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Regional Mismatch and Unemployment: Theory and Evidence from Italy, 1977-1998

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Abstract

This paper describes the functioning of a two-region economy characterized by asymmetric wage-setting. Labor market tightness in one region (the leading-region) affects wages in the whole economy. In equilibrium, net labor demand shifts towards the leading region raise unemployment in the rest of the economy and leave regional wages unchanged, causing an increase in aggregate unemployment. This model has some success in explaining the evolution of regional unemployment rates in Italy during the period 1977-1998. Based on SHIW micro data on earnings and ISTAT data on unemployment rates we find strong evidence that wages in Italy only respond to labor market tightness in the North. We estimate that around one third of the increase in aggregate unemployment in Italy can be explained by regional mismatch, mainly due to an excess labor supply growth in the South.

JEL Classification: E24, J23, J31

Keywords: Regional imbalances, Wage curve, Unemployment.

1. Introduction

Italian unemployment grew roughly monotonically between the late 1970s and the late 1980s, increasing from about 7% in 1977 to almost 12% in 1989, and remained roughly untrended thereafter. The rise in unemployment during the 1980s was mainly concentrated in the South. While Northern unemployment, lower for a start, stayed basically untrended, moving from approximately 6% in 1977 to 7% in 1998, Southern unemployment more than doubled in this 21-years span, increasing from 10% to 22% (see Figure 1). Shocks to aggregate labor demand, linked to the oil price shocks, the fall in the investment/GDP ratio and the fiscal adjustment implied by Maastricht criteria, as well as institutional rigidities, seem to have played a role (see Padoa-Schioppa 1999). However, such forces do not seem to have prevented the quasi full-employment in the North, while hitting seriously the Southern economy. It seems therefore that investigating the source and the characteristics of regional imbalances is the most natural way of understanding the dynamics of the Italian labor market, and the rise in its unemployment rate.

This is the approach of this paper, which aims at evaluating whether the unbalanced evolution of labor demand and supply across different geographical areas - which we refer to as regional mismatch - is partly responsible for the increase in aggregate unemployment.

The question of whether regional mismatch carries the responsibility for the rise in southern (and hence aggregate) unemployment has relevant policy implications and lies at the core of the current Italian debate on the performance of its labor market and the increased disparities between the North and the South. Implicitly, the above hypothesis is contrasted with the widespread view that exogenous changes in regional wage pressure - defined as any factor affecting regional wages at given unemployment - bear the main responsibility for the rise in Southern unemployment. Such view is reported in several studies on the Italian labor market (see, among others, Bodo and Sestito 1991 and Brunello et al. 2001), and has often motivated IMF policy recommendations for Italy. In particular, IMF (2000, p. 19) states that for given unemployment rates, labor costs declined considerably more in the Center-North than in the country as a whole. Labor demand, however, evolved quite similarly across the country [...] and this needs to be borne in mind in designing a wage policy to boost employment. Although it is indisputable that some rise in relative wage pressure did occur in the South (and we will report evidence on this), the point we make in this paper is that it cannot be blamed for the entire rise in Southern unemployment.

Since the early work by Lilien (1982), the study of labor market mismatch (along a number of dimensions) and its relationship with aggregate unemployment has been pursued actively by economists. Lilien (1982) interprets mismatch as sectoral turbulence, and argues that the variance of the sectoral growth rates in employment should adequately account for fluctuations in employment due to mismatch. He finds that the mismatch hypothesis has some success in explaining US employment data but his findings have been effectively criticized (Abraham and Katz 1986, Blanchard and Diamond 1989). Layard et al. (1991, chapter 6) follow a different approach and measure mismatch by the variance of sectoral unemployment rates. They conclude that, under the assumption that ``wage behavior in a sector is caused primarily by unemployment in that sector rather than by unemployment in some leading sector [...], mismatch has increased in no country [...] studied except Sweden.'

Italy makes no exception in the findings of Layard et al. (1991). A simple inspection of the data in Figure 1 shows why one might come to this conclusion: during the 1977-89

period, while unemployment diverged across Italian regions, wage differentials shrunk in favor of the South. Changes in relative wages across geographical areas correlate positively with changes in relative unemployment, casting some doubts on whether regional shifts in (net) labor demand can be held responsible for the increase in aggregate unemployment in Italy. However, as we will argue below, this conclusion is specific to the wage-setting model adopted in Layard et al. (1991). In particular, we show that alternative wage-setting hypotheses deliver quite different rationalizations of the available evidence on wage and unemployment differentials.

In order to investigate this issue, we provide a model of a two-region economy, in which wages nationwide only respond to the tightness of the labor market in the North. Such an asymmetric wage-setting model - for which we provide empirical evidence - may be motivated by the centralized structure of wage bargaining, which allows economic conditions prevailing in tighter markets to affect wages everywhere in the economy (see Fabiani et al. 2001). We show that, if this is the case, a shift in net labor demand towards the North generates rising unemployment in the South and stable wage differentials. The intuition is as follows: a rise in labor demand in the North tends to reduce local unemployment and, through wage setting, increase wage claims in the whole economy. Higher wage claims in turn reduce employment in both regions. As a result of the two effects, equilibrium unemployment remains unchanged in the North and increases in the South, thus aggregate unemployment increases. Regional wages, determined by Northern unemployment, remain unaffected by labor demand shifts. Observed changes in relative wages (see Fig. 1) can therefore only be rationalized by changes in regional wage pressure, but this by no means implies that wage pressure is the exclusive explanation for the rise in regional unemployment differentials and aggregate unemployment.

It is important to recognize that a leading-region model of wage determination is not necessary to deliver aggregate unemployment effects of higher regional mismatch. It is known since the seminal work of Lipsey (1960) that higher dispersion of local unemployment rates can negatively affect the aggregate performance of the labor market (a mechanism also exploited in later work by Layard et al. 1991 and Manacorda and Petrongolo 1999). However, this effect is second order insofar it relies crucially on the convexity of the wage curve, i.e. on the fact that wages are more sensitive to unemployment when the labor market is tighter. In our model, by contrast, regional imbalances in labor demand have first order effects on aggregate unemployment, independently of any non-linearity in wage setting.

By studying the effects of regional mismatch when the wage-setting process is asymmetric, this paper brings together two strands of literature. The idea that wage claims in Italy are mainly driven by the unemployment conditions prevailing in the North has received wide support in empirical studies of the Italian labor market (see Bodo and Sestito, 1994, Casavola et al. 1995, and Brunello 2000). Also, pronounced unemployment disparities between the North and the South of Italy have prompted several authors to investigate the determinants and the consequences of such disparities on aggregate performance (see Attanasio and Padoa-Schioppa, 1991, Brunello et al. 2000, 2001, and references therein). The novel contribution of this paper is to investigate the consequences of regional shocks in the demand and the supply of labor when wages nationwide respond to labor market conditions in the North.

In doing this, we treat regional changes in labor supply and thus interregional migration as exogenous. The effects of endogenous labor migration, eventually equalizing geographical differences in expected income, have long been recognized (Harris and Todaro 1970 and Hall 1970) and embodied in the long-run equilibrium of more recent models of regional mismatch (Pissarides and Wadsworth 1987 and Jackman et al. 1991). However, in empirical terms exogenous regional labor force does not seem an unrealistic assumption for Italy where, even in the face of persistent and increasing

differences in expected income across regions, internal migration has declined steadily (see, among others, Attanasio and Padoa-Schioppa 1991, and Faini et al. 1997). This suggests that migration costs must be substantial. We discuss this issue further in Section 4.

The organization of the paper is as follows. Section 2 proposes a model of a two-region economy, with a leading-region wage setting mechanism, and illustrates the effects of regional mismatch on aggregate unemployment. Section 3 estimates a regional wage equation for Italy over the period 1977-1998, using micro data from the Bank of Italy Survey of Households' Income and Wealth. We find that, conditional on a set of individual attributes and regional trends, wages nationwide respond to the unemployment rate in the North. In Section 4 we assess the impact of regional mismatch and regional wage pressure on aggregate unemployment, using the framework of Section 2. Sections 5 discusses our main findings and Section 6 concludes.

2. The theoretical framework

In this section we develop a simple two-region model of the labor market, which illustrates how regional demand and supply shocks affect the aggregate unemployment rate when wage setting is asymmetric. By asymmetric wage setting we mean a scenario in which the labor market conditions prevailing in one of the two regions (the so-called leading region, which is generally the low-unemployment one) affect wage claims throughout the economy. A comparison of the predictions of this model with one characterized by symmetric wage setting is given in Section 2.6.

