

**The Effect of Social Security Contributions on Wages:
The Colombian Experience***

Andres J. Vargas**

January, 2007

(Preliminary do not Quote)

In this paper, I use a differences-in-differences approach to estimate what fraction of social security contributions employers pass on to workers in the form of lower wages. To do this I use the Colombian social security reform of 1993 that transformed the institutional framework for pension funds and health care provision. The reform increased social security contributions by 10 percentage points and improved the quality and quantity of the benefits. My work extends the literature by estimating how this effect varies across family structure groups that differ on their valuation of the benefits. I find that about half of the higher contributions were passed on to female formal workers as lower wages. This means that the hourly wages of female workers with access to social security benefits decrease by 5% relative to the wages of those without access to the benefits. On the other hand, I do not find a significant effect on the hourly earnings of male workers with access to social security benefits. Across family structure groups, I find that the effect is particularly important among married mothers and single head-of-household women, who experience full transfer of the higher contributions in the form of relative lower wages, whereas for married women without young children, single dependent women, and men in any family structure group the effect is not statistically significant. The patterns of how these estimated effects vary across demographic groups are consistent with the theoretical link between the magnitude of the effects and the workers' valuation of the social security benefits.

Keywords: Social security, wages, differences-in-differences, pensions, health care.

JEL Classification Codes: J31, J32, J33, J42.

The theory of compensating differentials predicts that, under full valuation of the benefits, workers who receive more generous fringe benefits are paid a lower wage than comparable workers who receive fewer fringe benefits, all else being equal. Consequently, an increase in a benefit-linked payroll tax will result in lower wages but no

* I would like to thank. Steve Trejo, Dan Hamermesh, Gerald Oettinger, Jacqueline Angel, Dan Slesnick, Adriana Kugler, Stefano Farne, and seminar participants at the University of Texas at Austin, the Second Conference on aging in the Americas, and Texas Tech University for their insightful and valuable comments. I am also grateful to Cesar Caballero and Alejandra Corchuelo, from the Colombian National Department of Statistics DANE, for providing me with the data. All remaining errors are mine.

** Andres J. Vargas. Texas Tech University; Department of Economics; Box 41014; Lubbock, TX 79409, Phone: (806) 742-2201, Fax: (806) 742-1137, E-mail: andres.vargas@ttu.edu.

change in the level of employment. In this paper, I estimate the fraction of social security contributions that is transferred to workers in the form of lower wages, and how it varies according to the workers valuation of the benefits, using as a natural experiment the Colombian social security reform of 1993.

The end of the 1980's and early 1990's was a period of deep structural transformations in Latin America. These reforms were part of efforts to liberalize economies and increase the participation of the market in the production and allocation of goods and services, and were the product of the collapse most economies experienced during the 1980's due to their mounting fiscal and monetary imbalances.¹ In Colombia the main reforms during this period included the approval of a new constitution, key reforms to the labor market, a major trade reform, and liberalization in direct foreign investment.

More than two years after these reforms were put in place Colombia implemented a social security reorganization that transformed the institutional framework for pension funds and health care provision (Law 100 of December 1993). Regarding the health care regime, the social security reform replaced the existing discretionary affiliation system that covered only the worker, by a mandatory one that features a stricter prepayment system and covers also the spouse and children, or the parents of the worker. On the subject of pensions, the reform introduced a fully funded social security system giving workers the choice between the traditional benefit defined in the existing pay-as-you-go system, and the new one of individual capitalization of public funds. The greater benefits also brought along an increase in employees and employers' pension and health care contributions, raising the payroll tax rate by over 10 percentage points.

¹ Heckman and Pages (2004).

There is a large amount of work on the effects of the trade and labor reforms on the Colombian labor market. The literature on the social security reform, however, has focused on its overall economic effects, with only one study dealing with its labor market implications. Kugler and Kugler (2003) analyze the effect of the reform on wages and employment using a panel of manufacturing plants in Colombia for the 1982-1996 period. Their estimates indicate that a 10 percentage point increase in payroll taxes reduces wages between 1.4% and 2.3%, and employment between 4% and 5%. Nevertheless, their firm-level data only provide information on the average wage and tax rate, do not allow controlling for individual demographic characteristics, and only measure the aggregate effect on the manufacturing sector.

The differences-in-differences estimation approach I follow in this paper uses the partial compliance with the regulation and the gradual rise in social security contributions generated by the Colombian reform to estimate the effect of the contributions on wages and how it varies according to the workers valuation of the benefits. Although I cannot measure this valuation directly, I believe that marital and headship status and the presence of young children in the household are good proxies for this valuation. Consequently, I estimate the effects of the social security reform by categorizing agents according to their family structure type and comparing, within each category, the hourly wage of those with social security benefits to the hourly wage of those without benefits, and evaluating how they changed from before to after the reform. The findings of this paper have important policy implications for they reveal the degree of wage pass-through of the cost of the regulation, which in the end determines who would pay for an expansion in social security benefits, or an extension in its coverage.

