Are there dual labor markets in Chile?: empirical evidence

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Abstract

In this paper we use a switching regression method to test the hypothesis that segmentation in the Chilean labor market exists. The results support the labor segmentation hypothesis and consequently they contradict those of Corbo and Stelcner (1983). The explanation for this is that we do not make any a priori definition of the population, as Corbo and Stelcner do. In fact, our results show that any a priori definition of the sample will lead to rejecting the segmentation hypothesis.

1. Introduction

This paper follows a popular view about the way labor markets work in less developed countries (LDCs). The basic underlying idea is that labor markets are best characterized by the existence of more than one sector, for instance, in promotions, stability, and job security protection. Although segmentation is usually considered a stylized fact of LDC's labor markets, empirical research has not provided evidence to support this view. Corbo and Stelcner (1983), in an important paper, argue that "the structures of earnings functions are not statistically different across sectors of economic activity." Corbo and Stelcner's methodology, however, has important problems that bias the results and lead to wrong conclusions.

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To discuss segmentation is a challenging task as there are different reasons which explain the existence of segmented markets. Depending upon the underlying factors which explain segmentation, different policy recommendations are suggested. Hence, if segmentation is either explained, for instance, in terms of market protection policies or ascribed to the distribution of non-observable wage-related characteristics, the policy prescriptions are necessarily quite different.

Although there does not exist any consensus as to exactly what causes segmentation, all hypotheses explaining it predict the existence of more than one wage structure. This is the only implication that matters in our analysis, so we will not discuss the reasons underlying segmentation at any length in this paper. We will only attempt to ascertain whether more than one wage structure does in fact coexist.

The topic was studied for the first time in the early 1970s, in the classical paper by Doeringer and Piore (1971). The bulk of studies prompted by the existence of poverty blocks in some cities in industrialized countries is reviewed in Cain (1976), but the analysis was only dealt with very sporadically until a novel econometric technique was proposed by Dickens and Lang (1985), giving the topic a new thrust. In the mid-1980s, the quite popular "efficiency wage" and "interindustry wage" differentials literature became related to the segmentation hypothesis, where the link is the "internal labor market" mechanisms that would be creating the different wage structures which are not related across sub-markets.

The discussion in Chile has been important in the Latin American context. Corbo and Stelcner initiated the discussion when they suggested that no segmentation was present in the Chilean market. Uthoff (1986) criticizes Corbo and Stelcner's view, by arguing that the definition of the sectors was not appropriate. Riveros (1983) supported Corbo and Stelcner's conclusions and Romaguera (1986), by re-estimating the models, provided evidence that suggests quite the opposite. Since then, several other studies have analyzed the problem in Latin America, taking the more general perspective associated with wage differentials. Abuhadba and Romaguera (1993) as well as Lang et al. (1988) found that the huge institutional contrast between Latin America and the USA does not preclude the important similarities in the interindustry wage differentials pattern. In particular, they found that substantial wage differentials persist over time and that they are correlated across occupations. These findings stressed the importance of analyzing the existence of segmentation in the economy, and they underlie the prevailing notion – based on the Chilean results – that Latin American labor markets are segmented. Furthermore, often the governments in the region have followed policy orientations derived from non-tested dual labor markets, which in an arbitrary manner break them up into formal and informal sectors. [1]

It is reasonable, then, that the Chilean labor market presents a very interesting

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[1] See, for example, PREALC (1978).

case in which to test the existence of the segmentation hypothesis. Apart from the possibility of comparing previous results, the Chilean case is interesting because labor market regulations, which can be associated with segmentation, have been changing over time. Besides, the analysis of an LDC allows for interesting comparisons between Chile and other countries.

In this paper we do not define markets on an ex ante basis, but instead we resort to a switching regression approach. The sample shows, in itself, if there is more than one sector rendering any a priori definition of sectors futile. To be fully assured that our results are robust, we analyze the Chilean labor market over an uninterrupted 10-year period.

The sample used in this study was obtained from a survey carried out by the Department of Economics of the University of Chile. Ten cross-section regressions were performed. This procedure was preferred to a panel data methodology since many structural changes have taken place in Chile over the period under analysis. In particular, the progressive implementation of the labor law since 1981 and the increasing participation in labor unions may make a panel data analysis inadequate. Furthermore, some of the same structural changes could account for the changes in the degree of segmentation that we are interested in analyzing.

Only males, between 16 and 65 years of age, living in the area of Greater Santiago and working in the private sector were included. This is important since the literature on segmentation concerning LDCs emphasizes that this phenomenon is mainly observed in urban areas. Moreover, by this sample selection criterion we are controlling for any gender discrimination or institutional private–public sector differences which might exist. The total sample considered blue and white collar workers as well as the self-employed. [2]

In section 2 we present an outline of the estimation problems to test this theory. In section 3 we address the methodology used; in the subsequent section we show our main results, to finally draw our conclusions in the fifth and last section.

