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Local Multipliers, Unemployment and Migration: An Empirical Analysis of the United States

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Local Multipliers, Unemployment and Migration: An Empirical Analysis of the United States

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Abstract

This paper shows that within a regional economy, employment in the nontradable sector benefits from attracting jobs in the tradable sector. I rework Moretti's study of U.S. cities (AER 2010) and find that one new job in a given city's tradable sector will result into 1.02 new jobs in the nontradable sector in the same city. I show Moretti overestimated the size of this local multiplier by 0.57, because he made five perfunctory assumptions that had a major impact on his results.

Subsequently I extend Moretti's analysis by including the unemployment rate and migration. The size of the local multiplier increases with the unemployment rate in a city. Almost all jobs in the nontradable sector created by the local multiplier effect are fulfilled by workers that migrate from other regions, therefore local unemployment is not reduced.

These findings are important for regional economic policy. They suggest that cities with a high unemployment rate will experience the greatest increase in local employment in the nontradable sector by attracting tradable industries, but their current residents are not likely to benefit from the additional jobs. Therefore it remains to be seen if policy to attract tradable firms - to boost local employment - is welfare improving.

Keywords: Local multipliers, Unemployment, Regional policy

JEL codes: J23; R11; R12; R23; R58.

1 Introduction

"Every time a local economy generates a new job by attracting a new business, additional jobs might also be created, mainly through increased demand for local goods and services. This positive effect on employment is partially offset by general equilibrium effects induced by changes in local wages and prices of local services." (Moretti, 2010)

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The goal of this paper is to determine the long run effect of labour demand shocks in the tradable sector on employment in the nontradable sector in the same region.

According to Bartik (2001) the U.S. government currently emphasizes "labour supply policies" to reduce poverty. These policies consist of a direct interaction with the unemployed to increase the quantity or quality of their labour supply. Common examples are job training or welfare reform policies that make it harder to get benefits. There is little emphasis on "labour demand policies". These policies stimulate employers to create more jobs or increase the quality of their jobs. Bartik argues that a successful reduction of poverty will only be achieved by a combination of both policies. A possible local labour demand policy is to attract tradable jobs and benefit from the additional jobs created in the nontradable sector. I will analyse the effectiveness of this policy with Moretti's framework and discuss the impact on local welfare.

First, I will investigate the dynamics of a city with a tradable and a nontradable good by building a simple model. I will adopt and explain Moretti's conceptual framework. Second, I will rework Moretti's empirical analysis of U.S. cities (Moretti, 2010) by following his definition of the long-term employment multiplier at the local level - the number of extra jobs created in the nontradable sector in a sub-national region as a result of one new jobs in the tradable sector of this same region - and analysing the same U.S. census data. I will demonstrate that Moretti made five perfunctory assumptions which have a major impact on his results. Third, I will extend this work by including a non-parametric analysis of the effect of the unemployment rate on the size of the local employment multiplier and by analysing the data for local and migrated workers separately.

Industries in the tradable sector supply an area significantly larger than the region their are located in, e.g. (inter)nationally. Demand for the goods they produce is therefore not determined regionally. The most common example of a tradable industry is manufacturing, but it also includes tradable services. Firms in these industries are likely to cluster in areas with low factor prices or areas with similar firms to benefit from local spillovers. Industries in the nontradable sector supply locally and demand for nontradable products is determined regionally.

New jobs in the tradable sector in a city will increase wages in the number of workers. These new workers will spend a substantial part of their earnings on local goods. This increases demand for the nontradable goods in the city and creates extra jobs in the nontradable sector. It is unlikely an increase in the nontradable sector will have the same effect on the tradable sector, as demand for the tradable good is not determined locally. For example, it is very likely that the presence of Microsoft in Seattle, WA has increased the number of barbers and theatres in Seattle, but it is unlikely that a sudden increase of barbers in Flint, MI would attract a large software firm (Moretti, 2012).

I rework Moretti's study (2010) of U.S. cities and find that one new job in the tradable sector in a U.S. city will results into 1.02 new jobs in the nontradable sector in the same city. Moretti used the exact same IPUMS data, but estimated a much larger multiplier of 1.59. I show Moretti's results are an overestimation, because he made five perfunctory assumptions that had a

major impact on his results. I will improve upon his analysis by

- removing industries from the analysis that are not observed in every period
- excluding mining and agriculture as nontradable industries;
- using a more advanced shift-share instrument that is exogenous to local policy that would increase employment over all sectors;
- weighting both time intervals in the dataset equally;
- providing a more accurate estimate for the relative size of the nontradable sector to the tradable sector.

I will show that each change reduces the estimated size of the multiplier.

Subsequently I will extend Moretti's analysis in two ways. First, I include a non-parametric analysis of the effect of the unemployment rate on the size of the local multiplier. Cities with a high unemployment rate have a larger local multiplier, this allows policy makers to determine which cities would benefit the most from attracting tradable jobs. Second, I analyse the data for local and migrated workers separately. Jobs created in the nontradable sector due to the local multiplier effect are fulfilled by workers migrating from other regions. There is no significant effect on employment levels for current residents in the nontradable sector.

The structure of my paper is as follows. Chapter 2 discusses the current literature, my model and Moretti's theoretical framework. Chapter 3 describes the empirical methods of analysis and Chapter 4 gives an overview of the data I use. Chapter 5 then examines the local multiplier in U.S. cities and Chapter 6 provides critiques on Moretti's previous estimates. In Chapter 7 I discuss my two extensions before drawing conclusions in Chapter 8.

2 Theory and Literature

Studies have shown positive welfare effects (Greenstone and Moretti, 2003) and agglomeration spillover effects (Greenstone, Hornbeck and Moretti, 2008) due to the attraction of a large firms. When there is an exogenous increase in the tradable sector the labour market will adapt endogenously allowing for an additional increase in jobs. In the U.S. "for each additional job in manufacturing in a given city¹, 1.6 jobs are created in the nontradable sector in the same city" (Moretti, 2010). The size of this multiplier has been differentiated based on the nature of the jobs in the tradable sector and the nature of the jobs in the nontradable sector. In U.S. cities the multiplier for skilled jobs is 2.5 compared to 1 for unskilled workers (Moretti, 2010) and in Sweden the multiplier effect was found particularly large for jobs with high levels of human capital and for high-technology industries (Moretti and Thulin, 2013). The difference in size

¹Moretti used city for metropolitan area, I will do the same.

can (partially) be explained by the higher income of skilled workers. On the other hand for each extra (un)skilled tradable jobs the extra nontradable jobs are mostly (un)skilled as well. So apart from the difference in wages there could also be a difference in preferences between skilled and unskilled workers and a technological spillover from skilled tradable jobs to skilled nontradable jobs. In either case the type of tradable jobs policy makers would like to attract depends on the type of unemployment there is in the region.

The local multiplier in Europe differs significantly from the U.S.. The entire EU has a local multiplier of 1.12 for TL2²-regions and Sweden has a local multiplier of 0.71 (Van Dijk, forthcoming). Swedish municipalities have an estimated multiplier of 0.49 (Moretti and Thulin, 2013) and there is no significant multiplier in Italian local labour markets (de Blasio and Menon, 2011). Since these studies all use slightly different methods, definitions and units of analysis, these numbers are hard to compare. But it does suggest that the multiplier of the tradable sector on the nontradable sector is larger in the U.S. than in Europe. In this paper I will improve upon the estimates of Moretti for U.S. cities. The local multiplier of jobs in government on jobs in the private sector has also been studied, in this case for U.K. Local Authorities. Specifically, each additional public sector job creates 0.5 jobs in the nontradable sector while crowding out 0.4 jobs in the tradable sector (Faggio and Overman, 2014).

In this chapter I will look at these local multipliers and try to understand why we expect them.

2.1 Conceptual Framework

To better understand local multipliers I will use the same conceptual framework as Moretti (2010, 2011) throughout this paper, albeit with some extensions. Each region (metropolitan area) is a competitive economy where tradable goods are priced exogenously and nontradable goods are priced locally. Goods that are traded outside the region, so nationally or internationally, are all defined as tradable goods. In practice this will be all manufacturing industries. In contrast to Moretti I make a special note of industries that produce traded goods, but are not always able to relocate jobs when wages increase such as mining and agriculture. Moretti considers services as nontradable goods, but improvements are possible by allowing for some tradable services. Labour is mobile within each city and wages in all sectors are determined locally. The labour supply is upward sloping and labour mobility between regions depends on the housing supply, but it will not be zero or infinite.

