

Malgouyres, Clement

**Conference Paper**

## Trade Shocks and Local Employment Multipliers: Evidence from France

53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy", 27-31 August 2013, Palermo, Italy

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Malgouyres, Clement (2013) : Trade Shocks and Local Employment Multipliers: Evidence from France, 53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy", 27-31 August 2013, Palermo, Italy, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/123997>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Trade Shocks and Local Employment Multipliers: Evidence from France

PRELIMINARY

Clément Malgouyres\*  
European University Institute

May 2013

## Abstract

In this paper, I develop a simple model of spatial equilibrium to investigate theoretically what determines the sign and magnitude of “local multipliers” (defined as elasticity of employment in the non-tradable sector with respect to increase in employment in the tradable sector). I then estimate the local multiplier with data for France. In order to cope with possible endogeneity issues, I use a shift-share instrument, already used in the literature, and build another instrument based on trade shocks, in the spirit of Autor *et al.* (2012) (referred to as “import-per-worker” index (*IPW*) below).

I confirm the results by Autor *et al.* (2012) that both manufacturing and non-manufacturing local employment and labor earnings are negatively affected by the rising exposition to Chinese imports. I find that rising Chinese imports penetration account for about 14 % about France’s decline in manufacturing employment. Interestingly, average wages in the manufacturing sectors increase while they decrease in the non-manufacturing sector, suggesting important composition effects and/or improvement in manufacturing productivity are associated with increase in Chinese imports penetration.

Regarding the local multiplier I find an elasticity situated between 0.32 and 0.50, implying a job-to-job effect between 1.2 and 1.9. That is considerably higher than previous studies for Europe and similar to previous findings based on American data but much lower than figures usually quoted to justify place-based and industrial policies.

**JEL-Classification:** J23, J30, R11, R23

## 1 Introduction

In most European countries and US states, local governments spend large amounts of public funds in order to encourage business to invest and create jobs in within their boundaries. An important share of such local subsidies are directed towards tradable goods producing sectors, that are supposed to “provide greater economic development benefits” (Bartik, 2003)<sup>1</sup>. An important ra-

---

\*email address: clement.malgouyres@eui.eu, The access to the data was carried through the CASD (Centre d’accès sécurisé à distance) dedicated to researchers authorized by the French “Comité du secret statistique”.

<sup>1</sup>It is estimated that in France in 2004 “Regions” (there are 22 regions in Metropolitan France) were spending 12.2 % of their entire budget on local economic development subsidies, the manufacturing sector was the second largest recipients of such subsidies after tourism. The funds allocated have increased by 16% between 2004 and 2006. All level of local governments spent 6 billions euros in business incentives in 2004. (CourDesComptes, 2007). Such policies are common practice in most OECD countries.

tionale behind these policies is the claim that each job directly created will boost employment in sectors that are either providing inputs to the tradable sector or providing non-tradable goods and services to the newly employed workers. This is what is often referred to as the *local multiplier effect*, defined here as the elasticity of non-tradable local employment with respect to local tradable employment. It is a parameter of interest because it drives to a large extent the ability of local development policies to pursue their primary stated objective of stimulating local employment. In spite of the ubiquity of the local multiplier effect in arguments in favor of industry-oriented place-based policies the question did not seem to have been rigorously documented before the work of Moretti (2010) and has yet not been carried out in France where many politicians and experts have referring to the local multiplier effect of manufacturing jobs.<sup>2</sup>

In this paper, I estimate the local multiplier effect using exhaustive data on local employment and wages in France, a country where local development policies aimed at manufacturing firms are increasingly widespread and in which no study of local multiplier effect has not been carried yet. I consider total hours worked and total earnings instead of *headcount* (i.e. number of employed individuals) as outcomes. These alternative variables might a more accurate measure of local multipliers as total hours worked or earnings per job differ between the typical tradable and non-tradable sector job and what might ultimately be considered most relevant to policy-makers is the surge in local purchasing power following the creation of one local job. To cope with likely endogeneity issues, I use an instrument based on international trade shock in the spirit of Autor *et al.* (2012) and compare the results with those obtained with the “Bartik”-instrument. The international trade instrument measures the value of Chinese “imports-per-worker” (IPW) for a given local labor market in France. Increasing in IPW are expected to decrease employment in tradable industries and we use this source of variation in manufacturing employment as an instrument for actual variation in tradable jobs. Using the fact that the Bartik instrument induces positive variation in employment while the IPW instrument induces negative variation, I investigate whether there is asymmetry in local multipliers. Finally, I use the same specification as Autor *et al.* (2012) and investigate the local labor market effects of increasing Chinese imports penetration.

The logic underpinning the local multiplier effect is straightforward. A job creation in the tradable sector increases the local purchasing power, part of which will be devoted to purchase non-tradable items, hence increasing the local demand for labor in that sector. Clearly the magnitude of that effect will be affected by the share of income spent by workers on non-tradable items and the labor intensity of that sector. Countervailing general equilibrium effects might however temper this direct *income* effect. Increase in labor demand might drive wages up in all sectors, thus depressing the supply of non-tradable goods, due to an increase in costs. Moreover rigidity in the supply of housing might imply that the local expansion of one sector will (partly or totally depending on housing supply elasticity) occur the expense of the other one. This complex set of interdependencies appears hard to conceptualize outside of a formal framework.

It is worth stressing that the multiplier effect here refers to a pecuniary externality (demand effect) and not to some technological spill-overs. Such spill-overs are most plausibly very limited

---

<sup>2</sup>For instance, the French Minister for Industrial Affairs interviewed by the newspaper “Le Monde” in June 2012 justified his plans to keep a factory running by claiming that each job in that particular factory was generating seven other jobs, among both the inputs suppliers of that factory and the firms providing services bought locally by workers. The Rapport Gallois claim the industry job-multiplier to be somewhere between 3 and 4. However, there exists to our knowledge no available econometric study on French data backing such a statement.

between firms operating very different technologies as is the case for firms belonging to the traded and non-traded sectors. Moreover previous evidence suggests that agglomeration effects are weak in France and are mainly related to within-industry agglomeration (Martin *et al.*, 2011).

Accordingly, I frame the study of local multipliers within a formal model of spatial equilibrium in the spirit of Roback (1982) or Moretti (2011) focusing on demand-driven local multiplier effects. It allows us to precisely link the magnitude and sign of the local multiplier effect to fundamental parameters of the economy such as the preferences of consumers for non-tradable goods, labor intensity of tradable and non-tradable sector, local elasticity of housing supply.

I find evidence of a strong and significant local multiplier in France, with an average elasticity of non-tradable to tradable employment of 0.33 with the “Bartik”-instrument and 0.29 with the instrument based on Chinese imports penetration. These estimates suggest job-to-job effects that are much higher than previous findings for European countries and similar to what has been found in the United States. While 2SLS estimates are very similar for both instruments, the effect is slightly lower when using the international trade instrument, suggesting the presence of an asymmetric effect: the absolute value of non-manufacturing job losses associated with the destruction of a manufacturing job is lower than the non-manufacturing job creation associated with the creation of one manufacturing job. However, we find no conclusive evidence of asymmetric local multipliers.

This paper is structured as follows: in Section 2, I briefly review some of the empirical literature on local multipliers. In Section 3, I develop a simple model of spatial equilibrium in order to investigate what determines the sign and magnitude of the elasticity non-tradable sector employment with respect to a shock to tradable sector productivity. In Section 4, I present the data used. I expose the specification and empirical strategy followed to estimate local multipliers in Section 5. In Sections 6 and 7, I present and comment the different sets of results.

## 2 Literature review

This paper is directly related to a recent literature, starting with Moretti (2010), aiming at estimating the elasticity of local non-tradable employment with respect to non-tradable employment - as opposed to the elasticity of overall employment to public spending which is what most macroeconomic papers on multipliers investigate.<sup>3</sup>

Moretti (2010) uses with US census data for 1980, 1990 and 2000. He finds an elasticity of 0.34 implying that each tradable job induces 1.59 non-tradable ones. He then look at how this effect varies for subsets of the tradable sector. Notably, he finds that skilled jobs are associated with much stronger effects: an elasticity of 0.257 and 2.52 jobs induced (barely significant at the 10% level). However he does not investigate what drives this effect - is it higher purchasing power per job created or is there a properly specific effect associated with high human capital jobs? Moretti and Thulin (2012) is a replication of Moretti (2010) based on Swedish data. They find a much lower effect than in the US with a average of 0.49 non-tradable jobs per tradable job (0.75 when focusing, as I will, on private employment). They find a much stronger effect for high-tech jobs

---

<sup>3</sup>These two elasticities are most likely related but there is still no consensus on how they theoretically relate to each other (Mendel, 2012). The focus of our review is on the applied microeconomics strand of the literature focusing on non-tradable to tradable elasticity. See Mendel (2012) for a seemingly exhaustive review of the macroeconomic literature.

(1.11 induced jobs) and jobs occupied by individuals with tertiary education (2.79). Again there is no investigation of whether higher purchasing power per job or some sort of externalities (e.g. knowledge spillover) drive that effect. It is especially important to discriminate between these two hypotheses as a stronger effect conditional on purchasing power of high tech jobs would be most plausibly explained by a physical externality which constitutes a market failure as opposed to purely pecuniary externalities.

They explain disparities between US and Swedish results by differences in labor supply elasticity (lower in Sweden due to both unemployment benefits and lower labor mobility) and tradable sector technologies (higher tradable sector wage premium in the US<sup>4</sup>). The empirical specification adopted by Moretti and Thulin (2012) differ from Moretti (2010) as they allow for local labor markets' fixed-effects and use a specification that is linear in change in employment as opposed to being linear in change of log of employment. It is therefore not clear to which extent their results are comparable.

Finally de Blasio and Menon (2011) use the same specification as in Moretti (2010) with Italian data. They find no evidence of a positive local multiplier. They carry out some sub-sample analysis (e.g. Northern versus Southern LLMs) but in none of their specification they find evidence of positive spill-overs from tradable to non-tradable employment. They explain these results by low labor mobility, a centralized nominal wage-setting system (which prevent wages from adjusting to local productivity) and heavy regulation of the non-tradable sector which undermines the elasticity of its supply.

Though there are some differences in specification, all three papers resort to the same *shift-share instrumental variable* in the spirit of Bartik (1991) to deal with possible endogeneity issues. I adopt the same empirical strategy. Unlike them however, I do not focus only on employment but also look at hours worked as a variable of interest. While all three papers implicitly embeds their empirical analysis within a theoretical framework - especially Moretti and Thulin (2012) - in order to interpret their results, none of them develop a formal model to investigate the theoretical determinants of the local multiplier. I depart from them by developing a simple formal model of spatial equilibrium.

A recent paper by Magrini and Gerolimetto (2011), based on US data on employment provided by the Bureau of Economic Analysis from 2001 to 2008 for 363 Metropolitan Statistical Areas (MSA), follows a very different empirical approach to estimating local multipliers by estimating a fully non-parametric model accounting for spatial dependencies between unit of observations. This allows the authors to study how the multiplier varies with, for instance, the size of the local labor market (as measured by total tradable employment) or whether there is some asymmetry at work (i.e. different elasticity for tradable jobs creation and destruction). It appears that the local multiplier (expressed in elasticity) is increasing with LLM size and that elasticities are lower when tradable jobs are destroyed than when they are created. In the same spirit but within a parametric setting, I test for the asymmetry of the local multiplier by estimating including a quadratic term of tradable employment growth.

