Policy Research Working Paper 7543

The Great Recession and Job Loss Spillovers

Impact of Tradable Employment Shocks on Supporting Services

Ha Nguyen
Shawheen Rezaei
Divya Agarwal

WORLD BANK GROUP
Development Research Group
Macroeconomics and Growth Team
January 2016

Policy Research Working Paper 7543

Abstract

This paper explores the spillover effects of job losses via input-output linkages during the Great Recession. Exploiting exogenous variation in tradable employment shocks across U.S. counties, the paper finds that job losses in a county's tradable sectors cause further job losses in the county's supporting services. For a given county, a 10 percent exogenous decline in tradable employment reduces supporting industries' employment by 3.8 percent. In addition, a county's regional supporting services are relatively less affected by its tradable job losses than its local supporting services are, which reinforces the argument that the spillovers are due to input-output linkages.

This paper is a product of the Macroeconomics and Growth Team, Development Research Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at hanguyen@worldbank.org.

THE GREAT RECESSION AND JOB LOSS SPILLOVERS: IMPACT OF TRADABLE EMPLOYMENT SHOCKS ON SUPPORTING SERVICES

Updated January 2021

Ha Nguyen[1]
Development Research Group
The World Bank,

Shawheen Rezaei
Harvard University,

and

Divya Agarwal
Columbia University

Keywords: Unemployment, Job losses, Spillovers, Great Recession

JEL code: E32, J46

[1] We thank Luis Serven and Aart Kraay for very helpful comments and feedback. The views expressed in this paper are those of the authors only and do not necessarily reflect those of the World Bank or the countries it represents.
Contact address: Ha Nguyen, Development Research Group, The World Bank, 1818 H St Washington D.C. 20433. Email hanguyen@worldbank.org

1 Introduction

It is important to understand if, how, and to what extent, unemployment spreads across sectors and geographic areas during a recession. Such propagation, if proven true, could provide a basis for government intervention in times of economic recession to prevent the ripple effects of adverse employment shocks from cascading through the economy.

The Great Recession provides a unique context for studying this issue as it was the most devastating economic event in the world economy since the 1930s. During this time, unemployment in the U.S. reached even as high as 10%. Employment in many industries, such as automobile, oil, and gas, dropped as much as 30 to 40% between 2007 and 2010 (Nguyen, 2015). Such economic fluctuations have left economists puzzled about many aspects of unemployment: Why was it so high? Did job losses propagate from one sector to another, and if so, how?

This paper examines how job losses propagated across sectors via input-output linkages during the Great Recession. Although many economists would agree that job losses could propagate, few have successfully captured the magnitude of this phenomenon given the difficulty of pinpointing an exogenous source of employment declines. Since employment across various industries is interrelated, overcoming endogeneity bias is a formidable obstacle to accurately measuring this effect.

The identification strategy we utilize in this paper is the following: we exploit exogenous variation in *the change in tradable employment* in a U.S. county and examine the subsequent spillover effect on its *local supporting service industries*, i.e. those that provide support to

tradable production, such as warehousing, transportation, human resource management, marketing and IT support.[2]

These exogenous job losses are *a county's tradable job losses that are only driven by declines in national tradable employment*, and not by county-specific issues. The idea is based on Bartik (1991). For brevity, we refer to this exogenous source of job losses as Bartik job losses. We find that counties with greater exogenous losses in tradable employment experienced more severe job losses in supporting service industries. Quantitatively, Bartik job losses of 10% led to a 3.76% decline in a county's supporting services employment during the Great Recession.

Furthermore, we split the supporting services, based on two Herfindahl indices, into industries dealing with more local support and those dealing with more regional support. Supporting industries that have smaller Herfindahl indices are considered local, as their diffused market concentration suggests that they serve a more localized area. The job loss spillover is much more significant for the more local supporting sectors. Bartik job losses of 10% cause a 4.38% decline in local supporting services employment. As we will discuss in detail later, this may be due to more local industries' greater dependence on the success of the given county's tradable sector. In turn, we find that more regional supporting industries are less affected by the county's tradable job losses given that these industries' have greater geographic coverage.

The concept of job loss spillover via production linkages has not been a subject of many empirical studies. One reason for this may be the difficulty in distinguishing job loss propagation pathways in data, which does not readily point out causality. In other words, given that job losses in any industry may affect employment in other industries, it becomes exceedingly difficult to determine the direction in which a spillover travels. For example, unemployment in the

[2] The detailed list of supporting service sectors is in section III.

automobile industry could reduce the need for freight, causing workers in the freight industry to lose their jobs. Laid-off workers in the freight industry, however, may be less inclined to purchase new cars, therefore causing demand-driven unemployment in the automobile industry. As demonstrated by the aforementioned scenarios, job loss spillovers oftentimes occur simultaneously and in multiple directions, making the determination of causality within a particular spillover channel quite a challenge.

We overcome this identification challenge by utilizing Bartik job losses to capture exogenous job losses. We argue that tradable job losses driven by aggregate shocks are exogenous to a county and are not driven by a county's fundamentals. Mathematically, Bartik job losses are defined as $\sum_{i \in Tradable} \left(\frac{l^i_{c,2007}}{l^T_{c,2007}} \times \Delta \log l^i_{USA} \right)$, where $l^i_{c,2007}$ is the employment of tradable industry i in county c and $l^T_{c,2007}$ is the employment of all tradable industries in county c before the Great Recession. The national job losses of industry i during the Recession are $\Delta \log l^i_{USA}$. Since there are more than 3000 counties in the U.S, changes in national tradable employment are largely exogenous to a county; that is, such changes are little affected by any county's changes in fundamentals, such as productivity shocks or an increase in minimum wages during the Recession.

Although supporting sectors only accounts for just a fraction of employment, this does not imply that job losses spillovers via input-output linkages are insignificant. We focus on the relationship between tradable and supporting sectors because the econometric identification is clearer. Spillovers via input-output linkages could operate via other channels, such as intra-county tradable-tradable linkages (e.g. car assembly plants and car parts producers within a county) or inter-county linkages. However, these channels are more difficult to identify and establish a relationship from.

The paper is organized in the following way: Section 2 gives a literature review; Section 3 presents the data; Section 4 describes our identification strategy in greater details; Section 5 examines the main results; Section 6 presents two extensions; and Section 7 concludes.

2 Literature Review

Our paper is related to current literature on the severe decline in demand during the Great Recession. Most prominently, Mian, Sufi, and other co-authors have examined the effects of the decline in housing net-worth on consumption and employment during the crisis. Mian, Rao, and Sufi (2013) find that ZIP codes with higher pre-crisis household leverage (and steeper subsequent declines in housing net-worth in the Great Recession) cut their consumption more sharply during this period. Similarly, Mian and Sufi (2014) find that housing net worth declines were driving consumption cuts and job losses during the Recession. Nguyen (2015) examines job loss spillovers driven by the demand channel. In particular, he argues that job losses in the tradable sector caused further job losses in local retail and restaurant industries, via the aggregate demand channel.

