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Raw labor: homogeneous or heterogeneous?

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1. Introduction[1]

ElSalario is the Spanish name of Argentina´s *WageIndicator* site. It is one of the more than 40 *WageIndicator* websites in the world. The core of these websites is the so-called *Salary Checker*, which provides free, reliable information on average wages earned in an occupation in a country, taking into account the different individual factors affecting them.[2]

According to the human capital theory, each worker´s earnings consist of two additive components: raw labor and human capital. Raw labor refers to the initial earnings capacity of each individual before the acquisition of any human capital. Human capital is the result of education and labor experience.

Other factors which affect earnings are gender, experience, responsibility within the firm´s hierarchy and size of the firm.

These concepts have been operationalized through the so called Mincer earnings equation.

A type of Mincer earnings function is used in the estimations of the *WageIndicator* salary checker:

$$\text{Log } w = \mathbf{a} + \mathbf{b}\, edu + \mathbf{c}\, sup + \mathbf{d}\, exp + \mathbf{e}\, (exp)^2\, sz + \mathbf{f}\, gen + \varepsilon$$

where w stands for wages; *edu*, for level of education; *sup*, for supervision; *exp*, for years of experience; *sz*, for firm size, and *gen*, for gender; *edu*, *sup*, *sz* and *gen* are dummy variables.

The coefficients **b,c,d,e** are semi-elasticities, i.e.

$$\frac{d \log (w)}{d\, edu} = \mathbf{b}$$

where **b** measures the proportional change in w when *edu* changes in one unit.

Most of the analyses on the Mincer earnings equation have dealt with the values of the slopes but little attention has been paid to the intercept values. This is easily understandable: the main interest has primarily been focused on the effects that variables like education, tenure, gender, etc. exert on the level of wages.

However, the value of the intercept has its own interest.

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1 The authors are indebted to Luis E. Campoverde for his cooperation in this research.

2 For an explanation of the economic model underlying the WageIndicator salary checker see Beker, V.A., (2008). *The economic model underlying theWageindicators salary checks*. Buenos Aires, Universidad de Belgrano, at http://www.wageindicator.org/documents/publicationslist/publications_2008/080820-Victor-Beker%20-%20Salary-check.pdf

The constant **a** is related to the initial earnings capacity. This capacity is given by innate ability, understood as a time invariant level of skills that exists prior to the start of the human capital accumulation process.

In a cross section of individuals, the error term typically can be interpreted as capturing the unmeasured differences in innate ability among individuals. So, if we call w_0 the average earnings power of an individual with no human capital at all –one endowed with only raw labor-, and putting aside for a moment the rest of the variables, it can be approximated by $w_0 = \exp(\mathbf{a} + 0{,}5\sigma^2)$ where σ^2 is the mean square error of the regression. Thus, **a** is the deterministic core of raw labor average wage.

It is an open question whether that raw labor deterministic component of the wage has a specific value for each occupation or not.

In the literature it is usually assumed that individual-specific differences affect the intercept. It is common in economic models of the labor market to assume heterogeneous innate abilities, which influence the marginal product each worker produces. So, in principle it should be expected to find also differences in the estimates of the intercept among different occupations.

However, this was not the point of view in the early classics.

2. From Adam Smith to Karl Marx

As is well known, for Adam Smith and David Ricardo –Smith´s immediate follower- labor embodied in commodities was the primary determinant of prices. The number of hours labor that a good can be exchanged for constituted its inherent worth for them.

Marx follows Smith´s and Ricardo´s contributions but introduces the distinction between simple and skilled labor.

We can find here a remote antecedent of today´s distinction between raw labor and human capital.

In Marx´s theory of value, skilled labor is computed as a multiple of simple labor. As the source of exchange value, all labor is reduced to simple homogeneous labor.

¨Skilled labor counts only as simple labor intensified, or rather, as multiplied simple labor, a given quantity of skilled being considered equal to a greater quantity of simple labor.¨ (Marx, 1967, p. 44).

Wages are determined by the cost of reproduction of the labor force measured in units of simple labor. The labor force is viewed as a quite homogenous commodity. So, the unskilled labor force should have the same value notwithstanding the sector of the economy where it is employed.

3. The human capital theory

It has been argued that the concept of human capital can be traced to the founder of economics: Adam Smith. He defined four types of fixed capital; one of them was human capital.[3]

However, the human capital theory as such has been developed in the last 50 years.

Modern labor economics point of departure has been the observed fact that earnings are not uniform across the population but differ for various demographic groups. For instance, women earn less than men; earnings increase with age, but at a decreasing rate. In addition, wages rise with education yet they vary across occupations.

This led to view labor as a conglomeration of heterogeneous human beings each differing in on-the-job productivity. Since education and training reflect labor quality, human capital theory developed to study how society invests to enhance worker quality, and hence worker productivity.

Mincer (1958) was the first to employ prominently the term human capital in his seminal paper devoted to develop this new approach to earnings distribution.

Human capital theorists concentrated on the variation in earnings within labor as a whole.[4] The Mincer earnings equation was the main econometric tool for that analysis.

