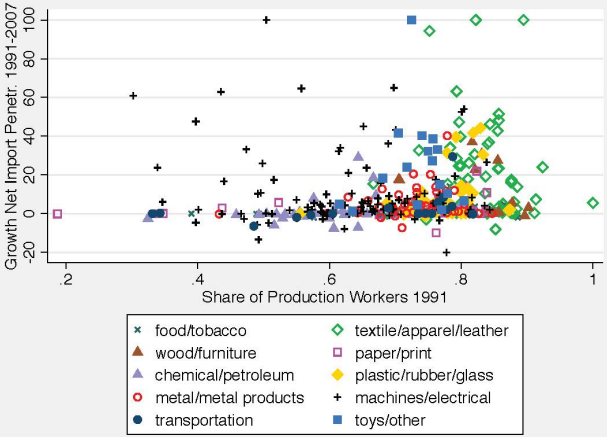
- China probably had a long-standing comparative advantage in manufacturing, but it remained latent during the Maoist era. Strength only emerged in late 1980s.
- In 1992, China moved from a comparative disadvantage to comparative advantage in manufactures, and from a comparative advantage to disadvantage in primary products.
- However, as noted by Figure 4, China's net import penetration varied substantially across industries. Because of this variation, U.S. industries, and the regions in which they locate, vary widely in their exposure to import competition from China.

Figure 4

Figure 4: ΔChina-U.S. Net Import Penetration in Detailed Manufacturing Industry, 1991 - 2007



WTO Accession 2001

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- WTO membership meant that China liberalized many state-owned manufacturing firms and got steadier access to raw materials, helping productivity growth.

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- Trade imbalances complicate the standard trade model. Under balanced trade, U.S. workers shift from import-competing to export-oriented industries.
- With a large trade deficit, workers in import competing industries have to leave the traded goods sector and possibly the workforce entirely.
- At some point in the future, Chinese savings would fall, consumption would rise, and the trade flows would go in the other direction.

Figure 5

Figure 5: U.S. and China Current Account Balances (% of GDP) 1985 - 2012

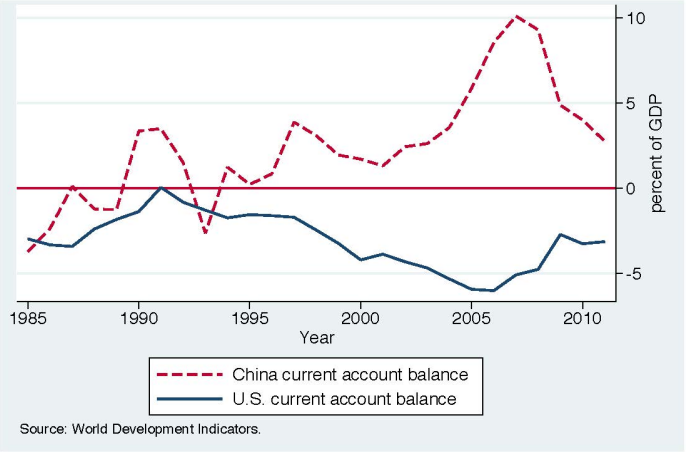

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Table of Contents

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- Model proposed in this paper follows a trend of incorporating gravity-type structures, which allows for tractable descriptions of labor mobility between regions or industries.
- If there are frictions to worker mobility, then there are potentially several margins through which trade shocks could affect labor markets.

A Bare Bones Model

- Model contains a single labor-market friction – imperfect labor mobility within the country. Contrary to many other models, but perhaps better in tune with data.

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- Model contains a single labor-market friction – imperfect labor mobility within the country. Contrary to many other models, but perhaps better in tune with data.
- Begin with an assumption of complete geographic labor immobility. Variation in regional exposure to foreign competition comes from differences in regional industry specializations.

Gravity-Like Trade

Trade has a gravity-type structure – total demand by the U.S. aggregate economy for traded output produced in U.S. region i is:

$$X_i = \sum_k \frac{A_{i,k}\tau_{i,k}^{-\theta}}{\Phi_k} E_k \tag{1}$$

where $A_{i,k}$ is the production capacity of industry k in region i, $\tau_{i,k}$ is an iceberg transportation cost to ship goods from region i in industry k to the U.S. market, θ is the trade-cost elasticity, E_k is aggregate U.S. expenditure on industry k, and $\Phi_k = \sum_{i'} A_{i'}\tau_{i',k}^{-\theta}$ is a competitiveness index for the U.S. market in industry k.