2.1 The economy

The economy consists of region 1 (the leading region) and region 2 (the secondary region), each endowed with a large number of identical firms and a homogeneous labor force. Firms in each region produce a homogeneous regional good employing local labor, and sell it in competitive markets. Individuals in each region supply labor inelastically and have identical preferences defined over consumption of both regional goods.

Individuals are either employed or unemployed. If employed, they earn a wage determined in their regional labor market; if unemployed, they earn some unemployment income, financed with a lump-sum tax on the wage of the employed. For the sake of simplicity, but with no loss of generality, we normalize unemployment income (and consumption) to zero.

Goods are perfectly mobile, as each regional product is traded in the whole economy, but both workers and firms are immobile.

Equilibrium in regional labor markets is determined by the interaction between a labor demand schedule (stemming from profit-maximizing decisions of firms) and a wage-setting schedule relating wages bargained to unemployment. Wage-setting is asymmetric in the sense that the unemployment rate in region 1 drives wage claims in both region 1 and region 2. Assume, as it seems reasonable, that consumers are indifferent as to whether a given good is produced in region 1 or region 2 (i.e. type 1 goods produced in region 1 are perfect substitutes for type 1 goods produced in region 2).

Regional demand and supply shocks affect both regional and aggregate unemployment due to regional specialization in production. The assumption of complete regional specialization stems from regional comparative advantages in the presence of

constant returns to labor. Let's imagine that region 1 has a comparative advantage in the production of good 1, and that initially each region produces both goods. Labor is freely mobile across sectors within regions, but immobile across regions, and products are freely mobile across the whole economy. This implies that workers in each region are paid the same wage, independent of the sector in which they are employed, and that the price of each good is homogeneous across regions. In this case, even slight comparative advantages would drive the equilibrium in each region towards a corner solution in which only one good is produced.[1]

2.2 Labor demand

The first building block of our model is a labor demand schedule for each region, which is derived from profit maximization at the firm level. Firms in each region employ local labor and sell their output in the whole economy. We characterize equilibrium in the market for each regional good, and from this we derive the labor market schedule in each region.

The demand for regional goods is determined by the solution to the optimization problem of the representative worker in each region. Individuals in region r $(r = 1,2)$ have constant-returns Cobb-Douglas preferences defined over consumption of goods produced in each region, c_{1r} and c_{2r}, and solve the following consumer problem

$$(1) \qquad \begin{aligned} &\max_{c_{1r},c_{2r}} V_r(c_{1r},c_{2r}) = c_{1r}^{\alpha_1} c_{2r}^{\alpha_2} = c_{1r}^{\alpha} c_{2r}^{1-\alpha} \\ &\text{s.to } p_1 c_{1r} + p_2 c_{2r} \le w_r, \quad r = 1,2 \end{aligned}$$

where the parameters $\alpha_1 \equiv \alpha$ and $\alpha_2 \equiv 1-\alpha$ represent consumer tastes for the two regional goods, p_1 and p_2 represent their prices, and w_r represents regional wages.[2] Note that preferences are identical across regions. The first-order conditions to the maximization in (1) are:

$$(2) \qquad \begin{aligned} p_1 c_{1r} &= \alpha w_r \\ p_2 c_{2r} &= (1-\alpha) w_r, \quad r = 1,2, \end{aligned}$$

from which it follows that α and $1-\alpha$ represent the expenditure shares for each good for households in both regions:

$$(3) \qquad \alpha = \frac{p_1 c_{1r}}{p_1 c_{1r} + p_2 c_{2r}}, \quad 1-\alpha = \frac{p_2 c_{2r}}{p_1 c_{1r} + p_2 c_{2r}}, \quad r = 1,2.$$

On the production side, we assume that both goods are produced according to a linear technology that uses only labor as a factor of production. Denoting by Y_{jr} the

[1] This result is based on the (reasonable) assumption that consumers are indifferent as to whether a given good is produced in region 1 or region 2 (i.e. type 1 goods produced in region 1 would be perfect substitutes for type 1 goods produced in region 2).

[2] To check the robustness of our results to the parametric specification of preferences, in Appendix A we allow for CES preferences, with an arbitrary value of the elasticity of substitution between c_{1r} and c_{2r} and we estimate the impact of regional mismatch as σ ranges between 0 and 2.

output of firm j in region r, the firm level production function is $Y_{jr} = A_r N_{jr}$, where N_{jr} denotes firm-level employment and A_r denotes the local state of technology. Aggregation across firms gives regional output:

$$(4) \qquad Y_r = A_r N_r, \quad r = 1,2,$$

where $N_r = \sum_j N_{jr}$.

Market clearing in region 1 and region 2 implies $Y_1 = c_{11}N_1 + c_{12}N_2 = c_{11}\left(N_1 + \frac{c_{12}}{c_{11}}N_2\right)$, and $Y_2 = c_{21}\left(N_1 + \frac{c_{22}}{c_{21}}N_2\right)$ respectively, i.e. the production of each good must equal its consumption in the whole economy. Given the first order conditions in equation (2), $c_{11}/c_{12} = c_{21}/c_{22} = w_1/w_2$, which, combined with market-clearing, implies $c_{11}/c_{21} = c_{12}/c_{22} = Y_1/Y_2$. Substituting this into (3) allows to rewrite α and $1-\alpha$ as shares of regional products in national output:

$$(5) \qquad \alpha = \frac{p_1 Y_1}{p_1 Y_1 + p_2 Y_2}, \quad 1-\alpha = \frac{p_2 Y_2}{p_1 Y_1 + p_2 Y_2}.$$

Profit maximization of firms gives $w_r = p_r A_r, \quad r = 1,2,$ which implies that α and $1-\alpha$ also represent the shares of regional labor income in the total wage bill:

$$(6) \qquad \alpha = \frac{w_1 N_1}{w_1 N_1 + w_2 N_2}, \quad 1-\alpha = \frac{w_2 N_2}{w_1 N_1 + w_2 N_2}.$$

In this stylized model, one can therefore read off changes in preferences for goods produced in each region by simply looking at the wage bill share of its workers. It is easy to see why this is the case: α is the share of workers' expenditure on goods produced in region 1, irrespective of where they reside. Because of perfect competition, this is also the share of revenues over national output accruing to firms in region 1. Because of linear technology, this is in turn equivalent to the share of the wage bill accruing to workers residing in region 1. Similarly for region 2.

Finally, because preferences are identical across regions and homogeneous of degree 1, and the total wage bill is entirely spent on consumption, in equilibrium total expenditure equals total utility, or $w_1 N_1 + w_2 N_2 = (A_1 N_1)^{\alpha}(A_2 N_2)^{1-\alpha}$.[3] Embodying this last expression into equation (6), one can derive a labor demand schedule in logarithms

$$(7) \qquad \begin{aligned} \ln w_1 &= \ln\alpha - \ln N_1 + \alpha\ln(A_1 N_1) + (1-\alpha)\ln(A_2 N_2) \\ &= \ln\alpha + \alpha\ln A_1 + (1-\alpha)\ln A_2 - (1-\alpha)\ln\frac{1-u_1}{1-u_2} - (1-\alpha)\ln\frac{l}{1-l} \end{aligned}$$

for region 1, and similarly for region 2, where u_1 and u_2 denote the unemployment rates of the leading and the secondary region, respectively, and l and $1-l$ denote the corresponding labor force shares.

---

[3] Note that $p_1 c_{1r} + p_2 c_{2r} = c_{1r}^{\alpha} c_{2r}^{1-\alpha}$ implies $\alpha = (p_1 c_{1r})/\left(c_{1r}^{\alpha} c_{2r}^{1-\alpha}\right)$. Given the market clearing condition this in turn implies $\alpha = (p_1 Y_1)/\left(Y_1^{\alpha} Y_2^{1-\alpha}\right) = (w_1 N_1)/\left[(A_1 N_1)^{\alpha}(A_2 N_2)^{1-\alpha}\right]$

Note finally that equation (7) describes a downward sloping labor demand schedule, i.e. a positive relationship between w_r and u_r, $r = 1,2$, despite the absence of diminishing returns to labor in production. In our model, such relationship stems from the consumption response of a change in regional wages. If, say, w_1 rises, p_1 also rises (given $p_1 = w_1 / A_1$): as good 1 is now more expensive c_{11} and c_{12} fall, therefore Y_1 falls and u_1 rises. In other words, a rise in local wages translates into a rise in the price of locally produced goods, and this tends to harm local employment.