When a local economy attracts a new manufacturing firm or an existing manufacturing firm expands this increases the number of jobs in the tradable sector. This is a direct increase in the number of jobs in the region. These extra workers will spend part of their income on local goods and services, or nontradable goods. The size of this spending increase depends on the workers wages and preferences. This spending will increase demand for some nontradable goods

²TL2 and TL3 regions correspond to the second and third level NUTS regions respectively.

in the region, depending on which specific non-traded goods are demanded and their respective technologies there will be an increase in labour demand in the nontradable sector.

The increased demand for labour in the nontradable sector will increase employment and wages in the nontradable sector. High mobility and/or unemployment permits easy expansion of employment, therefore the multiplier effect on employment can be greater and the effect on wages smaller. On the other hand low mobility and/or a low unemployment rate will have a dampening effect on the employment multiplier, but will increase the effect on wages. The increased wages in the nontradable sector will also have an effect on people living in the region that are currently not participating in the labour market. Higher wages will convince some of them to join the labour market. Therefore the unemployment rate will not tell the complete story as the participation rate might change as well.

Finally the increased wages will make the region more attractive to workers from other regions. Therefore part of the new jobs might be fulfilled by workers from other regions, dampening the effect on unemployment in the region. This effect is especially relevant for policy makers as they want to attract firms because the multiplier effect is beneficial for their constituent and don't want part (or all) of the benefits to be reaped by inhabitant of other regions.

Studies have shown a significant positive multiplier of extra jobs in the tradable sector on jobs in the nontradable sector in the same region (Moretti, 2010; Moretti and Thulin, 2013). Possible factors that influence the magnitude of the local multiplier are: the wages in the tradable sector, consumer preferences, the unemployment rate, the technologies and labour mobility within the nontradable sector, and labour mobility between regions.

The increase in labour demand in some tradable sub-sector also has an effect on the rest of the tradable sector. Demand for labour (and land) increases, which will increase factor prices. Since tradable firms are price takers, when wages and other factor prices go up less efficient firms might close down and move to a cheaper region or hire fewer workers. Therefore the increase in jobs in a tradable sub-sector has a negative effect on the rest of the tradable sector.

When a new firm locates in a region there can also be agglomerations effects such as a positive spillover (Greenstone, Hornbeck and Moretti, 2008) to the incumbent firms in the region. Improved technologies can create efficiency benefits and therefore increase labour demand and wages. Depending on which effect is greater, the crowding out effect or the spillover effect, the multiplier of extra jobs in one tradable sub-sector on other jobs in the tradable sector could go either way, but it is expected to be smaller than the multiplier on the nontradable sector.

When the spillover effect improves technology and increases wages in the tradable sector this can also directly affect the wages in the nontradable sector. Because of the mobility of workers within a city between the tradable and the nontradable sector, wages in the nontradable sector will have to increase with the wages in the tradable sector, to keep the nontradable sector competitive, this is the Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964).

3 Empirical method

3.1 Regression analysis

The goal of this paper is to determine the long run effect of labour demand shocks in the tradable sector on employment in the nontradable sector in the same region. There are different ways to analyse this, but I will focus on the methods similar to those used in Moretti (2010) and Moretti and Thulin (2013).

I will determine the relationship between changes over time in the number of workers in the tradable sector in a region and the number of workers in the nontradable sector in a region by two-step least squares regression using panel data. I will use the change over time in the log of the number of jobs in the tradable sector in a region $\Delta N_{c,t}^T$ as the independent variable and the change over time in the log number of jobs in the nontradable sector in a region $\Delta N_{c,t}^{NT}$ as the dependent variable. Apart from this I will add an intercept α and dummy variables d_t for every time-period apart from the first. This results into

$$\Delta N_{c,t}^{NT} = \alpha + \beta \Delta N_{c,t}^T + \gamma' d_t + \Delta \varepsilon_{c,t}. \quad (3.1)$$

All unobservable region-specific fixed effects are cancelled out due to the differencing and only the truly random component $\Delta \varepsilon_{c,t}$ remains. Using least-squares regression, the intercept and the time dummy variables will capture any general booms and recessions that occur in specific year and all other co-movement between jobs in the tradable and the nontradable sector are captured by β .

There will be three types of co-movement captured by β , first of all the causal effect of extra jobs in the tradable sector on employment in the nontradable sector, this is the effect I want to measure. This result will be confounded due to endogeneity, an increase in jobs in the nontradable sector that effects employment in the tradable sector. And omitted variables, for example effective local government will increase jobs in both sectors.

3.1.1 Regression Weights

Since $\Delta N_{c,t}^T$ and $\Delta N_{c,t}^{NT}$ are both measures of relative change, regions with only a few workers will have the same effect on the regression as very large regions with many workers. To correct for this I use weighted LS, where the weight of each observation is given by the total number of workers employed in the tradable or nontradable sector at the start of the interval

$$w_{c,t} = N_{c,t-s}^T + N_{c,t-s}^{NT} \quad (3.2)$$

3.1.2 Instrumental Variable

Since I am only interested in the causal effect of a change in the number of jobs in the tradable sector on the number of jobs in the nontradable sector I need a way to filter out the other two unwanted co-movements captured by β when using weighted LS.

To achieve this I will use an instrumental variable derived from the well-established shift-share approach introduced by Bartik (1991) and I will use this instrument to do a weighted 2SLS analysis. The instrument (3.3) is an improved version of the instrument used by Moretti (2010). It is based on the lagged size of each industries in the region and the combined growth of each industry in all other regions.

$$\Delta \tilde{N}_{c,t}^T = \sum_{j \in T} \left(\frac{N_{jc,t-s}}{N_{c,t-s}^T} \Delta N_{j,-c,t} \right) \quad (3.3)$$

Consider for example the production of computer hardware. If there is a productivity shock in computer hardware in China, there will be more exports to the U.S. and the demand for in the U.S. produced computer hardware will decline. This decline will be measured by $\Delta N_{j,-c,t}$ which approximates the percentage growth in across industry j between period $t-s$ and period t .

It is likely that a region with a large share of employment in the production of computer hardware will be affected more by this shock than regions with a smaller share. The share of jobs in region c that is part of industry j at time $t-s$ is given by $N_{j,c,t-s}/N_{c,t-s}^T$. Combining this results into to the instrument given in (3.3). I use the share of the industry in the region and not the size, because this way $\Delta \tilde{N}_{c,t}^T$ will be identical to $\Delta N_{c,t}^T$ if all regions are affected in exactly the same way by a national change in any industry j .

Under the assumption that the national changes in employment are exogenous to a specific region a weighted 2SLS regression with this instrument will identify the effect of an increase in jobs in the tradable sector on employment in the nontradable sector, avoiding the problems caused by endogeneity and omitted variables seen in the LS regression. I exclude the change in the own region when calculating the overall growth out of concern that the changes in the region may drive the national changes, violating the assumed exogeneity.

3.1.3 Interpretation

The estimated value of β represents an elasticity between jobs in the tradable sector and jobs in the nontradable sector. For example when $\beta = 0.3$, a 10% increase in the number of jobs in the tradable sector will results into a 3% increase in the number of jobs in the nontradable sector. In order to express the multiplier in an absolute number of jobs I need the relative size of the nontradable sector to the tradable sector. I calculate this by adding up the number of workers in the nontradable sector in each region at the start of each interval and dividing this by the added

number of workers the tradable sector. The relative size is therefore given by

$$r = \frac{\sum_{S \setminus t_1} N_t^{NT}}{\sum_{S \setminus t_1} N_t^T}, \quad (3.4)$$

which is consistent with the way the individual regression weights are defined as the sum of all weights used is equal to the sum of the numerator and the denominator

$$\sum_{S \setminus t_1} \sum_{C_t} w_{c,t} = \sum_{S \setminus t_1} N_t^T + \sum_{S \setminus t_1} N_t^{NT}. \quad (3.5)$$

One additional job in the tradable sector will result into $r\beta$ extra jobs in the nontradable sector.

