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A new approach to gender wage gaps in Chile

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The purpose of this study is to examine gender wage gaps in Chile using a new database, the Social Protection Survey (EPS) 2002-2006, which makes it possible to control for actual work experience and its timing. Potential work experience variables do not reflect the intermittent and discontinuous participation of women in the Chilean labour market. Corrections are also introduced for occupational selection, and two key variables are instrumented: education and work experience. Although there are still wage differences between men and women, the introduction of controls for actual work experience and the instrumentation of this work experience and education bring the hourly wage gap down to some 11% to 18%, figures much lower than those reported in earlier studies for Chile. Contrary to expectations, this gap has widened in recent years.

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I

Introduction

In Chile, as in other Latin American countries, studies have been done on wage discrimination against women in the labour market. Numerous reports place the female labour force participation rate in Chile among the lowest in the region and indicate a large gender wage gap, with the female monthly wage averaging just 67% of its male equivalent.¹

Many studies, including some very recent ones, have set out to quantify the wage gap between men and women in Chile (Bravo, Sanhueza and Urzúa, 2008a and 2008c; Gill, 1992; Gill and Montenegro, 2002; Montenegro, 2001; Paredes, 1982; Paredes and Riveros, 1994). These studies have produced different estimates for the extent of wage discrimination against women in Chile. Most of them conclude that women receive much lower wages than men. However, it is difficult to establish whether wage gaps are actually due to productivity differences (men and women differ in observable and unobservable characteristics) or to “discrimination”.

The purpose of the present study is to examine these wage gaps using a new database, the panel of

the Social Protection Survey (EPS) 2002-2006, which makes it possible to control for men’s and women’s actual work experience and its timing (how recently work experience was acquired). Earlier studies did not have this information and the only control was a potential work experience measure whose variables did not reflect women’s intermittent and discontinuous participation in the Chilean labour force. Corrections are also introduced for non-participation and occupational selection and two key variables are instrumented: education and work experience. With the exception of Bravo, Sanhueza and Urzúa (2008a), the earlier literature did not deal with this problem of endogeneity.

This paper is structured as follows. Section II presents empirical evidence on the wage gap affecting women in Chile. Section III describes the methodology applied. Section IV specifies the data and models to be estimated. Section V gives the results and interprets the estimates. Lastly, section VI offers conclusions.

II

The literature on gender wage gaps in Chile

There is a huge literature on wage gaps between men and women in Chile. The results differ depending on the model specification and databases used. Most studies employ standard measures of cumulative actual experience and potential experience. On the whole, larger gender wage gaps are reported in the higher deciles or among people with a higher level of education. Pioneering studies carried out by Paredes (1982) and Paredes and Riveros (1994) estimate the average wage gap at between 20% and 30%, depending on the controls and specification used.

More recently, there have been five new studies on gender wage gaps in Chile: Bravo, Sanhueza and Urzúa (2008a, 2008b and 2008c), Ñopo (2007), Peticarà (2007) and Peticarà and Astudillo (2008).

Bravo, Sanhueza and Urzúa (2008a) simultaneously model occupational, educational and wage segregation. Using cross-sectional data from the 2002 EPS, the authors find that there are large hourly wage gaps between men and women in Chile, but that these depend critically on the level of experience accumulated and on education. Wage gaps are not statistically significant for individuals with a low education level (incomplete secondary education), but where they do become very substantial is for those with a high level. Bravo, Sanhueza and Urzúa (2008c) examine wage gaps between men and women in three occupational categories, namely business school graduates, doctors

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¹ See SERNAM (2007) and Acosta, Peticarà and Ramos (2007).

and lawyers, using a University of Chile student database that contains detailed family histories and even a measure of self-esteem. The authors find significant wage differentials only among lawyers.

Perticar and Astudillo (2008) employ quantile regression techniques and the decomposition technique suggested by Machado and Mata (2005) to evaluate the unexplained wage gap right across the conditional wage distribution. Importantly, they introduce controls for actual work experience. The authors estimate a “characteristics” effect (wage gap attributable to differences in the characteristics of men and women) that is small and statistically non-significant until around percentile 50 (median), where it turns positive (favourable to women) and rises monotonically to reach 7% in percentile 90. The “parameter” effect is invariably negative throughout the distribution, but tends to be magnified in higher percentiles. In the upper tail of the wage distribution, women compensate for “discrimination” with better attributes. These results are consistent with the findings of Bravo, Sanhueza and Urzua (2008a), Gill and Montenegro (2002) and Montenegro (2001).

Perticar (2007) carried out a sensitivity analysis to evaluate the wage gap in Chile using the 2004 EPS and controlling for actual work experience for the first time. The author found that including actual work experience variables reduced the wage gap by about 50%, but the unexplained wage gap tended to widen when selection bias was controlled for.

The study by Nopo (2007) is perhaps one of the most innovative, as it uses matching techniques to evaluate the gender wage gap in the 1992-2003 period. This author matches up men and women by their demographic and occupational characteristics and finds clear evidence of a wage “ceiling” for women in Chile.² He also observes that the unexplained component of the wage gap is proportionally greater for individuals with high wage, university education and managerial jobs, a finding that is qualitatively similar to the one reported by Gill and Montenegro (2002) and Montenegro (2001).

Lastly, there are the studies by Montenegro (2001) and Gill and Montenegro (2002), who use the National Socio-economic Survey (CASEN) and quantile regression techniques to decompose the gender wage gap into an explained component (differences in attributes between men and women) and an unexplained component (the usual measure of discrimination) or coefficients effect. These authors find systematic differences in returns to education and experience by gender throughout the conditional wage distribution. The unexplained gap (discrimination) rises from 10% to 40% as we approach the highest percentiles of the conditional income distribution.

² There is said to be a “ceiling” or “glass ceiling” when the unexplained component of the pay gap is proportionally greater in the upper income deciles.

III

Methodological considerations

Many methodological approaches have been used in different studies to evaluate gender wage gaps. Recent reviews of the literature include Gunderson (2006), Altonji and Blank (1999), Blau (1998) and Blau and Kahn (2000).

