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U.S. Self-employment*

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Abstract

This paper investigates effects of increased Chinese import competition (following a change in U.S. trade policy that eliminated uncertainties surrounding tariff rates on Chinese imports) on self-employment across U.S. local markets. Areas most exposed to the trade policy change experienced a more significant decline in self-employment, which, in turn, explains about an 11.5% reduction in total employment. Further, effects almost entirely come from non-manufacturing sectors and are larger on incorporated self-employed business owners. Finally, the impact varies considerably across different groups characterized by gender, age, and education, and the results are robust to the choice of controls.

JEL Classification: F14, F16, J23, J24, L26, R12, R23

Keywords: Entrepreneurship, Chinese Import Competition, NTR, NTR Gap, PNTR
Incorporated Self-employment, Unincorporated Self-employment

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1 Introduction

In October 2000, U.S. Congress passed a bill granting Permanent Normal Trade Relations (PNTR) to China that would be effective upon China's accession to the World Trade Organization (WTO). Before this date, Normal Trade Relations (NTR) tariffs rates were extended to China annually and subject to the President and Congress's approval. Given the tension in U.S.-China relations during the 1990s, substantial uncertainties were surrounding the renewals. For example, the House vote against annual NTR renewal in 1999 was 39% (Pierce and Schott, 2016). If annual renewal had failed, tariffs on Chinese imports would have risen to the rates set by the Smoot-Hawley Tariff Act of 1930.

With eliminating uncertainty about tariff rates after becoming a WTO member in late 2001, China's export to the U.S. has surged. Increased imports from China would be expected to be higher in industries where the gap between the Smoot-Hawley (non-NTR) tariff rate and NTR tariff rate is larger because a larger gap implies that the industry experienced a greater trade liberalization after the bill's passage. In a seminal work, Pierce and Schott (2016) show that industries more exposed to the potential change in tariff rates indeed have experienced higher imports from China and more significant employment loss. Subsequent research has explored the variation in exposure to the change in trade policy across U.S. local labor markets to address the impact of Chinese import competition on socio-economic outcomes, including regional employment, population growth, mortality, etc.

This paper investigates the effects of rising imports from China following the granting of PNTR to China on self-employment. I study the impact on self-employment for several reasons. First, self-employed individuals make up a large portion of small businesses in the U.S., which disproportionately contribute to jobs in the economy and economic progress (Fairlie et al., 2019). They also play an important role in employment dynamics (Levine and Rubinstein, 2018). Second, they hold a substantial portion of the U.S. wealth (De Nardi et al., 2007). Finally, self-employed business owners have long been considered entrepreneurs, and a large volume of studies has investigated various innate characteristics and economic factors that affect entrepreneurship (Hurst and Pugsley, 2017).

Using U.S. Census decennial surveys and the American Community Surveys, I identify individuals who report self-employment as their primary worker class. My analysis further distinguishes between incorporated and unincorporated self-employed individuals because recent studies have shown that these two groups have different human capital traits and income profiles (Levine and Rubinstein, 2017). The geographic unit used in the analysis is the commuting zone (CZ) which represents a cluster of counties with strong commuting ties between workers and businesses (Tolbert and Sizer, 1996). Finally, exploiting variation in exposure to PNTR to China across CZs, I investigate the effects of increased Chinese imports on self-employment using a difference-in-differences model.

The main findings of this study can be summarized as follows. First, I find a negative and significant impact of Chinese import competition on self-employment. For example, an interquartile increase in the NTR gap in a CZ would have lowered the CZ's incorporated and unincorporated self-employment by 3.9% and 3.4%, respectively, over the next decade. I also find that the effects almost entirely come from non-manufacturing sectors. Second, the reduction in self-employment can explain about an 11.5% decline in total employment, and thus the decrease in self-employment constitutes a significant portion of the total employment adjustment. Finally, I find that the effects of increased Chinese imports on self-employment vary considerably across groups defined by gender, age, and education. Effects on self-employment have been higher among females and less-educated individuals. I consider several potential channels that drive the results and argue that supply and demand channels have been important. Several sensitivity checks support the results of the paper.

This paper relates to a growing literature investigating the impact of China's rising trade on the U.S. and other economies. There are two distinct approaches in this literature. The first approach is the one advanced by Pierce and Schott (2016) and used in this paper -exploring plausibly exogenous variation in exposure to PNTR to China across U.S. industries or local markets. The second approach, proposed by Autor et al. (2013), explores variation in exposure to Chinese import growth across U.S. commuting zones since 1990.¹ However, studies that

¹Autor et al. (2013) use Chinese import growth in other high-income countries as an instrument for the import growth in the U.S. to address simultaneity stemming from the fact that Chinese import growth may respond to local demand shocks.

have used either of these approaches have reached mostly similar conclusions: increased Chinese import competition has had substantial adverse effects on employment across industries and local-labor markets (Acemoglu et al., 2016, Fort et al., 2018).