3.1.4 Alternative Method: Direct Difference

Instead of using the change in the log of the number of jobs and a regression weight, it is also possible to do the analysis directly with the change in the number of jobs in each sector, $\Delta N_{c,t}^T$ and $\Delta N_{c,t}^{NT}$. This exact method is used in the analysis of Sweden by Moretti and Thulin (2013). In this case the OLS regression is given by

$$\Delta N_{c,t}^{NT} = \alpha + \beta \Delta N_{c,t}^T + \gamma' d_t + \varepsilon_{c,t} \quad (3.6)$$

and no weights are necessary. The parameter β directly represents the effect of the local multiplier. One additional jobs in the tradable sector will result into β extra jobs in the nontradable sector. The instrument becomes

$$\Delta \tilde{N}_{c,t}^T = \sum_{j \in T} (N_{j,c,t-s} \Delta N_{j,-c,t}) \quad (3.7)$$

because the lagged size of an industry is used instead of the lagged share. There is no literature on which method is preferable, so I will consider both for my analysis.

4 Data

For my analysis of U.S. cities I used United Status Census Data from 1980, 1990 and 2000 provided by IPUMS USA (Ruggles et al., 2010).

4.1 Cities

The U.S. Census data provides a 1-in-20 national random sample of the population for 1980, 1990 and 2000. The sample of 1980 is unweighted and the sample of 1990 and 2000 are weighted. For each individual it contains the metropolitan area his household lived in, his employment status, the industry he worked in (standardised to a 1990 basis) and his migration status compared to five years earlier.

The number of cities included in the dataset increases over time, therefore the panel dataset is unbalanced. I do not remove cities to balance the dataset, instead I introduce two subsets, C_{1990} and C_{2000} . C_{1990} includes all cities observed in 1980 and 1990 and C_{2000} includes all cities observed in 1990 and 2000.

There is a similar problem with the observation of industries. The industries of 1980 and 2000 are recoded to the three-digit industry codes of 1990. This results in some industries that are not observed at all in 1980 or 2000 according to the 1990 industry codes. This is a problem for my estimation as it is based on relative change, and this would sometimes imply an infinite change. To prevent this I choose to remove all industries that do not have at least one employed worker observed in each time period. This results in the removal of 8 tradable industries and 16 nontradable industries.

For my initial analysis I select all employed workers and aggregate those living in the same metropolitan area and working in the same industry. I aggregate them based on the weight attributed to each individual and for every observed year. The results of this aggregation is captured by N_{jct} , the number of workers in industry j of city c at time t . I consider $|T| = 74$ tradable industries and $|NT| = 119$ nontradable industries. The time period is given by $S = \{1980, 1990, 2000\}$. The time between two observations is $s = 10$. Overall I observe $|C| = 245$ cities, $|C_{1990}| = 226$ of those I observe in the period 1980-1990 and $|C_{2000}| = 238$ of those I observe in the period 1990-2000.

The distribution of employment across industries is shown in Table 1. You can clearly see the decrease of employment in manufacturing over time. My sample contains cities ranging in size from 30.000 to 7.000.000 workers. As shown in Table 2 and 3 the share of jobs in manufacturing can differ by almost a factor 18.

4.1.1 Migration

The data on U.S. cities can also be used to determine the effect of the local multiplier on migration. It is possible to determine separate multipliers for locals and migrations by splitting the observed workers into two categories. The workers that lived in the same house, PUMA³ or county five years earlier and those who did not. I call the first group locals and the second group outsiders. I do the same aggregation as before, but now for each group separately. I remove all workers of whom I do not know their migration status. This results into two separate variables: $N_{j,c,t}^L$ as the number of locals working in industry j of city c at time t and $N_{j,c,t}^O$ as the number of outsiders working in industry j of city c at time t . All derivative definitions are completely analogous to those related to $N_{j,c,t}$.

The ratio of locals to migrants over time is shown for each industry in Table 4. There are relatively more locals working in the tradable sector than in the nontradable sector. In 2000 the migration status of all workers was observed, but in 1990 only 61% was observed and in 180

³PUMA identifies the Public Use Microdata Area (PUMA) where the housing unit was located.

only 50%. By removing all these workers I will structurally underestimate employment in 1980 and 1990. To adjust for this I will rescale the number of jobs in the observations from these two periods by 2 and 1.64 respectively. More details on the distribution of locals and migrants across the labour force can be found in Table ?? on page ??.

4.1.2 Unemployment

I derive the unemployment rate in each city directly from the census data. I do this in three steps. First I constructed $L_{c,t}$ the number of individuals participating in the labour market of city c at time t by adding up the (weighted) total of all employed and unemployed individuals per year and city. Second I constructed $N_{c,t}$ the number of employed in city c at time t by adding up the (weighted) total of all employed individuals per year and city. I define the unemployment rate as

$$u_{c,t} = 100 \left(1 - \frac{N_{c,t}}{L_{c,t}} \right). \quad (4.1)$$

I use this measure to do a non-parametric analysis of the size of the local multiplier later on. I do not consider the industry explicitly when calculating the unemployment rate and therefore no industries are excluded. As shown in Figure 1 the unemployment rate lies between 3.5% and 8% for most cities. Therefore I will focus my non-parametric estimation on this range. It will be hard to say anything significant about the effect of a very low unemployment rate on the local multiplier.

A simple regression analysis shows the unemployment rate is independent of the size of a city ($p = 0.74$) and the share of workers in manufacturing ($p = 0.30$). So there is less need to worry about endogeneity problems. Another regression shows cities with a high unemployment rate experience less growth, both in the tradable ($p < 0.001$) and in the nontradable sector ($p < 0.001$). This makes sense as booming regions generally have lower unemployment.

5 Local Multiplier in U.S. Cities

I estimate the size of the local multiplier of an increase in the number of jobs in the tradable sector on employment in the nontradable sector in metropolitan areas in the United States. For this analysis I use the United States Census Data from 1980, 1990 and 2000 on metropolitan areas. Moretti (2010) used the exact same dataset and estimated a local employment multiplier of 1.59. I contacted Moretti about his method of estimation and he graciously provided me with the Stata files he used. This allowed me to exactly replicate his results.

During this replication I found the method he used, does not completely correspond to the description he gives in his paper. He also makes some assumptions that I consider to be inconsistent or inaccurate. My estimation as described in Chapter 3 differs from Moretti's method in five ways. In Chapter 6 I argue why I make these changes and I show the major impact of

these changes on the estimation of the local multiplier.

This Chapter focusses on a weighted two-stage least squares regression of (3.1) with the instrument given by (3.3). I relate the change over time in the log number of workers in the nontradable sector $\Delta N_{c,t}^{NT} = \ln N_{c,t}^{NT} - \ln N_{c,t-10}^{NT}$ to the change over time in the log number of workers in the tradable sector $\Delta N_{c,t}^T$. As a comparison I also include the estimates for the local multiplier without using the instrument, these should overestimate as the dependent variable is endogenous.

Moretti and Thulin (2013) estimates the size of the local multiplier in Sweden according to a different method, described in Section 3.1.4. This methods does not use logs, but just the change over time in the number of workers $\Delta N_{c,t}^{NT} = N_{c,t}^{NT} - N_{c,t-10}^{NT}$. Their paper also includes the results for U.S. cities, but does not redo the analysis with this different method. Therefore I also estimate the local multiplier for U.S. cities using this direct difference panel regression given by (3.6).

Finally I compare my results to my exact replication of Moretti (2010).

5.1 Results and discussion

The results for the estimations using differences of logs, the estimations using differences and the exact replication of Moretti are given in Table 5 on page 25.

The extreme outcome for the differences regression is immediately apparent. There is no significant effect in the LS analysis, but a very large negative multiplier of -2.8 when I use 2SLS estimation. This result has to be incorrect as it implies that every new job in the tradable sector crowds out almost three jobs in the nontradable sector. It is important to realise that if jobs in the tradable sector were competing directly with jobs in the nontradable sector this would imply a negative local multiplier, but -2.8 is too unlikely. Even if the labour supply was fixed a new job in the tradable sector would only make one less worker available for the nontradable sector, implying a lower bound to the local multiplier of -1.