One of the most popular procedures in the literature on gender wage gaps is to estimate a linear model that uses some measure of earnings (monthly or hourly wage) as a dependent variable and an array of controls plus a dummy capturing the individual’s gender as regressors. The coefficient of this dummy is then interpreted as the wage gap between men and women. Another approach sets out to evaluate the

wage gap using the classic decomposition of Oaxaca (1973) and Blinder (1973), subsequently generalized by Oaxaca and Ransom (1994) and Neumark (1988).

The present study opts to use the traditional approach and estimate the model³

$$\ln W_{it} = \alpha + X_{it}\beta + \gamma G_i + \mu_i + u_{it} \quad (1)$$

where $\ln W_{it}$ is the logarithm of the wage for individual i in period t ; the explanatory variables used are a set

³ Perticar and Bueno (2008) use both approaches and compare the results obtained.

of regressors that include regional controls, such as whether the individual is working with or without an employment contract, education, work experience, marital status and company size. The G_i variable is a dichotomous or dummy variable indicating gender and takes the value 1 if the individual is a woman. Lastly, the error term is composed of an individual effect μ_i and an idiosyncratic error term μ_{it} .

The G_i coefficient is interpreted as the wage gap between men and women; if this coefficient is negative and statistically different from zero, the interpretation is that women are paid less on average than men.

Note that the random effects and fixed effects approach could be used for this model. The random effects model can be estimated only under the assumption that there is no correlation between the individual effect μ_i and the explanatory variables of the model. If, however, the individual effect is correlated with some variable in X (such as education or work experience, for example), the random effects estimator will be inconsistent. Conversely, the fixed effects method does not allow the gender wage gap coefficient to be estimated, since the G_i variable—which is invariant in time—is absorbed if this method is applied.

It is important to stress that the database used in this study allows the problems of endogeneity and modelling of individual effects to be addressed simultaneously, while also providing us with good measures of actual work experience, which are so hard to come by in Chilean databases.

1. Potential experience versus actual work experience

With the exception of those by Bravo, Sanhueza and Urzúa (2008a and 2008b), studies of gender wage gaps in Chile have used measures of potential work experience. Potential experience is estimated by subtracting years of education and the age of entry into the school system (six in Chile) from the person's current age. Comparing men and women by "potential experience" is not accurate because women tend to have intermittent working careers, usually as a result of having and caring for children. In other words, it may be the case that there are wage differences in favour of men because men and women with the same potential experience differ in actual experience (specifically, women average less actual experience than men). Consequently, the wage gap could be explained by differentials in actual experience rather than by discrimination.

In view of the above and for the purposes of the analysis of wage gaps in this study, employment history variables and labour intermittency variables were constructed in accordance with the idea developed by Light and Ureta (1995), who developed variables reflecting not just the number of years worked over an individual's career, but also the timing of that work experience. Those authors set out to generate variables for quantity and months worked during each of the years comprising an individual's employment history. The purpose of this type of specification is to highlight the fact that women's employment histories are far more chequered than men's and that accordingly it is not enough to model wages as a function of continuous work experience variables; other dimensions such as the timing of spells of employment need to be measured too. As Stanley and Jarrell (1998), Weichselbaumer and Winter-Ebmer (2005) and Gunderson (2006) point out, studies reporting large wage gaps between men and women do not usually control properly for work experience or do not include a control for selection. Given the availability of information in the database that will be used, and to establish a comparison between this methodology and earlier studies in which potential work experience is included as a measure, two sets of models will be estimated, one using the measures of actual work experience, permitting the construction of variables that reflect the continuity of men's and women's work experience, and one using the potential work experience measure.

2. Endogeneity and sample selection

In the wage model described earlier, there is a problem of endogeneity with two of the regressors, education and work experience. In particular, education may be correlated with an (unobservable) skills component; if this skills effect is positively correlated with education and with wages as well, the effect of the education variable will be overestimated. Furthermore, the work experience variable may be correlated with the individual effect, as individuals who are more "skilled" or better equipped to prosper in the labour market will tend in turn to have higher wages and more work experience.

If a correlation is suspected between the individual effect and explanatory variables, the random effects estimator will not be consistent. The fixed effects estimator cannot be obtained, since the gender effect will be diluted along with the fixed

effect and we will not be able to evaluate the gender wage differential.

To solve this problem of endogeneity, the model used is that of Hausman and Taylor (1981), which seeks to estimate the model coefficients using an instrumental variables estimator. In particular, model (1) can be described as follows:

$$Y_{it} = X_{it}\beta + Z_i\gamma + \mu_i + u_{it} \quad (2)$$

where the X variables vary over time, whereas the Z variables (including the individual's gender) are invariant over time. The individual effect may be correlated with some of the variables in X or in Z . In each set of variables there are exogenous variables (X_1, Z_1) and endogenous variables (X_2, Z_2). In particular, Hausman and Taylor propose using the following set of variables as instruments: $A = [QX_1 \ QX_2 \ PX_1 \ Z_1]$. The QX variables are the X variables expressed as deviations from their mean, while the PX variables are the X_1 variables expressed as averages. Thus, variables that are exogenous and variant over time can be used twice over as instruments. Variables that are exogenous and invariant over time (Z_1 in our particular case of the individual's gender) are used as instruments of themselves. The order condition for identification is that the number of variables in X_1 must be as large as the number of variables in Z_2 . For the Hausman and Taylor estimator to be more efficient than the fixed effects estimator, the number of exogenous variables that are variant over time must be larger than the number of endogenous variables that are invariant over time.

Once the problem with the endogeneity of the education and work experience variables has been solved, we find that there are two further problems when it comes to estimating a wage equation and comparing wages by gender. The first problem is the well-known one of selection bias, since only the wages of individuals in work are observed. The second concerns men and women who do not exogenously choose the occupations they work in, so that even when the average wage differential between men and women remains positive, this may be related to self-selection decisions by women.

Akin to the correction for selection bias used by Heckman (1979) is the idea developed by Lee (1998), who suggests a multinomial logit model estimated to predict the likelihood of occupational allocation. The occupational model is given by:

$$I_{ij}^* = Z_{ij}Y_{ij} + V_{ij} \quad (j = 1, 2, 3, 4, 5) \quad (3)$$

where I is the (unobserved) latent variable and Z is a vector of variables (personal characteristics of individuals and their families) which determines the likelihood of an individual working in each of the occupations, while subscript i is the individual and j the six occupational categories used in this model (professional and managerial workers, professional technical workers, clerks, sales assistants, skilled workers in agriculture and industry and unskilled workers). The I variable can take the values 1 to 6. The individual picks the alternative that maximizes his or her utility $P(y_i = j) = P_{ij} = \text{prob}(I_{ij}^* > I_{ik}^*)$ whenever $i \neq k$.

