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Is the Italian Labour Market Segmented?

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IS THE ITALIAN LABOUR MARKET SEGMENTED?

by Piero Cipollone*

Abstract

This paper evaluates the existence of segmentation in Italy along the lines of the dual labour market theory, serving as a possible contribution to the present debate about increasing poverty and source strategies to counter it. I show that even workers belonging to traditionally strong groups – male breadwinners in the central age-groups – may be confined to the secondary segment of the labour market because of rationing or other barriers to entry the primary segment. For the most part they are poorly educated blue-collar workers in industry, construction and retail sales. For them, return to education is almost nil and wages do not rise much with experience, so measures to increase workers' human capital may not be effective in reducing poverty; direct income support to the poor might prove a better policy.

JEL classification: J42, C25.
Keywords: segmented labour market, wage equations, switching model.

Contents

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1. Introduction[1]

In recent years there have been a number of studies of income distribution in Italy. One finding has been that an increasing share of “new poor” consists not of socially excluded but of people with permanent, full-time jobs. Low wages and fragmented work histories seem to be at the root of this trend. The estimated incidence of low paid workers differs according to data source and methodology, but an overall, conservative assessment would put it at more than 10 per cent of all employees. According to the Commission of Inquiry on Social exclusion in Italy (2000), which looks at household expenditures estimated by the ISTAT Survey of Household Budgets,[2] in 1999 almost a tenth of households, whose head was an employee, were below the poverty line. Lucifora (1993), working on the 1987 wave of the Bank of Italy Survey of Household Income and Wealth, estimated that about 15 per cent of full-time workers had labour income below two-thirds of the median annual wage. This share declined from 16.9 per cent in 1977 to a minimum of 8.1 per cent in 1989, rose to 15.7 in 1993, and after a fall in 1995, reached a peak of 18.3 per cent in 1998 (Brandolini, Cipollone and Sestito, 2001). The number of low-paid jobs among full-time, prime-age non-farm workers is increasing rapidly (Figure 1).

In addition to the magnitude of the phenomenon authors stress the lack of mobility out of poverty: poor families are likely to stay poor. Individuals with a relatively weak position in the earnings distribution suffer a high probability of remaining there or even falling further behind. Thus some workers may be caught in a low-income trap for much of their working lives (Cappellari, 1999). It has been estimated that about half of the workers in the bottom tenth of the distribution in 1975 were still there in 1988; The proportion rose to 60 per cent for the bottom fifth (Lucifora, 1998).

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[1] I am grateful to Andrea Brandolini, Luigi Cannari, Marco Magnani, Alfonso Rosolia, Paolo Sestito and Fabiano Schivardi for their comments. A special thank goes to Federico Cingano and Paolo Zaffaroni for their critical review of the paper; their suggestions allowed me to considerably improve the paper. All errors are my responsibility. The opinions expressed do not involve Bank of Italy.

[2] Brandolini (1999) provides a full assessment of the characteristics of several data sources for the analysis of income distribution in Italy.

These figures suggest that poverty among working people is spreading, and this is a novel feature of the Italian labour market. The concern for its potentially disruptive social consequences feeds a mounting debate on strategies for public intervention to invert the trend. However, the existence of the working poor is not peculiar to Italy but a common feature of many OECD countries. The discussion of the best policy to cope with the "new poor", which has increasingly involved international organisations (OECD, 1999), has yet to generate any sort of consensus because of the disagreement on causes of low-wage jobs.

Figure 1

Share of low-paid workers in Italy, 1977-1998

(percentage values)

Source: Brandolini, Cipollone and Sestito (2001).

Human capital theory has tended to emphasise personal characteristics as the main factor in labour income. Low-wage workers are regarded as unproductive because of lack of skills. This view implies that the most effective anti-poverty strategy is increasing the skill level of low-wage workers, by direct state intervention or by means of appropriate incentive systems.[3]

Other economists contend that productivity is a characteristic of jobs, not of workers. In this view, often referred to as dual or segmented labour market theory, there are two types of jobs in the economy: the primary segment with relatively high wages, good working conditions and opportunities for raises; and the secondary segment with low wages, poor working conditions, high turnover and little chance to improve earnings (Doeringer and Piore, 1971). In this view poverty arises from the scarcity of primary segment jobs by comparison with the number of applicants. Some workers are rationed, forced to accept jobs in the secondary tier. Since investment in human capital cannot increase the number of prime jobs, training programs cannot eliminate poverty. A policy consistent with this analysis would involve a substantial role for income support, perhaps conditional on holding a job, and a fair system of rationing.

A better understanding of the wage determination process would be a major contribution to designing appropriate policies. This paper contributes to this research agenda by discussing the existence of segmentation in the Italian labour market. To this end I have adopted the methodology for testing dual labour market theory developed by Dickens and Lang (1985a, 1985b, 1986, 1987a, 1987b, 1988, 1993). The results tend to confirm the theory.

The paper is organised as follows. Section 2 provides a descriptive and non-technical presentation of the test; the formal model and the statistical framework are presented in the appendix. Data description and sample restrictions are discussed in section 3. Section 4 presents the results; section 5 tackles endogeneity. Section 6 describes the distribution over industries and job categories of secondary-segment jobs. Section 7 discusses further some result for southern workers and section 8 concludes.

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[3] This is the rationale for income support for working people who enter some kind of training program.

2. The Dickens-Lang test for dual labour market

The test for the dual labour market is a sequence of two formal tests whose results must be supported by less formal evaluations; it is described in tables 1 and 2. This section provides a non-technical description; the formal presentation is in the appendix.

2.1 The logic of the test

The first step in the procedure (level 1 in Table 1) consists in testing the basic prediction of the dual market hypothesis of two distinct segments in the labour market: the primary and the secondary segment. This hypothesis is not rejected if a model using two wage equations provides a better description of the data than a single-wage-equation model. However, this result alone is not enough to provide clear evidence of the duality of the market: the characteristics of the two equations must also conform to segmented labour market theory. According to its predictions, human capital variables affect wages positively only in the primary segment of the market; thus the coefficients of experience and education should be significantly greater than zero only in the equation representing the upper tier. Wages in the secondary market should not be influenced by human capital variables, whose coefficients should be close to zero for that tier. Moreover, the primary segment equation should lie consistently above the secondary tier, except at the entry level. Summing up, dual labour market theory passes the first level of the test if there are two equations whose characteristics fit the predictions of the theory. Level 2 (Table 2) investigates the mechanism that sorts workers into the primary and the secondary segments. If people were free to choose, there would be no concern about workers being in the secondary segment. They would make their choice by comparing the maximum level of utility obtainable from each segment. If workers' utility depends only on wages the choice of the segment boils down to a choice between wage equations.

However, non-pecuniary aspects of the job are also very important for people's well-being. Nonetheless, I assume that these elements do not explain workers' choices, because their contribution to utility does not change with the observable characteristics of the individual. This is a crucial assumption and accordingly deserves some further comment. The assumption can be restated by saying that two different individuals will make the same evaluation of a job's non-pecuniary characteristics. Such a strong assumption can destroy all credibility of the test if the population is very heterogeneous. For example the assumption would be simply indefensible when considering both men and women workers; in this case the evaluation of part-time could not be the same for the two groups. Yet the assumption can be valid if analysis is restricted to relatively homogenous groups: as will be discussed in the data section, the empirical specification refers exclusively to employees, males, heads of family, aged 20-65 years. This is a relatively homogenous group, so the assumption about non-pecuniary aspects can be held to be reasonable.

Even within a very homogenous group, however, non-pecuniary preferences are likely to differ, violating the above assumption. As will be clear in a moment, the second level of the test exploits precisely the fact that the data will probably reject the above assumption. The heart of the test is thus to evaluate whether such rejection can be ascribed to a difference in tastes. In other words, level 2 of the procedure tests whether the selection process is based on individual choice; the alternative hypothesis is that workers are not free to enter the segment they wish because of rationing or other barriers. This way we can test one of the most far-reaching claims of dual labour market theory, namely that people cannot choose freely and that poverty is due to people's being trapped in the secondary segment. Thus in the second part of the procedure it is necessary to check whether the selection mechanism is based on the comparison of the utility function only, which means verifying that the only determinant of people's choices is wages. An inability to predict decisions this way signals the omission of some important determinant of the decision mechanism. The mis-specification could derive from the fact that the evaluation of non-pecuniary aspects actually depends on people's observable characteristics and cannot be taken as invariant across individuals. Alternatively, it could derive from entry barriers whose magnitude is not random but is correlated to the observable characteristics of individuals. For example suppose that the mechanism sorts into the secondary market more workers from families with poor education than would be predicted by the wage equations: having poorly educated parents reduces one's chances of entering the primary market. One might contend that the children of parents with little education have a stronger preference for the secondary market than those with better educational background. But such an explanation cannot be satisfactory unless we can support it with a convincing story to account for this bizarre difference in tastes. Otherwise one has to concur that workers whose father did not go to high school face some kind of barrier to primary segment entry.[4]

2.2 Advantages and shortcomings of the Dickens-Lang test

The Dickens-Lang test is a considerable improvement on the traditional methodology for testing dual labour market theory, which required the researcher to define an ex-ante criterion, usually income, to determine who has to be classified as poor. The standard criterion is to classify as low-wage those who earn less than two-thirds of the median wage. Once the relevant group has been defined, the researcher looks at its characteristics in terms of education, age, gender, race and the like. However, this method can suffer from selection bias if people with given characteristics choose low-wage jobs for non-pecuniary reasons. In principle, this could be resolved with switching methods in which the regimes are observable, i.e. one assumes the regimes to which each worker belongs. The model adopted here, by contrast, explicitly accounts for self-selection without imposing any a priori criterion on the distribution of the primary-secondary segment across observed characteristic of workers. This is a key property of Dickens-Lang, and I have used it because it may serve as an initial guide to define what segment of the labour force, if any, is involved in the secondary market. At the same time, this statistical framework has at least three shortcomings: a) it requires a linear relationship between wage and education and the multivariate normal distribution of the error terms; b) the identification of the parameter relies completely on the functional form; c) it does not takes into accounts endogeneity problems which might involve both education and experience coefficients in the wage equation because of the possible correlation between compensating differentials and unobserved ability components. The empirical implementation copes with endogeneity by running some robustness tests but the other two weaknesses cannot be solved so easily. Therefore the results must be interpreted with care.

