Andersen, Lykke Eg

Working Paper

Wage differentials between Bolivian cities

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INSTITUTO DE INVESTIGACIONES SOCIO-ECONOMICAS
UNIVERSIDAD CATOLICA BOLIVIANA

WAGE DIFFERENTIALS BETWEEN BOLIVIAN CITIES[1]

Lykke E. Andersen
IISEC-UCB
La Paz, Bolivia

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Summary: This paper uses Bolivian household survey data to show that there are large and persistent wage differentials between Bolivian cities. Generally, workers in the tropical lowlands tend to earn about 50% more per hour than workers with similar characteristics in the temperate highlands. Temperature differences was shown to be the most effective variable in explaining such differences, but telephone density also seemed to have an impact on labor productivity and wages. The study suggests that measures to create a more pleasant indoor climate in the highland cities may increase worker productivity and thereby wages and living standards for those who are currently disadvantaged. Investment in communication infrastructure may increase productivity in all of Bolivia.

[1] This paper was prepared as part of a larger study for the Inter-American Development Bank on Geography and Development in Bolivia. The author is grateful for the financial support received from the IDB and for useful comments received from Justo Espejo and from the other team members: Eduardo Antelo, José Luis Evia, Osvaldo Nina, and Miguel Urquiola.

1. Introduction

Bolivia is often characterized as a tropical country because of its location just south of the equator. Huge altitude differences, however, imply very different climates across the country and at least half of the population lives in distinctly non-tropical areas.

International evidence has suggested that a tropical location imply a developmental disadvantage compared to a temperate location – mainly because of heat, humidity, and high disease burdens (Gallup, Sachs, & Mellinger 1998).

Because of Bolivia's very distinct geographical regions, it is possible to test this hypothesis using regional data instead of international data. And the evidence from within Bolivia is clearly at odds with the international data. Empirical evidence from household surveys in all major Bolivian cities show that workers in tropical cities, such as Santa Cruz de la Sierra, Trinidad and Cobija earn about 50% more than similar workers in highland cities such as El Alto, Oruro, and Potosi. The only city that does not conform to the negative altitude-wage relationship is La Paz, whose workers enjoy about 25% higher wages than those in neighboring El Alto[2]. See table 1.

Table 1: Wage indices for workers in Bolivia's cities 1989 – 1995 (El Alto = 100)

City (meters above sea level)	1989 (Round 1)	1990 (Round 3)	1991 (Round 4)	1992 (Round 5)	1993 (Round 6)	1994 (Round 7)	1995 (Round 8)
Potosi (4070 m)	81	75	100	87	84	100	79
El Alto (3848 m)	100	100	100	100	100	100	100
Oruro (3709 m)	88	100	109	100	77	100	100
La Paz (3640 m)	109	107	126	123	124	132	124
Sucre (2790 m)	114	100	125	110	100	111	100
Cochabamba (2558 m)	121	120	125	123	121	124	119
Tarija (1866 m)	100	100	126	121	100	115	111
Santa Cruz (416 m)	138	132	146	159	142	147	151
Trinidad (236 m)	124	130	144	145	128	130	142
Cobija (221 m)	143	140	-	-	-	-	-

Source: Author's regressions. See Tables B1-B7 in Appendix B.

The purpose of this paper is to investigate the underlying causes of these geographic differences. The paper is organized as follows. Section 2 presents a decomposition of the causes of wage inequality in urban Bolivia and shows that geography is indeed a significant factor. Section 3 suggests that the causes of such geographical wage differentials must be found in external factors causing differences in productivity, and temperature was found to be the most important factor. Section 4 applies a regional decomposition, which shows that differences in temperature and telephone density are the most important causes of regional wage differentials. Section 5 concludes.

[2] La Paz and El Alto is sometimes regarded as one city with La Paz holding all the rich neighborhoods and El Alto housing most of the poor and especially the new migrants from rural areas. If La Paz and El Alto is treated as one city, the wage-altitude relationship is even more clear.

2. Fields decomposition of wage inequality in urban Bolivia

A very convenient and consistent way of decomposing inequality measures has been developed by Gary S. Fields (see Fields 1996, 1997). It is easily applied to standard 'earnings regressions' where the logarithm of earnings is regressed on education, experience, experience squared and a number of other variables potentially determining earnings[3]. The method just requires multiplying each coefficient estimate with the standard deviation of the explaining variable and the correlation between that variable and the dependent variable. The resulting 'relative factor inequality weights' are scaled to sum to 1.

The method has been applied in this way to Bolivian household survey data by Fields *et al* (1998) and they concluded that "Nearly all of the earnings inequality explained is explained by education" and "All of the other variables taken together explain only a small fraction of what education does". However, since the total explanatory power of the earnings regression never exceeded 0.37, education could not explain more than 37% of total variation (in fact only 16.6 - 25.7% in their regressions). This leaves ample room for other factor's that may have been left out of the regressions – for example geographic variables.

Table 2 below summarizes an exercise very similar to the one done by Fields *et al* (1998). For all persons aged 13-65 with positive earnings in the survey period, we have regressed the logarithm of the average hourly wage on years of education, experience, experience squared, a gender dummy, and an ethnicity dummy. Compared to the above mentioned study we have added a set of dummy variables describing the sector in which the individual works (agriculture, construction, trade, etc.) as well as a set of dummy variables for the city of residence (geographic variation). By adding these two sets of dummies we greatly reduce education's share of explained inequality (41.8% - 68.9%) compared to the study of Fields *et al* (1998).

Table 2: Field's decomposition of explained wage inequality in urban Bolivia

	Round 1 March 1989	Round 3 Sept. 1990	Round 4 Nov. 1991	Round 5 Nov. 1992	Round 6 July-Dec. 1993	Round 7 July-Dec. 1994	Round 8 June 1995
Education	53.0%	41.8%	56.6%	61.8%	61.4%	68.9%	66.2%
Experience	12.9%	15.3%	14.8%	6.2%	7.8%	2.4%	3.6%
Gender	7.5%	13.6%	8.4%	8.8%	6.4%	8.4%	5.8%
Ethnicity	6.3%	4.3%	n.a.	n.a.	1.7%	0.7%	n.a.
Work sector	9.1%	16.8%	11.5%	10.5%	14.3%	10.6%	12.4%
Geography	11.1%	8.9%	8.8%	12.7%	8.5%	9.0%	12.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
R^2	0.2935	0.2670	0.3089	0.3852	0.4253	0.4017	0.3346
No. obs.	5533	9092	8123	7708	5985	9210	8526

Note: Data are from Rounds 1, 3, 4, 5, 6, 7 and 8 of the Integrated Household Surveys conducted by the National Statistical Institute in all major cities of Bolivia. The samples include urban residents aged 13-65 with positive earnings in the survey period.