2.3 Regional mismatch

Region-specific demand and supply variables are represented by α and l respectively. They are relative indicators and therefore are meant to isolate purely regional shocks from aggregate changes. As mentioned in Section 2.1, we treat labor force changes as exogenous, i.e. we do not allow for differences in employment prospects to affect migration or labor force participation.

A measure of mismatch across regions is given by the index

$$D_{12} = d\ln\frac{\alpha}{1-\alpha} - d\ln\frac{l}{1-l} = -D_{21}. \tag{8}$$

This is an indicator of relative shifts in the demand for goods (workers) produced (employed) in the two regions, net of relative labor supply shifts. It has the desirable property of having the same absolute magnitude and opposite signs for the two regions.[4] A convenient approximation to our index is

$$D_{12} \cong d(u_2 - u_1) + d\ln\frac{w_1}{w_2}, \tag{9}$$

deriving from the first order Taylor approximation $\ln(1-x) \cong -x$, valid for x close enough to zero. We expect that a shift in net relative demand towards region 1 (region 2) will either reduce its unemployment rate relative to region 2 (region 1), or raise its relative wages, or both. We show below that when we close the model with a wage setting schedule for each region, wages are unaffected by net demand shifts, and regional shifts in demand favoring the leading region fully translate into a rise in unemployment in the secondary region.

2.4 Wage-setting

[4]Previous concepts of mismatch (see Jackman et al. 1991) focus on the dispersion of relative unemployment rates, rather than on the direct evolution of sectoral demand and supply of labour. By focusing on the (endogenous) unemployment dispersion, the LNJ index does not distinguish pure demand and supply imbalances from adjustments in relative wages and unemployment rates due to different sources. Some later work (Nickell and Bell 1995) focused directly on demand/supply measures, but used absolute rather than relative measures of mismatch, given by $d\ln(\alpha / l)$, which would not necessarily have the same absolute magnitude and opposite signs for the two groups of workers considered. A relative measures of mismatch, similar to the one adopted in this paper, is used by Manacorda and Petrongolo (1999).

As far as wage setting is concerned, we consider a downward-sloping relationship between wages and unemployment.[5] In particular, we adopt the following double-logarithmic specification

(10) $\ln w_r = z_r - \gamma \ln u_1, \quad r = 1,2,$

where wages set in the whole economy respond negatively to the unemployment rate of the leading region (region 1). Wage pressure, defined as any residual factor affecting wages at given unemployment, is denoted by z_r, and is allowed to vary across regions.

2.5 Equilibrium

Equilibrium unemployment and wages are determined by labor demand (7) and wage setting (10).

Let us define the change in aggregate wage pressure at constant factor shares as $dz = \alpha dz_1 + (1-\alpha) dz_2$; and similarly the change in labor productivity at constant factor shares as $d\ln A = \alpha d\ln A_1 + (1-\alpha) d\ln A_2$. By total differentiation of equations (7) and (10) we obtain the equilibrium change in local unemployment rates:

(11) $$du_1 = \frac{u_1}{\gamma}\left(dz - d\ln A - \ln \frac{Y_1}{Y_2} d\alpha \right).$$

(12) $$du_2 = \frac{u_1(1-u_2)}{\gamma(1-u_1)}\left(dz - d\ln A - \ln \frac{Y_1}{Y_2} d\alpha \right) + (1-u_2)(dz_2 - dz_1) + (1-u_2) D_{12}$$

Equations (11) and (12) illustrate the effect of any exogenous shock on the unemployment rate of each region.

Aggregate shocks, measured as the excess aggregate wage pressure dz over the feasible average wage growth, raise unemployment in both regions. Note that the feasible growth in the average wage is measured by the average increase in labor productivity, $d\ln A$, plus the welfare effect that each region enjoys for a change in tastes towards the good produced in the leading region (i.e. $d\ln V_r = \ln(c_{1r}/c_{2r}) d\alpha = \ln(Y_1/Y_2) d\alpha$, $r = 1,2$).

The wage pressure differential $dz_2 - dz_1$ raises unemployment in region 2, while leaving unemployment in region 1 unaffected. The intuition is the following: a rise in $dz_2 - dz_1$ first generates higher relative wages in region 2 and, other things equal, an increase in u_2 and a fall in u_1. The second-round effect involves a generalized rise in wage claims, via the fall in u_1 (equation), raising both unemployment rates. In equilibrium u_1 stays unchanged and u_2 increases.

[5]The existence of a inverse relationship between wages and unemployment is largely acknowdged in empirical research (Blanchflower and Oswald 1994 and Card 1995), although no single microfoundation is to date recongnized as superior to others. It is not in the scope of this paper to investigate such microfoundations. It has been argued that a downward sloping relationship between wages and unemployment may stem from wage bargaining (Manning 1993), efficiency wages (Shapiro and Stiglitz 1984), or search frictions (Pissarides 2000). See Card (1995) for a discussion.

Finally, a net demand shift towards region 1 ($D_{12} > 0$) also raises unemployment in region 2 and leaves unemployment in region 1 unchanged. Again, the negative effect on u_1 ($du_1 < 0$) of a net demand shift towards region 1 ($D_{12} > 0$) turns out to be perfectly offset by the resulting rise in wage claims everywhere in the economy. The leading region is thus fully sterilized from sectoral shocks.

The aggregate unemployment rate u is given by a weighted average of regional unemployment rates: $u = lu_1 + (1-l)u_2$. The change in u is therefore

$$
\begin{aligned}
du &= (u_1 - u_2)dl + ldu_1 + (1-l)du_2 \\
&= (u_1 - u_2)dl + \frac{u_1(1-u)}{\gamma(1-u_1)}\left(dz - d\ln A - \ln\frac{Y_1}{Y_2}d\alpha \right) \\
&\quad +(1-l)(1-u_2)(dz_2 - dz_1) + (1-l)(1-u_2)D_{12}.
\end{aligned} \tag{13}
$$

The term in dl is a compositional effect, due to the inter-regional migration of the labor force. It tends to have a negative impact on aggregate unemployment if there are net migration flows towards the leading region, which is plausibly the low-unemployment one. Aggregate unemployment increases when aggregate wage pressure rises over the feasible real wage, when wage pressure in the secondary region grows faster than in the leading one, and when net demand shifts towards the leading region. The last two effects are solely induced by the unemployment response in the secondary region.

As far wages are concerned, it follows from equations (10) and (11) that

$$
d\ln w_r = dz_r - dz + d\ln A + \ln\frac{Y_1}{Y_2}d\alpha, \quad r = 1,2 \tag{14}
$$

i.e. in equilibrium wages only depend on deviations of regional wage pressure from its feasible trend, and are unaffected by net relative demand shocks.

It is instructive to summarize the equilibrium conditions for unemployment and wage differentials in the following two equations:

$$
du_2 - du_1 = D_{12} - d\ln\frac{w_1}{w_2} \tag{15}
$$

$$
d\ln\frac{w_1}{w_2} = dz_1 - dz_2, \tag{16}
$$

which hold locally for low enough values of the unemployment rates. From equations (15) and (16), relative wages are only affected by relative wage pressure; while relative demand shifts only affect unemployment differentials. One could therefore infer the impact of demand and supply shifts over the unemployment differential by simply parsing out actual relative wage changes from actual changes in the unemployment differential. The effects of a net demand shift towards region 1 is illustrated graphically in Figure 2.

2.6 A comparison with the symmetric wage setting model

The model of the previous sections implies starkly different predictions from a symmetric wage setting model, in which regional wages only respond to the state of the local labor market. The model is discussed in length in Layard et al. 1991 and Manacorda and Petrongolo 1999 (where it is applied to skills mismatch). Here we simply report the main implication of this model, namely that if local wages only depend on local unemployment, any net relative demand shift in favor of the North ($D_{12} > 0$) would still increase Southern unemployment, but would at the same time reduce Northern unemployment. Increasing dispersion of local unemployment rates would then imply an increase in aggregate unemployment due to the convexity of the wage curve. The model would still account for rising unemployment differentials, but its potential to explain changes in aggregate unemployment would be dampened.

