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Effects of Exposure to Chinese Imports on School Spending and Revenue from Property Tax

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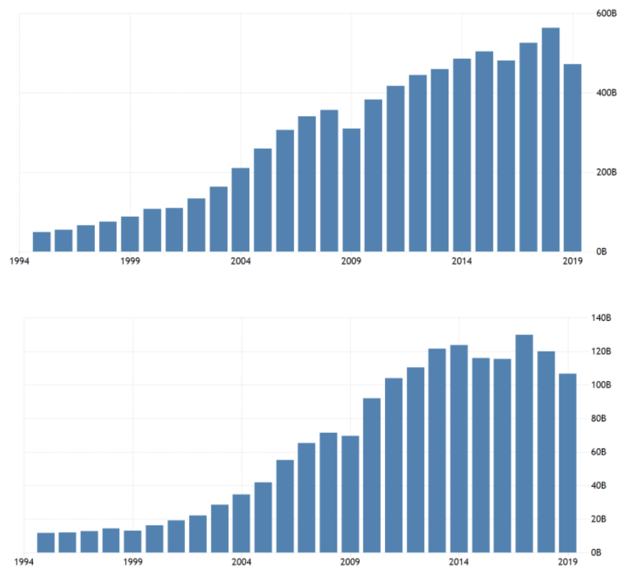
Abstract

I analyze the effect of exposure to Chinese import competition on school revenues per student from property tax, from local sources, and school expenditures per student in 676 Commuting Zones (CZ) from 1990 to 2007. I discover a negative relationship on the CZ level between exposure per worker to Chinese import competition and school expenditure per student, as well as school revenue per student from local sources. In contrast, impact on school revenue per student from property tax is not statistically significant. On average, in a given period, an increase of 1000 dollars in import exposure is related to a decrease of 210.4 dollars in school expenditure per student and a reduction of 83.15 dollars in school revenue per student from local sources. In addition, different CZs face unequal levels of exposure, which eventually lead to differences in student outcomes.

Introduction

In recent years, especially after the election of President Trump in 2016, the trade between the U.S and China has been a popular topic in international trade literature. The popularity does not come from anywhere but the larger and broader impact of this trade relationship on the U.S. Economy. Evident from the figures below, both U.S. imports from and exports to China has increased dramatically ever since China's entry into the World Trade Organization (WTO) in 2001. As of December 2016, China is both the largest trading partner and the source of imports for the U.S., accounting for 15.9% of the total value of trade and 21.1% of the total value of imports (Census Bureau, 2020). The U.S. imports from China in 2018 are up 427% from 2001.

Figure 1. US imports (billion $) from (up) and exports to (down) China, 1995 to 2019 (Trading Economics, 2020)



Like many other trade relationships between developed and developing countries, the trade between the U.S. and China is not balanced in terms of types of goods and services exchanged. According to the Heckscher-Ohlin model of international trade, China is relatively more labor-abundant, while the U.S. is relatively more capital-abundant. Therefore, in the bilateral trade between these two countries, China exports more labor-intensive goods while the U.S. provides more capital-intensive products. Therefore, labor-intensive sectors in the U.S. have to face import competition from similar industries in China, and the magnitude of the economic consequences of this competition varies between regions due to their diverse industrial structures.

In the trade literature, there has not been a shortage of studies on the labor market effects of the trading activities with China since China joined WTO in 2001. However, only a fraction of that attention has focused on other parts of local economies that may experience more indirect impacts from trade, such as the education system. In this paper, I am exploring the research question: What are the effects of the import competitions from China on the U.S. public school spending and school revenue from property tax on a Commuting Zone level? This paper aims to shed some light on the educational impacts of international trade by connecting U.S. imports from China with changes in school financial performance, which can further affect students' future outcomes. It shows that, on average, CZs that experience an increase in Chinese import exposure see a drop in school revenue and expenditure. What's more, CZs that are more affected suffer more from the exposure than CZs that are less impacted. This gap leads to an enlarging gap between different CZs in terms of students' future wages and length of education. In addition, there may also be discrepancies in the quality of education, such as a lower teacher/student ratio in more impacted CZs.

The rest of the paper is structured as follows. In Literature Review, I will present related studies on the impacts of trade on the labor market and local business activities, as well as papers on educational outcomes. In Empirical Framework, I will introduce the model and present the summary statistics of variables used in the model. In results, I will include the results and interpretation of them, followed by connections between the results and educational outcome and areas of improvement in Conclusion.