This literature has also investigated the effects of Chinese import competition on various other social and economic outcomes, such as earnings and employment trajectories of US workers (Autor et al., 2014), crime and government transfers (Che et al., 2018), school completion rate (Greenland and Lopresti, 2016), internal migration (Greenland et al., 2019), mortality (Pierce and Schott, 2020), marriage and fertility (Autor et al., 2019b), price and consumer welfare (Amiti et al., 2020, Jaravel and Sager, 2018), and U.S. politics and voting (Autor et al., 2019a, Che et al., 2016). Liang and Goetz (2016) investigate the effects of self-employment on the impact of Chinese import growth on wage-salary employment.² However, to the best of my knowledge, no studies have investigated the impact of Chinese import competition on self-employment.

This paper also contributes to a large literature in labor economics that investigates entrepreneurship determinants. These studies have usually identified self-employed individuals as entrepreneurs (Fairlie, 2014, Hamilton, 2000). One strand of this literature has investigated the role of personal traits (e.g., risk tolerance, patience, individualism) in becoming an entrepreneur (Chanda and Unel, 2021, Levine and Rubinstein, 2017). A larger strand of this literature has investigated how outside factors can affect entrepreneurship. These factors include liquidity and credit constraints (Cagetti and De Nardi, 2006, Hurst and Lusardi, 2004), family wealth and inheritance (Hurst and Lusardi, 2004, Lindquist et al., 2015), immigration (Fairlie and Meyer, 2003, Kerr, 2018), and tax policies (Cagetti and De Nardi, 2009, Cullen and Gordon, 2007), among many others.

In this literature, my paper relates to the studies that have investigated the impact of globalization on entrepreneurship (Dinopoulos and Unel, 2015, Dinopoulos et al., 2020, Grossman, 1984, Rauch and Watson, 2004). However, these studies have been theoretical or model-based simulations.³ There are also a few studies that have empirically investigated the effects of foreign

²Specifically, they include the initial self-employment share interacted with Chinese import growth as an independent variable in the Autor et al. (2013) model and estimate the effect over 2000-2007 using the OLS method.

³For example, Dinopoulos et al. (2020) develop a computable general equilibrium model of trade with occupational choice and revenue-generating tariffs to study the impact of the recent tariff wars between the U.S. and

investment on entrepreneurship and self-employment (Eren et al., 2019). The main challenge in econometric analysis has been identifying exogenous trade or investment shocks. This paper aims to close this gap.

The rest of the paper is organized as follows. The next section introduces data sources and explains how the key variables are constructed. Section 3 presents and discusses the econometric specification used in my analysis. Section 4 presents the benchmark results, discusses possible channels, explores heterogeneity across demographic groups, and presents sensitivity checks. Section 5 concludes the paper.

2 Data and Descriptive Statistics

This section discusses the sources and construction of the sample I use in my analysis. The period in this analysis covers the years 1990, 2000, 2016, and the availability of data dictates the choice of these years.

2.1 Data on Self-employment

Data on self-employment and other workers are from the Census decennial surveys for the years 1990 and 2000, and the American Community Survey (ACS) files for 2015-2017, which are publicly available data from the Integrated Public Use Micro Samples (IPUMS) prepared by Ruggles et al. (2020). I pool the ACS 2015-2017 files and treat them as referring to 2016 to increase sample size and the precision of estimates. I do not use the data beyond 2017 to prevent the effects of tariffs imposed by the Trump administration in early 2018.⁴

The analysis is at the commuting zone (CZ) level because this is the smallest geographic unit that can be consistently constructed over a long time period. Further, CZs represent clusters of counties with strong commuting ties between employers and employees (Tolber and Sizer 1996). Using crosswalk files from Autor et al. (2013) and Autor et al. (2019), Public Use Microdata Areas (PUMAs) reported in the surveys are mapped to 741 commuting zones that cover the

China on entrepreneurship and income distribution.

⁴My analysis compares two periods: 1990-2000 and 2000-2016. China's accession to the WTO happened in December 2001, and ideally, the two periods should be 1990-2001 and 2002-2016. However, geographic identifiers used in this analysis are not available for 2001-2004.

entire area of the U.S. over the sample period.⁵ Alaska and Hawaii are excluded, and the final sample includes 722 CZs.

Each census survey covers several million individuals, and provides information about demography (i.e., gender, age, race), education (e.g., years of schooling), work (e.g., employment status, worker class, industry worked, occupation, income, etc.), immigration status, and so on. I consider individuals 16 years and older who are not residents of institutional group quarters. In addition, I exclude all individuals with imputed/missing employment status and worker class. Individuals are classified as incorporated self-employed, unincorporated self-employed, or wage and salary workers. Using the information on worker class and employment status, I reclassify the population into four categories: incorporated self-employed, unincorporated self-employed, wage and salary workers, and others (i.e., unemployed or not in the labor force).

Levine and Rubinstein (2017) show that incorporated and unincorporated self-employed individuals differ in their human capital traits and income profiles. For example, incorporated self-employed individuals are more educated, perform tasks demanding strong cognitive abilities, and earn more than unincorporated and salaried workers. Therefore, they argue that incorporated self-employment is a better proxy for entrepreneurship; consequently, my analysis distinguishes these two groups.