The literature mentioned above consider local multipliers as stemming mainly from surge in demand for final goods. Naturally, an increase in local manufacturing activities is also expected to increase local purchase in inputs. Using input-output tables to document inter-industry linkages, it would be in principle possible to decompose the overall local multiplier into an effect related

---

<sup>4</sup>We note however that that last point is not really corroborated by their empirical results which would suggest that the gap between the average and high skill multiplier should be higher in the US while it turns out to be larger in Sweden.

demand for non-tradable inputs and an effect related to demand for non-tradable final goods. Given the features of the data used, it appears difficult to carry out empirically such an exercise in a credible manner.

This paper is also closely related to the empirical literature in international trade that uses local labor markets as a unit of observation in order to capture the local general equilibrium effects of rising exposure of developed economies to imports from low-wage countries. Autor *et al.* (2012) divide the United States into 722 “commuting zones” (a type of unit of observation closely related to the concept of “employment zone” that we use here). Using an instrument variable approach that we will explain in more details in Section 5.3, they find that region experience increase in their exposure to Chinese imports have seen lower employment in both manufacturing and non-manufacturing (suggesting the presence of local multiplier effect) and increase in local unemployment. They find little evidence of out-migration in responses to shocks suggesting that most of the medium-run adjustment to trade shock is occurring within each commuting zone. We estimate specifications closely related to that of Autor *et al.* (2012) in Section 6.

### 3 Theoretical framework

When a job is generated in the tradable sector, demands for local non-tradable goods and housing increase, generating a host of general equilibrium effects. In order to take these interconnections explicitly into account, I develop an extension of static models of spatial equilibrium in the spirit of Glaeser (2008) or Moretti (2011) with two cities indexed by  $A$  and  $B$ . Within this context, I will study the effect of an increase in the productivity of the tradable sector onto employment in the non-tradable sector in city  $A$ .

In each of these cities, there are 3 sectors:

- a tradable good sector, with constant returns to scale (CRS). The tradable good’s price is exogenous, constant across LLMs and normalized to 1. The technology uses labor only. The labor market in this sector is characterized by search and matching frictions and use labor only.
- a non-tradable good sector, with CRS. Its price  $p_N$  is endogenous and varies across LLMs. The labor market is frictionless and the sector uses both labor and capital (rented on external markets).
- a construction sector, with decreasing returns to scale. Its price  $p_H$  is endogenous and varies across LLMs. It uses only land and capital. Decreasing returns in the construction sector implies a finite elasticity of housing supply.

The main difference between the construction sector and the non-tradable good sector is that, while both produce a non-tradable good, the construction sector produces housing which determines the population at equilibrium.

Workers have idiosyncratic preferences for cities (or alternatively have positive and idiosyncratic mobility costs). Such heterogeneity implies that utility is not equalized across space but that there is a worker, referred to as the “marginal migrant”, who is perfectly indifferent between the two cities  $A$  and  $B$ . Workers are perfectly mobile across sectors so that utility in each city is equalized across sectors.

I assume away agglomeration economies in my model in the sense that local productivity does not depend on city size. As mentioned in the literature review, empirically urbanization agglomeration economies (cross-sectors spill-overs) are weak in France and most agglomeration economies seem related to localization economies whereby a sector's productivity is affected by the sectoral and not the overall scale (or density) of local economic activity. Hence, when studying the effect of in manufacturing on non-manufacturing employment, it seems reasonable to ignore agglomeration economies and focus on the demand-driven shock (the pecuniary externality). Moreover, in this model, the tradable sector does not use non-tradable outputs but only labor (which is a non-tradable input), hence the demand-driven effect in this framework is only related to increase in demand final good.

### 3.1 Preferences

Individuals have identical preferences up to a scale factor  $\varepsilon_i$  that represents their idiosyncratic taste for a city A. They are endowed with one unit of labor that they supply inelastically. Their preferences are represented by the Cobb-Douglas utility function with preferences defined over a tradable good, a non-tradable good and housing.

I assume that capital and land is owned by absent agents, so that individuals' income comes solely from their expected wages  $W_c$ . Given local prices  $(p_{Hc}, p_{Nc})$ , individual  $i$  with the following indirect utility function:

$$\begin{aligned} V_{ci} &\equiv V(p_{Nc}, p_{Hc}, W_c; G_c, \varepsilon_{ic}) = \underbrace{G_c W_c (P_c)^{-1}}_{\equiv C_c} \varepsilon_{ic} \text{ where } P_c \text{ is a local price index} \\ &= \underbrace{G_c W_c (p_{Nc})^{-\theta} (p_{Hc})^{-\tau}}_{\equiv C_c} \varepsilon_{ic} \text{ (with Cobb-Douglas)} \end{aligned}$$

where  $\tau$  and  $\theta$  are the Cobb-Douglas share of housing and non-tradable respectively.  $G_c$  shifts the marginal utility of consumption and represents an exogenous consumption amenity.

The overall population of the economy is exogenous and denoted  $N$ , where we have  $N_A + N_B = N$ . Given local real incomes and amenities, the probability that an individual choose city A over city B is given by:

$$P(V_{Ai} > V_{Bi}) = P\left(\varepsilon_{Ai}/\varepsilon_{Bi} > \frac{W_B (p_{NB})^{-\theta} (p_{HB})^{-\tau} G_B}{W_A (p_{NA})^{-\theta} (p_{HA})^{-\tau} G_A}\right) \quad (1)$$

I assume that the difference of the idiosyncratic taste variable between the city A and B follows an exponential distribution with parameter  $\lambda$ :  $\varepsilon_i \equiv \varepsilon_{iA}/\varepsilon_{iB} \sim \exp(\lambda)$ . That assumption allows us to rewrite Equation 1 as :

$$P(V_{Ai} > V_{Bi}) = N_A = \exp\left(-\lambda \frac{W_B}{W_A} \left[\frac{p_{HB}}{p_{HA}}\right]^{-\tau} \left[\frac{p_{NB}}{p_{NA}}\right]^{-\theta} \frac{G_B}{G_A}\right) = \exp\left(-\lambda \frac{C_B}{C_A}\right) \quad (2)$$

In the presence of idiosyncratic valuation of locations, not all workers are indifferent between each two places but only the marginal migrant whose realization of  $\varepsilon_A/\varepsilon_B$  is such that:  $V_{Ai} = V_{Bi}$ .

A non-degenerate distribution of idiosyncratic tastes for cities implies that local labor supply is not perfectly elastic. Hence unlike in the classical model of Roback (1982), any increase in nominal wage will not perfectly offset by variations in local prices unless  $\lambda = \infty$  in which case  $\varepsilon$  has a degenerate distribution at 0 (see e.g. Moretti (2011)).

Given that production functions exhibit constant returns to scale, the price of non-tradable  $p_N$  is entirely determined by technology. The price of housing will vary in order to ensure that the marginal individual is indifferent between locations  $A$  and  $B$ . The position of that individual in the support of the distribution of  $\varepsilon$  will determine relative city size.

The assumptions I will formulate regarding the working of the productive side of the economy will allow us to express local prices  $p_N$  and wages  $w$  as function of exogenous parameters. I turn now to the description of the technology.

## 3.2 Technology

### 3.2.1 Tradable and Non-Tradable Sectors

Both sectors are perfectly competitive and workers can move freely from a sector to another. In the tradable sector, each firm operates a CRS production function that uses only labor. Given “tradability” and the absence of transport costs, the price of tradable is constant across cities and normalized to 1. The tradable production is by:

$$Y_{Tc} \equiv A_{Tc} L_{cT} \quad (3)$$

where  $A_{Tc}$  is a city-specific “productive amenity”.

There are search and matching frictions on the labor market for tradable-sector jobs and no friction on the labor market for non-tradable sector jobs.<sup>5</sup> Due to search and matching frictions, firms and employees get to bargain over the surplus associated with a match in the tradable sector. I assume Nash-Bargaining with equal shares, so that the surplus is equally split. Because this is static model with no utility from unemployment, the surplus for workers is equal to the wage and as a consequence wages are equal to half of the productivity of the tradable sector in city  $c$ ,  $A_{Tc}$ .

Labor market tightness of the tradable sector in city  $c$  is denoted by  $q_c$ . I use a Cobb-Douglas functional form with CRS for the matching function mapping vacancies ( $V_c$ ) and jobs searches ( $L_{Tc}$ ) into number of matches.

$$M_c(L_{Tc}, V_c) = m_c L_{Tc}^\chi V_c^{1-\chi} = m_c q_c^{1-\chi} L_{Tc} \quad \text{where} \quad q_c \equiv \frac{V_c}{L_c} \quad (4)$$

The cost of posting a vacancy is  $v_c$ . The free-entry condition pins down the equilibrium labor market tightness and employment rate.

$$m_c q_c^{-\chi} \frac{1}{2} A_{cT} = v_c \Leftrightarrow q_c^{FE} = \left( \frac{m_c}{2v_c} A_{cT} \right)^{\frac{1}{\chi}}$$

That implies the following employment rate (defined as  $h_c \equiv m_c (q_c^{FE})^{1-\chi}$ ):

$$h_c = \psi_c^{\frac{1}{\chi}} (A_{cT})^{\frac{1-\chi}{\chi}} \quad \text{where} \quad \psi_c \equiv \frac{m_c}{(2v_c)^{1-\chi}} \quad (5)$$

I restrict on values of the parameters such that  $h_c \leq 1$ .<sup>6</sup>

<sup>5</sup>Generalizing the model to introduce frictions in both sectors does not change the qualitative conclusions of the model.

<sup>6</sup>The condition for full-employment implies the following restriction on the relative values of labor market frictions and TFP:  $\frac{A_{cT}}{2} = v_c m_c^{\frac{1}{1-\chi}}$ .



In the non-tradable sector, each firm operates a CRS Cobb-Douglas production function.

$$Y_{Nc} \equiv F_{Nc}(A_{Nc}, L_{Nc}, K_{Nc}) = A_{Nc} L_{Nc}^\delta K_{Nc}^{1-\delta} \quad (6)$$

The main difference between tradable and non-tradable are the working of the labor market (frictions for tradable, frictionless for non-tradable) and the fact that the price of non-tradable  $p_N$  varies across cities (like that of housing that is another type of non-tradable). The rental rate of capital is denoted  $r$  and is constant across cities.

### 3.2.2 Construction Sector

The construction sector uses land plots ( $L$ ) and decides on how much height ( $h$ ) to build on each plot of land. Each city has a limited (exogenous) supply of available land  $\bar{L}$ . I assume that the cost of opportunity of developing land is zero so that all of the land will be developed as long as the price of land  $p_L$  is strictly positive. The maximization program of each developer is as follows<sup>7</sup>:

$$\max_{h,L} \{p_H h L - c h^\kappa L - p_L L\} \quad (7)$$

where  $\kappa > 1$  which reflects decreasing returns to scale: for a given quantity of land  $L$ , it is increasingly costly to add height  $h$  on that land.