Literature Review

Local Labor Market Effects

Given the enormous size of imports from China and China's comparative advantage in unskilled manufacturing sectors, it's not difficult to connect trade with China and its negative impact on U.S. employment, especially in the competing manufacturing sectors. Compared to the Chinese counterparts, production of the same goods and services in the U.S. incur a higher labor cost, which leads to losses of orders to the Chinese factories. From 1999 to 2011, job losses from rising Chinese import competition are estimated to be in the range of 2 to 2.4 million (Acemoglu, Autor, Dorn, Hanson, & Price, 2016). Another study links the sharp drop in U.S.

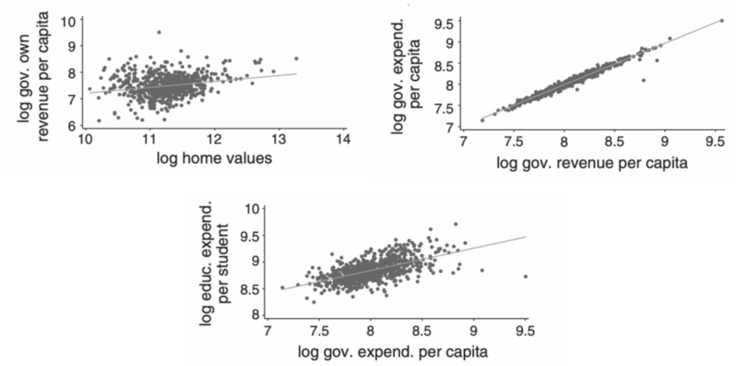
manufacturing employment after 2000 to changes in U.S. trade policies that eliminated potential tariff increases on Chinese imports (Pierce & Schott, 2016).

Not only is the U.S. manufacturing employment suffering from import competition, but the impacts also land differently across the nation as different regions house different types of manufacturing industries. In their influential paper on the local labor market effects of rising Chinese import competition, Autor, Dorn, and Hanson find that rising imports cause higher unemployment, lower labor force participation, and lower wages in local labor markets that have import-competing manufacturing industries (Autor, Dorn, & Hanson, 2013). Pierce and Schott (2016) also discover that sectors more exposed to the changes in U.S. trade policies on China experienced more significant employment loss.

Extended Local Economic Impacts

The impacts of Chinese import competition extend beyond loss of employment. The economies in the profoundly affected regions is likely to suffer from declines in manufacturing sectors. Feler and Senses (2017) discover that areas in the U.S. with declining labor demand and incomes due to increasing import competition from China experience relative declines in housing prices and business activity. Figure 2 shows the relationships between the log value of home value, government revenue, government expenditure, and educational expenditure. Declines in property value and business activities lead directly to reductions in revenue for local governments, constraining their ability to provide quality public services.

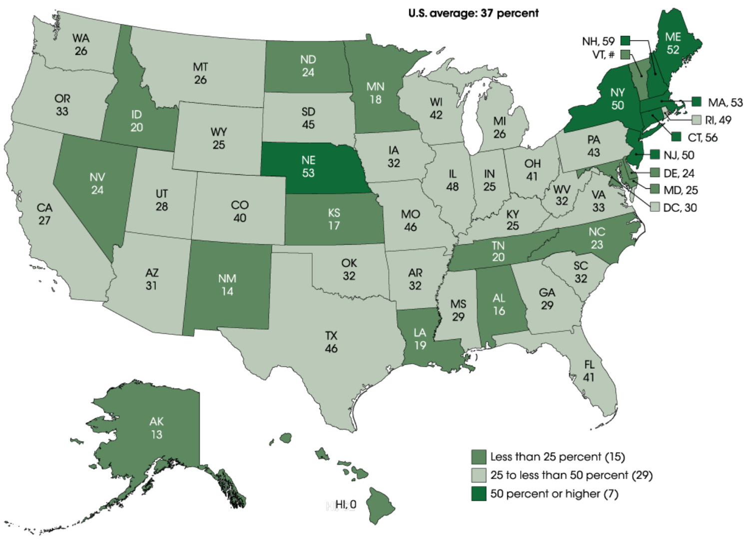
Figure 2. Home Values, Government Revenue, and Educational Expenditure (Feler and Senses, 2017)