Unlike in the symmetric wage-setting model, where regional imbalances affect the aggregate unemployment through higher dispersion along a convex wage-setting function, the curvature of the wage function does not play a key role when wage setting is asymmetric. In this case, the effect of regional mismatch on aggregate unemployment simply depends on the magnitude of the unemployment response in region 2.

3. The wage equation

3.1 The data

Having ascertained that, under asymmetric wage setting, aggregate unemployment is affected by shifts in net demand towards the leading region, we now turn to the empirical analysis of Italian wage setting. Specifically, we estimate a wage equation for Italy, using information from two data sets for the period 1977 to 1998. Regional employment and labor force data are those published by the Central Statistics Bureau (ISTAT, *Annuario Statistico Italiano*, various issues). Data on wages are obtained from the individual records of the Bank of Italy Survey of Households' Income and Wealth (SHIW), a repeated cross sectional survey.[6] The survey has been run continuously from 1977 to 1984, then in 1986, 1987 and in every other year thereafter until 1995. There was no survey in 1997 but the survey was run again in 1998.

The SHIW is the only Italian publicly available source of micro data on earnings that spans over this long period. We use all the available waves from 1977 to 1998.[7] Over this sample period the survey covers 183,382 individuals. We restrict to employees with a reported wage, aged 18-65. By restricting to employees only, our sample drops from 183,382 to 67,222 observations while by further restricting to those aged 18-65 the sample size falls to 66,092 observations. Note finally that the SHIW only provides information on yearly earnings net of taxes and social security contributions, and inclusive of overtime payments and bonuses. We therefore only include full-year employees, which

[6]The SHIW does not allow to compute ILO unemployment rates, as the only available information on labor market status is whether an individual ever worked during the year preceding the survey. For further details on the SHIW, see Cannari and Gavosto (1994) .

[7]We exclude the 1987 wave, when the variable denoting the region of residence is coded at a somewhat less detailed level.

leaves us with a final sample of 57,446 observations. Finally, earnings are deflated using the national consumer price index with base 1977.

One of the main advantages of the data set we use is that it provides individual information on gender, age, education of workers, and region of residence. Since most of the increase in (Southern) unemployment was concentrated among the less educated, the youngest and female workers, it seems appropriate to control for the varying composition of employment along these dimensions. Failure to do so might induce spurious correlation between regional unemployment and wages, simply due to the circumstance that where unemployment increases among the less skilled, the average wage increases as well, even at fixed individual wages.

Table 1 provides some descriptive statistics of our sample. Worker characteristics are computed as averages over the sample period, at the beginning, and at the end of the sample. Compared to the South, employees in the North are on average younger, less educated, and include a higher proportion of women, arguably reflecting the circumstance that Southern unemployment is concentrated among these groups. Trends in these characteristics are similar across areas, with an overall increase in educational attainment and in female participation. It is difficult to detect any clear trend in the age composition of employment: if any, there is evidence of a greater rise in the number of prime age workers in the South than in the North. Northern workers earn on average higher wages than Southern workers despite the fact that workers in the North are on average younger and less educated than those in the South. The raw differential is in the order of 12 percentage points in 1977 and falls to about to 6 percentage points in 1998.

3.2 Estimation

Existing evidence on wage curves supports the idea of a strongly asymmetric wage setting mechanism for Italy. Bodo and Sestito (1994) use average contractual wage rates for blue collars in manufacturing for the period 1960-1991, and find that the evolution of the unemployment rate in the North explains changes in wages both in the North and in the South. Very similar results are obtained on firm-level data on average earnings for blue collars for the period 1985-1990. Casavola et al. (1995) estimate various specifications of a wage equation for Italy on a sample of small firms over the period 1986-1993 and find that firm-level wages in the South are not affected by the local unemployment rate, and only weakly affected by the local male unemployment rate. The wage-setting role of the North is also emphasized by Brunello et al. (2000), who estimate a reduced-form equation for the Italian NAIRU on aggregate data. The drawback of these studies is that they fail to control for individual worker characteristics.

Blanchflower and Oswald (1994, chapter 7) use micro data from the International Social Survey Programme for the years 1986 and 1989 and control for observable individual characteristics. They find that wages in Italy are responsive to local labor market conditions but this result disappears when regional fixed effects are included. It is clear that omission of regional dummies simply allows to capture the negative cross-sectional correlation between local unemployment rates and wages. Where unemployment is higher (in the South), wages happen to be lower on average.

In order to test for an asymmetric model of wage determination, we estimate a wage equation of the form

$$(17) \qquad \ln w_{irt} = \theta_r + x'_{irt}\beta + g_r(t) - \gamma \ln u_{*t} + e_{irt},$$

where i indexes individuals, r regions and t years. Clearly $i \in r$, where $r = 1$ (North) , or $r = 2$ (South)[8]. We adopt alternative measures of the unemployment rate u_{*t} : local unemployment u_{rt}, Northern unemployment u_{1t}, and Southern unemployment u_{2t}. All specifications include regional fixed effects (θ_r) and control for a number of observable characteristics (x_{irt}), namely sex, age and education. In order to account for regional wage pressure, we include a macroeconomic effect $g_r(t)$ which is allowed to vary across regions, and is modelled as a cubic time trend.

While the twofold regional aggregation adopted greatly simplifies our empirical analysis and closely resembles the model of Section 2, one might worry that some relevant variation in the data is lost, in turn affecting the precision of our estimates. To address this point, we simply look at what portion in the variation of a more disaggregate measure of regional unemployment and wages can be explained by the North/South divide. We therefore regress the unemployment rate in ten Italian regions (see footnote 7) on a constant, a dummy for North, an unrestricted time effect and an interaction of the North dummy with year dummies. The regression gives an R^2 of 90%, suggesting that differences between the North and the South pick most of the variation in regional unemployment rates. A similar exercise on log wages gives an R^2 of almost 70%. This suggests that little information is lost by moving from a ten-fold to a two-fold regional classification.

Estimation of equation (17) is performed on individual data using a GLS procedure, with weights given by the SHIW sampling weights. The presence of variables measured at different levels of aggregation on the two sides of the wage equation may induce a downward bias in the estimated standard errors. To avoid this problem, we allow for an arbitrary variance covariance structure of the disturbances within each group of observations, defined at the same level of aggregation as the unemployment variable, and correct the estimated standard errors accordingly. So, for example, if the relevant unemployment rate is the leading-sector, we cluster the error term by year, while if the relevant unemployment rate is the local one, we cluster the error term by year and region.

Estimation results are reported in Table 2. Column I estimates a leading-region wage-setting model in which Northern unemployment is included as a regressor: in this specification the unemployment variable has the expected negative impact on wages. The elasticity of wages with respect to Northern unemployment is about 12% and statistically significant at conventional levels. All others coefficients have the expected sign: women earn systematically less than men, and earnings rise with age and education. In column II we report the estimate for the symmetric wage-setting model, in which wages may respond to variations in the local unemployment rate. The coefficient on local unemployment is small, just below 6%, and not significantly different from zero. Finally, Southern unemployment is included in the specification of Column III, delivering a positive but non significant coefficient.

The specification of column I, in which the North is the leading region, is the only one which delivers an estimate of the unemployment elasticity of wages that has the expected sign. At the same time, the results of columns II and II lend some additional support to the idea that wages nationwide depend on the unemployment rate in the North. Consistently with an asymmetric wage setting model, in equilibrium Southern wages depend on local unemployment along a labor demand curve: a rise in wages nationwide induced by exogenous changes in Northern unemployment implies a reduction in labor demand and therefore a rise in Southern unemployment, thus explaining the positive unemployment

[8] includes: (1) Piedmont - Val d'Aosta - Liguria, (2) Lombardy, (3) Trentino Alto Adige - Veneto - Friuli Venezia Giulia, (4) Emilia Romagna, (5) Tuscany - Umbria - Marches, (6) Latium. includes: (7) Campania, (8) Abruzzi - Molise - Apulia, (9) Basilicata - Calabria, (10) Sicily -Sardinia.

coefficient in column III. Since wages in the North are negatively affected by Northern unemployment while wages in the South are positively correlated to Southern unemployment, on average wages do not respond to the state of the local labor market, consistently with the estimates of Column II.