Adding dummy variables to the basic Mincer earnings function allowed getting estimates of earnings differences across each category. So, the basic Mincer earnings function was modified to incorporate region, union membership status, city size, gender, ethnicity, tenure on the job, and a host of other factors that could affect earnings.

4. Some alternative approaches

Labor economists have started to pay particular attention to the introduction of heterogeneity in the slopes of the wage equation. Because variables such as gender and race are often correlated not only with earnings but also with schooling and experience, the original Mincer earnings function parameters need not accurately reflect those of the entire population. As such, earnings function parameters can differ by race, gender, or location. For example, some studies have found the schooling coefficients to be larger for women.

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3 "Fourthly, of the acquired and useful abilities of all the inhabitants or members of the society. The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person." Smith (1776), Book 2.

4 See Polachek (2007) for a survey on the development of the human capital approach and the Mincer earnings function in particular.

Correlated random coefficient wage regression model is the term used to refer to the standard Mincer wage regression model where all coefficients are individual specific. Papers devoted to specification and estimation issues surrounding a random coefficient model of the wage regression include Heckman and Vitlacyl (1998, 2005),Wooldridge (1997), and Angrist and Imbens (1994).

5. Testing the intercept with data for Argentina

As stated before, *Elsalario* is the Spanish name of Argentina´s Wage Indicator site. From mid-2006 to March 2007, 4.830 surveys were completed. The data were processed using OLS. The results were used for the Argentinian salary checker[5].

Using 85 equations –each for everyone of the 85 occupations- a test was carried out in order to test if the estimates of the intercepts did or did not differ significantly.

5.1. Methodology

We have the following two equations:

$$w_{Ai} = \alpha + F_A(\exp_{Ai}, \exp^2_{Ai}, gen_{Ai}, edu_{Ai}, frm2_{Ai}, frm3_{Ai}, tax_{Ai}, \sup_{Ai}) + \varepsilon_{Ai} \qquad (1)$$

$$i = 1,\ldots,n$$

$$w_{Bj} = \beta + F_B(\exp_{Bj}, \exp^2_{Bj}, gen_{Bj}, edu_{Bj}, frm2_{Bj}, frm3_{Bj}, tax_{Bj}, \sup_{Bj}) + \varepsilon_{Bj} \qquad (2)$$

$$j = 1,\ldots,m$$

Equations 1 and 2 are earnings functions for two different occupations, A and B. Here, w_A and w_B are the log hourly gross wages for each occupation, a and β are intercepts, and F_A and F_B are linear functions on the explanatory variables; *frm2* and *firm3* are dummy variables representing different firm sizes. The corresponding error terms, ε_A and ε_B, are assumed to be *normally distributed* with zero mean and variances, σ_A and σ_B.

In this setting we wish to compare the intercepts from the two equations; more precisely, we wish to test the hypothesis that a is equal to β. In order to do this, we estimate first the two equations using *Ordinary Least Squares*, OLS, to obtain a and b, the OLS estimators of a and β. Here we have that,

[5] See www.elsalario.com.ar/main/Comparatusalario

$a \sim N(a, \sigma_a^2)$ and

$b \sim N(\beta, \sigma_b^2)$

that is, a and b are *normally distributed* with means a and β respectively, and variance σ_a^2 and σ_b^2. The variances σ_a^2 and σ_b^2 are unknown and have to be estimated; we employ the usual estimator to get s_a^2 and s_b^2, the estimated variances of a and b.

We can now construct the test statistic, t, which will allow us to test the hypothesis that a is equal to β:

$$t = \frac{(a-b)-(\alpha-\beta)}{\sqrt{s_a^2 + s_b^2}}$$

This test statistic follows a *Student's t-distribution* with $n+m-2k$ degrees of freedom ($k-1$ being the number of explanatory variables, so in our case k equals 9). Under the null hypothesis a equals β so we are left with

$$t = \frac{(a-b)}{\sqrt{s_a^2 + s_b^2}}$$

which we can compare to critical values from the corresponding *t-distribution* to determine whether the null hypothesis can be rejected. For large samples, typically $(n+m)$ such that $n+m-2k \geq 30$ we can approximate the *t-distribution* with the *Standard Normal Distribution*.

The previous analysis was applied to a group of 85 occupations. So we had a total of 3.570 pair wise comparisons, that is, compared each occupation to all the remaining occupations, performing a total of 3.570 hypothesis tests.

5.2. Results

We had a total of 4.830 observations distributed among 85 occupations. The number of observations differs among occupations, with a minimum of 23 and a maximum of 484, the average being 57.

For each occupation we estimated the regression equation presented as (1) or (2) obtaining a total of 85 intercept terms with its corresponding standard errors. These results are presented in table 1 ordered by the coefficient's value.

Results from the hypothesis tests are shown on table 2. In order to simplify the presentation we will not show the results from each test, but instead we show for each occupation, in percentages, how many times the null hypothesis of equal intercepts was rejected. Column 1 in table 2 shows, in percentage values, how often the null hypothesis was rejected at a 10 % confidence level, and column 2 shows, in percentage values, how often the null hypothesis was rejected at a 5 % confidence level.