[3] Please see Appendix A for a theoretical derivation of the Fields decomposition.

Education accounts for 41.8% - 68.9% of explained variation in our regressions with returns to education varying between 7.2 and 10.1 with no discernible trend. (See full regression results in Tables B1-B7 in Appendix B). Experience accounts for 2.4% to 15.3% of explained variance in our regressions and has the typical shape of diminishing returns. It seems that the importance of experience have fallen over time. The reasons why education and experience should affect productivity and thereby the wage rate are well explained by the Human Capital Theory.

Gender accounts for 5.8% - 13.6% with women earning 19 - 30% less than men in similar circumstances. The theoretical reasons for such a gender difference are less clear, but the lower wage rate for women may be partly explained by lower productivity due to recurrent career breaks caused by child rearing. Work experience may also be overstated for women when calculated in the standard way (age – years of education – 6), if they have had several children during that period. This is especially so for Bolivia where women get an average of 4 to 5 children.

Ethnicity accounts for 0.7% to 6.3% of explained variation in the years for which there exist language data. People who speak an indigenous language typically earn 8 - 16% less than those who do not. There is no theory to explain this, except discrimination.

The sector of work accounts for 9.1% - 16.8% of explained variation in our regressions. Typically the sector with highest earnings is the financial sector while community service jobs (sanitation, etc) pay the lowest wages. The theoretical reason for wage differences between sectors is that different sectors have different capital intensities. High levels of capital tend to rise labor productivity and wages. Workers in the financial sector, for example, tend to be supplied with computers, telephones, etc, while the street vendor has little equipment, and sometimes may even have to refuse a sell because she does not have sufficient small change.

Finally, we find that the geographical dummies account for 8.5% to 12.7% of total explained variation. We do not have well known theories explaining such geographical variation, but in the following section, we will try empirically to find out what causes the geographical differences in Bolivia.

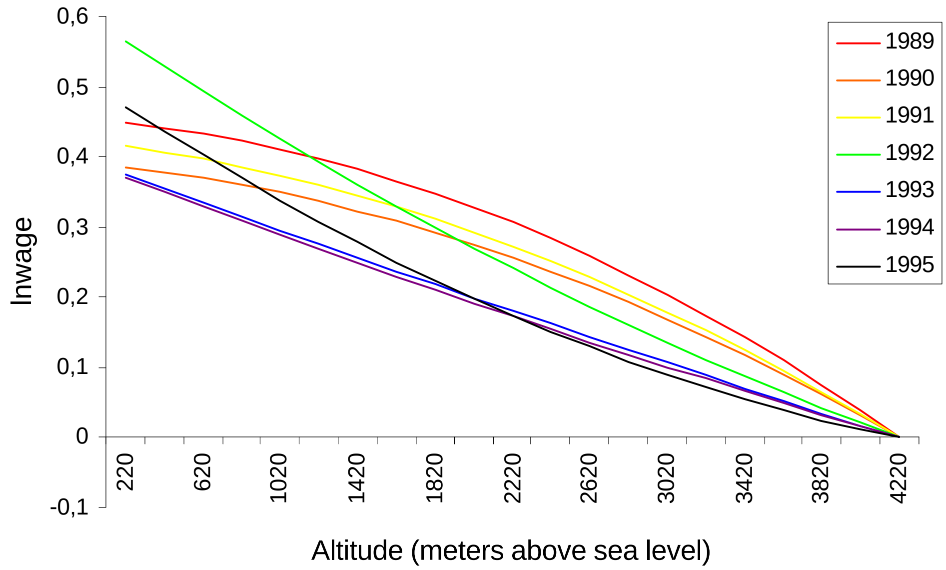
3. Geographical variation in wages in urban Bolivia

If we substitute the city dummies in regressions B1-B7 with an altitude variable, we get highly significant negative coefficients on that variable for all years. If we add a squared altitude variable we still get the highest wages at the lowest altitudes. Figure 1 summarizes the regression results for Rounds 1 to 8 of the EIH and shows how persistent the wage-altitude relationship is over time. The relationship is not significantly non-linear, though, and tables B8-B9 in Appendix B show the regression results with only the linear altitude term included.

Since the altitude observations are clustered at only nine different values (one for each city), OLS is likely to underestimate the true standard errors and we have instead used the Huber/White/sandwich estimator, which corrects for correlation within groups (Moulton 1986). Even with cluster correction, altitude is highly significant for all years.

Workers at the lowest altitudes earn, on average, Bs1.45 - Bs1.76 more per hour than workers at the highest altitudes. That is a lot since average hourly wages in that period increased from only Bs1.24 to Bs2.77. The relationship seems reasonably stable over time, with no discernible trend.

Figure 1: The impact of altitude on log hourly wage 1989 - 1995



Source: Authors regressions. See Tables B8-B9 of Appendix B.

Altitude in itself cannot explain differences in productivity and wages, though, unless the lack of oxygen at high altitudes should impair worker productivity. This explanation is ruled out as bodies quickly adjust to thin air by generating a higher density of red blood cells and thereby increase the body's ability to absorb oxygen. So we will have to look behind altitude for factors that may affect worker productivity.

Since we have already accounted for individual labor characteristics (such as education, experience, gender, and ethnicity), we will now look at external factors that may affect labor productivity. The factors investigated in this paper are to a large extent determined by available data, and they include: i) temperature, ii) telephone density, and iii) public investment in transport infrastructure.

In the general absence of air conditioners and room heaters, the climate may be important for productivity. Both too cold temperatures and too hot temperatures are expected to impair productivity and thus to reduce equilibrium wages. We will therefore include an average temperature variable as well as its square in our regressions and see how much of the geographical variation can be explained by differences in temperature. Since we only have urban workers in our sample, precipitation is not expected to be important for productivity.

A telephone can increase your productivity significantly if the people you need to interact with also have telephones. We will therefore try to include the density of telephones (number of telephones in state/number of people in state) in our regressions and see how much of the geographical variation that variable can explain.

Bad physical infrastructure can significantly decrease productivity by consuming both time and money. We will therefore also try to include public per capita investments in transportation infrastructure in our regressions.

Table 3 shows regression results with these variables included[4]. We have included them step-wise starting with natural geography variables, then adding infrastructure variables, and finally also controlling for personal characteristics.