We have performed several robustness checks on our analysis (not reported in the paper). First, we have run the same regressions as in Table 2 on data grouped within cells defined by the interaction of sex, age, education and region. This tests the robustness of our results to different levels of aggregation of the dependent variable. Second, we have experimented with alternative parameterizations of the wage pressure term, by including a quadratic and quartic polynomial trend in turn. Third, we have estimated the same equations as in Table 2 allowing for a ten-fold regional classification, as a opposed to a two-fold one. Fourth, we have included industry and occupational dummies as additional regressors. This ensures that our estimated coefficient on the relevant unemployment rate is not simply picking the effect of changes in the industrial or occupational structure across regions. Fifth, we have included the region Latium in the South instead of North. Finally, we have tried to account explicitly for selection into employment using a Heckman (1979) two-stage selection model for participation in employment (identified by household structure). The results in Table 2 turned out to be robust to all these different specification checks.

Consistently with most of previous work in this area, the results of this section confirm the existence of an asymmetric wage setting model for Italy: unemployment rates in the North shape wage claims throughout the economy. With respect to the existing evidence, we have extended the analysis of the Italian wage curve until 1998, and showed that this relationship is robust to the inclusion of individual controls and regional fixed effects.

4. Results

We next assess the impact of regional mismatch and relative wage pressure on the evolution of aggregate unemployment in Italy using the stylized model of Section 2. We have argued that, in addition to aggregate forces (that we label aggregate wage pressure) plus compositional effects, two sources of regional imbalances can in principle be held responsible for in the rise in aggregate unemployment: rises in net labor demand in favor of the North and rises in relative wage pressure in favor of the South. We now calibrate of the model using the data at hand and try to assess the importance of these two factors.

In Table 3 we report the levels and the annual growth rates of the relevant variables for the North (first row), the South (second row), and their difference (bottom row). Over the whole sample period, workers in the North account on average for about 70% of the employed population (column I), 68% of the labor force (column II) and 71% of the wage bill (column IV). Also, wages are on average higher in the North than in the South (column III). Estimated trends in these variables illustrate that relative employment has been rising in the North and falling in the South (column V) with a growth of about 0.4 percentage points a year in the North-South differential. Differences in relative supply go in the opposite direction (column VI): labor supply increases more in the South than in the North, with a fall of approximately 0.2 percentage points a year in the North-South differential. Finally, wage differentials fall by about 0.3 percentage points a year in favor of the South (column VII). Since relative wages and relative employment move in opposite directions, the rate of growth of relative demand (column VIII) is essentially zero. However, since supply grows more in the South than in the North, demand *net* of supply grows in the North relative to the South, with a trend of almost 0.3 percentage points a year (column IX).

With these estimates at hand, we can evaluate the effect of regional mismatch and relative wage pressure on Southern and aggregate unemployment, as implied by equations (12) and (13), respectively. This exercise is performed in Table 4. Clearly, as equation (11) shows, no change in Northern unemployment can be explained by imbalances between the two regions. In our model, the northern leading region is fully sterilized from sectoral shocks.

Column I reports the coefficient on the net demand index D_{12} and the relative wage pressure term $dz_1 - dz_2$, which is simply the time average of $1-u_2$ (see equation (12)). Shifts in demand, supply, net demand and relative wage pressure are obtained from Table 3 and reported in columns II-V of Table 4 for convenience. Columns VI to VIII report the estimated effect of each of these forces on Southern unemployment, which are obtained by multiplying the values in column II to V by the coefficient in column I. Regional mismatch, reported in column VIII, is responsible for an increase in Southern unemployment of about 0.25 percentage points a year, which accounts for 40% of the actual rise from 10% in 1977 to 22% in 1998. Because there is virtually no change in relative demand over this period, the effect of mismatch is almost exclusively attributable to shifts in relative labor supply (column VI). Column IX reports the effect of relative wage pressure that accounts for a rise in Southern unemployment of about 0.32 percentage points a year, i.e. around 53% of the total rise in unemployment in the South. The difference between the actual growth in southern unemployment, reported in column XI, and the estimated effect of net demand shifts plus changes in relative wage pressure is reported in column XII. As equation (11) shows, this term accounts for the effect of aggregate wage pressure (plus measurement and labor market errors). The effect of the excess wage growth over feasible wage growth accounts for a mere 0.05 percentage points change a year in southern unemployment, i.e. around 7% of the actual change.

In the second row of the Table we report the effect of the same shifts on aggregate unemployment. Clearly, the impacts of mismatch and regional wage pressure are equal to southern changes, weighted by the time average of the corresponding labor force share $1-l$ (see equation (12)), which is equal to 0.319, as reported in Table 3. An additional term is included in the Table (row X), representing the compositional effect due to changes in labor force in the North relative to the South. Regional mismatch predicts an annual rise in aggregate unemployment of about 0.08 percentage points, adding to roughly 1.7 percentage points over the whole sample period. This accounts for approximately one third of the actual increase in aggregate unemployment from 7% in 1977 to 12% in 1998. Changes in regional wage pressure account for a rise of about 0.1 percentage points a year in aggregate unemployment, around 43% of the total actual change. Compositional effects also contribute to the rise in aggregate unemployment, since labor force rises in the South relative to the North (where unemployment is on average lower). The contribution of this compositional effect though is very small, in the order of 6% of the total. The residual 20% is explained by aggregate wage pressure.[9]

Although the table makes no specific calculation for Northern unemployment, one can easy see from equation (12) that changes in the unemployment rate in the North can only be explained by aggregate wage pressure. Using the estimate of the aggregate wage pressure term from equation (13) which is reported in the first row, column XI of table 4, and multiplying this term by $(1-u_1)/(1-u_2)$ this leads to an estimate of the effect of aggregate wage pressure on northern unemployment of about 0.050 percentage points a years which is very close to the actual change of 0.058 percentage points a year.

Overall our data suggest that a substantial proportion of the rise in aggregate unemployment can be explained by a shift in net demand for labor in favor of the North

[9]Clearly, the bulk of the increase in unemployment took place before 1989 (see Figure 1). Therefore most of the explanatory power of the regional mismatch story also refers to the 1977-1989 sub-period.

over the period of observation. Such a shift is mainly explained by changes in relative supply. Although we do not dispute that the exogenous rise in wages at the South relative to the North had a significant - and quantitatively large - effect on changes in aggregate unemployment (in the order of 43%), we attribute to regional mismatch about 33% of the total rise in aggregate unemployment in Italy between 1977 and 1998. Interestingly, we also conclude that aggregate shocks (aggregate wage pressure) explains only around 20% of the total rise in unemployment in Italy between 1977 and 1998.[10]

5. Discussion

Two natural questions arise in the light of our results. First, what are the economic forces that raised net labor demand in the North relative to the South? And, second, why did regional imbalances show such a degree of persistence? Several and non mutually exclusive explanations can be put forward.

The answers to the first question lie in a number of adverse shocks that hit Southern Italy more heavily than the North since the 1970s. In particular, it is argued that the effects of the two oil price shocks were particularly severe in the South, where energy-intensive sectors covered a larger employment share than in the North. Moreover, the dismantling of state owned enterprises that started in the 1980s had stronger effects on Southern regions, which relied more heavily on public employment (see Faini 1999). Finally, labor supply in the South increased relative to the North, due both to lower migration flows from the South to the North and to higher population growth in the South.

In order to get a sense of the relative importance of migration and population growth in explaining changes in regional labor supply, we have decomposed changes in the North/South relative labor force into three terms: changes in internal migration rates, changes in labor force participation, and residual changes due to mortality and natality (plus migration to and from abroad). Our back-of-envelope calculations show that changes in internal migration can explain up to 60% of the actual change in relative labor supply over the period of analysis (-0.159 percentage points a year), while differences in natality and mortality account for around 70% of the actual fall in supply (-0.193 percentage points a year). Clearly, the sum of these changes predicts a stronger fall in relative labor supply than that actually observed (-0.271). This happens because labor market participation fell in the South relative to the North (by 0.081 percentage points a year), which partly offset the rise in population there.[11]

Concerning the persistence of regional imbalances, the general view on mismatch is that it is a short-run phenomenon (see - among others - Layard et al. 1991, chapter 6). Any imbalance in demand relative to supply should disappear in the long-run, either because labor migrates from the South to the North, reducing labor supply in the South, or because increased supply eventually creates its own demand by attracting more firms in the South and changing the North/South output mix.