Change in Regional Output

If there is a change in traded output in regions that supply the U.S., we can derive the impact on region i by totally differentiating equation (1):

$$\hat{X}_i = \sum_k \phi_{i,k}\hat{E}_k - \theta\hat{w}_i + \sum_k \phi_{i,k}\hat{A}_k + \sum_k \phi_{i,k}\sum_{i' \neq c} \rho_{i',k}\hat{A}_{i',k} - \sum_k \phi_{i,k}\rho_{c,k}\hat{A}_{c,k} \qquad (2)$$

where c indexes China, $\phi_{i,k} = \frac{X_{i,k}}{X_i}$ is the share of industry k in region i's total sales to the U.S. market, and $\rho_{i,k} = X_{i,k}E_k$ is the share of region i in total U.S. expenditure on industry k. Also, assume that $\hat{A}_{i,k} = \hat{A}_k - \theta\hat{w}_i$ (i.e. local productivity changes are reflected in national productivity changes and local wage changes).

The China Shock

- We are primarily interested in the last part of equation (2), which captures the growth of China's productive capacity on traded output in U.S. region i. Rewrite this as:

$$\sum_k \phi_{i,k} \rho_{c,k} \hat{A}_{c,k} = \sum_k \phi_{i,k} \left[\frac{X_{c,k} \hat{A}_{c,k}}{E_k} \right] \tag{3}$$

  which is the weighted average exposure of region i to changes in U.S. industry import penetration mandated by changes in Chinese production capabilities.

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  which is the weighted average exposure of region i to changes in U.S. industry import penetration mandated by changes in Chinese production capabilities.

- Because weights $\phi_{i,k}$ vary across regions of the U.S., the exposure to Chinese traded goods varies across U.S. regions.

Identifying the Reduced-Form Impact of the China Trade Shock

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- The first term in equation (1) is $\sum_k \phi_{i,k} \hat{E}_k$, which is the regional exposure to U.S. industry demand shocks. Reduced form regressions of regional outcomes on regional trade exposure might be contaminated by U.S. product demand shocks.

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- Following Autor, Dorn, and Hanson (2013), this paper instruments for the growth in U.S. imports from China with the growth in Chinese imports in other high-income markets.

Table 1

Table 1: Imports from China and Other Developed Economies 1991 – 2007 (in Billions of 2007$), and their Correlations with U.S.-China Imports

	United States	Japan	Germany	Spain	Australia
Δ Chinese Imports (Bil$)	303.8	108.1	64.3	23.2	21.5
No. Industries with Import Growth	385	368	371	377	378
Correlation w/ U.S.-China Imports	1.00	0.86	0.91	0.68	0.96
	8 Non-US Countries	Finland	Denmark	New Zealand	Switzerland
Δ Chinese Imports (Bil$)	234.7	5.7	4.7	3.8	3.3
No. Industries with Import Growth	383	356	362	379	343
Correlation w/ U.S.-China Imports	0.92	0.58	0.62	0.92	0.55

Correlations of imports across 397 4-digit industries are weighted using 1991 industry employment from the NBER Manufacturing database.

Instrumental Variables Strategy

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- There is a concern that demand changes might be correlated across high-income countries.
- Autor, Dorn, and Hanson (2013) also used a gravity-based strategy that used Chinese changes in revealed comparative advantage as an instrument (eliminating differences based on import demand in the purchasing country).
- Results did not change much, so they believe that it is not a major concern.

Wage Changes from Shocks

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- One can estimate equation (2) without this term, in which case the reduced form result captures the effect on region i directly through changes in output, or indirectly through wages.
- Or, one can use $\hat{w}_i$ as a dependent variable in a regression.

Change in National Industry Productivity

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- Autor, Dorn, and Hanson (2013, 2015) note that there is near zero correlation between technological change and exposure to trade with China across U.S. local labor markets.
- So there is little to no omitted variables bias from excluding this.

Production Capacity in Other Countries

- The fourth term in equation (2) is $\sum_k \phi_{i,k} \sum_{i' \neq c} \rho_{i',k} \hat{A}_{i',k}$, which is the change in production capabilities in other supplying countries.

