DEMAND-DRIVEN PROPAGATION:

EVIDENCE FROM THE GREAT RECESSION

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ABSTRACT

This paper presents evidence for the demand-driven propagation of job losses in the U.S. during the Great Recession. Using county-level tradable job losses (driven by declines in aggregate demand) as an instrument, it shows that retail and restaurant employment fell by 0.34% for every 1% job losses in the rest of the county's economy. The finding is not driven by the collapse in house price, or by credit supply problems. In addition, the spillover is more severe for more income-elastic retail and restaurant industries, which strengthens the argument for the demand-driven propagation.

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1. INTRODUCTION

Economists and policy makers have been concerned about downward demand spirals in recessions- the idea that initial job losses can lead to additional cuts in consumption, and as a consequence, further job losses. Since the start of the Great Recession, the concern has been raised again by many economists. Paul Krugman, for example, at the height of the economic crisis, argued that "*rising unemployment will lead to further cuts in consumer spending. Weak consumer spending will lead to cutbacks in business investment plans. And the weakening economy will lead to more job cuts, provoking a further cycle of contraction…To pull us out of this downward spiral, the federal government will have to provide economic stimulus in the form of higher spending and greater aid to those in distress*" (New York Times, November 14, 2008).

This paper provides empirical evidence to support the demand-driven propagation channel during the Great Recession. In particular, it shows that in a county, unemployment in retail and restaurants (RR), was caused by job losses in the rest of the county's economy, which comprises of tradable, construction and other services (TCS). To address endogeneity issue, I use a Bartik instrument (Bartik, 1991), which captures a county's tradable job losses driven by declines in aggregate demand, to instrument for job losses in the rest of the county's economy. I find that a 1% decrease in TCS employment causes a 0.28% to 0.34% decrease in retail and restaurant employment between 2007 and 2010. This could arguably be caused by laid-off workers cutting their consumption, consequently hurting local retailers and restaurants.

There has been little empirical evidence so far to support the demand propagation channel. This is partly because it is very difficult to separate different rounds of job losses in the data. In other words, we are not certain if one's job loss causes others' job losses, or the other way around. For example, laid-off automobile workers could postpone purchasing new TV sets, and cut back their restaurant meals. If this were the case, restaurant workers would then lose their jobs and would no longer be able to afford new cars, which would affect the jobs of automobile workers. The impacts of unemployment are intertwined, occur at the same time, and are difficult to separate.

This paper overcomes the difficulty by using a Bartik instrument. As will be clearer in the identification strategy section, the Bartik instrument captures *a county's tradable job losses that are only driven by declines in U.S.'s tradable aggregate demand*, and not by county-specific issues. Since there are more than 3000 counties in the U.S, the U.S.'s tradable aggregate demand is largely exogenous to a county, that is, it is little affected by county-specific fundamentals. This implies that reverse causality and county-specific omitted variable problems are not likely at play.

A county's Bartik instrument in the Great Recession is determined by (1) how exposed the county was to tradable industries, and (2) how those tradable industries' aggregate demand fell. Let's take Elkhart County- Indiana, as an example. Elkhart County is best known for producing recreation vehicles (RV). It has been referred to as the "RV Capital of the World". Before the recession, one in every four jobs in Elkhart was tied to the service or manufacturing of RV and component parts. The county suffered badly when the recession hit, and demand for recreational vehicles in the U.S. came to a halt. The county's unemployment rate reached 18.8% in April 2009 -- the highest in the nation at the time. The job losses in the RV industry came as a shock to the county; they were driven by the county's pre-existing exposure to the RV industry, and by the massive collapse of RV demand.

The Bartik instrument is then used to instrument for the county's job losses in tradable, construction, and other services (TCS). Note that TCS and retail and restaurants (RR) cover the whole economy. I am going to be agnostic about how tradable job losses spill over to TCS job losses. Several possible spillover mechanisms could be at play. It could be demand-driven (e.g., laid off tradable workers stop going to theaters). It could be via input-output linkages (e.g., shut down factories stop hiring private security firms, see Nguyen and Rezaei (2015) for a study). It is even possible that job losses in tradable industries lead to job gains in TCS, as now we have more laid off tradable workers looking for jobs. I nevertheless do not take a stand on the mechanisms of the propagation.

Finally, I estimate the impact of the *instrumented* TCS job losses on the job losses in retail and restaurants, and argue that the estimated impact reflects the demand-driven mechanism. Following Mian and Sufi (2014), retail and restaurant job growth is chosen as the outcome variable because these sectors represent end consumption, that is, they are not inputs into production processes. In addition, I find that negative spillovers from TCS job losses are stronger and more statistically significant for more income-elastic RR industries than for less income-elastic ones. This finding strengthens the argument for demand-driven spillovers.

I do not find evidence for nominal wage declines in retail and restaurant sectors. More precisely, counties that were more exposed to tradable industries did not see their nominal retail and restaurant wages drop more during the Great Recession. This is an evidence against the reallocation of labor from TCS to RR. Since the wage adjustment was not in place, the quantity of RR labor has to fall to cope with the collapse in demand.

Particular attention is paid to competing channels. First, I argue that the propagation of job losses is not driven by a collapse in house prices, a prominent factor in the Great Recession. Additionally, the relationship is not driven by the credit channel, i.e., the possibility that the negative spillover from TCS job losses to RR job losses is due to credit supply issues. For example, underwater tradable firms may default to local banks, who would then be unable to provide credit to RR firms. However, I show econometrically that this is not the case.

The paper is organized as follows: section 2 provides a literature review; section 3 discusses the data; section 4 presents a model and the identification strategy in details; section 5 reports the main results; section 6 discusses alternative hypotheses; finally, section 7 concludes.

2. Literature review

Recent literature has increasingly focused on the role of demand in the Great Recession. On the empirical front, a series of papers by Atif Mian, Amir Sufi and other co-authors show that in counties that have higher pre-crisis household leverage, consumption cuts and employment losses during the crisis are higher (Mian and Sufi, 2010; Mian, Sufi and Rao, 2013; Mian and Sufi 2014; Mian, Sufi and Trebbi, 2015). This is because when house price slumps, deleveraging households have to cut consumption, which leads to job losses. This paper takes the demand channel one step further. While Mian and Sufi's papers discuss the job losses due to deleveraging households, this paper focuses instead on the spillovers from TCS job losses to RR job losses, and argues this as evidence for demand propagation in the Great Recession.