Several factors may explain why regional mismatch could not trigger substantial labor migration towards the North. Among these, a reduction in nominal wage differentials, an increase in the housing price differentials, and an increase in income taxation progressiveness to the detriment of the North may have played an important role (see Attanasio and Padoa-Schioppa 1991). In addition, the sort of enclave mechanism which

[10]This result however is somewhat sensitive to our specification of preferences. In the appendix we illustrate how departures from the Cobb-Douglas assumption may potentially affect our results, which suggests that the point estimates of this section should be treated with some caution.

[11]In order to make these computations we have used data on net migration rates between the South-West and the rest of the country, and between the North-West and the rest of the country in 1970, as provided by Attanasio and Padoa-Schioppa (1991), Table 6.4.

pulled workers from the countryside in the South to the big industrial gateways in the North, where family or friends already lived and worked, came to an end as the manufacturing sector started to experience its secular decline in the 1970s, and the Government increasingly supported the Southern regions in the form of disability pensions and public sector jobs. A further explanation lies in the role of family ties and intergenerational transfers. In the (near) absence of unemployment benefits, the male head of the household, who is working or in many cases receiving state transfers in the form of pensions, acts as a medium of redistribution to the unemployed youths. As the evidence goes, youths in Italy live long with their families (see ISTAT 1995) and keep relatively high pattern of consumption, often made possible by the economies of scale of a shared housing. Young unemployed workers in the South may not be willing to give up such a level of consumption for an insecure and relatively badly paid job in the North.[12] Finally, with scarcity of jobs in the South, but with solid family ties, young Southern workers are left with no choice but acquiring extra education. This in turn implies high job expectations that become increasingly difficult to fulfill.

Even with little worker mobility, but with the capacity of increased labor supply in the South to create its own demand, regional mismatch would not be as a persistent phenomenon. One reason why this may not be the case is that the externalities and scale economies deriving from agglomeration (largely emphasized in the new economic geography literature, see Fujita et al. 2000) may have prevented firms from relocating to the South of Italy, even in the face of increasing unemployment disparities. Firm agglomeration is likely to be particularly relevant in Italy, whose economic success is often linked to the existence of the so-called industrial districts, i.e. regions that accommodate many small firms producing similar goods (Fujita and Thisse, 2002, p. 268). More than 90% of these industrial districts are located in the North (Paniccia, 2002).

Two questions that we do not address explicitly in this paper is why wages in Italy seem to respond to the state of the local labor market in the North only, and why wage differentials shrunk in favor of the South in the 1970s and 1980s. A plausible hypothesis is that both these two factors were the result of the explicitly egalitarian aim of the Italian trade unions (Cella and Treu 1989). Although it is outside the scope of this paper to investigate the reasons why this was the case, it is interesting to observe that such egalitarian aim was pursued successfully at least up to the mid 1980s. A tool that served this equalizing policy was the Scala Mobile, a wage indexation mechanism that linked wage growth to inflation with highly redistributive effects. The existing evidence suggests that this played an important role in compressing wage differentials up at least the mid 1980s (Manacorda 2002), including the differential between the North and the South. A second avenue for wage equalization worked through centralized bargaining. It is not implausible to speculate that the only way unions were to gain the support of the working class, mainly employed in the industrial North, was by linking wage growth to unemployment changes there rather than unemployment changes nationwide.

By focusing on the unemployment effects of persistent regional mismatch in an asymmetric wage setting framework, the analysis of this paper has policy implications. Policy instruments that are likely to alleviate the effects of regional mismatch include both direct measures aimed at reducing regional imbalances between the demand and the supply of labor, as well as interventions on features of regional wage setting. From the discussion above it follows that, in order to reduce mismatch, subsidies aimed at reducing the cost of geographical mobility of labor and capital should be advocated. It is argued that reforms of the prevailing wage-setting mechanism would also help insofar they make wages more responsive to local labor market conditions than what they currently are. The process of wage determination in Italy has undergone profound changes over the 1990s:

[12]See Bentolila and Ichino (2000), Becker et al. (2001) and Manacorda and Moretti (2002) for the economic role of family ties in Italy, and Daveri and Faini (1999) for a study of the role of risk in migration decisions.

national wage settlements have been progressively supplemented by firm-level agreements (Casadio 1999) and the Scala Mobile has gradually lost importance up to its abolition in the early 1990s (Manacorda 2002). Reforms to the wage bargaining system that would allow regional unions determine wages in their respective regions might be preferable to a single national union determining a differentiated wage for each region (see Faini 1999a,b). While in the first case the union would be a monopolist capable of discriminating between regions, in the second case there would be stronger competition among regional unions and lower average wage pressure. Specifically to our model, higher responsiveness of wages to local rather than northern unemployment would reduce the impact of regional mismatch on both southern and aggregate unemployment.

6. Conclusions

In this paper we have presented a stylized two-region model of wage determination where wages nationwide respond to the unemployment rate in some leading region. A strong implication of this model is that the leading region (in our case the North) is completely sheltered from sectoral shocks. Regional mismatch therefore has the potential to affect aggregate unemployment only via its impact on the unemployment rate in the South.

On the empirical side, we have argued that the gap between the demand and the supply of labor in Italy grew in favor of the North between 1977 to 1998, mostly due to a faster rise in supply in the South. This trend has the potential to explain increasing unemployment differentials between the North and the South.

We estimate that the effect of regional mismatch is responsible for about 40% the increase in Southern unemployment over our sample period, and for one third of the increase in aggregate unemployment. Although admittedly this quantitative result depends on a Cobb-Douglas specification of consumer preferences, our results remains qualitatively true when a more general specification of utility is used (CES). We argue that the faster rise in labor supply in the South was due to a combination of two factors: faster population growth in the South and declining internal migration. Relative labor force participation fell in the South, but this was insufficient to offset the effect of demographics.

Our analysis also shows that a sizeable proportion (around 43%) of the rise in aggregate unemployment in Italy over the period of observation is due to a faster (exogenous) rise in wages in the South relative to the North, while only around 20% of the total is due to aggregate factors, i.e. a faster rise in negotiated wages nationwide relative to the growth warranted by productivity gains.

The results of this paper shed some additional light on the determinants of the regional disparities and their macroeconomic consequences in Italy (and possibly in other regions of Europe). At the same time, they highlight some puzzles and new directions for research. We argue that the bulk of the regional mismatch problem in Italy stemmed from an increase in labor supply in the South, which was not matched by an equal increase in labor demand. One is left then with the question as to why migration of labor or relocation of firms failed to restore equilibrium in the long run. In the last section of the paper we offer some temptative explanations for these facts. This highlights the need for more work on the microeconomic determinants of the location choices of Italian firms and workers.

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Appendix
CES utility function

One of the building blocks of our model is Cobb-Douglas preferences. Below we check how sensitive our results are to this assumption, by adopting (more general) CES preferences.

Suppose that consumers in both regions have CES preferences over regional goods, while the specification of technology in both regions remains unchanged from equation (1). Consumers solve the following problem

$$(18)\qquad \max_{c_{1r},c_{2r}} V_r(c_{1r},c_{2r}) = \left[\alpha c_{1r}^{\rho} + (1-\alpha)c_{2r}^{\rho}\right]^{1/\rho}; \quad \rho < 1$$
$$\text{s.to } p_1 c_{1r} + p_2 c_{2r} \le w_r, \quad r = 1,2$$

where $\sigma = 1/(1-\rho)$ represents the elasticity of substitution between the two commodities.