Results presented in table 2 show that, among most occupations, intercept terms do not seem to statistically differ from one another. Exceptions are, for example, Power production plant operators whose intercept term appears to differ from those of roughly 80 % of the other occupations, or IT applications programmers whose intercept term seems to differ from those of roughly 70 % of the other occupations.

However, the intercept seems to be homogenous for most of the occupations. What does it mean?

It seems to indicate that labor heterogeneity stems from factors like education, tenure, gender, etc. while raw labor is basically homogenous. The differences in innate ability among individuals are randomly distributed and mostly captured by the error term.

That is to say that once factors like gender, education, tenure, ethnicity, etc. have been taken into account there remains –for most of the occupations- a homogeneous substratum of raw labor.

The exceptions seem to rely on some occupations which require some special skills (Power production plant operators, surgeons or IT applications programmers) or a particular profile (Secretaries), both of which have as a prerequisite a particular innate ability. This special innate ability commands a premium over the rest of the occupations as reflected in the intercept values.

6. The cases of Brazil and the United Kingdom

Meusalario is the Portuguese name of Brazil´s Wage Indicator site. The same procedure applied for the Argentinian salary checker was used to process the Brazilian online survey.

The regressions were calculated for a total of 173 occupations out of 28.432 filled online questionnaires. A test was also carried out in order to verify if the estimates of these intercepts did or did not differ significantly.

As shown in Table 3, the results coincide with the ones obtained for Argentina. In the great majority of cases the intercepts do not differ significantly.

Again, the exceptions have to do with some occupations which require some innate ability like General Practitioner or aircraft pilots, or are highly qualified, like civil or mechanical engineers.

Finally, the same analysis was done with the data used for the U.K.´s Wage Indicator site. The results coincide with the ones obtained for Argentina and Brazil. Moreover, in the case of the U.K., only 7% of the occupations show an intercept which significantly differs from the rest (see Table 4).

7. Some implications

The results obtained using the Wage Indicator data for Argentina, Brazil and U.K. favor the hypothesis of homogeneous innate abilities.

If so, it means that, on a basis of an essentially homogeneous raw labor, heterogeneities are mainly built through the education process and the accumulation of experience.

The fact that innate abilities are homogeneous may have important consequences from the economic point of view.

For instance, Galor and Zeira (1993) developed a model to analyze the direct effects of inequality on human capital accumulation and economic performance in the presence of imperfect capital markets. Assuming that human capital investment is indivisible, they showed that initial income distribution can affect output and investment in the long run. They assumed that individuals have identical innate ability and as a result, in their model different patterns of distribution are conducive to better economic performance. In other words, more equal income distribution does not necessarily imply better economic performance.

On the contrary, assuming heterogeneous innate abilities, Chiu (1998) showed that a more equal originating distribution implies a higher steady-state output level. Assuming that receiving a certain level of education is essential in having one's innate ability fully developed and used, he showed that greater income inequality can imply lower human capital accumulation and deterioration in subsequent generations' distribution of initial income.

This is just one example on how the fact that innate abilities be homogeneous or heterogeneous may lead to opposite conclusions.

Appendix

Table 1. Argentina: intercept term values and standard errors

Occupation	Intercept term	St. Error	Occupation	Intercept term	St. Error
Power production plant operators	2,98150	0,13599	Road, rail or air transport manager	1,89680	0,30973
Secretary	2,85833	0,34230	Office clerk	1,88670	0,08198
IT applications programmer	2,75053	0,12799	Electronics engineering technicians	1,88284	0,28385
Systems analysts	2,56808	0,29830	Hotel and Restaurant Managers	1,87619	0,56016
Secondary education teacher	2,54309	0,29825	IT consultant	1,87435	0,27470
Surgeon	2,53258	1,58044	IT software tester	1,86641	0,20874
Marketing manager	2,51350	0,32324	Hotel front desk receptionists	1,84700	0,31887
Petroleum and natural gas refining plant operators	2,43770	0,34655	Accounting and bookkeeping clerks	1,84528	0,12554
Primary school teachers	2,37293	0,14925	Lawyers	1,83798	0,55056
Payroll clerk	2,36223	0,18773	IT information analyst	1,82943	0,23630
IT user support technician	2,34445	0,15789	Graphic designer	1,81329	0,17378
Research and development manager	2,33046	0,25530	Business administration professionals	1,80828	0,49133
Salary or personnel administrator	2,29195	0,42417	Legal assistants	1,76472	0,24506
Quality controller / inspector machines, appliances, vehicle	2,24860	0,25060	Social work professionals	1,74887	0,40412
Telephone switchboard operators	2,24844	0,10217	Quality controller / inspector other products	1,74214	0,31112
Web programmer	2,22428	0,16119	Housekeeper in hotels, offices or other establishments	1,73015	0,34513
Nurse	2,21168	0,31421	Shelf fillers	1,72227	0,11552
First line supervisor housekeeping workers	2,18367	0,27898	Office manager	1,71630	0,22418
Physical and engineering science technicians nec	2,16241	0,27253	Officer armed forces	1,64809	0,59205
Policy manager	2,14161	0,52005	Commercial traveller	1,63434	0,24556
Market vendor	2,10072	0,16020	Security guards	1,63352	0,21975
Personnel and careers professionals	2,08006	0,29110	Journalists	1,62948	0,34823
Transport clerk	2,07912	0,19331	Warehouse operative	1,61400	0,24337
Economists	2,06600	0,64612	Public relations officer	1,61186	0,25750
Physician (self employed)	2,05390	1,17702	Health associate professionals	1,61025	0,38502
Mechanical engineering technicians	2,05201	0,23049	Personnel officer	1,58674	0,43090
Statistical, finance and insurance clerks	2,04467	0,25535	Senior government official	1,53198	0,36592
Supply and Distribution Mangers	2,03854	0,69553	Finance or sales associate professionals	1,52292	0,50182
Petroleum chemist	2,03115	0,47378	University professor	1,49327	0,43482
Civil engineers	2,02646	0,85075	Stock clerk	1,48628	0,43082
Tax clerk	2,02286	0,28758	Industrial machinery mechanic	1,47346	0,55620
Electrical engineers	2,01155	0,52088	Client information worker	1,45451	0,38081
Cashiers and ticket clerks	2,00667	0,43997	Sales representative	1,42531	0,30746
Shop Managers	1,99746	0,23128	Tax advisor	1,38785	0,34047
Vocational education teachers	1,99412	0,26818	Computer equipment operator	1,30481	0,21460
Telephonist	1,99105	0,34387	IT software engineer	1,19539	0,54950