Table 3: Regressions of log hourly wage rates on regional and personal characteristics, EIH Round 7

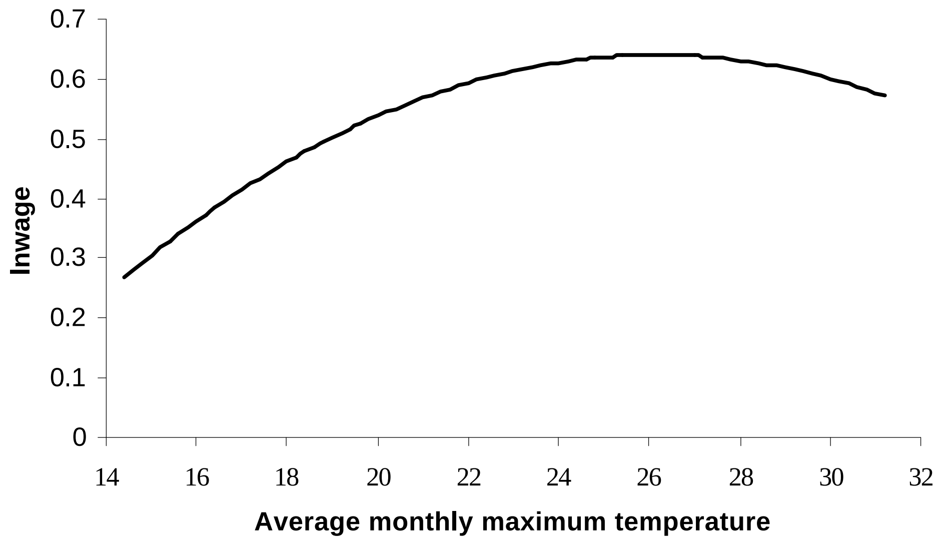
	(1)	(2)	(3)	(4)	(5)
Constant	0.4378	-1.5837	-2.7499***	-2.4271***	-2.5035***
Temperature	0.0217* (0.0102)	0.2128* (0.0936)	0.2864*** (0.0613)	0.1328** (0.0534)	0.1407** (0.0527)
Temperature squared	--	-0.0042* (0.0021)	-0.0059*** (0.0014)	-0.0025* (0.0012)	-0.0027* (0.0012)
Departmental telephone density	--	--	0.0093*** (0.0025)	0.0075** (0.0024)	0.0080*** (0.0024)
Departmental per capita transport investment	--	--	-0.0040 (0.0031)	-0.0034 (0.0033)	-0.0032 (0.0033)
Female	--	--	--	-0.3443***	-0.2810***
Ethnic origin	--	--	--	-0.0579	-0.0581
Years of Scholing	--	--	--	0.0993***	0.0922***
Experience	--	--	--	0.0456***	0.0439***
Experience^2	--	--	--	-0.0006***	-0.0005***
Sector: Agriculture	--	--	--	--	0.0419
Sector: Mining	--	--	--	--	0.3230***
Sector: Utility	--	--	--	--	0.2371***
Sector: Construction	--	--	--	--	0.1155***
Sector: Trade	--	--	--	--	-0.0203
Sector: Hotel	--	--	--	--	0.0269
Sector: Transportation	--	--	--	--	0.3251***
Sector: Finance	--	--	--	--	0.5658***
Sector: Enterprise services	--	--	--	--	0.2021***
Sector: Public Admin.	--	--	--	--	0.0709
Sector: Community services	--	--	--	--	-0.3309***
Sector: Social services	--	--	--	--	0.0780
R^2	0.018	0.028	0.038	0.381	0.396
N	9,201	9,201	9,201	9,201	9,201

Source: Authors' calculations using household survey information from EIH Round 7 (1994).
Note: Standard errors are cluster corrected using the Huber/White/sandwich estimator.
* - significant at the 10 percent level.
** - significant at the 5 percent level.
*** - significant at the 1 percent level.

[4] In the IDB report that this paper is a part of, we generally use Round 7 (1994) because it is the last round with ethnicity variables and because it is the round with the highest number of observations. Transport investment data are also from 1994, while telephone densities are from 1995.

The results show that temperature is highly significant in a non-linear fashion. Wages increase with temperature until a maximum is reached at 26 degrees, then they decrease slightly as the temperature increases further (see figure 2).

Figure 2: Simulated effect of temperature on log hourly wage



Telephone density is shown to have a highly significant positive effect on wages, while the effect of public investment in transportation infrastructure had no significant effect.

4. Regional decompositions of geographical effects

The importance of geographical differences (natural and man-made) can also be illustrated by the use of a regional decomposition. We divide the 10 cities into three regions: 1) Highlands (La Paz, El Alto, Oruro, Potosí), 2) Valleys (Sucre, Cochambamba, Tarija), and 3) Lowlands (Santa Cruz de la Sierra, Trinidad, Cobija). For each explanatory variable of interest we multiply the average difference between two regions with the estimated coefficient of that variable to find the contribution from that variable to regional differences.

The regional decomposition is complementary to the Fields decomposition, and the results have a different interpretation. The regression results behind the Fields decomposition show, for example, a large effect of education on wages. This need not carry over to the regional decomposition, however, if the regional differences in education levels are small. A summary of regional means is provided in Table 4.

Table 4: Regional averages of variables of interest calculated from EIH Round 7 (1994)

	Highlands	Valleys	Lowlands
Log hourly income	**0.8590**	**0.9079**	**1.0761**
1. Natural geography			
- Temperature	17.3347	26.0403	29.7979
- Temperature squared	305.1746	683.2965	888.0504
2. Infrastructure			
- Telephone density	60.0942	48.4769	64.3688
- Transport investment per capita	30.0338	25.0799	18.5532
3. Individual characteristics			
- Years of education	9.9903	10.3425	9.5611
- Experience	19.0335	18.4866	17.1094
- Experience squared	531.2845	520.6799	450.9456
- Ethnicity	0.4925	0.5413	0.1351
- Gender	0.4083	0.4287	0.4053

Source: Authors' calculations using household survey information from EIH Round 7 (1994).

The regional averages from Table 4 are used together with regression coefficients from Regression (5) in Table 3 to generate the decomposition in Table 5.