A selectivity term for each observation (λ_{ij}) is constructed on the basis of this model and then introduced as an independent variable for the regression. For the purposes of this study, the regressions have been estimated separately for each occupation (j) and the coefficient of the gender variable in each occupation will thus reflect the wage gap between men and women after controlling for the existence of occupational self-selection.

The specific occupation equation (for $j = 1, 2, \dots, J$) will be given by:

$$\ln W_{it} = \alpha + X_{it}\beta + \gamma G_i + \lambda_{ij}\theta_j + \mu_i + u_{it} \quad (4)$$

where once again $\ln W_{it}$ is the wage logarithm for individual i in period t ; the X_{it} matrix includes regional controls, employment characteristics, education variables, work experience and marital status, among other things. The G_i variable refers to the individual's gender and the λ_{ij} variable is the selection coefficient or Mills ratio constructed from the model estimate given in (3).

IV

Data and models to be estimated

The data used in this study come from the Social Protection Survey (EPS), whose purpose is to gather information on the labour market and the Chilean social protection system. It is a longitudinal survey that has so far been applied in three rounds, 2002, 2004 and 2006. The fourth round will not be held until December 2009.

The EPS includes information on about 17,000 individuals, of whom 50% are women. It records general information about respondents and information on their work history, family income, assets, social protection, health, training and personal history, among other aspects.

The self-reported work histories in the EPS contain fairly detailed (self-reported) information about respondents' periods of activity (employment and unemployment) and inactivity. This report can be used to reconstruct the work histories of men and women whose reported employment between January 2002 and the latest survey registers information about wages. Self-reported employment histories go back only to the beginning of 1980. For this reason, all the estimates are presented for men and women who were under 50 in 2006. This decision is justified by the consideration that respondents over 50 (in 2006) were aged over 24 in 1980, the assumption accordingly being that their work histories are underreported.⁴

The final sample contains information on 26,655 employment events for 10,068 individuals, 27% of observations being from 2002, 37% from 2004 and 35% from 2006.

The data in tables 1 and 2 give a better idea of how far the accumulation of actual experience differs between men and women. These tables present empirical distributions of the portion of time worked during the last five and 10 years, for men and women respectively, by education level and age band. If we

observe women aged 40 to 49 with less than 12 years of formal schooling, only 16.3% have worked more than 90% of the time in the past five years, while just 13.3% have worked more than 90% of the time in the past 10 years. Some 72.7% have worked less than 10% of the time in the past five or 10 years.

It would seem that continuous employment is far from being the norm among women with a low education level. More educated women present more continuous patterns of employment: 66.1% (58.7%) of women with 16 years of education or more have worked over 90% of the time in the past five or 10 years. The employment patterns of educated women still fall well short of the norm for men, however. In the group aged 40-49 with 16 years of education or more, some 85% of men have worked for more than 90% of the time in the past five or 10 years.

There is clear evidence for the need to introduce proper controls into the wage equation if men's and women's wages are to be compared. Specifically, the models presented in the following section will control not only for actual work experience, but also for the timing of that experience.

Table 3 shows the averages and standard deviations of the main variables used in this study, for men and women. As can be seen, men and women differ substantially in their levels of actual work experience. We find that men earn a significantly higher average hourly wage: \$6,019, as compared to \$5,277 for women, with a standard deviation of \$17,781 for men and \$9,487 for women. Regarding the average education of parents, we do not find any significant difference for men or women.

Three sets of results are presented. First, model (1) is estimated as a random effects model, ignoring the fact that the education and work experience variables could be correlated with the error term. Three versions of this estimation are presented, with potential experience, with actual experience, and with variables reflecting the timing of work experience. Three continuous variables are constructed: months worked in the past five years, months worked in the past 10 years and months worked in the past 15 years. Thus, the coefficient of the months worked in the past five years variable and the coefficient of the months worked in the past 10 years variable indicate the additional returns from months worked

⁴ Given that work histories are self-reported, it is reasonable to think that events from further back will be reported less reliably, and this reporting error could be greater among older individuals (40-49). Nonetheless, there are two reasons for ignoring this problem in the present study. The first is that we are instrumenting both the education and the work experience variables (which potentially present measurement errors), and the second is that we tried out specifications with even younger samples of women, taking under-40s only, for example. Sample sizes are substantially reduced when this is done and some standard errors are magnified, but the results are qualitatively similar.

TABLE 1

**Continuity in the employment histories of men and women,
by age band and education level, as of 2006**

Gender and years of education	Time worked over the last five years (Percentages)				
	Over 10%	Over 30%	Over 50%	Over 70%	Over 90%
Male					
0-11 years educ.					
20-29	91.7	69.5	56.6	41.7	16.5
30-39	95.1	90.9	84.3	72.7	48.1
40-49	96.7	91.6	84.2	70.3	47.5
12 years educ.					
20-29	93.1	62.9	48.9	33.1	13.1
30-39	97.7	94.7	90.2	82.3	59.5
40-49	99.0	98.5	94.4	88.1	66.7
12-15 years educ.					
20-29	70.3	40.7	28.4	21.3	9.4
30-39	98.9	96.3	89.8	81.7	61.6
40-49	99.3	98.5	93.5	87.7	72.8
16 years educ.					
20-29	66.2	24.9	13.7	9.2	5.7
30-39	92.3	83.4	78.6	69.8	52.8
40-49	99.0	97.3	95.2	92.4	84.0
Female					
0-11 years educ.					
20-29	61.9	39.1	19.6	10.8	3.3
30-39	75.4	50.0	35.0	24.6	12.9
40-49	72.7	52.6	40.6	28.3	16.3
12 years educ.					
20-29	81.5	44.0	28.6	15.8	6.9
30-39	78.4	58.2	45.2	33.5	22.5
40-49	81.1	62.7	49.9	38.4	26.1
12-15 years educ.					
20-29	79.5	41.3	31.9	16.2	5.0
30-39	86.4	76.4	65.5	53.8	36.1
40-49	85.9	73.6	63.5	55.4	43.0
16 years educ.					
20-29	54.1	20.6	10.5	5.5	2.0
30-39	89.5	71.0	64.5	57.4	44.6
40-49	95.0	88.3	83.7	74.7	66.1

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

in more recent years. In the second set of estimates, the Hausman and Taylor method is used to correct for endogeneity in education and work experience. Once again, three versions are estimated with different measures of work experience. None of these models includes correction for occupational selection.