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- If these change in response to changing supply conditions from China, excluding them from a reduced-form regression still captures the effect of changes in Chinese production capacity.
- The specification in (2) does not allow for input-output linkages. The model will not capture the effect of a change in final goods production in the U.S. on production of intermediate inputs in the U.S..

Table of Contents

Labor Market Adustment to Trade

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- More intense competition in product markets.
- Then shock is transmitted to regions that have concentrations of competing manufacturing industries.

Industry Adjustment to Import Competition

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Industry Adjustment to Import Competition

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- Bernard, Jensen, and Schott (2006) find that plants facing greater increases in exposure to trade are subject to higher rates of exit.
- Those that survive have lowered unemployment or higher rates of changing manufacturing category.

Change in Labor Force

Acemoglu, Autor, Dorn, Hanson, and Price (2016) focus on industry-level data and examine time period from 1991-2011. They estimate the following model, similar to equation (2):

$$\Delta L_{j,\tau} = \alpha_\tau + \beta_1 \Delta IP_{j,\tau} + \gamma X_{j,0} + \varepsilon_{j,\tau} \tag{4}$$

where $\Delta L_{j,\tau}$ is the log change in employment in industry j over time τ, $\Delta IP_{j,\tau}$ is the log change in import penetration from China during that time, and $X_{j,0}$ is a set of industry controls from the beginning of the period.

Table 2

Table 2: Industry-Level Changes in Chinese Import Exposure and U.S. Manufacturing Employment, 1991 - 2011

	1991-2011		1991-1999	1999-2011	1999-2007	2007-2011
	Mean/SD	Median	Mean/SD	Mean/SD	Mean/SD	Mean/SD
100 x Annual Δ in U.S. Exposure to Chinese Imports	0.50	0.14	0.27	0.66	0.84	0.30
	(0.94)		(0.75)	(1.33)	(1.61)	(1.68)
100 x Annual Log Δ in Emp. (Manufacturing Industries)	-2.71	-2.05	-0.30	-4.32	-3.62	-5.73
	(3.07)		(3.49)	(3.85)	(4.15)	(5.02)

Statistics are based on 392 4-digit manufacturing industries. The change in U.S. exposure to Chinese imports is computed by dividing 100 x the annualized increase in the value of U.S. imports over the indicated period by 1991 U.S. market volume in that industry. Employment changes are computed in the County Business Patterns. All observations are weighted by 1991 industry employment.

Import Exposure and Manufacturing Unemployment

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- The period 2007-2011 contains the global financial crisis, which saw falls in both employment and the rate of import growth.
- The fall in U.S. manufacturing employment also accelerated during this time.

Table 3

Table 3: Industry-Level Changes in Chinese Import Exposure and U.S. Manufacturing Employment, 1991 - 2011

	Stacked First Differences		
	1991-2011		1991-2007
	(1)	(2)	(3)
100 x Annual Δ in U.S.	-0.81***	-1.30***	-1.24***
Exposure to Chinese Imports	(0.16)	(0.41)	(0.37)
1{1991-1999}	-0.08	0.05	0.04
	(0.36)	(0.36)	(0.36)
1{1999-2011}	-3.79***	-3.46***	
	(0.33)	(0.33)	
1{1999-2007}			-2.58***
			(0.38)
Estimation Method	OLS	2SLS	2SLS

N = 784 (392 4-digit manufacturing industries x 2 periods 1991-1999 and 1999-2011 or 1999-2007). Employment changes are computed in the County Business Patterns and are expressed as 100 x annual log changes. Observations are weighted by 1991 employment. Standard errors in parentheses are clustered on 135 3-digit industries. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Estimates of Equation (4)

- Table 3 presents estimates of equation (4) in stacked first differences for 1991-1999 and 1999-2011. The change in the import penetration ratio and the time dummies are the only regressors.

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- Column 1 shows that the relationship between the import penetration ratio and employment is negative and highly significant over the time period.
- Column 2 instruments for the import penetration ratio using Chinese exports to other countries, and finds a larger effect.
- Column 3 restricts our attention to the period 1999-2007 using a time dummy and finds a similar effect.