Table 5: Decompositions of log hourly wage in 1994 based on regression (5) in Table 3

	Lowlands - Highlands	Lowland – Valleys	Valleys – Highlands
Income differences	**0.2171**	**0.1681**	**0.0490**
1. Contributions from geography			
- Temperature	0.1865	-0.0218	0.2082
2. Contributions from infrastructure			
- Telephone density	0.0344	0.1279	-0.0935
- Transport investment	0.0369	0.0210	0.0159
3. Contributions from individual characteristics			
- Education	-0.0396	-0.0720	0.0325
- Experience	-0.0410	-0.0228	-0.0183
- Ethnicity	0.0208	0.0236	-0.0028
- Gender	0.0008	0.0066	-0.0057
- Work sector	-0.0128	-0.0110	-0.0018
4. Other contributions	0.0311	0.1167	-0.0855

Source: Authors' calculations using household survey information from EIH Round 7 (1994).

Table 5 shows that temperature and telephone density are by far the most important determinants of regional differences in wage rates. Temperature differences explain most of the wage difference between highlands and valleys, while differences in telephone density explain most of the difference between valleys and lowlands.

Differences in transport investment and personal characteristics do little to explain regional differences compared to differences in temperature and telephone density.

5. Conclusions

Using household survey data, this paper has shown that there are large and persistent wage differentials between Bolivian cities, with workers in the lowlands earning about 50% more than workers with similar characteristics in the highlands.

Temperature and telephone density was found to be the most important factors behind the urban wage differentials. The temperatures in the valley region seem to be ideal for urban Bolivian workers, while the low temperatures in the highlands seriously impair productivity. Anybody working in a typical modern, unheated, un-insulated, thin-walled office building at about 4000 meters altitude during the winter can testify to this. The high temperatures at the lowest altitudes have a slightly negative effect on wages, but the effect is small compared to the effect of the cold temperatures in the highlands.

In the long run, it is likely that measures to create a more pleasant indoor climate in the highlands may increase worker productivity, wages, and living standards for those who are currently receiving the lowest wages[5]. Such measures include the advancement of proper building techniques (adobe instead of hollow brick, thermal windows that let the heat in and keep it in, solar heating systems, etc), and possibly energy subsidies (currently, the use of one electric radiator easily costs more than the salary of an unskilled worker). The first measures would be better and more sustainable than the latter, but some technology transfer from more advanced cold countries may be necessary if progress is to be made. The building techniques that are currently fashionable in highland cities are certainly not compatible with the current fashion in women's office wear.

The general density of telephones is also shown empirically to have a significant effect on wages (and indirectly on productivity). We would therefore expect that support to the development of telephone networks (and other business infrastructure with positive externalities) would improve worker productivity in all of Bolivia. Currently, it costs 3-4 years of unskilled salary to obtain a telephone line in areas covered by the network. In other areas telephone service is not available at all. The recent advancement of cell phones does help, though.

There are two potentially important issues that this micro-level analysis has ignored. The first is differences in price level and costs of living. If costs of living are higher in the lowlands, this would help explain why workers can command higher wages there. I do not have comparable data on costs of living in different Bolivian cities, but between 1991 and 1997, prices have increased faster in Cochabamba (86%) and Santa Cruz (82%) than in La Paz (75%) and El Alto (69%), thus lending some credibility to this hypothesis.

The second issue is local labor supply shortages. If there are labor supply shortages in the lowlands and labor surplus in the highlands, this would help explain the wage differentials. We would expect that internal migration would help to equilibrate such labor supply differences, however, and indeed we observe dramatic migration streams from the highlands to the lowlands in the period under investigation.

[5] Not including rural workers who have different needs than urban workers.

The remaining differences in unemployment rates do not account for the observed wage differentials. The unemployment rates in the highlands remain very low (under 2.5 percent in 1994) and the highest unemployment rate (3.5%) is observed in Tarija (in the Valley region).

Appendix A: A theoretical derivation of the Fields decomposition

Consider a standard earnings regression:

$$Y = \sum_j a_j Z_j$$

where Y is a vector of log wages for all individuals in the sample and Z is a matrix with j explanatory variables, including an intercept, years of education, experience, experience squared, gender, etc for each individual.

A simple measure of inequality is the variance of the log wage. We therefore take the variance on both sides of the earnings equation. The right hand side can be manipulated using the following theorem:

> **Theorem (Mood, Graybill, and Boes):** Let $Z_1,\ldots,Z_J$ and $Y_1,\ldots,Y_M$ be two sets of random variables and $a_1,\ldots,a_J$ and $b_1,\ldots,b_M$ be two sets of constants. Then

$$\operatorname{cov}\left[\sum_{j=1}^{J} a_j Z_j ; \sum_{m=1}^{M} b_m Y_m\right] = \sum_{j=1}^{J}\sum_{m=1}^{M} a_j b_m \operatorname{cov}\left[Z_j, Y_m\right].$$

Applying the theorem in the context of a single random variable $Y=\sum_j a_j Z_j$, we have

$$\operatorname{cov}\left[\sum_{j=1}^{J} a_j Z_j ; Y\right] = \sum_{j=1}^{J} \operatorname{cov}\left[a_j Z ; Y\right]$$

But since the left-hand side of this expression is the covariance between Y and itself, it is simply the variance of Y. Thus,

$$s^2(Y) = \sum_{j=1}^{J} \operatorname{cov}\left[a_j Z_j ; Y\right]$$

Or, upon dividing through by $s^2(Y)$,

$$1 = \frac{\sum_{j=1}^{J} \operatorname{cov}\left[a_j Z_j ; Y\right]}{s^2(Y)} \equiv \sum_{j=1}^{J} s_j ,$$

Where each s_j is given by

$$s_j = \frac{\operatorname{cov}\left[a_j Z_j ; Y\right]}{s^2(Y)} = \frac{a_j \cdot s(Z_j) \cdot cor\left[Z_j ; Y\right]}{s(Y)}.$$

The s_j's are the factor inequality weights and they add to 1 over all explanatory factors. Each s_j is decomposable in an intuitively appealing manner. For example, years of education (edu) explains a larger share of income inequality:

- The higher the regression coefficient on education (a_{edu}) in the earnings regression.
- The higher the standard deviation of years of education (s_{edu}).
- And the higher the correlation between education and earnings ($cor(\text{edu}, Y)$).

Fields (1996) also shows that this decomposition carries over to other commonly used inequality measures, such as the Gini coefficient, the Atkinson index, the generalized entropy family, as well as the log variance.

Tables B1-B7 in Appendix B shows how to apply the Fields decomposition in practice.