In the third place, the observations are grouped into six occupations (professional and managerial workers, professional technical workers, clerks, sales assistants, skilled manual workers and unskilled workers) and we estimate occupation-specific wage models that correct for sample selection.

TABLE 2

**Continuity in the employment histories of men and women,
by age band and education level, as of 2006**

Gender and years of education	Time worked over the last 10 years (Percentages)				
	Over 10%	Over 30%	Over 50%	Over 70%	Over 90%
Male					
0-11 years educ.					
20-29	90.1	62.3	44.2	21.6	3.8
30-39	95.5	92.8	88.3	76.9	44.6
40-49	96.6	91.9	87.7	80.4	48.5
12 years educ.					
20-29	89.9	70.2	51.5	38.1	31.5
30-39	97.9	94.4	90.5	83.6	53.9
40-49	99.1	98.8	96.6	91.8	67.8
12-15 years educ.					
20-29	66.2	27.2	11.7	4.4	0.7
30-39	99.2	95.6	88.2	74.9	47.7
40-49	99.3	95.3	94.4	89.1	71.3
16 years educ.					
20-29	56.5	10.9	6.2	3.0	0.3
30-39	94.0	79.3	68.9	51.0	29.0
40-49	99.6	98.4	96.8	95.2	85.2
Female					
0-11 years educ.					
20-29	64.4	28.4	12.4	3.5	0.7
30-39	79.2	49.4	36.4	22.6	9.2
40-49	73.3	51.7	39.2	26.1	13.3
12 years educ.					
20-29	73.1	54.5	42.0	34.8	31.1
30-39	83.8	59.3	48.7	31.2	15.9
40-49	83.7	58.6	47.5	33.5	20.9
12-15 years educ.					
20-29	67.	27.0	7.9	3.6	0.8
30-39	93.1	79.6	62.6	49.1	29.8
40-49	88.6	74.3	68.2	58.6	38.1
16 years educ.					
20-29	49.4	7.2	4.0	1.8	0.6
30-39	90.9	70.2	59.6	45.7	26.4
40-49	96.0	87.6	82.0	72.4	58.7

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

TABLE 3

Averages and standard deviations of the main variables for men and women

	Men		Women	
	Average	Standard deviation	Average	Standard deviation
North	0.13	0.33	0.11	0.31
South	0.49	0.50	0.45	0.50
Small firm	0.53	0.50	0.56	0.50
Medium-sized firm	0.15	0.36	0.12	0.32
Large firm	0.25	0.44	0.27	0.44
Married	0.73	0.44	0.50	0.50
Separated	0.07	0.25	0.17	0.37
Years of education	10.3	3.5	11.7	3.5
Employment contract	0.65	0.48	0.68	0.47
Actual experience	18.8	6.2	15.1	6.7
Potential experience	23.5	9.3	21.4	9.1
Mother can read	0.84	0.36	0.90	0.30
Father can read	0.87	0.33	0.92	0.28
Mother without education	0.20	0.40	0.14	0.35
Mother with basic education	0.49	0.50	0.52	0.50
Mother with secondary education	0.28	0.45	0.31	0.46
Mother with higher education	0.03	0.18	0.03	0.18
Father without education	0.20	0.40	0.18	0.38
Father with basic education	0.43	0.50	0.43	0.50
Father with secondary education	0.31	0.46	0.33	0.47
Father with higher education	0.06	0.23	0.06	0.24
Monthly wage (pesos)	294 847	747 040	215 895	368 050
Hourly wage (pesos)	6 021	17 819	5 293	9 527
2002	0.25	0.43	0.25	0.43
2003	0.04	0.20	0.04	0.20
2004	0.19	0.39	0.19	0.39
2005	0.18	0.38	0.18	0.39
2006	0.20	0.40	0.21	0.41
2007	0.13	0.34	0.13	0.33
Months worked over last 5 years	56.0	8.5	51.6	14.1
Months worked over last 10 years	110.2	18.8	97.6	29.8
Months worked over last 15 years	158.7	34.6	135.2	47.5

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

V

Results

The estimates are arrived at using the sample of individuals aged 18 to 49. Monthly wages and hourly wages in the main occupation are taken in all cases. Hourly wages are estimated by dividing the monthly wage by the number of hours worked a month, as self-reported by the individual. Wages are deflated by the consumer price index (IPC) for the month the

wage is reported.⁵ Annual dummies are added in all the regressions to control for real wage growth, and these same dummies interacted by gender are

⁵ If the job was ongoing at the time of interview, the month and year of the interview are taken. If the job had ended, the month and year it ended are taken.

added so that the behaviour of the wage gap can be observed over time.

To begin with, we shall see the results obtained from the estimates with each of the work experience measures (potential experience, actual experience and alternative experience), without correcting for selection bias.

For the measure of alternative experience in particular, three continuous variables are constructed: months worked in the past five years, months worked in the past 10 years and months worked in the past 15 years. Thus, a positive coefficient for the months worked in the past five years variable is an indication that months of more recent work experience are better rewarded in the labour market.

In all the specifications attempted, the wage gap between men and women is clearly negative. In other words, women are paid less than men. The largest gaps are obtained with the model where only potential experience is controlled for, which gives a

monthly wage gap of about 32%,⁶ while the hourly wage gap is distinctly smaller at about 21% (see tables 4, 5 and 6).

In the second set of estimates presented, the Hausman and Taylor method is used to correct for endogeneity in education and work experience. Once again, three versions are given with different measures of work experience.

The smallest wage gap is obtained in the Hausman and Taylor models (see tables 7 and 8), when the wage gap found is in the order of 12% for hourly wages and 19% for monthly wages.