My results show that a 10 percentage point increase in payroll taxes, accompanied by an improvement in the quality and quantity of the benefits, reduce the hourly wages of female workers with access to social security benefits by 5% relative to the hourly wages of those without access to the benefits. On the other hand, I do not find a significant effect of the reform on the hourly earnings of male workers with access to social security benefits. Among females, the impact is greater for married mothers and single head-of-household females, who experience full transfer of the higher contributions in the form of relative lower wages, whereas it is not significantly different from zero for single dependent women and married women without young children. Among men, the effect is not statistically significant for any of the family structure groups considered. The patterns of how these estimated effects vary across demographic groups are consistent with the theoretical link between the magnitude of the effects and the workers' valuation of the social security benefits.

This paper is structured by presenting in the next section a brief background of the social security reform in Colombia. Section II continues with a review of the empirical and theoretical literature on the effects of social security contributions on wages. Section III lays out the empirical identification approach. Section IV presents the data and descriptive statistics. Section V presents the results and section VI summarizes and concludes.

I. The Colombian Social Security Reform of 1993

The social security reform of 1993 transformed the institutional framework for pension funds and health care provision. Under the previous health care system 15% of the population was covered by the public Social Security Institute (ISS), other 15% of the

population could afford private health care or was covered by alternative services, and the remaining 70% of the population did not have any access to proper health care services. The Law 100 of December 1993 aimed to increase the quality and coverage of health care by implementing a regime based on competition among insurance administrators and health care providers. The reform replaced the ISS' existing system, which was in practice a last-resort individual health insurance mainly used by poor workers or higher income people with elevated health care costs, with a mandatory system with a stricter prepayment program that covers also the family of the worker and provides a choice between services.

The reform brought along an increase in the contributions as well. Table 1 shows that health contributions increased gradually from 7% in 1992, to 8% in April 1994, and 12% in 1996.² The employer must pay two thirds of these contributions, whereas the workers only pay one third. Consequently, the reform raised employer contributions by 3.3 percentage points, whereas it augmented employees' contributions only by 1.7 percentage points.

Regarding pensions, the reform introduced a fully funded social security system giving the workers the choice between the benefit defined in the existing pay-as-you-go system, and the new one of individual capitalization of public funds in which pension benefits depend upon fund performance. As shown in Table 1, pension contributions increased gradually over a three-year period from 8% in 1992, to 11.5% in April 1994, to 13.5% in January 1996.³ The employer must pay three fourths of the pension contributions, whereas the workers only pay one fourth. Consequently, the reform raised

² The final increase actually occurred in January 1995.

³ Although not shown in Table 1, pension contributions increased to 12.5% in January 1995.

employer contributions by 4.84 percentage points, while it augmented employees' contributions only by 0.67 percentage points.

Table 1
Mandatory NonWage Labor Costs
Percentage of Basic Wages (1)

	Pre-reform Rates (1992)			During-reform Rates (1994)			Post-reform Rates (1996)		
	Employer	Employee	Total	Employer	Employee	Total	Employer	Employee	Total
Social Security Contributions	11.99	5.01	17.00	15.96	5.54	21.50	20.13	7.38	27.50
Pensions (2)	5.29	2.71	8.00	8.63	2.88	11.50	10.13	3.38	13.50
Health	4.70	2.30	7.00	5.33	2.67	8.00	8.00	4.00	12.00
Professional Risks (3)	2.00	-	2.00	2.00	-	2.00	2.00	-	2.00
Other Payroll Taxes	9.00	-	9.00	9.00	-	9.00	9.00	-	9.00
Labor Training	2.00	-	2.00	2.00	-	2.00	2.00	-	2.00
Social Assistance Programs	3.00	-	3.00	3.00	-	3.00	3.00	-	3.00
Family Subsidy	4.00	-	4.00	4.00	-	4.00	4.00	-	4.00

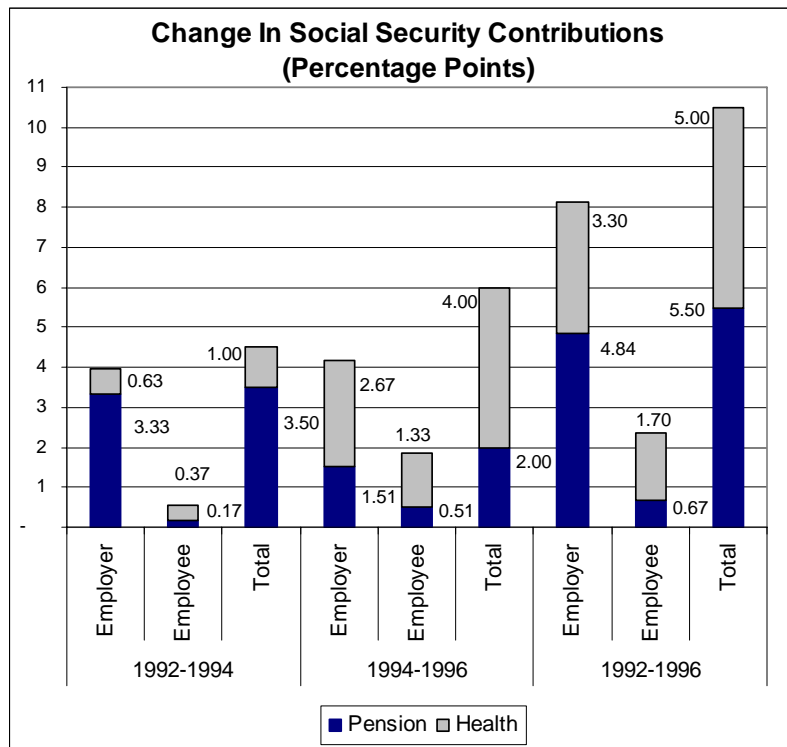
Source: Law 100 of 1993, Decree 685 of 1994, Decree 2926 of 1994, Lora and Henao (1997), Lopez(2003).