There are surprisingly few studies on cross-sector spillovers based on production linkages. Bodrin et al. (2013), using U.S. national data, examine job loss propagation from the construction sector to other sectors. They argue that this channel has important effects on aggregate employment. Li and Martin (2015), also using national data at the sector level, find the financial sector to be the "epicenter" during the Great Recession, from which emanates job loss spillovers into other sectors. Unlike those two papers, we utilize *sectoral* data at the *county* level, and for that reason, we are less concerned about the endogeneity issue.

In a different context, using national employment data at the sectoral level, Acemoglu et al. (2016) study the transmission of trade shocks across U.S. manufacturing industries, via input-

output linkages. The trade shock they refer to is the rising import competition from China. They find that inter-industry linkages do in fact magnify the employment effects of trade shocks.

Our paper is related to literature that uses the Bartik instrument to isolate exogenous changes in labor demand. Blanchard and Katz (1992) construct exogenous employment shocks at the state level from 1970 to 1989, and estimate the effects of the shocks on unemployment and wages. Since their Bartik instrument includes all industries in all sectors, they do not estimate the spillover effects of job losses. Moretti (2010) uses three years of data (1980, 1990 and 2000) and a Bartik-typed instrument to estimate the *long-term* employment multiplier across U.S. cities. Although we use a similar approach to Moretti (2010), our focus is different. While Moretti's focus is on the long-run "geography of jobs" (i.e. how jobs are allocated across the country), we are interested in identifying the input-output linkage channel and estimating the short-run job loss spillover from tradable industries to supporting industries.

Our paper is also related to a growing amount of literature on labor market dynamics during the Great Recession. Ohanian (2011) argues that the decline in economic output and income during the Great Recession was due to severe distortions in the labor market, and not due to declines in capital or productivity. Hoffman and Lemieux (2016) show that the collapse in construction employment was a major factor contributing to the fall in overall employment. Kroft et al. (2016) show that the massive 2008 employment collapse, combined with the slow recovery in demand prevented employment from picking up quickly. Similarly, Foster et al. (2016) find that job destruction in the 2008–2009 period was accompanied by a very large drop in the job creation rate, which limited the scope for re-allocation of jobs and pushed many laid-off workers into long-term unemployment.

3 Identification Strategy

Our identification strategy involves the generation of Bartik job losses which capture exogenous changes in employment. We use Bartik job losses to isolate the exogenous change in tradable employment in every U.S. county. In using this identification strategy, we find that counties with larger Bartik job losses experience more severe job losses in their supporting services sector.

3.1 A simple model

Our empirical regressions can be better understood as the derivatives of simple production functions, which illustrate the relationship between inputs and outputs. These functions are the following:

$$L_{s,c} = \theta T_c^{\alpha} \quad (1)$$

$$T_c = \omega L_{T,c}^{\beta} \quad (2)$$

where $L_{s,c}$ is supporting sector employment, $L_{T,c}$ is tradable employment, T_c is tradable output, the subscript c identifies a given county, and θ, ω, α and β are parameters. The underlying assumption with these equations is that employment in the supporting service sector is determined by productivity (θ) and tradable output (T_c), which in turn is produced by tradable employment.

We can manipulate equations (1) and (2) to derive our desired regression. We first combine the two equations by substituting T_c from equation (1) into equation (2) to get:

$$L_{s,c} = \theta \omega^{\alpha} L_{T,c}^{\alpha\beta} \quad (3)$$

Next, if we take the log of both sides, equation (3) becomes:

$$\log(L_{s,c}) = \log(\theta \omega^{\alpha}) + \alpha\beta \log(L_{T,c}) \quad (4)$$

We can then use equation (4) to derive the change in employment from 2007 to 2010:

$$\log (L_{s,c})_{2010} - \log (L_{s,c})_{2007} = \alpha\beta[\log (L_{T,c})_{2010} - \log (L_{T,c})_{2007}] + [\log(\theta\omega^{\alpha})_{2010} - \log(\theta\omega^{\alpha})_{2007}] \quad (5)$$

From this, equation (5) provides a basis for our regression. Using equation (5), we arrive at an OLS regression:

$$\boldsymbol{\Delta \log (L_{s,c}) = \beta_0 + \beta_1 \Delta \log(L_{T,c}) + controls_c + \varepsilon_c} \quad \textbf{(6)}$$

where $\Delta\log (L_{s,c})$ is the log change in supporting sector employment in county *c* from 2007 to 2010, $\Delta\log(L_{T,c})$ is the log change in tradable employment in county *c* during the same period, and $controls_c$ are all of the control variables (we describe these in the next section).

Equation (6), however, has some drawbacks. First is the issue of omitted variable bias. For instance, county-specific changes, such as a change in productivity (i.e.,$[\log(\theta\omega^{\alpha})_{2010} - \log(\theta\omega^{\alpha})_{2007}]$), could affect employment in both tradable and supporting sectors. Secondly, reversed causation also poses a threat to this identification strategy, as some might question whether a drop in supporting sector employment causes a decrease in tradable employment. For example, if this were the case, the shutting down of a warehouse would cause a manufacturing company to shut down factories.

We overcome these challenges by identifying an exogenous component of the change in tradable employment. The exogenous component is the change in tradable employment driven by aggregate (national) shocks. We argue that this instrument is not driven by county-specific factors. We explain this exogenous component in details below.

3.2 Bartik job losses

Bartik job losses are tradable job losses driven by aggregate shocks rather than county specific issues. Therefore, reverse causality and potentially county specific omitted variable problems, such as productivity shocks or higher minimum wages, are not likely to affect Bartik

job losses. To see the relationship between a county's tradable job losses and Bartik job losses, consider the log change in tradable job losses of county *c*:

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

where $l_{c,t}^T$ is total tradable employment in county *c* at time *t* and $l_{c,t}^i$ is tradable industry *i*'s employment in county *c* at time *t*.