The first-order conditions to the maximization in (18) are:

$$(19)\qquad p_1 = \alpha\left(\frac{V_r}{c_{1r}}\right)^{1/\sigma}$$

$$(20)\qquad p_2 = (1-\alpha)\left(\frac{V_r}{c_{2r}}\right)^{1/\sigma}$$

$$(21)\qquad p_1 c_{1r} + p_2 c_{2r} = w_r, \quad r = 1,2,$$

Equations (19) and (20) can be rewritten as

$$(22)\qquad \frac{\alpha}{1-\alpha} = \frac{p_1}{p_2}\left(\frac{c_{11}}{c_{21}}\right)^{1/\sigma} = \frac{p_1}{p_2}\left(\frac{c_{12}}{c_{22}}\right)^{1/\sigma}.$$

Equation (22) implies $c_{11}/c_{21} = c_{12}/c_{22}$. Combining this with the market clearing conditions $Y_1 = c_{11}\left(N_1 + \frac{c_{12}}{c_{11}}N_2\right)$ and $Y_2 = c_{21}\left(N_1 + \frac{c_{22}}{c_{21}}N_2\right)$ gives $c_{11}/c_{21} = c_{12}/c_{22} = Y_1/Y_2$ and finally

$$(23)\qquad \frac{\alpha}{1-\alpha} = \frac{p_1}{p_2}\left(\frac{Y_1}{Y_2}\right)^{1/\sigma} = \frac{p_1}{p_2}\left(\frac{A_1 N_1}{A_2 N_2}\right)^{1/\sigma}.$$

The profit maximization condition for firms implies $w_r = p_r A_r, \quad r = 1,2.$ Therefore (23) can be rewritten as

$$(24)\qquad \ln\left[\frac{\alpha A_1^{\rho}}{(1-\alpha)A_2^{\rho}}\right] = \frac{1}{\sigma}\ln\left(\frac{N_1}{N_2}\right) + \ln\left(\frac{w_1}{w_2}\right)$$

or alternatively

$$\ln\left[\frac{A_1^{\rho}\alpha l^{\rho-1}}{A_2^{\rho}(1-\alpha)(1-l)^{\rho-1}}\right]^{\sigma} = \left[\ln\left(\frac{N_1}{N_2}\right)-\ln\left(\frac{l}{1-l}\right)\right]+\sigma\ln\left(\frac{w_1}{w_2}\right) \cong (u_2-u_1)+\sigma\ln\left(\frac{w_1}{w_2}\right). \tag{25}$$

According to equation (25), the regional mismatch index under CES preferences is

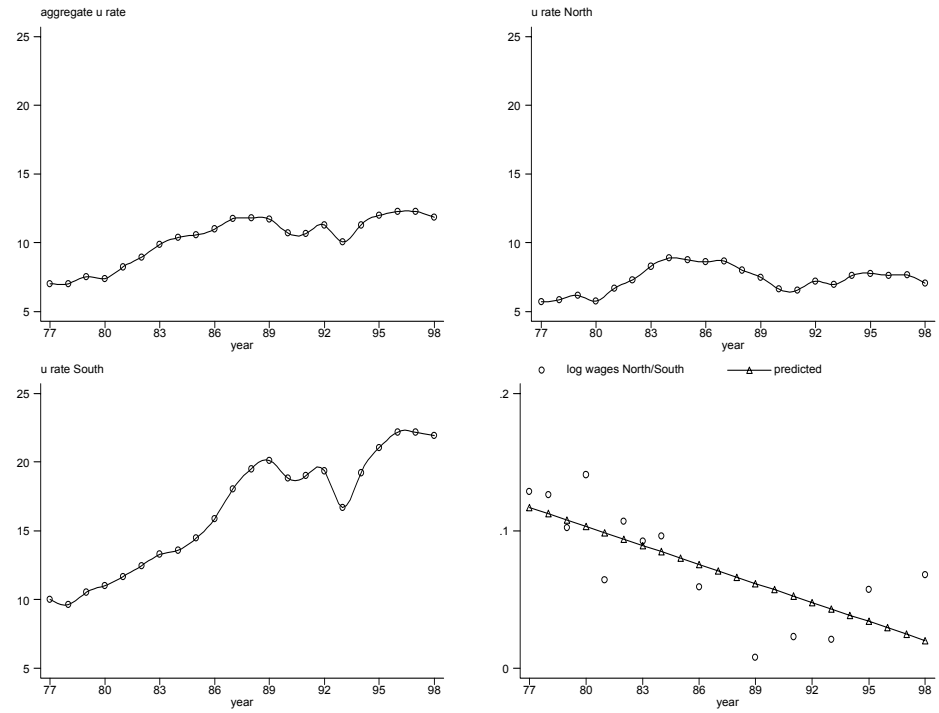
$$D_{12}^{\sigma} \cong d(u_2-u_1)+\sigma d\ln\left(\frac{w_1}{w_2}\right), \tag{26}$$

with $D_{12}^{1} = D_{12}$.

In Table A1 we estimate the trend in D_{12}^{σ} for values of σ in the range [0,2]. The first column reports the annual change in the South-North unemployment differential. The second column reports estimates of D_{12}^{σ}, as the sum of the annual average change in u_2-u_1 and the proportional annual average change in w_1/w_2, multiplied by σ. Note that, given equation (26), D_{12}^{σ} represents the part of the change in the South-North unemployment differential that can be explained by regional mismatch.

As σ increases, the estimated mismatch index is reduced, due to the higher weight on relative wage changes. Since wage differentials evolved in favor of the South, it turns out that for high enough values of σ, relative wage changes overweight changes in the unemployment differential and the demand index switches sign. In any case, the change in net relative demand is not significantly different from zero for values of σ above 1.5. For $\sigma = 0$, corresponding to Leontieff preferences, the demand shift is exactly equal to the change in unemployment differentials: relative wage changes do not induce any substitution between the two labor inputs. For $\sigma = 0.5$, observed demand shifts account for approximately 60% of the total change in unemployment differentials. When $\sigma = 1$, which is Cobb-Douglas case, this accounts for approximately 40% of the rise in the unemployment rate differential. Note that such predicted change in u_2-u_1 is simply equal to the rise in u_2, given that Northern unemployment is not affected by regional mismatch when preferences are of Cobb-Douglas type, as illustrated in Section 2.

Figure 1

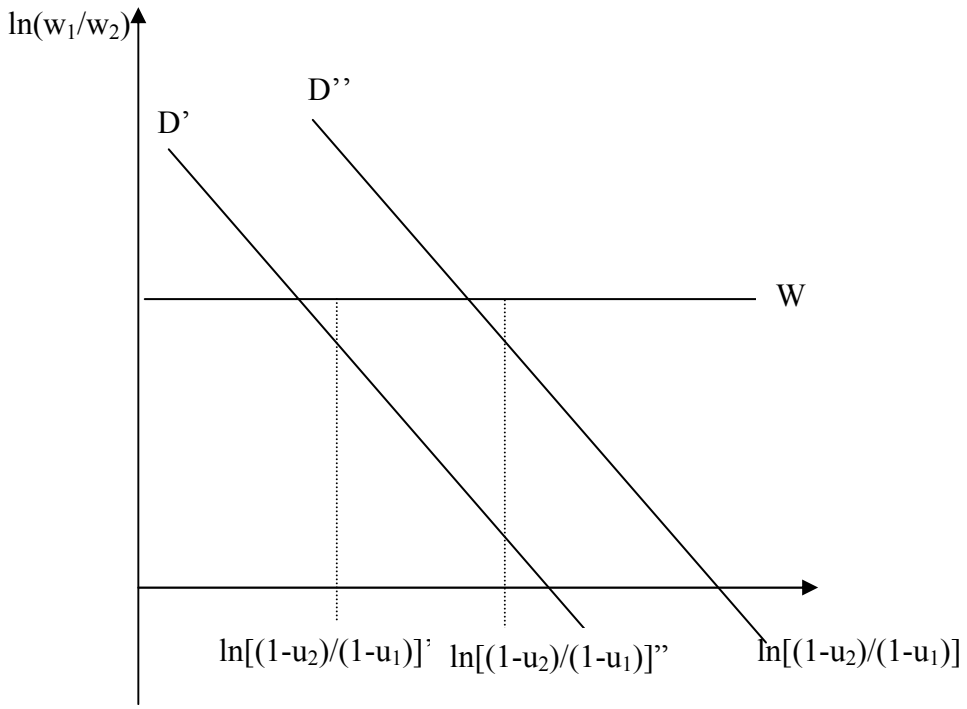


Unemployment and Relative Wages in Italy, 1977-1998

Notes: North includes the following regions: Piedmont, Val d'Aosta, Liguria, Lombardy, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Emilia Romagna, Tuscany, Umbria, Marches, Latium. South includes: Campania, Abruzzi, Molise, Apulia, Basilicata, Calabria, Sicily and Sardinia. The predicted series of relative wages is obtained by regressing log(relative mean wages) on a constant and a linear trend. See also notes to table 1.

Figure 2

Regional mismatch in an asymmetric wage-setting model.



Notes. The figure illustrates a net labor demand shift in favor of the leading region of the economy (1). Equilibrium in region 1 is given by the intersection of a flat relative wage curve (W) and a downward sloping labor demand schedule (D). A demand shift from region 2 to region 1 shifts D up. Relative wages remain unchanged and relative employment in region 1 increases.