This paper is also related to a large, and hotly debated, literature on fiscal multipliers. Estimated fiscal multipliers vary widely (see Ramney, 2011 for a literature review). Many have found multipliers that are smaller than one, and potentially close to zero, while others have found substantially larger multipliers.[2]

[2] For the U.S., Barro and Redlick (2011) find that the multiplier for temporary defense spending is 0.4-0.5 contemporaneously and 0.6-0.7 over two years. Ramney (2011) uses a narrative approach to construct U.S. government spending news variables, and obtains the multipliers in the range

If downward demand-driven spiral exists as shown in this paper, this lends support to demand-stabilizing fiscal policies. The finding of my paper, therefore, is consistent with large rather than small fiscal multipliers.

The literature has also provided some theoretical foundation for demand-driven propagation. Early sticky-price models emphasize the role of aggregate demand as a key driver of the business cycle (see, e.g., Christiano, Eichenbaum and Evans, 2005; Galı, 2010; Woodford, 2003). More recently, theoretical papers, motivated by the crisis, discuss the aggregate demand effects. Eggertsson and Krugman (2012) build a simple new Keynesian model of debt-driven slumps, in which deleveraging agents depress aggregate demand. The paradox of thrift, a multiplier and demand propagation emerge naturally from their model. Guerrieri and Lorenzoni (2011) model an economy's responses to an unexpected, permanent tightening of borrowing capacity. In that environment, constrained consumers are forced to repay their debt, and unconstrained consumers increase their precautionary savings. This depresses the interest rate and causes output loss. Heathcote and Perri (2015) focus on self-fulfilling unemployment. In their model, since households expect high employment, they have strong pre-cautionary incentives to cut spending, making the expectation of high employment a reality.

Related to the theme of this paper, Autor et al (2013) and Acemoglu et al (2015) analyze long-term local impacts of trade competition. They show that import

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from 0.6 to 1.2. Nakamura and Steinsson (2014) exploit regional variations in military buildups to estimate the multiplier of military procurement in the range of 1.4-1.9. In Serrato and Wingender (2014) and Shoah (2015), the estimated multipliers are as high as 1.88 and 2.12. More recently, Kraay (2012, 2014) use World Bank lending to low-income countries as an instrument to arrive at the estimated fiscal multiplier of around 0.4 to 0.5.

competition from China depresses manufacturing jobs in the U.S., but there is no significant spillover effect to non-manufacturing job losses. Their finding differs to mine, probably because of two reasons. First, the impact of import competition is more gradual and less intense than the impact of the demand collapse in the Great Recession. Second, the timeframe they consider is longer (i.e., from 1990 to 2007), which could allow for wage and sector adjustments. Indeed, Autor et al (2013) find that nonmanufacturing wages fall in areas that house import-competing manufacturing industries. They consider this as evidence for a "*combination of a negative demand shocks and positive shocks to nonmanufacturing labor supply, as workers leaving manufacturing seek jobs outside of the sector*" (Autor et al, 2013, page 2148). In contrast, during the Great Recession, I find that local waged tend to be sticky, a result also found in Mian and Sufi (2014). The swift and dramatic demand collapse during the Great Recession might have prevented local labor markets from adjusting.

Finally is the literature that utilizes the Bartik instrument. The instrument is first developed by Bartik (1991) to isolate exogenous shifts in labor demand in a local community. Therefore, the instrument is sometimes referred to as Bartik instrument. The instrument is used later by Blanchard and Katz (1992), Autor and Duggan (2003), Luttmer (2005), Wolzinak (2010), and Bertrand et al. (2015), among others.

3. DATA

Three major sources of data are used in the paper. The first source is the Census Bureau. County employment data by industry are from the County Business Patterns (CBP) dataset. CBP data are recorded in March each year. Employment data in 2007 and 2010 are chosen, because March of 2007 and March of 2010 are closest to the bottom and peak of the nation's unemployment rate. CBP data at the four-digit industry level are used.[3] I place each of the four-digit industries into one of four categories: retail and restaurants, tradable, construction and other services, following Mian and Sufi (2014).

The full list of *retail and restaurants* are shown in table 3.1. They are local stores, serving local residents. In 2007, they constitute 19.6% of national total employment. Their demand is generally income elastic (with many retailers of durable goods and restaurants), which makes them ideal candidates for spillover impacts.

A 4-digit NAICS industry is defined as *tradable* if it has tangible imports plus exports equal to at least $10,000 per worker, or if total exports plus imports exceed $500M. They consist of mostly oil, gas, mining and manufacturing.[4] Table 3.2 indicates that tradable industries account for about 15% of a county's total employment. *Construction* industries are those that are related to construction, real estate, or land development. The remaining industries are classified as *other services*. They consist of wholesales, transportation, finance, schools, hospitals, government etc. They account for about 52% of a county's workforce in 2007. All in all, tradable, construction and other services (TCS) account for 79%, and retail and restaurants (RR) account for about 21% of a county's employment.

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[3] County data at the four-digit industry level are sometimes suppressed for confidentiality reasons. However, the Census Bureau provides a range within which the employment number lies. As in Mian and Sufi (2014), I take the mean of this range as a proxy for the missing employment number in such cases.

[4] Please see http://faculty.chicagobooth.edu/amir.sufi/data-and-appendices/unemployment_miansufi_EMTRA_final_APPENDIX.pdf for a complete industry classification.

NAICS	Industry name	Percentage of total employment, 2007
4411	Automobile dealers	1.05
4412	Other motor vehicle dealers	0.15
4413	Automotive parts accessories and tire stores	0.41
4421	Furniture stores	0.23
4422	Home furnishing stores	0.27
4431	Electronics and appliance stores	0.42
4451	Grocery stores	2.13
4452	Specialty food stores	0.15
4453	Beer wine and liquor stores	0.13
4461	Health and personal care stores	0.89
4471	Gasoline stations	0.73
4481	Clothing stores	1.06
4482	Shoe stores	0.18
4483	Jewelry luggage and leather goods stores	0.14
4511	Sporting goods hobby and musical instrument stores	0.38
4512	Book periodical and music stores	0.16
4521	Department stores	1.36
4529	Other general merchandise stores	1.12
4531	Florists	0.09
4532	Office supplies stationery and gift stores	0.27
4533	Used merchandise stores	0.12
4539	Other misc store retailers	0.23
7221	Full-service restaurants	3.76
7222	Limited-service eating places	3.4
7223	Special food services	0.49
7224	Drinking places (alcoholic beverages)	0.31
	Total	19.63

Table 3.1: Retail and restaurants industries
Source: Mian and Sufi (2014)

The second source of data is from the Bureau of Labor Statistics (BLS). The BLS' Quarterly Census of Employment and Wages provide average weekly wages within a quarter for every NAICS 4-digit to 6-digit industry, across U.S. counties. For the analysis on wage rigidity, I choose average weekly nominal wages for *Retail* (NAICS code 44-45) and *Full Service Restaurants* (NAICS code 7221). To be consistent with the timing of employment data, average weekly wages during quarter I-2007 and during quarter I-2010 are chosen.