Appendix B: Regression results

Table B1: Fields Decomposition of Wage Inequality *Round 1* *March 1989*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-1.1214	-18.2860	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.0834	25.9790	8.3850	4.4723	0.3807	0.1419	15.57%	15.57%	53.04%
experi	0.0495	17.8270	20.6583	13.4030	0.0405	0.0269	2.95%		
experi2	-0.0006	-11.8370	606.3739	695.6608	-0.0175	0.0077	0.84%	3.79%	12.91%
woman	-0.1897	-7.7280	0.4321	0.4954	-0.2139	0.0201	2.20%	2.20%	7.51%
sucre	0.1412	2.3420	0.0394	0.1945	-0.0019	-0.0001	-0.01%		
lapaz	0.0914	2.5400	0.2988	0.4578	-0.0048	-0.0002	-0.02%		
cocha	0.2092	5.3020	0.1701	0.3758	0.0526	0.0041	0.45%		
oruro	-0.1201	-2.3150	0.0636	0.2440	-0.0486	0.0014	0.16%		
potosi	-0.1876	-2.9500	0.0371	0.1890	-0.0756	0.0027	0.29%		
tarija	0.0635	0.8900	0.0271	0.1625	-0.0113	-0.0001	-0.01%		
cruz	0.3828	9.6100	0.2153	0.4111	0.1307	0.0206	2.26%		
trinidad	0.2375	2.8430	0.0186	0.1351	0.0233	0.0007	0.08%		
cobija	0.4283	2.2710	0.0031	0.0557	0.0208	0.0005	0.05%	3.25%	11.09%
ethnic	-0.1611	-6.3730	0.4998	0.5000	-0.2099	0.0169	1.85%	1.85%	6.32%
agricult	0.0926	1.0470	0.0156	0.1240	0.0426	0.0005	0.05%		
mining	0.0695	0.8430	0.0196	0.1386	0.0060	0.0001	0.01%		
utility	0.3641	2.5010	0.0053	0.0724	0.0447	0.0012	0.13%		
construc	0.0624	1.2410	0.0661	0.2485	0.0223	0.0003	0.04%		
trade	-0.0513	-1.3680	0.2362	0.4248	-0.1396	0.0030	0.33%		
hotel	0.0622	1.0490	0.0423	0.2012	-0.0299	-0.0004	-0.04%		
trans	0.1154	2.4660	0.0815	0.2736	0.0766	0.0024	0.27%		
finance	0.4349	4.1630	0.0108	0.1032	0.0803	0.0036	0.40%		
entserv	0.3664	4.4160	0.0183	0.1341	0.1089	0.0053	0.59%		
pubadm	0.0055	0.1080	0.0626	0.2422	0.0639	0.0001	0.01%		
comserv	-0.0720	-1.8880	0.1961	0.3971	-0.1449	0.0041	0.45%		
socserv	0.0795	1.7560	0.1160	0.3203	0.1537	0.0039	0.43%		
foreign	0.1196	0.6850	0.0036	0.0601	0.0265	0.0002	0.02%	2.68%	9.13%
No. obs. = 5533		SD(lnwage) = 0.9118			SUM =	0.2676	29.35%	29.35%	100.00%
F(27,5505) = 85		Mean(lnwage) = 0.2155			R2 =	0.2935			

Table B2: Fields Decomposition of Wage Inequality *Round 3* *September 1990*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-0.9319	-19.3670	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.0718	29.1310	8.1406	4.6815	0.3234	0.1087	11.16%	11.16%	41.79%
experi	0.0525	22.2370	20.4269	12.9350	0.0709	0.0481	4.94%		
experi2	-0.0007	-14.5050	584.5515	653.6463	0.0190	-0.0083	-0.86%	4.08%	15.29%
woman	-0.3034	-14.5520	0.4086	0.4916	-0.2261	0.0337	3.46%	3.46%	12.96%
sucre	0.0208	0.4010	0.0370	0.1889	-0.0061	0.0000	0.00%		
lapaz	0.0719	2.4300	0.2926	0.4550	-0.0225	-0.0007	-0.08%		
cocha	0.1998	6.0750	0.1640	0.3703	0.0476	0.0035	0.36%		
oruro	-0.0679	-1.5850	0.0631	0.2431	-0.0332	0.0005	0.06%		
potosi	-0.2470	-4.6940	0.0377	0.1905	-0.0654	0.0031	0.32%		
tarija	-0.0429	-0.7320	0.0284	0.1663	-0.0229	0.0002	0.02%		
cruz	0.3201	9.9060	0.2223	0.4158	0.1077	0.0143	1.47%		
trinidad	0.2993	4.2520	0.0182	0.1337	0.0325	0.0013	0.13%		
cobija	0.4828	3.1520	0.0034	0.0580	0.0314	0.0009	0.09%	2.37%	8.87%
ethnic	-0.1425	-6.9140	0.4183	0.4933	-0.1601	0.0113	1.15%	1.15%	4.33%
agricult	0.1853	2.0980	0.0106	0.1026	0.0400	0.0008	0.08%		
mining	0.2364	3.5480	0.0210	0.1432	0.0367	0.0012	0.13%		
utility	0.3597	3.1740	0.0062	0.0788	0.0425	0.0012	0.12%		
construc	0.0301	0.7340	0.0670	0.2500	0.0022	0.0000	0.00%		
trade	-0.0693	-2.2470	0.2059	0.4044	-0.1379	0.0039	0.40%		
hotel	0.0028	0.0500	0.0309	0.1729	-0.0319	0.0000	0.00%		
trans	0.0669	1.7380	0.0796	0.2707	0.0499	0.0009	0.09%		
finance	0.7023	8.0330	0.0108	0.1036	0.0878	0.0064	0.66%		
entserv	0.4068	5.8960	0.0184	0.1342	0.0905	0.0049	0.51%		
pubadm	0.1974	5.1080	0.0790	0.2698	0.0822	0.0044	0.45%		
comserv	-0.1007	-3.3030	0.1916	0.3936	-0.1569	0.0062	0.64%		
socserv	0.2163	5.9290	0.1164	0.3207	0.1641	0.0114	1.17%		
foreign	0.7310	5.4110	0.0044	0.0659	0.0484	0.0023	0.24%	4.48%	16.76%
No. obs. = 9092		SD(lnwage) = 0.9744028			SUM =	0.2602	26.70%	26.70%	100.00%
F(27,9052) = 122		Mean(lnwage) = 0.3087125			R2 =	0.2670			