A possible explanation for this result is the effect of outliers. This can be seen in all stages of the analysis as shown in Figure 2b, Figure 2d and Figure 2f. These outliers don't have this effect when using log differences. This could explain why Moretti used log differences for the U.S., but it is unclear whether this problem is unique to the U.S. data. Using the log difference analysis on the Swedish data would be an interesting comparison.

Now consider the log difference approach. The weighted LS panel estimation of the elasticity between $\Delta N_{c,t}^{NT}$ and $\Delta N_{c,t}^T$ is $\hat{\beta}_{LS} = 0.536$. This strong relationship can also be seen in Figure 2a on page 27. This is an overestimation of the true elasticity β as it includes effects due to the endogeneity of $\Delta N_{c,t}^T$ and effects due to omitted variables. A weighted 2SLS panel estimation correct for these effects. The instrument $\Delta \tilde{N}_{c,t}^T$ is strong as shown by the Kleibergen-Paap Wald rk F-statistic ($F = 24.1$) and the clear correlation in Figure 2c. The exogenous dependent variable $\Delta \hat{N}_{c,t}^T$ is predicted with $\Delta \tilde{N}_{c,t}^T$ and $\Delta N_{c,t}^T$. A scatter plot of these predicted values against $\Delta N_{c,t}^{NT}$

is shown in Figure 2e. The weighted 2SLS estimate of the elasticity between $\Delta N_{c,t}^{NT}$ and $\Delta N_{c,t}^T$ is $\hat{\beta}_{2SLS} = 0.253$. Based upon (3.4) the nontradable sector is 4.02 times larger than the tradable sector. Multiplying the relative size with the elasticity given a local long-term employment multiplier of 1.02 extra jobs in the nontradable sector for each job created in the tradable sector in the same city.

This finding is highly relevant for policy makers. Attracting tradable jobs to a region can be a great impulse for employment in both the tradable and the nontradable sector. This could be an important part of the "labour demand policies" as described by Bartik (2001). In Chapter 7 I will investigate what influences the size of this multiplier and whether the new jobs in the nontradable sector are fulfilled through migration or through increased participation.

When I replicate Moretti's method exactly, the weighted 2SLS estimate of the elasticity between $\Delta N_{c,t}^{NT}$ and $\Delta N_{c,t}^T$ is $\hat{\beta}_{LS} = 0.336$. This is more than one standard deviation removed from my estimate, due to four improvements I made to his method. According to Moretti the nontradable sector is 4.73 times larger, resulting in a multiplier of 1.59. In the next chapter I will explain why I made these five changes, but this results already shows they have a major impact on the estimation.

6 Critiques on Moretti

I started out trying to replicate Moretti (2010) using the same IPUMS dataset to estimate the local multiplier in U.S. cities. When I did not succeed to recreate his exact results I contacted Moretti about his methods of estimation. I would like to thank him for providing me with the exact Stata file he used to get his estimate of the local multiplier. From this file I could reverse engineer the assumptions Moretti made in his analysis.

I discovered three discrepancies between the method Moretti describes in his paper and the method he actually used. First, he states "*the sample includes two observations per city, corresponding to the periods 1980–1990 and 1990–2000*", but he also includes cities observed in just one interval. Second, he states " *$\Delta N_{c,t}^T$ is measured using changes in manufacturing employment, while $\Delta N_{c,t}^{NT}$ includes all other industries excluding agriculture, mining, government and the military*", whilst he does include agriculture and mining as nontradable industries. Third, he states he uses "*the weighted average of nationwide employment growth by 77 narrowly defined industries within manufacturing*", but in fact he uses 82 industries within manufacturing in the 1980-1990 period and 74 industries within manufacturing in the 1990-2000 period. In the rest of this Chapter I will compare my improved method to the method Moretti actually used, not the method described in his paper.

When I modify my own analysis to fit Moretti's assumptions I get the exact same results as in his paper, a local multiplier of 1.59. But I do not agree with all his assumption, therefore I reworked his analysis by making five changes to his method:

- I remove industries from the analysis that are not observed in every period (balance);
- I exclude mining and agriculture as nontradable industries (exclude);
- I use a more advanced shift-share instrument (instrument);
- I weigh both time intervals in the dataset equally (weights);
- I provide a more accurate estimate for the relative size of the nontradable sector to the tradable sector (size).

The modified estimation of the local multiplier is 1.02, as described in the previous chapter. In this chapter I will show that these five changes are improvements and that therefore Moretti's estimate is a large overestimation. I also estimate how each individual assumption affects the estimated size of the local multiplier on average, as shown in Table 6.

6.1 Remove unbalanced industries

In his paper Moretti argues his panel data is balanced, but in fact it is unbalanced in two ways. There are both cities and industries in the dataset that are not observed in each time interval. There is no reason to remove the cities that are only observed once, because this doesn't bias the estimated elasticity. I do exclude 24 of the 245 industries that are not observed in all periods, because this does make the estimated elasticity less reliable as argued in Section 4.1. This reduces the estimated local multiplier with 0.04.

6.2 Exclude mining and agriculture

Moretti defines the tradable sector as all manufacturing industries and the nontradable sector as agriculture, forestry, and fisheries; mining; construction; transportation, communications, and other public utilities; wholesale trade; retail trade; finance, insurance, and real estate; business and repair services; personal services; entertainment and recreation services; and professional and related services. As mentioned in Section 2.1 I change his definition by excluding agriculture and mining as nontradable industries. Mining is not a nontradable industry, because the product of this industry can be sold over the entire country and abroad. I also don't include mining as a tradable industry, because firms cannot relocate to a region with lower wages as firms need to be near the resources found in the ground. Both arguments also hold for agriculture, albeit less strict. Excluding agriculture and mining decreases the estimated local multiplier with 0.06.

6.3 Improve the instrument

Moretti uses the sum of all metropolitan areas, including the own city, to determine the shift-share instrument

$$\Delta \tilde{N}_{c,t}^T = \sum_{j \in T} \left\{ \frac{N_{j,c,t-s}}{N_{c,t-s}^T} \left[\ln \left(\sum_{c' \in C} N_{j,c',t} \right) - \ln \left(\sum_{c' \in C} N_{j,c',t-s} \right) \right] \right\} \quad (6.1)$$

whilst I use (3.3). I exclude the change in the own city when calculating the overall growth out of concern that the changes in the region may drive the national changes, violating the assumed exogeneity.

Analysis with this improved instrument reduces the estimated size of the local multiplier with 0.19.

6.4 Weigh time intervals equally

Moretti weights all observations, those over the interval 1980-1990 and those over the interval 1990-2000, by their size in 1990 in his regression analysis. This can be expressed as

$$w_{c,t} = N_{c,1990}^T + N_{c,1990}^{NT}, \quad (6.2)$$

but this is problematic for cities observed in 1980 as shown in the following example.

Consider a true local multiplier of 1 and a city in 1980 with 100 workers in the tradable sector and 500 workers in nontradable sector. If this city attracts 10 tradable jobs between 1980 and 1990, the multiplier will create 10 additional jobs in the nontradable sector. Using (6.2) the weight of the city is 620, whilst if the same changes were observed from 1990 to 2000, the weight would be 600. This is inconsistent, because observations of the interval 1980-1990 are overweighted.

In both cases the estimation results $\hat{\beta} = 0.2$. If we calculate the relative size of the nontradable sector to the tradable sector consistent to the defined weight, this results into $r = 4.6$ for this observation in 1980-1990 and $r = 5$ for the same observation in 1990-2000. It is clear that only the latter will result into a correct estimate of the true multiplier ($r\hat{\beta} = 1$). Therefore I will use the combined size of the tradable and the nontradable sector in a city at the beginning of the interval to determine the regression weight.

$$w_{c,t} = N_{c,t-10}^T + N_{c,t-10}^{NT}. \quad (6.3)$$

This change decreases the estimated local multiplier with 0.08. In the next section I will define the relative size of the nontradable sector to the tradable sector accordingly.