Table 1 reports descriptive statistics on different classes of workers over the sample years. Column 1 in Table 1 presents the statistics related to all self-employed individuals, whereas columns 2 and 3 present the same statistics for incorporated or unincorporated business owners, respectively. The last column reports the corresponding statistics for wage and salary workers. The share of all self-employed individuals in the total employment is about 8.6%, and the percentage of unincorporated self-employment is about 5.5%. College-educated represents individuals with at least some college education, and routine tasks represent activities that can be readily codified and computerized.⁶

Columns 1-3 reveal that most self-employed are white, slightly older, males, and mainly

⁵Crosswalk files are available at David Dorn's website: <https://www.ddorn.net/data.htm>.

⁶Using the U.S. Department of Labor's Dictionary of Occupations, Autor and Dorn (2013) measure routine task content by occupation listed in the Census's surveys. They then identify routine occupations such that they accounted for 1/3 of U.S. employment in 1980. I use their crosswalk files and definition to identify routine occupations in the sample surveys.

Table 1: Summary Statistics on Worker Class

	Self-employed Individuals			Wage
	All	Incorp.	Unincorp.	Workers
	1	2	3	4
Female (%)	36.5	30.0	40.3	48.2
Age	45.1 (11.1)	46.3 (10.4)	44.4 (11.3)	39.1 (12.6)
White (%)	83.3	84.7	82.6	76.7
College Educated (%)	64.3	72.8	59.6	63.9
Hours Worked	41.3 (15.9)	45.1 (14.6)	39.2 (16.2)	39.8 (11.2)
Routine Tasks (%)	22.6	18.4	24.5	29.6
Annual Income (\$1,000)	63.1 (90.3)	94.0 (119.5)	45.1 (61.1)	48.1 (45.7)
Manufacturing (%)	4.8	6.2	3.9	13.6

Notes: The data draw on the Census 1990 and 2000 decennial surveys and the 2015-2017 ACS files from IPUMS (Flood et al. 2020). The sample covers working age individuals (ages 16-64) who are employed in the non-agricultural private sector. College educated represents all individuals who have at least some college education. Numbers in parentheses are standard errors.

employed in the private service sector. However, the statistics vary significantly across the two groups of self-employed. Incorporated businesses are more likely to be male, more educated, work longer hours, and perform more non-routine tasks than the unincorporated (and wage workers). Further, their average annual income is substantially higher than the other two groups.⁷ These findings corroborate Hamilton (2000) and Levine and Rubinstein (2017).⁸ The last row, which shows the share of each self-employment group working in manufacturing, shows that the majority of self-employed individuals work in non-manufacturing sectors.

Although not shown in this table, the self-employment rate is higher among immigrants than US-born individuals. The share of self-employment among immigrant workers is about 11

⁷These are earned incomes, which are expressed in thousands of 2012 dollars using the PCE index from the Bureau of Economic Analysis. Top-coded incomes are corrected using a procedure in Autor et al. (2008), and the bottom 1 percent is trimmed from the sample.

⁸Hamilton (2000), for example, reports that the median income of self-employed individuals is lower than that of wage workers. Since most self-employed people are unincorporated, the median income is mainly determined by that group.

Table 2: Average Decadal Self-employment Growth Rates (%)

	Incorporated		Unincorporated	
	1990–2000	2000–2016	1990–2000	2000–2016
All Industries	3.1	1.0	1.3	−0.2
Manufacturing	0.3	−1.6	−1.3	−2.6
Non-manufacturing	3.4	1.2	1.4	−0.1

Notes: The data draw on the Census 1990 and 2000 decennial surveys and the 2015-2017 ACS files from IPUMS (Flood et al. 2020). Non-manufacturing includes the mining, construction, and private service sectors.

percent, whereas that among US-born natives is about 8.1 percent. Incorporation rates among the two groups are 3.0% for natives and 3.8% for immigrants. The self-employment rate is lower among Hispanic workers than non-Hispanics: 7.8 percent for Hispanics and 8.7 percent for non-Hispanics. Lower self-employment among Hispanics is mainly driven by their low incorporation rate (2.0% for Hispanics and 3.3% Non-Hispanics).

Table 2 shows the average annual growth rates of self-employment across different industries over the two periods: 1990-2000 and 2000-2016. The growth rate of either type of self-employment is substantially lower in the second period.⁹ The average annual growth rate of incorporated (unincorporated) self-employment is about 3% (1.3%) in 1990-2000 and decreased to about 1% (−0.2%) in 2000-2016. A similar pattern is observed across manufacturing and non-manufacturing sectors (including mining, construction, and service sectors).