School Funding and Student Performance

As an example of public facilities, public schools rely heavily on local financial support to provide education for students from kindergarten to 12th grade. According to Education Week, they receive funding from three sources: states, local districts, and the federal government. The states contribute around 48% of the budget for elementary and secondary schools from a combination of income taxes, corporate taxes, sales taxes, and other fees. Local districts provide about 44%, which mostly come from local property tax. A recent study shows that local property tax account for more than a third of school funding (Reschovsky, 2017). Figure 3 shows that property tax accounts for between 25 and 50 percent of total revenue for schools in over half of all the states. Finally, the federal government covers approximately 8% of the budget. What's more, the federal- and state-level sources only include the essential funding for schools and are usually less responsive than local sources to changes in demand on the school side (Chen, 2020). Therefore, as local governments collect less revenue from local property tax, schools are expected to experience a decline in their budgets as well.

Figure 3. Property tax revenues as a percentage of total school revenues, by state: school year 2016-17 (National Center for Educational Statistics, 2020)



Shifting the focus from changes in school revenue to potential impacts of these changes on students, I find that there is no lack of studies that focus on the connection between school revenue and student performance. Linking school spending and finance reform data with nationally representative data on children born between 1955 and 1985 followed through 2011, Jackson et al. (2016) show that a 10% increase in per-pupil spending each year for all 12 years of public school leads to 0.31 more completed years of education, about 7% higher wages, and a 3.2 percentage point reduction in the annual incidence of adult poverty. Additionally, children from low-income families experience these positive effects more conspicuously. Some scholars also look at the differential academic impacts of school funding on the academic performance of students. With data from 54 districts, Payne and Biddle (1999) show that well-funded schools in communities with low levels of poverty earn much higher achievement scores in mathematics than miserably funded schools in high-poverty communities.

In addition to the positive impacts of increases in school funding on aspects of students' future performance, such as wages and years of education, better education also has other indirect effects on students. Education can indirectly improve an individual's health through work and economic condition, given the better chance of employment and more of an opportunity for enjoyable work life. The well-educated also have a more positive lifestyle as they are more likely to exercise and get annual health check-ups(Ross & Chia-Ling Wu, 1995). As people obtain more years of education, they are less likely to commit personal crimes, such as assault and injury (Groot & van den Brink, 2010). Although these findings do not necessarily translate into adverse effects in students' future performance in the face of drops in school spending, a lack of increases in spending is connected with failure to capture these positive effects.

Empirical Framework

The estimation strategy of exploring the relationship between Chinese import competition and school expenditure and revenue from property tax is based on the empirical framework developed by Autor, Dorn, and Hanson (2013). I borrow their 2SLS model of estimating exposure to Chinese import competition while replacing variables related to the labor market with school financial variables to explore the connection between import exposure and educational outcomes.

First Stage: Instrumental Variable Approach

The measurement of the import competition from China is based on the changes in the value of U.S. imports from China within a period on a CZ level. The use of CZs instead of larger geographical divisions such as states or census divisions is to capture the potential differences in exposure to Chinese import between different zones within states or other larger divisions. The Chinese import exposure index, ΔIPW_{uit}, is calculated using the share of CZ employment in national employment in specific industries j as a proxy for CZ share of changes in U.S. imports from China:

$$\Delta IPW_{uit} = \sum_{j} \frac{E_{ijt}}{E_{ujt}} * \frac{\Delta M_{ucjt}}{E_{it}}$$

In this equation, ΔIPW_{uit} is the measurement of import exposure per worker in CZ i over period t. ΔM_{ucjt} is the change in U.S. imports from China in industry j over period t. E_{ijt} is employment in industry j in CZ i at the beginning of the period t. E_{ujt} is the total employment in the U.S. in industry j at the beginning of t. E_{it} is employment of CZ i at the beginning of t. The sum over all industries j gives the Chinese import exposure index for CZ i.