2. Segmentation theory estimation

Several empirical studies support the hypothesis that workers with the same human capital receive different wages depending upon the sector where they work [3]. From our point of view we must say that neoclassic theory predicts that without specific regulations only one labor market will exist. Segmentation does not arise if, for instance, one product market is protected while others are not. Through arbitrage workers will equate wages, labor conditions and productivity

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[2] This avoids the composition problem arising from the heterogeneous conditions prevailing in the country. For example, if there is a drought in the southern part of the country, there will be an increase in unemployment, possibly affecting the degree of ''segmentation'' associated with agriculture (more important in that area).

[3] Cain (1976) and Katz and Summers (1989) offer some interesting approaches to the literature.

across sectors. Only different degrees of regulation among labor sectors, and particularly different monitoring costs of these regulations, will generate wage or working status segmentation.

Dickens and Lang (1985) suggest that the following consensus on some aspects of the segmentation theory exists:

1. The primary sector workers (presumably protected) receive a higher wage than those working in the secondary (presumably non-protected) sector.
2. The primary sector should show higher returns to schooling and work experience than the secondary sector.

These propositions, however, pose two problems. First, in order to compare predicted incomes in the labor sectors, we must initially define the human capital levels that are going to serve as a reference for the comparison. Second, it is not clear why the protected sector should pay a higher return to human capital as shown in our previous example.

The theory does not suggest that the primary sector should pay more for any human capital level, but it seems reasonable to think that if segmentation is explained by entry restrictions to the protected sector, the predicted wage in the primary sector should be higher, at least for the mean human capital level of the sample. This is the main criterion considered for sector definition. Having thus identified the sectors, we establish whether different human capital returns between them exist or not.

There are several problems in testing the existence of a dual labor market correctly. To begin with, critics may hold the view that to advocate a dual market scheme is incorrect, and what one should really do is to test for a single-equation model of the human capital type, including a heteroscedastic error term structure, however bizarre it may be (Heckman and Hotz, 1986). There have been a vast number of studies that have estimated wage equations – in different countries for that matter – none of which have taken into account the heteroscedastic nature of the error term. The results we show in Appendix A for the OLS estimations follow this same line. However, realizing that we also have this same problem, we decided to estimate these single-equation models allowing for a fairly complex heteroscedastic structure, and then compare the results with those of our dual labor market using a goodness of fit test. [4,5]

One way in which we could pursue the examination of dual labor markets is to analyze each market separately. This is tantamount to considering a switching regression model where the sample separation is known beforehand. The problem of this approach, however, is that the sample separation is unknown in general. If

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[4] We thank an anonymous referee for this suggestion.

[5] In Dickens and Lang (1987), a test was made using a very complex heteroscedastic error term structure, with the Panel Study of Income Dynamics data set of 1980, and the evidence reported there – on the basis of a goodness of fit test – amply rejects the heteroscedastic single-equation model in favor of the dual market hypothesis.

we have wage data and other observable traits such as schooling and experience we do not know "a priori" which observations belong to which market. This is referred to in the literature as a problem of unknown sample separation.

There has been much research in this area, especially concerning different types of switching models: Fair and Jaffee (1972), Rosen and Nadiri (1974), Bergstrom and Wymer (1976), and Johnson and Taylor (1977). In relation to labor market segmentation we can mention, among others: Heckman and Hotz (1986), Reich (1984), Rosenberg (1979), Osterman (1975), Magnac (1991), Boston (1991). However, within the context proposed here, that is, switching models, the literature is somewhat lacking, save for Dickens and Lang (1985). The reasons behind this may be the many difficulties encountered in the estimation process, which unfortunately sometimes prove to be intractable.

The type of model which we will try to estimate has many of the technical optimization problems which are frequent in switching regression models with exogenous switching and unknown sample separation. This particular case is extensively discussed by Quandt and Ramsey (1978). An example of a model of this type is the watermelon-market model considered in Goldfeld and Quandt (1975). Here they show the unboundedness of the likelihood function. Furthermore, they posit that in most complicated models where sample separation is unknown, it is likely that the same problem will arise. Another problem of these models, as pointed out in Goldfeld and Quandt (1978), is the possibility of encountering false maxima, as long as the errors are allowed to be correlated.

3. Methodology

In this study we will consider the following three-equation regression model:

$$Y_{iP} = X'_{iP}\beta_P + u_{iP} \tag{1.a}$$

$$Y_{iS} = X'_{iS}\beta_S + u_{iS} \tag{1.b}$$

$$Y_{i3} = Xw_{i3}\beta_3 + u_{i3} \tag{1.c}$$

where the X_{ij}s ($j = P, S$ for the primary and secondary sectors respectively, and $j = 3$ for the switching equation variables) are non-stochastic regressors with coefficients β_j, and u'_{ij}s are normal iid disturbances with zero means and variances σ_j^2. The Y_{ij}s are latent non-observable variables. Instead we observe variables Y_i, defined by:

$$Y_i = Y_{iP} \text{ if } Y_{i3} \leq 0 \tag{2.a}$$

$$Y_i = Y_{iS} \text{ if } Y_{i3} > 0 \tag{2.b}$$

The problem is to estimate the parameters $\{(\beta_j, \sigma_j^2), j = P, S, 3\}$, from the observed sample $\{(Y_i, X_{iP}, X_{iS}, X_{i3}), i = 1, \ldots, N\}$. This defines a general form of the two-regime switching regression model in which the probability of selection