2.2 Data on Trade

Data on trade come from Greenland et al. (2019), who constructed the CZ-level trade data using industry-level non-NTR and NTR tariff rates in 1999 from Pierce and Schott (2016). Let $NTRGap_j$ denote the difference between non-NTR rate and NTR rate in industry j , i.e. $NTRGap_j = NonNTRRate_j - NTRRate_j$. Here, $NTRRate_j$ refers to normal trade relations tariff rates which, in China’s case, were subject to annual renewal by the United States; and $NonNTRRate_j$ represents tariff rates set by the Smooth-Hawley Tariff Act. Pierce and Schott

⁹One may think that the Great Recession drives the lower growth rates during the second period. However, this is not the case. Growth rates over 2000-2007 are also lower than those in the first period. For example, the average annual growth rate of incorporated (unincorporated) self-employment between 2000 and 2007 is about 0.3 (0.1) percent.

(2016) show that NTR gaps vary substantially across industries, and much of the variation comes from non-NTR rates.

A commuting zone’s exposure to permanent normal trade relations (PNTR) to China, denoted by $NTRGap_z$, is calculated as

$$NTRGap_z = \sum_j \frac{L_{zj90}}{L_{z90}} NTRGap_j, \quad (1)$$

L_{zj90}/L_{z90} is the share of industry j in CZ z ’s total employment in 1990, which are calculated using County Business Pattern (CBP) data from the US Census Bureau. Thus, $NTRGap_z$ is a local employment-weighted average of each industry’s exposure to PNTR. NTR gaps also vary considerably across CZs, with a mean and standard deviation of 6.3% and 4.9%, respectively.

3 Empirical Methodology

To estimate the impact of China’s accession to the WTO on self-employment, I estimate the following difference-in-differences (DID) model:

$$\Delta E_{zt} = \beta NTRGap_z \times \mathbb{I} + \gamma_t X_z \times \mathbb{I} + \theta \text{Pop}_{\mathcal{G}_z, t-1} + \eta_{rt} + \varepsilon_{zt}, \quad (2)$$

where E_{zt} denotes the number of self-employed individuals in the non-agricultural private sector in CZ z in year t , and $\Delta E_{zt} = (E_{zt} - E_{zt-1})/L_{z,90}$ is the decadal change in self-employment normalized by the 1990 CZ adult population.¹⁰ The normalization is done to control for the cross-zone differences in the population. \mathbb{I} is an indicator variable that equals zero for the 1990-2000 period and one for 2000-2016. The coefficient β measures the effect of exposure to PNTR to China (following its accession to the WTO in late 2001) on self-employment change.

The set X_z represents the 1990 CZ-level covariates potentially correlated with the NTR gap. This set includes CZ demographics (the population shares of white, Hispanics, immigrant, and college-educated), the share of employment among women, the share of employment in routine occupations, the average offshorability of tasks that workers perform, and the unemployment

¹⁰ ΔE_{zt} over the 2000-2016 period is divided by 1.6 to put both periods on a comparable decadal scale. When I consider a particular type of self-employment, say unincorporated, ΔE_{zt} denotes the decadal change of unincorporated self-employment normalized by the initial CZ population. For each CZ and year, I calculate E_{zt} by multiplying the share of self-employment in CZ total employment (calculated from the ACS data) with the CZ employment numbers (from the Bureau of Labor Statistics), which are available at the county-level since 1990.

rate. Using the 1990 data reduces concerns regarding reverse causality. The coefficients on these variables are different across the two periods to capture their differential effects over time.

I include the initial employment share of different demographic groups because the distribution of self-employed individuals varies across gender, race, and education groups, as shown in Table 1. Further, the impact of trade shocks is likely to be more substantial in CZs with higher employment shares in routine tasks and a higher average offshorability index. Levine and Rubinstein (2017), for example, show that people who open incorporated (unincorporated) businesses are less (more) likely to have been previously working in routine occupations.¹¹

Population change can also affect self-employment -e.g., areas experiencing higher population growth may offer more business opportunities. However, Greenland et al. (2019) show that local-labor markets most exposed to Chinese import competition experienced a reduction in population growth over the next decade; and thus including the population growth constitutes a bad control (Angrist and Pischke, 2009). Because local-population growth shows persistence over time (Monras, 2018), I include lagged decadal population growth, $\text{Popg}_{z,t-1}$, to control for the persistent part of the population growth.

Finally, Census-region-by-decade fixed effects, η_{rt} , are included to control for region-specific shocks and trends, and ε_{zt} denotes the error term. In estimating (2), I weight regressions by the 1990 CZ adult population to generate population-relevant estimates, and robust standard errors are clustered at the CZ level.

4 Results

This section presents and discusses the impact of Chinese import penetration on self-employment. It also investigates the effects on self-employment across different groups based on gender, age, and education and discusses the implications of the findings. Finally, it presents several sensitivity checks to examine the robustness of the results.

¹¹The initial share of employment that is in manufacturing is another control variable that can be included. However, as Pierce and Schott (2020) also note, NTR gaps and manufacturing employment shares are highly correlated ($\rho \approx 0.9$) because most of the products exposed to PNTR are manufacturing goods. Therefore, including manufacturing employment shares poses serious collinearity, making it hard to identify the impact of Chinese import competition. When I include the initial manufacturing employment shares into the model, estimates on NTRgap become noisy (i.e., having high standard errors) and sensitive to the set of controls.