Three results deserve particular attention. First, there is a strong upward trend in real wages, which saw

⁶ It should be noted that the coefficient of the dummy is $\hat{\beta}_1 = -0.381$. The pay differential between men and women is calculated using the expression $100[\exp(\hat{\beta}_1) - 1]$. Replacement with the value of $\hat{\beta}_1$ gives a gap of about 32% to the detriment of women.

TABLE 4

Model I, potential experience, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.381	***	0.0134	-0.238	***	0.013
North	-0.063	***	0.0165	-0.073	***	0.016
South	-0.183	***	0.0108	-0.166	***	0.010
Married	0.074	***	0.0100	0.077	***	0.010
Separated	0.069	***	0.0156	0.058	***	0.016
Years of education	0.038	***	0.0050	0.011	***	0.005
Years of education2	0.002	***	0.0002	0.004	***	0.000
Potential experience	0.026	***	0.0016	0.020	***	0.002
Potential experience2	0.000	***	0.0000	0.000	***	0.000
Employment contract	0.218	***	0.0076	0.116	***	0.008
2003 dummy	0.066	***	0.0095	0.061	***	0.010
2004 dummy	0.099	***	0.0098	0.121	***	0.010
2005 dummy	0.110	***	0.0100	0.164	***	0.011
2006 dummy	0.178	***	0.0118	0.223	***	0.013
2003*female dummy	0.012		0.0151	0.007		0.016
2004*female dummy	0.006		0.0156	0.007		0.017
2005*female dummy	-0.003		0.0154	-0.005		0.016
2006*female dummy	0.009		0.0189	-0.004		0.020
Constant	10.895	***	0.0516	7.312	***	0.061
Number of observations		26 655			26 655	
R ²		0.3614			0.3516	
χ^2 test		7 481.65			7 335.09	
P value χ^2 test		0.000			0.000	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 5

Model I, actual experience, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.307	***	0.014	-0.187	***	0.013
North	-0.055	***	0.016	-0.067	***	0.016
South	-0.170	***	0.011	-0.155	***	0.010
Married	0.067	***	0.010	0.078	***	0.010
Separated	0.066	***	0.015	0.062	***	0.016
Years of education	0.028	***	0.005	0.000		0.005
Years of education ²	0.002	***	0.000	0.004	***	0.000
Actual experience	0.046	***	0.002	0.033	***	0.002
Actual experience ²	-0.001	***	0.000	-0.001	***	0.000
Employment contract	0.208	***	0.008	0.107	***	0.008
2003 dummy	0.064	***	0.009	0.064	***	0.010
2004 dummy	0.092	***	0.010	0.121	***	0.010
2005 dummy	0.101	***	0.010	0.166	***	0.011
2006 dummy	0.169	***	0.012	0.224	***	0.013
2003*female dummy	0.003		0.015	-0.001		0.016
2004*female dummy	-0.003		0.016	-0.001		0.017
2005*female dummy	-0.014		0.016	-0.014		0.017
2006*female dummy	-0.013		0.019	-0.022		0.020
Constant	10.933	***	0.048	7.384	***	0.058
Number of observations		26 655			26 655	
R ²		0.3713			0.3545	
χ^2 test		7 907.06			7 459.46	
P value χ^2 test		0.000			0.000	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 6

Model I, alternative experience, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.283	***	0.014	-0.170	***	0.013
North	-0.056	***	0.016	-0.067	***	0.016
South	-0.168	***	0.011	-0.154	***	0.010
Married	0.070	***	0.010	0.080	***	0.010
Separated	0.070	***	0.015	0.065	***	0.015
Years of education	0.023	***	0.005	-0.003		0.005
Years of education ²	0.002	***	0.000	0.004	***	0.000
Actual experience	-0.011	***	0.005	-0.007		0.005
Actual experience ²	0.000	***	0.000	0.000		0.000
Months worked last 5 years	0.003	***	0.000	0.002	***	0.000
Months worked last 10 years	0.002	***	0.000	0.001	***	0.000
Months worked last 15 years	0.001	***	0.000	0.001	***	0.000
Employment contract	0.202	***	0.008	0.101	***	0.008
2003 dummy	0.068	***	0.009	0.068	***	0.010
2004 dummy	0.097	***	0.010	0.124	***	0.010
2005 dummy	0.107	***	0.010	0.170	***	0.011
2006 dummy	0.169	***	0.012	0.225	***	0.013
2003*female dummy	0.007		0.015	0.002		0.016
2004*female dummy	-0.004		0.016	-0.002		0.016
2005*female dummy	-0.011		0.015	-0.011		0.017
2006*female dummy	-0.007		0.019	-0.017		0.020
Constant	10.934	***	0.048	7.376	***	0.058
Number of observations		26 655			26 655	
R ²		0.3813			0.3596	
χ^2 test		8 323.10			7 665.08	
P value χ^2 test		0.000			0.000	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 7

Hausman and Taylor model, correcting for endogeneity in actual experience and years of education, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.273	***	0.019	-0.187	***	0.018
South	-0.164	***	0.013	-0.155	***	0.013
Married	0.024	***	0.012	0.059	***	0.013
Separated	0.038	***	0.017	0.060	***	0.018
Years of education	0.032	***	0.005	0.013	***	0.005
Years of education ²	0.001	***	0.000	0.003	***	0.000
Employment contract	0.187	***	0.007	0.095	***	0.008
2003 dummy	0.066	***	0.010	0.082	***	0.010
2004 dummy	0.093	***	0.010	0.138	***	0.011
2005 dummy	0.107	***	0.013	0.199	***	0.013
2006 dummy	0.163	***	0.015	0.254	***	0.016
2003*female dummy	-0.005		0.014	-0.012		0.015
2004*female dummy	-0.016		0.015	-0.017		0.016
2005*female dummy	-0.028	*	0.015	-0.033	***	0.016
2006*female dummy	-0.029		0.018	-0.047	***	0.019
Actual experience	0.057	***	0.004	0.038	***	0.004
Actual experience ²	-0.001	***	0.000	-0.001	***	0.000
Constant	10.988	***	0.062	7.383	***	0.072
Number of observations		26 535			26 092	
χ^2 test		4 822.83			4 716.23	
P value χ^2 test		0.00			0.00	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 8