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[4] Casavola and Sestito (1995) provide an evaluation in the Italian context of the importance of family linkages and networking as a channel to access specific segments of the labour market

Table 1

Descriptive Presentation of the Test

Testing level 1

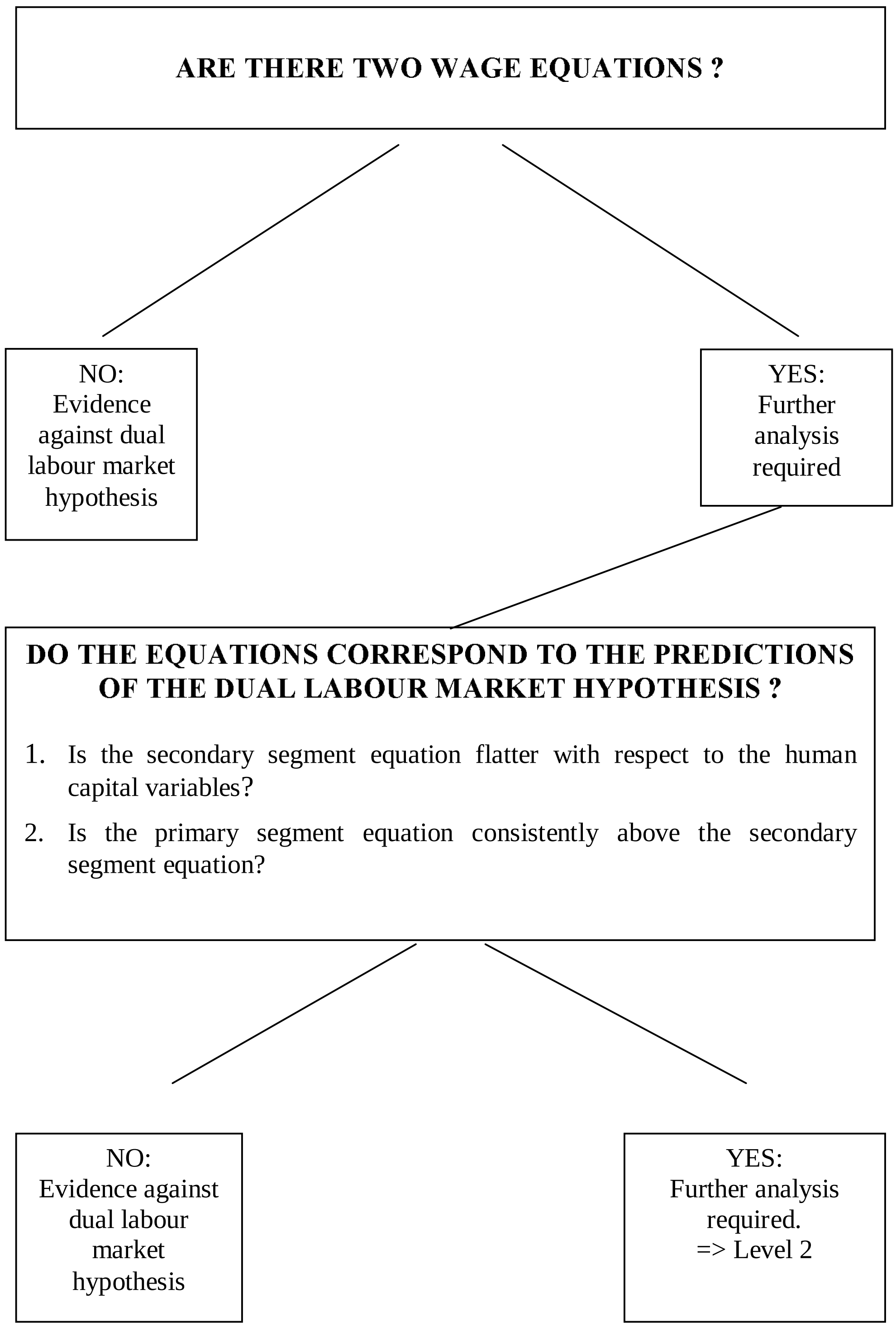
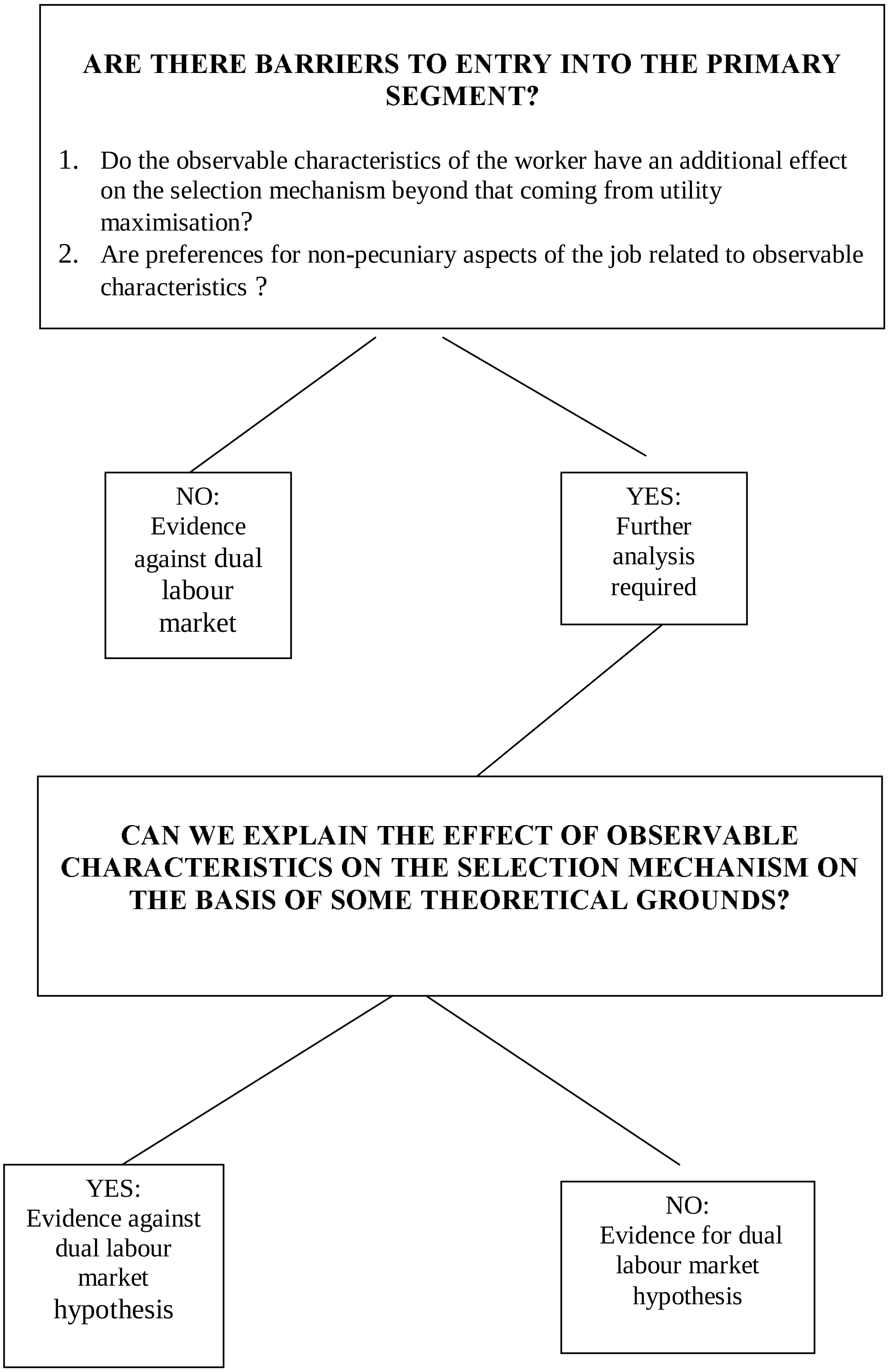


Table 2

Descriptive Presentation of the Test

Testing level 2



3. Data and sample restrictions

The test used the 1995 Bank of Italy's Survey of Household Income and Wealth (SHIW).[5] The individuals considered are male employees, heads of household, aged between 20 and 65, working at least 20 hours a week in the private, non-farm sector as their primary job. These restrictions reduce the sample to 1,461 of the 6,503 employees covered in the 1995 SHIW. The wage considered is the hourly wage including all benefits and net of all taxes. This variable is not directly measured by the survey and was accordingly derived from the yearly labour income (including all benefits and net of all taxes) using the number of months worked, the hours of work in the reference week and assuming 4 work weeks in a month.[6]

I decided to look at this narrow segment of the labour force for two reasons. I needed a very homogenous group of workers to make the assumption on the non-pecuniary aspects reasonable, so that the level two results could be interpreted in terms of barriers to entry or discrimination. Also, I wanted the test to be as conservative as possible. One should expect it to be harder to find evidence for the dual market among prime age males than among any other population group. For this group is the core of the labour force, the strongest in the market; hence if we find evidence of segmentation in this group we can be confident that the results are robust and not due to the selection of some marginal group.