Table 1
Labor force composition (thousands) in the Greater Santiago area

Year	White collar	Blue collar	Self-employed	Total
1980	694	975	25	1694
1981	734	1055	20	1809
1982	739	829	22	1590
1983	668	795	6	1469
1984	649	841	17	1507
1985	674	868	11	1553
1986	772	886	25	1683
1987	729	918	15	1662
1988	687	1044	9	1740
1989	740	942	11	1693

Note: Data were provided by the survey which the Department of Economics of the University of Chile prepares each year.

of regime P or S is stochastic but varies linearly with the extraneous variables X_{i3}, as in Goldfeld and Quandt (1972). If we consider the case in which $\sigma_3^2 = 1$, required for identification purposes, following Hartley (1978), we arrive at the log-likelihood function:

$$L\left(\beta_P, \beta_S, \beta_3, \sigma_P^2, \sigma_S^2 \right) = \sum_{i=1}^{N} \log \left[\Theta_i f_P(Y_i) + (1 - \Theta_i) f_s(Y_i) \right] \qquad (3)$$

with

$$f_j(Y_i) = \frac{1}{\sqrt{2\pi\sigma_j^2}} \exp\left[-\frac{1}{2\sigma_j^2} \left(Y_i - X'_{ij} \beta_j \right)^2 \right] \qquad (4)$$

$$j = P, S, 3$$

and

$$\Theta_i = F_3(0) = \Phi\left(-X'_{i3} \beta_3 \right)$$

where Φ denotes the standard normal cdf. To estimate this model we consider the case where the regressors X_{iP} and X_{iS} are schooling, potential work experience, [6] experience squared, and experience times schooling. Apart from schooling, the definition of the switching variables include three industry dummies, for non-tradables (Ntrad), export manufacturing (Export) and import substitutes (Impsub), with agriculture as the base; and two occupational dummies (White and Blue), for white and blue collar workers, respectively, with self-employed workers as the

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[6] Since actual work experience is not available from the Chilean survey we proxy experience by age minus schooling minus 6.

Table 2
Labor force composition (thousands) in the Greater Santiago area according to economic line of work

Year	Agriculture	Non-traded	Export	Import subst.
1980	72	1035	120	467
1981	77	1147	141	444
1982	87	1036	84	383
1983	56	1025	75	313
1984	29	1076	83	319
1985	50	1072	81	350
1986	87	1100	113	383
1987	61	1062	100	439
1988	72	1088	114	466
1989	66	1071	110	446

Note: Data were provided by the survey which the Department of Economics of the University of Chile prepares each year.

base. [7] The labor force composition for the Greater Santiago area according to its occupational and economic working categories appears in Tables 1 and 2 respectively.

Contrary to Dikens and Lang, the reason why we incorporated these variables in the switching equation is because they have been considered by Corbo and Stelcner and in all subsequent articles dealing with segmentation in Latin America (e.g., Romaguera, Uthoff, Riveros). By incorporating these variables, which are conceptually justified as exogenous variables in the literature, we are able to understand the nature of the different results about structural wage determination in the different sectors. [8]

The public sector was left out of the study on purpose in order to work with a more homogeneous group, which in this case is the private sector. Accordingly, our results will be all the more significant if we detect the presence of dual labor markets in this group.

To complete our model specification, we impose the conditions $\sigma_{P3} = \sigma_{S3} = 0$, meaning that we are considering a model with exogenous switching. In this way

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[7] Workers are classified automatically into three distinct categories by the survey which the Department of Economics of the University of Chile conducts every year. White collar workers correspond primarily to employees who receive their pay on a regular basis while blue collar workers do not. Self-employed workers are self-explanatory. Furthermore, economic activities in the Greater Santiago area are classified into four different groups, exclusively and comprehensively: non-tradable industries (comprising services basically), export manufacturing industries (these exclude agricultural products), import substitution industries and agriculture (the Greater Santiago area includes several farms, which export their produce).

[8] If these variables are not considered to be strictly exogenous to the wages, the same result could be obtained by supposing they are equal to their expected value conditioned on the particular values taken on by the traditional human capital variables. Otherwise, since these outcome variables are dichotomous, we would require linear aproximation assumptions on the same.

we can include several variables which have been associated with segmentation in LDCs in the switching equation in an exogenous manner. This is in line with our intention to verify the existence of segmentation rather than explaining the underlying causes. Furthermore, we do not do this to overcome a generalized convergence problem, but to test the validity of Corbo and Stelcner's result for a long time period. Formally, the system of equations for the dual market was estimated using maximum likelihood optimization techniques. [9]

4. Results

The results of the estimation process, for the 10-year period considered (1980–1989) are shown in Appendix A. Having estimated our model, the next step is to test whether or not the data support the dual market hypothesis. It is not enough to expect that the dual market model equations have more explanatory power than the single-equation model. It is also necessary that the estimated model be compatible with the dual market tenets. This means that at least one wage equation should predict a higher wage than the other, and both sectors be upward sloping in schooling and experience. For these purposes, we relied on several different tests, namely, (1) log-likelihood ratio tests, (2) goodness of fit tests, and (3) estimated returns to human capital variables.

