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## ABSTRACT

### Place Based Policies with Unemployment<sup>\*</sup>

Many countries have policies aimed at creating jobs in depressed areas with high unemployment rates. In standard spatial equilibrium models with perfectly competitive labor and land markets, local job creation efforts are distortionary. We develop a stylized model of frictional local labor markets with the goal of studying the efficiency of unemployment differences across areas and the potential for place based policies to correct local market failures. Our model builds on the heavily studied Diamond-Mortensen-Pissarides framework, adapted to a local labor market setting with a competitive housing market. The result is a simple search analogue of the classic Roback (1982) model that provides a tractable environment for studying the effects of local job creation efforts. In the model, workers are perfectly mobile and the productivity of worker-firm matches may vary across metropolitan areas. In equilibrium, higher local productivity results in higher nominal wages, higher housing costs, and lower unemployment rates. Although workers can move freely to arbitrage away differences in expected utility across metropolitan areas, equilibrium unemployment rates are not equalized across space. We find that if hiring costs are excessive, firms may post too few vacancies. This problem may be offset via local hiring subsidies of the sort found in many place based policies. The optimal hiring subsidy is city specific in the sense that it depends upon the local productivity level.

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# 1 Introduction

Unemployment rates vary enormously across cities and regions. In most countries, variation in unemployment rates across labor markets at a moment in time rivals that of variation over the business cycle. For example, column 1 of Table 1 reports unemployment rates in US metropolitan areas with the highest and lowest unemployment rates in 2008 according to the American Community Survey. In that year, the unemployment rate in Flint – the city at the top of the list – was almost 15 percent, while the unemployment rate in Iowa City – located less than 500 miles from Flint – was only 2.6 percent. The 12 percentage point difference between these two cities is more than double the change in national unemployment rates observed over the course of the Great Recession and even larger compared to the typical business cycle.<sup>1</sup> Notably, these spatial differences in unemployment rates are not simply an artifact of differences in the average characteristics of residents. Estimates of city-specific unemployment rates that condition on individual characteristics also exhibit a remarkable degree of variability.

Perhaps even more surprising is the fact that these staggering geographical differences are not transitory, but last decades. Figure 1 shows unemployment rates in 1990 and 2008 across 239 metropolitan areas. The figure shows a remarkable degree of persistence, with a regression coefficient of 0.509 (.045) and  $R^2$  of 0.35.<sup>2</sup> European labor markets also exhibit marked and long lasting differences in regional unemployment rates (Overman and Puga, 2002; Elhorst, 2003). If anything, differences in Europe can be even more long lasting. For example, the unemployment rate in Southern Italy has been three to four times higher than the unemployment rate in Northern Italy for the past three decades. In 2008, the unemployment rate in Sicily was above 16 percent, while the rate in Veneto (in the Italian North-East) was only 4 percent. Similar regional differences, albeit somewhat smaller, are observed in Spain, France and Germany.

Given the persistence of these vast cross-sectional differences in unemployment rates, it is not surprising that an increasing number of countries have adopted place based policies transferring resources towards particular geographical areas. Most developed countries have some form of place based policy. Such policies are typically targeted towards areas with weak demand for labor and high unemployment rates, often with the explicit goal of reducing unemployment.

Economists have long pointed out two important limitations with such policies. First,

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<sup>1</sup>The national unemployment rate at the peak of the Great Recession was only 4.7 points higher than the rate in 2006, at the bottom of the cycle.

<sup>2</sup>A weighted regression that uses the 1990 city population as weights yields very similar estimates: The regression coefficient is 0.515 (.044) and  $R^2 = 0.36$ .

standard spatial equilibrium models (e.g. Roback, 1982) suggest that it may be difficult for place-based policies to improve the utility levels of area residents, as increases in labor demand in a region may be offset by increases in local costs of living. Second, such policies may be highly inefficient. Under the standard modeling assumptions of static market clearing, the absence of agglomeration and crowding effects, and the absence of prior distortions due to taxes, place based policies may generate large deadweight losses by creating incentives to invest, work, and live in less productive or hospitable areas.

Recently, a variety of authors have sought to relax some of these assumptions. For example, Glaeser and Gottlieb (2008), Kline (2010), and Kline and Moretti (2012) study the implications of agglomeration externalities for the efficiency of place based policies from the point of view of local and national governments. In a different vein, Albouy (2009) indicates that the federal tax code already distorts locational incentives, which may provide a rationale for offsetting policies.

Thus far, however, not much work has been devoted to studying the implications of labor market frictions for the efficiency of place based policies. Given the large geographical differences in the prevalence of unemployment observed in the real world, understanding spatial equilibrium when the labor market does not instantly clear would appear to be of primary importance.<sup>3</sup> The absence of a theoretical framework to understand the efficiency of place based policies in the presence of unemployment is particularly notable in light of the fact that most such programs usually state job creation as a primary goal, often with an explicit emphasis on reducing local unemployment.

In this paper, we develop a stylized model of frictional local labor markets with the goal of studying the efficiency of unemployment differences across areas and the potential for place based policies to correct local market failures. Our model builds on the heavily studied Diamond (1982) - Mortensen (1982) - Pissarides (1985) framework, adapted to a local labor market setting with a competitive housing market. The result is a simple search analogue of the classic Roback (1982) model that provides a tractable environment for studying the effects of local job creation efforts.