The FOCs for height is :  $p_H = \kappa c h^{\kappa-1}$ . Combined with  $\bar{L}$  this condition gives the aggregate housing supply function :

$$H_S = h^* \bar{L} = \left( \frac{p_H}{\kappa c} \right)^{1/(\kappa-1)} \bar{L} \quad (8)$$

## 3.3 Equilibrium Conditions

### 3.3.1 Housing market

Given demand for housing per capita derived from a the Cobb-Douglas preferences and population  $N_c$ , we get the following equilibrium housing price function:

$$p_{Hc} = \left[ \frac{W_c N_c}{\bar{L}_c} \tau \right]^{\sigma_c} [c \kappa_c]^{1-\sigma_c} \quad (9)$$

where  $\sigma_c \equiv \frac{\kappa_c - 1}{\kappa_c}$ .

For  $\kappa_c$  close to 1 (cost function quasi linear),  $\sigma_c$  is close to 0 and an increase in population is associated with limited increases in housing price, while for large values of  $\kappa_c$  (strongly convex cost function) increase in housing prices respond one to one to increase in population or average expected income.

### 3.3.2 Labor Market and the “Law of One Wage”

In both sector expected wages are equal so as to leave workers indifferent. In the friction-less non-tradable sector, wages are equal to the marginal product of labor given an optimal choice of capital. The CRS assumption is crucial as it implies that the effect on wages of a change in any parameter underpinning the marginal cost does not depends on the elasticity labor supply but solely on “technological” parameters.

<sup>7</sup>This functional form is borrowed from Glaeser (2008). It has the advantage of generating an industry with increasing costs given a limited supply of land, while each firm exhibits, conditionally on having access to enough land, constant returns to scale and hence have zero profit.

In the special case of Cobb-Douglas production function presented above, we have the following wage rate for the non-tradable sector:

$$w_{Nc} = \delta(p_{Nc})^{1/\delta} \left( \frac{1-\delta}{r} \right)^{(1-\delta)/\delta} \quad (10)$$

In the tradable sector as explained above, wages are equal to half of the surplus associated with a match.

$$w_{Tc} = \frac{1}{2} A_{Tc} \quad (11)$$

As individuals are identical in both their preferences there is no mobility costs between sectors, expected wages are equal in both sectors. This in turn implies a relationship between  $p_{Nc}$  and  $A_{cT}$ . Setting  $\mathbb{E}w_{Tc} = h_c w_{Tc}$  equal to  $w_{Nc}$  yields the equilibrium price of non-tradable good.

$$p_{Nc} = (\mathbb{E}w_{Tc})^\delta \delta^{-\delta} \left( \frac{r}{1-\delta} \right)^{1-\delta} \quad (12)$$

The model exhibits a Balassa-Samuelsion effect in the sense that  $p_{Nc}$  is increasing in  $A_{cT}$  with an elasticity of  $\delta$ .<sup>8</sup>

### 3.3.3 Market clearing condition in the non-tradable sector

Due to the non-tradable nature of the good demanded, the market must clear in each city. I can directly relate employment in the non-tradable sector with total demand for this good. Using equation (6) and the fact that firms' FOCs imply that  $K_{NT}^* = \frac{w(1-\delta)}{r_{NT}\delta} L_{NT}^*$  where  $r_{NT}$  is the cost of capital for the non-tradable sector, we have :

$$N_c \times C_{Nc} = A_{Nc} L_{Nc}^\delta K_{Nc}^{1-\delta} \quad (15)$$

Given optimal choice of capital and CB preferences, we can write  $L_{Nc}$  as:

$$L_{Nc} = \frac{1}{A_{NT}} \left( \frac{1-\delta}{r\delta} \right)^{1-\delta} \frac{N_c (\mathbb{E}w_c)^\delta}{p_{Nc}}. \quad (16)$$

## 3.4 The Local Multiplier Effect

Taking all the equilibrium relationships into account we want to look at the effect of an increase in productivity in the tradable sector in city A ( $A_{TA}$ ) on employment in the non-traded sector.

This has a direct consequence on nominal wages in the tradable sector: they increase with an elasticity of one.

$$\frac{\partial w_{AT}}{\partial A_{NT}} \frac{A_{TA}}{w_{TA2}} = 1$$

That yields an increase in expected income in the tradable sector:

---

<sup>8</sup>More generally, if we denote  $c_m^T(w_T, r_T, A_T)$  and  $c_m^{NT}(w_{NT}, r_{NT}, A_{NT})$  marginal costs, in the tradable and non-tradable sectors respectively, we see that  $w_T = w_{NT} = w$  implies :

$$c_m^{NT}(w, r_{NT}, A_{NT}) = p_{NT} \Rightarrow \frac{dp_{NT}}{dA_{NT}} = \frac{\partial c_m^{NT}}{\partial w} \frac{\partial w}{\partial A_T} \quad (13)$$

$$= \frac{\partial c_m^{NT}}{\partial w} / \frac{\partial c_m^T}{\partial w} \frac{\partial c_m^T}{\partial A_T} p \quad (14)$$

$$\epsilon_{A_{TA}}^{\mathbb{E}w_{TA}} \equiv \frac{\partial \mathbb{E}w_{TA}}{\partial A_{TA}} \frac{A_{TA}}{\mathbb{E}w_{TA}} = \frac{1}{\chi} \quad (17)$$

The across-sector non-arbitrage condition implies :

$$\epsilon_{A_{TA}}^{P_{NA}} \equiv \frac{\partial P_{NA}}{\partial A_{TA}} \frac{A_{TA}}{P_{NA}} = \delta \frac{\partial \mathbb{E}w_{TA2}}{\partial A_{TA}} \frac{A_{TA}}{\mathbb{E}w_{AT}} = \delta \left( \frac{1}{\chi} \right) \quad (18)$$

As we restrict  $\delta$  between 0 and 1, the Balassa-Samuelson effect only partially offset the increase in nominal wages. As a result, a larger share of the national population will want to move to city A. Depending on housing supply parameters, this will affect more or less equilibrium housing prices. Because national population is fixed, an increase in population of region A implies a declines in the population of region B.

The change in population in B can be expressed as:

$$\frac{\partial N_B}{\partial A_{TA}} = -\frac{\partial N_A}{\partial A_{TA}} \Leftrightarrow \epsilon_{A_{TA}}^{N_B} \equiv \frac{\partial N_B}{\partial A_{TA}} \frac{A_{TA}}{N_B} = -\frac{\partial N_A}{\partial A_{TA}} \frac{A_{TA}}{N_A} \frac{N_A}{N_B} = -\epsilon_{A_{TA}}^{N_A} \frac{N_A}{N_B}$$

Hence housing prices will be affected in city B as well.

Using Equation 9, we compute the elasticity of housing prices in both regions with respect to  $A_{TA}$ :

$$\epsilon_{A_{TA}}^{P_{HA}} = \sigma_A \left( \epsilon_{A_{TA}}^{N_A} + \epsilon_{A_{TA}}^{\mathbb{E}w_{AT}} \right) \quad \text{and} \quad \epsilon_{A_{TA}}^{P_{HB}} = -\sigma_B \epsilon_{A_{TA}}^{N_A} \frac{N_A}{N_B}$$

The difference between the two elasticities is thus:

$$\epsilon_{A_{TA}}^{P_{HA}} - \epsilon_{A_{TA}}^{P_{HB}} = \epsilon_{A_{TA}}^{N_A} \left( \sigma_A + \sigma_B \frac{N_A}{N_B} \right) + \epsilon_{A_{TA}}^{\mathbb{E}w_{AT}} \sigma_A \quad (19)$$

Using the changes in local nominal incomes and prices computed in equations (17), (18) and (19) and the probability of location in A (Equation 2).

$$\begin{aligned} \Delta N_A &= \lambda \frac{C_B}{C_A} (\Delta C_A - \Delta C_B) \\ &= \lambda \frac{C_B}{C_A} (\tau (\Delta P_{HA} - \Delta P_{HB}) - \theta \Delta P_{NA} + \Delta \mathbb{E}w_{AT}) \\ &= \lambda \frac{C_B}{C_A} \left( \tau (\Delta N_A \left( \sigma_A + \sigma_B \frac{N_A}{N_B} \right) + \Delta \mathbb{E}w_{AT}) + \Delta \mathbb{E}w_{AT} (1 - \tau \theta) \right) \\ &= \lambda \frac{C_B}{C_A} (\Delta N_A \tau \left( \sigma_A + \sigma_B \frac{N_A}{N_B} \right) + \Delta \mathbb{E}w_{AT} (1 - \tau \theta - \sigma_A \tau)) \\ &= \lambda \frac{C_B}{C_A} \frac{1 - \theta \delta - \sigma_A \tau}{1 + \lambda \frac{C_B}{C_A} \tau \left[ \sigma_A + \sigma_B \frac{N_A}{N_B} \right]} \Delta \mathbb{E}w_{AT} \\ &= \lambda \frac{C_B}{C_A} \frac{1 - \theta \delta - \sigma_A \tau}{1 + \lambda \frac{C_B}{C_A} \tau \left[ \sigma_A + \sigma_B \frac{N_A}{N_B} \right]} \frac{1}{\chi} \Delta A_{TA} \end{aligned}$$

Cobb-Douglas preferences for consumers and Cobb-Douglas technology as non-tradable technology implies that the increase in nominal income per capita will have no effect on demand for non-tradable goods. The ‘‘Balassa-Samuelson’’ effect induces a negative supply shock that drives prices up and perfectly offset the positive demand shock related to the increase in the nominal average income. Hence, given my choice of functional form, the only source of local multiplier

stems from migration from region B to region A.

Hence we obtain the final expression for the local multiplier effect within this model:

$$LM_A = \lambda \frac{C_B}{C_A} \frac{1 - \theta\delta - \sigma_A\tau}{1 + \lambda \frac{C_B}{C_A} \tau \left[ \sigma_A + \sigma_B \frac{N_A}{N_B} \right]} \frac{1}{\chi} \Delta A_{TA} \quad (20)$$

The local multiplier increases with housing supply elasticity (i.e. decreases with  $\sigma_A$ ) which determines also the extent which new labor will flow to a city experiencing an increase in wages. Strong heterogeneity in idiosyncratic city valuation (i.e. small value of  $\lambda$ ) always decreases the value of the local multiplier.

The share of expenditures on non-tradable goods ( $\theta$ ) surprisingly decreases the value of the local multiplier and so does the labor intensity of the non-tradable sector technology ( $\delta$ ). This is explained by the Balassa-Samuelson effect. For a given increase in tradable productivity, the resulting rise in non-tradable prices will be all the more important that this sector is labor intense (high value of  $\delta$ ). An increase in  $p_{NA}$  will negatively affect welfare more strongly if workers spend a high share of their income on non-tradable goods ( $\theta$ ). As a result, welfare in city A will not rise as much as if  $\theta$  was low and less people will be willing to move from city B to city A, thus limiting the increases in local aggregate income.

The effect in this model is symmetric (the elasticity does not depend on the sign of  $\Delta A_{TA}$ ). In the Appendix I show a model that exhibits asymmetric multipliers due to downward wage rigidity in the traded sector.

The model provides a guide to empirical approach. As local employment in both sectors is driven by both amenities and productivity, regressing observed non-tradable employment on tradable employment would not allow to identify the local multiplier. Indeed the least-square estimator would fail to distinguish between the effect of rising labor demand by the tradable sector on employment in the non-tradable sector (the proper local multiplier) and amenity-driven labor supply shocks driving employment in both sectors. The theoretical framework highlights the need for a demand-driven source of variation in tradable-sector employment in order to identify the local multiplier. The two instruments presented in the next section aim at providing such variation.