One problem remains in using ΔIPW_{uit} as the import exposure index. The change in imports from China to the U.S. can have two sources: supply-driven import shocks as a result of rising productivity in Chinese exporting industries and demand-driven import shocks as a result of increasing demand for imported Chinese goods and services. A similar import exposure index, ΔIPW_{oit}, is created to rule out the demand-driven shock:

$$\Delta IPW_{oit} = \sum_j \frac{E_{ijt-1}}{E_{ujt-1}} * \frac{\Delta M_{ocjt}}{E_{it-1}}$$

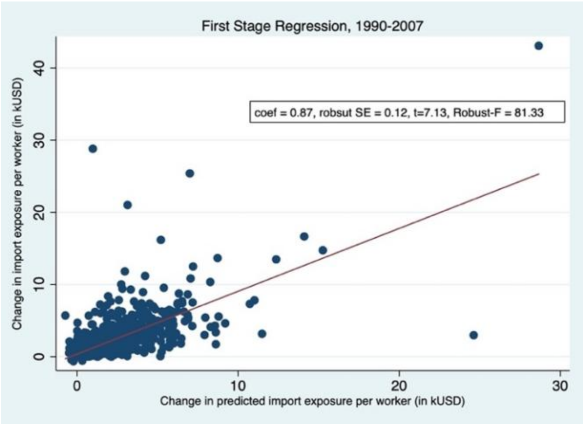
ΔM_{ocjt} is the change in imports from China by a selected group of high-income countries in industry j over period t. Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland are chosen because they have comparable trade data in the entire sample period. E_{ijt-1} is employment in industry j in CZ i at the beginning of the period before period t. E_{ujt-1} is the total employment in the U.S. in industry j at the beginning of the period before period t. E_{it-1} is the population of CZ i at the beginning of the period before period t. The sum over all industries j gives the instrument for predicting $\Delta \widehat{IPW}_{uit}$. The purpose of using lagged employment data is to eliminate the changes in employment due to the anticipation of changes in Chinese imports. The first-stage instrumental variable regression is:

$$\Delta IPW_{uit} = \alpha_0 + \alpha_1 * \Delta IPW_{oit} + \epsilon$$

the coefficient $\widehat{\alpha_1}$ is then multiplied with ΔIPW_{oit} to predict ΔIPW_{uit}. Figure 4 plots the results of this regression.

The use of ΔIPW_{oit} to instrument ΔIPW_{uit} relies on the assumption that variation in the instrumental variable is driven by changes in supply from China due to decreases in trade costs and more substantial comparative advantage for China in different sectors. Autor, Dorn, and Hanson (2013) mention three potential threats to

Figure 4. Plot of ΔIPW_{uit} against ΔIPW_{oit}



this assumption. First, the growth in Chinese imports for high-income countries may be correlated. Second, the Chinese import shocks in the import-competing sectors for the selected high-income countries may be a result of a negative productivity shock in the U.S. instead of a positive productivity shock in China. Third, a similar negative productivity shock may happen in these high-income countries, which drives the increases in Chinese imports.

They rule out the first threat by replacing U.S. imports from China with estimated changes in China's comparative advantage and market access in a modified gravity model. Although they are unable to rule out the last two threats completely, they argue that growth in China's exports is strongly related to factors specific to China.

Initially, I attempted to calculate ΔIPW_{uit} and ΔIPW_{oit} with data from the same sources and the method described in their paper but extended to 2016. For trade-related data, they used the UN Comtrade Database, which provides bilateral trade value data between different countries. Different goods are categorized by the six-digit Harmonized Commodity Description and Coding System (HS). They aggregated the six-digit HS codes to four digits and matched them to Standard Industrial Classification (SIC) industry categories.

The employment data used in calculating trade shock indices are collected from the County Business Patterns (CBP) database. It is an annual data series that provide employment, firm size, and payroll information by county and industry. They use an estimation method (with limited detail in their paper) by creating a sample of county employment and regressing the CBP data with that sample although the CBP database also has the exact employment number by county and industry. As I used the exact employment number instead of their method to estimate CZ employment structures, my calculations are drastically different from theirs. Therefore, I decided to use their ΔIPW_{uit} and ΔIPW_{oit} and restrict the periods to a pre-period of 1990-2000 and a post-period of 2000-2007.

Second Stage: Shared Components

There are two second-stage models: one about school revenue from property tax and the other about school expenditure.

The models share a common independent variable ΔIPW_{uit} from the first stage, which is the prediction based on ΔIPW_{oit}.

They also include two types of fixed effects to combat the potential biases. The year fixed effects ($i.year$) controls for the changes in property tax revenue due to changes in time, so that growth/decline in school expenditure per student in CZ i during period t ($\Delta expenditure_{it}$) or school revenue per student from property tax in CZ i during period t ($\Delta property\ tax_{it}$) from 1990 to 2007 is not counted as effects of Chinese import competition. The location fixed effects ($i.location$) account for differences in $\Delta expenditure_{it}$ or $\Delta property\ tax_{it}$ across different regions (e.g., census divisions or states) that are due to similar characteristics of CZs in the same region. For example, CZs in the same census division may have related policies that are different from CZs in other divisions regarding the proportion of school revenue that comes from local property tax.