Implications

Clearly, exposure to Chinese imports affect industry employment, but the distributional consequences may turn on the following questions:

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- Do industry shocks translate into localized employment shocks?
- Are trade-induced employment contractions offset by employment gains elsewhere in the U.S.?
- Do trade adjustments occur on the employment margin, the wage margin, or both?
- Are the costs borne disproportionately by workers at trade-impacted firms and/or trade-impacted local labor markets, or are the costs more diffuse?

Regional Employment Impacts

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- Local exposure to the China Shock varies due to the tendency of industries to cluster in a specific part of the country. Manufacturing is disproportionately located in the Southeast and Midwest.
- Autor, Dorn, and Hanson (2013) divide the U.S. in commuting zones (CZs) that have the characteristics of a local labor market.

Figure 6a

Figure 6: Geographic Exposure to Trade Shocks at the Commuting Zone (CZ) Level

A. Quartiles of Unconditional Exposure

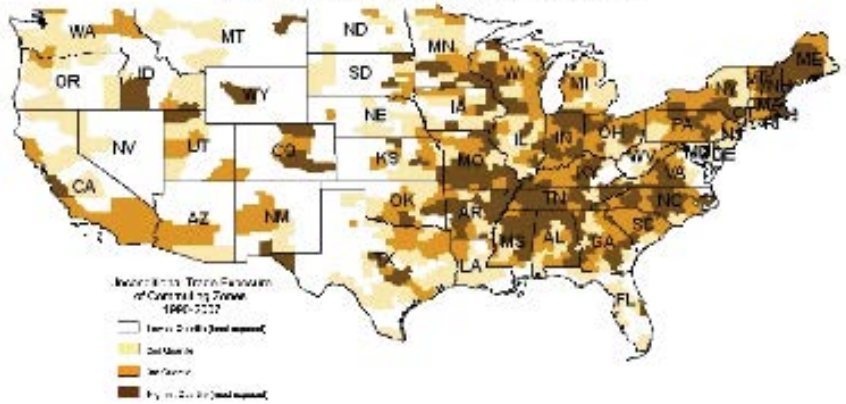
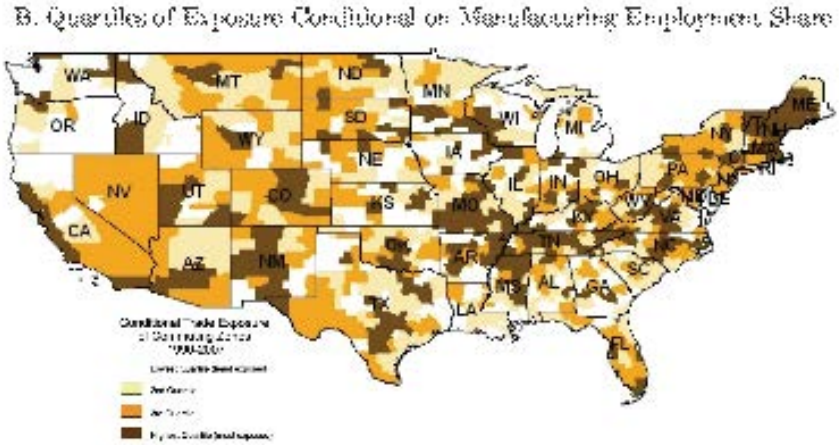


Figure 6b


B. Quartiles of Exposure Conditional on Manufacturing Employment Share
WA
MT
ND
MN
OR
ID
SD
WI
MI
WY
NY
VT
NH
ME
NE
IA
PA
NV
UT
CO
KS
MO
IL
IN
OH
WV
MD
DE
CA
AZ
NM
OK
AR
KY
VA
NC
TN
MS
AL
GA
SC
LA
FL

Exposure by Commuting Zone

- Panel A of Figure 6 shows the level of exposure to Chinese imports by commuting zone.

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- Panel A of Figure 6 shows the level of exposure to Chinese imports by commuting zone.
- Panel B shows the level of exposure conditional on manufacturing employment in the commuting zone.

Exposure by Commuting Zone

- Panel A of Figure 6 shows the level of exposure to Chinese imports by commuting zone.
- Panel B shows the level of exposure conditional on manufacturing employment in the commuting zone.
- Mountain West seems somewhat more exposed in Panel B.