## 4 Data Description

I use administrative data for France over three years (1995,2001,2007). I aggregate data on employment and earnings for each year at the “local labor market” level (*zone d’emploi* in French). The definition of “zones d’emploi” is based on a criterion of self-contained commuting which limits the acuity of issues usually associated with spatial contagion across administratively defined units.

The database I use is called DADS (Déclaration annuelle des données sociales). It contains exhaustive data on non-agricultural salaried workers in France<sup>9</sup> I focus on the competitive sector and do not include workers employed by fully public institutions in the sample. The DADS database has extensively been used in labor economics and urban economics.<sup>10</sup> I observe from about 17.5 million jobs in 1995 to a little less than 22.2 million in 2007. That database is an employer-employee matched database which allows us to sort worker according to a very fine

<sup>9</sup>It is a weakness of this dataset not to contain information on the self-employed but I can check, using publicly available data on Insee.fr, that self-employed and agricultural workers represent less than 10% of working population. That small share is partly explained by the fact that, in France, a large part of workers usually considered are self-employed are in fact legally salaried worker of their own mono-employee firm.p

<sup>10</sup>For instance, Combes *et al.* (2010) use the DADS data-set over a different period to estimate agglomeration economies in France, controlling for workers fixed-effects.

sectoral classification the NAF 2003 nomenclature which maps uniquely to the NACE rev 1.1 classification that I will use as our main classification. The NACE sector with whom an employee is associated depends on the NACE code of the plant (establishment) she is working in. That NACE code is itself determined based on what the main activity of the plant (not of the firm). Hence, a large industrial firm could also be considered as having employees in the service sector if one of its establishment is specialized in R&D. Based on that nomenclature, I can distinguish between employment in the tradable and the non-tradable sector, using the sector of activity of the firm and of the establishment.<sup>11</sup> I restrict the sample to workers aged between 16 and 64 and keep information on wages and hours worked. I aggregate these data at the NACE code, year and LLM level. Then I aggregate the data at the non-tradable versus tradable level for each LLM-year (1995, 2001 and 2007). I take the first difference of the data and obtain a final dataset of 348 LLMs observed over two periods.

I use trade data on French imports from China from 1995 to 2007 from the website <http://comtrade.un.org> maintained by the International Merchandise Trade Statistics Section (IMTSS) of the United Nations Statistics Division (UNSD). The imports flows are reported in current thousand of dollars for each 6-digit product code of the Harmonized System (HS) nomenclature of year 1992. To map 6-digit HS product codes into 4-digit NACE sector codes, I use conversion tables available on Eurostat’s website RAMON<sup>12</sup> that allows me to map a) HS 1992 classification into the HS 2007, b) HS 2007 into CPA (Classification of product and activites) and finally CPA into NACE rev 1.1. I deflate imports using the French CPI. More details are provided in the Appendix E.

## 5 Statistical model and empirical strategy

### 5.1 Specification

In this model, we estimate two main equations : 1) estimate the impact of rising Chinese competition on local employment and earnings, 2) use that instrument in order to estimate local multipliers.

To estimate the direct impact of Chinese imports penetration, I use the following baseline specification:

$$\Delta \log Y_{ct} = \beta \Delta IPW_{ct} + \delta_t + \epsilon_{t,c} \quad (21)$$

The outcome variable is the change in log of variable  $Y$  where  $Y$  will be employment and earnings in manufacturing and non-manufacturing sectors.  $\delta IPW_{ct}$  represents here the change in the value of imports per worker in thousands dollars.

To estimate local multipliers, I specify log-level specification :

$$N_{ct} = \alpha_c + \beta T_{ct} + \delta_t + \epsilon_{t,c} \quad (22)$$

where  $N_{ct}$  and  $T_{ct}$  stand for the log of tradable and non-tradable employment respectively. First-

<sup>11</sup>The share of service workers has increased in the industrial sector, however the production they are engaged in does not depend on local demand but rather on the firm-level decisions. It would be therefore misleading to count such workers as working in the non-tradable sector.

<sup>12</sup>The url is the following: [http://ec.europa.eu/eurostat/ramon/index.cfm?TargetUrl=DSP\\_PUB\\_WELC](http://ec.europa.eu/eurostat/ramon/index.cfm?TargetUrl=DSP_PUB_WELC)

differencing equation 22 allow us to control for time-invariant heterogeneity. I obtain :

$$\Delta N_{ct} = \beta \Delta T_{ct} + \Delta \delta_t + \Delta \epsilon_{t,c} \quad (23)$$

where  $\Delta$  denotes the first-difference operator.<sup>13</sup>

When estimating Equation 21, I will also add initial share (1995) of manufacturing in local employment as an additional control.

## 5.2 Construction of the Instrument Variables

In this section, we present the instrument variables used in the estimation and highlight to different issues possibly confounding our effects.

As explained above, there might be contemporaneous shocks that drive both non-tradable and tradable employment, making  $L_T$  endogenous with respect to  $L_{NT}$  even after conditioning on LLM-level fixed-effects.

In order to cope with this issue, I build two instrument variables for  $\Delta T$  that are arguably exogenous with respect to  $\Delta N$ . The first instrument I use is the classic ‘‘Bartik’’-instrument. It is built by interacting the sectoral composition of each LLM during the baseline year with contemporaneous national growth rate for each industry. The goal is to isolate variations in employment that are determined by national trends and preexisting sectoral composition and not by shocks in the local labor supply (e.g. positive shock to amenities). The economic assumption underpinning the validity of this instrument is that local labor supply shocks are not correlated with sectoral national trends. Provided this is the case, the instrument will identify demand-driven changes in local employment.<sup>14</sup>

The ‘‘Bartik’’-instrument uses national trends interacted with initial local sectoral composition. National trends for sector  $s$  here is supposed to proxy the labor demand by this sector.

<sup>13</sup>For instance, in his study of the incidence of local labor demand shocks, Notowidigdo (2011) also uses a specification in terms of elasticity. Moretti and Thulin (2012) on the other hand estimate a model that is linear in first-difference. Their specification is the following :

$$\Delta N_{ct} = \beta \Delta T_{ct} + \alpha_c + \delta_t + \epsilon_{t,c} \quad (24)$$

$T_{ct}$  and  $N_{ct}$  refer respectively to employment in tradable and non-tradable sector employment at time  $t$  and in city/LLM  $c$ .  $\alpha_c$  refers to a LLM fixed-effect. They estimate fixed-effect panel model on data that are expressed in first-difference which amounts to allow the variable expressed in level to have both individual fixed-effect and linear time-trend.

<sup>14</sup>Formally the instrument is built the following way:

$$\begin{aligned} \mathbf{g}_{\bar{c}st} &= \frac{T_{st+1} - T_{st} - (T_{cst+1} - T_{cst})}{T_{st}} \\ \omega_{cst} &= \frac{T_{cst}}{T_{ct}} \\ \Delta \hat{T}_{ct} &= \sum_{s \in S} \omega_{cs0} \mathbf{g}_{\bar{c}st} \end{aligned}$$

where  $T_{st}$  is national employment of sector  $s$  at time  $t$  and  $T_{cst}$  is local employment of sector  $s$  at time  $t$  in area  $c$  and  $\mathbf{g}_{\bar{c}st}$  refers to the national growth rate of sector  $s$  during period  $t$  to  $t+1$  (excluding area  $c$ ) and  $\omega_{c,s,t}$  refers to the share in terms of variable  $N$  (employment or hours worked) of sector  $s$  in LLM  $c$  at time  $t$ .  $\Delta \hat{N}_{c,t}$  denotes the predicted evolution of  $N$  given that each sector in city  $c$  would have followed the national trend over period  $t$  to  $t+1$ . Finally  $\hat{T}_{c,t}$  is the Bartik-instrument I use in our estimation and express the predicted growth rate of  $N$  in city  $c$  given that each sector in city  $c$  would have followed national trends where the city  $c$  is excluded from the national trend. For applications of the same instrument in different settings, see Blanchard and Katz (1992), Bound and Holzer (2000), Autor and Duggan (2003), Luttmer (2005) and Notowidigdo (2011). In order to increase the plausibility of that instrument exogeneity, I compute national trends excluding the LLM of which I construct the labor demand index. The most important LLM is that of Paris which represents 7.5 % of overall employment in France in 1995.

However such a trend is ultimately affected by labor supply shocks as it is just the aggregation of local trends through cities. Negative labor supply shocks, to the extent that they are large and do not cancel out across cities, could be driving the national level trends which would undermine the credibility of such trends as proxy for demand.

To cope with this potential issue, I use a second instrument, inspired from Autor *et al.* (2012). They collect data on American imports from China at the sectoral level. They then interact initial industrial composition (employment at the 4-digit SIC level) with sectoral trends in Chinese imports to construct a measure of local labor market’s exposition to imports, called “imports-per-worker”.

A concern might be the possibility that increasing US imports of manufacturing goods made in China are a symptom and not a cause of American declining industrial employment which has started before China became an important trade-partner. To cope with this issue they use imports by other high-income countries (including for instance Germany, Australia etc.) from China as instrument for actual US imports.

For my purpose, estimating local multipliers, I need a source of plausibly exogenous variation in local labor demand. French imports from China might not be a very good variable to work with as they might be indeed the results of a decline in French manufacturing activities. Hence I compute changes in exports by China towards the rest of the world except France for each sector NACE over the two periods of interest. I interact these growth rates with initial sectoral composition of each local labor market to obtain a measure of each area’s exposure to rising Chinese competitiveness that is independent from factors specific to France.

A city’s tradable sector will be more or less affected by rising Chinese imports depending on its initial specialization. Hence, under the economic assumption that local labor supply shocks are unrelated to lagged sectoral composition and trends in overall Chinese exports to high-income OECD countries, the local variation in imports exposition will pick up variation in labor demand.

I first compute an index of sectoral imports exposition that represent the quantity of imports per worker (*IPW*) in a sector  $s$  for year  $t$ :  $IPW_{st}$ :  $IPW_{st} = \frac{M_{st}}{T_{st}}$ , where  $M_{st}$  stands for imports from China to France in thousands of dollars for period  $t$  and sector  $s$  and  $T_{st}$  is the value of employment for France in sector  $s$  at period  $t$ . I now compute the *IPW* level at the local level according to the following formula:

$$\Delta IPW_{ct} = \sum_s \eta_{sc0} \Delta IPW_{st} \quad (25)$$

where  $\eta_{sc0} = \frac{T_{sc0}}{T_{c0}}$  (the employment share sector  $s$  in city  $c$  during the initial period) and  $\Delta$  refer to changes. I build the variable  $\Delta EPW_{ct}$  analogously replacing French imports of Chinese goods by Chinese exports towards the rest of the world except France.

### 5.3 Discussion on the Instruments

While they share common elements, these two instruments are very different in the sense that the “Bartik”-instrument relies on a positive first-stage while the *EPW* instrument induces a negative effect on manufacturing employment. If local multipliers are asymmetric (their size depends on the sign of the shock to the labor market), that difference of sign in first-stage could have implications for the estimation of the local multipliers.