In the model, workers are perfectly mobile and the productivity of a worker-firm match may vary across metropolitan areas. In equilibrium, higher local productivity results in

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<sup>3</sup>Beaudry, Green, and Sand (2012) develop and estimate a multi-sector model of frictional local labor markets where industrial policies can have complex equilibrium effects on wages and population. However, they do not study the welfare properties of their model. A recent paper by Lutgena and Van der Linden (2012) makes progress in developing a tractable search-matching equilibrium in which searching for a job in another region is possible without migrating. Wrede (2012) uses a search and matching framework to understand the equilibrium relationship between local amenities, wages, rents and unemployment. See also earlier work by Francis (2009), Molho (2001), and Epifani and Gancia (2005). Boadway et al. (2004) study policies that should be implemented to restore efficiency when there is an inefficient distribution of firms.

higher nominal wages, higher housing costs, and lower unemployment rates. Although workers can move freely to arbitrage away differences in expected utility across metropolitan areas, equilibrium unemployment rates are not equalized across space. In addition to search frictions, we allow for the presence of hiring costs, which have been shown to be empirically important for hiring behavior (Hamermesh, 1989; Bloom, 2009). As in Pissarides (1999, 2009) these costs are not sunk at the time that matches are formed and can therefore influence the wage bargain. We show that if hiring costs are excessive, firms may post too few vacancies. This problem may be offset via hiring subsidies of the sort found in many place based policies. The optimal hiring subsidy is city specific in the sense that it depends upon the local productivity level.

Thus, in our simple setting, excessive hiring costs provide a theoretical rationale for place based hiring subsidies even when workers are perfectly mobile.<sup>4</sup> These subsidies ought to be targeted to less productive areas with lower wages. Relative to a neoclassical environment, the underlying motivation for such subsidies is that workers are not perfectly mobile between unemployment and employment. Search frictions yield rents, which, if split incorrectly, yield inefficient job creation behavior.

We stress that our discussion is meant to stimulate further work on efficiency considerations in the local labor market literature rather than to assess the desirability of any particular policy. Local hiring subsidies of the sort studied in our model are likely to face significant implementation problems as authorities cannot easily infer which matches are new.

## 2 Spatial Variation in Unemployment Rates and Public Policy

We begin by documenting more carefully the vast cross-sectional differences in unemployment rates across cities. Figure 2 shows a histogram of unemployment rates across US metropolitan areas in 1990, 2000 and 2008. To create the figures, we used data from the 1990 and 2000 Census of Population and the 2008 American Community Survey.<sup>5</sup> National labor market

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<sup>4</sup>There are of course several other possible sources of inefficiency in frictional labor markets, many of which can yield a role for policy. Gibbons and Katz (1991), for example, propose a simple model of equilibrium unemployment that arises due to adverse selection in the labor market. Acemoglu (2001) develops a two-sector search model with holdup where too few “good” capital intensive jobs are provided in equilibrium, while Acemoglu and Shimer (1999) discuss implications of holdup for efficiency of the mix of jobs under a host of different modeling assumptions.

<sup>5</sup>The Censuses of Population and the American Community Survey have nearly identical definitions of unemployment. Both ask a household respondent to report on whether household members who didn’t work in the previous week have been actively searching for work over the previous four weeks.

conditions vary substantially across the dates of these three samples. While the 1990 and 2008 samples occurred at the onset of what turned out to be deep recessions, the 2000 Census was collected at the peak of the strongest labor market expansion since World War Two.<sup>6</sup>

Despite being situated at different points of the business cycle, all three samples yield a similar picture – one in which U.S. local labor markets display wide heterogeneity in unemployment rates. In each year, the unemployment rates in the metro areas at the top of the distribution are several times higher than the unemployment rates in metro areas at the bottom of the distribution. For example, the unemployment rates in cities at the top of the 2008 distribution are three to five times higher than the unemployment rates in cities at the bottom (column 1 of Table 1). Earlier years are characterized by even a wider range of variation. The standard deviations across metropolitan areas in 1990, 2000 and 2008 are, respectively, .018, .018 and .016, while the differences between the first and the 99th percentiles are 6.1, 5.9 and 5.1 percentage points; well above the differences in national unemployment rates observed over the business cycle.

Of course, unemployment rates are known to depend upon worker skills and demographics, which may vary significantly across metropolitan areas. However, spatial differences in unemployment rates across labor markets are difficult to explain by differences in resident characteristics. Estimates of city-specific unemployment rates that condition on individual characteristics continue to exhibit a remarkable degree of variability. Column 2 of Table 1 shows metropolitan area-specific unemployment rates for 2008, adjusted for education, age, gender, and race. These estimates are obtained from an individual level linear probability regression of an indicator for unemployment on metropolitan area indicators and indicators for education, age, gender, and race.<sup>7</sup> A comparison of columns 1 and 2 indicates that controlling for individual characteristics reduces spatial variation in unemployment rates only marginally. For example, covariate adjustments reduce the gap in the probability of unemployment between Flint and Iowa City from 12.0 to 10.8 percentage points.

For a broader assessment, Figure 3 shows the distribution of unemployment rates across US metropolitan areas in 1990, 2000 and 2008 after controlling for education, age, gender, and race. A comparison of Figure 3 and Figure 2 confirms that the dispersion of the conditional unemployment rates does not differ substantially from the dispersion of the unconditional rates. Indeed, the standard deviations of the conditional distributions in 1990, 2000 and 2008 are, respectively, .018, .017 and .016; virtually unchanged relative to the unconditional distributions.