Education attainment is one of the survey's categorical variables. To construct the educational variable actually used, I mapped the categories into the minimum numbers of years of schooling required to reach any specific grade. Experience is then constructed as potential experience, subtracting from the respondent's current age the number of year of schooling (augmented by 6, the school entry age).

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[5] Brandolini and Cannari (1994) provide a full description of the Survey.

[6] The actual rule used to compute hourly wages is $Wh = YLI / (ML * HW * MW)$ where YLI is annual after-tax labour income, ML is the number of months worked, HW is the number of hours worked in the reference week and MW is the number of weeks worked in a month. I assumed that $MW=4$ on the basis of the fact that people working 12 months have about 4 weeks of paid holidays. This implies that for each month worked, people have 1/3 of a week of vacation.

4. Results

4.1 Testing level 1: how many wage equations?

The first question is the existence of two wage equations in the Italian labour market. The model specified is very simple: a standard human capital equation with the log of wage explained by educational achievement, experience, family background and dummies for residence (North *vs.* South and large *vs.* small cities). This specification is admittedly very simple, leaving out many important determinants of wage setting such as firm specific components and the local market.[7] Table 3 reports the estimation results of the basic model under the alternative assumptions of one and two wage equations. It reports the values of the different log likelihood functions needed to run the likelihood ratio test (described by equation 13 in the Appendix). The OLS column represents the estimates of the restricted model (equation 15 in Appendix), which assumes of a single wage equation. The three columns under the heading "switching model" report the estimates of the unrestricted model (14), which allows for the existence of two different wage equations. In comparing the two models the value of the likelihood ratio is 137.04 (=-2*(-395.268+326.750)); the probability of drawing a value greater than 137.04 from a chi-squared distribution with 14 degrees of freedom[8] is nil. This evidence is strong enough to suggest that a one-equation model imposes very strong restrictions, not supported by the data.

[7] Casavola and others (1999) estimated for the Italian case a fully specified wage equation that includes, in addition to the usual human capital variables, both individual and firm-specific effects as well as local market conditions

[8] As is noted by Dickens and Lang (1985b), even though the restricted model (15) is nested in the general model (14), when the switching model is constrained to the single-equation case several parameters are not identified; for example the two covariances are not identified. This complicates the calculation of the degrees of freedom. Here I follow their suggestion to look at the results of the Monte Carlo simulation by Goldfeld and Quandt (1976), which suggest that setting the degrees of freedom equal to the number of restrictions plus the number of non-identified parameters yields a conservative test using the chi-squared distribution. Overall I have 14 degrees of freedom: 7 restrictions result from imposing equality of the parameters of the two equations (6 for coefficients and one for the variances), 5 from setting to zero the parameters of the switching equation, plus 2 unidentified covariances.

4.2 Testing level 1: do these equations resemble the predictions of dual labour market theory?

At this stage it is necessary to discuss the qualitative results of the model in order to assess how reasonable they are and how well they square with predictions of dual labour market theory.

4.2.1 Do the characteristics of the two wage equations fit theory's predictions?

One of the most important predictions of dual labour market theory is that only the primary segment wage equation should be increasing with human capital; secondary market equation should be flat with respect to education and experience. On the other hand, the entry level wage might be higher in the secondary market, attracting people not interested in a long-term relationship that yields a higher return later in life. The results closely conform to these predictions. The primary segment wage equation shows strong returns to human capital, well above those estimated with OLS, while in the secondary segment they are almost zero (Figure 2). The return to education in the primary sector is just above 9 per cent, again as greater as one and a half the level of OLS estimate (Figure 2). The same story, although not as neat, is told by the coefficient of experience, which is 1.8 per cent in the primary segment as against the 1.2 per cent in the single-equation model.[9]

In the primary market, the father's level of education helps substantially in getting high salary jobs, most probably located in large cities.

In the secondary market the return to education is near to zero, just as the theory predicts. However, there is a slightly positive return to experience in the later stages of working life; this is not a surprise for the Italian economy, given the widespread adoption of seniority rules.

The entry wage for the secondary market is estimated to be high in absolute value and much higher than in the primary segment. This could be due in part to the fact that the

[9] From a statistical point of view the overlapping areas of the confidence intervals are small. The 1 per cent confidence interval for experience is (0.021 , 0.012) in the primary segment, and (0.014, 0.010) in the single-equation model.

sample considers only workers over 20 , while people in the secondary tier tend to start work younger than that. Thus the high level of the constant may be picking up the effect of the experience accumulated between the actual entry age and age 20. It could also be the effect of a wage premium for the shorter term relationship between workers and firms.

In sum, the evidence shows that in the Italian labour market there are at least two wage equations whose characteristics do resemble those predicted by dual labour market theory. Level 1 of the Dickens-Lang test has been passed.

Table 3

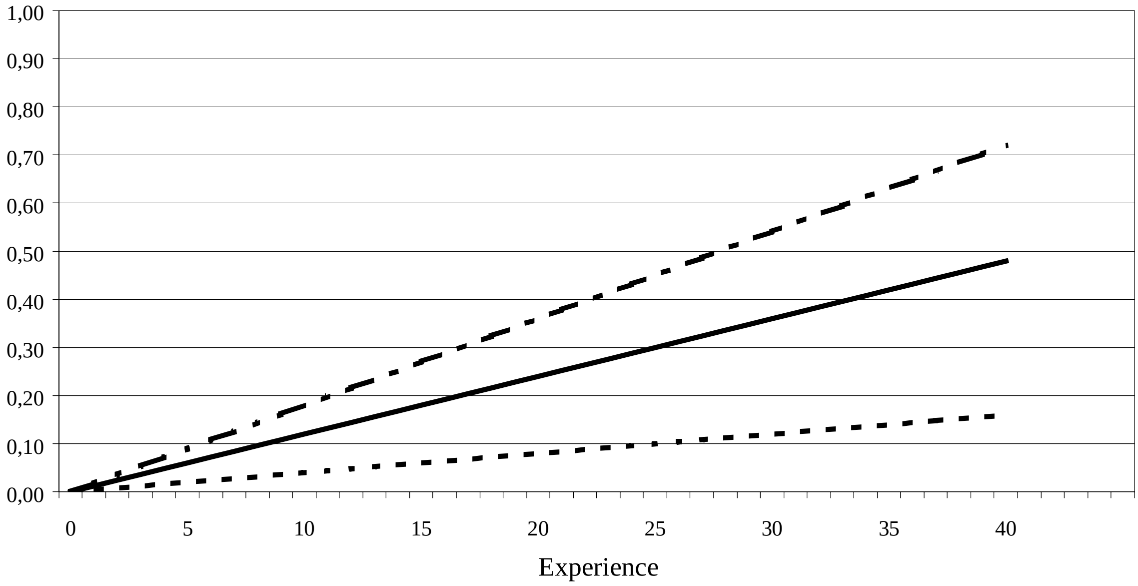
Testing Level 1: Are There Two Wage Equations?
(coefficients unless otherwise specified; standard errors in parenthesis)

	Mean	OLS	Switching model		
			Primary Segment	Secondary segment	Switching equation
Constant	--	1.63	1.03	2.17	-1.92
		(.044)	*(.164)*	*(.073)*	*(.414)*
Years of education	9.62	.062	0.092	.012	.160
		(.0027)	*(.009)*	*(.007)*	*(.031)*
Experience	27.03	.012	0.018	.004	
		(.0009)	*(.002)*	*(.0015)*	
Fathers education	4.65	.0077	.010	constrained to 0	.034
		(.00252)	*(.004)*		(.024)
Residence in the South	.295	-.103	-.087	-.081	1.04
		(.018)	*(.047)*	*(.049)*	*(.308)*
Residence in big city	.11	.034	.116	-.170	.885
		(.027)	*(.047)*	*(.079)*	*(.444)*
Variance		.10	.151	.064	constrained to 1
Covariance with switching error		--	.208	-.197	--
Log likelihood		-395.268		-326.750	
Number of observations		1461		1461	

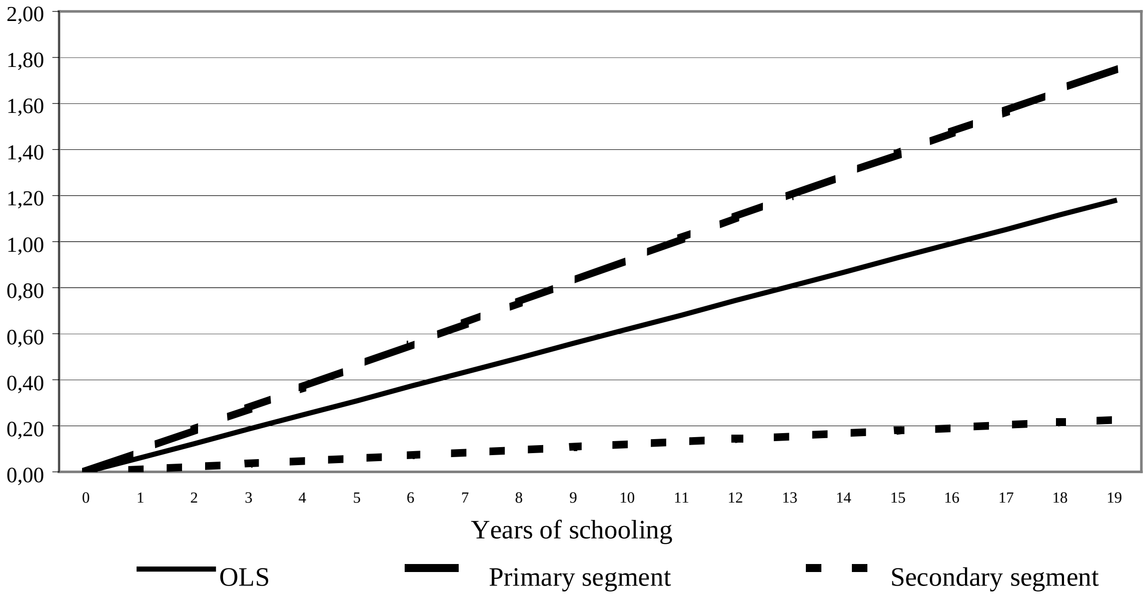
This description of the Italian labour market finds support in previous research. Ichino and Erickson (1994) found that workers at a given job grade within the firm receive fairly similar wages in different firms, although this is less true the higher the level of skill. This can be interpreted as evidence of the presence of at least two wage equations, one applying to workers in the lower tail of the wage distribution, which is basically flat with respect to human capital endowment, and the other depending much more on individual characteristics.