The theoretical framework does not present asymmetric local multiplier in the sense that, the elasticity of non-tradable employment wrt to a positive shock to tradable sector productivity is equal to the negative of the same elasticity wrt to a negative shock. Intuitively, one can see that this is related to the fact that reallocation across sectors is costless. Given the relative geographic immobility of households, a individual who lost her job in the manufacturing sector is likely to be looking for a job in the non-manufacturing in the same city. Hence, a negative demand shock to productivity of the manufacturing sector very plausibly induces a positive labor supply shock in the local non-manufacturing sector. By the same token, a positive productivity shock to local manufacturing sector will induce a negative labor supply shock in the manufacturing sector as individuals looking for jobs will reallocate their search effort towards the traded industries. In both cases, labor supply shocks to the non-manufacturing sector due to inter-sector reallocation will tend to lower the size of the local multiplier. There can be an asymmetry of the local multiplier, i.e. elasticity depending on the sign of the shock, only to the extent that the process of reallocation of manpower from one sector to another is asymmetric. This could be the case if, for instance, new manufacturing jobs have a higher propensity than non-manufacturing jobs to be taken up by workers moving from another location or previously unemployed. In that case, the local multiplier would be higher when the traded sector faces a positive shock than when it faces a negative shock.

The “Bartik”-instrument appears appropriate to test for asymmetric local multipliers because i) it takes both negative and positive values (unlike the EPW instrument), ii) it appears reasonable to assume that 2 realizations of the “Bartik”-instrument of opposite sign and equal absolute value represent labor demand shocks of similar magnitude (Notowidigdo, 2011). We test empirically this possibility.

A possible threat to identification could come from reverse causality rather than confounding factors. Such issue could arise if, for instance, firms in the manufacturing sector take local amenities into account when choosing where to locate. In the Appendix C, I present results showing that growth in non-tradable employment does not affect tradable employment causally. It suggests that reverse causality is not a major issue for estimation.

## 5.4 Descriptive statistics

Table 1 displays some statistics regarding average wages and working time in both sectors. It also shows the ratio of employment and hours in the non-tradable sector to employment and hours in the tradable sector. There has been over the period 1995-2007, a strong increase in the weight of the non-tradable sector relative to the tradable sector, both in terms of hours worked and in terms of employment. In line with descriptive findings in other studies, workers in the tradable sector tend to have higher wages than in the non-tradable sector. That premium increases slightly over the period going from 0.76 euros per hour (a 6.33% premium) in 1995 to 1.15 euros (7.51%). I see a strong reduction in the hours worker per year between 1995 and 2001 which is a consequence of the implementation of the working time reduction scheme voted in 1997 (from 39 to 35 weekly hours).

The geography of rising exposition to Chinese exports and how it relates to the evolution of employment in the tradable sector is summarized, for the period 2001-2007, by two maps in Figure 1a. One can see the extent of deindustrialization in France over the period, as the top quintile of employment zones in terms of manufacturing growth rate include negative values. On the other



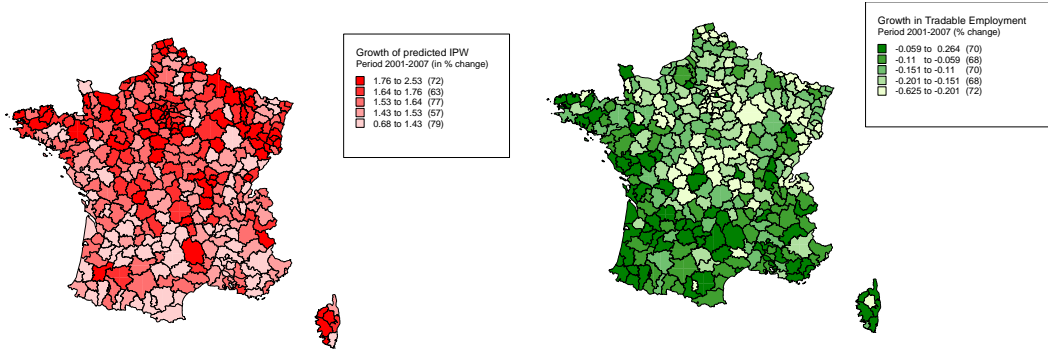
Table 1: Hours, wages and employment in tradable and non-tradable sectors

	Year	1995	2001	2007
Ratio non tradable / tradable	Employment	2.71	3.43	4.17
	Hours worked	2.21	2.68	3.31
Average annual hours worked per job	Tradable	1605.312	1445.29	1482.936
	non tradable	1309.107	1130.037	1176.997
Average hourly wage 2001 Euros	Tradable	12.819	14.601	16.446
	Non tradable	12.055	13.624	15.297

<sup>1</sup> Notes: The sample includes all workers from 16 to 64 in the private sector only. Data are deflated with Personal Consumption Price Index (CPI) for France.

Figure 1: Geographical Overview

(a) The Geography of (Rising) Chinese Imports Exposition      (b) The Geography of (Declining) Tradable Employment



hand, there has been not zone in France who has seen its *IPW* index decrease over the period. The growth rate ranges between 68 and 253 %.

In the following section, I present the results regarding the direct impact of Chine imports penetration. Section 7 shows results regarding local multipliers.

## 6 The Impact of Chinese Imports Penetration

### Employment and Earnings in the Tradable Sector

The first specification takes employment and hours worked in the manufacturing sector as a dependant variable. Results are shown in Table 2. Column (1) suggests that as  $IPW$  increase by 1000\$ is associated with a decrease of manufacturing employment growth rate of 0.3 percentage point. We see in Column (2) that instrumenting  $IPW$  by  $EPW$  yields a lower (absolute) coefficient of 0.29. OLS and 2SLS estimates are different and the OLS upward bias suggests that part of France’s increasing imports of Chinese products is explained by French specific demand factors as opposed to Chinese supply shocks. Controlling for initial share of employment in the tradable sector reduces further the magnitude of the coefficient as can be seen in Column (3). When looking at overall hours supplied in the manufacturing level as opposed to simple headcount, we see Column (4) to (6) that the effect is of consistently higher magnitude, suggesting that local manufacturing employment’s reaction to increasing Chinese competition is negative both in terms of extensive and intensive margins. When normalizing coefficient of Column (2), we find that a one standard deviation increase in  $\Delta IPW$  is associated with a 0.15 standard deviation decrease in manufacturing employment growth rate.

Table 2: Effect on % Change in Employment and Hours Workers in the Manufacturing Sector

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS: Jobs	2SLS: Jobs	-	OLS: Hrs	2SLS: Hrs	-
	b/se	b/se	b/se	b/se	b/se	b/se
$\Delta IPW$	-1.235*** (0.288)	-1.301*** (0.303)	-1.305*** (0.302)	-1.210*** (0.242)	-1.427*** (0.327)	-1.431*** (0.314)
share_one1_1			-24.508*** (4.302)			-23.157*** (4.565)
Observations	696	696	696	696	696	696
Adj-Sq	0.527	0.527	0.558	0.167	0.165	0.213

Notes: Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1,5 and 10 % level of significance respectively.

I now try to put these results into perspective and gauge their economic significance. Employment in the tradable sector in France decline by 11.6% over the period 1995-2007 and by 14.79% if one consider the period 2001-2007 only<sup>15</sup>. I can predict import-driven changes in growth rate in manufacturing by using our 2SLS estimates times the observed change in import-per-worker at the city level times the share of variation in imports explained by supply factor which I consider to be equal to the  $R^2$  of the first stage.<sup>16</sup> If we assume that changes in local manufacturing sector exposition are not only relative but absolute,<sup>17</sup> computing the mean of the predicted change (weighted by initial local employment in the tradable sector) allows to retrieve the nation-wide effect of Chinese imports penetration on manufacturing employment. I find an nation wide effect of -6.97%-points for the period 2001-2007. Hence, under the stated assumptions, we find that

<sup>15</sup>That figure is based on the exhaustive job-level dataset “DADS postes” when aggregated at the sector/year level for all of France.

<sup>16</sup> $\hat{g}_{ct} = R^2 \cdot \hat{\beta} \cdot \Delta IPW_{ct}$

<sup>17</sup>That assumption implies for instance that decline in region  $a$  does not cause growth in region  $b$ : a manufacturing job lost in region  $a$  is a job lost for France as a whole.

Chinese imports are responsible for 26 % of the decline of French manufacturing sector over the last period. This exercise is therefore consistent with the notions that i) trade with emerging China have become increasingly relevant for industrial employment in developed economies, ii) other factors lie behind the rapid acceleration in the decline of industrial employment in France.

We now turn to the effect on annual labor earnings and hourly wage. Results are displayed in Table 3. Effect of Chinese imports penetration on earnings seem weaker than that on employment and hours worked (Column (2) and (3)). It implies that hourly wage in manufacturing will tend to grow faster in cities whose local manufacturing sector is initially more exposed to Chinese competition. That effect is confirmed to be statistically significant in Columns (5) and (6). Estimates in Column (5) suggest that a one standard deviation increase in  $\Delta IPW$  is associated with a 0.74 percentage points increase in wages. The sign of this effect might seem at first very counter-intuitive as positive supply shock in competing Chinese manufacturing firms should translate into a local decline in demand for labor, thus pushing local wage down. There are two main potential explanations: (i) Strong changes in employment in manufacturing suggest that countervailing composition effects might be at work. Low-wage, low-skill manufacturing sub-sectors might reduce their workforce the most drastically thus pushing local average wages up (increase in share of “high-wage” industries), (ii) Within a manufacturing sub-sector, firms might be letting their least senior or least productive workers go first, keeping only well-paid, more productive workers. It could also be the case, as documented with firm-level data by Bloom *et al.* (2011), that firms faced with Chinese competition invest more in productivity-improving technologies (which might tend to reduce the labor intensity of the production process). I cannot test for the hypothesis ii), but I provide some evidence inconsistent with explanation (i). When running a simple regression of the change in  $IPW$  at the sectoral level over the period 1995-2007 ( $\Delta IPW_{s,9507}$  where  $s$  is a 4-digit NACE sector) on initial sectoral hourly wage, I find no evidence a statistical association. This suggests that (initially) low-wage industries were not on average more exposed to rising Chinese competition. Investigating the source of this positive average wage effect will be the topic of further research. Looking at worker-level data or disaggregating local employment data by type of occupation (to see whether the “skill- intensity” of local manufacturing sector increases with rising Chinese competition).

Table 3: % Change in Total and Hourly Earnings in the Tradable Sector

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS: Tot	2SLS: Tot	-	OLS: Av Hrly	2SLS: Av Hrly	-
	b/se	b/se	b/se	b/se	b/se	b/se
$\Delta IPW$	-1.143***	-1.328***	-1.332***	0.066	0.099	0.099
	(0.240)	(0.352)	(0.344)	(0.096)	(0.109)	(0.108)
share_one1_1			-21.598***			1.560
			(4.737)			(1.413)
Observations	696	696	696	696	696	696

*Notes:* Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1,5 and 10 % level of significance respectively.

## Employment and Earnings in the Non-Tradable Sector

The main focus of this paper is the effect of growth of tradable employment on non-tradable employment. Hence I now turn to the effect of Chinese imports penetration employment and hours worked in the non-tradable sector as a dependant variable. There are no obvious reasons why tradable industries should not be affected directly by Chinese competition, except through the negative demand shocks to non-tradable output engineered by the decline in manufacturing employment. I will come back to the estimation the local multiplier per se in the next section. We show the results in Table 4.