Although there are many different versions of dual market theory, most of them agree in that primary sector jobs are rationed, and that this would be the reason for the wage structure differential across sectors. As mentioned above, it is not the purpose of our analysis to test whether queuing shows up in the Chilean data, but rather to firmly establish the existence of two sectors, which is contrary to Corbo and Stelcner's findings. However, we have to point out that the existence of differentiated wage structures hints, in general, at some kind of segmentation present in the market rather than a Roy (1951) type model scenario, where workers have heterogeneous skills and are free to enter the sector that gives them the highest income as in Heckman and Sedlacek (1985). Be that as it may, in our study the question remains open as to what exactly may be causing the segmentation in the Chilean labor market: rationing in the primary sector or persistence due to exogenous factors as in the Roy (1951) model. Our results will show, however, that the latter explanation cannot be disregarded trivially.

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[9] None of the more important econometric software packages have built-in programs that can solve such system of equations. We relied on four basic optimization algorithms: (i) Davidon–Fletcher–Powell (DFP) [Davidon (1959) and Fletcher and Powell (1963)], which we resorted to the most (ii) steepest ascent, (iii) Newton's and (iv) the EM algorithm proposed by Dempster et al. (1977). Of these, the most suitable ones for our purposes proved to be EM and DFP, where the latter was the most expedient and efficient. Initial values for DFP were provided by EM, and for the latter algorithm the corresponding values were generated by ordinary least squares.

The single-equation model is nested in the switching model, if and when the latter is constrained to yield a single-equation model; this leaves several parameters unidentified. However, Monte Carlo results (Goldfeld and Quandt, 1975) suggest that one can use a log-likelihood test to see whether a two-equation model fits the data better than a single-equation model, by setting the degrees of freedom equal to the number of constraints plus the number of unidentified parameters. In this way, twice the difference between the log likelihood values for the two models yields a conservative test using the chi-square distribution.

In every year considered in the study, and since the critical value for the chi-square distribution is 22.4 (for 13 degrees of freedom and 95% confidence), the log-likelihood ratio tests reject the hypotheses that the labor market is best characterized by one sector rather than by two. This is the strongest evidence which so far supports the dual labor market hypothesis for the Chilean labor market, also in contradiction to the evidence obtained by Corbo and Stelcner.

As stated above, we used a goodness of fit test in order to compare our results which were obtained by resorting to the dual labor market model against those yielded by a single-equation model with a complex heteroscedastic error term structure. [10] Since our dual labor market model used 19 parameters and to render the comparison fair, we decided to allow the single-equation model a total of 20 parameters: 5 to describe the regression line (a constant, schooling, experience, experience squared, and experience interacting with schooling), and 15 to describe the heteroscedastic nature of the error term, following White's well-known test. The test we used was the Chernoff–Lehmann statistic (Chernoff and Lehmann, 1954). The critical points fall between those of the $\chi^2(M-1)$ and $\chi^2(M-m-1)$ distributions where M stands for the number of cells considered in the test and m for the number of estimated parameters. In our example we used 50 cells, which provide the test with a reasonable statistical power. For all 10 years the heteroscedastic single-equation model is rejected. The year which comes closest to the null hypothesis is 1983, when the statistic attains a value of 76.7, which is significant at any conventional level. On the other hand, we could not reject the dual market hypothesis at the 0.05 level in any of the 10 years. Again, 1983 comes closest to the rejection level with a value of 43.6 for the Chernoff–Lehman statistic.

We have naturally not exhausted the possibilities for the error term structure, but this evidence supports the idea that the dual labor market model has fared considerably better than the single-equation model. This enables us to conclude that the former model offers a more plausible description of the Chilean wage distribution.

Having estimated the system of Eqs. (1), it is straightforward to calculate the estimated returns to schooling and experience in the primary and secondary

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[10] We are indebted to an anonymous referee for this suggestion.

Table 3
Returns (%) to human capital variables in the primary (P) and secondary (S) sectors and predicted wages

Year	Schooling		Experience		Log wage		% of workers in each sector	
	P	S	P	S	P	S	P	S
1980	10.3	5.3	4.4	1.3	4.11	3.33	38%	62%
1981	17.1	2.8	3.7	1.1	3.99	3.59	43%	57%
1982	16.9	3.0	3.0	0.3	4.15	3.80	42%	58%
1983	16.7	6.7	3.9	1.7	4.41	3.77	42%	58%
1984	15.6	4.7	4.0	1.4	4.56	3.78	43%	57%
1985	17.1	4.0	3.4	1.1	4.48	3.91	46%	56%
1986	16.9	2.7	2.7	0.5	4.69	4.01	51%	49%
1987	16.9	3.9	3.1	1.3	4.95	4.31	43%	57%
1988	16.0	5.2	2.5	1.4	5.27	4.58	35%	65%
1989	17.1	3.9	3.1	0.8	5.15	4.76	44%	56%