Spatial differences in unemployment rates are often used by policy makers to justify the

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<sup>6</sup>Both the Census of Population and the American Community Survey are collected in the Spring.

<sup>7</sup>Entries in the table are the rescaled coefficients on the metropolitan area indicators.

adoption of policies that transfer resources towards areas with weak demand for labor and high unemployment rates. For example, the European Union Regional Development Fund explicitly targets regions with high unemployment and low (nominal) income for generous business subsidies and public investment. Remarkably, the European Union legislation generally prohibits state aid, but makes explicit exceptions for place based policies that target “deprived” regions with low per capita GDP and high unemployment.

National governments have embraced these policies. Since the 1970’s, the main business support scheme in the UK – the Regional Selective Assistance – has provided discretionary grants to firms in disadvantaged regions, defined as regions with high unemployment and low levels of per capita GDP (Crisculo et al. 2012). Italy has long provided regional transfers that single out high unemployment regions, especially in the South, for special infrastructure investments and, more recently, for hiring incentives and other labor market subsidies (See for example Deidda et al, 2012). Sweden, France and Germany have similar programs (Marx, 2001). In the US, the federal urban Empowerment Zone (EZ) program was explicitly designed to benefit neighborhoods with high unemployment rates (Busso, Gregory, and Kline, 2012).

A growing empirical literature assesses the local job creation effects of place based policies (e.g., Ham et al, 2011; Neumark and Kolko, 2010; Crisculo et al., 2012). Consistent with the stated goals of many such programs, the implicit assumption in the literature has been that the desirability of these policies should be assessed based upon their ability to create jobs in weak labor markets. Yet, in standard spatial equilibrium models with complete markets, such job creation efforts tend to be highly inefficient as they divert economic activity to less productive areas. Indeed, in standard models, such as that of Busso, Gregory, and Kline (2012), successful job creation resulting from targeted incentives is actually a sufficient statistic for the size of a program’s deadweight losses. The ideal place based subsidy would simply raise wages (or change other prices) in a way that raises the real income of the targeted group without changing behavior.

We now turn to the development of a simple spatial equilibrium model with frictional unemployment that explicitly acknowledges the possibility of inefficiencies in local labor markets. We then discuss a possible economic rationale for place based policies in settings where equilibrium unemployment is above its efficient level.

### 3 Model Setup

Consider a small representative city to which homogeneous workers may freely migrate and search for a job. Jobs are filled probabilistically via a constant returns to scale matching function  $M(U, V)$  which takes the number of unemployed workers  $U$  and job vacancies  $V$  as

arguments. Letting  $\theta \equiv \frac{V}{U}$  denote market tightness, the constant returns to scale assumption implies we can write the job filling rate as  $q(\theta) \equiv \frac{M(U,V)}{V} = M(\theta, 1)$  which we assume obeys  $q'(\theta) < 0$ ,  $\lim_{\theta \rightarrow 0} q(\theta) = \infty$ , and  $\lim_{\theta \rightarrow \infty} q(\theta) = 0$ . Likewise, the job finding rate is  $\theta q(\theta) = \frac{M(U,V)}{U}$  which obeys  $\lim_{\theta \rightarrow 0} \theta q(\theta) = 0$ , and  $\lim_{\theta \rightarrow \infty} \theta q(\theta) = \infty$ .

Whether searching or employed, workers inelastically demand a unit of housing which they rent at rate  $c$ . Housing is supplied on a spot market according to marginal cost so that:

$$c = g'(N) \tag{1}$$

where the function  $g(\cdot)$  represents the total cost of producing housing for the local workforce of size  $N$  and is assumed to be twice differentiable and convex.

The steady state value of searching for a job is given by:

$$rJ^U = b + A - c + \theta q(\theta) (J^E - J^U) \tag{2}$$

where  $r$  is the interest rate. The flow utility of unemployment  $b$  captures the generosity of the local safety net and the value of leisure. The term  $A$  gives the consumption value of the local mix of amenities in the city. The term  $J^E$  gives the (steady state) value of employment which obeys the recursion:

$$rJ^E = w + A - c + s (J^U - J^E) \tag{3}$$

with  $w$  representing the wage and  $s$  an exogenous separation probability.

We depart from the standard general equilibrium assumption of a fixed workforce by assuming that workers may freely exit the city and obtain flow utility  $z$ . Thus we have the restriction that in an interior equilibrium:

$$rJ^U = z. \tag{4}$$

This condition is analogous to the standard free-mobility assumption of Roback (1982) who requires that agents everywhere have equal utility. Here they need only have equal values of *search* across communities.<sup>8</sup> The value of employment may vary across communities if it is offset by differences in the local cost of living or the probability of finding a job. Condition (4) in conjunction with the housing supply function (1) will pin down a unique steady state city size  $N$ .