Tradable job losses $\sum_{i \in T} \left(\frac{l_{c,2007}^i}{l_{c,2007}^T} \times \Delta \log l_c^i \right)$, however, might not be exogenous to a county's fundamentals. For example, labor supply issues (such as a raise in the minimum wage) or changes in regulations in the county could affect tradable employment in that county. Instead, Bartik job losses capture only tradable job losses driven by changes in aggregate shocks. To see this, we rewrite tradable job losses as:

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

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

The first term, $\sum_{i \in T} \left(\frac{l_{c,2007}^i}{l_{c,2007}^T} \times \Delta \log l_{USA}^i \right)$ represents Bartik job losses. It is the sum of all the individual Bartik job losses for all tradable industries. For each industry *i*, Bartik job losses are the product of the county's pre-existing exposure to the industry (relative to total tradable employment), $\frac{l_{c,2007}^i}{l_{c,2007}^T}$, and the national change in the industry's employment, $\Delta \log l_{USA}^i$. We interpret $\Delta \log l_{USA}^i$ as a change in industry *i's* aggregate shocks (Bartik, 1991). Since there are more than 3000 counties in the U.S., the aggregate changes should not be affected by changes in

a county's fundamentals. Note that $\sum_{i \in T}\left(\frac{l^i_{c,2007}}{l^T_{c,2007}} \times \Delta \log l^i_{USA}\right) = \sum_{i \in T}\left(\frac{l^i_{c,2007}}{l^T_{c,2007}} \times (\log l^i_{USA,2010} - \log l^i_{USA,2007})\right)$. Therefore, a negative result implies job losses.

The only situation in which an industry's Bartik job losses might not be exogenous is when production of that industry is heavily concentrated in one county. In that case, $\Delta \log l^i_{USA}$ could be influenced by county *c*-industry *i* specific supply issues. We examine such a 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 job losses are exogenous to a county.

The second term, $\sum_{i \in T}\left(\frac{l^i_{c,2007}}{l^T_{c,2007}} \times (\Delta \log l^i_c - \Delta \log l^i_{USA})\right)$, can be interpreted as tradable job losses driven by county-specific issues. It is the difference between actual tradable job losses and those that are driven by aggregate shocks.

Using Bartik job losses as an exogenous source of variation in tradable job losses, we can rewrite the regression as follows:

$$\boldsymbol{\Delta \log\,(L_{s,c}) = \beta_0 + \beta_1 bartik_c + controls_c + \varepsilon_c} \quad \textbf{(7)}$$

Note that all of the regressions are weighted by the number of households in each county (following Mian and Sufi, 2014). In addition, all of the standard errors in this paper are robust and clustered at the state level.

4 Data Analysis

The primary source of our data is the Census Bureau. We use employment data in March 2007 and March 2010 from the County Business Pattern (CBP) dataset, given that these dates represent the lowest and highest points of the U.S. unemployment rate during the Great Recession. This data comes with flags representing employment ranges, which we replace with average employment values. We use the NAICS codes obtained from the CBP dataset at the six-digit level for supporting industries and at the four-digit level for tradable employment as provided by data from Mian and Sufi (2014). In later parts of the paper, we also use employment data by firm size from the CBP dataset in order to examine potential problems related to credit.

What classifies an industry as tradable or supporting? For the purposes of this paper, we follow Mian and Sufi (2014)'s classification of the tradable sector based on global trade data: a 4-digit NAICS industry is defined as *tradable* if it has imports plus exports equal to at least $10,000 per worker, or if total exports plus imports exceed $500M. Regarding the supporting industries, we base our categorization of a NAICS code on whether the industry aids the tradable sector, be it through local or regional support. In order to be identified as a supporting industry for our purposes, the given industry should support tradable industries, but it cannot also deal with the residential population. In determining the suitability of an industry, we examine each NAICS code provided on the NAICS Association's website (www.naics.com). Table 3.2 presents a full listing of supporting industries. A more detailed description of this methodology is provided in the Appendix.

A factor prevents us from using the input-output table. We use six-digit NAICS codes to classify our industries, whereas the input-output table provided by the Bureau of Economic Analysis (BEA) mainly uses NAICS codes up to two or three digits. For example, the BEA

input-output table includes the code 562 (Waste management and remediation services). Note that this could mean residential or commercial waste management. Our focus only includes 562112 (Hazardous Waste Collection) and 526221 (Hazardous Waste Treatment and Disposal) from the broader 562 category, because we are more confident that Hazardous Waste Collection serves the tradable sectors rather than local residents.

We also use Mian and Sufi (2014)'s data for several of our regressions. Most notably, we use several pre-crisis county characteristics in 2007 as controls: percentage white, the log of median household income, the log of median home value, percentage of homes occupied by owners, percentage of population with less than high school diplomas, percentage with only high school diplomas, percentage with college degrees, unemployment rate, poverty rate, and percentage urban. We have also included pre-crisis household leverage in 2006 as it serves as a strong proxy for household cuts in consumption (see Mian and Sufi, 2010). Aside from this, we also use their data for the robustness checks we conduct later in the paper, in which we test the influence of credit constraints on the change in supporting sector employment.

Summary statistics for the variables used in our regressions are provided in Table 4.1. Supporting sector employment makes up 3.5% of the total employment in 2007, while tradable employment makes up around 14.5%. On average, a given county lost a staggering 16.1% of tradable employment between 2007 and 2010. In fact, tradable job losses driven by aggregate shocks (i.e. Bartik) for a county between 2007 and 2010 are 18.3% on average.

Most of the variables have full coverage. The only exception is pre-crisis leverage. This variable represent how indebted households in a county were before the crisis. Mian and Sufi (2010) show that pre-crisis household leverage is strongly connected to the decline in

consumption during the Great Recession. This is an important control variable, and so we have also included it in some of the regressions.

Statistics	N	mean	sd	p10	p90
Tradable employment/Population, 2007	3108	0.050	0.047	0.008	0.103
Supporting sector employment/Population, 2007	3093	0.012	0.017	0.004	0.023
Tradable employment/Employment, 2007	3102	0.145	0.107	0.030	0.288
Supporting sector employment/Employment, 2007	3146	0.035	0.037	0.012	0.064
Log change in tradable employment, 2007-2010	3013	-0.161	0.421	-0.580	0.186
Log change in supporting sector employment, 2007-2010	3131	-0.040	0.506	-0.600	0.505
Bartik	3128	-0.183	0.083	-0.282	-0.073
% White, 2007	3135	86.997	15.017	65.834	98.827
Median household income, 2007	3135	35597.430	9147.112	26312.470	46608.320
Median home value, 2007	3135	82862.160	45629.080	45377.850	127120.500
% Owner occupied, 2007	3135	74.063	7.541	64.320	81.818
% With less than high school diploma, 2007	3135	22.565	8.705	12.584	34.965
% With only high school diploma, 2007	3135	34.706	6.571	26.398	42.903
% With college education, 2007	3135	10.994	4.961	5.924	17.494
Unemployment rate, 2007	3135	5.820	2.730	2.998	9.071
Poverty rate, 2007	3135	14.154	6.454	7.261	22.605
% Urban, 2007	3135	39.318	30.881	0.000	84.608
Leverage, 2006	2219	1.573	0.584	0.971	2.366