Model III, Hausman and Taylor model, correcting for endogeneity in actual experience, alternative experience and years of education, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.207	***	0.019	-0.127	***	0.019
South	-0.191	***	0.013	-0.187	***	0.013
Married	-0.008		0.012	0.024	*	0.013
Separated	0.002		0.017	0.020		0.018
Employment contract	0.198	***	0.008	0.108	***	0.008
2003 dummy	0.049	***	0.010	0.067	***	0.010
2004 dummy	0.074	***	0.011	0.122	***	0.011
2005 dummy	0.078	***	0.013	0.178	***	0.014
2006 dummy	0.137	***	0.015	0.239	***	0.016
2003*female dummy	-0.007		0.014	-0.015		0.015
2004*female dummy	-0.019		0.015	-0.022		0.016
2005*female dummy	-0.028	*	0.015	-0.035	***	0.016
2006*female dummy	-0.031	*	0.018	-0.050	***	0.020
Actual experience	0.064	***	0.004	0.044	***	0.004
Actual experience ²	-0.001	***	0.000	-0.001	***	0.000
Years of education	0.019	***	0.006	0.014	***	0.007
Years of education ²	0.000		0.000	0.001	***	0.000
Constant	11.223	***	0.066	7.625	***	0.077
Number of observations		26 535			26 092	
χ^2 test		3 361.25			2 583.83	
P value χ^2 test		0.00			0.00	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 9

Model III, estimation by instrumental variables (Hausman and Taylor method); endogenous variables: actual experience, alternative experience and years of education, monthly and hourly wage model
(Natural logarithms)

Gender	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Female	-0.208	***	0.019	-0.126	***	0.019
South	-0.190	***	0.013	-0.185	***	0.013
Married	-0.001		0.012	0.031	***	0.013
Separated	0.010		0.018	0.028		0.018
Employment contract	0.196	***	0.008	0.105	***	0.008
2003 dummy	0.056	***	0.010	0.072	***	0.010
2004 dummy	0.082	***	0.011	0.128	***	0.011
2005 dummy	0.090	***	0.013	0.185	***	0.014
2006 dummy	0.149	***	0.015	0.247	***	0.016
2003*female dummy	-0.006		0.014	-0.014		0.015
2004*female dummy	-0.019		0.015	-0.022		0.016
2005*female dummy	-0.028	*	0.015	-0.035	***	0.016
2006*female dummy	-0.029		0.018	-0.049	***	0.020
Actual experience	0.032	***	0.010	0.018	*	0.011
Actual experience ²	-0.001	***	0.000	-0.001	***	0.000
Months worked last 5 years	0.002	***	0.000	0.001	***	0.001
Months worked last 10 years	0.001	***	0.000	0.001	***	0.001
Months worked last 15 years	0.000		0.000	0.000		0.001
Years of education	0.018	***	0.006	0.013	*	0.007
Years of education ²	0.000		0.000	0.001	***	0.000
Constant	11.238	***	0.066	7.631	***	0.078
Number of observations		26 535			26 092	
χ^2 test		3 446.14			2 622.75	
P value χ^2 test		0.00			0.00	

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

* Statistically significant at 10%.

*** Statistically significant at 1%.

considerable growth in the 2002-2006 period. The wage gap between men and women, however, has tended to widen; on the whole, this gap is found to be greatest in 2005 and 2006, rising from about 12% to 16% (hourly wage, see table 9). This reveals that real wage growth was not uniform for men and women.

Second, the introduction of variables to control not only for the number of years of work experience but also for the timing of that experience reveals that the returns on years of recent work experience are higher. Analysis of the table 9 results in particular shows that the returns on recent years of work experience are twice as great as the normal rate of return.

Third, the results of the different estimation methods reveal the importance of taking account of the potential endogeneity of the education and work experience variables, which are evaluated using a Hausman test. The null hypothesis of these exogenous variables is rejected in all cases. If the work experience and education variables are instrumented,

there is a tendency to underestimate the effect of work experience and overestimate the effect of education on wages (see figure 1).

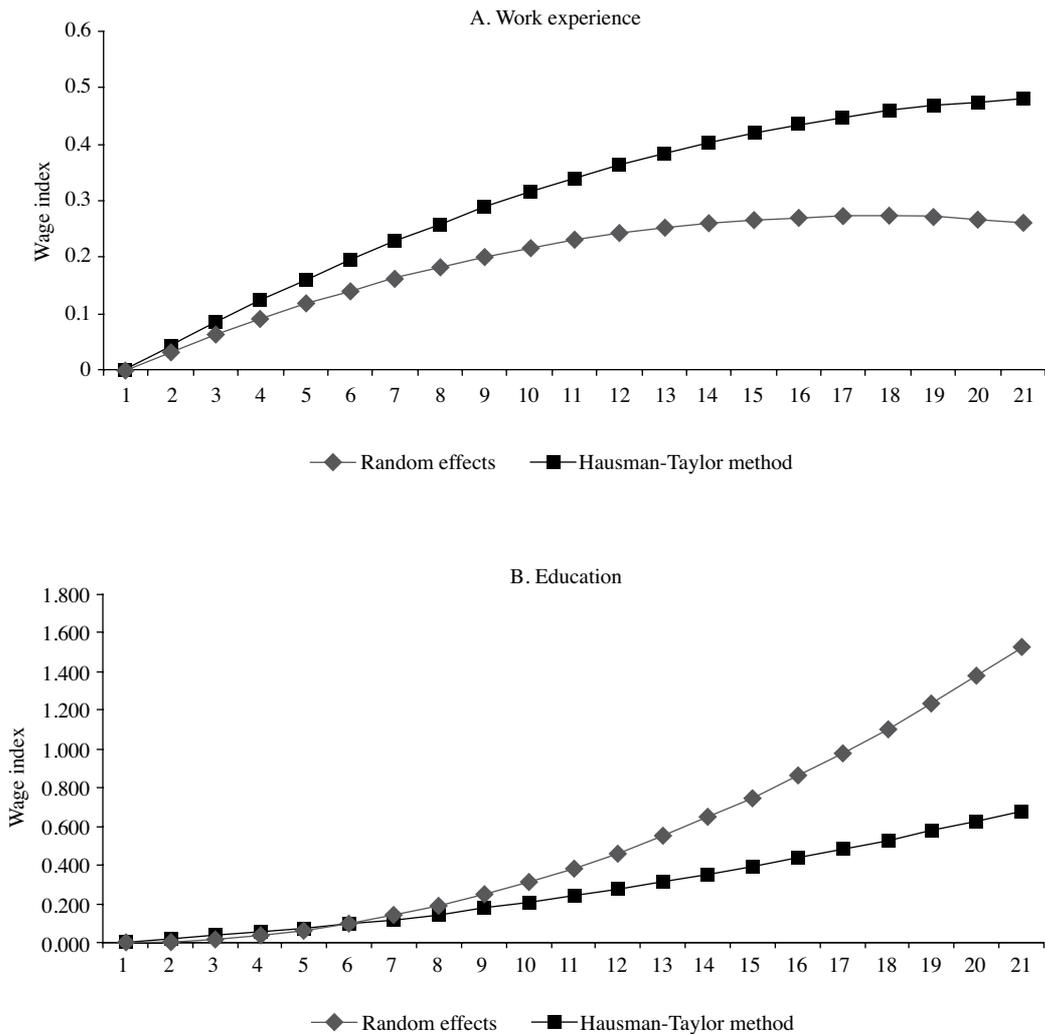
Fourth, specific models which also correct for sample selection are presented for each occupational group. Table 8 summarizes the coefficients found for the female variable in these estimates.⁷ Once again, the wage gap remains unfavourable to women in all the specifications. Intra-occupation analysis reveals important differences, however.