Firms may post vacancies which entail flow cost  $k$ . Following Pissarides (1999, 2009)

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<sup>8</sup>In this respect, the model bears a similarity to the Harris and Todaro (1970) model of rural-urban migration.

we assume the firm must pay a fixed hiring cost  $H$  before hiring a worker with whom it is matched.<sup>9</sup> Note that  $k$  and  $H$  are distinguished by the fact that the vacancy costs are already sunk by the time the firm is matched with the worker, while the hiring costs are not. The value  $J^V$  of posting an unfilled vacancy is given by:

$$rJ^V = -k + q(\theta)(J^F - J^V - H) \quad (5)$$

The value  $J^F$  of a filled vacancy obeys:

$$rJ^F = p - w + s(J^V - J^F) \quad (6)$$

where  $p$  is the productivity of the match which we assume is city specific and common to all matches in the city. This parameter is important because it governs the strength of the local labor market. We are interested in understanding how the optimal policy depends on  $p$ .

Free entry of firms drives the value of an unfilled vacancy to zero:

$$rJ^V = 0. \quad (7)$$

In a steady state, there will be no migration and the local unemployment rate  $u \equiv \frac{U}{N}$  will be determined by the usual function of inflow and outflow rates:

$$u = \frac{s}{s + \theta q(\theta)}. \quad (8)$$

Finally, we assume wages are set via Nash bargaining over the match surplus, so that:

$$(1 - \beta)(J^E - J^U) = \beta(J^F - J^V - H) \quad (9)$$

where the parameter  $\beta$  gives the worker's share of the match surplus. Note that the surplus being bargained over is net of the hiring cost. A model with holdup would bargain over the surplus ignoring some portion of the hiring cost.<sup>10</sup>

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<sup>9</sup>See Hamermesh (1989), Caballero, Engel, and Haltiwanger (1997), and Bloom (2009) for evidence on hiring costs.

<sup>10</sup>Note that this equation pins down the worker's *entry* wage which is key to the job creation decisions of firms. As Pissarides (1999) notes, workers may try to force a renegotiation of the wage after the firm has already paid the hiring cost. This could lead to a different "inside" wage. We ignore this possibility in what follows. Evidence on the importance of such holdup problems is mixed (see Card, Devicienti, and Maida, 2010).

## 4 Equilibrium

We show in the appendix that the nine equations of our model can be reduced to the following three relationships which characterize the behavior of the endogenous variables  $\theta$ ,  $c$ , and  $w$ :

$$\frac{r+s}{q(\theta)} = \frac{1-\beta}{k} (p-b-(r+s)H) - \beta\theta \quad (10)$$

$$\begin{aligned} c &= p + A - z - (r+s)H - \frac{k}{1-\beta} \frac{r+s}{q(\theta)} \\ &= b + A - z + k \frac{\beta}{1-\beta} \theta \end{aligned} \quad (11)$$

$$w = \beta(p - (r+s)H) + (1-\beta)(c + z - A) \quad (12)$$

Condition (10) is standard and can be graphed as the intersection of a modified job creation curve and a Beveridge curve (Pissarides, 1999). Not surprisingly, equilibrium market tightness is an increasing function of local productivity  $p$  and a decreasing function of hiring costs  $H$ . It is also straightforward to verify that equilibrium market tightness is a decreasing function of worker's bargaining power  $\beta$ , and the costs  $k$  of posting a vacancy. An interesting feature of this equation is that it does not depend on the local amenity level  $A$  or the outside option  $z$ . This is an artifact of our (somewhat artificial) assumption that firms do not use land to produce goods, which conveniently blocks one channel of feedback from the housing market to the labor market.

The local cost of living  $c$  is an increasing function of market tightness and therefore match productivity  $p$ . It also varies one for one with the amenity level  $A$  and the outside option  $z$  (which can be thought of as the amenity value of the outside world) in order to keep workers indifferent.

Finally, the wage is a bargaining power weighted average of output net of hiring costs and the cash flow required for workers to obtain utility level  $z$  which is  $z$  plus the local cost of living  $c$ . Wages are increasing in local market tightness and hence in productivity.<sup>11</sup> Because firms do not use land, wages are invariant to the local amenity level  $A$ . Relaxing this restriction, would make wages a decreasing function of the amenity level as in Roback (1982). The remaining key endogenous variables: population ( $N$ ) and equilibrium unemployment ( $u$ ) can be inferred directly from (1) and (8).

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<sup>11</sup>Note that the positive relationship between tightness and wages is at odds with the older compensating differential intuition of Hall (1972).

## 5 Efficiency

The social planner seeks to maximize the total surplus in the economy relative to the outside option which is given by:

$$S = [(p - sH)(1 - u) + (b - k\theta)u + A - z]N - g(N).$$

Total surplus  $S$  consists of the output of productive matches net of the steady state costs of hiring replacements plus the leisure associated with unemployment minus the flow cost of maintaining unfilled vacancies. This must then be netted out relative to the outside option which offers workers utility level  $z$ . The planner also deducts from the surplus the real costs of housing the local workforce.

Because we are not concerned with transitional dynamics, we now limit our analysis to the case where agents have discount rates of zero which allows us to compare steady states without considering the convergent paths between steady states. The static planner's problem is to simply:

$$\max_{\theta, N} S \quad \text{s.t.} \quad u = \frac{s}{s + \theta q(\theta)}.$$

This problem can be thought of as choosing the equilibrium the agent faces before entering the economy. The first order conditions of this problem are:

$$g'(N) = (p - sH)(1 - u) + (b - k\theta)u + A - z \tag{13}$$

$$(p - b - sH) \frac{\partial u}{\partial \theta} + ku + k\theta \frac{\partial u}{\partial \theta} = 0 \tag{14}$$

where  $\alpha \equiv -\frac{q'(\theta)}{\theta}$  is the (negative) elasticity of the matching function. The first condition determines optimal city size and, given our competitive housing market assumption, can be restated as:

$$c = (p - sH)(1 - u) + (b - k\theta)u + A - z.$$

For this to coincide with (11) when agents have discount rates of zero, we need the following to hold:

$$(p - sH)(1 - u) + (b - k\theta)u + A - z = p + A - z - sH - \frac{k}{1 - \beta} \frac{s}{q(\theta)}.$$

This can be restated as:

$$\frac{s}{q(\theta)} = \frac{1 - \beta}{k} (p - b - sH) - \beta\theta,$$

which coincides with (10) when  $r = 0$ . Thus, city size is always efficient. This is unsurprising

since workers are free to move and we have assumed a perfectly competitive housing market with no externalities.