The two models are weighted by the beginning of period CZ's total enrollment because CZs with a larger student population should be more representative than those with a smaller student population. Clustered standard errors are used at the state level to allow for potential interactions between different CZs within the same state.

Second Stage: Revenue from Property Tax

The model for school revenue from property tax contains six components. The dependent variable is $\Delta property\ tax_{it}$. I choose CZ enrollment data at the beginning of t for the conversion into per student terms to attenuate the heteroskedasticity problem brought by diverse sizes of school systems across different commuting zones.

I also include the beginning of period school revenue from property tax per student in CZ i ($property\ tax_{it}$) to account for the possible scenario in which impact of the same amount of $\Delta property\ tax_{it}$ may be different for CZs with various initial school revenue from property tax per student (e.g., a CZ with \$1000 $property\ tax_{it}$ and a CZ with \$200 $property\ tax_{it}$ can feel a decrease of \$100 in $property\ tax_{it}$ differently).

Additionally, I control for the changes in school revenue from the federal government per student in a given period t in CZ i ($\Delta federal_{it}$) and the changes in school revenue from the federal government per student in a given period t in CZ i ($\Delta state_{it}$) because local governments may adjust $property\ tax_{it}$ based on how much $\Delta property\ tax_{it}$ can be covered by a positive $\Delta federal_{it}$ or $\Delta state_{it}$ so that they can spend the excess amount of property tax revenue on other public services. Changes in school revenue per student from other local sources ($\Delta local_{it}$) is also added to account for potential adjustments to structures of school funding on the local level.

The model is:

$$\Delta property\ tax_{it} = \beta_0 + \beta_1 \times \Delta \widehat{IPW}_{uit} + \beta_2 \times property\ tax_{it-1} + \beta_3 \times \Delta federal_{it}$$
$$+ \beta_4 \times \Delta state_{it} + \beta_5 \times \Delta local_{it} + \beta_6 \times i.location + \beta_7 \times i.year + \epsilon_{it}$$

Second Stage: School Expenditure

The model for school expenditure contains five components. The dependent variable is $\Delta expenditure_{it}$.

In addition to ΔIPW_{uit}, $i.location$, and $i.year$ that are also part of the previous model, this model includes the beginning of period school expenditure per student on CZ level ($expenditure_{it}$), which serves a similar purpose as $property\ tax_{it}$ to address the differences in changes in school expenditure per student that are related to the size of the initial expenditure. CZs with smaller school expenditures per student may experience a minor change in expenditure compared to those with larger initial expenditure simply because they have less room for adjustment.

The model is:

$$\Delta expenditure_{it} = \gamma_0 + \gamma_1 \times \Delta \widehat{IPW}_{uit} + \gamma_2 \times expenditure_{it-1} + \gamma_3 \times i.location + \gamma_4 \times i.year + \epsilon'_{it}$$

The educational data is from the Common Core of Data. It provides the total expenditure, total local revenue from property tax, total salaries, total Federal revenue, total State Revenue, and enrollment on the school district level for about 13,000 school districts in the U.S. between 1990 and 2007. Converted to constant 2007 U.S. dollars, the school district level data is aggregated to Commuting Zone level with a crosswalk from counties to 1990 Commuting Zone divisions created by Autor et al. (2013). Then, the data on revenue and expenditure are converted to per capita terms.

Summary statistics

In Table 1, summary statistics for the variables used in the two models are presented. The tables are split into the two periods used in this study, 1990-2000 and 2000-2007.

Table 1: Summary statistics for educational data and import exposure indices

1990-2000	count	mean	sd	min	max
$\Delta property\ tax_{it}$ (\$)	676	743.84	1486.22	-3744.49	6709.89
$\Delta expenditure_{it}$ (\$)	676	3366.02	1613.99	-6156.46	9727.19
ΔIPW_{uit} (k \$)	676	1.117	.976	-.0754	25.41
$property\ tax_{it-1}$ (\$)	676	2616.65	1612.17	0	8636.45
$expenditure_{it-1}$ (\$)	676	12869.27	3177.19	6862.93	23125.20
$\Delta federal_{it}$ (\$)	676	192.74	179.90	-2173.04	3589.29
$\Delta state_{it}$ (\$)	676	1287.57	1134.92	-2045.33	14367.45
$\Delta local_{it}$ (\$)	676	513.44	563.13	-2168.03	5165.10