Figure 2

Estimated Age –Log Hourly Earnings Profiles



Estimated Education–Log Hourly Earnings Profiles



4.3 Testing level 2: are there entry barriers to the primary labour market?

The second level is in determining whether some crucial coefficients of the selection equation are equal to the difference in the corresponding coefficients of the wage equations. Three basic tests were run. To be clear about the test let us look for example to the father's education coefficient in the selection equation. This coefficient is positive (0.034 in Table 3), meaning that workers with better educated parents have a higher probability of belonging to the primary segment. The question is whether this coefficient is statistically equal to the difference between the corresponding coefficients in the two wage equations. If so, the effect of the father's education on the probability of being in the primary segment simply reflects the different effects on wages. But if there is something beyond the effect through wages, it could be that people with poorly educated parents have lower preferences for the primary segment or else that they face some kind of entry barriers.

Technically this is tantamount to performing a likelihood ratio test comparing the unrestricted model with an analogous one in which the coefficient of the father's education in the switching equation is constrained to be equal to the difference between corresponding coefficients in the two wage equations.[10] Figure 3 reports the result of the second level of the test for the coefficients of years of schooling, father's education and the big city dummy. The dotted line shows the value of the likelihood ratio test for several levels of the variance of the switching equation.[11] The solid line is the probability of observing a value greater than the one in the likelihood if the distribution is a chi square with 1 degree of freedom.

Panel a) refers to years of education. The test rejects the hypothesis that the effect of education on the probability of being in the primary market reflects only the differences between the slopes of the two wage equations. The p-values are steadily below 5 per cent regardless of the value of the variance of the switching equation. This result means that more

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[10] However, things are a bit more complex than what is described in the test; in fact when the restriction on the father's level of education in the switching equation in imposed, then the variance of the switching equation can be identified.

[11] This is because I was not able to achieve convergence in the likelihood of the restricted model when the variance of the switching was allowed to change with all the other coefficients. I therefore kept the variance as a predetermined parameter and repeated the test for several values of the variance.

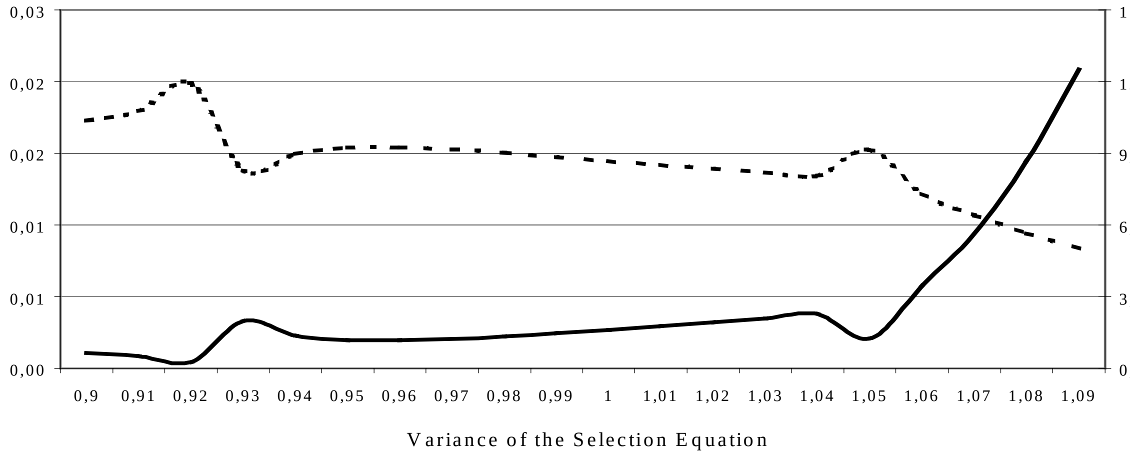
years of schooling increase the likelihood of being in the primary segment not only via higher wages but also via some other effect. However, it is plausible that this added effect is because the better educated have stronger preferences for better non-pecuniary characteristics, so this is not necessarily evidence of discrimination against the less educated worker.

Panel b) refers to the coefficients of father's years of schooling. The result is only a weak evidence that the coefficient of father's education in the switching equation differs from the difference between the corresponding coefficients in the two wage equations. The probability of a value greater than the one observed in the test is never less than 20 per cent. That is, there is almost no evidence that people whose fathers are poorly educated face barriers to entry into the primary segment. The third test (panel c) was run on the coefficient that represents the effect of living in a large city. There is somewhat stronger evidence that the coefficient in the switching equation diverges from the difference between the corresponding coefficients in the wage equations. For several values of the variance of the switching equation, the probability of a value greater than that obtained in the test is less than 10 per cent. There is no reason to presume that this is because people in small towns prefer secondary market jobs. Rather, this results offers evidence, albeit not strong, that workers in small towns face some barrier.[12] Overall the evidence of existence for such a barrier is not very strong, but this might be because I was not able to achieve convergence of the likelihood when all coefficients are estimated simultaneously.

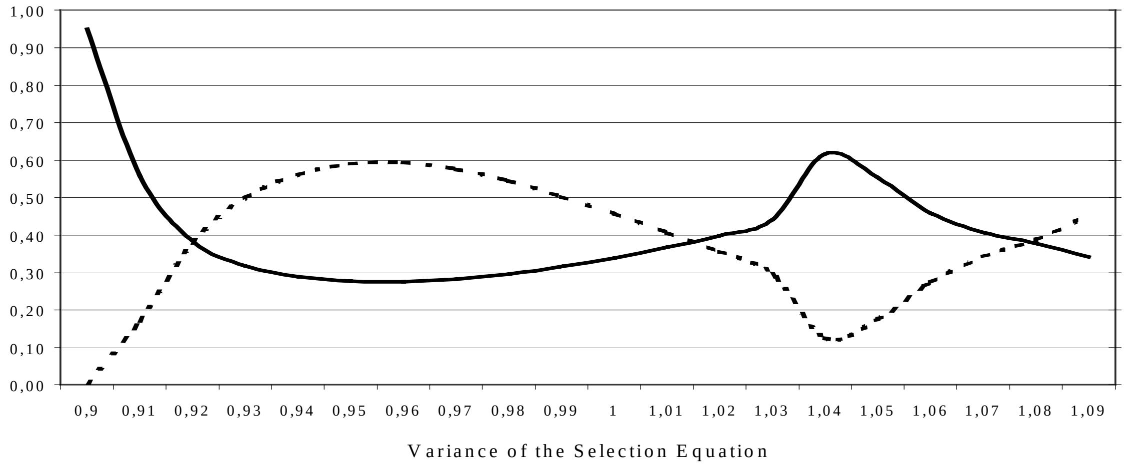
[12] This effect could depend on the fact that more capable people prefer large cities, but the equation offers some controls for individual characteristics that should reduce the risk that this result simply reflects the sorting mechanism.

Figure 3

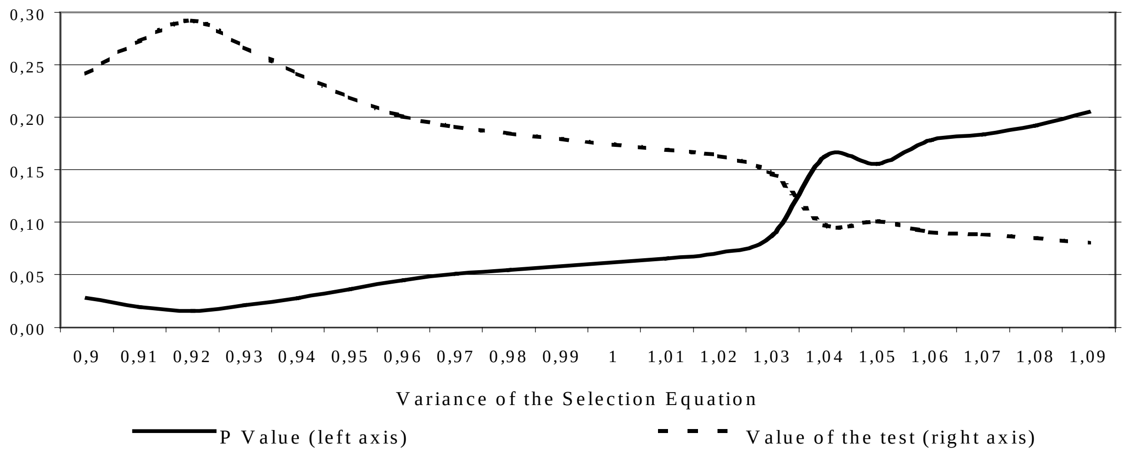
a) Test on the coefficient of years of schooling



b) Test on the coefficient of father's years of schooling



c) Test on the coefficient of dummy "large city"



5. Dealing with endogeneity

In the foregoing I ignored the fact that both labour market experience and educational attainments may be correlated with unobservable individual ability components. In this case, the standard OLS estimates for schooling and experience will be biased, either upwards or downwards, and the Dickens-Lang framework becomes inapplicable. Since endogeneity seriously weakens the results presented above the problem must be tackled. The strategy envisages two tests for robustness. First I estimate the one-equation model using an instrumental variable method to appraise the severity of endogeneity. Second for the switching model a two-step procedure is adopted. First, I run OLS regressions of both education and labour market experience on age and a set of family background indicators; then I use the fitted values of these two equations instead of the original variables in the switching model.