sectors. Given estimates for the log earnings equation, for instance, of the primary sector as in (6):

$$E\left(\log Y_i | Y_i = Y_{ip}\right) = \beta_{P0} + \beta_{P1} s_i + \beta_{P2} e_i + \beta_{P3} e_i^2 + \beta_{P4} e_i s_i \qquad (5)$$

the implied rate of return to schooling is

$$\partial E\left(\log Y | Y = Y_p\right) / \partial s = \beta_{p1} + \beta_{p4} \bar{e} \qquad (6)$$

and the rate of return to experience is

$$\partial E\left(\log Y | Y = Y_p\right) / \partial e = \beta_{P2} + 2\beta_{P3} \bar{e} + \beta_{P4} \bar{s} \qquad (7)$$

The returns to schooling, experience and the predicted wages (in logs) for mean human capital levels are shown in Table 3.

The results show that returns to human capital variables are different across sectors. The coefficients have all the expected signs and are all significant at the standard levels of confidence. Moreover, the sector for which we obtained higher wage predictions is also the one where the human capital returns are higher. Specifically, the return to schooling in the secondary sector is quite low, as suggested by the traditional literature on segmentation. On the other hand, the same return in the primary sector is considerably higher, and larger than most studies have shown. [11] Along the same times, the return to experience is considerably higher in the primary than in the secondary sector. This is possibly associated with more on-the-job training received in the former sector.

The wage ratio for the primary and secondary sectors shows a 50% premium

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[11] The policy implications of this finding are very important. Thus, one should not evaluate the returns to education without giving due consideration to the sectors in which individuals will work.

for working in the former sector. Moreover, as shown in Appendix A, the estimated intercepts are always larger for the secondary sector. [12] To compensate for these differences in the intercepts, the returns to human capital variables are larger in the primary sector.

In the light of these results, we cannot necessarily rule out the free entry hypothesis to the primary sector in favor of the more popular rationing idea. Indeed, it could well be, for instance, that a worker facing a cash constraint chooses voluntarily to belong to the informal sector rather than the primary one, where he otherwise would be maximizing his lifetime income. [13]

By examining both the signs and sizes of the coefficients of the switching variables, we expected to gather useful information as to how the segmentation process has evolved in the past decade and the variables accounting for sector membership. However, we do not have a consistent set of variables explaining the probability of belonging to any sector over the years. [14] This is quite important, since it suggests that we should not derive policy prescriptions from this sort of aggregate data. Thus, it is possible that segmentation is associated with non-observable variables, such as firm size, intelligence, etc. Other possible reasons underlying this lack of consistency in the coefficients are the changes that have occurred in the labor market regulations in Chile over the past years. However, this is not completely convincing, because segmentation as measured by the log-likelihood ratio tests has not diminished despite the deregulation process experienced by the labor market. In any case, the results allow us to measure the size of the secondary sector directly from the estimation of the switching regressions. The rule which accomplishes this is: [15]

Assign Y_i to regime P if $\epsilon_{i3} \leq 0$

and

Assign Y_i to regime S if $\epsilon_{i3} > 0$

where ϵ_{i3} is the following conditional expectation:

$$\epsilon_{i3} = E[Y_{i3}|Y_i] = X'_{i3}\beta_3 - \frac{\omega_p(Y_i)f_3(0)}{\theta_i} + \frac{\omega_s(Y_i)f_3(0)}{(1 - \theta_i)} \tag{8}$$

[12] There are several explanations for this fact. Apart from the statistical ones, one could argue that workers in the primary sector require more on-the-job training, so the smaller wage at the beginning of their career should reflect this difference.

[13] We thank an anonymous referee for addressing this point.

[14] Thus, more schooling in the early 1980s enhanced the probability of belonging to the primary sector, but this is not observed for 1984, 1985, 1986 and 1989. Likewise, workers in the non-tradable and import substituting industries appear to belong more probably to the secondary sector, but this does not seem to be significant for 1989.

[15] For a formal proof see Hartley, 1978. Even though this rule to reckon sectoral composition is different from the one used by Dickens and Lang (1985), the results obtained with the Chilean sample are very similar to the ones we report in Table 3, with the difference well below 5% in all years.