Table B3: Fields Decomposition of Wage Inequality *Round 4* *November 1991*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-1.1680	-25.8860	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.0992	36.5570	9.5454	4.0796	0.4054	0.1640	17.47%	17.47%	56.55%
experi	0.0461	19.2980	18.6125	12.2538	0.1074	0.0606	6.46%		
experi2	-0.0006	-11.3000	496.5604	580.3018	0.0534	-0.0176	-1.88%	4.58%	14.83%
woman	-0.2543	-12.4870	0.3768	0.4846	-0.1974	0.0243	2.59%	2.59%	8.39%
sucre	0.2477	4.8170	0.0370	0.1889	0.0053	0.0002	0.03%		
lapaz	0.2571	8.5330	0.2590	0.4381	0.0366	0.0041	0.44%		
cocha	0.2549	7.8050	0.1702	0.3758	0.0338	0.0032	0.34%		
oruro	0.0904	2.2600	0.0764	0.2657	-0.0233	-0.0006	-0.06%		
potosi	-0.0912	-1.7740	0.0393	0.1943	-0.0662	0.0012	0.12%		
tarija	0.2566	4.3470	0.0262	0.1598	-0.0012	0.0000	-0.01%		
cruz	0.4637	15.3030	0.2439	0.4294	0.0807	0.0161	1.71%		
trinidad	0.4445	6.7630	0.0205	0.1416	0.0193	0.0012	0.13%	2.71%	8.78%
agricult	-0.1505	-1.8670	0.0123	0.1101	-0.0068	0.0001	0.01%		
mining	0.2511	4.2470	0.0253	0.1572	0.0511	0.0020	0.21%		
utility	0.2273	2.4160	0.0088	0.0936	0.0384	0.0008	0.09%		
construc	0.0612	1.7930	0.0912	0.2879	-0.0046	-0.0001	-0.01%		
trade	-0.0384	-1.4690	0.2242	0.4171	-0.1017	0.0016	0.17%		
hotel	-0.0351	-0.7110	0.0368	0.1883	-0.0479	0.0003	0.03%		
trans	0.3350	4.5450	0.0148	0.1209	0.0788	0.0032	0.34%		
finance	0.6570	7.4770	0.0103	0.1009	0.0985	0.0065	0.70%		
entserv	0.1897	3.5200	0.0299	0.1704	0.0881	0.0028	0.30%		
pubadm	0.0332	0.8310	0.0601	0.2377	0.0616	0.0005	0.05%		
comserv	-0.2569	-6.5070	0.1126	0.3162	-0.1867	0.0152	1.61%		
socserv	0.1461	4.4070	0.2359	0.4246	0.0031	0.0002	0.02%		
foreign	-0.2454	-0.2530	0.0001	0.0089	-0.0047	0.0000	0.00%	3.54%	11.46%
No. obs. = 8132	SD(lnwage) = 0.9391				SUM =	0.2900	30.89%	30.89%	100.00%
F(25,8106) = 145	Mean(lnwage) = 0.5363				R2 =	0.3089			

Table B4: Fields Decomposition of Wage Inequality *Round 5* *November 1992*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-0.9982	-25.0420	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.0911	42.4940	10.0956	5.2598	0.4680	0.2242	23.82%	23.82%	61.84%
experi	0.0449	19.9320	18.0623	12.2830	0.0338	0.0186	1.98%		
experi2	-0.0006	-12.0960	477.0982	576.0233	-0.0120	0.0040	0.42%	2.40%	6.24%
woman	-0.2899	-14.7430	0.3769	0.4846	-0.2263	0.0318	3.38%	3.38%	8.77%
sucre	0.0999	2.0490	0.0380	0.1911	-0.0188	-0.0004	-0.04%		
lapaz	0.2259	8.0160	0.2549	0.4359	0.0347	0.0034	0.36%		
cocha	0.2345	7.5110	0.1529	0.3600	0.0065	0.0005	0.06%		
oruro	0.0269	0.6540	0.0597	0.2370	-0.0495	-0.0003	-0.03%		
potosi	-0.1286	-2.4700	0.0334	0.1798	-0.0558	0.0013	0.14%		
tarija	0.2074	3.7860	0.0283	0.1660	-0.0177	-0.0006	-0.06%		
cruz	0.5943	21.5240	0.2658	0.4418	0.1536	0.0403	4.28%		
trinidad	0.4492	6.9410	0.0193	0.1376	0.0282	0.0017	0.19%	4.89%	12.70%
agricult	0.1050	1.5140	0.0157	0.1245	0.0367	0.0005	0.05%		
mining	0.1845	2.9800	0.0209	0.1431	0.0450	0.0012	0.13%		
utility	0.2646	3.0540	0.0098	0.0987	0.0614	0.0016	0.17%		
construc	0.0755	2.3830	0.0990	0.2987	-0.0020	0.0000	0.00%		
trade	-0.0885	-3.6780	0.2295	0.4205	-0.1407	0.0052	0.56%		
hotel	-0.0505	-0.4750	0.0064	0.0800	-0.0018	0.0000	0.00%		
trans	0.3488	5.0170	0.0158	0.1246	0.0872	0.0038	0.40%		
finance	0.5503	5.7790	0.0082	0.0902	0.0886	0.0044	0.47%		
entserv	0.1392	2.7040	0.0316	0.1751	0.1128	0.0027	0.29%		
pubadm	0.1202	3.1940	0.0644	0.2455	0.1096	0.0032	0.34%		
comserv	-0.2600	-6.2700	0.1017	0.3023	-0.1927	0.0151	1.61%		
socserv	0.1122	3.2510	0.2061	0.4046	0.0001	0.0000	0.00%		
foreign	0.1941	0.6790	0.0009	0.0295	0.0162	0.0001	0.01%	4.02%	10.45%
No. obs. = 7708		SD(lnwage) = 0.9411			SUM =	0.3625	38.52%	38.52%	100.00%
F(25,7682) = 193		Mean(lnwage) = 0.6291			R2 =	0.3852			