The planner's second condition, given in (14), governs efficiency of the job creation process which determines the local unemployment rate. Note that:

$$\frac{\partial u}{\partial \theta} = -\frac{1-\alpha}{s}q(\theta)u^2$$

where  $\alpha \equiv -\frac{q'(\theta)}{q(\theta)}$  is the (negative) elasticity of the job filling rate. With this convention, (14) can be rewritten:

$$\frac{s}{q(\theta)} = (p-b)\frac{1-\alpha}{k} - \alpha\theta$$

For this to coincide with (10), we need

$$\frac{1-\beta}{k}(p-b-sH) - \beta\theta = (p-b)\frac{1-\alpha}{k} - \alpha\theta. \quad (15)$$

Note that in the absence of hiring costs ( $H = 0$ ) this condition is satisfied whenever  $\alpha = \beta$ , which is often referred to as the Hosios (1990) condition. There is, in general, no reason to expect this condition to be satisfied. Rearranging (15), we have that the optimal hiring cost obeys:

$$H^* = \frac{\alpha - \beta}{s(1-\beta)}(p-b+k\theta).$$

when  $\beta < \alpha$ , the optimal hiring cost is positive while when  $\beta > \alpha$  the optimal cost is negative (i.e. a hiring subsidy). It is possible to derive an alternative expression for the optimal hiring cost in terms of observed prices by noting that (10) and (11) imply:

$$k\theta = \frac{1-\beta}{\beta}(c-b+z-A).$$

Thus,

$$\begin{aligned} H^* &= \frac{\alpha - \beta}{s} \left( \frac{p}{1-\beta} + \frac{c+z-A}{\beta} - \frac{b}{\beta(1-\beta)} \right) \\ &= \frac{1}{s\beta} \frac{\alpha - \beta}{1-\alpha} (w-b) \end{aligned} \quad (16)$$

We have then that the ideal hiring cost is proportional to the local wage level  $w$  net of the value of the leisure  $b$ . Presumably,  $b$  does not vary substantially across communities (at least relative to  $w$ ). From (12) the wage is higher in more productive areas.

## 6 Place Based Hiring Subsidies

The policy implications of condition (16) depend on the relative magnitude of the parameters  $\beta$  and  $\alpha$ . When  $\beta > \alpha$ , equilibrium unemployment is *above* its social optimum. This occurs because high bargaining power on the part of workers leads to excessive wages and therefore too little job creation, with job seekers inefficiently crowding each other out. Efficiency can be restored in such cases by imposing a hiring subsidy.

By contrast, when  $\beta < \alpha$ , equilibrium unemployment is *below* its social optimum. In this case, low bargaining power on the part of workers leads to low wages and excessive job creation, with vacancies inefficiently crowding each other out. Efficiency can be restored in such cases via hiring costs, which, if too low can be bolstered by taxing new hires.

Most estimates of  $\alpha$  place it at or above one half, with Shimer (2005) settling on a value of  $\alpha = 0.72$ . By contrast, labor economists examining the wage impact of shocks to firm profitability have repeatedly found estimates of  $\beta$  well below one half. Abowd and Lemieux (1993), for example, find in a sample of unionized plants in Canada that  $\beta$  is no greater than 0.4. Unsurprisingly, researchers studying environments where workers are less formally organized typically find much lower bargaining shares (Barth et al., 2011; Card, Devicienti, and Maida, 2010; Carlsson, Messina, and Skans, 2011; Guiso, Pistaferri, and Schivardi, 2005).

The empirical finding that  $\beta < \alpha$  has the rather counter-intuitive implication that positive hiring costs are optimal. If actual hiring costs are below the optimum, a hiring tax could be welfare improving. Despite being politically unpalatable, this possibility illustrates the point that labor market failures are not always remediable with subsidies.

However a finding that  $\beta < \alpha$  does not itself imply that existing hiring costs are too low or that hiring should be taxed. Although a calibration is beyond the scope of this paper, empirical estimates suggest that actual hiring costs are in fact very large (Bloom, 2009). One justification for place based subsidies then could be that hiring costs are too high – that is, that hiring costs take the value  $\bar{H} > H^*$ . In such cases efficiency can be restored via an offsetting hiring subsidy.

If one ignores the costs of raising the necessary funds, the optimal subsidy  $B^*$  takes the form:<sup>12</sup>

$$B^* = \bar{H} - \frac{1}{s\beta} \frac{\alpha - \beta}{1 - \alpha} (w - b).$$

This subsidy is decreasing in  $w$ , providing a rationale for intervening more heavily in areas

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<sup>12</sup>Raising the funds with taxes on labor will induce additional distortions, hence reducing the size of the optimal subsidy.

with lower wages. Indirectly, this suggests subsidizing areas with lower productivity.<sup>13</sup> Of course,  $\bar{H}$  and  $b$  may themselves vary across cities due to differences in regulations and variation in the generosity of the social safety net. Areas with greater hiring costs require a larger subsidy for obvious reasons. Interestingly, areas with a more generous safety net also require a larger hiring subsidy.