The third major source of data is from the work of Atif Mian, Amir Sufi and other co-authors. Data for pre-crisis household leverage is taken from Mian, Rao and Sufi (2013). It is calculated as households' debt to income ratio in 2006. Data for the change in housing net worth between 2006 and 2009 is from Mian and Sufi (2014). The two proxies are strongly correlated and my results with either or both proxies are robust and significant. Other pre-crisis county-level control variables are also from Mian and Sufi (2014): fraction of white population, median household income, fraction of homes that are owner-occupied, fraction of population with less than high school diploma, fraction of population with only a high school diploma, unemployment rate, poverty rate, and fraction of urban population.

Table 3.2 presents the summary statistics of the variables used in the paper. Most of the variables have full coverage, except wages and the leverage proxies. Between 2007 and 2010, on average, TCS industries lost about 8% of their jobs. Among them, tradable industries lost 19% of their jobs (more precisely, the change in log of tradable employment is -0.19) and construction lost 17.7%. The job losses in RR industries are more modest, on average 4.4%. Nominal retail and restaurant weekly wages increased 2.3% and 9.3%, respectively. Note that federal minimum wage increased 40% (from $5.15 to $7.25 an hour) during the same period.

	N	mean	SD	10th	90th
Retail and restaurant employment/Employment, 2007	3132	0.210	0.058	0.144	0.277
TCS employment/Employment, 2007	3084	0.791	0.055	0.724	0.856
Tradable employment/Employment, 2007	3085	0.146	0.107	0.031	0.288
Construction employment/Employment, 2007	3131	0.130	0.065	0.067	0.210
Other services employment/employment 2007	3134	0.516	0.104	0.386	0.647
Δ log of RT employment, 2007-2010	3132	-0.044	0.151	-0.183	0.111
Δ log of TCS employment, 2007-2010	3084	-0.080	0.128	-0.222	0.053
Δ log of tradable employment, 2007-2010	3048	-0.190	0.407	-0.609	0.133
Δ log of construction employment, 2007-2010	3126	-0.177	0.269	-0.484	0.122
Δ log of other services employment, 2007-2010	3134	-0.030	0.135	-0.173	0.110
Δ log of retail wage, 2007-2010	3099	0.029	0.101	-0.064	0.145
Δ log of restaurant wage, 2007-2010	2223	0.093	0.134	-0.030	0.248
Household leverage (debt/income), 2006	2219	1.573	0.584	0.971	2.366
Δ housing net worth, 2006-2009	944	-0.065	0.085	-0.172	0.003
Number of households, 2007	3135	36939	110855	2420	72622
fraction white, 2007	3135	0.870	0.150	0.658	0.988
Median Household Income ($), 2007	3135	35597	9147	26312	46608
fraction homes owner occupied, 2007	3135	0.741	0.075	0.643	0.818
fraction with less than a highschool diploma, 2007	3135	0.226	0.087	0.126	0.350
fraction with only a highschool diploma, 2007	3135	0.347	6.571	26.398	42.903
Unemployment rate, 2007	3135	0.058	0.058	0.058	0.058
Poverty rate, 2007	3135	0.142	0.065	0.073	0.226
fraction urban, 2007	3135	0.393	0.309	0.000	0.846

Table 3.2 Summary Statistics

Finally, house prices over time by counties are provided by Zillow Research. I use the house prices in March 2010 and March 2007, to match with the timing of the employment data. Due to house price data limitations, there are only 989 counties with house prices.

4. MODEL AND IDENTIFICATION STRATEGY

4.1 Model

To provide insights to the identification strategy, consider a small open economy (county *c*) with two sectors: retail and restaurants (RR), and others (TCS). TCS contains tradable, construction, and other services (such as wholesales, finance, schools, hospitals, utilities, government services…).

Consumers have Cobb-Douglas preferences over the two sectors' output with share θ for TCS goods and $1\text{-}\theta$ for RR goods. Production for each sector *i* is as follow:

$$P_{ic}Y_{ic}=P_{ic}A_{ic}l_{ic}^{\alpha_i}e_{ic}^{1-\alpha_i}$$

where A_{ic} is the county-sector productivity term, P_{ic} is the output price, l_{ic} is labor in sector *i* in county *c*. e_{ic} represents the local fixed factors of county c . Assume all income from labor and local fixed factors stay within county *c*. Since a fraction $1\text{-}\theta$ of total income is spent on RR goods, the equilibrium relation between RR and TCS employment is:

$$P_{RR,c}A_{RR,c}l_{RR,c}^{\alpha_{RR}}e_{RR,c}^{1-\alpha_{RR}} = \frac{1-\theta}{\theta}\left[P_{TCS,c}A_{TCS,c}l_{TCS,c}^{\alpha_{TCS}}e_{TCS,c}^{1-\alpha_{TCS}}\right]$$

Hence,

$$\alpha_{RR}\log(l_{RR,c}) + (1-\alpha_{RR})\log\left(e_{RR,c}\right) = \log\left[\frac{P_{TCS,c}A_{TCS,c}}{P_{RR,c}A_{RR,c}}\right] +$$
$$\alpha_{TCS}\Delta\log(l_{TCS,c}) + (1-\alpha_{TCS})\log\left(e_{TCS,c}\right)$$

Since the local fix factors are constant over time, and assuming the production functions does not change over time (i.e. α_{RR} and α_{TCS} are constant), we have:

$$\alpha_{RR}\Delta\log(l_{RR,c}) = \alpha_{TCS}\Delta\log(l_{TCS,c}) + \Delta\log\left[\frac{P_{TCS,c}A_{TCS,c}}{P_{RR,c}A_{RR,c}}\right] \quad (1)$$

(1) is the equilibrium relation between RR and TCS job losses. I will return to this equation later.

4.2 The Bartik instrument

I use Bartik instrument (Bartik, 1991) to instrument for $\Delta\log(l_{TCS,c})$, the TCS job losses. To see the relationship between TCS job losses and the Bartik instrument, consider the TCS job losses of county *c*:

$$\Delta\log(l_c^{TCS}) \approx \frac{l_{c,2010}^{TCS} - l_{c,2007}^{TCS}}{l_{c,2007}^{TCS}}$$

$$= \sum_i^{TCS} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \frac{l_{c,2010}^i - l_{c,2007}^i}{l_{c,2007}^i} \right)$$

where $l_{c,t}^{TCS}$ is TCS employment in county *c* at time *t; $l_{c,t}^i$* is industry *i*'s employment in county *c* at time *t*. We split the job losses to those in tradable industries (T), and those in construction and service industries (CS):

$$\Delta\log(l_c^{TCS}) = \sum_i^{TCS} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \frac{l_{c,2010}^i - l_{c,2007}^i}{l_{c,2007}^i} \right)$$

$$= \sum_i^{T} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \frac{l_{c,2010}^i - l_{c,2007}^i}{l_{c,2007}^i} \right) + \sum_i^{CS} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \frac{l_{c,2010}^i - l_{c,2007}^i}{l_{c,2007}^i} \right)$$

$$\approx \sum_i^{T} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta\log l_c^i \right) + \sum_i^{CS} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta\log l_c^i \right)$$

where $\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta\log l_c^i \right)$ are the job losses of all tradable industries in county *c* (as a fraction of the county's total TCS employment).