Table 1

Descriptive statistics
Means/proportions

Variables		1977-98 average		1977		1998	
		North	South	North	South	North	South
Ln real wage		3.812	3.751	3.685	3.560	3.827	3.760
Sex	Females	36.93	29.24	31.05	25.68	43.07	31.06
Education	No schooling	1.43	3.23	5.26	5.22	0.37	1.15
	Primary school	18.78	20.07	36.67	30.69	7.75	10.66
	Junior school	35.94	29.47	30.37	28.87	42.32	34.10
	High school	34.58	34.92	22.31	23.72	38.46	40.24
	University	9.27	12.30	5.38	11.50	11.10	13.86
Age	18-20	3.31	2.54	4.85	4.43	1.62	1.03
	21-30	26.60	20.20	27.40	29.98	24.44	15.24
	31-40	28.61	29.93	26.41	24.85	30.59	30.48
	41-50	26.39	27.78	23.72	21.75	30.95	32.23
	51-65	15.09	19.55	17.61	18.99	12.40	21.02
No. observations		40,947	16,499	1,851	519	3,444	1,566

Notes. Source: SHIW individual records, 1977-1984, 1986, 1989, 1991, 1993, 1995, 1998. North includes the following regions: Piedmont, Val d'Aosta, Liguria, Lombardy, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Emilia Romagna, Tuscany, Umbria, Marches, Latium. South includes: Campania, Abruzzi, Molise, Apulia, Basilicata, Calabria, Sicily and Sardinia. Data are weighted by post-stratification individual weights. Wages are defined as take home annual pay net of taxes, social security contributions and inclusive of overtime payments and bonuses. Wages are deflated using the national consumer price index with base 1977. Selection criteria: full year employees, aged 18-65, with a reported wage.

Table 2

Regional wage equations, Italy: 1977-1998
Two-fold regional classification
(dependent variable: logarithm real wages)

Variables		Specification I		Specification II		Specification III	
Ln unemployment rate							
	North	-0.125	(0.063)				
	Local (2 regions)			-0.058	(0.059)		
	South					0.080	(0.112)
South		13.390	(12.771)	25.527	(20.797)	15.570	(12.911)
Trend		1.574	(3.701)	-2.768	(4.432)	-6.843	(4.374)
	*South	-5.163	(4.364)	-9.341	(7.123)	-5.911	(4.412)
$(Trend)^2$		-0.086	(0.420)	0.397	(0.504)	0.834	(0.500)
	*South	0.648	(0.495)	1.125	(0.811)	0.733	(0.501)
$(Trend)^3$		0.000	(0.016)	-0.018	(0.019)	-0.034	(0.019)
	*South	-0.027	(0.019)	-0.045	(0.031)	-0.030	(0.019)
Sex	Females	-0.267	(0.010)	-0.267	(0.008)	-0.267	(0.010)
Education	No schooling	-0.434	(0.106)	-0.433	(0.098)	-0.429	(0.102)
	Primary	-0.257	(0.112)	-0.256	(0.102)	-0.252	(0.107)
	Junior	-0.108	(0.113)	-0.107	(0.102)	-0.103	(0.109)
	High	0.065	(0.116)	0.065	(0.103)	0.070	(0.112)
	University	0.213	(0.112)	0.214	(0.100)	0.218	(0.108)
Age category	21-30	0.256	(0.022)	0.256	(0.026)	0.256	(0.022)
	31-40	0.418	(0.029)	0.418	(0.032)	0.418	(0.028)
	41-50	0.517	(0.025)	0.517	(0.030)	0.517	(0.024)
	51-65	0.526	(0.029)	0.526	(0.032)	0.526	(0.028)
Constant		-3.834	(10.952)	9.312	(13.094)	22.279	(12.789)
R^2		0.324		0.323		0.323	

Notes. Number of observations: 57,446. Estimation method: generalized least squares, with observations weighted by sampling weights. Estimated standard errors, corrected for clustering, are reported in brackets. “South” is a dummy variable for Southern regions. “trend” is linear trend divided by 10. Reference group: North, male, missing education, 18-20 years old. For definition of variables and sources see Table 1.

Table 3

Relative quantities and wages: 1977-1998

Region	Average levels[+]				Annual Growth rates*100[++]				
	Employment share	Labor force share	Relative wages	Wage bill share	Employment share	Labor force share	Relative wages	Wage bill share	Demand-Supply
	I	II	III	□V	V	VI	VII	VIII	IX=VIII-VI
	N_r/N	l_r	w_r/w	α_r	$dln(N_r/N)$	$Dln(l_r)$	$dln(w_r/w)$	$dln(\alpha_r)$	$dln(\alpha_r/l_r)$
North	0.699 (0.008)	0.681 (0.007)	1.018 (0.009)	0.712 (0.008)	0.117 (0.033)	-0.087 (0.039)	-0.075 (0.029)	0.042 (0.046)	0.129 (0.031)
South	0.301 (0.008)	0.319 (0.007)	0.946 (0.029)	0.284 (0.009)	-0.280 (0.078)	0.185 (0.082)	0.306 (0.097)	0.026 (0.141)	-0.158 (0.104)
					$dln(N_1/N_2)$	$dln[l_1/(1-l_1)]$	$dln(w_1/w_2)$	$dln[\alpha_1/(1-\alpha_1)]$	D_{12}
North/South					0.397 (0.112)	-0.271 (0.121)	-0.380 (0.125)	0.016 (0.186)	0.287 (0.134)

Notes. For sources and definitions see notes to Figure 1. Growth rates evaluated by interpolating a linear trend in the series of logarithms of relevant variables. The mismatch index D_{12} is defined in equation (7). [+]Standard deviations in parenthesis. [++]Standard errors in parenthesis.

Table 4

The impact of regional mismatch and other factors on Italian unemployment: 1977-1998

						Annual changes in unemployment rates (∗100)						
						Estimated contribution of					Actual	Total wage pressure
Coefficient	Annual growth rates (∗100) in					Supply	Demand	Demand–Supply	Wage pressure	Compostion. effect		
	Labor force Share	Wage bill Share	Demand-Supply	Wage pressure								
I	II	III	IV=III-II	V		VI=I*II	VII=I*III	VIII=I*IV	IX=I*V	X	XI	XII=XI-VII-VIII-VII
$(1-u_2)$	$d\ln[l/(-l)]$	$d\ln[\alpha/(-\alpha)]$	D_{12}	dz_1-dz_2								
0.852 (0.043)	-0.271 (0.121)	0.016 (0.186)	0.287 (0.134)	-0.380 (0.125)	South	-0.231 (0.103)	0.014 (0.159)	0.245 (0.114)	0.324 (0.126)		0.616 (0.053)	0.046 (0.040)
					Aggregate	-0.074 (0.033)	0.004 (0.051)	0.078 (0.036)	0.104 (0.034)	0.015 (0.000)	0.241 (0.037)	0.045 (0.038)

Notes. The first row computes the separate contribution of changes in relative demand for labor (VI), relative supply of labor (VII) and relative wage pressure (IX) in the change in Southern unemployment, as implied by equation (12). The difference between the actual change in unemployment (XI) and the total explained (VIII+IX) is reported in column XII. This is an estimate of the contribution of aggregate wage pressure in explaining Southern unemployment (plus measurement error). The second row makes the same computation for aggregate unemployment. The contribution of each factor in explaining aggregate unemployment is obtained by multiplying each element in the first row by the average labor force share of the South (0.319). An additional term in included in the second row, which accounts for the compositional effect of changes in regional labor force composition on aggregate unemployment (X).

Table A1

The impact of regional mismatch on North-South unemployment differentials for alternative values of σ.

Actual annual change in u_2-u_1 (*100)	Predicted annual change in u_2-u_1 (*100) (Estimated impact of regional mismatch)				
	Elasticity of substitution (σ)				
	0	0.5	1	1.5	2
0.557	0.557	0.367	0.241	-0.013	-0.204
(0.061)	(0.061)	(0.079)	(0.112)	(0.186)	(0.246)

Notes. The table reports the implied change in unemployment differentials due to regional mismatch under the assumption of CES preferences, for alternative values of σ, using the expression $D_{12}^{\sigma} = d(u_2 - u_1) + \sigma d\ln w_1/w_2$. Standard errors in parenthesis.