The effect is weaker and less precisely estimated (we can preview already that this suggests that the elasticity measured by the local multiplier will be lower than 1). Normalizing variables, estimate from Column (2) suggests that a one standard deviation increase in  $\Delta IPW$  cause a decline in non-tradable employment of 0.04 standard deviation. We notice that estimates in Column (4) to (6) are consistently lower (in absolute value) than in Columns (1) to (3), which contrasts strikingly with results in Table 4. Hence adjustment at the extensive and intensive margins seem to go in opposite way : reduced number of jobs but with higher annual hours worked per job.

We turn in the next subsection to the reaction of overall labor earnings and hourly wages by sector.

Table 4: % Change in Employment and Hours Workers in the Non-Tradable Sector

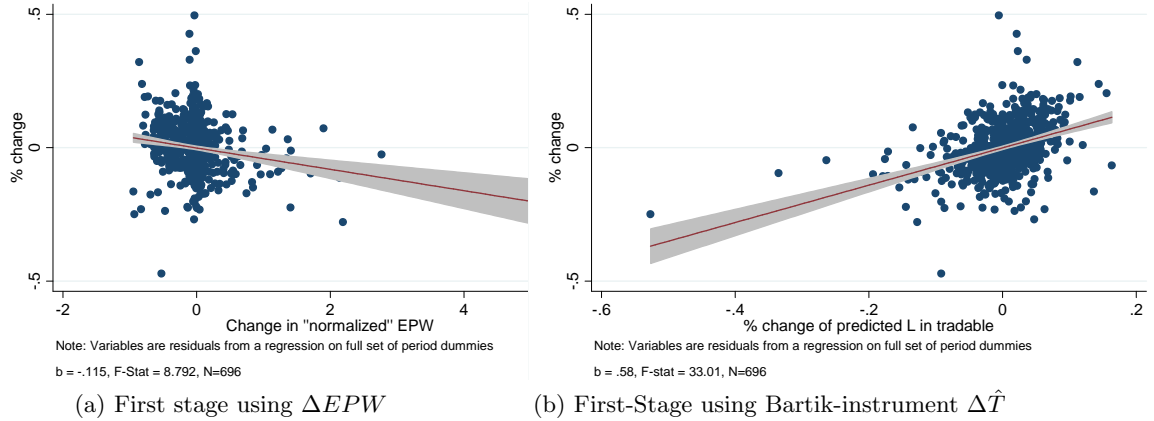
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS: Jobs	2SLS: Jobs	-	OLS: Hrs	2SLS: Hrs	-
	b/se	b/se	b/se	b/se	b/se	b/se
$\Delta IPW$	-0.360**	-0.660***	-0.660***	-0.213	-0.463**	-0.463**
	(0.164)	(0.224)	(0.222)	(0.146)	(0.203)	(0.203)
share_one1_1			-3.437			0.213
			(3.277)			(3.245)
Observations	696	696	696	696	696	696
Adj-Sq	0.727	0.725	0.725	0.192	0.188	0.188

*Notes:* Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1,5 and 10 % level of significance respectively.

Table 5 displays results for (labor) earnings and hourly wages in the non-manufacturing sector. We notice that earnings are negatively affected even though the effect is not very precisely estimated and the estimated coefficient is different than zero only at the 10 % significance level. Unlike manufacturing sector hourly wages, local wages in the non-tradable sector are negatively affect, even though the effect is relatively weak : a one standard deviation increase in  $\Delta IPW$  is associated with a decrease of 0.12 percentage point in the hourly growth rate. Chinese imports penetration reduce both employment and hourly wages in the non-tradable sector. Trade shocks trigger a reallocation of workers from manufacturing to services which might contribute to lower wages.

Employment effects are weaker in the non-manufacturing sector than in the manufacturing sector which suggests less recomposition effects within that sector. Firms in this sector did not face increase in Chinese competition they had lower incentives to stimulate their productivity. These two facts might explain why there are no, unlike in the manufacturing sector, effect countervailing

Figure 2: First-Stages EPW and Bartik instrument



the initial negative shock in terms of equilibrium wages.

Table 5: % Change in Total and Hourly Earnings in the Non-Tradable Sector

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS: Tot	2SLS: Tot	-	OLS: Av Hrly	2SLS: Av Hrly	-
	b/se	b/se	b/se	b/se	b/se	b/se
$\Delta IPW$	-0.243	-0.583**	-0.583**	-0.030	-0.121*	-0.120*
	(0.167)	(0.232)	(0.232)	(0.054)	(0.071)	(0.068)
share_one1_1			2.564			2.351**
			(3.639)			(0.921)
Observations	696	696	696	696	696	696

Notes: Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\*, and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1, 5 and 10 % level of significance respectively.

## 7 Results on the local multiplier

### Local Multipliers

Graphs of the first-stages for both instruments are included in Figure 2. Column (2) of Table 6 report the first stage of both instruments. Both instruments affect significantly the endogenous variable and are associated with high F-statistics: 33 for the “Bartik”-instrument and 8 for the *EPW* (with a robust clustered t-value of -2.96). That indicates that that these instruments are relevant even if the *EPW* is relatively weak.

I report average local multipliers in Table 6. In all regressions, the estimated elasticity is significantly different from zero, with at least 1 % confidence level. The OLS estimate is equal 0.303 and is situated between our two IV estimates. The “Bartik” estimate is 0.327 while the *IPW* estimate is 0.507.

The magnitude of the difference between the least-square and two-stage least square estimates is small. This suggests that most of the local variation in actual local employment in the tradable

Table 6: Estimates of Average Local Multipliers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	FS	RF	IV Bartik	FS	RF	IV IPW
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
$\Delta T$	0.303*** (0.038)			0.327*** (0.061)			0.507*** (0.180)
Bartik		0.582*** (0.101)	0.190*** (0.052)				
IPW					-3.115*** (0.750)	-1.579*** (0.537)	
Observations	696	696	696	696	696	696	696
Adj-Sq	0.780	0.573	0.733	0.779	0.517	0.729	0.754

*Notes:* Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The Bartik instrumental variable is constructed by interacting initial (i.e. at year of the beginning of the periods) cross-sectional differences in sectoral composition with contemporaneous sectoral nation-wide change in employment. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1,5 and 10 % level of significance respectively.

sector is driven by demand rather than supply shocks.

Given the expression for local population and employment in city  $A$  (equation (2)), and considering a situation where observed variation in local non-tradable employment in city  $A$  comes solely from variation in tradable productivity and amenities in city  $A$ , I can express the variance of  $\Delta T_A$  (percent change in tradable sector employment in  $A$ ) as:

$$\text{Var}[\Delta T_A] = (\epsilon_{A_T}^{T_A})^2 \text{Var}[\Delta A_T] + (\epsilon_{G_A}^{T_A})^2 \text{Var}[\Delta G_A] + 2\epsilon_{A_T}^{A_T} \epsilon_{G_A}^{T_A} \text{Cov}[\Delta A_T, \Delta G_A]$$

where  $\epsilon_Y^X$  stands for the elasticity of variable  $X$  w.r.t. variable  $Y$ . Taking the theoretical model “seriously”, we can express the bias of the OLS estimator of Equation (23) as:

$$\text{Bias}_{OLS} = \epsilon_{A_T}^{T_A} \epsilon_{G_A}^{N_A} \frac{\text{Cov}[A_T, G_A]}{\text{Var}[\Delta T_A]} + \epsilon_{G_A}^{T_A} \epsilon_{G_A}^{N_A} \frac{\text{Var}[\Delta G_A]}{\text{Var}[\Delta T_A]} \quad (26)$$

Given Equation (26), we can interpret the low magnitude of the OLS bias. A low value of  $\frac{\text{Var}[\Delta G_A]}{\text{Var}[\Delta T_A]}$  implies that most of the variation in local tradable employment is explained by demand factors and is consistent with a low bias of the OLS estimate.

We report estimates for the hours and earnings multipliers in, respectively, Tables 7 and 8.

The average tradable to non-tradable employment ratio over the two periods is 3.8, which means that the number of additional non-tradable jobs induced by the creation of one job in the tradable sector is about 1.2 based on the estimate obtained with the Bartik-instrument. This result is close to Moretti (2010) who finds an average effect of 1.59 jobs with US data and higher than what Moretti and Thulin (2012) find based on Swedish data and a fortiori much higher than findings for Italy by de Blasio and Menon (2011) who find a null effect. We can see in Tables 7 and 8 that “earnings” and “hours” multipliers are of a similar magnitude.

The elasticity is 0.507 based on the IPW instrument suggesting a job-to-job effect of 1.9 non-traded job per traded job created. That is considerably higher than what is found with the Bartik instrument, suggesting as seen next section, a potential asymmetry. The two estimator are not necessarily independent and it appears difficult to test whether their difference is statistically sig-

nificant. It is interesting to note however that our highest multiplier effect found remains much lower than what the figures that have been extensively used to justify place-based policies and industrial policies in France. For instance, in a very influential report, Louis Gallois mention a local multiplier effect between 3 and 4 (Gallois, 2012).

I cannot empirically discriminate between the reasons for the difference between my results for France and lower results for other European countries. There are however a few intuitively appealing explanations. In the theoretical framework above, we saw that the local elasticity of housing and the dispersion of idiosyncratic valuation of locations (which can also be interpreted as a distribution of mobility affects respectively positively and negatively the local multiplier effect. Lower labor mobility in Italy in comparison with France (as documented in Gáková and Dijkstra (2008)) constitute a plausible explanations for discrepancy between de Blasio and Menon (2011)'s results and mine. The lower labor supply reaction is magnified by the centralized nature of wage determination in Italy implies that local productivity or labor demand shocks do not transmit to wages as fast as in France, reducing further the surge in local purchasing power following the creation of a manufacturing job.

Table 7: Estimates of Average Local Mutlipliers: Hours

	(1) OLS b/se	(2) FS b/se	(3) RF b/se	(4) IV Bartik b/se	(5) FS b/se	(6) RF b/se	(7) IV IPW b/se
$\Delta T$ : Hours	0.295*** (0.030)			17.713*** (5.449)			0.324** (0.140)
Bartik		0.619*** (0.097)	0.110*** (0.042)				
D_epw_1					-3.416*** (0.816)	-1.108** (0.484)	
Observations	696	696	696	696	696	696	696
Adj-Sq	0.372	0.262	0.200	0.343	0.158	0.198	0.370

Table 8: Estimates of Average Local Mutlipliers: Earnings

	(1) OLS b/se	(2) FS b/se	(3) RF b/se	(4) IV Bartik b/se	(5) FS b/se	(6) RF b/se	(7) IV IPW b/se
$\Delta T$ : Earnings	0.347*** (0.033)			0.241*** (0.062)			0.439** (0.183)
Bartik		0.550*** (0.124)	0.132*** (0.046)				
$\Delta IPW^W$					-3.179*** (0.878)	-1.397** (0.550)	
Observations	696	696	696	696	696	696	696

Notes: Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Variables are always expressed in percentage change across periods. The instrumental variable is constructed by interacting initial (i.e. at year of the beginning of the periods) cross-sectional differences in sectoral composition with contemporaneous sectoral nation-wide change in employment and hours worked. All specification include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at at the 1,5 and 10 % level of significance respectively.