Tradable job losses $\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta \log l_c^i\right)$ might not be exogenous to a county's fundamentals. For example, labor supply issues (such as a raise in minimum wages, or strengthened regulations in the county) and changes in productivity could affect tradable jobs in that county. For that reason, we cannot use tradable job losses as an instrument. We have to use the Bartik instrument, which captures only tradable job losses driven by changes in aggregate demand. To see this, rewrite tradable job losses $\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta \log l_c^i\right)$ as:

$$\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta \log l_c^i\right)$$

$$= \sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta \log l_{USA}^i\right) + \left\{\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times (\Delta \log l_c^i - \Delta \log l_{USA}^i)\right)\right\}$$

The first term, $\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta \log l_{USA}^i\right)$, is the Bartik instrument. It is the sum of all tradable industries' Bartik instruments. For each industry *i*, it is the product of the county's pre-existing exposure to the industry, $\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}}$, and the national change in the industry's employment, $\Delta \log l_{USA}^i$. We interpret $\Delta \log l_{USA}^i$ as change in industry *i's* aggregate demand. Since there are more than 3000 counties in the U.S., the aggregate demand changes are not affected by a county's fundamentals.

An industry's Bartik instrument might not be exogenous to a county when production of that industry is heavily concentrated in one county. In that case, $\Delta \log l_{USA}^i$ could be influenced by county *c*-industry *i* specific supply issues. I examine such possibility among 61,714 county-industry pairs in 2007 and do not find it to be problematic. The average concentration of an industry in a county in 2007 is very small, at 0.013%. The only two pairs with more than 20% of national employment concentrated in one county are cut and sew apparel manufacturing in Los Angeles, CA (33.9%), and railroad rolling stock manufacturing in Erie, Pennsylvania (23.2%). Therefore, generally, tradable Bartik instrument is exogenous to a county.

The second term, $\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times (\Delta\text{log}l_c^i - \Delta\text{log}l_{USA}^i)\right)$, can be interpreted as tradable job losses driven by county-specific supply-side issues. It is the difference between actual tradable job losses and those that are driven by aggregate demand.

Hence, we can write TCS job losses as follows:

$\Delta \log(l_c^{TCS}) =$ Bartik instrument + $\sum_i^T \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \left(\Delta\text{log}l_c^i - \Delta\text{log}l_{USA}^i\right)\right)$

+ $\sum_i^{CS} \left(\frac{l_{c,2007}^i}{l_{c,2007}^{TCS}} \times \Delta\text{log}l_c^i\right)$, where the Bartik instrument will be used to instrument for $\Delta \log(l_c^{TCS})$.

4.3 Identification strategy

Rewrite equation (1):

$$\alpha_{RR}\Delta\text{log}(l_{RR,c}) = \alpha_{TCS}\Delta\text{log}(l_{TCS,c}) + \Delta\text{log}\left[\frac{P_{TCS,c}A_{TCS,c}}{P_{RR,c}A_{RR,c}}\right] \quad (1)$$

The identifying assumption for the use of the Bartik instrument is that the instrument is not correlated with the relative price and productivity changes. That is, the pre-existing exposure to tradable industries is not correlated with the subsequent relative changes in prices and productivity between TCS and RR sectors.

This is a reasonable assumption. Although one could worry that the county productivity could adjust to the shock to tradable sector, productivity is not easy to change in a short period. In addition, there is ample evidence for downward nominal wage rigidity in the Recession (Daly, Hobijn and Ni, 2013; Mian and Sufi, 2014). In section 6, I also find RR wages not correlated with the Bartik instrument.

The IV regression is as follows:

$$\Delta \log(l_c^{RR}) = c + instr[\Delta \log(l_c^{TCS})] + lev_c + controls_c + \varepsilon_c \qquad (2)$$

where $instr[\Delta \log(l_c^{TCS})]$ represents TCS job losses instrumented by the Bartik instrument. $\Delta \log(l_c^{RR}) = \log\left(l_{c,2010}^{RR}\right) - \log\left(l_{c,2007}^{RR}\right)$ is the log change in retail and restaurant employment; $\Delta \log(l_c^{TCS})$ is the log change in tradable, construction and services employment in county *c*. Note that all standard errors in this paper are robust and clustered at the state level. They are also weighted by county number of households

Lev_c are important control variables. They capture household leverage and change in housing net worth. Mian, Rao and Sufi (2013) and Mian and Sufi (2014) show that pre-crisis household leverage, (or similarly, the change in housing net worth during the Recession) is the factor behind the demand collapse. When house price slumps, highly leveraged households had to deleverage, leading to a sharp reduction in consumption. Mian and Sufi (2014) find that in counties with higher pre-crisis household leverage (and larger declines in housing net worth during the crisis), retail and restaurant employment dropped more. Equation (2) therefore examines two sources of demand shocks to retail and restaurant industries: the first one is from deleveraging households, the second one is from laid-off TCS workers cutting consumption.

Even when we could identify the exogeneity of TCS job losses, it is not guaranteed that retail and restaurant job losses follow TCS job losses. When prices and wages are flexible, the county economy could maintain full employment if retail and restaurant wages adjust downward, allowing the sectors to absorb unemployed TCS workers. In section 6 however, we find that retail and restaurant nominal wages are sticky during the Great Recession.

Even if we correctly identify that TCS job losses cause RR job losses, this does not entirely definite that the spillover is demand driven. We need to consider potential competing mechanisms. In section 6, I argue that the relationship is not due to the house price collapse or credit-related issues, two prominent features of the Great Recession. In addition, I find that the spillover is stronger for income-elastic retail and restaurant industries, which lends additional support to the demand-propagation argument.

5. MAIN RESULTS

In this section, counties with higher TCS job losses are shown to experience sharper job drops in retail and restaurants. The relationship is robust to pre-crisis county demographic and economic characteristics.

5.1 OLS regressions

Before proceeding to the main regressions, I would like to examine the simple OLS relationship between TCS job losses and retail and restaurant job losses. Table 5.1 reveals that TCS job losses are significantly associated with RR job losses. Every 1% job losses in TCS is associated with 0.217% job losses in retail and restaurants. The coefficients, are of course biased: they do not capture the causal effects of TCS job losses on RR job losses. Many sources of bias could take place. To identify a causal impact, we need to use the Bartik instrumental variable.