— The smallest hourly wage gaps are found among professional technical workers and clerks (10% and 6%, respectively). The largest gaps are found

⁷ In the estimates prepared with the Hausman and Taylor methodology, only the coefficient of the female variable is presented. As with previous models, controlling for actual experience considerably reduces the component potentially attributable to "discrimination". These estimates can be consulted in Perticarà and Bueno, 2008.

FIGURE 1

The effects of education and work experience in alternative models: random effects model versus Hausman-Taylor estimation



Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

among sales assistants (23%) and agricultural workers and skilled workers (17%). The wage gap between male and female professionals, while negative and large (33%), is not statistically significant, as the sample sizes in this group are smaller. The wage gap for unskilled workers is approximately 13%.

— In some specifications, the coefficient of the Mills ratio is not statistically different from zero, except in the following specifications: professionals,

hourly wage, sales assistants and unskilled workers. There is no evidence of occupational bias in these groups (see table 10).

— The gap for sales assistants and skilled manual workers is not only large but tends to widen over the period considered. While this gap stands at around 26% and 16% in the base year, in 2006 it is around 30% for both groups. The wage gap for unskilled workers almost doubles to about 22% in 2006 (see table 11).

TABLE 10

Hausman and Taylor model. Coefficients of the female variable in occupation-specific wage regressions, controlling for occupational bias, monthly and hourly wage model
(Natural logarithms)

	Monthly wage			Hourly wage		
	Coefficient	Statistical significance	Standard error	Coefficient	Statistical significance	Standard error
Professional and managerial workers	-0.140		0.186	-0.333		0.212
Intermediate-level professional technical workers	-0.223	***	0.041	-0.105	***	0.042
Clerks	-0.146	***	0.039	-0.067	*	0.039
Sales assistants	-0.303	***	0.042	-0.261	***	0.042
Skilled manual and agricultural workers	-0.271	***	0.041	-0.188	***	0.042
Unskilled workers	-0.264	***	0.038	-0.146	***	0.038

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

N.B.: The coefficients of the Mills ratios are all statistically significant at 1%, except in the following specifications: professionals, hourly wage; sales assistants, hourly and monthly wage; unskilled workers (see explanation in text on page _____). In all cases, the χ^2 tests present high values, leading to rejection of the null hypothesis that all the coefficients are zero.

* Statistically significant at 10%.

*** Statistically significant at 1%.

TABLE 11

Evolution of occupation-specific wage gaps, selected occupations, 2002 and 2006
(Percentages)

	Monthly		Hourly	
	2002 gap	2006 gap	2002 gap	2006 gap
Sales assistants	-26.1	-32.6	-23.0	-30.0
Skilled manual workers	-23.7	-31.9	-17.2	-27.6
Unskilled manual workers	-23.2	-28.5	-13.6	-22.3

Source: prepared by the authors on the basis of the Social Protection Survey (EPS) 2002-2006.

N.B.: The gap is estimated as $100 \left[\exp(\hat{\beta}_1) - 1 \right]$, where β is the coefficient of the female variable in the occupation-specific regression.

VI

Conclusions

The purpose of this paper has been to study wage gaps using a new database in Chile: the data panel of the Social Protection Survey (EPS) 2002-2006, which makes it possible to control for men's and women's actual work experience and its timing. Earlier studies did not have this information and only controlled with a measure of potential work experience; however, such a measure does not reflect women's pattern of

intermittent and discontinuous participation in the Chilean labour market. Corrections have also been introduced for non-participation and occupational selection, and two key variables have been instrumented: education and work experience.

This study provides a detailed sensitivity analysis. It observes that the wage gap between men and women is clearly negative in all the specifications tried out

(base model, instrumental variables, controlling for selection). In other words, women are paid less than men. The largest gaps are obtained in the model where only potential experience is controlled for.

Among the main conclusions are the following. First, the data show a large rise in real wages in the 2002-2006 period. Second, it is the most recent years of work experience that present the highest rate of return. Third, the different specifications tried out force us to recognize the enormous importance of controlling for the potential endogeneity of the work experience and education variables. When instrumenting education and experience, we observe that if ordinary least squares (OLS) estimates or a panel data estimate fail to take this endogeneity into account, they tend to overestimate the effect of education (assign too much value to it) and underestimate the effect of work experience.

This study evaluates occupation-specific gaps and even introduces corrections for occupational self-selection, using the methodology proposed by Lee (1998). Even after cleaning up the endogeneity estimates and introducing the control for selection, the occupation-specific gaps are greatest for specialized workers and sales assistants (26% and 16%, respectively) and lowest among professional technical workers and clerks (10% and 6%, respectively). The wage gap for unskilled workers is 13%. Furthermore, the gap is not only large for sales assistants and skilled manual workers, but tended to widen over the period considered, from 26% and 16% in the base year to 30% in 2006 for both groups. The wage gap in the unskilled group almost doubled to some 22% in 2006.