Table 4.1: Summary statistics

NAICS	Industry Name
484110	General Freight Trucking, Local
484220	Specialized Freight (except Used Goods) Trucking, Local
488210	Support Activities for Rail Transportation
488510	Freight Transportation Arrangement
488991	Packing and Crating
493110	General Warehousing and Storage
493120	Refrigerated Warehousing and Storage
493130	Farm Product Warehousing and Storage
493190	Other Warehousing and Storage
541214	Payroll Services
541219	Other Accounting Services
541511	Custom Computer Programming Services
541512	Computer Systems Design Services
541513	Computer Facilities Management Services
541519	Other Computer Related Services
541611	Administrative Management and General Management Consulting Services
541612	Human Resources Consulting Services
541613	Marketing Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting
561110	Office Administrative Services
561410	Document Preparation Services
561499	All Other Business Support Services
561910	Packaging and Labeling Services
562112	Hazardous Waste Collection
562211	Hazardous Waste Treatment and Disposal
811212	Computer and Office Machine Repair and Maintenance
811213	Communication Equipment Repair and Maintenance
811219	Other Electronic and Precision Equipment Repair and Maintenance
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair

Table 4.2: Supporting industries

5 Main Results

This section explores the relationship between job losses in a county's tradable and supporting service sectors, showing that the two are positively correlated. This finding is robust to the pre-crisis controls.

Table 5.1 below presents the baseline results underlying the job loss spillover effect from the tradable sector to supporting industries. It includes four regressions: the first reveals the relationship between supporting sector employment and tradable sector employment, the second including the county level controls, the third includes leverage, and the fourth shows the relationship with both controls and leverage. The positive coefficient of our explanatory variable indicates that a greater decrease in tradable employment leads to a greater decline in employment in supporting industries. Column 1 reveals that across counties, a 10% decrease in tradable jobs driven by Bartik jobs, on average, caused a 3.37% decrease in supporting sector employment between 2007 and 2010. This relationship is significant at a 5% level. The relationship is stable when other county level demographic and income characteristics are included. It is also stable with pre-crisis household leverage. Household leverage has been identified by Mian and Sufi (2010) as an important explanation for the drop of non-tradable employment during the Great Recession. Given this, it is an important control variable to include. Column 3 includes just leverage and shows that its inclusion that does affect our results. Given the additions of control variables, the coefficient for Bartik jobs losses gradually increases from 0.337 (in column 1) to 0.376 (in column 4).

VARIABLES	Log change in supporting employment, 2007-2010			
	[1]	[2]	[3]	[4]
Bartik job change	0.337**	0.348**	0.367**	0.376**
	[0.153]	[0.142]	[0.163]	[0.152]
% White, 2007		0.001		0.001
		[0.001]		[0.001]
Log of median household income, 2007		0.055		0.043
		[0.123]		[0.160]
Log of median homevalue, 2007		-0.058		-0.058*
		[0.035]		[0.057]
% Owner occupied, 2007		-0.005***		-0.005***
		[0.001]		[0.002]
% With less than high school diploma, 2007		0.000		0.000
		[0.002]		[0.002]
% With only high school diploma, 2007		-0.001		-0.001
		[0.002]		[0.002]
Unemployment rate, 2007		0.014**		0.015**
		[0.006]		[0.007]
Poverty rate, 2007		-0.006		-0.007
		[0.005]		[0.006]
% Urban, 2007		-0.001		-0.001
		[0.000]		[0.001]
Leverage, 2006			-0.008	0.003
			[0.013]	[0.018]
Constant	0.030	0.400	0.051	0.534
	[0.027]	[1.091]	[0.039]	[1.263]
Observations	3,035	3,035	2,218	2,218
R-squared	0.004	0.016	0.005	0.018

Robust standard errors in brackets (*** p<0.01, ** p<0.05, * p<0.1).
All regressions in this paper are weighted by number of households. Standard errors are clustered at the state level.

Table 5.1: Baseline results

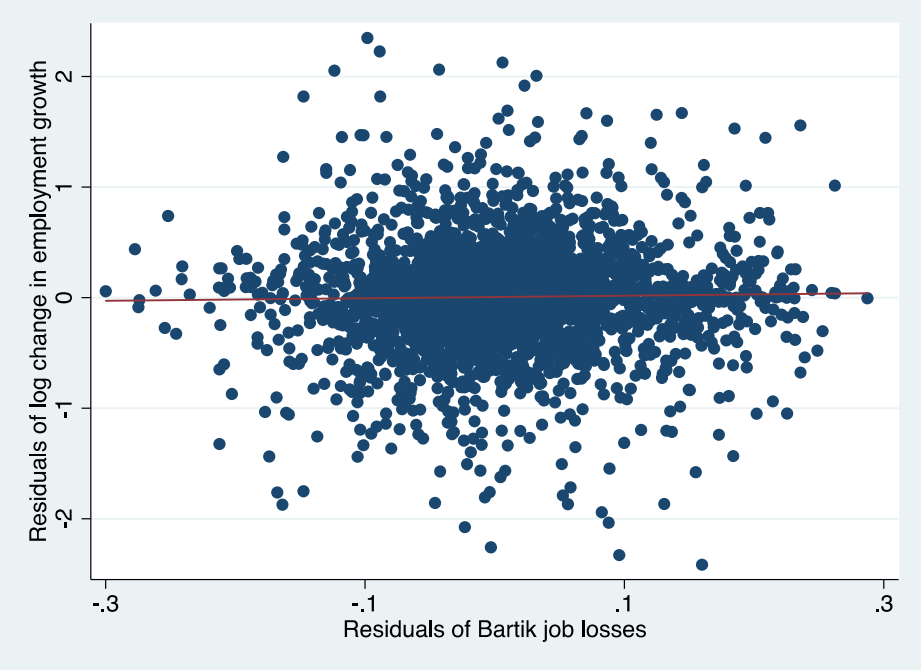

Figure 5.1: Scatter plot of regression [2] in Table 5.1

Figure 5.1 shows the scatter plot between the residuals of the log change in supporting sector employment and the residuals of Bartik job losses (i.e. column 2 in table 5.1). It shows that the positive relationship is quite robust and not dependent on any outliers (see figure A.1 in the Appendix for the full sample). This figure depicts a scatter plot of the data when three outliers are removed. For the rest of the paper we use this smaller sample.