Market analyst	1,98804	0,25456	Municipal clerk	1,12519	0,49639
Financial department manager	1,97064	0,70301	Specialist medical practitioner	1,10635	1,18178
Police officer	1,96704	0,18747	Physician	1,09310	0,68586
ICT network and hardware professionals	1,94393	0,23467	Truck driver	1,09299	0,43257
Bakers, pastry-cooks and confectionery makers	1,92388	0,21995	Lawyers	0,76899	0,55496
Chemical engineers	1,91351	0,37905	Industrial engineer	0,43971	0,56708
Electronics engineers	1,90310	0,66492			

Table 2. Argentina: % rejections of the null hypothesis of equal intercepts

Occupation	1	2	Occupation	1	2
Power production plant operators	80,95%	77,38%	Road, rail or air transport manager	5,95%	4,76%
Secretary	65,48%	53,57%	Office clerk	19,05%	14,29%
IT applications programmer	72,62%	64,29%	Electronics engineering technicians	7,14%	4,76%
Systems analysts	44,05%	29,76%	Hotel and Restaurant Managers	2,38%	0,00%
Secondary education teacher	40,48%	27,38%	IT consultant	8,33%	4,76%
Surgeon	0,00%	0,00%	IT software tester	14,29%	5,95%
Marketing manager	36,90%	19,05%	Hotel front desk receptionists	7,14%	4,76%
Petroleum and natural gas refining plant operators	23,81%	8,33%	Accounting and bookkeeping clerks	19,05%	13,10%
Primary school teachers	40,48%	27,38%	Lawyers	2,38%	1,19%
Payroll clerk	36,90%	23,81%	IT information analyst	13,10%	4,76%
IT user support technician	36,90%	26,19%	Graphic designer	17,86%	11,90%
Research and development manager	27,38%	15,48%	Business administration professionals	4,76%	1,19%
Salary or personnel administrator	8,33%	4,76%	Legal assistants	13,10%	9,52%
Quality controller / inspector machines, appliances, vehicle	19,05%	9,52%	Social work professionals	4,76%	3,57%
Telephone switchboard operators	32,14%	22,62%	Quality controller / inspector other products	11,90%	4,76%
Web programmer	26,19%	16,67%	Housekeeper in hotels, offices or other establishments	9,52%	3,57%
Nurse	9,52%	5,95%	Shelf fillers	21,43%	15,48%
First line supervisor housekeeping workers	10,71%	5,95%	Office manager	16,67%	13,10%
Physical and engineering science technicians nec	10,71%	5,95%	Officer armed forces	3,57%	1,19%
Policy manager	2,38%	1,19%	Commercial traveller	17,86%	14,29%
Market vendor	15,48%	8,33%	Security guards	19,05%	15,48%
Personnel and careers professionals	9,52%	5,95%	Journalists	14,29%	7,14%
Transport clerk	11,90%	8,33%	Warehouse operative	19,05%	14,29%
Economists	1,19%	0,00%	Public relations officer	17,86%	14,29%
Physician (self employed)	0,00%	0,00%	Health associate professionals	11,90%	4,76%
Mechanical engineering technicians	9,52%	5,95%	Personnel officer	10,71%	3,57%
Statistical, finance and insurance clerks	9,52%	5,95%	Senior government official	15,48%	10,71%
Supply and Distribution Mangers	1,19%	0,00%	Finance or sales associate professionals	7,14%	3,57%
Petroleum chemist	3,57%	1,19%	University professor	14,29%	5,95%
Civil engineers	0,00%	0,00%	Stock clerk	14,29%	5,95%
Tax clerk	8,33%	5,95%	Industrial machinery mechanic	5,95%	3,57%
Electrical engineers	2,38%	1,19%	Client information worker	16,67%	11,90%
Cashiers and ticket clerks	3,57%	2,38%	Sales representative	23,81%	16,67%
Shop Managers	8,33%	7,14%	Tax advisor	23,81%	16,67%
Vocational education teachers	8,33%	7,14%	Computer equipment operator	42,86%	38,10%
Telephonist	7,14%	3,57%	IT software engineer	16,67%	10,71%
Market analyst	8,33%	7,14%	Municipal clerk	27,38%	16,67%
Financial department manager	1,19%	0,00%	Specialist medical practitioner	0,00%	0,00%
Police officer	10,71%	7,14%	Physician	14,29%	4,76%
ICT network and hardware professionals	8,33%	5,95%	Truck driver	38,10%	23,81%
Bakers, pastry-cooks and confectionery makers	11,90%	5,95%	Lawyers	53,57%	34,52%
Chemical engineers	5,95%	3,57%	Industrial engineer	76,19%	59,52%
Electronics engineers	1,19%	0,00%			