6.5 Correct relative sector size

After $\hat{\beta}$ - the elasticity between jobs in the tradable and the nontradable sector - is estimated, the local multiplier can be calculated with the relative size between these two sectors. Moretti considers the average size of the tradable and nontradable sector in 1990 over all cities that were observed in the 1980-1990 interval, to find a relative size of

$$r = \frac{\sum_{C_{1990}} N_{c,1990}^{NT}}{\sum_{C_{1990}} N_{c,1990}^T} = 4.74. \quad (6.4)$$

Whilst this method might result in a reasonable estimate of the relative size between the tradable and the nontradable sector when considered over all three periods, we estimate the size of the multiplier based on the growth from 1980-1990 and from 1990-2000, but not from 2000 onwards. Since the relative size of the tradable sector has decreased over time, Moretti's method leads to an underestimation of the size of the tradable sector. Additionally this definition is inconsistent with his definition of the weights used for individual observations in the regression.

Therefore I use the size of the tradable and the nontradable sector at the start of each interval for all cities to determine the relative size of the sectors. Cities that are observed in both intervals will be included twice, once with their size in 1980 and once with their size in 1990. I define the relative size this way in (3.4) and find

$$r = \frac{\sum_{C_{1990}} N_{c,1980}^{NT} + \sum_{C_{2000}} N_{c,1990}^{NT}}{\sum_{C_{1990}} N_{c,1980}^T + \sum_{C_{2000}} N_{c,1990}^T} = 4.02. \quad (6.5)$$

This change reduces the estimation of the local multiplier by 0.21.

6.6 Overestimation

The description in each section above shows why the changes I made improve the reliability of the estimation. The sum of the average of all these changes adds up to 0.57, so these changes have a significant effect on the estimated multiplier. Coincidentally this is equal to total difference between Moretti's and my estimate of the local multiplier. Therefore I can easily demonstrate the impact of each change graphically as show in Figure 3 on page 28.

7 Extensions to migration and unemployment

7.1 Migration in U.S. cities

The data on U.S. cities can also be used to determine the effect of the local multiplier on migration. As a next step I determine separate multipliers for locals and migrations by splitting the observed workers into two categories. I estimate the size of the local multiplier of an increase

in the number of jobs in the tradable sector on employment by local workers in the nontradable sector in metropolitan areas in the United States. I compare this to the size of the local multiplier on employment by recently moved workers in the nontradable sector. Finally I relate these two estimates to the local multiplier for all workers in the nontradable sector.

I modify equation 3.1 to create two separate regressions

$$\Delta N_{c,t}^{O,NT} = \alpha_O + \beta_O \Delta N_{c,t}^T + \gamma_O d_t + \varepsilon_{c,t} \quad (7.1)$$

$$\Delta N_{c,t}^{L,NT} = \alpha_L + \beta_L \Delta N_{c,t}^T + \gamma'_L d_t + \varepsilon_{c,t} \quad (7.2)$$

one for local workers and one for migrants. Where the first are counted by $N_{j,c,t}^L$ and the latter by $N_{j,c,t}^O$. Therefore the change over time in the log number of workers in the nontradable sector are given by

$$\Delta N_{c,t}^{O,NT} = \ln \left[\sum_{j \in NT} N_{j,c,t}^O \right] - \ln \left[\sum_{j \in NT} N_{j,c,t-s}^O \right], \quad (7.3)$$

$$\Delta N_{c,t}^{L,NT} = \ln \left[\sum_{j \in NT} N_{j,c,t}^L \right] - \ln \left[\sum_{j \in NT} N_{j,c,t-s}^L \right], \quad (7.4)$$

completely analogous to the definitions used in Chapter 5. Because 50% of the data on migration is missing in 1980 and 39% of the data on migration is missing in 1990 I rescale the number of nontradable jobs in the observations from these two period by 2 and 1.64 respectively.

7.1.1 Results

From Table 7 on page 26 it is clear there is no significant effect of extra jobs in the tradable sector on the number of local workers in the nontradable sector. In contrast there is a very large multiplier for migrants. For every extra job in the tradable sector there will be 1.43 new jobs for migrants in the nontradable sector. These results are striking because 79% of all observed workers are locals and the instrument is strong ($F > 17$), so if there was a significant effect I would have been able to find it. There is a clear relationship between jobs in the tradable sector and jobs in the nontradable sector fulfilled by locals as shown by the LS estimates, but it is due to endogeneity or omitted variables.

This fits perfectly with the idea that the dominant adjustment mechanism in the U.S. to a labour demand shock is labour mobility (Blanchard and Katz, 1992). According to Bartik (1991, 2001) 25% of new jobs are filled by increases in the labour force participation of local residents in the long run, with the remaining 75% go to migrants. My results for adjustments to the local multiplier in the nontradable sector is even stronger. When I apply Bartik's estimate to the new jobs in the tradable sector and my estimate to the new jobs in the nontradable sector, one extra job in the tradable sector will result into the employment of 0.25 locals and 2.18 migrants.

This result is very relevant for policy makers as it contradicts that attracting a manufacturing

jobs can help local unemployed to get a job in the nontradable sector. Attracting tradable jobs will have a significant effect on employment, but by attracting workers from other regions. Almost no local unemployed will get a job, but the unemployment rate will decrease because of the denominator effect.

As shown by de Blasio and Menon (2011) and Faggio and Overman (2014) the multiplier in Europe is a lot smaller. This could be explained by a paper by Decressin and Fatás (1995). They state a labour demand shock in Europe is less likely to lead to workers moving than in the U.S. The dominant mechanism in Europe is an adjustment of the participation rate. This could completely change the story for the distribution of jobs between locals and migrants. I expect the relative effect on employment for locals is larger in Europe, and it would be interesting to test this with European data.

Additionally, in our current society skilled workers are more mobile than unskilled workers (Moretti, 2012), this will affect the type of nontradable jobs that are fulfilled by local and migrants, and should also be further investigated.

7.2 Unemployment in U.S. cities

The size of the local multiplier depends on the elasticity of the labour supply. This elasticity is determined in part by the unemployment rate. In this section I show that the local multiplier increases with the unemployment rate. Therefore the unemployment rate is a good indicator for the impact of the local multiplier when attracting a manufacturing firm as local policy.

I determine the effect of the unemployment rate on the local multiplier with a non-parametric regression. The OLS estimate of β from (3.1) is given by the least squares solution

$$\hat{\beta} = \arg \min_{\alpha, \beta, \{\gamma\}_{t \in T}} \sum_{t=1}^T \sum_{c=1}^C (\Delta N_{c,t}^{NT} - \alpha - \beta \Delta N_{c,t}^T - \gamma d_t). \quad (7.5)$$

Instead I use the Nadaraya-Watson kernel regression (Nadaraya, 1965; Watson, 1964) to estimate β as a function of the unemployment rate

$$\hat{\beta}(u) = \arg \min_{\alpha, \beta, \{\gamma\}_{t \in T}} \sum_{t=1}^T \sum_{c=1}^C \left\{ (\Delta N_{c,t}^{NT} - \alpha - \beta \Delta N_{c,t}^T - \gamma d_t) K \left(\frac{u_{c,t} - u}{h} \right) \right\} \quad (7.6)$$

I use the uniform kernel

$$K \left(\frac{u_{c,t} - u}{h} \right) = 1 \left(\left| \frac{u_{c,t} - u}{h} \right| \leq 1 \right) \quad (7.7)$$

and do two regressions, one with bandwidth $h = 0.5$ and one with bandwidth $h = 1$. The bandwidth determines which observations are used to determine the local multiplier. For example when $h = 1$ I use all cities with an unemployment rate between 4% and 6% to estimate

the local multiplier at $u = 5\%$. A wider bandwidth will reduce the variance, but increase the bias of the estimation. As can be seen in Figure 1 on page 26 most cities have an unemployment rate between 3.5% and 8%, therefore estimates based on data outside this range will be unreliable.

7.2.1 Results

Figure 4 on page 28 shows the relationship between the local multiplier and the unemployment rate. Both curves show the size of the multiplier increases with the unemployment rate when $u \in [4.5, 7]$ and it is clear the relationship becomes less volatile when I pick a larger bandwidth. I did not estimate the local multiplier outside this range with $h = 1$, because this would rely on observation outside the interval $u \in [3.5, 7]$.