Table 4

Table 4: Import Competition and Outcomes in U.S. Local Labor Markets, 1990 - 2007

A. Δ Fraction of Working Age Population in Manufacturing, Unemployment, NILF

Employed in Manufacturing (1)	Employed in Non-Manufacturing (2)	Unemployed (3)	Not in Labor Force (4)
-0.60***	-0.18	0.22***	0.55***
(0.10)	(0.14)	(0.06)	(0.15)

B. Δ Log Population, Log Wages, Annual Wage and Transfer Income

Δ Log CZ Population (log pts) (5)	Δ Avg Log Weekly Wage (log pts) (6)	Δ Annual Wage/Salary Inc per Adult (US$) (7)	Δ Transfers per Capita (US$) (8)
-0.05	-0.76***	-549.3***	57.7***
(0.75)	(0.25)	(169.4)	(18.4)

N=1444 (722 commuting zones x 2 time periods 1990-2000 and 2000-2007). Employment, population and income data is based on U.S. Census and American Community Survey data, while transfer payments are based on BEA Regional Economic Accounts. All regressions control for the start of period percentage of employment in manufacturing, college-educated population, foreign-born population, employment among women, employment in routine occupations, average offshorability index of occupations, and Census division and time dummies. Models are weighted by start of period commuting zone share of national population. Robust standard errors in parentheses are clustered on state. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Results by Commuting Zone

- Columns 1-4 of Table 4 shows that an increase in exposure to imports lowered manufacturing employment and raised number unemployed or not in the labor force. A $1000 per-worker increase in import exposure reduces the number of workers employed in manufacturing by 0.60%.

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- Autor, Dorn, and Hanson (2013) show that this holds for workers at all education levels.
- Column 5 of Table 4 shows a modest and insignificant effect of increased import exposure on working age population.
- Autor, Dorn, Hanson, and Song (2014) show at the individual level that there is little geographic migration in response to a trade shock.

National Impacts vs. Regional Impacts

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- Acemoglu, Autor, Dorn, Hanson, and Price (2016) use an expanded version of equation (4) to see if adverse impacts are offset by gains elsewhere in the economy.
- They estimate that, had import penetration from China not grown after 1999, there would be 560,000 fewer manufacturing jobs lost (out of 5.8 million manufacturing jobs lost total).

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- Paper notes that positive employment effects due to cheaper inputs of intermediate goods are possible in theory, but neither Pierce and Shott (2015) nor Autor, Dorn, and Hanson (2013) find an effect in this direction.

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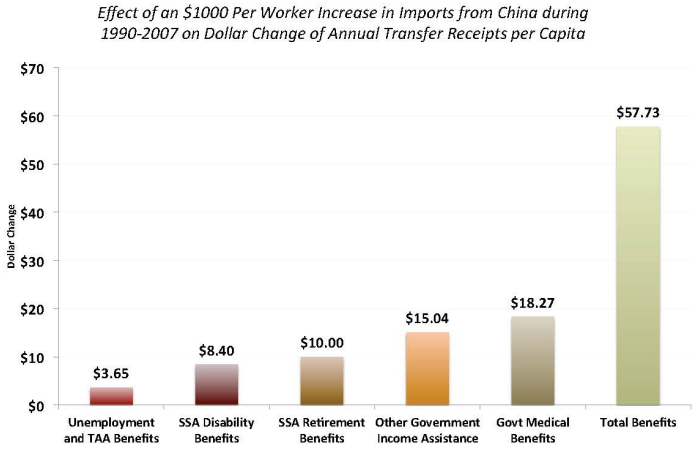
- An increase of $1000 in exposure to Chinese imports reduces the earnings of the average still-employed worker (earning $40,000 a year) by about 0.76 log-points of wage, or around $213 a year.
- A reduction in employment and wages in a CZ also results in an increase in transfer benefits (specifically, unemployment insurance and Trade Adjustment Assistance). Also, a prolonged downturn increases the number of people who qualify for means-tested benefits (TANF, food stamps, etc.).

Figure 7

Figure 7: Imports from China and Induced Government Transfer Receipts in Commuting Zones, 1990 - 2007



Impacts on Transfer Programs

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- TAA and unemployment are actually the smallest category in this figure. Disability, retirement, and health care benefits, which are designed to be more permanent, are actually the largest categories.