6. Extensions

In this section we will provide further evidence that the transmission mechanism for job loss spillovers takes place via input-output linkages. In order to do so, we conduct two exercises. In the first exercise, we argue that credit-led spillovers were not likely the driving force of the spillover. In the second exercise, we split a county's supporting sectors into those that serve a more local geographic area and those that serve a larger regional area. We show that those that serve locally are more affected by the county's Bartik job losses—further supporting the input-output linkage channel.

6.1 Credit-led spillovers?

Spillovers from the tradable sectors to supporting industries could occur by means of credit channels. For instance, when an underwater tradable firm is late in repaying debt, it affects bank lending to firms in supporting industries. If this were the case, supporting firms that are smaller in size should experience greater declines in employment when faced with an exogenous tradable employment shock, on the ground that that they are likely to have less access to credit. If this is the case, it would weaken our argument for the spillovers based on input-output linkages.

VARIABLES	1 to 4	5 to 9	10 to 19	20 to 49	50 to 99
	Aggregate supporting services				
	[1]	[2]	[3]	[4]	[5]
Bartik	0.016	0.017	-0.082	0.278	0.826**
	[0.101]	[0.171]	[0.162]	[0.312]	[0.410]
Controls	Yes	Yes	Yes	Yes	Yes
Constant	-0.479	1.907	-0.868	-1.992	-4.206
	[0.758]	[1.390]	[1.187]	[1.742]	[3.286]
Observations	2,084	1,257	970	778	481
R-squared	0.025	0.011	0.025	0.023	0.040

Table 6.1: Testing credit supply constraints

We find, however, that this is not the case. To test this hypothesis, we use an approach similar to that introduced in Mian and Sufi (2014). We divide supporting firms based on firm size (1 to 4 workers, 5-9 workers, 10-19 workers, 20-49 workers, 50-99 workers). Subsequently, we regress the change in the number of firms (by firm size) against Bartik job losses over six regressions. If credit constraints were a problem, the coefficients of Bartik job losses would decrease as firm size increases, signifying that smaller supporting service firms (i.e., those with presumably less access to credit) would be hit harder by the tradable employment shock. Table

6.1 shows that this is not the case. Many of the coefficients are not significant. Further, when they are, they do not decrease in magnitude as assumed under the credit constraint hypothesis.

6.2 'Local' versus 'regional' supporting sectors

In this section, we will further divide the supporting industries into two separate subgroups. As can be seen in Table 3.2, the supporting sector includes a diverse array of industries, which may react differently to changes in tradable employment given that the nature of their workforces—the supply of workers available, the skillsets necessary, etc.—is inherently different. In addition, the scope of services might also be different across supporting sectors. Some industries serve more locally, while some others serve broader geographical areas. Therefore, we split the supporting sector into two subgroups, which we name: 'local' and 'regional' supporting services. The classification is based on two Herfindahl indices, which we refer to as the standard index, H_1^i , and the modified index, H_2^i:

$$H_1^i = \sum_c \left(\frac{l_c^i}{l_{USA}^i} \right)^2$$

$$H_2^i = \sum_c \left(\frac{l_c^i}{l_{USA}^i} - \frac{l_c^T}{l_{USA}^T} \right)^2$$

The standard index is commonly used in the literature. It measures how spread out a supporting industry is across counties. H_1^i is the standard Herfindahl index of supporting sector *i.* $\frac{l_c^i}{l_{USA}^i}$ is the share of supporting sector *i* in county *c*, calculated as the ratio between employment of sector *i* in county *c* and total employment of sector *i*. The standard index for industry *i,* H_1^i, would take the smallest value if industry *i* is perfectly spread out across counties; this would indicate that industry *i* serves locally. Conversely, if industry *i* is all concentrated in a single county, H_1^i would take the value of 1, which is the largest possible value for H_1^i.

In addition to the standard Herfindahl index, we also create a modified Herfindahl index by subtracting the share of tradable industries from the standard measure in order to measure market concentration while also considering the relative share of tradable industries. $\frac{l_c^i}{l_{USA}^i}$ is the share of the supporting sector *i* in county *c*. $\frac{l_c^T}{l_{USA}^T}$ is the share of tradable employment in county *c*. If a supporting sector *i* is located in perfect proportion to the counties' shares of tradable industries, the value of the modified Herfindahl index would be zero. This would imply that supporting industry *i* is located where tradable industries are—an indication that the supporting industry serves local tradable industries. In other words, those supporting industries that have a small modified Herfindahl index values are considered local. The standard and modified Herfindahl indices yield very similar results as the correlation between the two indices is .98. We present the results with the modified Herfindahl index here, and leave those with the standard index in the Appendix. The classification of each industry into local and regional supporting sectors is shown below in Table 6.2b. We classify the top 14 industries as local, and the bottom 15 as regional.

Summary statistics for a county's local and regional industries are provided in Table 6.2a. While the local portion of supporting services comprises of a slightly larger portion of workforce, employing a bit over 2.3% of the total employment in 2007, the regional portion makes up slightly over 1.3%.

Statistics	N	mean	sd	p10	p90
Local supporting sector employment/Population, 2007	3074	0.08	0.011	0.002	0.015
Local supporting sector employment/Employment, 2007	3114	0.023	0.024	0.008	0.045
Regional supporting sector employment/Population, 2007	2710	0.005	0.014	0.001	0.009
Regional supporting sector employment/Employment, 2007	2761	0.013	0.031	0.003	0.025

Table 6.2a: Summary statistics for local and regional industries

NAICS	Industry Name	Modified Herfindahl	Local (l) Regional (r)
484220	Specialized Freight (except Used Goods) Trucking, Local	0.001201	l
484110	General Freight Trucking, Local	0.00134	l
541219	Other Accounting Services	0.001874	l
493110	General Warehousing and Storage	0.002287	l
561110	Office Administrative Services	0.003353	l
811219	Other Electronic and Precision Equipment Repair and Maintenance	0.003672	l
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair	0.004667	l
561410	Document Preparation Services	0.004911	l
493130	Farm Product Warehousing and Storage	0.005773	l
493190	Other Warehousing and Storage	0.005910	l
561499	All Other Business Support Services	0.006142	l
561910	Packaging and Labeling Services	0.006186	l
541614	Process, Physical Distribution, and Logistics Consulting	0.006207	l
493120	Refrigerated Warehousing and Storage	0.006388	l
541612	Human Resources Consulting Services	0.006618	r
541511	Custom Computer Programming Services	0.006821	r
811213	Communication Equipment Repair and Maintenance	0.007847	r
541613	Marketing Consulting Services	0.007908	r
488510	Freight Transportation Arrangement	0.008280	r
541512	Computer Systems Design Services	0.008515	r
562112	Hazardous Waste Collection	0.008640	r
488991	Packing and Crating	0.009334	r
488210	Support Activities for Rail Transportation	0.009852	r
541611	Administrative Management and General Management Consulting Services	0.010226	r
541519	Other Computer Related Services	0.010330	r
811212	Computer and Office Machine Repair and Maintenance	0.011539	r
541513	Computer Facilities Management Services	0.019112	r
562211	Hazardous Waste Treatment and Disposal	0.023096	r
541214	Payroll Services	0.037047	r

Table 6.2b: Supporting industries classified as local or regional

Tables 6.2c and 6.2d depict the results of the two separate categories of regressions when the supporting sector is split into local and regional industries, respectively, based on the modified Herfindahl index. In each table, the first column depicts the relationship between a county's Bartik job losses and the log change in the county's supporting sector employment without controls. The second regression then adds controls, while the third adds leverage, and the fourth regression includes both controls and leverage. Adding control variables especially increases the magnitude of the local baseline regression, and notably impacts significance.