Table 3. Brazil: % rejections of the null hypothesis of equal intercepts

Occupation	% rejections	Intercept value
General Practitioner GP	96.53%	2.87912
Aircraft pilots and related associated profesionals	86.13%	2.38619
Civil Engineer	83.24%	2.26532
Mechanical Engineer	76.88%	2.11987
Insurance Representative	73.99%	0.10291
IT system analist	70.52%	2.05078
Bank clerk	70.52%	2.13485
Communication professional	63.58%	0.27306
Chemical Engineer	58.38%	2.08442
Authors and related writers	53.76%	0.39389
Legal Assistant	53.76%	0.25567
Electrical line installer o repairer	52.60%	1.92807
Lifting - truck operator	51.45%	1.75785
Financial manager	50.29%	0.42689
Electrical engineer	49.13%	1.81909
Sales manager	46.82%	0.25514
Car, taxi and van drivers	46.24%	1.51149
Corporate core services manager	45.66%	0.55632
Electronics engineerin techinician	42.77%	1.47196
Other phisical or engineering science technician	42.20%	1.67191
Other manufacturing helper	39.88%	0.57382
Profesional sportsperson	39.31%	-0.04021
Supply and distribution mangers	36.42%	0.5436
Stock clerk	36.42%	0.49972
Statistical, finance and insurance clerks	35.26%	0.68444
Financial analyst	34.10%	1.54272
Order Clerk	32.37%	0.57446
Legal Advisor	29.48%	1.72162
Researcher and development manager	27.75%	0.4898
Electronics engineer	26.59%	1.54431
Dentist	26.59%	2.03086
Logistics worker	26.01%	0.77814
Telecommunications engineer	26.01%	1.82278
Social work associate professional	25.43%	1.60953
Electrical engineering techinician	25.43%	1.54176
Secretary (general)	24.86%	0.75816
First line supervisor of manufacturing workers	24.86%	1.51775
Payrol clerk	24.86%	0.74729
Travel agent	24.28%	1.45852
Lawyer	23.12%	1.50616
Buyers	23.12%	0.72326
Lathe or turning ma<zchine tool setter - operator	23.12%	1.39467
ITA applications programmer	21.97%	1.3702
Porter	21.97%	1.38109
Office clerk	21.39%	0.86627
Metallurgy technician	21.39%	1.34447
Accounting and bookkeeping clerks	20.81%	0.97718
Salary or personnel administrator	20.81%	0.90617
Personnel and careers professionals	20.23%	0.83144
Shop Managers	20.23%	0.8439
Other software or multimedia developer or analyst	20.23%	0.5958
Sales agent	19.65%	0.79611
Civil engineer technician	19.65%	1.44862
ICT network and hardware professionals	19.08%	0.94262