VARIABLES	Δlog(retail and restaurant employment)				
	[1]	[2]	[3]	[4]	[5]
Δlog(TCS employment)	0.241***	0.186***	0.253***	0.163***	0.217***
	[0.056]	[0.050]	[0.080]	[0.042]	[0.062]
leverage 2006		-0.028***	-0.025***	-0.025***	-0.018*
		[0.003]	[0.007]	[0.006]	[0.010]
Δ housing net worth			0.023		0.051
			[0.046]		[0.054]
fraction white				0.006	-0.011
				[0.019]	[0.024]
median household income				0.000	0.000**
				[0.000]	[0.000]
fraction owner-occupied				-0.102	-0.076
				[0.062]	[0.069]
fraction less than highschool				-0.025	0.029
				[0.061]	[0.090]
fraction highschool				0.049	0.131
				[0.114]	[0.138]
unemployment rate				-0.228	-0.430*
				[0.170]	[0.232]
poverty rate				0.157	0.362**
				[0.118]	[0.163]
fraction urban				-0.030***	-0.046***
				[0.008]	[0.015]
Constant	-0.035***	0.012	0.016	0.054	-0.011
	[0.009]	[0.013]	[0.020]	[0.039]	[0.056]
Observations	3,123	2,211	935	2,211	935
R-squared	0.062	0.147	0.223	0.164	0.261

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5.1: Simple OLS relationship TCS and RR job losses.

5.2 The Bartik instrument

Two components of the Bartik instrument are the exposure to tradable employment, and the declines in aggregate demand for the industries.

The Great Recession is associated with a massive collapse in demand, particularly for tradable goods. Within an average county, tradable jobs shrank by about 19% between 2007 and 2010 (Table 3.2). At the national level, some industries lost as much as 47% of their employment. Hardest hit industries are apparel manufacturing, motor vehicle manufacturing, furniture, electronics, construction-related, and oil and gas extraction (Table 5.2a).

NAICS	Industry	log(emp 2010)-log(emp 2007)
3152	Cut and sew apparel manufacturing	-0.476
3362	Motor vehicle body and trailer manufacturing	-0.464
3363	Motor vehicle parts manufacturing	-0.397
3361	Motor vehicle manufacturing	-0.383
3315	Foundries	-0.334
3342	Communications equipment manufacturing	-0.327
3372	Office furniture (including fixtures) manufacturing	-0.316
3341	Computer and peripheral equipment manufacturing	-0.313
3332	Industrial machinery manufacturing	-0.310
3344	Semiconductor and other electronic component manufacturing	-0.287
3399	Other miscellaneous manufacturing	-0.281
3334	Ventilation heating air -conditioning and commercial refrigeration	-0.265
2111	Oil and gas extraction	-0.254
3335	Metalworking machinery manufacturing	-0.252
3261	Plastics product manufacturing	-0.249
3333	Commercial and service industry machinery manufacturing	-0.248
3366	Ship and boat building	-0.229
2123	Nonmetallic mineral mining and quarrying	-0.227
3231	Printing and related support activities	-0.225
3353	Electrical equipment manufacturing	-0.223

Table 5.2a: Hardest hit tradable industries
(only large industries with more than 50,000 workers in 2007 are included).

Understandably, if a county is exposed to tradable industries, and worse, to the hardest hit industries, the county's Bartik instrument will be negative with a large magnitude. Table 5.2b lists ten large U.S counties with the most and least negative Bartik instruments. The value of the average Bartik instrument is -0.034. This implies on average, tradable job losses driven by aggregate demand accounts for 3.4% of TCS employment. Note that the average total tradable job losses only account for 2.8% of TCS employment (Table 5.2c)

fips	County name	State	Bartik instrument
18067	Howard County	IN	-0.2134
1049	DeKalb County	AL	-0.1977
13295	Walker County	GA	-0.1848
18039	Elkhart County	IN	-0.1694
47073	Hawkins County	TN	-0.1581
4001	Apache County	AZ	-0.0013
8117	Summit County	CO	-0.0012
22115	Vernon Parish	LA	-0.0011
11001	District of Columbia	DC	-0.0007
51013	Arlington County	VA	-0.0007

Table 5.2b: Counties most and least exposed to tradable
(note: only counties with more than 20,000 households are included)

	N	Mean	SD	10th	90th
Tradable job losses	3084	-0.028	0.063	-0.093	0.016
Bartik	3128	-0.034	0.032	-0.075	-0.005
Supply-driven tradable job losses	3074	0.006	0.056	-0.041	0.054

Table 5.2c: Supply-driven and demand-driven tradable job losses

How is the Bartik instrument related with a county's characteristics? Beside historical and idiosyncratic reasons, it is reasonable to predict that how much a county is exposed to tradable production could be driven by some of the county's characteristics, such as its abundance of land, its location next to key transportation hubs, education of the workforce etc. Table 5.2d presents associations between the Bartik instrument and counties' pre-crisis characteristics. The Bartik instrument seems to correlate with housing supply elasticity, education, and urbanization.

VARIABLES	bartik instrument
housing supply elasticity	-0.003*
	[0.001]
fraction white	-0.006
	[0.010]
median household income	0.000
	[0.000]
fraction owner-occupied	0.011
	[0.015]
fraction less than highschool	-0.089***
	[0.032]
fraction highschool	-0.041
	[0.027]
unemployment rate	-0.014
	[0.113]
poverty rate	0.147***
	[0.038]
fraction urban	0.020***
	[0.007]
Constant	-0.030
	[0.021]
Observations	867
R-squared	0.267

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5.2d: The Bartik instrument and county characteristics

Most notable is housing supply elasticity. It was developed by Saiz (2010) to measure how abundantly land for development is available. It has been shown, by Mian and Sufi (2014) and others, to be powerful in explaining the run up in house prices and household leverage before Great Recession, as well as the collapse of house prices during the Recession. Table 5.2d reveals that more abundant land and lower education are associated with a more negative Bartik instrument.