5.1 The effect of endogeneity on the single-equation model

In the one-equation model, the effect of endogeneity on the return to human capital is quite strong. The return to one year of education is reduced from 8.8 per cent in the instrumental variable[13] method to 6.2 per cent using OLS (Table 4). At face value this would imply that education and unobserved ability are negatively correlated. Such a result is consistent with previous analysis for the Italian economy and can be explained by parents' investing more for children who are less endowed, because for these children the opportunity cost of an additional year of schooling is lower (Cannari and D'Alessio, 1996). Using the father's level of education as an instrument weakens the direct effect of this variable on earnings. The coefficients of the other variables change only marginally. In particular, the return to experience does not change at all.

5.2 The effect of endogeneity in the switching regression model

Replacing the true variables with the fitted values for education and experience, increases the return to schooling by about the same amount in both segments but does not

[13] As instruments I use age, both linear and quadratic, parents' education, and occupational status.

qualitatively alter the overall picture. The return to education in the primary segment rises to about 13.2 per cent per year of schooling, 4.0 points more than using the actual variable; it also increases in secondary segment but the coefficient is poorly estimated. As in the single-equation model, father's years of education loses its positive effect in the primary segment.

The return to experience increases in the primary segment but is halved in the secondary market, thus widening the difference between the two tiers.

Aside from these differences endogeneity does not alter the overall qualitative picture by comparison with the previous section. In what follows therefore, I will use the coefficients estimated in the model without controlling for endogeneity.

Table 4

Assessing the effect of endogeneity
(coefficients unless otherwise specified; standard errors in parenthesis)

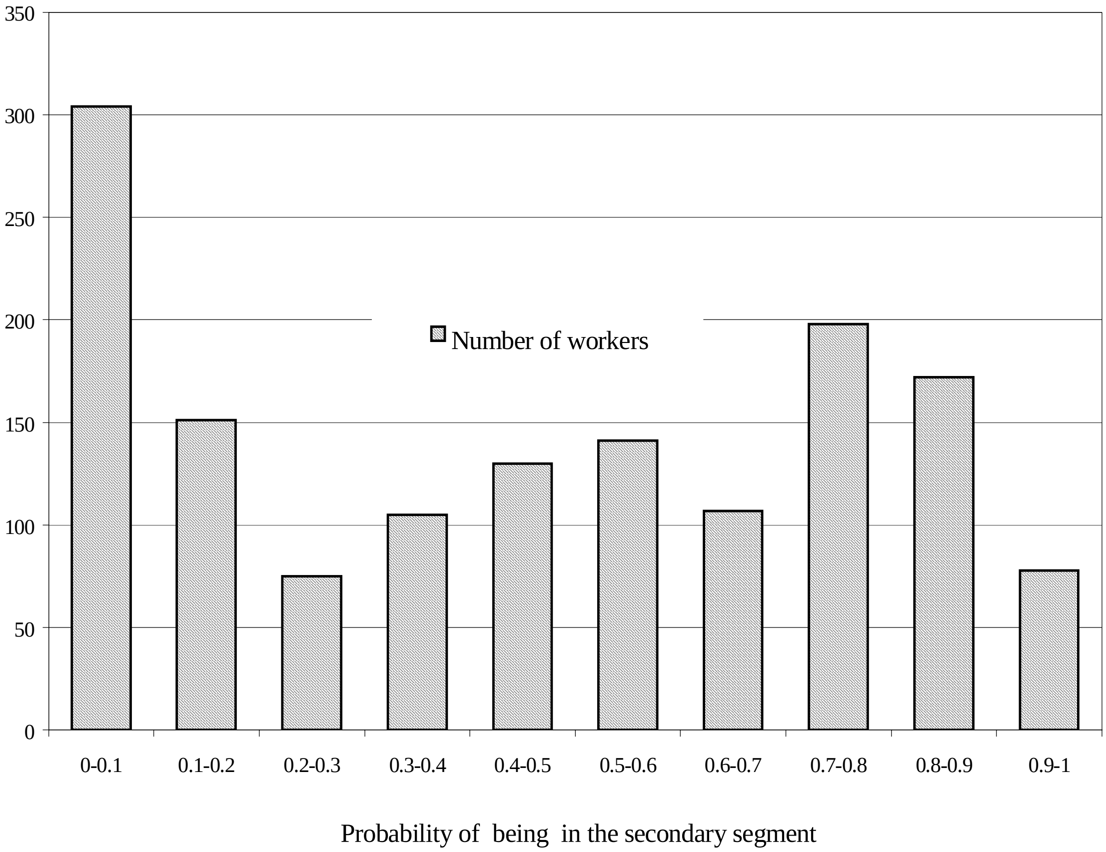
	Results without controls for endogeneity (Model of table 3)				Results with controls			
	OLS	Switching model			Instrumental variables	Switching model with fitted values for years of schooling and experience		
		Primary Segment	Secondary segment	Switching equation		Primary Segment	Secondary segment	Switching equation
Constant	1.63	1.03	2.17	-1.92	1.39	0.62	2.07	-0.95
	(.044)	*(.164)*	*(.073)*	*(.414)*	*(.078)*	*(.221)*	*(.19)*	*(.478)*
Years of education	.062	0.092	0.012	.160	.088	0.132	.018	.078
	(.0027)	*(.009)*	*(.007)*	*(.031)*	*(.008)*	*(.016)*	*(0,012)*	*(.047)*
Experience	.012	0.0176	.004		.013	0.021	.0024	
	(.0009)	*(.002)*	*(.0015)*		*(.001)*	*(.0025)*	*(.0016)*	
Father's level of education	.0077	.010	constrained to 0	.034	-.004	-.008		.009
	(.00252)	*(.004)*		(.024)	*(.004)*	*(.007)*		(.021)
Residence in the South	-.103	-.087	-.081	1.04	-.091	-.141	-.015	.62
	(.018)	*(.047)*	*(.049)*	*(.308)*	*(.019)*	*(.084)*	*(.063)*	*(.247)*
Residence in big city	.034	.116	-.170	.885	.024	.105	-.181	.98
	(.027)	*(.047)*	*(.079)*	*(.444)*	*(.027)*	*(.058)*	*(.128)*	*(.342)*
Variance	.10	.151	.064	constrained to 1	.108	.201	.095	constrained to 1
Covariance with switching error	--	.208	-.197	--		296	-.271	
Log likelihood	-395.268		-326.750				-467.267	
Number of observations	1461		1461		1461		1461	

6. Who is in the secondary market?

The estimated parameters can be used to compute, for each observation, the probability of belonging to the primary or the secondary segment. Figure 4 reports the distribution of workers according to their probability to being in the secondary market.

Figure 4

Distribution of workers according to the predicted probability of being in the secondary segment



This distribution is a gauge of the quality of the information provided by the model. If the estimated probabilities were all around 50 per cent it would be impossible to tell a worker's segment.

Table 5

Composition of the Sample by Workers' Characteristics and Segment

	Primary segment (1)	Not classified (1)	Secondary segment (1)	Percentage in the sample (2)	Total number of workers
North and Centre	29.5	27.5	43.0	70.6	1031
South	59.5	32.1	8.4	29.4	430
Residence in big city	76.3	18.6	5.1	10.7	156
Residence in small town	33.8	30.1	36.1	89.3	1305
Education:					
no education	12.5	0.0	87.5	1.6	24
5 years	13.6	17.2	69.2	21.1	308
8 years	18.9	34.0	47.1	35.0	512
13 years	63.2	36.0	0.8	36.7	536
18 years	97.5	2.5	0.0	5.5	81
Father's Education:					
no education	23.2	23.2	53.7	28.1	410
5 years	34.1	34.4	31.6	51.4	751
8 years	64.9	25.8	9.3	13.3	194
13 years	77.4	19.0	3.6	5.7	84
18 years	81.8	13.6	4.5	1.5	22
Age					
20-30	42.8	30.8	26.4	10.9	159
31-40	40.5	32.5	27.0	30.9	452
41-50	35.9	29.4	34.8	36.8	538
51-65	37.2	21.8	41.0	21.4	312
Total	38.3	28.9	32.8	100.0	1461

(1) Share of workers with the referred characteristic classified in the specified sector.
(2) Share of workers with the referred characteristics out of all workers.

The ideal situation would be a bimodal distribution, with all workers having a very high probability of being in one segment or the other. The estimated distribution does in fact resemble this ideal one. It is bimodal, with the two modes in ranges 0-0.1 and 0.7-0.8. There are about 300 workers, almost 21 per cent of the sample, with probability of under 10 per cent of being in the secondary segment; i.e. they have a 90 per cent likelihood of belonging to the primary market. The number of workers in the secondary segment is somewhat smaller: 250 (17 per cent of the sample) with a high probability (above 0.8). In short the model classifies about 40 per cent of the sample with a high degree of confidence. Another 21 per cent of the sample can be assigned to the secondary market with a probability of between 60 and 80 per cent.