### Testing for Asymmetry of the Effect

The symmetry of the local multiplier in the theoretical model is strongly related to the assumptions that costs to reallocate cross sectors and cities are symmetric. Consider the case where it is costly for workers to move from manufacturing to the service sector but not the other way around.

In that case, negative shock to manufacturing’s productivity will not trigger a larger labor supply shock in the service sector as worker in manufacturing stick to their jobs for lower wages. On the other hand, increase in the productivity manufacturing might induce workers in the service sector to switch sector to enjoy higher wages (at no reallocation cost). In this configuration, negative variation in manufacturing employment would be associated with higher local multipliers because the employment consequences of the negative demand shock to non-tradable products would not be mitigated by a positive labor supply shock on the job markets for non-traded sector jobs. In the opposite configuration (costly reallocation from services to manufacturing and costless the other way around), the asymmetry would go the other way: positive shocks to manufacturing would be associated with higher local multipliers than negative shocks.<sup>18</sup> Here we propose to test for this in a very simple manner.

To test empirically this possibility, we use the following specification:

$$\Delta N_{ct} = \alpha_t + \beta \cdot \Delta T_{ct} + \phi \cdot (\Delta T_{ct})^2 + \varepsilon_{ct} \quad (27)$$

According to specification in Equation (27), the elasticity of  $N$  with respect to  $T$  is a function of  $\Delta T$ . We have :  $\epsilon_T^N|_{\Delta T=0} = \beta$  and  $\epsilon_T^N|_{\Delta T=X} = \beta + 2\phi \cdot X$ .

Table 9 shows results from OLS, Reduced Form and 2SLS estimation using the “Bartik”-instrument.

Table 9: (Parametric) Test for Asymmetry of Local Multipliers

	(1) OLS b/se	(2) First Stage b/se	(3) Reduced Form b/se	(4) 2SLS b/se
$\Delta T$	0.301*** (0.038)			0.374*** (0.074)
$(\Delta T)^2$	-0.061 (0.103)			0.259 (0.219)
$\hat{\Delta T}$		0.86*** (0.098)	0.336*** (0.077)	
$(\hat{\Delta T})^2$		0.498*** (0.159)	0.299* (0.146)	
Observations	696		696	696
Adj-Sq	0.78		0.736	0.771

Notes: Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The Bartik instrumental variable is constructed by interacting initial (i.e. at year of the beginning of the periods) cross-sectional differences in sectoral composition with contemporaneous sectoral nation-wide change in employment. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1,5 and 10 % level of significance respectively.

Estimates of  $\hat{\phi}$  are imprecise in column (3). Nonetheless Columns (2) and (3) suggest some degree of asymmetry in the response of non-traded employment to traded job creation. Using point estimates from Column (3), we see that a one standard deviation positive (negative) shock to manufacturing employment (sd = 0.1345) is associated with an elasticity of 0.4436 (0.3043). Such asymmetry would not be consistent with the fact that IV estimates are higher with *EPW* than with the Bartik-instrument, as  $\hat{\phi} > 0$  implies that negative shocks are associated with a higher elasticity. The test above propose to test the null hypothesis of no asymmetry against a

<sup>18</sup>Stronger downward wage rigidity in the manufacturing versus non-tradable sector would also yield asymmetric multipliers in the model presented above.



very specific parametric alternative hypothesis. Therefore it would be informative to carry out a test less sensitive to the parametric assumption underlying the hypothesis of asymmetry.

## 8 Conclusion

In this paper, I develop a formal theoretical model of spatial equilibrium to investigate what are the determinants driving the local multiplier effect. Elasticity of housing supply, share of income spent on housing and non-tradable as well as labor intensity of non-tradable production technology are important parameters underlying this effect.

I use detailed French data on local employment and wages to estimate the local multiplier. Our empirical approach relies on the fact that the rise of Chinese exports is mainly supply-driven and exogenous to idiosyncratic factors affecting the French economy.

Our empirical findings show that the average multiplier in France is much higher comparison with other European countries in which similar studies have been carried out (Sweden and Italy). I find an elasticity of 0.3 implying that each additional job in the tradable sector induces the creation of 1.2 job. Candidate explanations for that stronger effect in France include mainly a higher wage flexibility and a higher mobility of regions (which suggest a higher local labor supply elasticity).

The existence of a positive multiplier is not in itself a market failure. Hence while it seems that policies promoting growth of employment in the tradable sector can boost employment via the multiplier effect, it does not imply that such policies will be welfare improving. The conditions under which the local multiplier is a policy relevant parameter from a theoretical point of view and the conditions under which place-based policies are justified still need to be determined. The theoretical model developed in the theoretical part appears a natural framework in which to carry out this analysis.

Regarding the effect of rising Chinese imports penetration, we roughly confirm the effect found by Autor *et al.* (2012). Local employment and total labor income in the manufacturing sector is strongly reduced in employment zone most exposed to Chinese imports. That affects local economies beyond the manufacturing sectors and non-tradable employment is also significantly affect. Interestingly, hourly wage rate are positively affected in the manufacturing sector, plausibly because of a combination of trade-induced productivity gains and composition effects (in terms of workers and industry shares). The between-industry effect (shifts in the employment share of low-pay industries) does not seem to be a driving force behind this effect however. That suggests within-industry workforce adjustments and productivity improvements might be behind this effect.

## References

- AUTOR, D. H., DORN, D. and HANSON, G. H. (2012). *The China Syndrome: Local Labor Market Effects of Import Competition in the United States*. NBER Working Papers 18054, National Bureau of Economic Research, Inc.
- and DUGGAN, M. G. (2003). The rise in the disability rolls and the decline in unemployment. *The Quarterly Journal of Economics*, **118** (1), 157–205.
- BARTIK, T. J. (1991). *Who Benefits from State and Local Economic Development Policies?* No. wbsle in Books from Upjohn Press, W.E. Upjohn Institute for Employment Research.

- (2003). *Local Economic Development Policies*. Upjohn Working Papers 03-91, W.E. Upjohn Institute for Employment Research.
- BLANCHARD, O. J. and KATZ, L. F. (1992). Regional evolutions. *Brookings Papers on Economic Activity*, **23** (1), 1–76.
- BLOOM, N., DRACA, M. and REENEN, J. V. (2011). *Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity*. NBER Working Papers 16717, National Bureau of Economic Research, Inc.
- BOUND, J. and HOLZER, H. J. (2000). Demand shifts, population adjustments, and labor market outcomes during the 1980s. *Journal of Labor Economics*, **18** (1), 20–54.
- COMBES, P.-P., DURANTON, G., GOBILLON, L. and ROUX, S. (2010). Estimating agglomeration economies with history, geology, and worker effects. In *Agglomeration Economics*, NBER Chapters, National Bureau of Economic Research, Inc, pp. 15–66.
- COURDES COMPTES (2007). *Les aides des collectivités territoriales au développement économique*. Rapport public thématique, Cour des Comptes.
- DE BLASIO, G. and MENON, C. (2011). Local effects of manufacturing employment growth in Italy. *Giornale degli Economisti e Annali di Economia*, **10** (3).
- GALLOIS, L. (2012). *Rapport sur la compétitivité française*. Tech. rep.
- GÁKOVÁ, Z. and DIJKSTRA, L. (2008). *Labour mobility between the regions of the EU-27 and a comparison with the USA*. Regional Focus: Papers on Regional Policy 02/2008, EU Directorate-General for Regional Policy.
- GLAESER, E. (2008). *Cities, agglomeration, and spatial equilibrium*. Oxford University Press.
- INSEE (2003). *Liste des activités et emboîtement CITI-NACE-NAF*. Guide d’utilisation naf rev. 1, INSEE.
- JENSEN, J. B. and KLETZER, L. G. (2005). *Tradable Services: Understanding the Scope and Impact of Services Outsourcing*. Working Paper Series WP05-9, Peterson Institute for International Economics.
- LUTTMER, E. F. P. (2005). Neighbors as negatives: Relative earnings and well-being. *The Quarterly Journal of Economics*, **120** (3), 963–1002.
- MAGRINI, S. and GEROLIMETTO, M. (2011). *A spatial nonparametric analysis of local multipliers*. ERSA conference papers ersa11p1692, European Regional Science Association.
- MARTIN, P., MAYER, T. and MAYNERIS, F. (2011). Spatial concentration and plant-level productivity in France. *Journal of Urban Economics*, **69** (2), 182–195.
- MENDEL, B. (2012). Local multiplier: Theory and evidence.
- MORETTI, E. (2010). Local multipliers. *American Economic Review*, **100** (2), 373–77.
- (2011). *Local Labor Markets*, Elsevier, *Handbook of Labor Economics*, vol. 4, chap. 14, pp. 1237–1313.

— and THULIN, P. (2012). *Local Multipliers and Human Capital in the US and Sweden*. Working Paper Series 914, Research Institute of Industrial Economics.

NOTOWIDIGDO, M. J. (2011). *The Incidence of Local Labor Demand Shocks*. NBER Working Papers 17167, National Bureau of Economic Research, Inc.

ROBACK, J. (1982). Wages, rents, and the quality of life. *Journal of Political Economy*, **90** (6), 1257–78.

## A Downward Wage Rigidity in the Tradable Sector

We use the model presented in Section XX. We consider two periods with downward wage mobility. In period 0 the initial equilibrium holds. Between periods 0 and 1, a shock to tradable sector productivity  $\Delta A_{TA}$  occurs in city  $A$ . When the shock is positive the wages evolve according to the Nash-Bargaining rule and the elasticity of wage is the same as what was initially computed (is equal to 1). Accordingly the reaction of the employment rate in equilibrium is equal to  $1/\chi$  as in the exposition in the main text.

Downward wage rigidity translates into the model through the fact that when  $\Delta A_{TA}$  is negative, wages in the tradable sector remain constant:  $w_{AT,1} = w_{AT,0} = \beta A_{TA,0}$ .

As a result, the elasticity of the surplus associated with a match  $S = (1 - \beta)(A_{TA,1} - w_{AT,0})$  changes:

$$\Delta S \simeq (S_1 - S_0)/S_0 = \frac{(A_{TA,1} - w_{TA,0}) - (1 - \beta)A_{TA,0}}{(1 - \beta)A_0} = \frac{A_{TA,1} - A_{TA,0}}{A_{TA,0}} \frac{1}{1 - \beta} \simeq \frac{1}{1 - \beta} \Delta A$$

As a result the change in expected wage becomes:  $\Delta \mathbb{E}w_{TA} = \Delta h_A = \frac{1 - \chi}{\chi} \Delta S = \frac{1 - \chi}{\chi} \frac{1}{1 - \beta} \Delta A$  if  $\Delta A < 0$ .

Hence taking  $\Delta A > 0$ , we have :

$$LM_A|_{\Delta A} \lesseqgtr -LM_A|_{-\Delta A} \Leftrightarrow 1 \lesseqgtr \frac{1 - \chi}{1 - \beta} \Leftrightarrow \chi \lesseqgtr \beta \quad (28)$$

In that setting, positive shocks will be associated with higher (lower) multiplier if the elasticity of the matching function with respect to labor market tightness ( $1 - \chi$ ) is lower than the share of surplus going the firm ( $1 - \beta$ ). Wage rigidity in this setting implies no asymmetry if  $\chi = \beta$ , which, interestingly, corresponds as well to the Hosios-condition for our economy.