The positive coefficients of tradable employment in each regression indicate that greater Bartik job losses lead to a greater decrease in a county's supporting employment. Across counties and holding control variables constant, a 10% decline in Bartik jobs causes a 4.38% decrease in a county's local supporting jobs. The relationship is significant at a 5% level. Bartik job losses, however, do not seem to affect a county's regional supporting jobs. In the regional regressions the coefficients of the explanatory variable, while positive, are not significant. In other words, exogenous tradable employment shocks in a county during the Great Recession did not possess a significant spillover effect for the county's regional supporting industries.

The findings reinforce the argument for the input-output linkage channel. Since both local supporting industries and regional supporting industries are located in the same county, the different impacts of local tradable job losses on them indicate that transmission mechanisms relying on county-specific factors did not play an important role. If a local county-specific factor, such as a credit crunch, played a dominant role, both types of supporting industries should have reacted similarly. The fact that a county's local supporting industries are more affected by its tradable industries than the county's regional supporting industries suggests the spillovers occur via the input-output linkage channel.

VARIABLES	Log change in local supporting employment, 2007-2010			
	[1]	[2]	[3]	[4]
Bartik	0.366**	0.425***	0.408**	0.438**
	[0.139]	[0.152]	[0.153]	[0.165]
% White, 2007		0.001		0.001
		[0.001]		[0.001]
Log of median household income, 2007		0.032		0.038
		[0.152]		[0.202]
Log of median homevalue, 2007		-0.153*		-0.160
		[0.080]		[0.117]
% Owner occupied, 2007		-0.004***		-0.004*
		[0.001]		[0.002]
% With less than high school diploma, 2007		0.001		0.000
		[0.003]		[0.003]
% With only high school diploma, 2007		-0.002		-0.002
		[0.004]		[0.004]
Unemployment rate, 2007		0.017*		0.020**
		[0.008]		[0.009]
Poverty rate, 2007		-0.013***		-0.014**
		[0.005]		[0.006]
% Urban, 2007		-0.001		-0.001
		[0.001]		[0.001]
Leverage, 2006			-0.031**	0.005
			[0.014]	[0.025]
Constant	-0.001	1.829	0.064	1.866
	[0.034]	[1.144]	[0.047]	[1.241]
Observations	3,014	3,014	2,219	2,219
R-squared	0.003	0.017	0.006	0.019

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

Table 6.1c: Impacts on local supporting sector employment

VARIABLES	Log change in regional supporting employment 2007-2010			
	[1]	[2]	[3]	[4]
Bartik	0.182	0.181	0.186	0.189
	[0.250]	[0.238]	[0.260]	[0.245]
% White, 2007		0.000		0.001
		[0.002]		[0.002]
Log of median household income, 2007		-0.024		0.094
		[0.188]		[0.227]
Log of median homevalue, 2007		0.015		-0.026
		[0.051]		[0.078]
% Owner occupied, 2007		-0.003		-0.004
		[0.002]		[0.002]
% With less than high school diploma, 2007		-0.002		-0.003
		[0.003]		[0.003]
% With only high school diploma, 2007		0.002		0.003
		[0.003]		[0.003]
Unemployment rate, 2007		0.005		0.004
		[0.008]		[0.009]
Poverty rate, 2007		0.002		0.003
		[0.007]		[0.008]
% Urban, 2007		-0.001		-0.001
		[0.001]		[0.001]
Leverage, 2006			0.003	0.020
			[0.017]	[0.031]
Constant	0.036	-0.268	0.031	-0.526
	[0.043]	[1.878]	[0.050]	[2.018]
Observations	2,582	2,582	2,134	2,134
R-squared	0.000	0.004	0.001	0.005

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

Table 6.1d: Impacts on regional supporting sector employment

7 Conclusion

The Great Recession was a painful period in world economic history. Behind the dry numbers are actual people and communities that suffer from job losses and the resulting hardship. It is important to understand the impacts of the Great Recession, in particular, how shocks transmit across economic sectors.

This paper is an effort to better understand the transmission of job losses during Great Recession. We focus only on the transmission via input linkages. We find that counties with higher tradable job losses driven by aggregate shocks experience greater declines in supporting service employment. The results reveal that across counties, a 10% decrease in Bartik jobs, on average, caused a 3.76% decrease in supporting sector employment between 2007 and 2010. These results are statistically significant and are robust across numerous control variables.

Additionally, disaggregating the supporting sectors based on the modified Herfindahl index into two separate subsectors—local and regional—reveals that the impact of the exogenous shock was much greater and more significant for the supporting services that serve local markets compared to those that serve larger geographic areas. Holding the controls constant, across counties, a 10% decline in Bartik jobs causes a 4.38% decrease in a county's local supporting jobs. We argue that this is due to local industries' high dependence on local tradable employment. Furthermore, we find that these results are not influenced by household leverage or credit supply constraints. The results hence are argued to reflect the impact of cross-sectoral job loss spillovers during the Great Recession.

References

Acemoglu, Daron & David Autor & David Dorn & Gordon H. Hanson & Brendan Price (2016) "Import Competition and the Great U.S. Employment Sag of the 2000s," *Journal of Labor Economics,* vol 34, pp 141-198

Bartik, Timothy J. (1991) *Who Benefits from State and Local Economic Development Policies?* Kalamazoo, MI: W.E. Upjohn Institute for Employment Research

Blanchard, Olivier & Lawrence F. Katz, (1992). "Regional Evolutions," Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution, vol. 23(1), pages 1-76.