5.3 First stage relationship

VARIABLES	Δlog(TCS employment)				
	[1]	[2]	[3]	[4]	[5]
bartik instrument	0.797***	1.123***	1.176***	0.998***	1.041***
	[0.149]	[0.098]	[0.142]	[0.121]	[0.150]
leverage 2006		-0.042***	-0.027***	-0.042***	-0.021***
		[0.006]	[0.008]	[0.006]	[0.008]
change in housing net worth			0.134***		0.180***
			[0.040]		[0.040]
fraction white				0.040*	0.028
				[0.024]	[0.027]
median household income				0.000***	0.000***
				[0.000]	[0.000]
fraction owner-occupied				-0.125***	-0.107**
				[0.049]	[0.045]
fraction less than highschool				-0.051	0.031
				[0.058]	[0.061]
fraction highschool				0.007	0.042
				[0.087]	[0.090]
unemployment rate				0.156	0.382**
				[0.180]	[0.154]
poverty rate				0.136	0.138
				[0.103]	[0.134]
fraction urban				-0.039***	-0.047***
				[0.013]	[0.016]
Constant	-0.059***	0.028**	0.011	0.041	-0.038
	[0.010]	[0.012]	[0.017]	[0.046]	[0.048]
Observations	3,066	2,211	935	2,211	935
R-squared	0.058	0.209	0.275	0.239	0.334
F-stat	**28.53**	**73.83**	**26.00**	**42.17**	**42.67**

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5.3: First stage relationship

Table 5.3 presents the results for the relationship between the Bartik instrument and the log change in TCS employment. This is the first stage of the IV regression. Note that the sample is matched that of the second stage. F-statistics are consistently high and larger than 10, implying a strong relationship between the instrument and the instrumented variables. The relationship is interpreted as follows. Every tradable job lost due to aggregate demand decline leads to 1.041 jobs lost in TCS.

5.4 Baseline results

Tables 5.4a presents the reduced form relationship between the Bartik instrument and retail and restaurant job growth. Column [1] does not include the proxies for household leverage, while columns [2] to [5] do. After the inclusion of the leverage proxies, the relationship between the Bartik instrument and the RR job growth becomes positive and highly significant. This is because the Bartik instrument and household leverage are positively correlated[5]. Overall, a 1% decrease in the Bartik instrument causes a 0.278% decline in retail and restaurant employment between 2007 and 2010.

Table 5.4b shows the IV regressions between TCS job losses and retail and restaurant job losses, which show the baseline results of the paper. The positive coefficients in columns [2] to [5] imply that higher TCS job losses during the Great Recession led to stronger declines in retail and restaurant employment. Across counties, a 1% decrease in TCS job losses caused a 0.279% to 0.341% decrease in RR job losses. . This is above and beyond the direct effect of household deleveraging on retail and restaurants, as documented by Mian and Sufi (2014).

[5] As table 5.2c discloses, the Bartik instrument is negatively correlated with housing supply elasticity. Hence it should be positively correlated with household leverage. In words, counties with abundance of land have more exposure to tradable production households (i.e. more negative Bartik instrument). At the same time, households were less leveraged in the run up to the Recession.

The relationship is robust to a series of county characteristics. These control variables (except urbanization) do not seem to affect retail and restaurant job losses.

VARIABLES	Δlog(retail and restaurant employment)				
	[1]	[2]	[3]	[4]	[5]
bartik instrument	0.007	0.297***	0.314**	0.355***	0.278***
	[0.116]	[0.096]	[0.156]	[0.128]	[0.059]
leverage 2006		-0.036***	-0.032***	-0.023**	-0.033***
		[0.005]	[0.010]	[0.010]	[0.007]
Δ housing net worth			0.056	0.088	
			[0.049]	[0.057]	
fraction white				-0.004	0.013
				[0.025]	[0.020]
median household income				0.000***	0.000
				[0.000]	[0.000]
fraction owner-occupied				-0.100	-0.123**
				[0.067]	[0.061]
fraction less than highschool				0.050	-0.019
				[0.084]	[0.059]
fraction highschool				0.145	0.056
				[0.152]	[0.124]
unemployment rate				-0.362	-0.220
				[0.247]	[0.181]
poverty rate				0.374**	0.161
				[0.159]	[0.120]
fraction urban				-0.060***	-0.039***
				[0.016]	[0.008]
Constant	-0.054***	0.021	0.019	-0.012	0.067*
	[0.011]	[0.016]	[0.024]	[0.053]	[0.036]
Observations	3,066	2,211	935	935	2,211
R-squared	0.000	0.121	0.174	0.232	0.146

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5.4a: Reduced form relationship between the Bartik instrument and RR job growth

VARIABLES	Δlog(retail and restaurant employment)				
	[1]	[2]	[3]	[4]	[5]
Δlog(TCS employment)	0.009	0.264***	0.267**	0.279***	0.341**
	[0.143]	[0.076]	[0.123]	[0.065]	[0.133]
leverage 2006		-0.025***	-0.025***	-0.021***	-0.016*
		[0.003]	[0.007]	[0.007]	[0.010]
Δ housing net worth			0.021		0.027
			[0.051]		[0.062]
fraction white				0.002	-0.014
				[0.018]	[0.024]
median household income				0.000	0.000*
				[0.000]	[0.000]
fraction owner-occupied				-0.088	-0.064
				[0.061]	[0.068]
fraction less than highschool				-0.005	0.039
				[0.061]	[0.089]
fraction highschool				0.054	0.130
				[0.104]	[0.125]
unemployment rate				-0.263	-0.492*
				[0.172]	[0.253]
poverty rate				0.123	0.326**
				[0.117]	[0.164]
fraction urban				-0.028***	-0.044***
				[0.009]	[0.016]
	-0.053***	0.014	0.016	0.056	0.001
Constant	[0.018]	[0.012]	[0.020]	[0.040]	[0.056]
Observations	3,066	2,211	935	2,211	935
R-squared	0.004	0.141	0.223	0.152	0.249

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 5.4b: Baseline results

The causal relationship seems stronger than the simple correlation relationship in section 5.1. The magnitude of the coefficients in Table 5.4b is larger than that in table 5.1. This is possible, as the IV is estimating the local average treatment effect (TCS job losses caused by demand-driven tradable job losses) whereas the

OLS is estimating the average association over the entire population (all TCS job losses).

Figure 5.4 shows the scatter plot depicting the correlation between the Bartik instrument and RR job growth, after controlling for household leverage (i.e. the scatter plot for column [2] in Table 5.4a). The scatterplot shows that the relationship is robust and does not depend on any set of counties.

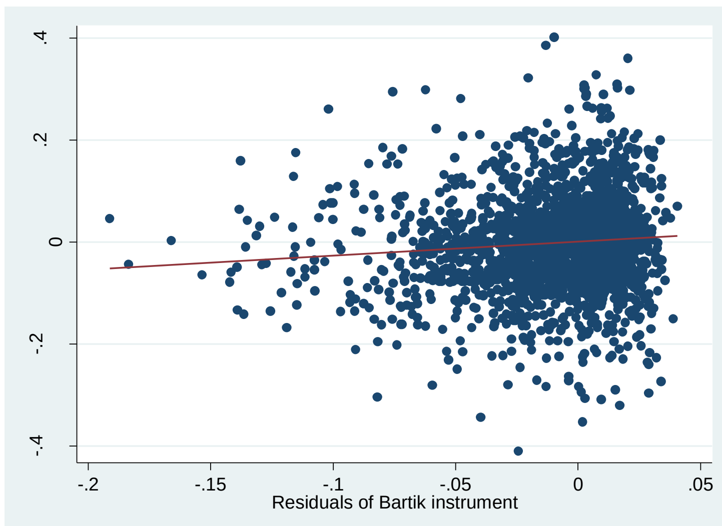

Figure 5.4: Scatterplot between the Bartik instrument residuals and RR employment growth residuals (column [2], table 5.4)

In summary, section 5 shows a very strong and robust causal relationship between a county's job losses in tradable, construction and other services and those in retail and restaurants. In the next section, I will focus on examining competing hypotheses to the demand channel.