Occupation	% rejections	Intercept value
Other services manager	19.08%	0.8071
Personnel officer	19.08%	0.62904
Production clerk	19.08%	1.41295
ITA operations technician	18.50%	0.91786
Transport clerk	18.50%	0.74277
Other electrician	17.92%	1.48321
Other finance or sales associate professional	17.34%	1.16115
Receptionist	17.34%	1.09469
Social work professionals	17.34%	0.62447
Other health associate professionals	17.34%	1.34791
Petroleum or natural gas refining plant operator	17.34%	1.67532
Call centre agent outbound	17.34%	1.5635
Draughtsperson	16.76%	1.16898
Other client information worker	16.76%	0.81419
Sales clerk	15.61%	1.0927
Display decorator	15.61%	1.17852
First line supervisor of mechanics, installer or repaires	15.61%	0.58497
Aministrative services manager	15.03%	1.09502
Marketing clerk	15.03%	1.24976
Accounting associate professional	14.45%	1.05179
Personnel planning clerk	14.45%	1.01486
ITA user support technician	14.45%	1.07884
Door to door salesperson	14.45%	0.97163
Primary school teacher	14.45%	1.26645
Transport and storage lobourers	14.45%	1.09374
Financial clerk	14.45%	1.27326
Other department manager	14.45%	0.87906
Credit analyst	13.87%	0.5583
Other shop manager, non - owner	13.29%	1.13301
Other teaching professionals	13.29%	0.70889
Other IT network or hardware professional	13.29%	1.14694
Shelf stacker	13.29%	1.04382
Other personal care or related worker	13.29%	1.16942
Mechanical engineering technician	13.29%	0.73474
Electronics mechanic or servicer	13.29%	0.77756
Invoice clerk	12.72%	1.00555
Medical laboratory technician	12.72%	1.50767
Chemical process operator	12.72%	1.54922
Occupational health or safety officer	12.14%	1.09437
Marketing professional	12.14%	0.70095
Logistics manager	12.14%	0.75315
Sales representative other products	11.56%	1.05948
Administrative secretary	11.56%	1.05196
Personnel clerk	11.56%	1.05816
Typist or word processing operator	11.56%	0.97912
Administrative and executive secretaries	11.56%	1.27694
Business administration professionals	10.98%	0.95809
IT software engineer	10.98%	1.0273
Policy manager	10.98%	1.2945
Form filling assistance clerk	10.98%	1.10861
Buyer other products/services	10.98%	0.9882
Other sales worker	10.40%	1.0783
Accountant	10.40%	0.79308
Telephone switchborard operator	10.40%	1.15803
Production or operations manager	10.40%	0.94384
Vocational education teachers	10.40%	1.36672
Machine tool setter or machine tool setter - operator	10.40%	1.0153
ITA network specialist	10.40%	1.39202

Occupation	% rejections	Intercept value
Production planning clerk	10.40%	0.85477
Chemical engineering technician	10.40%	1.36112
Other teaching professionals	10.40%	0.55157
Education advisor	10.40%	0.47374
ITA manager	9.83%	1.282
Protective services workers	9.83%	1.25659
Chemist	9.83%	0.97494
Cashier	9.83%	1.24221
Computer equipment operator	9.83%	0.9758
Police officer	9.83%	1.41993
Other health associate professionals	9.25%	1.12915
Ticket - clerk and cashier	9.25%	0.95107
Other business professional	8.67%	1.40121
Human respirces manager	8.09%	0.96756
Electrician	8.09%	0.91782
Power production plant operator	8.09%	1.20965
Accounts clerk	8.09%	0.94643
IT projet leader	8.09%	1.49129
Telecommunications engineer technician	8.09%	1.53406
Truck driver	7.51%	0.90884
Building architect	7.51%	1.23438
Printing machine operator	7.51%	1.13692
Other legal profesional	6.94%	0.76302
Multimedia designer	6.94%	0.98891
Cleaner in offices, schools or other establishments	6.94%	1.0193
Other professional engineer	6.94%	1.71535
Graphic designer (secondary level)	6.36%	1.11854
Textile, garment and related trades workers	5.78%	0.93408
ITA hardware testing technician	5.78%	0.88156
Markwet - oriented miced crop and animal producers	5.20%	1.02472
Quality controller/inspector chemical products	5.20%	1.08579
Education methods specilalist	5.20%	1.6101
Financial department manager	4.62%	1.11608
Nursing associate professional	4.62%	1.11693
Personnel department manager	4.62%	1.04848
Mathermaticians and related professionals	4.62%	1.12837
Tax advisor	4.62%	0.90105
Mining manager	4.62%	0.98141
IT department manager	4.62%	0.73098
Shop salespersons	4.62%	1.02237
Quality controller/inspector other products	4.62%	1.04089
Electrical - equipment assembler	4.62%	1.03728
Senior government official	4.05%	0.96051
Physiotherapist	4.05%	1.24138
Market analyst	3.47%	1.01021
Debt - collectors and related workers	3.47%	0.97021
Car driver	3.47%	1.18839
Other secretary	2.89%	1.26174
Database administrator (dba)	2.89%	1.28979
Economist	2.31%	1.07421
Construction manager	2.31%	1.04553
Distriburtion centre or warehouse manager	2.31%	0.81606
Agricultural machinery mechanic	1.73%	1.17861
Company Directors and chief executives	1.16%	1.37605
Executive secretary	1.16%	1.52551
Marketing manager	1.16%	1.49605
Manufacturing Managers	1.16%	1.17964
Legal and related associate professionals	0.58%	1.61639

Occupation	% rejections	Intercept value
Farm, forestry and fisheries managers	0.58%	1.05883
Biologists, botanists, zoologists and related professionals	0.58%	1.12183
Company director, chief executive of 10 - 50 employees	0.00%	1.47999