Table 3: Effects of Exposure to PNTR to China on Self-employment Changes in the U.S.

	A. Without Controls			B. With Controls		
	All 1	Incorp 2	Unincorp 3	All 4	Incorp 5	Unincorp 6
NTRGap	-0.050*** (0.012)	-0.019*** (0.005)	-0.030*** (0.009)	-0.040*** (0.012)	-0.015** (0.006)	-0.025*** (0.008)

Notes: Each regression uses 1,444 observations from 722 U.S. commuting zones. All regressions include region-by-period fixed effects, and are weighted by the 1990 CZ working-age population. Robust standard errors in parentheses are clustered at the CZ-level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

4.1 Benchmark Results

Table 3 presents results from stacked regressions over 1990–2000 and 2000–2016 periods based on equation (2). All regressions include region-by-year fixed effects. Columns 1-3 report estimates without CZ-level controls, whereas columns 4-6 have controls. For brevity, I do not report estimates on CZ-level controls. In this and subsequent tables, All represents both incorporated and unincorporated self-employment.

According to column 1, exposure to the PNTR to China has a negative and highly significant effect on self-employment. The impact on incorporated and unincorporated self-employment is also negative and significant. Note that the sum of coefficients in columns 2 and 3 equals that in column 1 because I classified all self-employed individuals into incorporated and unincorporated self-employment. Adding the initial CZ-level controls lowers estimated coefficients, but effects remain highly significant.

The estimate in column 4 implies that an interquartile increase in the NTR gap (about 0.059) would have decreased the decadal change in self-employment in a CZ by about 0.24 percentage points. The average self-employment in 2000 is about 6.5% of the 1990 CZ population, and thus an interquartile increase in the NTR gap would have lowered the CZ’s self-employment by 3.7% over the next decade. Similarly, it would have decreased incorporated and unincorporated self-employment change by 0.09 and 0.15 percentage points, respectively, which further implies a 3.9 and 3.4% decline in incorporated and unincorporated self-employment.¹²

¹²Incorporated (unincorporated) self-employment in 2000 is about 2.2% (4.3%) of the 1990 CZ population.

Table 4: Effects of Exposure to PNTR to China on Self-employment Change, by Industry

	Manufacturing			Non-Manufacturing		
	All 1	Incorp 2	Unincorp 3	All 4	Incorp 5	Unincorp 6
NTRGap	-0.002 (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.038*** (0.012)	-0.015** (0.006)	-0.024*** (0.008)

Notes: Each regression uses 1,444 observations from 722 U.S. commuting zones. All regressions include the initial CZ-level controls, lagged population growth, region-by-period fixed effects, and are weighted by the 1990 CZ population. Robust standard errors in parentheses are clustered at the CZ-level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4 reports the effects of Chinese import competition on self-employment in manufacturing and non-manufacturing sectors (which includes mining, construction, and private service sectors). The impact on self-employment in manufacturing is negative, small, and statistically insignificant, which is not surprising given that self-employment constitutes a small portion of employment in manufacturing. Estimates in columns 4-6 indicate that the effects reported in Table 3 stem almost entirely from non-manufacturing sectors.

To put these findings into context, I also estimate the impact of exposure to PNTR to China on total employment (including self-employment), and Table 5 reports the results. The effect on decadal change in total employment is negative and highly significant, and around 60 percent of this reduction comes from manufacturing. The effect on employment in non-manufacturing is also negative and statistically significant at the 10%-level. These findings are consistent with previous studies (Autor et al. 2013 and 2016, and Pierce and Schott 2016).¹³ A comparison of these estimates with previous ones implies that around 11.5% ($\approx 0.040/0.349$) decline in total employment stems from a reduction in self-employment. Similarly, the reduction in self-employment in non-manufacturing constitutes about 27.3% ($\approx 0.038/0.139$) of the employment decline in this sector.

In sum, China's accession to the WTO has a sizable negative impact on both incorporated and unincorporated self-employment, and effects almost entirely come from non-manufacturing

¹³Autor et al. (2013) use a different approach to estimate the impact of Chinese import competition on the employment share of the working-age population over the 1990-2007 periods. They find that it lowered manufacturing employment share and had a negative but insignificant impact on non-manufacturing employment share.

Table 5: Effects of Exposure to PNTR to China on Employment Change

	Total	Manufacturing	Non-Manufacturing
NTRGap	-0.349*** (0.094)	-0.211*** (0.020)	-0.139* (0.083)

Notes: Each regression uses 1,444 observations from 722 U.S. commuting zones. All regressions include the initial CZ-level controls, lagged population growth, region-by-period fixed effects, and are weighted by the 1990 CZ population. Robust standard errors in parentheses are clustered at the CZ-level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

sectors. In other words, the increased import competition from China adversely affected entrepreneurship in the U.S. (even if one considers only incorporated self-employed business owners as entrepreneurs). In addition, the decline in self-employment is responsible for about an 11.5% reduction in total employment and about 27.3% in non-manufacturing employment.