Boldrin, Michele, Carlos Garriga, Adrian Peralta-Alva and Juan Sanchez (2013) "Reconstructing the Great Recession," *Federal Reserve Bank of St. Louis Working Paper* 2013-006B

Foster, Lucia, Cherul Grim and John Haltiwanger (2016) "Reallocation in the Great Recession: Cleansing or Not?" *Journal of Labor Economics,* vol 34, pp 293-331

Hoffmann, Florian and Thomas Lemieux (2016) "Unemployment in the Great Recession: A comparison of Germany, Canada and the United States" *Journal of Labor Economics,* vol 34, pp 95-139

Kroft Kory & Fabian Lange & Matthew J. Notowidigdo & Lawrence F. Katz (2016). "Long-Term Unemployment and the Great Recession: The Role of Composition, Duration Dependence, and Nonparticipation," *Journal of Labor Economics*, University of Chicago Press, vol. 34(S1), pages S7 - S54.

Li, Nan and Vance Martin (2015), "Real Sectoral Spillovers: A Dynamic Factor Analysis of the Great Recession," *Working Paper.*

Mian, Atif and Amir Sufi (2010), "Household leverage and the recession of 2007-2009?" *NBER Working Paper 15896*

Mian, Atif and Amir Sufi (2014), "What Explains the 2007-2009 Drop in Employment?"*Econometrica*, Vol. 82, No. 6, 2197-2223

Mian, Atif, Kamalesh Rao and Amir Sufi (2013), "Household Balance Sheets, Consumption, and the Economic Slump" *Quarterly Journal of Economics*, 128 (4): 1687-1726

Moretti, Enrico (2010) "Local Multipliers" *American Economic Review: Papers & Proceedings* 100: 1–7

Nguyen, Ha (2015), "Demand-driven Propagation: Evidence from the Great Recession," *World Bank Policy Research Working Paper 7456*

Ohanian, Lee (2011) "Accounting for the Great Recession: Why and how did the 2007-2009 U.S. recession differ from all others?" *Economic Policy Paper 11-1, Federal Reserve Bank of Minneapolis*

Shoag, Daniel and Veuger, Stan, (2015), Uncertainty and the Geography of the Great Recession, *Working Paper Series*, Harvard University, John F. Kennedy School of Government

Appendix

In defining supporting industries, we rigorously examined all of the NAICS codes provided on the NAICS Association's website. We made our decisions based on the descriptions of each industry described under a given NAICS code. If the code potentially supported the tradable sectors, we then asked if any industries under the code a. dealt with the residential population (such as 561720, which includes housekeeping services) or b. functioned far from the tradable industries (such as 484121 and 484122, which deal with long-distance freighting and trucking). If either was thought to be true, the code was removed. The following table includes descriptions of all the industry NAICS codes that we included in the supporting sector as well as the reason for inclusion:

NAICS	Industry Name	Description	Reason for Inclusion
484110	General Freight Trucking, Local	Provides local general freight trucking, generally with a one-day return Note: We exclude industries 484121 (General Freight Trucking, Long-Distance, Truckload) and 484122 (General Freight Trucking, Long-Distance, Less Than Truckload) because these industries are not stationed locally; thus inclusion of them would therefore contaminate our results.	Helps fulfill the need for transportation to support tradable industries, as manufactured goods, etc. require freight trucks to move them from factories to warehouses, stores, etc.
484220	Specialized Freight (except Used Goods) Trucking, Local	Provides local specialized trucking, generally with a one-day return	Same as aforementioned industry
488210	Support Activities for Rail Transportation	Provides specialized services for railroad transportation including servicing, repair, maintenance, loading and unloading of rail cars, and operating terminals	Aids rail transport which is vital to support the transportation of tradable industries
488510	Freight Transportation Arrangement	Arranges transportation of freight between shippers and carriers, includes freight forwarders, marine shipping agents, etc.	Necessary for freight transportation industry which serves tradable industries as it provides services spanning transportation modes
488991	Packing and Crating	Deals with packing, crating, and otherwise preparing goods for transportation	Same as aforementioned industry

493110	General Warehousing and Storage	Responsible for storing goods in warehouses	Considered supporting because this industry stores tradable goods
493120	Refrigerated Warehousing and Storage	Responsible for storing goods that require refrigeration	This industry is included for the same reasons as the previous code except that this industry deals with tradable goods that require refrigeration.
493130	Farm Product Warehousing and Storage	Responsible for storage of farm products.	Since farm products are tradable goods, this industry falls under the supporting category
493190	Other Warehousing and Storage	Provides storage for specific industries, such as lumber, whiskey, etc.	Considered supporting because this industry stores tradable goods
541214	Payroll Services	Deals with accounting, billing, and bookkeeping	Considered supporting given that the tradable industries require its service
541219	Other Accounting Services	Provides accounting services, and other services like provide tax return preparation or payroll services	Same as aforementioned industry
541511	Custom Computer Programming Services	Engaged in writing, modifying, testing, and supporting software to meet the needs of a particular customer	Included because many tradable industries utilize software and computers for their businesses
541512	Computer Systems Design Services	Involved in planning and designing computer systems that integrate computer hardware, software, and communication technologies; also involved in system installation and training and supporting users of the system	Same as aforementioned industry
541513	Computer Facilities Management Services	Provides on-site management and operation of clients' computer systems and/or data processing facilities as well as support to these systems	Necessary to aid computer and software industries that serve tradable industries
541519	Other Computer Related Services	Provides computer related services, such as computer disaster recovery services and software installation	Necessary to aid computer and software industries that serve tradable industries
541611	Administrative Management and General Management Consulting Services	Provides operating advice and assistance to businesses and other organizations on administrative management issues	Tradable companies require consulting services in order to deal with back-end challenges
541612	Human Resources Consulting Services	Provides advice and assistance to businesses and organizations in the areas of human resource and personnel policies, employee benefits planning, communication, and administration, and compensation planning and administration.	Same as aforementioned industry

541613	Marketing Consulting Services	Provides operating advice and assistance to businesses and organizations on marketing issues, such as developing objectives and policies, sales forecasting, new product development, and marketing planning and strategy.	Same as aforementioned industry
541614	Process, Physical Distribution, and Logistics Consulting	Provides operating advice and assistance to businesses and organizations in the areas of manufacturing operations and production, productivity, transportation, warehousing, etc.	Same as aforementioned industry
561110	Office Administrative Services	Responsible for providing a range of day-to-day office administrative support services.	It is included as it provides office support services which are important for the day-to-day functioning of tradable industries
561410	Document Preparation Services	Deals with letter or resume writing; document editing and other secretarial services.	It is included as it provides office support services
561499	All Other Business Support Services	Provides business support services	Included for aforementioned reasons
561910	Packaging and Labeling Services	Deals with packaging client-owned materials	Integral part of the transportation of tradable goods
562112	Hazardous Waste Collection	Deals with collecting and hauling hazardous waste within a local area and operating hazardous waste transfer stations	Tradable industries, such as manufacturing, create harmful byproducts that require disposal
562211	Hazardous Waste Treatment and Disposal	Engaged in operating treatment and disposal facilities for hazardous waste	Same as previous industry
811212	Computer and Office Machine Repair and Maintenance	Deals with repair and maintenance of computers and other office machines	Integral for the day-to-day functioning of tradable industries
811213	Communication Equipment Repair and Maintenance	Deals with repair and maintenance of communications	Same as aforementioned industry
811219	Other Electronic and Precision Equipment Repair and Maintenance	Responsible for repair and maintenance of electronic and precision equipment	Supports functioning of certain tradable industries
811310	Commercial and Industrial Machinery	Deals with repair and maintenance of commercial and industrial machinery and equipment.	Same as aforementioned industry