Table 4. United Kingdom: % rejections of the null hypothesis of equal intercepts

Occupations	% rejections	Intercept term
Researcher/Writer	73,41%	3,44486
Brand Manager, Product Manager	60,12%	0,80194
Quantity Surveyor	53,18%	3,06904
Solicitor	52,02%	3,17841
Financial Analyst	52,02%	3,26796
Credit Controllers	43,93%	0,81024
Computer Application Programmer	38,73%	3,15801
Secretary (general)	34,10%	0,89265
Laboratory Technician, Analyst	33,53%	1,3615
Sales and Marketing Manager	31,79%	2,94774
Call Center Agent, Call Center Operator	30,64%	1,62544
Chefs, Cooks	30,64%	1,26159
Other shop manager, non-owner	28,32%	1,16722
HR consultant	28,32%	2,82589
Addetto Logistica	26,59%	1,60537
Bus Driver, Recreational	26,01%	1,71171
Business Professionals Nec	24,28%	1,69708
Production or Operations Manager	23,70%	1,6506
Responsabile del Personale	23,12%	2,82544
200000000	22,54%	1,29296
Civil Service Executive Officers	21,97%	1,69962
Other Finance or Sales Associate Professional	21,39%	1,22896
Manager of Small Enterprises in Wholesale and Retail Trade	20,23%	1,84587
Helpdesk Information Provider, Computer Assistant	19,08%	1,71204
Truck Driver	16,18%	2,03946
Biologists, Botanists, Zoologists and Related Professionals	15,61%	2,84248
Chemical Engineers	15,03%	2,88407
Finance and Investment Analysts/Advisers	14,45%	2,86868
Careers Advisers and Vocational Guidance Specialists	14,45%	2,71461
Heavy Truck and Lorry Drivers	13,29%	2,43447
Retail Cashiers and Checkout Operators	13,29%	1,92374
Sales Assistant	12,72%	1,89427
41900000000	12,72%	2,71454
Computing Services Manager	12,72%	2,62209
Legal Assistant	12,14%	2,83704
Marketing Manager	12,14%	2,65337
Department Manager	12,14%	2,54036
Salary or Personnel Administrator	11,56%	2,58579
Administrative Secretaries and Related Associate Professional	11,56%	2,5344
Electronics and Telecommnications Engineering Technicians	11,56%	2,47492
Systems Analyst	11,56%	2,92742
Team Leader	11,56%	2,58186
Other Department Manager	10,98%	1,67188
IT Systems Administrator	10,98%	2,48225
Design and Development Engineers	10,98%	2,56203
Youth and Community Workers	10,98%	2,78936
Human Resource Manager	10,98%	2,81878
Marketing Staff	10,40%	2,36962
Legal Professional	10,40%	2,57466
Motor Vehicle Mechanics and Fitters	10,40%	2,4237

Occupations	% rejections	Intercept term
Segurity Guard	9,83%	1,99581
Legal Secretary	9,83%	2,29992
Chemist	9,83%	2,53751
Directors Secretary	9,83%	2,58772
Manager Other Department	9,25%	2,46457
Production and Operations Manager in Business	9,25%	2,57158
Other Services Manager	9,25%	2,58939
Classroom Teacher	9,25%	2,55261
Head of Department, Head of Year, Head of House	9,25%	2,61223
General Manager	8,67%	2,4148
Civil Service Administrative Officers and Assistants	8,67%	2,45394
Transport and Distribution Manager	8,67%	1,7669
Directors and Chief Executives	7,51%	1,89851
Personnel Office	7,51%	2,56712
Host (ess)	7,51%	1,93756
Accounting Associate Professional	7,51%	2,43637
Administrator	6,94%	2,12838
Accountants	6,94%	2,32277
Personnel Planning Clerk	6,94%	2,44297
Institution Based personal Care Workers	6,94%	2,45153
Facilities Manager	6,94%	2,62103
Payroll Officer	6,36%	1,71324
Sales Representative	6,36%	1,58401
Clerical Assistant	5,78%	2,11417
University Lecturer	5,78%	2,28773
Administrative Assistant	5,20%	2,1278
Accountats	5,20%	2,18081
Administrative Services Manager	5,20%	2,07913
IT Consultant, Business Consultant	5,20%	2,36447
Financial and Accounting Techinicians	5,20%	2,1804
Service Engineer/Technician	5,20%	2,0096
Accounts Clerk	5,20%	2,04228
Customer Care Manager	5,20%	2,54512
Store Manager	5,20%	2,05145
Supervisor	5,20%	2,1786
Teaching Professional Nec	5,20%	2,37823
Van Driver, Deliveryman	5,20%	2,07835
Other IT Network or Hardware Professional	5,20%	2,89581
Bookkeeper	5,20%	2,08768
Manager of Small Enterprises in Construction	5,20%	2,00319
Administrative Officer	4,62%	2,21932
Office Manager	4,62%	2,15937
Warehouse Operative	4,62%	1,93982
Database administrator (dba)	4,62%	2,91787
Accounts and Wages Clerks, Bookkeepers, Other Financial Cler	4,05%	2,46305
Educational Assistants	4,05%	1,78735
Electrical Engineer	4,05%	2,20104
Higher Education Teaching Professional	4,05%	2,06636
Clerk	4,05%	1,71407
Other business Professional	4,05%	2,51435
Cleaner	4,05%	2,20425
Commercial Traveller	4,05%	1,39781
Lawyer	4,05%	1,59717
Electronics and Telecommnications Engineers	3,47%	2,11863
Agricultural or Insdustrial Machinery mechanics and Fitters	3,47%	2,14796
Marketing Assistant	3,47%	2,13127
Website Builder/Programmer	3,47%	1,57896
Network Engineer	3,47%	2,27845