Appendix A. Regression results (dependent variable: log hourly wage)

	1980 Switching OLS	1980 Prim.	1980 Sec.	1981 Switching OLS	1981 Prim.	1981 Sec.	1982 Switching OLS	1982 Prim.	1982 Sec.	1983 Switching OLS	1983 Prim.	1983 Sec.	1984 Switching OLS	1984 Prim.	1984 Sec.
Constant	0.91 (8.04)	0.95 (3.51)	1.91 (18.3)	1.22 (11.2)	0.81 (3.52)	2.41 (16.0)	1.61 (13.60)	1.57 (9.03)	2.69 (14.00)	1.34 (10.53)	1.31 (4.59)	2.42 (14.20)	0.96 (7.28)	0.97 (4.17)	2.58 (18.01)
Schooling	0.20 (23.9)	0.21 (12.3)	0.098 (9.48)	0.19 (23.9)	0.23 (15.9)	0.076 (5.60)	0.19 (21.40)	0.19 (16.00)	0.08 (4.56)	0.20 (21.70)	0.23 (12.80)	0.09 (5.40)	0.23 (24.3)	0.24 (17.10)	0.07 (6.22)
Experience	0.12 (15.6)	0.13 (8.78)	0.069 (10.22)	0.11 (15.1)	0.11 (7.78)	0.071 (8.28)	0.09 (11.60)	0.08 (5.96)	0.07 (6.86)	0.08 (10.4)	0.09 (5.11)	0.06 (5.83)	0.12 (14.60)	0.14 (10.20)	0.06 (6.54)
Experience2	-0.01 (12.3)	-0.009 (3.72)	-0.009 (8.86)	-0.01 (12.3)	-0.012 (5.18)	-0.001 (8.27)	-0.009 (8.22)	-0.007 (3.86)	-0.001 (5.74)	-0.009 (7.84)	-0.005 (2.04)	-0.0007 (5.77)	-0.001 (11.40)	-0.001 (6.85)	-0.0007 (5.70)
Exp.x School.	-0.004 (11.50)	-0.005 (9.49)	-0.002 (5.74)	-0.003 (9.12)	-0.003 (5.64)	-0.002 (5.10)	-0.003 (7.13)	-0.001 (2.43)	-0.004 (6.64)	-0.002 (4.68)	-0.003 (3.64)	-0.001 (1.77)	-0.004 (9.53)	-0.004 (8.65)	-0.001 (3.11)
Switching versus															
Constant		-2.37 (2.09)			4.69 (1.64)			1.55 (1.53)			-6.34 (0.01)			-0.18 (0.01)	
Schooling		0.12 (6.58)			0.17 (2.59)			0.08 (3.45)			0.22 (3.31)			-0.08 (2.15)	
Ntrad		-0.28 (0.29)			-6.14 (2.10)			-1.09 (2.60)			-1.13 (0.21)			-1.34 (0.06)	
Export		0.25 (0.24)			-4.63 (0.91)			-1.09 (2.02)			-0.79 (0.14)			0.35 (0.01)	
Impsub		2.36 (1.73)			-4.58 (2.04)			-1.75 (3.64)			0.61 (0.11)			-1.72 (0.07)	
White		1.68 (2.73)			0.37 (0.52)			0.65 (0.66)			5.80 (0.01)			-1.32 (1.92)	
Blue		-2.54 (2.92)			-4.11 (1.47)			-1.30 (1.40)			2.00 (0.001)			3.37 (0.18)	
Sigma 2(S)		0.32 (16.5)			0.33 (14.4)			0.17 (5.22)			0.34 (13.20)			0.42 (6.99)	
Sigma 2(P)		0.36 (7.03)			0.42 (9.34)			0.46 (12.93)			0.40 (7.11)			0.27 (11.91)	
Log-lik. ratio		310.00			329.00			269.00			255.00			464.00	

	1985 Switching			1986 Switching			1987 Switching			1988 Switching			1989 Switching		
	OLS	Prim.	Sec.	OLS	Prim.	Sec.	OLS	Prim.	Sec.	OLS	Prim.	Sec.	OLS	Prim.	Sec.
Constant	1.22 (9.15)	1.19 (5.05)	3.01 (18.0)	1.71 (14.20)	2.04 (12.01)	3.13 (18.70)	1.79 (14.30)	1.87 (8.04)	3.51 (27.3)	2.11 (17.80)	2.66 (7.25)	3.35 (24.10)	2.25 (18.7)	2.08 (10.4)	3.72 (23.0)
Schooling	0.22 (22.6)	0.23 (14.2)	0.06 (4.18)	0.21 (24.10)	0.20 (18.90)	0.06 (4.24)	0.21 (23.3)	0.22 (14.7)	0.05 (3.5)	0.21 (23.6)	0.20 (8.6)	0.08 (6.5)	0.20 (22.6)	0.21 (16.3)	0.07 (5.66)
Experience	0.11 (12.9)	0.11 (8.00)	0.04 (3.92)	0.08 (10.0)	0.05 (4.38)	0.05 (5.39)	0.09 (11.7)	0.10 (6.3)	0.10 (3.81)	0.08 (11.4)	0.07 (3.54)	0.05 (6.64)	0.09 (12.4)	0.10 (7.89)	0.05 (5.19)
Experience2	−0.001 (10.3)	−0.001 (6.28)	−0.0004 (3.43)	−0.007 (6.21)	−0.001 (0.23)	−0.007 (6.22)	−0.009 (8.74)	−0.010 (4.30)	−0.004 (3.45)	−0.008 (7.94)	−0.006 (2.27)	−0.006 (5.80)	−0.009 (9.12)	−0.001 (6.36)	−0.0001 (4.06)
Exp.x School.	−0.003 (7.53)	−0.003 (4.46)	−0.001 (1.82)	−0.002 (6.43)	−0.002 (4.48)	−0.001 (3.19)	−0.003 (7.10)	−0.003 (3.44)	−0.0004 (0.72)	−0.003 (7.52)	−0.002 (1.93)	−0.001 (3.20)	−0.003 (7.58)	−0.002 (4.07)	−0.002 (4.23)
Switching versus															
Constant		1.96 (1.8)			3.24 (0.03)			−2.01 (1.68)			−1.50 (1.17)			−0.29 (0.24)	
Schooling		−0.03 (0.54)			−0.06 (2.19)			0.13 (2.35)			0.14 (3.33)			−0.007 (0.20)	
Ntrad		−2.10 (3.1)			0.75 (1.94)			0.15 (0.18)			−0.45 (0.46)			−0.54 (1.11)	
Export		−1.93 (1.20)			0.78 (1.58)			0.52 (0.50)			0.19 (0.17)			−0.76 (0.33)	
Impsub		−1.31 (2.00)			1.49 (3.73)			1.29 (0.93)			0.15 (0.15)			−0.21 (0.42)	
White		2.55 (2.49)			0.16 (0.006)			1.34 (2.49)			0.75 (1.08)			3.34 (0.65)	
Blue		−1.33 (1.54)			−4.42 (0.04)			−2.55 (1.73)			−1.81 (2.43)			−0.94 (1.03)	
Sigma 2(S)		0.22 (8.12)			0.15 (6.13)			0.29 (11.00)			0.28 (12.91)			0.17 (6.37)	
Sigma 2(P)		0.52 (10.9)			0.43 (11.90)			0.44 (7.07)			0.38 (4.60)			0.51 (12.7)	
Log-lik. ratio		404.00			482.00			420.00			410.00			408.00	