## 7 Conclusion

In this paper, we studied some conditions under which local job creation could have an efficiency rationale. We found that, depending on the magnitude of hiring costs, firms may post too few vacancies, particularly in cities where the productivity of a match is low. In principle, this problem may be offset via place based hiring subsidies that vary with local productivity levels.

Hiring costs are not the only example of frictions that may plausibly depress local job creation. Another example is the presence of firing costs (Lazear, 1990; Bertola, 1990; Kugler and Saint-Paul, 2004; Hafstead, 2012). Although firing costs can be substantial in many European and developing countries, they have been understudied empirically. Their implications for place based policies are an important area for future research.

We stress that the goal of our exercise has not been to propose a specific policy but to stimulate further research on the welfare implications of cross-market variation in local unemployment rates. An important limitation of our steady state analysis is that it neglects trends in productivity which may be important for understanding empirical differences between declining Rust Belt cities and growing labor markets in the South (Blanchard and Katz, 1992). We also caution that in practice hiring subsidies may be prone to manipulation since officials cannot easily ensure that subsidies are not claimed on inframarginal workers whose hiring costs are already sunk from the perspective of the firm. Additional evidence on implementation of hiring subsidies and on the relation between hiring costs and local job creation rates is an important area for future work.

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<sup>13</sup>In a more general model where firms use land, wages would also depend negatively on the local amenity level. In such a case, areas with a more attractive mix of amenities ought to receive larger hiring subsidies.

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## Appendix

From (5) and (7)

$$J^F = \frac{k}{q(\theta)} + H$$

While from (6), we have that

$$J^F = \frac{p - w}{r + s}$$

Thus, the job creation side of the model requires

$$\frac{p - w}{r + s} = \frac{k}{q(\theta)} + H$$

which we rewrite:

$$q(\theta) = \frac{k(r + s)}{p - w - (r + s)H}. \quad (17)$$

Free mobility of workers and (2) imply that:

$$J^U = \frac{b + A - c + \theta q(\theta) J^E}{r + \theta q(\theta)} = \frac{z}{r}.$$

While solving (3) yields,

$$J^E = \frac{\frac{s}{r}z + w + A - c}{r + s}.$$

Thus, workers require that

$$b + A - c + \theta q(\theta) \left( \frac{\frac{s}{r}z + w + A - c}{r + s} \right) = \frac{z}{r} (r + \theta q(\theta)).$$

Which we rewrite:

$$\theta = \frac{z + c - b - A}{q(\theta) \left( \frac{w + A - c - z}{r + s} \right)}. \quad (18)$$

From (9), we have:

$$(1 - \beta) \left( \frac{w + A - c - z}{r + s} \right) = \beta \frac{p - w}{r + s} - \beta H$$

which can be directly rearranged to yield equation (12) in the text.

Plugging (17) into (18) and using (12) we have:

$$\begin{aligned}
\theta &= \frac{p - w - (r + s)H}{k} \frac{z + c - b - A}{w + A - c - z} \\
&= \frac{1 - \beta}{\beta} \frac{p + A - c - z - (r + s)H}{k} \frac{z + c - b - A}{p + A - c - z - (r + s)H} \\
&= \frac{1 - \beta}{\beta} \frac{z + c - b - A}{k}
\end{aligned} \tag{19}$$

We also have from (18) that

$$\theta q(\theta) = \frac{r + s}{\beta} \frac{z + c - b - A}{p + A - c - z - (r + s)H} \tag{20}$$

Plugging this into (19), we get:

$$\frac{1 - \beta}{\beta} \frac{z + c - b - A}{k} q(\theta) = \frac{r + s}{\beta} \frac{z + c - b - A}{p + A - c - z - (r + s)H}$$

which can be rearranged to yield equation (11) of the text. Finally, plugging (11) into (20) and rearranging yields (10).