(Original: Spanish)

Bibliography

- Acosta, E., M. Peticar and C. Ramos (2007), "Oferta laboral femenina y cuidado infantil", *Desafos al desarrollo de Chile: elementos para el dilogo de polticas*, Washington, D.C., Inter-American Development Bank.
- Altonji, J. and R. Blank (1999), "Race and gender in the labor market", *Handbook of Labor Economics*, O. Ashenfelter, R. Layard and D. Card (eds.), Amsterdam, Elsevier.
- Blau, F.D. (1998), "Trends in the well-being of American women, 1970-1995", *Journal of Economic Literature*, vol. 36, No. 1, Nashville, Tennessee, American Economic Association.
- Blau, F.D. and L. Kahn (2000), "Gender differences in pay", *Journal of Economic Perspectives*, vol. 14, No. 4, Nashville, Tennessee, American Economic Association.
- Blinder, A. (1973), "Wage discrimination: reduced form and structural estimates", *Journal of Human Resources*, vol. 8, No. 4, Madison, University of Wisconsin Press.
- Bravo, D., C. Sanhueza and S. Urza (2008a), "Ability, schooling choices and gender labor market discrimination: evidence for Chile", *Research Network Working Paper*, No. R-558, Washington, D.C., Inter-American Development Bank.
- _____ (2008b), "An experimental study about labor market discrimination: gender, social and neighborhood", *Research Network Working Paper*, No. R-541, Washington, D.C., Inter-American Development Bank.
- _____ (2008c), "Is there labor discrimination among professionals in Chile? Lawyers, doctors and business-people", *Research Network Working Paper*, No. R-545, Washington, D.C., Inter-American Development Bank.
- Gill, I. (1992), "Is there sex discrimination in Chile? Evidence from the CASEN survey", *Case Studies on Women's Employment and Pay in Latin America*, G. Psacharopoulos and Z. Tzannatos (eds.), Washington, D.C., World Bank.
- Gill, I. and C. Montenegro (2002), "Responding to earning differentials in Chile", *Crafting Labor Policy: Techniques and Lessons from Latin America*, I. Gill, C. Montenegro and D. Dormeland (eds.), Washington, D.C., World Bank.
- Gunderson, M. (2006), "Viewpoint: male-female wage differentials: how can that be?", *Canadian Journal of Economics*, vol. 39, No. 1, Quebec, Canadian Economics Association.
- Hausman, J.A. and W.E. Taylor (1981), "Panel data and unobservable individual effects", *Econometrica*, vol. 49, No. 6, Princeton, Econometric Society.
- Heckman, J. (1979), "Detecting discrimination", *Econometrica*, vol. 47, No. 1, Princeton, Econometric Society.
- Lee, W.K.M. (1998), "Gender inequality and discrimination in Singapore", *Journal of Contemporary Asia*, vol. 28, No. 4, London, Routledge.
- Light, A. and M. Ureta (1995), "Early-career work experience and gender wage differentials", *Journal of Labor Economics*, vol. 13, No. 1, Chicago, University of Chicago Press.
- Machado, J. and J. Mata (2005), "Counterfactual decomposition of changes in wage distributions using quantile regression", *Journal of Applied Econometrics*, vol. 20, No. 4, New Jersey, John Wiley & Sons.
- Montenegro, C. (2001), "Wage distribution in Chile: does gender matter? A quantile regression approach", *Working Paper Series*, No. 20, Washington, D.C., World Bank.
- Neumark, D. (1988), "Employers discriminatory behavior and the estimation of wage discrimination", *Journal of Human Resources*, vol. 23, No. 3, Madison, University of Wisconsin Press.
- Nopo, H. (2007), "The gender wage gap in Chile 1992-2003 from a matching comparisons perspective", *IZA Discussion Papers*, No. 2698, Bonn, Institute for the Study of Labor.
- Oaxaca, R.L. (1973), "Male-female wage differentials in urban labor markets", *International Economic Review*, vol. 14, No. 3, Philadelphia, University of Pennsylvania/Osaka University.

- Oaxaca, R.L. and M.R. Ransom (1994), "On discrimination and the decomposition of wage differentials", *Journal of Econometrics*, vol. 61, No. 1, Amsterdam, Elsevier.
- Paredes, R. (1982), "Diferencias de ingreso entre hombres y mujeres en el Gran Santiago, 1969 y 1981", *Estudios de economía*, No. 18, Santiago, Chile, University of Chile.
- Paredes, R. and L. Riveros (1994), "Gender wage gaps in Chile. A long-term review: 1958-1990", *Estudios de economía*, Santiago, Chile, University of Chile.
- Perticará, M. (2007), *Brechas salariales por género en Chile: un análisis de sensibilidad*, Santiago, Chile, ILADES-Georgetown University/Universidad Alberto Hurtado.
- Perticará, M. and A. Astudillo (2008), "¿Qué tan alta puede ser la brecha de salarios en Chile? Investigando diferencias salariales entre hombres y mujeres a partir de regresiones de cuantiles", *Working Papers Economic Series*, No. I-211, Santiago, Chile, ILADES-Georgetown University/Universidad Alberto Hurtado.
- Perticará, M. and I. Bueno (2008), "Entendiendo las brechas salariales por género en Chile", *Working Papers Economic Series*, No. I-212, Santiago, Chile, ILADES-Georgetown University/Universidad Alberto Hurtado.
- SERNAM (National Women's Service) (2007), *Cómo capitalizar el potencial económico de Chile ampliando las opciones laborales de la mujer: diagnóstico de género-Chile*, Santiago, Chile, National Women's Service (SERNAM)/ World Bank/Inter-American Development Bank.
- Stanley, T.D. and S.B. Jarrell (1998), "Gender wage discrimination bias? A meta-regression analysis", *Journal of Human Resources*, vol. 33, No. 4, Madison, University of Wisconsin Press.
- Weichselbaumer, D. and R. Winter-Ebmer (2005), "A meta-analysis of the international gender wage gap", *Journal of Economic Surveys*, vol. 19, No. 3, Oxford, Blackwell Publishing.