Absolute *t*-tests in parentheses.

and the ω_js $(j = P,S)$ are the "weights":

$$\omega_p(Y_i) = \theta_i f_p(Y_i)/h(Y_i) \tag{9.a}$$

$$\omega_s(Y_i) = (1 - \theta_i) f_s(Y_i)/h(Y_i) \tag{9.b}$$

and

$$h(Y_i) = \theta_i f_p(Y_i) + (1 - \theta_i) f_s(Y_i)$$

Our results, also shown in Table 3, suggest that over 50% of the workers belong to the secondary sector, which is impressive not only by US standards, but also by Latin American ones. [16]

5. Conclusions

In this paper we have presented strong evidence showing that the labor market in Chile can best be characterized by two labor markets instead of one. Our findings contradict Corbo and Stelcner's and in a sense close a long discussion in the related literature on the existence of segmentation in Latin America and its underlying factors. Our approach represents a considerable advance over other studies that have tried to explain the stylized facts observed both in Chile and other countries of the region, where selection bias has been a mayor issue rendering prior interpretations confusing.

Consequently, besides the evidence provided by the log-likelihood ratio and goodness of fit tests, suggesting that a two-market model is more consistent with the data than a single-market one, we obtained a consistent set of parameters for each subsector over the years. We also found evidence for the existence of an important secondary sector including about 50% of the workers, which is considerably larger than the one observed in the USA and even larger than those reported in the literature on LDCs.

Naturally, there are other possible interpretations for our results. By resorting to complicated error term structures, or perhaps to non-linear forms in the wage equations, it could be possible to offer alternative explanations to our findings. We have explored some of these possibilities, only to realize that the simpler and more parsimonious dual labor market model is far superior.

Furthermore, the Chilean evidence seems to provide a different underlying explanation for the dual labor market hypothesis than the more popular queuing idea. Seemingly, we are facing a situation in which individuals could rationally begin their working career in the secondary sector and stay there throughout their lifetime, without there having to be necessarily any entry barriers into the primary sector. This explanation abides by Roy's persistence theory, where free entry is

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[16] In the case of the USA, estimations suggest that 12% of the labor force belong to the secondary sector, whereas in Latin America this figure is in the order of 40%.

allowed. Moreover, this line of reasoning provides a theoretical basis for the stylized facts that are all too often found in Latin America, where it is possible to observe the presence of informal workers coexisting with job opportunities in the primary sector.

As mentioned previously, the aim of this study was to show once and for all that there is sufficient evidence regarding the fact that the Chilean Labor market is better explained by a dual-labor model than by a single-equation model. This was done using a simple, though quite laborious, exogenous switching regression framework.

Future research is promising relaxing the conditions $\sigma_{P3} = \sigma_{S3} = 0$ in our switching model, and by doing thus incorporating the dual labor market characteristics endogenously. Although these conditions may appear to the non-specialist to be quite harmless, they make the whole model far more mathematically complex and ambitious than our present study ever purported to be. It is also promising to take into account several other issues which were left out on purpose, such as: the effect of changing labor laws in Chile, unionization and the different regulatory regimes which the labor market faced over the years.

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References

Abuhadba, M. and P. Romaguera, 1993, Inter-industrial wage differentials: Latin America, Journal of Development Studies 30(1).