6. ON THE TRANSMISSION MECHANISMS

This section discusses potential competing mechanisms, and argues that the evidence points to demand-driven propagation. First of all, it is not guaranteed that a drop in tradable employment will cause retail and restaurant employment losses. For example, Autor et al (2013) and Acemoglu et al (2015) find that import competition from China depresses manufacturing jobs in the U.S., but there is no spillover effect from manufacturing job losses to retail and restaurant job losses. Theoretically, if wages are flexible, a drop in TCS employment could even lead to a *rise* in retail and restaurant employment, because now there is an increase in labor supply.

I find little evidence for the downward adjustments of nominal wages in retail and restaurant sectors. Nominal wages tend to be sticky, in the sense that they do not decline more in areas more exposed to tradable production. Wages are measured as the average weekly wage during the first quarter of 2007, and that during the first quarter of 2010, for *Retail* (NAICS code 44-45) and *Full Service Restaurants* sector (NAICS code 7221).

Table 6.0 shows the regressions between the change in log wages of retail and restaurants and TCS job losses, with other control variables. Counties with more negative Bartik instrument, or counties with larger drops of TCS employment, do not seem to see stronger declines in retail and restaurant wages. This suggests that cross-sectoral reallocation of labor, from TCS to retail and restaurants, did not likely occur during the Great Recession. If there were hiring of unemployed TCS workers from restaurants, we would expect to see either hourly wages drop, or less hours worked per worker, both of which would result in lower average weekly wage. The wage stickiness result stands in contrast with what Autor et al. (2013) find: wages fall in areas more exposed to industries facing competition from China. This is considered as evidence for a combination of negative demand and labor reallocation from manufacturing to non-manufacturing. Note that the period Autor et al (2013) consider is longer (1990 to 2007), which might have allowed for gradual wage adjustments. In contrast, the massive collapse of demand during the Great Recession took place in such a short time, preventing local wages to adjust.

VARIABLES	Δlog(retail wage)		Δlog(restaurant wage)	
bartik instrument	-0.072		-0.130	
	[0.067]		[0.117]	
Instrumented Δlog(TCS jobs)		-0.071		-0.123
		[0.066]		[0.116]
leverage 2006	-0.019***	-0.022***	-0.012***	-0.017**
	[0.004]	[0.005]	[0.004]	[0.008]
Controls	Yes	Yes	Yes	Yes
Constant	-0.060	-0.057	0.175*	0.182*
	[0.048]	[0.048]	[0.093]	[0.095]
Observations	2,185	2,185	1,798	1,798
R-squared	0.209	0.194	0.176	0.153

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6.0: On nominal wage rigidity

Local nominal wage rigidity matters for demand driven propagation of job losses. If wages were flexible, we could still obtain full employment even with a negative demand shock, because wages would adjust to absorb additional labor. If local wages are sticky, the only way retail and restaurant firms adjust to the demand shock is to shed labor and scale down their businesses.

Even in the case that a drop in retail and restaurant employment accompanies a decline in tradable employment, it still does not mean the transmission operates through the demand channel. In the following sections, I examine in detail competing hypotheses: exposure to house price collapse and credit supply problems. I argue that none of the competing hypotheses square well with the data.

6.1 Housing

The house price collapse is one of the most dramatic characteristics of the Great Recession. Using Zillow Research's house price index, I estimate that house prices on average fell 11.2% between March 2007 and March 2010, across 945 counties where Zillow has data. With such a change, a reasonable concern is that housing could contaminate the proposed channel, in the following way: job losses in tradable, construction and services could depress house prices in a county, which then would reduce the net worth of locals. Bearing a negative wealth effect, they have to cut consumption, hurting the retail and restaurant sector. The spillover effect operates through the housing channel. This is a closely related channel to the demand propagation, but is not the same.

VARIABLES	Δlog(house price)	
bartik instrument	-1.506	
	[1.352]	
Instrumented Δlog(TCS jobs)		-1.499
		[1.634]
housing supply elasticity	0.055***	0.066**
	[0.020]	[0.031]
Controls	Yes	Yes
Constant	0.185	0.185
	[0.366]	[0.451]
Observations	529	529
R-squared	0.438	0.053

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6.1a: TCS employment and house prices

I do not see the housing channel in operation here. Table 6.1a shows the impacts of the Bartik instrument and the instrumented TCS job growth on log change of house prices between 2007 and 2010, with housing supply elasticity as a key control.

Housing supply elasticity (Saiz, 2010) measures how abundantly land for development is available. It has been shown, by Mian and Sufi (2014) and others, to be powerful in explaining the run up in house prices before Great Recession, and the collapse of house prices during the Recession. There is no evidence that TCS job losses cause the decline in house prices between 2007 and 2010, after housing supply elasticity is included. This evidence however should be treated with caution, as it is possible that the insignificance is partly due to the small sample size.

Alternatively, I include the 2007-2010 log change in house price into the IV regression (table 6.1b). The impact of TCS job losses on RR job losses remains robust.

VARIABLES	Δlog(RR job)	
	[1]	[2]
Instrumented Δlog(TCS jobs)	0.365***	0.378***
	[0.134]	[0.143]
leverage 2006	-0.005	-0.005
	[0.007]	[0.009]
Δ housing net worth		-0.007
		[0.075]
Δ log(house price)	0.015	0.018
	[0.029]	[0.036]
Controls	yes	yes
Constant	-0.030	-0.053
	[0.067]	[0.071]
Observations	917	670
R-squared	0.207	0.250

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6.1b: Change in house price and the relationship between TCS and RR job losses

6.2 Credit

The most prominent competing hypothesis is credit-led spillovers, that is, the spillovers from the TCS sector to the retail and restaurant sectors could take place via the credit market. For example, under-water tradable firms are late in their loan repayments, which weakens local banks' balance sheet. This in turn affects local lending to retail and restaurant firms. A decline in retail and restaurant employment therefore could be due to local credit problems, not local demand problems.