4.2 Channels

Exposure to the increased import competition from China can affect self-employment in various ways. First, as Greenland et al. (2019) show, areas most exposed to China shocks have experienced a reduction in their population growth, which, in turn, would adversely affect the demand for and supply of businesses offered by self-employed individuals. I re-estimate Greenland et al. (2019) using the data over 1990-2016 (their analysis uses the period 1990-2010). The estimated coefficient on NTRGap is -0.203 (0.082), implying that the increased import competition from China lowered the population growth.¹⁴

Second, as Table 5 shows, employment in areas exposed to shocks has declined substantially. In addition, Table 6 reports the effects of exposure to the PNTR to China on the average decadal growth of annual earned income.¹⁵ It has a negative effect on self-employed individuals' earned income, but estimates are noisy.¹⁶ Its effect on other workers' income is negative and highly

¹⁴I obtained U.S. county population data over the 1969-2019 period from U.S. National Cancer Institute: <https://seer.cancer.gov/popdata>. The point estimate is smaller than theirs (-0.283 (0.117)), but the broader conclusion remains the same.

¹⁵Earned income includes income from businesses and wage & salaries. However, census surveys often record the income of incorporated self-employed individuals as wage and salary because they are considered their companies' workers. As a result, the business income reported in surveys may not fully represent the actual business income. To overcome this hurdle, I consider the total earned income.

¹⁶The above findings are not surprising because income data for self-employed individuals are noisy, as shown by standard errors in Table 1).

Table 6: Effects of Exposure to PNTR to China on Earned Annual Income Growth

	Incorporated	Unincorporated	Wage Workers
NTRGap	-0.229 (0.198)	-0.011 (0.145)	-0.199*** (0.068)

Notes: Each regression uses 1,444 observations from 722 U.S. commuting zones. All regressions include the initial CZ-level controls, lagged population growth, region-by-period fixed effects, and are weighted by the 1990 CZ population. Robust standard errors in parentheses are clustered at the CZ-level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

significant. Now, the reduction in employment combined with lower income would reduce the demand for goods and services provided by self-employed individuals, which would lead to lower self-employment.

Finally and perhaps more directly, the further exposure to Chinese import competition after 2001 might have affected self-employment in non-manufacturing sectors through their input-output linkages with manufacturing. Businesses run by self-employed individuals are often very small and more likely to have strong links with domestic firms that they know.¹⁷ When increased competition from Chinese import force manufacturing firms to exit the market, this would also adversely affect non-manufacturing firms related to them. Further, well-established larger firms with solid supply chains in China switch to use/sell cheaper products from China, enabling them to expand their businesses. The increased competition from these large firms would naturally force small firms out of the market.

4.3 Effects on Self-employment Among Different Groups

The analysis so far treated all individuals in each type of self-employment the same. However, the effects can vary across subgroups (characterized by gender, age, education) for several reasons. For example, import competition may affect young adult business owners more adversely due to their lack of business experience. Another important reason can be credit constraints that some of the subgroups face. Several studies have shown that certain groups (e.g., women and minorities) face higher barriers in credit markets to get loans. For example, using data from

¹⁷CPS-March files provide information about firm size. About 74% (94%) of incorporated (unincorporated) self-employed business owners have less than ten employees (including owners). My analysis does not use CPS-March files because county identifiers are not available for most counties.

the Survey of Small Business Finances, Asiedu et al. (2012) find that the denial rate in loan applications is at least 50 percent higher for female-owned firms compared to white males.

This section investigates the impact of Chinese import growth on self-employment among different groups based on gender, age, and education. My analysis distinguishes differential effects across manufacturing and non-manufacturing sectors for each group. Therefore, I estimate the impact on each group using equation (2), keeping all the independent variables the same. Table 7 reports the results.

Panels 1.A and 1.B in Table 7 report results for females and males. The dependent variable in column 1 of Panel 1.A, for example, is the decadal change in female self-employment in manufacturing (normalized by the 1990 CZ population). Dependent variables in other columns and panels are defined similarly. Exposure to PNTR to China has a negative impact on self-employment among both genders, and as in Table 4, effects mostly come from non-manufacturing sectors. Estimates in 7 together with the corresponding population shares imply that the import competition has a substantially higher impact on incorporated self-employed females than males.

¹⁸ The impact on unincorporated self-employment is similar across both gender groups.

In this table, panels 2.A and 2.B present results across two age groups: 16-39 and 40 or more. Results in Panel 2.A show that exposure to PNTR to China has a negative impact only on unincorporated self-employed younger (i.e., age 16-39) workers in manufacturing. Results in Panel 2.B indicate that the exposure has a negative and significant effect on incorporated business owners who are 40+ years old, and its impact on unincorporated self-employment is higher among the younger group. For example, an interquartile increase in the NTR gap would have lowered the incorporated self-employment among older business owners by 5% over the next decade while reducing unincorporated self-employment among younger and older groups by 3.8% and 3.1%, respectively.