and Equipment (except Automotive and Electronic) Repair		

Table A.1: Supporting industries descriptions and reasons for inclusion

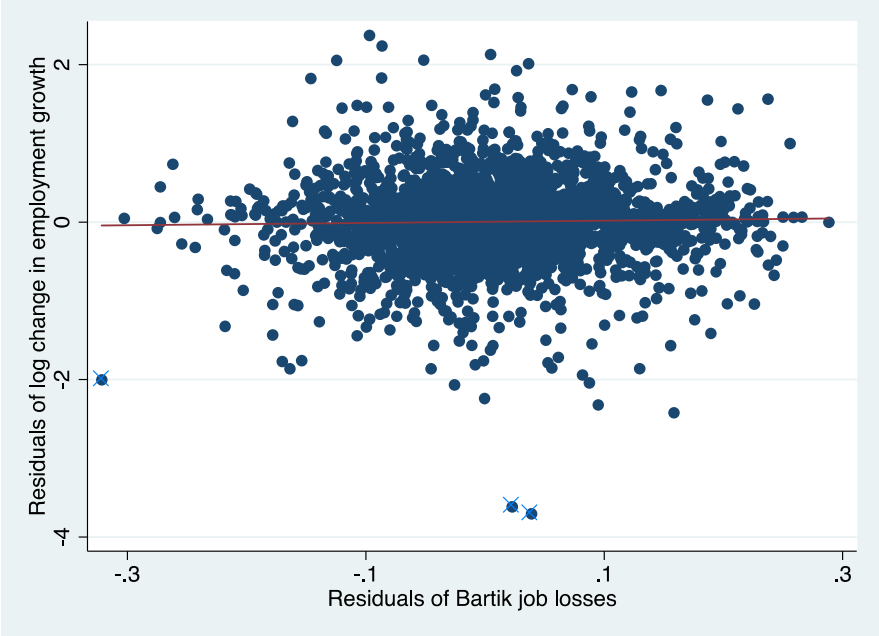

Figure A.1 Scatterplot of regression [2] in Table 5.1 including the three outliers as marked in this figure

NAICS	Industry Name	Modified Herfindahl	Local (l) Regional (r)
484220	Specialized Freight (except Used Goods) Trucking, Local	0.002071	l
493110	General Warehousing and Storage	0.004657	l
484110	General Freight Trucking, Local	0.004907	l
493130	Farm Product Warehousing and Storage	0.005402	l
541219	Other Accounting Services	0.006081	l
811219	Other Electronic and Precision Equipment Repair and Maintenance	0.006820	l
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair	0.007959	l
561499	All Other Business Support Services	0.008376	l
561410	Document Preparation Services	0.008500	l
493190	Other Warehousing and Storage	0.008593	l
561110	Office Administrative Services	0.008822	l
493120	Refrigerated Warehousing and Storage	0.008870	l
811213	Communication Equipment Repair and Maintenance	0.009771	l
541614	Process, Physical Distribution, and Logistics Consulting	0.010042	l
561910	Packaging and Labeling Services	0.010523	r
541511	Custom Computer Programming Services	0.012042	r
488991	Packing and Crating	0.012463	r
541512	Computer Systems Design Services	0.012938	r
541612	Human Resources Consulting Services	0.012972	r
541613	Marketing Consulting Services	0.013493	r
541519	Other Computer Related Services	0.014440	r
811212	Computer and Office Machine Repair and Maintenance	0.014802	r
541611	Administrative Management and General Management Consulting Services	0.015322	r
562112	Hazardous Waste Collection	0.015403	r
488210	Support Activities for Rail Transportation	0.015538	r
488510	Freight Transportation Arrangement	0.015745	r
541513	Computer Facilities Management Services	0.021722	r
562211	Hazardous Waste Treatment and Disposal	0.026548	r
541214	Payroll Services	0.049904	r

Table A.2: Supporting industries classified as local or regional according to a standard Herfindahl index

VARIABLES	Log change in local supporting employment, 2007-2010			
	Local			
	[1]	[2]	[3]	[4]
Bartik	0.356**	0.418***	0.402***	0.435**
	[0.136]	[0.151]	[0.150]	[0.165]
Leverage	No	No	Yes	Yes
Controls	No	Yes	No	Yes
Constant	0.004	1.179	0.068	1.210
	[0.034]	[1.155]	[0.045]	[1.251]
Observations	3,012	3,012	2,219	2,219
R-squared	0.003	0.017	0.006	0.018
	Regional			
Bartik	0.237	0.223	0.229	0.223
	[0.271]	[0.256]	[0.283]	[0.267]
Leverage	No	No	Yes	Yes
Controls	No	Yes	No	Yes
Constant	0.038	0.281	0.024	-0.013
	[0.046]	[1.941]	[0.054]	[2.084]
Observations	2583	2583	2132	2132
R-squared	0.001	0.005	0.001	0.006

Table A.3: Impacts on local and regional supporting sector employment using the standard Herfindahl index classification of supporting industries

Tables A.3 shows the results of regressions when the supporting sector is split into local and regional industries based on the standard Herfindahl index. These results are very similar to when the industries are divided based on the modified Herfindahl index, as the overall classification into local and regional differs by only two industries' NAICS codes. In both cases, the positive coefficients of tradable employment in the regressions indicate that greater Bartik job losses lead to a greater decrease in a county's supporting employment. Across counties and holding control variables constant, a 10% decline in Bartik jobs causes a 4.35% decrease in a county's local supporting jobs when the supporting service is split based on the standard

Herfindahl index compared to a 4.38% decreased when divided based on the modified Herfindahl. Both relationships are also significant at a 5% level. Bartik job losses, however, do not seem to affect a county's regional supporting jobs in either case. In the regional regressions the coefficients of the explanatory variable, while positive, are not significant. The regressions based on the standard Herfindahl reinforce the findings that Bartik job losses during the Great Recession had a significant spillover effect for a county's local but not regional supporting industries.