Workers are not assigned randomly to segments; rather, as shown in table 5, there is a strong association between segment attachment and individual's characteristics. For each characteristic I have computed the share of individuals belonging to primary or secondary market, or not classified. Workers with probability above two-thirds of being in the primary market are so assigned; if the probability is below 1/3, he is assigned to the secondary market. The remaining workers are not classified. With this rule 38.3 per cent of the sample is in the primary segment, 32.8 per cent in the secondary segment, and 28.9 per cent not classified. Thus even among workers who constitute the strongest component of the labour force there is a considerable risk of ending up in the secondary market.

The probability of being in the secondary market rises with age; almost all the individuals with no education (and about 70 per cent of those with only five years of schooling) work in the secondary segment. This share is almost nil for high school graduates. Having a father with at least an elementary school certificate greatly lowers the risk of working in the secondary tier. A higher share of people living in the South work in the primary segment. This is a most surprising result, worth discussing in some detail (section 7).

The results of table 5 confirm those of previous research on low-wage workers (Lucifora, 1998; Brandolini, Cipollone and Sestito, 2001); but they also support them statistically, because they are obtained by a methodology which, within the limits discussed in section 2.2, overcomes an important weakness of the standard methodology.

Previous studies on Italian economy have shown that human capital equations are significantly different in different sectors of the economy (Cannari, Pellegrini and Sestito, 1989). In spite of some inter-sectoral variability, a general pattern emerges from the sectoral wage equations: there seems to be a trade-off between entry level wage and the return to human capital. This is exactly the pattern described by dual labour market theory. Thus these results indicate that economic sectors cluster together in the primary and secondary segments. However, the two segments do not coincide with any specific industry; within each sector, good and bad jobs coexist.

Table 6

Workers' Distribution by Industry, Occupational Category and Segment Attachment (1)

	Industry	Construc-tion	Wholesale trade, hotels	Transporta-tion and communica tion	Banking and financial services	Business services	Services to households	Private non farm sector
Blue collar workers	*36.0*	*11.0*	*7.4*	*3.8*	*0.1*	*0.3*	*2.7*	*61.4*
Primary segment	15.6	19.3	33.3	21.4	50.0	75.0	47.5	20.5
Not classified	31.6	31.1	28.7	41.1	0	0	12.5	30.7
Secondary segment	52.9	49.7	38.0	37.5	50.0	25.0	40.0	48.8
White collar workers	11.0	1.2	3.2	3.4	4.0	1.7	0.6	25.1
Primary segment	51.3	55.6	55.3	61.2	79.7	72.0	55.6	59.4
Not classified	39.4	38.9	21.3	32.7	16.9	24.0	44.4	31.6
Secondary segment	9.4	5.6	23.4	6.1	3.4	4.0	0.0	9.0
Managers	5.5	0.2	1.4	1.3	4.0	0.8	0.3	13.5
Primary segment	77.8	66.7	50.0	78.9	93.2	100	50.0	80.2
Not classified	19.8	33.3	30.0	21.1	3.4	0	50.0	15.7
Secondary segment	2.5	0.0	20.0	0.0	3.4	0	0.0	4.1
All employees	*52.5*	*12.5*	*12.0*	*8.5*	*8.2*	*2.7*	*3.6*	*1461*
Primary segment	29.6	23.6	41.1	46.0	85.8	80.0	49.1	560
Not classified	31.9	31.9	26.9	34.7	10.0	15.0	20.8	422
Secondary segment	38.5	44.5	32.0	19.4	4.2	5.0	30.2	479

(1) Figures in Italics are the shares of the workers in the specified occupational category-industry cell; figures in the subsequent rows are the shares of the workers belonging to the specified occupational category-industry cell classified as primary, secondary or not classified; figures in the low-right-end corner are absolute numbers.

A more accurate description of the location of the two segments is provided by table 6, which shows the distribution between primary and secondary segment of workers who are in each industry-job category[14] cell; along the rows one can read, for example, the share of

[14] I consider only three occupational-categories; even though the Italian law divides employees into four categories: blue collar, white collar, technicians and managers. Because the sample is small I combine the latter two categories.

primary segment jobs to be found among blue collar workers in construction. In this table I adopted the same classification rule used for table 5, namely a two-third probability threshold.[15]

The main indication of the table is that the secondary market does not adhere precisely either to an industry-based or to a skill-based divide; it seems to be relatively pervasive. The secondary segment involves many industries. Four of the seven sectors considered have a high share of workers in the secondary segment: 38.5 per cent in manufacturing industry, 44.5 in construction, 32 per cent in wholesale trade and hotels, and 30.2 per cent in household services. Lower percentages are found in transport and communications, financial services and business services.

In part, these sectoral differences reflect skill composition; they are much smaller when one controls for skill categories. Thus the lesser diffusion of the secondary market in some service industries depends mainly on the smaller number of blue-collar workers.

However the primary/secondary divide does not coincide with skill categories. On the one hand, a significant fraction of white-collar workers appear to be in the secondary market (9 per cent for the entire private non-farm economy). In wholesale trade and hotels this rises to 23 per cent. Even managers in industry face some risk of being consigned to the secondary segment (4.1 per cent). On the other hand, 50 per cent of blue collar workers in the banking and financial sector hold primary segment jobs; the share jumps to 75 per cent in business services.

7. Why are there so many Southerners in the primary segment?

The high proportion of southern workers in the primary segment of the market seems to be at odds with the broadly shared notion of the South comparative backwardness. Further analysis of the reasons for this counterintuitive result will thus be worthwhile. Before getting into the specifics it will be useful to clarify that southerners' higher probability of being in the primary segment does not depend on sample composition in terms of education, large

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[15] A worker is in the primary segment if his probability is higher than 2/3. If it is lower than 1/3 he is in the secondary segment; otherwise, not classified.

city residence, family background. Indeed in the selection equation reported in table 3, where there are controls for all these variables, the coefficient of the South is positive, indicating the independent role of this factor.[16]

To explain this independence, we must look beyond the set of variables included in the selection equation. The basic starting point is that primary jobs prevail in the South both in the aggregate and within each industry. There are two natural explanatory hypothesis: the sectoral composition and the firm size composition of employment. The idea is that perhaps the South is marked by a sectoral composition of employment biased towards industries with a larger share of primary segment jobs, compared with the central and northern regions. But this is only part of the story, because even after controlling for sectoral composition, the South's share of primary workers remains higher; this residual prevalence can be accounted for by the fact that, within sectors, southerners work in larger firms, where the share of good jobs is higher.

To check whether this story is consistent, I can provide two pieces of evidence. It is convenient to use a few symbols. The aggregate shares of the primary and the secondary segment and of unclassified workers can be simply written as

$$\frac{N^P}{N} = \sum_i \sum_j \frac{N_{ij}}{N} P_{ij}^P \; ; \; \frac{N^S}{N} = \sum_i \sum_j \frac{N_{ij}}{N} P_{ij}^S \; ; \; \frac{N^{NC}}{N} = \sum_i \sum_j \frac{N_{ij}}{N} P_{ij}^{NC}$$

where N^P, N^S, N^{NC} are respectively the number of workers in the primary and the secondary markets and not classified ; N_{ij} is the number of the workers in job category *j* in industry *i* P_{ij}^P, P_{ij}^S, P_{ij}^{NC} are the shares of primary, secondary and unclassified workers in job category *j* and in industry *i*.

To evaluate why the South's share of primary workers is higher, I applied this decomposition to both areas. The differences in the share between the two areas can be disaggregated into a difference in the distribution of employment by industry and

[16] Federico Cingano has suggested that a possible explanation is that in the South the secondary segment overlaps significantly with the underground economy, so these workers might report themselves as unemployed rather than employed.

occupational category and a difference in the P_{ij}. For instance the difference in the share of primary market workers can be written as:

$$\left(\frac{N^P}{N}\right)_{South} - \left(\frac{N^P}{N}\right)_{North} = \sum_i \sum_j \left\{ \left[\left(\frac{N_{ij}}{N}\right)_{South} - \left(\frac{N_{ij}}{N}\right)_{North} \right] \left(P^P_{ij}\right)_{South} + \left[\left(P^P_{ij}\right)_{South} - \left(P^P_{ij}\right)_{North} \right] \left(\frac{N^P}{N}\right)_{North} \right\}$$

where the first addendum is the contribution of the difference in the employment distribution and the second is that of the difference in the intra-cell probabilities. Table 7 reports the results of the decompositions

Table 7

Decomposition of South-North differential in the distribution of workers by segment

	Share of workers in primary segment	Share of workers in secondary segment	Share of workers not classified
North	29.5	43.0	27.5
South	59.5	8.4	32.1
South-North difference	30.0	-34.6	4.5
Of which :			
-composition effect	-4.8	1.0	4.2
-intra-cell differences	34.9	-35.6	0.3

The South-North gap is virtually all due to intra-cell differences. The employment distribution by category and industry makes a negative contribution to the share of primary segment jobs in the South. That is, within each job category–industry cell, there is a higher probability of being in the primary segment in the South than in the North. A possible explanation is that average firm size, controlling for industry, is larger in the South (Table 8). Since larger firms are more likely to offer primary segment jobs, this could be at the root of the prevalence.