Occupations	% rejections	Intercept term
Personnel Administrator	3,47%	1,64371
Civil Service Higher Executive Officer	3,47%	2,52415
Other Health Assicuate Orifessuibak	2,89%	1,68389
Customer Advusir	2,89%	1,76376
Quality Managewr	2,89%	1,96542
Healthcare Assistant	2,89%	2,75108
IT Manager	2,89%	2,14561
Bank Clerk	2,89%	2,01238
Information Analyst	2,89%	2,21495
Materials Engineer	2,89%	1,75609
Sales Representative: Computer Equipment	2,89%	1,86933
Electrical /Electronics Engineers Nec	2,89%	2,00786
Buyer: Other Products/Services	2,89%	2,2512
Receptionist	2,31%	1,99323
Unit Manager	2,31%	2,44631
Administrative Manager	2,31%	1,88747
Support Worker	2,31%	1,87942
Direttore Finanziario	2,31%	1,97623
Shelf Stacker	2,31%	2,46357
Executive Scretary/Assistant	2,31%	1,88791
Civil Engineer	1,73%	1,52383
Legal Advisor	1,73%	1,9957
Insurance Representative	1,73%	2,55663
Social Work Professional	1,73%	1,77757
Catering manager	1,73%	2,54278
Management Accountants	1,16%	2,38604
Publicans and Manager of Licensed Premises	1,16%	2,3821
IT Software Engineer	1,16%	2,16258
Public Relations Officer	1,16%	2,02767
Manager of Small Enterprises Nec	1,16%	2,28333
IT Systems Analyst	1,16%	2,55408
Hospital Nurse	1,16%	2,41119
Chief Executive´s Secretary/PA	1,16%	2,36832
Personal Assistant	0,58%	2,52522
Personal Assistant	0,58%	1,77702
Management Consultants, Actuaries, Economists and Statici	0,58%	2,13461
Nursery Nurses	0,58%	1,53418
Team Leader, Supervisor Call Center	0,58%	2,34361
HR Advisor	0,58%	2,4968
Child-Care	0,58%	2,62705
Database Administrator, Network Administrator	0,58%	2,09481
Marketing Associate Professional	0,58%	2,01512
Accounting and Bookeeping Clerks	0,58%	2,38277
Receptionist, Counter Staff	0,58%	1,43955
Electrical Engineers	0,58%	2,11622
Office Manager	0,58%	2,04403
Graphic Designer	0,58%	1,73221
Local Government Clerical Officers and Assistants	0,58%	2,08059
Engineering Craftsman	0,58%	2,49907
42120500826	0,58%	2,56874
Marketing Professional	0,58%	2,75464
Customer Service Representative	0,58%	1,81692
Housing and Welfare Officers	0,58%	2,43421
Restaurant and Catering Managers	0,58%	2,03916
Financial Institution manager	0,58%	2,13097
Personnel Officer	0,58%	1,73915
Secretary	0,00%	2,11124
IT User support Technician	0,00%	2,21266

Occupations	% rejections	Intercept term
Software Engineer	0,00%	2,29604
Corporate Core Services manager	0,00%	2,18292
Financial Analyst	0,00%	2,15524
Other Teaching Professional	0,00%	2,32997
Personnel Assistant	0,00%	2,19203
Call Center Agent Inbound	0,00%	1,97097
Road, Rail or Air Transport Manager	0,00%	1,43388
Other Manufacturing Helper	0,00%	2,0813
Construction Manager	0,00%	2,10095
IT Applications Programmer	0,00%	1,34315
Architectural Technologists and Town Planning Technicians	0,00%	2,00809
Office Manager	0,00%	2,1756
Telephone Sales persons	0,00%	2,2319

References

Angrist, J. and Imbens, G. (1994) "Identification and Estimation of Local Average Treatment Effects", Econometrica, 62, 4,467-76.

Chiu, W. H.(1998). Income Inequality, Human Capital Accumulation and Economic Performance *The Economic Journal*, Vol. 108, No. 446, January, pp. 44-59.

Galor, 0. and Zeira, J. (1993). 'Income distribution and macroeconomics.' *Review of Economic Studies*, vol. 60, pp. 35-52.

Heckman, James and E. Vytlacil (1998) "Instrumental VariablesMethods for the Correlated Random Coefficient Model", *Journal of Human Resources*, Volume 33, (4), 974-987.

Heckman, James and E. Vytlacil (2005) "Structural Equations, Treatment Effects and Econometric Policy Evaluations. *Econometrica* 73(3), 669-738.

Marx, K. (1967). *Capital,* vol. 1, New York, International Publishers.

Mincer, J. (1958)"Investment in Human Capital and Personal Income Distribution" in *The Journal of Political Economy*.

Polachek S. W. (2007). Earnings Over the Lifecycle: The Mincer Earnings Function and Its Applications. Discurssion Paper Series. Institute for the Study of Labor, November.

Smith, A. (1776). An Inquiry into the Nature and Causes of the Wealth of Nations.

Wooldridge, Jeffrey M. (1997) "On Two-Stage Least Squares estimation of the Average Treatment Effect in a Random Coefficient Model", *Economic Letters* (56): 129-133.