Table B5: Fields Decomposition of Wage Inequality *Round 6* *July-Dec. 1993*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-0.8534	-17.9230	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.1006	39.2520	9.8169	4.9390	0.4992	0.2480	26.10%	26.10%	61.37%
experi	0.0504	19.8170	17.8395	12.3952	0.0467	0.0292	3.07%		
experi2	-0.0007	-12.4810	471.8622	575.7051	-0.0055	0.0021	0.23%	3.30%	7.75%
woman	-0.2514	-11.6210	0.3931	0.4885	-0.2093	0.0257	2.71%	2.71%	6.36%
ethnic	-0.0824	-3.6540	0.4793	0.4996	-0.1708	0.0070	0.74%	0.74%	1.74%
sucre	0.0415	0.7630	0.0379	0.1909	-0.0260	-0.0002	-0.02%		
lapaz	0.2412	7.6720	0.2754	0.4468	0.0712	0.0077	0.81%		
cocha	0.2094	5.8500	0.1380	0.3449	0.0152	0.0011	0.12%		
oruro	-0.2299	-4.8770	0.0558	0.2296	-0.0726	0.0038	0.40%		
potosi	-0.1553	-2.5360	0.0290	0.1678	-0.0528	0.0014	0.14%		
tarija	0.0497	0.8550	0.0334	0.1797	-0.0389	-0.0003	-0.04%		
cruz	0.4244	12.6530	0.2691	0.4435	0.1110	0.0209	2.20%		
trinidad	0.2802	4.0360	0.0218	0.1461	-0.0015	-0.0001	-0.01%	3.61%	8.48%
agricult	0.0625	0.8200	0.0160	0.1255	0.0060	0.0000	0.00%		
mining	0.3835	4.8240	0.0150	0.1218	0.0523	0.0024	0.26%		
utility	0.4572	3.3050	0.0046	0.0680	0.0506	0.0016	0.17%		
construc	0.0730	2.0270	0.0908	0.2873	-0.0073	-0.0002	-0.02%		
trade	-0.0916	-3.4290	0.2243	0.4172	-0.1196	0.0046	0.48%		
hotel	-0.4302	-3.5430	0.0060	0.0775	-0.0377	0.0013	0.13%		
trans	0.2913	3.6990	0.0150	0.1214	0.0758	0.0027	0.28%		
finance	0.5861	7.2380	0.0144	0.1189	0.1149	0.0080	0.84%		
entserv	0.1895	3.3260	0.0317	0.1751	0.1196	0.0040	0.42%		
pubadm	0.2537	5.8460	0.0583	0.2344	0.1349	0.0080	0.84%		
comserv	-0.3459	-7.7460	0.1070	0.3091	-0.2391	0.0256	2.69%		
socserv	0.1430	3.9000	0.2252	0.4178	-0.0033	-0.0002	-0.02%	6.08%	14.30%
No. obs. = 5985		SD(lnwage) = 0.9500			SUM =	0.4041	42.53%	42.53%	100.00%
F(25,5959) = 176		Mean(lnwage) = 0.7987			R2 =	0.4253			

Table B6: Fields Decomposition of Wage Inequality *Round 7* *July-Dec. 1994*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-0.6636	-17.9570	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.0930	49.0080	9.9389	5.6705	0.5024	0.2648	27.67%	27.67%	68.89%
experi	0.0438	22.2620	18.3601	12.9862	-0.0258	-0.0147	-1.53%		
experi2	-0.0005	-13.2900	505.7166	626.1846	-0.0706	0.0238	2.48%	0.95%	2.36%
woman	-0.2787	-15.6680	0.4117	0.4922	-0.2365	0.0324	3.39%	3.39%	8.44%
ethnic	-0.0410	-2.2870	0.3988	0.4897	-0.1306	0.0026	0.27%	0.27%	0.68%
sucre	0.1053	2.3890	0.0392	0.1940	-0.0397	-0.0008	-0.08%		
lapaz	0.3237	12.9430	0.2571	0.4370	0.0938	0.0133	1.39%		
cocha	0.2444	8.5120	0.1384	0.3454	0.0194	0.0016	0.17%		
oruro	-0.0560	-1.4340	0.0523	0.2227	-0.0478	0.0006	0.06%		
potosi	0.0137	0.2740	0.0293	0.1687	-0.0376	-0.0001	-0.01%		
tarija	0.1530	3.1650	0.0309	0.1730	-0.0249	-0.0007	-0.07%		
cruz	0.4683	18.6420	0.2718	0.4449	0.1008	0.0210	2.19%		
trinidad	0.2962	4.9450	0.0190	0.1364	-0.0084	-0.0003	-0.04%	3.62%	9.00%
agricult	0.0193	0.2820	0.0136	0.1158	0.0148	0.0000	0.00%		
mining	0.2902	4.2090	0.0138	0.1165	0.0496	0.0017	0.18%		
utility	0.2706	2.4870	0.0052	0.0717	0.0395	0.0008	0.08%		
construc	0.1129	3.9710	0.1066	0.3086	0.0174	0.0006	0.06%		
trade	-0.0241	-1.1170	0.2509	0.4336	-0.1054	0.0011	0.11%		
hotel	0.0134	0.1220	0.0051	0.0711	0.0124	0.0000	0.00%		
trans	0.3324	4.7350	0.0128	0.1125	0.0831	0.0031	0.32%		
finance	0.5636	7.5110	0.0112	0.1053	0.1030	0.0061	0.64%		
entserv	0.1876	3.9900	0.0315	0.1747	0.1172	0.0038	0.40%		
pubadm	0.0731	1.9490	0.0520	0.2221	0.0919	0.0015	0.16%		
comserv	-0.3365	-8.8740	0.0967	0.2955	-0.2252	0.0224	2.34%		
socserv	0.0722	2.3410	0.2039	0.4029	-0.0111	-0.0003	-0.03%	4.27%	10.62%
No. obs. = 9201		SD(lnwage) = 0.9568			SUM =	0.3844	40.17%	40.17%	100.00%
F(25,9175) = 246		Mean(lnwage) = 0.9323			R2 =	0.4017			