Table 8

Sample composition by firm size

		0- 4 employees	5-19 employees	20-49 employees	50-99 employees	100-99 employees	500 or more employees	total
Manufacturing	North	4.0	15.6	14.3	11.1	23.3	31.6	100
	South	3.8	16.9	14.4	9.4	13.1	42.5	100
Construction	North	17.3	41.8	12.2	4.1	12.2	12.2	100
	South	15.0	48.8	20.0	10.0	5.0	1.3	100
Wholesale, trade and hotels	North	20.5	40.2	13.4	9.8	4.5	11.6	100
	South	29.0	45.2	6.5	6.5	3.2	9.7	100
Transport and communications	North	6.0	11.9	9.0	9.0	10.4	53.7	100
	South	10.4	16.7	4.2	2.1	10.4	56.3	100
Banking and financial services	North	1.2	9.4	5.9	0.0	18.8	64.7	100
	South	2.9	8.8	0.0	0.0	20.6	67.6	100
Business services	North	14.3	28.6	10.7	17.9	7.1	21.4	100
	South	8.3	41.7	8.3	8.3	8.3	25.0	100
Household services	North	10.3	13.8	20.7	3.4	31.0	20.7	100
	South	58.3	12.5	4.2	4.2	4.2	16.7	100

In fact the share of employees in larger firms is higher in the South than in the North: not everywhere, but precisely in those industries where there is a predominance intra-cell probability of being in the primary segment.

8. Conclusions

The paper tests for the existence of segmentation in the Italian labour market along the lines suggested by dual market theory, as a contribution to the debate on the increase in poverty in Italy and an indication of possible remedies. It turns out that even workers who belong to traditionally strong groups – male, breadwinners, in the central age-groups – may be consigned to the secondary segment of the labour market by rationing or other entry barriers. These are individuals with poor education, coming from families with little educational background, serving mostly as blue-collar workers in small firms in manufacturing, construction and trade. For these workers the return to education is almost nil and wages do not increase much with experience either. The secondary market is not insignificant in size: almost on third of all workers are engaged in that segment.

These results suggest that programmes to increase workers' human capital may not be enough to reduce poverty, since in this large segment of the market skill, education and experience are not rewarded. A better policy approach could be such alternative as direct income support to the working poor.

Appendix : The model

General Setting

Consider a worker who maximises the lifetime utility function over wages and the non-pecuniary characteristics of the job

(1) $$U^0 = \log \int_0^\infty e^{-rt} w(t)\ \mathrm{dt}\ + \mathrm{NPA}\ ,$$

where r is the discount rate, *w(t)* the wage rate and NPA, the worker's evaluation of the non-pecuniary aspects. The wage is set according to a standard human capital formulation

(2) $$w(t) = \exp\left(X\beta + at + \eta \right) ,$$

where X are the observable characteristics of the worker, t years of experience and η the unobservable component of the wage that is assumed to be unrelated to the characteristics of the worker and time-independent. Substituting (2) into (1), assuming that $r\text{-}a>0$ and solving, the level of lifetime utility can be written as

(3) $$U^0 = X\beta + \eta - \log(r-a) + \mathrm{NPA}\ .$$

Assume that there exist two segments in the economy: primary and secondary. If the worker chooses to work in the primary segment, lifetime utility is represented by

(3.1) $$U_p^0 = X\beta_p + \eta_p - \log(r-a_p) + \mathrm{NPA}_{\mathrm{p}}\ ,$$

where subscript p denotes the primary segment. Alternatively, lifetime utility will be

(3.2) $$U_S^0 = X\beta_s + \eta_s - \log(d-a_s) + \mathrm{NPA}_{\mathrm{s}}\ ,$$

if the decision is to work in the secondary segment. If the choice is based on utility maximisation, then the worker will be in the primary segment if $U_p^0 > U_s^0$ with wage rate $\log(w_p) = X\beta_p + a_p t + \eta_p$ but in the secondary segment if $U_s^0 > U_p^0$ with a wage rate $\log(w_s) = X\beta_s + a_s t + \eta_s$.

Test level 1

As is illustrated in table 1, the first step is testing whether a two-wage-equation model explains the data better than a single wage equation. To perform the tests it is necessary to derive the likelihood function for both models and to compare their maximised value by a likelihood ratio test. For the two-equation model, I define the sample selection equation as the difference between the maximised levels of utility in the two segments

$$(4) \qquad Z = U_p^0 - U_s^0 = X(\beta_p - \beta_s) + (\eta_p - \eta_s) + \log\left[\frac{(d-a_s)}{(d-a_p)}\right] + \text{NPA}_p - \text{NPA}_s,$$

or $Z = P\Gamma + \eta_W$ where it is assumed that $\log\left[\frac{(d-a_s)}{(d-a_p)}\right] + \text{NPA}_p - \text{NPA}_s = \text{constant} + \eta_z$, so that P is the vector [*1, X*] and Γ the column vector of coefficients; the stochastic component η_w is therefore the sum of the stochastic components of the two wage equations (η_p and η_s) and the error term associated with the non-pecuniary components of utility (η_z). With this notation the model assumes the standard form of a switching model with one sorting equation and two regime equations:

$$(5) \qquad Z = P\Gamma + \eta_W,$$

$$(6) \qquad Y = \log(w_p) = \tilde{X}\tilde{\beta}_p + \eta_p \text{ if (Y,Z)} \in \Theta_\text{p},$$

$$(7) \qquad Y = \log(w_s) = \tilde{X}\tilde{\beta}_s + \eta_s \text{ if (Y,Z)} \in \Theta_\text{s},$$

where $\tilde{X} = [X{:}t]$ and $\tilde{\beta} = \begin{pmatrix}\beta \\ a\end{pmatrix}$. To simplify the derivation of the likelihood function, the standard index function framework can be used; define two indicator variables

$$\delta_p = \begin{cases} 1 & if \quad (\text{Y,Z}) \in \Theta_p \\ 0 & if \quad (\text{Y,Z}) \notin \Theta_p \end{cases} \quad \text{and} \quad \delta_s = \begin{cases} 1 & if \quad (\text{Y,Z}) \in \Theta_s \\ 0 & if \quad (\text{Y,Z}) \notin \Theta_s \end{cases},$$

that takes value 1 only when the regime they represent is chosen.[17] Suppose we can observe the segment in which the worker is employed. This implies that we know the value of the δ's. In this case the likelihood function (Heckman and MaCurdy, 1986) would be

(8) $$LF = \left\{\left[g_p(Y_p)\Pr(\delta_p = 1)\right]\right\}^{\delta_p}\left\{\left[g_s(Y_s)\Pr(\delta_s = 1)\right]\right\}^{\delta_s},$$

where

(9) $$\Pr(\delta_p = 1) = \int_0^{\infty} f(Z)\, dZ \quad \text{and} \quad \Pr(\delta_s = 1) = \int_{-\infty}^{0} f(Z)\, dZ,$$

(10) $$g_p = \int_{\Theta p/Yp} \frac{f(Y_p, Z)}{\Pr(\delta_p = 1)}\, dZ \quad \text{and} \quad g_s = \int_{\Theta s/Ys} \frac{f(Y_s, Z)}{\Pr(\delta_s = 1)}\, dZ,$$

and *f(.)* denotes a generic density function.[18] However, the above likelihood function is not appropriate when the segment is unknown (hence the values of the indicator variables δ's are unknown). To derive the correct likelihood function define $\delta = \delta_p + \delta_s$ which is by definition equal to 1 for each worker. In this case the likelihood function would be

(11) $$LFUN = \left\{\left[g_p(Y_p)\Pr(\delta_p = 1)\right] + \left[g_s(Y_s)\Pr(\delta_s = 1)\right]\right\}.$$

To test it is necessary to compare the maximum value of this likelihood with the maximum value of the likelihood for the alternative case, i.e. corresponding to one-equation model; this latter function is:

(12) $$LFR = g(Y)$$

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[17] With this more general formulation the present problem maps into the more general framework defined by Heckman and MaCurdy (1986, p. 1926, section 1.2.1, equation 1.2.13). Thus the derivation of the likelihood function will be a straightforward application of the Heckman-MaCurdy method.

[18] The integral on expression (10) sums over the sets $\Theta_{P/Yp}$ and $\Theta_{s/Ys}$, which are conditional sets defined as $\Theta_{P/Yp} = (Z{:}Z \geq 0);\ \Theta_{s/Ys} = (Z{:}Z < 0)$ and are derived from the unconditional sets $\Theta_P = (Y, Z{:}Z \geq 0);\ \Theta_s = (Y, Z{:}Z < 0)$ which depend on both Z and Y and that represent the support of the two regimes.

and it is a special case of (11) because in the one-equation case $g_p(Y_p) = g_s(Y_s) = g(Y)$. Thus the actual test for the existence of two equations is simply a likelihood test

$$(13)\quad LRT = -2\log\frac{\max\limits_{\vartheta}\prod_{i=1}^{N}\mathrm{LFR_i}}{\max\limits_{\delta}\prod_{i=1}^{N}\mathrm{LFUN_i}} = -2\log\frac{\max\limits_{\vartheta}\ \mathrm{LFR}}{\max\limits_{\delta}\ \mathrm{LFUN}} \qquad LRT \sim \chi^2_{Number\ of\ restrictions},$$

where N is the number of observations and ϑ and δ are the relevant parameters. If the two-equation model cannot be rejected, then the testing strategy moves on to analyse the two equations estimated along the lines indicated in table 1.