A closer inspection of the estimations with $h = 0.5$ is shown in Figure 5 on page 29. A simple estimation shows a linear relationship ($R^2 = 0.78$) between the unemployment rate and the size of the local multiplier for $u \in [4.5, 7]$. This estimated series also suggest the multiplier increases for very low unemployment rates and decreases for very high unemployment rates. It is difficult to judge whether this is significant., but I will try to explain both effects.

Cities with a very high employment rate could experience more structural frictions in their local labour market, for example a mismatch between the skills of their workers and the jobs available. This could also explain the smaller multiplier as these friction inhibit the labour market from adjust to an influx in tradable jobs. This leaves one intriguing result, the large local multiplier in cities with a very low unemployment rate $u < 4.5\%$. One possible explanation is that job growth is autocorrelated. Consider a city with high unemployment that has a sudden influx of high tech manufacturing jobs. Due to the local multiplier this also increases the number of jobs in the nontradable sector. As a results the unemployment rate drops. If this growth is persistent we might expect a high multiplier in the consecutive period as well, but the city now has a low unemployment rate.

It would be interesting to investigate the effect of the participation rate as well. If the multiplier is lower due to low unemployment and we explain this with less elasticity, this should result in higher wages instead. Finally a worthwhile expansion would be to see what the effect of the unemployment rate is for different skill levels. For example it would make sense if jobs for high skilled workers are influenced less.

8 Conclusion

Understanding urban labour markets is important for labour economists and regional policy-makers alike. Considering the spatial allocation of labour in cities will help to understand the effect of nationwide labour demand changes on wages and employment.

This paper has determined a significant positive long run effect of positive labour demand shocks in the tradable sector on employment in the nontradable sector in the same region. I

improved the method of estimating the local employment multiplier, which will be useful in further research. I showed that the unemployment rate influences the size of the local multiplier and I demonstrated that the local multiplier has a significant impact on migration. Still more details are needed to answer questions about the welfare effect of attracting tradable jobs to a city.

The significant multiplier found in this paper suggests that the tradable sector is the backbone of a regional economy. I focus on manufacturing as a tradable sector, but Table 1 on page 24 shows the decline of employment in manufacturing. Therefore other tradable industries will become even more important for the multiplier effect in the future. It is useful to extend the analysis of local multipliers to include other tradable industries, such as tradable services.

8.1 Critiques on Moretti

I estimated that for each job in manufacturing a city attracts, 1.02 jobs are created in the nontradable sector in the same city. With the same U.S. census data, an earlier study by Moretti (2010) estimated a local multiplier of 1.59. I have pointed out five perfunctory assumptions in Moretti's estimation that each lead him to this overestimation of the local multiplier effect.

Moretti's paper did not balance the panel data on the industries used, which overestimated the local multiplier by 0.06. It incorrectly considered mining and agriculture as nontradable industries which increased the multiplier by 0.05. The instrument used was not exogenous to local policy that would increase employment over all sectors, adding 0.21 to the multiplier. The regression overweighted the interval 1980-1990 with respect to the interval 1990-2000, which inflated the multiplier by 0.09. Finally the paper overestimated the relative size of the nontradable sector to the tradable sector which was then multiplied with the local elasticity between the two sectors. This leads to an overestimation of the local multiplier by 0.24.

In total Moretti overestimated the long term employment multiplier by 56%.

8.2 Migration

I investigated which workers fulfil the new jobs in the nontradable sector created through the local multiplier effect. When new jobs are created in a city these are fulfilled by workers already living in the city and by workers moving to the city from other areas. The extra jobs created in the nontradable sector are almost entirely fulfilled by workers that did not already live in the city these jobs were created in. The size of the local multiplier effect when I only considered these "migrants" is 1.43, whilst I did not find a significant multiplier when I only consider "locals".

This leaves the question of whom will fulfil the original increase in jobs in the tradable sector. This should be estimated in further research. If all new jobs in a city are fulfilled by workers that move there from other regions, attracting tradable jobs is not effective at fighting current unemployment.

8.3 Unemployment

I pointed to the relationship between the unemployment rate in a city and the size of the local multiplier. The size of the local multiplier increases when unemployment becomes larger. This effect is clearest in cities with an unemployment rate between 4.5% and 7%. At 4.5% unemployment the local multiplier lies around zero. This implies tradable jobs still don't crowd out jobs in the nontradable sector, but they also don't have a positive effect. For regions with around 6.5% unemployment the multiplier will lie above two.

I show that cities with little growth have a high unemployment rate ($p < 0.001$). Here lies a great opportunity to stimulate growth, as this implies cities with little growth would benefit most from the local multiplier effect.

The analysis of unemployment leaves one intriguing result: the local multiplier is also high for cities with a very low unemployment rate $u < 4.5\%$. Further analysis with more data on cities with low unemployment should be able to determine whether this is just an artefact of my analysis or whether there is something special about cities with very low unemployment rates.

8.4 Policy recommendations

Accurate estimates of the local multiplier are highly relevant for policy makers. First of all a big local multiplier makes attracting firms in the tradable sector more effective. Second, cities with a high unemployment rate are likely to have a big local employment multiplier. This is very useful as regions with a high unemployment rate tend to experience less growth. This could be an argument for the government to attract tradable jobs to low growth regions. These regions need an employment increase the most and experience the largest local multiplier. On the other hand even if competing for a tradable firm is beneficial for a city, this might not be beneficial for the country as a whole.

Policy-makers should also be aware of the migration that follows from the local multiplier effect. As discussed above only a small part of the new jobs is fulfilled by unemployed that were already living in the same city. The effect of attracting jobs in tradable sector on the real wage in the city should be estimated. If the real wage drops for incumbent workers due to the local multiplier effect, attracting tradable jobs to a city could decrease welfare for the local workers. Even though the extra jobs created because of the local multiplier will increase employment, these jobs will most likely not directly benefit their own constituents. Therefore it remains to be seen if policy to attract tradable firms to boost local employment is welfare improving.

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A Definitions

In this section I will provide some useful definitions used throughout in this paper.

A.1 Sets

- Define the set C as all regions considered within a country (but not necessarily all regions that exist within a country) and denote a specific region as $c \in C$.
- Define the set $S = \{t_1, t_2, \dots, t_n\}$ as all years that are considered for analysis, where t_1 and t_n are the first and final year used respectively and n is the number of periods observed. Define the number of years between two observations as $s \equiv t_i - t_{i-1}$, where s is constant, and denote a specific year as $t \in S$.
- Define the set J as all industries considered at some aggregation level and denote a specific industry as $j \in J$.

A.2 Subsets

- Define $C_t \subseteq C$ as all regions that are observed in period t and period $t - s$.
- Define $T \subset J$ as all industries that are considered tradable
- Define $NT \subset J$ as all industries that are considered nontradable, where $T \cup NT \subseteq J$.

A.3 Elements

- Denote the number of employed workers in industry j of region c at time t as $N_{j,c,t}$.

A.4 Summations

- Define $N_{c,t} \equiv \sum_J N_{j,c,t}$ as the total number of workers in city c at time t .
- Define $N_{c,t}^T \equiv \sum_T N_{j,c,t}$ as the total number of workers in the tradable sector of city c at time t .
- Define $N_{c,t}^{NT} \equiv \sum_{NT} N_{j,c,t}$ as the total number of workers in the nontradable sector of city c at time t .
- Define $N_t^T \equiv \sum_{C_t} N_{c,t-s}^T$ as the total number of workers in the tradable sector at time $t - s$ over all regions observed at both time t and $t - s$.
- Define $N_t^{NT} \equiv \sum_{C_t} N_{c,t-s}^{NT}$ as the total number of workers in the nontradable sector at time $t - s$ over all regions observed at both time t and $t - s$.