2000-2007	count	mean	sd	min	max
$\Delta property\ tax_{it}$ (\$)	676	647.24	713.42	-3603.14	10194.79
$\Delta expenditure_{it}$ (\$)	676	2365.03	1534.71	-8193.64	15543.91
ΔIPW_{uit} (k \$)	676	2.556	1.851	-.629	43.08
$property\ tax_{it-1}$ (\$)	676	3384.79	1953.06	0	11538.51
$expenditure_{it-1}$ (\$)	676	15980.17	3157.62	9586.78	30630.52
$\Delta federal_{it}$ (\$)	676	292.69	252.45	-656.82	4800.09
$\Delta state_{it}$ (\$)	676	675.76	796.57	-5228.81	17621.02
$\Delta local_{it}$ (\$)	676	587.06	1760.19	-1855.80	50123.81

Between 1990 and 2000, the mean value of $\Delta property\ tax_{it}$ was 743 dollars per student. However, there are huge variations between CZs. Some are reporting a decrease of 3744.49 dollars per student, whereas others are reporting an increase of 6709.89 dollars per student. The mean value of $\Delta property\ tax_{it}$ decreases slightly in the second period to 647.24 dollars per student with a smaller standard deviation. The minimum value did not change much, while the maximum value increased drastically to 10194.79 dollars per student. $\Delta expenditure_{it}$ experiences a decline of around 1000 dollars from the first period to the second period, and the gap between the minimum and maximum $\Delta expenditure_{it}$ gets wider over time.

The import exposure indices for the U.S. increased from 1117 dollars per worker in the pre-period to 2556 dollars per worker in the post period. There is also a wider gap between the most and the least impacted CZs between the two periods.

$\Delta federal_{it}$ experienced a relatively small increase of about 100 dollars between the two periods, whereas $\Delta state_{it}$ in the post-period dropped to approximately half of the value in the pre-period. $\Delta local_{it}$ shows a minimal increase over time.

Results

When running the model for property tax, I start from the simplest model and progress to the full model. In the simplest model (column 1), I only include ΔIPW_{uit}, $property\ tax_{it}$, and year dummies as an attempt to see if I can determine the general direction of the coefficient. In column 2, I add the revenue from the federal government, state governments, and local government except property tax into the simplest model to control for the potential impacts of Chinese import competition on school revenues from other sources. In column 3, I add the dummies that account for the nine census divisions as an attempt to rule out the impact of geographical differences between CZs that are located in different census regions. Finally, in column 4, I replace the census division dummies with dummies for states to capture more detailed differences between different states within the same census division (e.g., the state government may have the same regulations regarding the use of school revenue from the state). The results are presented in Table 2.

In column 1, the coefficient of ΔIPW_{uit} is positive, although not statistically significant at the 10% level. The coefficient of $property\ tax_{it}$ is small and statistically significant at the 10% level.

In column 2, the coefficient of ΔIPW_{uit} is still positive yet not statistically significant. The coefficient of $property\ tax_{it}$ has little change from column 1. Both $\Delta federal_{it}$ and $\Delta state_{it}$ have negative coefficients, although only the coefficient of $\Delta state_{it}$ is significant at the 1% level. Controlling for time, changes in other sources of CZ school revenue and beginning of period CZ school revenue per student from the

Table 2. Regression with clustered standard errors; location and year dummies are omitted in the table

Dependent Variable: $\Delta property\ tax_{it}$

VARIABLES	(1) Basic	(2) Add Revenue	(3) Add Census Division	(4) Use State
ΔIPW_{uit} (k \$)	6.963	7.804	-54.84	-79.72
	(38.78)	(28.44)	(39.51)	(50.14)
$property\ tax_{it}$ (\$)	0.141*	0.146***	-0.0187	-0.0629
	(0.0750)	(0.0433)	(0.0495)	(0.0389)
$\Delta federal_{it}$ (\$)		-1.023	-0.894	-0.634
		(1.176)	(0.890)	(0.823)
$\Delta state_{it}$ (\$)		-0.512***	-0.501***	-0.498***
		(0.106)	(0.0866)	(0.0955)
$\Delta local_{it}$ (\$)		0.0579	0.0161	0.0323
		(0.0436)	(0.0335)	(0.0360)
Observations	1,352	1,352	1,352	1,352
R-squared	0.048	0.303	0.476	0.622

Clustered standard errors (by state) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

federal government, an increase of 1 dollar in CZ school revenue per student from the state government is related to a decrease of 0.51 dollars in CZ school revenue per student from property tax. Intuitively, as schools receive more funding from state governments, they need less funding from local sources. The coefficient of other local revenue sources $\Delta local_{it}$ is positive as expected, albeit not significant.