Bergstrom, A. and C. Wymer, 1976, A model of disequilibrium neoclassical growth and its application to the United Kingdom, in: A.R. Bergstrom, ed., Statistical Inference in Continuous Time Economic Models (North-Holland, Amsterdam).

Boston, Th., 1991, Segmented labor markets: New evidence from a study of four race–gender groups, Industrial and Labor Relations Review 44.

Cain, G., 1976, The challenge of segmented labor market theories to orthodox theory: A survey, Journal of Economic Literature 15(4), 1215–57.

Chernoff, H. and E.L. Lehmann, 1954, The use of maximum likelihood estimates in chi squared tests for goodness of fit, Annals of Mathematical Statistics 25.

Corbo, V. and M. Stelcner, 1983, Earnings determination and labour markets: Gran Santiago, Chile – 1978, Journal of Development Economics 12(1/2).

Davidon, W.C., 1959, Variable metric method for minimization, AEC Research and Development Report ANL-5990 (Rev.).

Dempster, A., M.M. Laird and D.B. Rubin, 1977, Maximum likelihood from incomplete data via the EM algorithm, Journal of the Royal Statistical Society, Ser. B. 39, 1–38.

Dickens, W. and K. Lang, 1985, A test of dual labor market theory, American Economic Review September 75(4), 792–805.

Dickens, W. and K. Lang, 1987, A goodness of fit test of dual labor market theory, NBER, Working Paper No. 2350, August.

Doeringer, P. and M. Piore, 1971, Internal labor markets and manpower analysis (Lexington Books, Lexington, KY).

Fair, R.C. and D.M. Jaffee, 1972, Methods of estimation for markets in disequilibrium, Econometrica 40, 497–514.

Fletcher, R. and M.J.D. Powell, 1963, A rapidly convergent descent method for minimization, Computer Journal 6, 163–168.

Goldfeld, S.M. and R.E. Quandt, 1972, Nonlinear methods in econometrics (North-Holland, Amsterdam).

Goldfeld, S.M. and R.E. Quandt, 1975, Estimation in a disequilibrium model and the value of information, Journal of Econometrics 3(3), 325–348.

Goldfeld, S.M. and R.E. Quandt, 1978, Some properties of the simple disequilibrium model with covariance, Economics Letters 1(4), 343–346.

Hartley, M., 1978, Comments, Journal of the American Statistical Association 73, 738–741.

Heckman, J.J. and V.J. Hotz, 1986, An investigation of the labor market earnings of Panamanian males: Evaluating the sources of inequality, Journal of Human Resources 21(4), 507–542.

Heckman, J.J. and G. Sedlacek, 1985, Heterogeneity, aggregation and market wage functions: An empirical model of self selection in the labor market, Journal of Political Economy 93, 1077–125.

Johnson, P.D. and J.C. Taylor, 1977, Modelling monetary disequilibrium, in: M.G. Porter, ed., The Australian monetary system in the 1970s (Monash University, Melbourne, Australia).

Katz, L. and L. Summers, 1989, Industry rents: Evidence and implications, Brookings Papers of Economic Activity.

Lang, K., G. Marquez and P. Romaguera, 1988, Theories of wage determination: Lessons from Chile and Venezuela, Mimeo: Boston University, Presented at the NBER Summer Conference.

Magnac, T., 1991, Segmented or competitive labor markets, Econometrica 59(1), 165–87.

Osterman, P, 1975, An empirical study of labor market segmentation, Industrial and Labor Relations Review July, 28, 508–23.

PREALC, 1978, Sector informal: funcionamiento y políticas [The informal sector: Operation and policies] (PREALC) Santiago, Chile.

Quandt, R.E. and J.B. Ramsey, 1978, Estimating mixtures of normal distributions and switching regressions, Journal of the American Statistical Association 73, 730–752.

Reich, M., 1984, Segmented labour: Time series hypotheses and evidence, Cambridge Journal of Economics 8, 63–81.

Riveros, L, 1983, Verificación de diferencias estadísticas en los mecanismos de determinación de los ingresos entre sectores mediante la forma reducida de un modelo de capital humano [Verification of statistical differences in the wage-setting mechanisms by means of a reduced form of a human capital model], Estudios de Economía, No. 20, Departamento de Economía, Universidad de Chile.

Romaguera, P., 1986, Una nota sobre segmentación del mercado de trabajo en Chile: reconsideración de la evidencia empírica [A note on labor market segmentation in Chile: a re-appraisal of empirical evidence], Estudios de Economía 13(2), Departamento de Economía, Universidad de Chile.

Rosen, S. and M.I. Nadiri, 1974, A disequilibrium model of demand for factors of production, American Economic Review 62(2) 264–270.

Rosenberg, S., 1979, A survey of empirical work on labor market segmentation, Working Paper No. 138, Department of Economics, University of California–Davis, November.

Roy, A.D., 1951, Some thoughts on the distribution of earnings, Oxford Economics Papers 3, 135–146.

Uthoff, A., 1986, Changes in earnings inequality and labour market segmentation: Metropolitan Santiago 1969–78, Journal of Development Studies January.