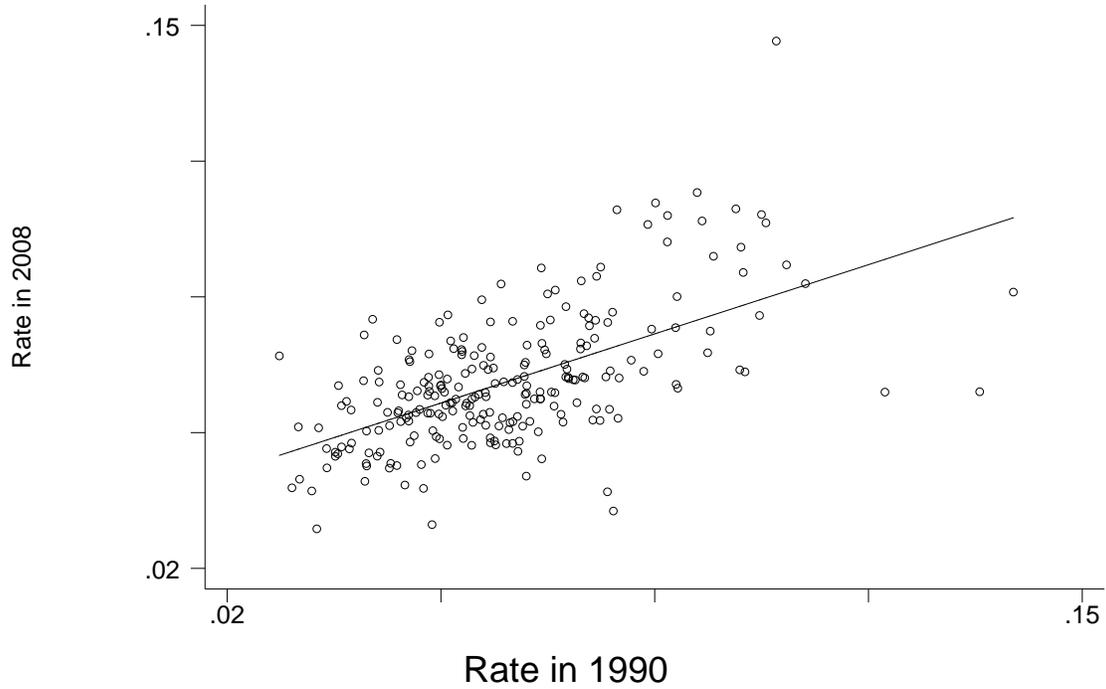
Table 1: Metropolitan Areas with the Highest and Lowest Unemployment Rates in 2008

Rank	Metropolitan Area	Unemployment Rate	Adjusted Unemployment Rate
		(1)	(2)
<u>Areas with the Highest Rate</u>			
1.	Flint, MI	.1462	.1399
2.	Yuba City, CA	.1099	.1072
3.	Anniston, AL	.1074	.0899
4.	Merced, CA	.1060	.0948
5.	Toledo, OH/MI	.1058	.1064
6.	Yakima, WA	.1047	.0970
7.	Detroit, MI	.1044	.1082
8.	Chico, CA	.1031	.1092
9.	Modesto, CA	.1027	.1021
10.	Waterbury, CT	.1023	.0918
<u>Areas with the Lowest Rate</u>			
276.	Provo-Orem, UT	.0391	.0369
277.	Madison, WI	.0389	.0511
278.	Odessa, TX	.0383	.0307
279.	Fargo-Morehead, ND/MN	.0362	.0467
280.	Charlottesville, VA	.0348	.0362
281.	Houma-Thibodoux, LA	.0337	.0107
282.	Billings, MT	.0304	.0324
283.	Rochester, MN	.0297	.0392
284.	Sioux Falls, SD	.0285	.0342
285.	Iowa City, IA	.0265	.0327

Notes: Data are from the 2008 American Community Survey. The sample includes all individuals in the labor force between the age of 14 and 70.

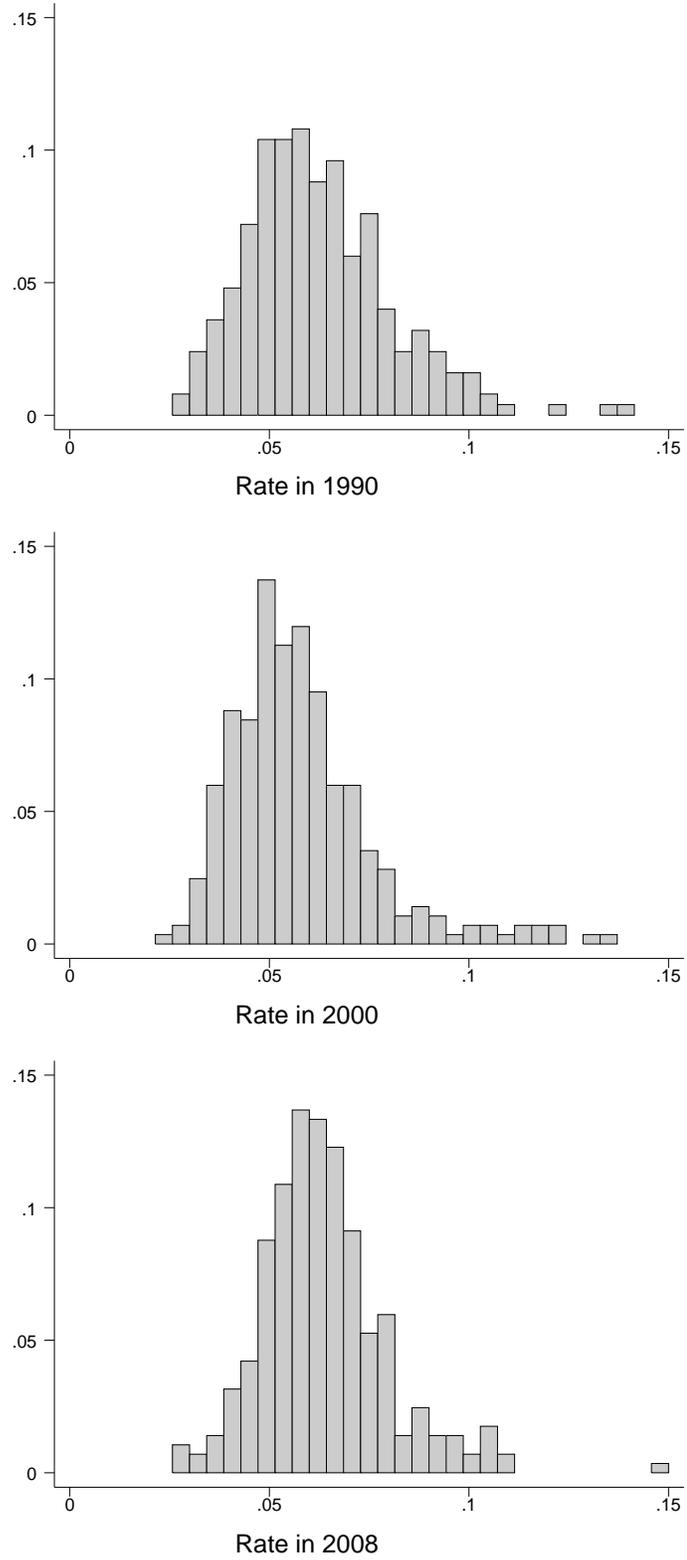
Adjusted unemployment rates are obtained from an individual level linear probability model regressing an indicator for unemployment on metropolitan area indicators and indicators for education, age, gender and race.