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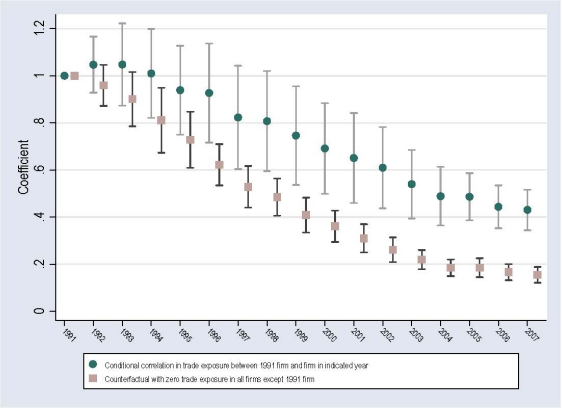
- Non-trade labor literature on job loss suggests that displacement destroys industry-specific human capital. Relatedly, when workers lose jobs, other firms in related industries may be facing the same challenges and not hiring.

Figure 8

Figure 8: Persistence of Trade Exposure since 1991



The graph plots regression coefficients and 90% confidence intervals obtained from 2×16 regressions that relate the 1991–2007 trade exposure of a worker's industry in the year indicated on the x-axis to the 1991–2007 trade exposure of the worker's initial 1991 industry. The counterfactual data series sets trade exposure to 0 for all firms except the worker's initial employer. It refers to a hypothetical scenario in which no worker joins a trade-exposed firm after separating from their initial firm, and so all persistence in trade exposure is due to workers who have not separated from their initial firm.

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- Stays high at first (relatively few workers having left initial job) and gradually falls to 0.43 (still significant) in 2007.
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- Counter factual analysis shows what would happen if worker left trade-exposed field after first job separation. Falls more rapidly and ends at 0.17 in 2007.
- Implication is that, if workers left manufacturing immediately upon losing job, they would have about 60% less exposure to trade shocks. But they tend to persist in trade exposed fields.

Variation by Income Level

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- Workers in the top earning tercile are more likely to relocate out of manufacturing after a trade shock than those in the bottom tercile.
- Their earnings loss is not significantly different from workers in less trade-exposed industries.

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(Re)Assessing the Gains from Trade

- China experienced one of the most substantial and rapid accumulations of wealth in human history, which resulted in a huge surge in exports to the U.S. (and other countries).

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- Standard trade model predicts that jobs in the U.S. should reallocate between tradeable sectors of the economy (with some limited movement to the non-tradeable sectors). Limited impact on aggregate employment.
- This has not happened in the U.S. – workers in import-competing sectors have largely moved either to non-tradeable sectors or out of the labor force. Big negative consequences for highly exposed labor markets.

Concentrated Effects

- Effect seems to be heterogeneous by wage. In response to a trade shock, a low wage worker will experience a proportionately larger decrease in annual and lifetime earnings, a diminished ability to exit the job before the shock hits, and a greater likelihood of exiting the labor market entirely than a high wage worker.

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- Concentration of trade exposed industries in certain local labor markets hinders movement of workers. Hence, a trade shock may impose larger adjustment costs than is typically assumed by the literature.
- China Shock seemed to diminish by the time it was recognized. Wages are rising in China, exports are increasingly moving from cheap manufactures to areas where it has a technological prowess. Trade war and COVID-19 also bringing this era to an end.

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Autor, Dorn, and Hanson Oeuvre

This paper is a sort of compendium of a series of papers that Autor, Dorn, Hanson, and various co-authors have written on this topic.

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- Trade and technology: Autor, David H., David Dorn, and Gordon H. Hanson. "Untangling trade and technology: Evidence from local labour markets." *The Economic Journal* 125, no. 584 (2015): 621-646.

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- Political Effects: Dorn, David, Gordon Hanson, and Kaveh Majlesi. "Importing political polarization? The electoral consequences of rising trade exposure." *American Economic Review* 110, no. 10 (2020): 3139-83.

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- National employment rate: Acemoglu, Daron, David Autor, David Dorn, Gordon H. Hanson, and Brendan Price. "Import competition and the great US employment sag of the 2000s." *Journal of Labor Economics* 34, no. S1 (2016): S141-S198.

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- Marriage markets: Dorn, David, and Gordon Hanson. "When work disappears: Manufacturing decline and the falling marriage market value of young men." *American Economic Review: Insights* 1, no. 2 (2019): 161-78.