In column 3, the coefficient of ΔIPW_{uit} becomes negative, although still insignificant. $\Delta federal_{it}$ is still not significant enough, either, while $\Delta state_{it}$ has a negligible change from column 2, although this model controls for differences between census regions. In other words, after eliminating differences between census divisions that can be correlated with $\Delta property\ tax_{it}$, the negative relationship between $\Delta state_{it}$ and $\Delta property\ tax_{it}$ still holds.

In column 4, the negative coefficient of ΔIPW_{uit} is larger in magnitude than in column 3, although not significant. The coefficient of $\Delta state_{it}$ is close to that in column 3, suggesting a consistent negative relationship between state-level and local-level CZ school revenue throughout the second stage regression.

The results of the second model about school expenditure are presented below in Table 3. In column 1, the basic model only includes $expenditure_{it}$ and year dummies. In column 2, similar to column 3 in Table 2, census division dummies are added to account for regional differences. The geographical controls are switched to state dummies in column 3 to control for differences between CZs in different states.

In all columns, ΔIPW_{uit} has a negative coefficient, indicating a consistent negative relationship between import exposure and changes in school spending. In column 2, the coefficient of ΔIPW_{uit} is significant at 1% level. Controlling for the beginning of period school expenditure per student, time, and census divisions, an increase of 1000 dollars in import exposure per worker in a CZ is correlated with a

Table 3. Regression with clustered standard errors; location and year dummies are omitted in the table

Dependent Variable: $\Delta expenditure_{it}$

	(1)	(2)	(3)
VARIABLES	Basic	Add Census Division	Use State
ΔIPW_{uit} (k \$)	-12.51	-143.4***	-210.4***
	(47.90)	(51.13)	(69.13)
$expenditure_{it}$ (\$)	0.0893	-0.163	-0.331*
	(0.0782)	(0.129)	(0.174)
Observations	1,352	1,352	1,352
R-squared	0.048	0.476	0.622

Clustered standard errors (by state) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

decrease of 143.4 dollars in school expenditure per student in that CZ. The magnitude of ΔIPW_{uit} increases to 210.4 dollars when census divisions are replaced with state controls.

Since the model for property tax returns results not significant enough, I modify that model to test if total local revenue sources are affected by the import exposure. I replaced $\Delta property\ tax_{it}$ with $\Delta total\ local_{it}$ and $property\ tax_{it}$ with $total\ local_{it}$. $\Delta total\ local_{it}$ is the sum of $\Delta property\ tax_{it}$ and $\Delta local_{it}$, while $total\ local_{it}$ is the sum of $property\ tax_{it}$ and $local_{it}$. $\Delta local_{it}$ is dropped from the first model. The columns follow the same structure as Table 2. Results are presented in Table 4.

Across all columns, there is a negative relationship between import exposure and changes in school revenue per student from local sources. Without geographical controls, the coefficients are not significant at the 10% level. Controlling for census

Table 4. Regression with clustered standard errors; location and year dummies are omitted in the table

Dependent Variable: $\Delta total\ local_{it}$

VARIABLES	(1) Basic	(2) Add Revenue	(3) Add Census Division	(4) Use State
ΔIPW_{uit} (k $)	-32.69	-21.99	-60.68**	-83.15**
	(45.50)	(40.78)	(28.92)	(33.78)
$total\ local_{it}$ ($)	0.305***	0.321***	0.308***	0.308***
	(0.0324)	(0.0242)	(0.0253)	(0.0254)
$\Delta federal_{it}$ ($)		-0.589	-0.501	-0.436
		(0.989)	(0.817)	(0.787)
$\Delta state_{it}$ ($)		-0.646***	-0.625***	-0.612***
		(0.130)	(0.119)	(0.135)
Observations	1,352	1,352	1,352	1,352
R-squared	0.048	0.303	0.476	0.622

Clustered standard errors (by state) in parentheses

*** p<0.01, ** p<0.05, * p<0.1

divisions, time, and other school revenue sources in column 3, an increase of 1000 dollars in import exposure per worker in a CZ is correlated with a decrease of 60 dollars in school expenditure per student from local sources. The magnitude of this coefficient increases when census division controls are replaced with state dummies while maintaining a significance level of 5%. Also, the coefficient of ΔIPW_{uit} in Table 3 is close to the coefficient in Table 1 albeit the standard error in Table 3 is much smaller than in Table 1. This shows that much of the changes in school revenue from local sources are due to changes in school revenue per student from property tax.