Table B7: Fields Decomposition of Wage Inequality *Round 8* *June 1995*

	Beta	t-value	Mean(X)	SD(X)	Corr (X,ln(wage))	Field's contribution to inequality			
Constant	-0.5093	-12.7540	1.0000	0.0000	0.0000	0.0000	0.00%		
yearsedu	0.0855	39.9540	9.8852	5.6250	0.4486	0.2158	22.16%	22.16%	66.22%
experi	0.0392	18.0820	18.4067	13.0078	-0.0013	-0.0007	-0.07%		
experi2	-0.0004	-9.9820	507.9898	634.0046	-0.0438	0.0123	1.26%	1.20%	3.57%
woman	-0.2061	-10.4260	0.4123	0.4923	-0.1850	0.0188	1.93%	1.93%	5.76%
sucre	0.0518	1.0640	0.0390	0.1937	-0.0424	-0.0004	-0.04%		
lapaz	0.2393	8.5210	0.2451	0.4301	0.0675	0.0069	0.71%		
cocha	0.1902	5.8700	0.1296	0.3359	0.0197	0.0013	0.13%		
oruro	-0.0324	-0.7770	0.0584	0.2345	-0.0475	0.0004	0.04%		
potosi	-0.2050	-3.6860	0.0290	0.1679	-0.0721	0.0025	0.25%		
tarija	0.1104	2.0990	0.0324	0.1769	-0.0260	-0.0005	-0.05%		
cruz	0.5073	18.7730	0.2819	0.4499	0.1235	0.0282	2.89%		
trinidad	0.4172	6.3750	0.0196	0.1387	0.0144	0.0008	0.09%	4.02%	12.01%
agricult	-0.1334	-2.0140	0.0183	0.1340	-0.0213	0.0004	0.04%		
mining	0.3809	5.3530	0.0160	0.1256	0.0577	0.0028	0.28%		
utility	0.3554	2.7420	0.0045	0.0671	0.0460	0.0011	0.11%		
construc	0.0808	2.4310	0.0927	0.2900	-0.0071	-0.0002	-0.02%		
trade	0.0335	1.4000	0.2505	0.4333	-0.0644	-0.0009	-0.10%		
hotel	-0.1652	-1.2480	0.0043	0.0655	-0.0129	0.0001	0.01%		
trans	0.4693	6.0130	0.0129	0.1129	0.0877	0.0046	0.48%		
finance	0.7107	8.7510	0.0121	0.1093	0.1260	0.0098	1.00%		
entserv	0.2374	4.4160	0.0298	0.1699	0.1083	0.0044	0.45%		
pubadm	0.1070	2.5000	0.0494	0.2166	0.0775	0.0018	0.18%		
comserv	-0.2829	-6.6700	0.1078	0.3102	-0.1929	0.0169	1.74%		
socserv	0.1116	3.1480	0.2101	0.4074	-0.0058	-0.0003	-0.03%	4.16%	12.44%
No. obs. = 8526	SD(lnwage) = 0.9738				SUM =	0.3259	33.46%	33.46%	100.00%
F(24,8501) = 178	Mean(lnwage) = 1.0208				R2 =	0.3346			

Table B8: Regression results for Rounds 1 – 5 with altitude instead of city dummies

	Round 1 (1989)		Round 3 (1990)		Round 4 (1991)		Round 5 (1992)	
Variable	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*
yearsedu	0.0857	17.443	0.0731	18.637	0.1021	27.160	0.0932	46.835
experi	0.0495	23.504	0.0529	12.941	0.0464	9.017	0.0458	9.321
experi2	-0.0006	-17.058	-0.0007	-8.423	-0.0006	-5.660	-0.0006	-5.843
woman	-0.1822	-5.035	-0.2998	-7.991	-0.2446	-4.913	-0.2863	-13.040
ethnic	-0.1421	-3.663	-0.1362	-3.647			-	-
altitude	-0.1074	-7.196	-0.0927	-7.013	-0.0995	-4.924	-0.1442	-6.961
agricult	0.0820	0.633	0.1812	2.404	-0.1563	-1.467	0.0903	0.812
mining	-0.0110	-0.172	0.1418	1.094	0.1886	1.953	0.1382	2.076
utility	0.3432	3.435	0.3426	1.585	0.2116	2.742	0.2584	5.326
construc	0.0543	2.563	0.0183	0.522	0.0599	1.386	0.0681	1.628
trade	-0.0558	-1.270	-0.0727	-1.038	-0.0435	-1.831	-0.0854	-1.753
hotel	0.0678	0.748	-0.0005	-0.004	-0.0290	-0.559	-0.0220	-0.573
trans	0.1028	1.382	0.0572	1.486	0.3421	4.341	0.3436	3.503
finance	0.4450	5.891	0.7059	4.952	0.6781	10.514	0.5587	7.521
entserv	0.3858	5.954	0.4161	11.553	0.2103	4.768	0.1662	1.511
pubadm	-0.0015	-0.062	0.1875	5.422	0.0383	0.673	0.1204	2.732
comserv	-0.0724	-1.431	-0.0987	-2.088	-0.2311	-4.772	-0.2172	-5.972
socserv	0.0628	1.211	0.1990	7.136	0.1326	3.224	0.0867	2.372
foreign	0.1250	1.017	0.7098	3.478	-0.3846	-6.883	0.1811	0.390
_cons	-0.7193	-11.499	-0.5804	-8.455	-0.6979	-15.613	-0.4017	-8.651
Num.obs		5533		9092		8132		7708
R^2		0.2875		0.2610		0.3012		0.3767

Note: t-values are based on cluster corrected standard errors estimated with the Huber/White/sandwich estimator.

Table B9: Regression results for Rounds 6 – 8 with altitude instead of city dummies

	Round 6 (1993)		Round 7 (1994)		Round 8 (1995)	
Variable	*Coeff.*	*t-value*	*Coeff.*	*t-value*	*Coeff.*	*t-value*
yearsedu	0.1016	19.023	0.0963	13.018	0.0882	23.469
experi	0.0506	15.348	0.0447	25.099	0.0397	15.576
experi2	-0.0007	-9.882	-0.0006	-17.063	-0.0004	-10.336
woman	-0.2476	-6.273	-0.2727	-5.701	-0.2013	-12.534
ethnic	-0.0971	-2.534	-0.0260	-0.974	-	-
altitude	-0.0942	-3.046	-0.0931	-3.013	-0.1221	-5.414
agricult	0.0703	0.937	0.0029	0.117	-0.1516	-3.772
mining	0.3229	2.380	0.2578	3.495	0.3212	8.122
utility	0.4460	4.608	0.2352	3.718	0.3235	4.909
construc	0.0709	1.741	0.1060	7.066	0.0671	1.070
trade	-0.0812	-2.884	-0.0114	-0.483	0.0315	0.858
hotel	-0.4403	-3.026	0.0452	0.241	-0.1863	-2.063
trans	0.3061	7.848	0.3550	5.037	0.4810	7.140
finance	0.6494	19.133	0.5876	12.330	0.7318	16.189
entserv	0.2294	2.722	0.2344	5.309	0.2638	5.501
pubadm	0.2768	6.043	0.0760	1.449	0.1058	2.038
comserv	-0.3055	-4.088	-0.2870	-3.272	-0.2368	-9.537
socserv	0.1334	1.930	0.0502	0.777	0.0829	2.015
foreign	-	-	-	-	-	-
_cons	-0.4342	-4.414	-0.2294	-2.006	-0.0052	-0.060
Num.obs		5985		9201		8526
R^2		0.4076		0.3859		0.3233

Note: t-values are based on cluster corrected standard errors estimated with the Huber/White/sandwich estimator.

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