Figure 1: Unemployment Rates in 1990 and 2008, by Metropolitan Area



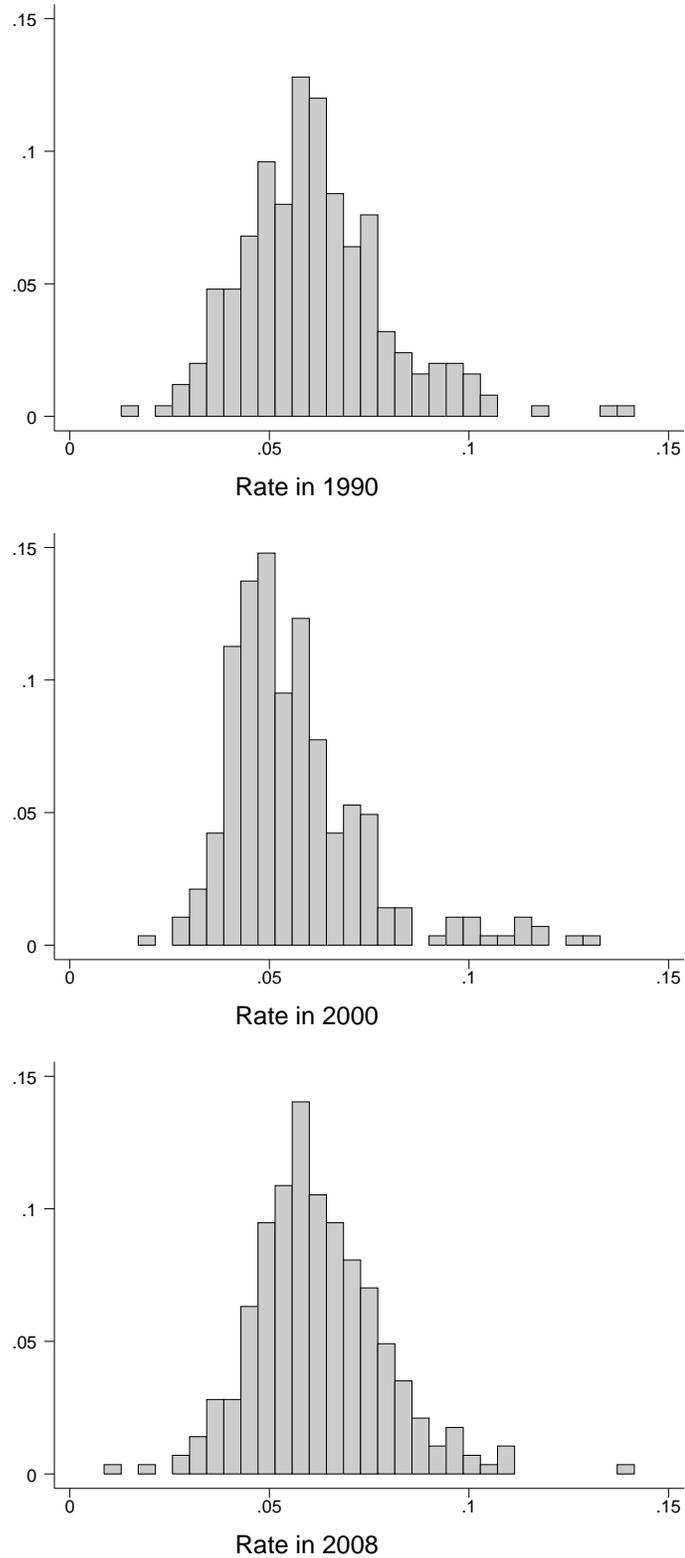
Notes: Data are from the 1990 Census of Population and the 2008 American Community Survey. The sample includes all individuals in the labor force between the age of 14 and 70.

Figure 2: Metropolitan Unemployment Rates in 1990, 2000 and 2008



Notes: Data are from the 1990 and 2000 Census of Population and the 2008 American Community Survey.

Figure 3: Metropolitan Unemployment Rates in 1990, 2000 and 2008 Adjusted for Age, Sex, Education and Race



Notes: Data are from the 1990 and 2000 Census of Population and the 2008 American Community Survey. Adjusted unemployment rates are obtained from an individual level linear probability model regressing an indicator for unemployment on metropolitan area indicators and indicators for education, age, gender and race.