However to actually run the test it is necessary to make some assumptions on the distribution of the vector of stochastic components:

$$(\eta_p, \eta_s, \eta_w) \sim \mathrm{N}(0, \Sigma),$$

and

$$\Sigma = \begin{pmatrix} \sigma_{pp} & \sigma_{ps} & \sigma_{pw} \\ \sigma_{sp} & \sigma_{ss} & \sigma_{sw} \\ \sigma_{wp} & \sigma_{ws} & 1 \end{pmatrix};$$

under these assumptions the likelihood function for the two-equation model is:

$$(14)\qquad LFUN = \prod_{i=1}^{N}\left\{\begin{array}{l} \sigma_{pp}^{-1/2}\phi(\frac{Y_{p,i} - \tilde{X}_i\tilde{\beta}_p}{\sigma_{pp}^{1/2}})\left\{1 - \Phi(\frac{-P_i\Gamma - \frac{\sigma_{pw}}{\sigma_{pp}}(Y_{p,i} - \tilde{X}_i\tilde{\beta}_p)}{(1 - \frac{\sigma_{pw}^2}{\sigma_{pp}})^{1/2}})\right\} \\ + \sigma_{ss}^{-1/2}\phi(\frac{Y_{s,i} - \tilde{X}_i\tilde{\beta}_s}{\sigma_{ss}^{1/2}})\left\{\Phi(\frac{-P_i\Gamma - \frac{\sigma_{sw}}{\sigma_{ss}}(Y_{s,i} - \tilde{X}_i\tilde{\beta}_s)}{(1 - \frac{\sigma_{sw}^2}{\sigma_{ss}})^{1/2}})\right\} \end{array}\right\},$$

where ϕ and Φ are density and cumulative distribution functions of a normal standard.

To derive the likelihood function (14), recall that the general form is given in (11)

$$LFUN = \prod_{i=1}^{N} \{[g_p(Y_{p,i})\Pr(d_{p,i=1})] + [g_s(Y_{s,i})\Pr(d_{s,i}=1)]\}. \tag{11.1}$$

I can rewrite the first addendum as:

$$\begin{aligned} g_p(Y_p)\Pr(\delta_p = 1) &= \left[\int_0^\infty \frac{f(Y_p, Z)}{\Pr(\delta_p = 1)} dz\right] \Pr(\delta_p = 1) \\ &= \int_0^\infty f(Y_p, Z) dz \\ &= g(Y_p) \int_0^\infty f(Z / Y_p) dz \end{aligned} \tag{11.2}$$

By the assumption about the vector of stochastic components $Y_P \sim N(\tilde{X}_P \tilde{\beta}, \sigma_{pp})$; therefore the *g(.)* density can be derived as

$$\begin{aligned} g(Y_p) &= \frac{\partial \Pr(Y_p \le y_p)}{\partial y_p} \\ &= \frac{\partial}{\partial y_p} \Pr\left(\frac{Y_p - \tilde{X}_p \tilde{b}_p}{\sigma_{pp}^{1/2}} \le \frac{y_p - \tilde{X}_p \tilde{b}_p}{\sigma_{pp}^{1/2}}\right) \\ &= \frac{\partial}{\partial y_p} \Phi\left(\frac{y_p - \tilde{X}_p \tilde{b}_p}{\sigma_{pp}^{1/2}}\right) \\ &= \sigma_{pp}^{-1/2} \phi\left(\frac{y_p - \tilde{X}_p \tilde{b}_p}{\sigma_{pp}^{1/2}}\right) \end{aligned} \tag{11.3}$$

Now I move to derive *f(Z/Y$_p$)*. Notice first that *f(Z/Y$_p$) ~N(* $\mu_{z/Yp}$. $\sigma_{z/Yp}$); with

$$\begin{aligned} \mu_{z/Yp} &= E(Z) + \frac{Cov(Z, Y_p)}{\sqrt{[Var(Z)Var(Y_p)]}} \frac{\sqrt{Var(z)}}{\sqrt{Var(Y_p)}} [Y_p - E(Y_p)] \\ &= P\Gamma + \frac{\sigma_{pw}}{\sigma_{pp}} [Y_P - \tilde{X}\tilde{\beta}_p] \end{aligned} .$$

and

$$\sigma_{z/Yp} = \sigma_{ww}(1 - \frac{\sigma_{pw}^2}{\sigma_{pp}}) = (1 - \frac{\sigma_{pw}^2}{\sigma_{pp}}) .$$

Therefore

$$\int_0^\infty f(Z/Y_p)dz = P\left[Z > 0 | Y_p\right]$$

(11.4)
$$= \Pr\left[\frac{Z - P\Gamma - \frac{\sigma_{pw}}{\sigma_{pp}}(Y_p - \tilde{X}\tilde{\beta}_p}{\sqrt{(1 - \frac{\sigma_{pw}^2}{\sigma_{pp}})}} > \frac{- P\Gamma - \frac{\sigma_{pw}}{\sigma_{pp}}(Y_p - \tilde{X}\tilde{\beta}_p}{\sqrt{(1 - \frac{\sigma_{pw}^2}{\sigma_{pp}})}}\right]$$
$$= 1 - \Phi\left[\frac{- P\Gamma - \frac{\sigma_{pw}}{\sigma_{pp}}(Y_p - \tilde{X}\tilde{\beta}_p}{\sqrt{(1 - \frac{\sigma_{pw}^2}{\sigma_{pp}})}}\right]$$

Analogous expression can be derived for the secondary market component. Thus likelihood function (14) in the main text is obtained by substituting expressions (11.4) and (11.3) into (11.2) and then into (11.1).

The alternative hypothesis, i.e. that there is only one segment, implies that there is only one wage equation with, one set of parameters $\tilde{\beta}_s = \tilde{\beta}_p = \tilde{\beta};\ \ \eta_s = \eta_p = \eta;\ \ \sigma_{pp} = \sigma_{ss} = \sigma$; therefore likelihood (14) collapses to

(15)
$$LFR = \prod_{i=1}^{N}\left\{\sigma^{-1/2}\phi(\frac{Y_i - \tilde{X}_i\tilde{\beta}}{\sigma^{1/2}})\right\},$$

which is the product of the densities for the single-equation case (3). The level 1 test is then implemented by plugging (14) and (15) into (13).

Test level 2

The existence of two equations with the expected characteristics is not sufficient evidence to prove the segmented labour market hypothesis. It must also be shown that people are not free to choose the segment they wish to work in. To translate this notion into actual empirical test, I recall that a worker chooses the segment for which maximised utility is highest; that is, the selection mechanism is the difference between levels of maximised utility.

$$Z = U_p^0 - U_{sp}^0 = X(\beta_p - \beta_s) + (\eta_p - \eta_s) + \log\left[\frac{(d-a_s)}{(d-a_p)}\right] + \text{NPA}_p - \text{NPA}_s$$

or

(16) $$Z = constant + X(\beta_p - \beta_s) + \eta_w .$$

This last equation can be rewritten in a more general form as

(4) $$Z = P\Gamma + \eta_W ,$$

which embodies (16) but allows for other factors influencing the worker's choice, in the sense that the elements of Γ are not necessarily equal to the differences of the coefficients of the two wage equations. In order to verify that the utility maximisation process is the only determinant of individuals' choices, it is required that (4) and (16) be the same equations; i.e. it is necessary to check that

(17) $$\begin{pmatrix} constant \\ \beta_p - \beta_s \end{pmatrix} \equiv (\tilde{\beta}_p - \tilde{\beta}_s) = \Gamma .$$

In other words, the test consists in a cross-equation restriction,[19] which can be implemented through a likelihood ratio that compares the maximum value of likelihood function (14) with that obtained under constraint (17). The form of this likelihood function, which is obtained by plugging (17) into (14), is

$$LFUN1 = \prod_{i=1}^{N} \left\{ \begin{array}{l} \sigma_{pp}^{-1/2} \phi(\dfrac{Y_{p,i} - \tilde{X}_i \tilde{\beta}_p}{\sigma_{pp}^{1/2}}) \left\{ 1 - \Phi(\dfrac{-P_i(\tilde{\beta}_p - \tilde{\beta}_s) - \dfrac{\sigma_{pw}}{\sigma_{pp}}(Y_{p,i} - \tilde{X}_i \tilde{\beta}_p)}{(1 - \dfrac{\sigma_{pw}^2}{\sigma_{pp}})^{1/2}}) \right\} \\ + \sigma_{ss}^{-1/2} \phi(\dfrac{Y_{s,i} - \tilde{X}_i \tilde{\beta}_s}{\sigma_{ss}^{1/2}}) \left\{ \Phi(\dfrac{-P_i(\tilde{\beta}_p - \tilde{\beta}_s) - \dfrac{\sigma_{sw}}{\sigma_{ss}}(Y_{s,i} - \tilde{X}_i \tilde{\beta}_s)}{(1 - \dfrac{\sigma_{sw}^2}{\sigma_{ss}})^{1/2}}) \right\} \end{array} \right\}$$

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[19] I thank Paolo Zaffaroni for suggesting that the test could be stated as a simple cross-equation restriction.

If restriction (17) is not rejected, then the selection mechanism can be considered due to preference, workers freely choosing the segment they want to work in. On the contrary, rejection of constraint (17) signals that some other factor underlies the assignment of the segment.

However, it is far too restrictive to constrain all coefficients of the selection equation to be equal to the difference between the corresponding coefficients of the two wage equations. If one allows workers to have a preference for one of the two segments, then the constant coefficients of the selection equation might be not equal to the difference between the two-wage-equation constants without implying the existence of entry barriers to one of the tiers. By the same token, some other coefficients of the switching equation are allowed to reflect heterogeneity in workers' tastes. To test for the existence of entry barriers against some workers, it is necessary to look for coefficients whose values do not equal the differences between the corresponding wage equation coefficients, yet cannot be plausibly explained on grounds of taste.

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