Conclusion

Following China's admission into WTO at the beginning of this century, there has been increased interest in studying the effects of the trading activities with China on the U.S. economy. As China has gradually become one of the largest trading partners of the U.S., scholars started to look at the impacts of rising imports from China, which stimulate more and more competition with U.S. firms in sectors such as traditional manufacturing.

Following Autor, Dorn, and Hanson's (2013) idea of disaggregating exposure per worker to Chinese competition from the country level to CZ level, I find that exposure to Chinese imports has negative impacts on both school expenditure per student and changes in school revenue per student from local sources. Specifically, controlling for differences across states and time, a one standard deviation increase in import exposure per worker is correlated with a 0.21 standard deviation decrease in school expenditure per student. In comparison, controlling for time, differences across states, and school revenue from state and federal sources, a one standard deviation increase in import exposure per worker is correlated with a 0.08 standard deviation decrease in school revenue per student from local sources. In terms of standard deviation interpretations, school expenditure is more negatively impacted by exposure to Chinese imports than school revenue from local sources. Since the model for school revenue per student from property tax does not return results significant enough, the negative impacts on school revenue per student from local sources might be due to other sources of local governments' revenue, such as income tax. Compared to property values, decreases in income are more direct and effective as workers are possibly paying less income tax due to lower incomes and unemployment.

One possible explanation for this difference in impacts on school expenditure and local revenue is that local governments might have room for adjustment in terms of the funding sent to schools. When local economies are negatively affected by rising exposures to Chinese imports, local governments can potentially increase the tax rates to smooth out part of the shock or devote a larger ratio of local revenue to schools. However, it might be difficult for schools to smooth out their expenditure, especially as increases in revenue from state governments almost dropped by half from the first period to the second period.

What's more, different CZs do not experience the same level of exposure. ΔIPW_{uit} of the CZ at the 10th percentile is about 3000 dollars less than the CZ at the 90th percentile, indicating that some CZs probably suffer more in terms of school revenue and expenditure than others. With the results of Table 3, I translate this difference in exposure to Chinese imports to an estimated gap of 631.2 dollars in school expenditure per student, which is roughly equivalent to 12.5% of the changes in school expenditure per student in Jackson et al.'s (2016) results. This number is an underestimation of the actual difference between the 10th percentile and the 90th percentile CZs in terms of differences in expenditure since Jackson et al. (2016) used a more extended period (12 years) than this study (8.5 years on average). This difference in school expenditure per student can lead to roughly a gap of 14 completed days of education, 0.9% of wages, and 0.4 percentage points in the annual incidence of adult poverty. The Census Bureau lists the annual median personal income as

31099 dollars in 2016, which means the workers in these two CZs can have a median wage difference of at least 300 dollars that is related to the difference in exposure per worker to Chinese imports in these CZs. Jackson et al. (2016) also point out that lower per student expenditure can also lead to negative effects on the quality of education which are harder to be quantified, such as a lower teacher/student ratio.

In other words, the results of this study depict an unequal future between different CZs. As CZs suffer differently from rising exposure to Chinese imports, students in more affected CZs get smaller funding than students in the less affected CZs. Consequently, they are likely to experience a worse future in terms of wages, length of education, and poverty than those from less affected places. They are more likely to then work in labor-intensive industries that face more severe exposure to imports, creating a loop of enlarging inequalities between CZs that passes on through generations.

There are undoubtedly many ways in which this study can be improved. A more recent version of the study can be helpful in terms of exploring if the trends from more than ten years ago still hold in more recent years. There are likely other variables that can influence school expenditure and revenue, which I did not include in this study. The estimated effects on student future outcomes are quite imprecise due to the assumptions made during the calculations; a more precise evaluation can better depict the educational outcomes of rising Chinese imports per worker.

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