A.5 Differences

- Define $\Delta N_{c,t}^T = \ln N_{c,t}^T - \ln N_{c,t-s}^T$ as the change in the log of the number of workers in the tradable sector in city c between time $t - s$ and time t .
- Define $\Delta N_{c,t}^{NT} = \ln N_{c,t}^{NT} - \ln N_{c,t-s}^{NT}$ as the change in the log of the number of workers in the nontradable sector in city c between time $t - s$ and time t .
- Define $\Delta N_{j,-c,t} = \ln \left(\sum_{c' \in C \setminus c} N_{j,c',t} \right) - \ln \left(\sum_{c' \in C \setminus c} N_{j,c',t-s} \right)$ as the change in the log of the total number of workers in industry j over all regions other than region c between time $t - s$ and time t .
- Define $\blacktriangle N_{c,t}^T = N_{c,t}^T - N_{c,t-s}^T$ as the change in the number of workers in the tradable sector in city c between time $t - s$ and time t .
- Define $\blacktriangle N_{c,t}^{NT} = N_{c,t}^{NT} - N_{c,t-s}^{NT}$ as the change in the number of workers in the nontradable sector in city c between time $t - s$ and time t .

B Tables and Figures

Table 1: Employment share in metropolitan areas by industry group

Industry	Census Year		
	1980	1990	2000
Tradables	22.6%	17.1%	14.6%
Manufacturing	22.6%	17.1%	14.6%
Nontradables	75.5%	80.9%	83.7%
Construction	5.9%	6.5%	6.9%
Transportation, communications, and other public utilities	8.0%	7.9%	7.9%
Wholesale trade	5.0%	4.9%	3.6%
Retail trade	17.3%	17.5%	17.5%
Finance, insurance, and real estate	7.4%	8.4%	7.7%
Business and repair services	4.3%	5.6%	7.0%
Personal services	3.3%	3.4%	3.4%
Entertainment and recreation services	1.2%	1.6%	1.6%
Professional and related services	22.9%	25.1%	28.1%
Other industries	2.0%	2.0%	1.7%
Agriculture, forestry, and fisheries	1.4%	1.6%	1.4%
Mining	0.6%	0.4%	0.2%
Total number of workers (x1000)	64,193	76,997	93,943
Relative size nontradable to tradable	3.340	4.717	5.742

Table 2: U.S. Cities with the smallest share of employment in manufacturing

City	Total employment	Share of Manufacturing
Anchorage, AK	109935	2.45%
Tallahassee, FL	112130	4.27%
Las Vegas, NV	603316	4.38%
Naples, FL	101054	4.44%
Laredo, TX	57604	4.64%

Table 3: U.S. Cities with the largest share of employment in manufacturing

City	Total employment	Share of Manufacturing
Danville, VA	46805	32.91%
Sheboygan, WI	56645	36.57%
Kokomo, IN	44280	36.97%
Hickory-Morgantown, NC	172012	40.96%
Elkhart-Goshen, IN	91050	44.04%

Table 4: Number of locals per migrant for each industry over time

Industry	Locals / Migrants		
	1980	1990	2000
Tradables	4.10	4.50	3.88
Manufacturing	4.10	4.50	3.88
Nontradables	3.33	3.71	3.43
Construction	3.72	3.75	3.74
Transportation	3.99	4.52	3.81
Wholesale trade	3.34	3.97	3.92
Retail trade	3.52	3.48	3.27
Finance	3.17	3.87	3.41
Business and repair services	3.01	3.12	2.76
Personal services	3.74	2.93	3.35
Entertainment	2.74	2.91	3.09
Professional services	3.01	3.87	3.53
Other industries	3.34	3.88	3.57
Agriculture	4.03	3.87	3.54
Mining	2.29	3.91	3.74
Total	3.48	3.83	3.49

Table 5: Elasticity between the tradable and the nontradable sector in U.S. Cities for three methods of estimation

	Difference of log		Difference		Replication	
	LS	2SLS	LS	2SLS	LS	2SLS
β	0.536*	0.253*	-0.880	-2.768*	0.554*	0.336*
	(0.030)	(0.082)	(0.979)	(0.679)	(0.036)	(0.056)
R^2	0.67	0.49	0.04	-0.14	0.71	0.61
F-value		24.1		25.8		68.6

Notes: Standard errors clustered by city in parentheses. * p-value < 0.01.

Figure 1: Distribution of the unemployment rate across all observed cities

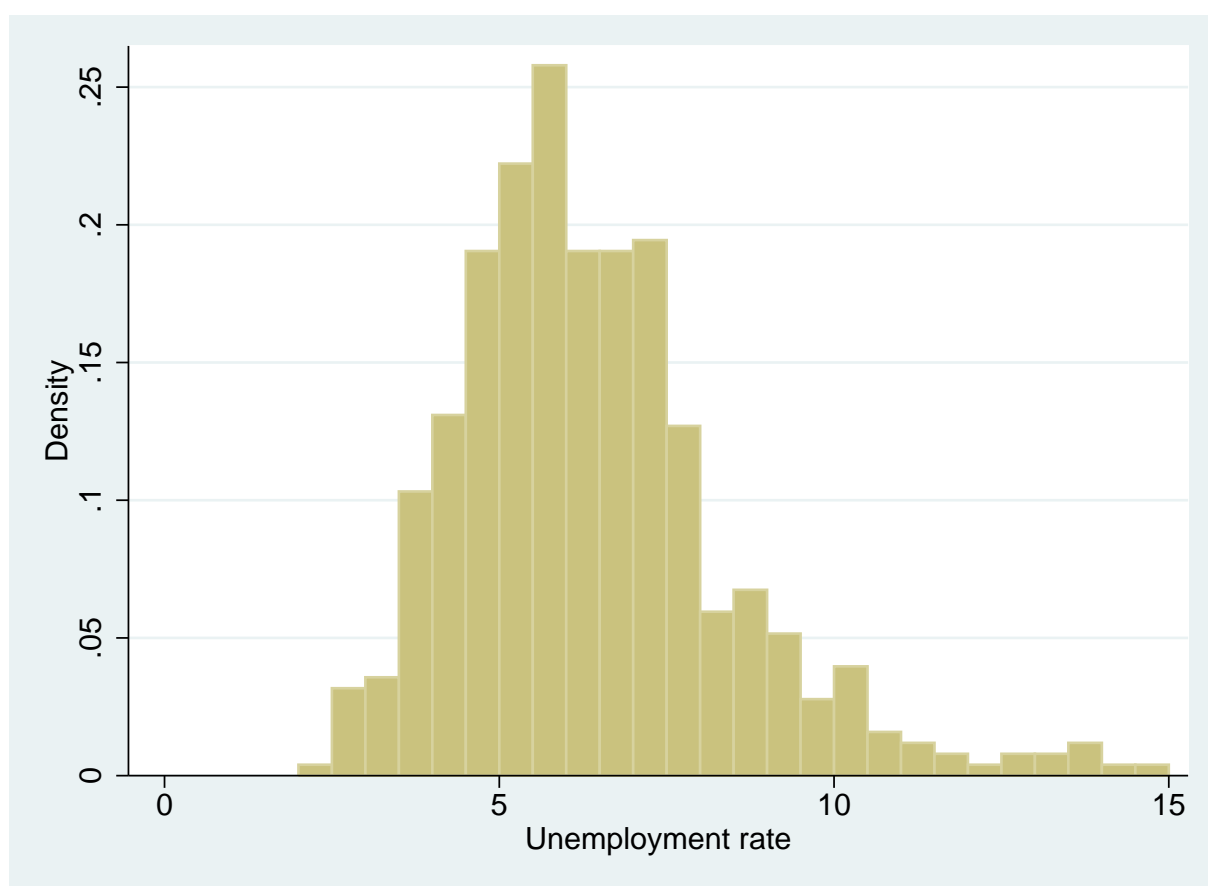


Table 6: Effect of proposed changes on the estimated size of the local multiplier

	Average change in multiplier
Remove unbalanced industries	-0.04
Exclude mining and agriculture	-0.06
Improve the instrument	-0.19
Weigh time intervals equally	-0.08
Correct relative sector size	-0.21
Total	-0.57

Table 7: Local multipliers for locals and migrants

Effect on	Elasticity LS	Elasticity 2SLS	Additional jobs for each new job
locals	0.498* (0.062)	-0.059 (0.190) [21.5]	-0.18 (0.59)
migrants	0.658* (0.111)	1.615* (0.350) [29.3]	1.43* (0.31)
all nontradable	0.536* (0.030)	0.253* (0.082)	1.02* (0.33)