## B Evidence with Individual Panel Data TO BE COMPLETED

In this Section, I study what compositional effects are at play in the determination of local average manufacturing wages response to trade shocks. I mainly focus on trade. I look at whether higher exposure to trade in the manufacturing sector affects individuals differently according to their initial occupational status. Compositional effects consistent with the results found above would be that workers with lower occupational status are more likely to be displaced out of the manufacturing sector to the tradable sector by trade shocks.

I use the DADS Panel. Selected sample: Workers with strong attachment to the labor market, stable in their sector (NACE) and location: same location/NACE with full time employment for 1994/1995.

I look at individuals initially employed in manufacturing. I consider the  $IPW$  computed for the NACE of employment in 1995 as the relevant measure of exposure to Chinese imports.

$$x_{i,S} = \alpha + \Delta IPW_{s(i)} \cdot \beta_{occ(i),S} + X_i \delta + \varepsilon_i \quad (29)$$

I look at the impact of  $IPW$  on several labor market outcome, most of them cumulated over the period 1995-2007. I denote  $x_{i,S}$  a labor market outcome (supply, earnings and others) experienced

by individual  $i$  cumulated over the period 1995-2007 in sector  $S$ . Generally,  $x_{i,S}$  is defined as :

$$x_{i,S} \equiv \sum_{t=1996}^{2007} I(S(it) = S) \cdot x_{it} \text{ for } S = T, N \quad (30)$$

$x_{it}$  will be earnings ( $w_{it}$ ) and labor supply ( $l_{it}$ ) by individual  $i$  in period  $t$ . I will also look at the probability of having zero earnings in a year.

To test the compositional effects, I focus on cumulated labor supply: overall ( $l_i = l_{i,T \vee N}$ ), in the manufacturing sector ( $l_{i,T}$ ) and the non-tradable sector ( $l_{i,N}$ ). I group occupational categories into two categories : (1) high-skill occupations, comprising managers, engineers (intellectual professions) and so-called intermediary professions (for instance technicians, foreman and floor supervisors), (2) low-skill occupations, comprising employees and workers. In that setting,  $\beta_{1,T} > \beta_{2,T}$  would imply that differential effect of trade exposure on labor supply across occupations could explain part of the rise in wages in the manufacturing sector.

Table 10: Average Effect of Initial Sector Exposure on Cumulative Labor Supply

	(1) Cum. Hrs Worked b/se	(2) Cum. Hrs Worked b/se	(3) CHW. 3 digit industry b/se	(4) CHW. out of 3 digit industry b/se	(5) CHW. tradable b/se
Male Dummy	2260.096*** (71.327)	2261.839*** (71.005)	2210.624*** (107.892)	-40.490 (76.712)	2523.900*** (92.664)
Low-Skill Occ.	-618.475*** (71.839)	-617.941*** (71.821)	195.129* (105.060)	-793.247*** (79.733)	3.078 (111.874)
High-Skill Occ.	-30.510 (149.319)	-31.936 (149.485)	-1336.828*** (192.605)	1294.714*** (135.641)	-1030.876*** (164.947)
$\Delta IPW$	-13.215*** (2.262)	-12.784*** (2.893)	-35.854*** (5.414)	23.104*** (4.124)	-29.376*** (4.817)
Observations	53030	53030	53030	53030	53030
Adj-Sq	0.064	0.064	0.041	0.039	0.051

Notes: Sample of workers strongly attached to the labor market: worked full-time in both 1994 and 1995 in the same area and same NACE.

Table 11: Skill-Specific Effect Initial Sector Exposure on Cumulative Labor Supply

	(1) Cum. Hrs Worked b/se	(2) Cum. Hrs Worked b/se	(3) CHW. 3 digit industry b/se	(4) CHW. out of 3 digit industry b/se	(5) CHW. tradable b/se
Male Dummy	2234.810*** (71.038)	2220.075*** (69.766)	2173.690*** (107.154)	-45.489 (77.909)	2500.433*** (94.046)
Low-Skill Occ.	-561.197*** (73.885)	-545.055*** (76.829)	200.930* (113.943)	-725.599*** (82.180)	2.775 (113.982)
High-Skill Occ.	-159.885 (161.724)	-180.305 (163.830)	-1620.073*** (204.947)	1429.691*** (137.914)	-1221.178*** (174.622)
$\Delta IPW$	-10.391*** (2.691)	-11.162*** (3.375)	-42.477*** (5.959)	31.392*** (5.465)	-34.132*** (6.544)
$\Delta IPW \times LS$	-9.498*** (3.407)	-12.516*** (4.228)	-2.468 (6.888)	-10.138* (5.650)	-0.984 (6.877)
$\Delta IPW \times HS$	12.280*** (4.356)	14.654*** (4.805)	30.779*** (8.317)	-16.148** (7.224)	20.768*** (7.630)
Observations	53030	53030	53030	53030	53030
Adj-Sq	0.064	0.064	0.041	0.040	0.052

Notes: Sample of workers strongly attached to the labor market: worked full-time in both 1994 and 1995 in the same area and same NACE.

## C Non-Tradable on Tradable Effects

As discussed in subsection 5.3, the two main worry regarding identification in my paper the possibility that local labor supply shocks might correlated with local labor demand shocks. When estimating the local multiplier however there is an additional issue of reverse causality. If companies choose areas based on local man-made amenities for instance (museums, quality of schools, night scene etc), it is possible that an expansion of non-tradable employment causally affect the local level of manufacturing employment. We use the fact that the Bartik-instrument is defined for non-tradable as well as tradable industries to test the causal impact of non-tradable on tradable employment. As can be seen from results below in Table 12. The OLS estimate shows a strong statistical association between the two variables. However the 2SLS estimate is negative and not significantly different than 0.

Table 12: Effect of Non-Tradable on Tradable using the Bartik instrument

	(1) OLS b/se	(2) 2SLS b/se
$\Delta N$	0.667*** (0.052)	-0.499 (0.380)
Observations	696	696
Adj-Sq	0.602	0.293

Notes: Baseline sample is a balanced panel of 348 employment zones. Observations are LLM-period. Variables in level are observed for 3 years: 1995, 2001 and 2007. After first-differencing the data, there are 2 observations per LLM. Outcomes variables are expressed in percentage change across periods. The Bartik instrumental variable is constructed by interacting initial (i.e. at year of the beginning of the periods) cross-sectional differences in sectoral composition with contemporaneous sectoral nation-wide change in employment. The EPW instrument is based on the initial sectoral composition with contemporaneous Chinese exports towards the rest of the world minus France. All specifications include period fixed effect. Standard errors are clustered at the LLM level. The subscripts \*\*\*, \*\* and \* are associated with rejection of the null hypothesis (i.e. the coefficient of interest is equal to zero) at the 1,5 and 10 % level of significance respectively.

## D Tradable-on-Tradable Sector

The theoretical framework exposed above contains only one tradable sector, hence we cannot formally model the impact of an increase in productivity in one part of the tradable sector on the rest in the same location. However in the absence of search and matching frictions and with constant returns to scale and starting from an equilibrium, if one divides artificially the tradable sector in two parts and allows one part to have its TFP increase, employment in the other part will plummet to zero. Because they produce the same good with the same inputs and because each technology is CRS, any increase in TFP in one part of the tradable sector will cause the other part to stop operating because given the new wages it will make a loss - while the non-tradable sector can adjust to new wages by increasing its prices. I do not expect such strong and unrealistic conclusions to hold in practice but given the goods they produce are easily tradable, tradable sector firms should not react as strongly as non-tradable sector firms to a shock in local demand.

To test this hypothesis, I use the same specification as in equation 23 with the modification that, both right and left hand side variables are employment in randomly defined subset of the tradable sector. I expect these estimates to be much lower or even negative. I randomly pick half (in expectation) of the sub-sectors contained in the tradable sector and run IV estimations on data

that result from 1000 different realizations of that random selection process. Results regarding the distribution of the estimates are shown in Table 13. Less than 30 % of estimates are significantly different from zero at the 5 % confidence level and the average effect is negative. This confirms our prior that producers of tradable goods are much less sensitive to local demand than producers of non-tradable goods.

Table 13: Distribution of estimates of tradable to tradable elasticities

	mean	p10	p25	p50	p75	p90
point estimate	-.26	-1.20	-0.22	0.15	.52	1.13
p-value < 10%	0.631					
p-value < 5%	0.284					

<sup>1</sup> *Notes:* 1000 simulations have been realized. For each simulation, the tradable sector was randomly divided into two subsets, each containing in expectation an equal number of sub-sectors (NAF code). The estimation uses the “Bartik”-instrument. The dependent variable is a randomly defined subset of the tradable sector, including (in expectation) half of the tradable subsectors, and the explanatory variable is the other subset. The IV for the explanatory variable is built following the same procedure as described in Subsection 5.1.

## E Classification of Tradable and Non-Tradable Activities

I use the so-called NAF 2003 nomenclature. I use the most detailed classification that contains a total 712 different classes. However we do not consider the classes that pertain to agriculture and public employment. Having such a high degree of detail is important as some broad sectors (for instance medical services) are divided into activities that are strictly publicly operated and financed (hospitals) and activities that are mostly private businesses (general practitioners and other doctor offices and so). Hence, it is important to be able to distinguish the first from the seconds in order to have a measure of non-tradable employment that is indeed dependent on local demand (and not solely on public expenditures) to operate. A detailed exposition of NAF and how it relates to NACE can be found in INSEE (2003). I follow the same approach than Moretti and Thulin (2012) in order to make our results more directly comparable with them and with Moretti (2010). All industries are considered as part of the tradable sector. All services are in turn considered as part of the non-tradable sector, except for those that are publicly financed and managed (e.g. public schools and hospitals...). This corresponds to NAF 2003 2-digit from 1 to 37 for the tradable sector and 40 to 99 for the non-tradable sector with the exception of a few 3 to 4 digit activities that we decide to drop because they are completely publicly provided in France - e.g. public education, public hospitals etc.

However, as was notably shown by Jensen and Kletzer (2005), many services activities are highly tradable – financial services, airline transportation, parts of the software programming sector etc. Hence, in an extension to this work I envision to adopt a new classification based on Jensen and Kletzer (2005) and other work on tradable services. The lack of data on international trade in services however would limit the relevance of the *IPW* instrument.

## F Trade and Employment Data

We use data on trade from the website [un.comtrade.org](http://un.comtrade.org). The trade data follow the product classification HS 1992 with 6 digit. The data on employment follows the NACE rev 1.1. classification which is equivalent to the 4-digit CPA 2002 classification. To convert HS-1992 6-digit codes into NACE 4-digit codes, we do the following:

- We use a file available on [un.comtrade.org](http://un.comtrade.org) to map HS-1992 into HS-2007.
- We use one file available on <http://ec.europa.eu/eurostat/ramon> to map HS-2007 into CPA 2002 which maps one-to-one to the NACE rev 1.1.

At each stage we drop non-unique matches. For each year, the non-matched proportion of trade never exceeds 9 % of the value of trade for French imports.