Finally, Panels 3.A and 3.B present estimates based on education level, where the Less-educated (More-educated) population represents individuals with high school or less (at least some college) education. As in the previous table, China's accession to the WTO has adverse

¹⁸The number of incorporated self-employed females (males) in 2000 (normalized by the 1990 CZ population) is about 0.006 (0.015). Thus, an interquartile increase in the NTR gap would have lowered the incorporated self-employment among females (males) by 7.4% (3.1%) over the next decade.

Table 7: Effects of Chinese Import Growth on Self-employment Among Different Groups

	Manufacturing			Non-manufacturing		
	All 1	Incorp 2	Unincorp 3	All 4	Incorp 5	Unincorp 6
<i>Panel 1.A: Females</i>						
NTRGap	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.015*** (0.005)	-0.007** (0.003)	-0.009** (0.004)
<i>Panel 1.B: Males</i>						
NTRGap	-0.001* (0.001)	-0.000 (0.001)	-0.001* (0.001)	-0.023*** (0.007)	-0.008** (0.004)	-0.015*** (0.005)
<i>Panel 2.A: Age < 40</i>						
NTRGap	-0.001** (0.000)	-0.000 (0.000)	-0.001** (0.000)	-0.013*** (0.004)	-0.003 (0.002)	-0.010*** (0.004)
<i>Panel 2.B: Age ≥ 40</i>						
NTRGap	-0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)	-0.026*** (0.008)	-0.012** (0.005)	-0.014*** (0.005)
<i>Panel 3.A: Less-educated</i>						
NTRGap	-0.002*** (0.000)	-0.001* (0.000)	-0.001** (0.001)	-0.024*** (0.005)	-0.007*** (0.002)	-0.017*** (0.004)
<i>Panel 3.B: More-educated</i>						
NTRGap	0.000 (0.001)	0.000 (0.001)	0.000 (0.000)	-0.015* (0.008)	-0.008 (0.005)	-0.007 (0.004)

Notes: Each regression uses 1,444 observations from 722 U.S. commuting zones. All regressions include the initial CZ-level controls, lagged population growth, region-by-period fixed effects, and are weighted by the 1990 CZ population. Less Educated (More Educated) represents individuals with high school or less (at least some college) education. Robust standard errors in parentheses are clustered at the CZ-level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

effects of self-employment among non-college-educated individuals but no impact on college-educated ones. In non-manufacturing sectors, it negatively impacts both groups, but effects are more substantial on less-educated self-employed individuals since self-employment is lower among less-educated workers. For example, an interquartile increase in the NTR gap would have lowered the incorporated (unincorporated) self-employment among less-educated business

owners by 7.1% (6.2%).

The analysis in this section uncovers considerable variation in the impact of rising Chinese import competition on self-employment across different demographic groups. Effects are more substantial on self-employment among females and less-educated individuals.

4.4 Sensitivity Checks

This section discusses several sensitivity checks to examine the robustness of the results. Table 8 reports the additional estimates of the effects of Chinese import competition on self-employment.¹⁹ Again, all regressions in Table 8 are weighted by the 1990 CZ population.

In calculating NTR Gap, all industries were considered. However, some researchers (e.g., Kovak (2013)) argue that it is more appropriate to use only traded-goods industries in calculating the degree of an exposure to trade (see also Borusyak et al. (2018)). Panel A in Table 8 reports results when the CZ-level NTR gaps are constructed using only traded-goods industries (the data from Greenland et al. 2019). The impact on manufacturing is again small and statistically insignificant. Point estimates on self-employment in non-manufacturing sectors are lower than the benchmark results, but the effect remains similar. An interquartile increase in the NTR gap (about 0.121) would have lowered the incorporated and unincorporated self-employment in non-manufacturing by 0.090 and 0.114 percentage points, respectively, over the next decade. These findings further imply about 4.0% and 2.7% decline in incorporated and unincorporated self-employment, respectively.

One concern about the results may be driven by the 2007-2009 recession, which was generated by the housing market crisis.²⁰ Studies have shown that adverse effects on consumers and labor markets were more severe in areas most exposed to the subprime mortgage crisis (Charles et al., 2018, Mian and Sufi, 2014, Mian et al., 2013). To control for the effects of the recession, following Greenland et al. (2019), I include two variables (interacted with a post-2001 dummy):

¹⁹For brevity, I only present sensitivity analysis for the benchmark estimates in Table 4 -analyses for the groups discussed in the previous section yield similar conclusions available upon request.

²⁰The fact that the 2000-2016 period includes several post-recession years (during which labor markets have recovered) should alleviate this concern to a large extent. Further, previous studies (e.g., Fossen Fossen (2020)) have shown that during the recession, individuals' likelihood of becoming self-employed increases. In this case, the benchmark estimates represent a lower bound for the negative effect of the import competition.