Notes: Standard errors clustered by city in parentheses.
Instrument F-statistic in brackets. * p-value < 0.01

Figure 2: Scatter plots of the multiplier estimation

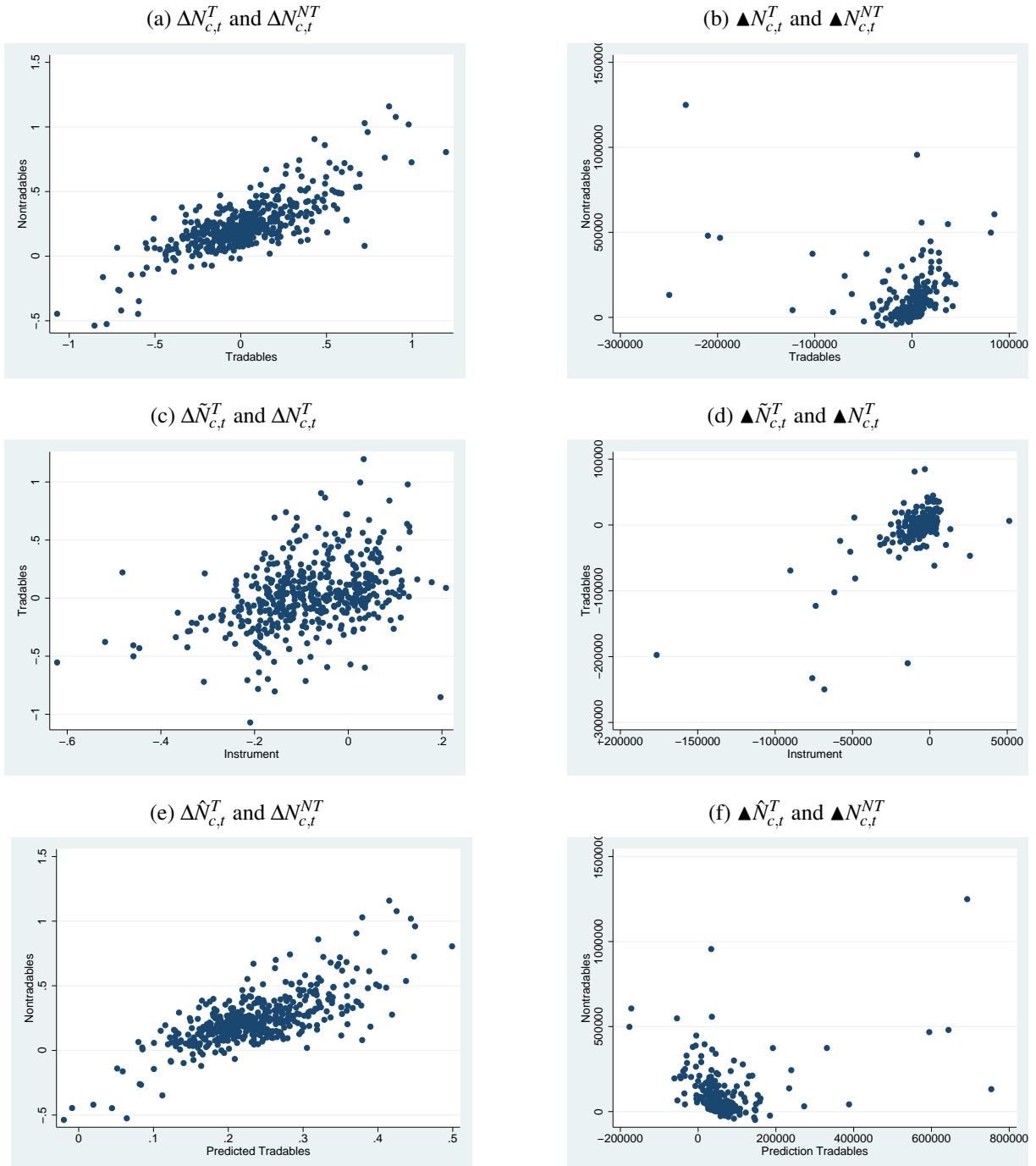


Figure 3: Effect of proposed changes on size local multiplier

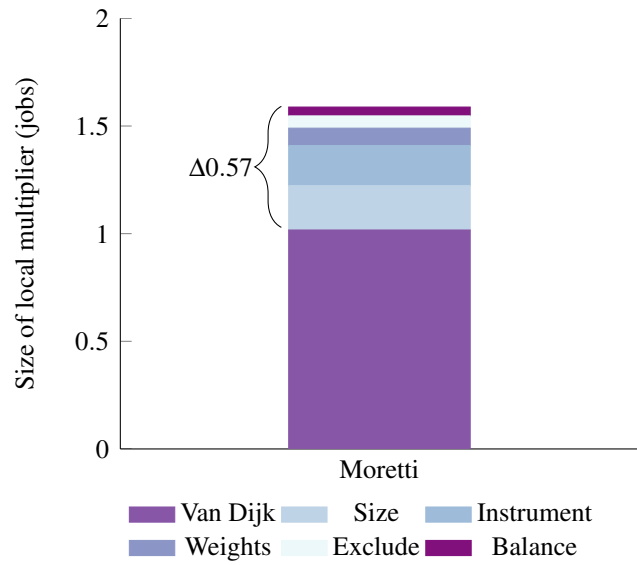


Figure 4: Non-parametric plot of the relationship between the size of the local multiplier and the unemployment rate for two different bandwidths.

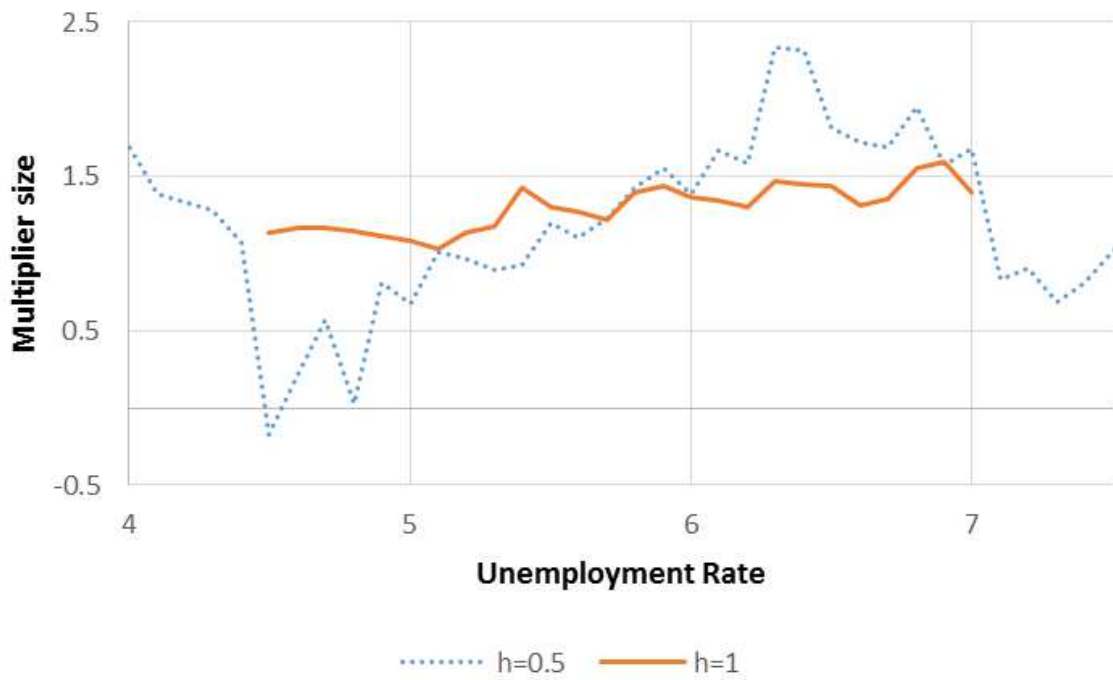


Figure 5: Estimation of the relationship between the size of the local multiplier and the unemployment rate