Table 6.2, however, shows this is not likely the case. I organize the regressions in two blocks. The first block, columns [1] to [3], shows log changes in the number of retail and restaurant firms between 2007 and 2010, by size (1 to 19 workers, 20 to 99 workers, and more than 100 workers). If credit channel were the problem, smaller retail and restaurant firms should get hit more in counties with larger TCS job losses, on the ground that smaller firms have more difficult access to credit. This is not the case here, as the coefficients become more positive for larger establishments. That is, (instrumented) job losses in TCS hurts larger RR firms more than it does smaller ones.

A concern is the result can be driven by numbers of smaller firms being inflated, due to larger firms cutting jobs and becoming smaller firms. This is a possibility. I try to mitigate this possibility by using few numbers of bins (only three bins covering three groups of firm size, versus six in the data). With fewer number of bins, the chance of firms moving to a different group is smaller.

The second block, columns [4] and [5], splits the counties into two groups, one with more national banks (National=1), and one with more local banks (Local=1) (similarly to Mian and Sufi, 2014). If credit were to play a key role in the transmission, retail and restaurant job losses would be more sensitive to instrumented TCS job losses in counties with more local banks, as local banks would be less likely to get help from outside their respective counties. I do not see that case in columns [4] and [5]. If anything, high TCS job losses reduces retail and restaurant employment more in counties with more national banks.

	Δlog(RR firms)			Δlog(RR jobs)	
VARIABLES	1 to 19	20 to 99	100+	National	Local
	[1]	[2]	[3]	[4]	[5]
Instrumented Δlog(TCS jobs)	0.208*	0.315**	0.848**	0.282***	0.268***
	[0.110]	[0.131]	[0.369]	[0.101]	[0.098]
leverage 2006	-0.002	-0.013	-0.024	-0.022***	-0.018
	[0.007]	[0.008]	[0.019]	[0.007]	[0.012]
Controls	Yes	Yes	Yes	Yes	Yes
Constant	-0.027	0.056	-0.100	0.009	0.152***
	[0.037]	[0.056]	[0.121]	[0.056]	[0.053]
Observations	2,211	2,210	1,846	1,178	1,033
R-squared	0.165	0.045	-0.001	0.218	0.062

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6.2: The credit channel

6.3: Income-elastic v.s. income-inelastic retail and restaurant sectors

In this extension, retail and restaurant sectors are disaggregated into income-elastic and income-inelastic groups. If the impact of TCS job losses on income-elastic RR industries is *larger* than that of income-inelastic ones, the finding would further support the demand-driven spillover. If non-demand factors were behind the spillover, there is no reason to expect that the impacts on income-elastic industries are larger.

naics	Name	Δlog(jobs)	Income elasticity
4422	Home furnishings stores	-0.360	Elastic
4521	Department stores	-0.330	Elastic
4412	Other motor vehicle dealers	-0.301	Elastic
4421	Furniture stores	-0.265	Elastic
4483	Jewelry luggage and leather goods stores	-0.228	Elastic
4512	Book periodical and music stores	-0.228	Elastic
4531	Florist	-0.224	Elastic
4411	Automobile dealers	-0.201	Elastic
4431	Electronics and appliance stores	-0.191	Elastic
4452	Specialty food stores	-0.149	Elastic
4532	Office supplies stationery and gift stores	-0.142	Elastic
4539	Other miscellaneous store retailers	-0.139	Elastic
4511	Sporting goods hobby and musical instrument stores	-0.116	Elastic
4461	Health and personal care stores	-0.059	Inelastic
4481	Clothing stores	-0.059	Inelastic
4482	Shoe stores	-0.050	Inelastic
7224	Drinking places (alcoholic beverages)	-0.049	Inelastic
4413	Automotive parts accessories and tire stores	-0.041	Inelastic
4471	Gasoline stations	-0.034	Inelastic
7222	Limited-service eating places	-0.028	Inelastic
7221	Full-service restaurants	-0.020	Inelastic
4451	Grocery stores	-0.014	Inelastic
4453	Beer wine and liquor stores	0.031	Inelastic
4533	Used merchandise stores	0.074	Inelastic
7223	Special food services	0.092	Inelastic
4529	Other general merchandise stores	0.244	Inelastic

Table 6.3a: Income-elastic and income-inelastic retail and restaurant industries

I categorize retail and restaurant industries to elastic and inelastic groups by the following rule: those with larger national employment declines during the Great Recession are considered income-elastic, the rest are income inelastic. Table 6.3a presents the categorization. It generally makes sense. Grocery, specialty food (e.g. meat, seafood, and bakery), beer, wine and liquor, health care and personal care, gasoline stations and used merchandise stores are considered more necessary for our day to day living when our income declines. They belong to the income inelastic group.

VARIABLES	Δlog(Retail and restaurant employment) income-elastic		income-inelastic	
Instrumented Δlog(TCS jobs)	1.024***	0.841**	0.078	0.127
	[0.283]	[0.330]	[0.123]	[0.123]
leverage 2006	0.009	-0.001	-0.029***	-0.025***
	[0.011]	[0.014]	[0.005]	[0.008]
controls	no	yes	no	yes
Constant	-0.170***	-0.136	0.061***	0.069
	[0.023]	[0.124]	[0.014]	[0.046]
Observations	2,219	2,219	2,219	2,219
R-squared	-0.036	0.004	0.072	0.085

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6.3b: Impacts on income elastic and income inelastic RR industries

Table 6.3b presents the findings. The job loss spillover to *income elastic* retail and restaurant industries is much larger and more significant than that to *income inelastic* counterparts. This implies that the income-inelastic retail and restaurant sectors were less affected by the TCS job losses. The finding strengthens the argument for a demand-driven propagation of job losses.

7. Conclusion

It is important to understand the impacts of the Great Recession, among them, how shocks transmit across economic sectors and geographic areas. This paper is among the effort to understand the Great Recession better. Utilizing the Bartik instrument, it provides empirical evidence for local demand-driven propagation of job losses. It finds that larger job losses in tradable, construction and services cause heavier retail and restaurant job losses during the Great Recession. The result is statistically very significant and robust, suggesting a powerful role of demand. The finding is not driven by the collapse in house prices, or by the credit shortage problem. Moreover, the propagation are stronger when I focus on the job losses of income-elastic retail and restaurant sectors, which provides further evidence for a demand story. Given the massive tradable employment losses, where some industries lost 30% to 40% of their workforce in such a short time span, it is not very surprising that counties could not absorb or respond to such massive shocks.

The paper has important policy implications. First of all, demand-driven mechanisms matter. This finding suggests a role for demand stabilizing policies to contain demand driven transmissions of negative shocks. Without such policies in place to assist hardest hit population and sectors, negative demand shocks can spread through other healthier sectors of the economy, and worsen the scale and scope of a recession.

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