Table 8: Effects of Chinese Import Growth on Self-employment: Robustness

Variable	Manufacturing			Non-manufacturing		
	All 1	Incorp 2	Unincorp 3	All 4	Incorp 5	Unincorp 6
<i>Panel A. Alternative weights</i>						
NTRGap	-0.001 (0.001)	-0.000 (0.000)	-0.000 (0.000)	-0.017** (0.007)	-0.007** (0.004)	-0.009** (0.004)
<i>Panel B. Great recession</i>						
NTRGap	-0.002* (0.001)	-0.000 (0.001)	-0.002** (0.001)	-0.044*** (0.012)	-0.014** (0.007)	-0.030*** (0.008)
<i>Panel C. Spillover Effects</i>						
NTRGap	-0.002** (0.001)	-0.001 (0.001)	-0.001* (0.001)	-0.046*** (0.001)	-0.014** (0.007)	-0.033*** (0.008)
<i>Panel D. Including pre-trends</i>						
NTRGap	-0.002* (0.001)	-0.000 (0.001)	-0.001** (0.000)	-0.038*** (0.011)	-0.012** (0.006)	-0.024*** (0.007)
<i>Panel E. State-by-year fixed effects</i>						
NTRGap	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.039** (0.015)	-0.010 (0.007)	-0.029*** (0.009)

Notes: Each regression uses 1,444 observations from 722 U.S. commuting zones. All regressions include the initial CZ-level controls, lagged population growth, region-by-period fixed effects, and are weighted by the 1990 CZ population. Robust standard errors in parentheses are clustered at the CZ-level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

debt-to-income ratio in 2001 and a housing price index that measures the structural break in prices between 2000 and 2006.²¹ Observe that the negative impact of the import competition is higher when these controls are included.²²

²¹Greenland et al. (2019) construct these variables using county-level data from Mian et al. (2013) and the Federal Housing Finance Agency. The source data are not available for all counties; as a result, the regression results reported in Panel B are based on 600 CZs.

²²Census decennial surveys and ACSs ask whether an owner-occupied housing unit was owned free and clear or was encumbered by a mortgage, loan, or other types of debt. Using these data, I calculate the fraction of households that were encumbered by a mortgage loan for 1990 and 2007. Including the mortgage variable in the model does not significantly impact results, i.e., estimates remain almost the same as the benchmark results.

Another concern is the spillover effects from neighboring CZs because areas most exposed to the trade shock are also more likely to be close to CZs that were also exposed. Ignoring the spillover effects may underestimate the impact. Using the squared-inverse distances between CZs as weights for each CZ, Greenland et al. (2019) measures the spillover effect as the weighted average of NTR gaps in all other CZs. Panel C reports the results and note that estimated impacts are higher than the benchmark results, especially for unincorporated self-employment in non-manufacturing. Estimates on the spillover variable are mostly positive and significant, usually at least at the 10% level.

Estimates become problematic when the outcome variable exhibits pre-trends correlated with the trade exposure. To control for potential pre-trends, I include lagged dependent variable.²³ As estimates in Panel D show, pre-trends do not play any significant role in the impact of the trade exposure. Although not reported, the effect of the lagged dependent variable is negative and significant in manufacturing but positive and insignificant in non-manufacturing sectors.

Finally, Panel E reports results when region-decade fixed effects are replaced by state-decade fixed effects, which capture any time-varying state-level factors that might affect self-employment. In this case, the increased number of fixed effects (from 18 to 92) may absorb considerable variation in the NTR gaps between states. Surprisingly, including them does not affect point estimates, as shown in Panel E. However, one may worry about over-controlling the model, and so I also consider an alternative specification by replacing region-decade fixed effects with only decade fixed effects. As a result, the negative impact of the exposure to NPTR to China becomes substantially higher (especially for unincorporated self-employment).

5 Conclusion

Recent studies have documented significant adverse effects of Chinese import competition on social and economic outcomes in the United States. This paper contributed to this literature by studying its impact on self-employed business owners, who constitute a significant portion of U.S. employment and play an essential role in job dynamism and wealth generation. A large volume

²³As an alternative way, I also consider self-employment change in 1980-1990 interacted with the period-fixed effects in my baseline specification (1). Results remain largely similar to those in Panel D.

of studies has already examined various factors that affect an individual's decision to become self-employed. However, the impact of trade on self-employment has not been investigated empirically because of data and identification challenges researchers have faced. This paper aimed to close this gap as well.

I use China's accession to the WTO as a natural experiment to investigate the impact of import competition on self-employment. Granting permanent low tariff rates to China has affected U.S. local markets differentially due to the differences in areas' industrial composition. I find that increased Chinese import competition stemmed from this accession had a considerable negative impact on self-employment, and effects come almost entirely from non-manufacturing sectors. Effects are higher on incorporated self-employment which exhibits more entrepreneurial traits. My analysis also reveals that a reduction in self-employment can explain more than a 10 percent decline in total employment. I argue that both supply and demand channels have played significant roles in the adverse impact of Chinese import competition. Finally, I also find considerable variation in effects across groups defined by gender, age, and education.

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