(1) Before the Law 100 of 1993 the basic wage used to calculate the contribution included a commuting subsidy for workers earning the minimum wage, but it does not include it thereafter.

(1) There is a 1 percent extra contribution for workers earnings more than 4 minimum wages

(2) The rate oscillates between 0.348% and 8.7% according to the degree of risk associated with the economic activity of the firm, its work injury rate, and its prevention programs The average is 2%.

Figure 1



Source: Law 100 of 1993, Decree 685 of 1994, Decree 2926 of 1994, Lora and Henao (1997), Lopez (2003).

Employers are also required to contribute to the General System of Professional Risks that covers health care expenses and gives economic compensations in the event of a work related accident or illness. The average contribution rate is 2%, and it oscillates according to the degree of risk associated with the economic activity of the firm, its work injury rate, and its prevention programs. These contributions are supplementary to other payroll taxes that were originally established to finance different forms of social security such as the National Apprenticeship Service (SENA), the Colombian Family Welfare Institute (ICBF), and the Family Compensation Funds. As seen in Table 1, these additional taxes over the wage bill were not changed by the labor and social security reforms, amount to 9% of basic wages, and apply to all types of labor contracts. For a detailed analysis of these payroll taxes in Colombia see Alm & Lopez (2002), and Lopez (2003).

To summarize, the social security reform gradually increased the overall pension and health contributions by 8 and 2 percentage points, for firms and workers respectively, raising the statutory payroll taxes for firms complying with the legislation. Figure 1 shows that the total increase in pension contributions is 5.5 percentage points, slightly greater than the 5 percentage point's increase in health contributions. In addition, it shows that during the 1992-1994 period the increase in contributions was mainly due to pensions, while during the 1994-1996 period the increase was mostly explained by health payments. Finally, Figure 1 shows that the increase in the employer social security contributions between 1992 and 1996 was 3.5 times bigger than the increase in employee contributions.

The higher contributions were related to an increase in the quality of the benefits, affecting the relationship between them. For pensions those contributions were more closely related to benefits for workers who changed to the individual capitalization system. Health-related social security contributions before the reform constituted in practice a last-resort individual health insurance but turned into a prepaid system that covers also the families and provides a choice between services. In both cases, however, the rates include a subsidy component across income groups, which also introduce an element of taxation.

II. Literature on the Effects of Social Security Contributions on Wages

Theoretically, social security contributions are considered a benefit-linked payroll tax because of the connection between the taxes paid by or on behalf of each worker and that individual's expected benefits. Hence, with the presence of tax-benefits linkages workers receive a higher compensation, and the contributions are analogous to a price paid for a privately supplied commodity (Summers 1989). A general payroll tax, on the other hand, has no linkage to benefits for the individual taxpayer and therefore carries efficiency costs. The benefit linkages of social security contributions depend on the extent to which workers perceive that they are getting them back as benefits and how much the individual values those benefits. This depends in turn on the quality of the services offered by the entities financed by the tax. If they are perceived as good, employees will consider the contributions as a deferred compensation or insurance program, and will accept a reduction in the net wage with no employment effects. If they are perceived as bad, the contributions will be considered as a pure tax with the corresponding effects on

employment. Additionally, as mentioned by Gruber (1997), a key determinant of tax-benefits linkages is the extent to which the benefits are provided to both contributors and non-contributors, in the sense that if equal benefits are extended to the non-contributors for free, or at a highly subsidized rate, it will mitigate any tax benefits linkages for workers. In most real-world social security systems, the link between contributions and benefits is ambiguous because the benefits financed by payroll taxes are not exactly accrued by employees. Hence, contributions to social security programs often contain an element of pure taxation in concert with elements of deferred compensation or insurance program.

Gruber (1997) develops the standard model to analyze the wage effects of social security contributions. He uses a partial equilibrium model of the labor market with benefit-linked payroll taxes levied on both employers and employees. In that model an increase in the employer's contributions drives wages down, while an increase in the employees' contributions drives wages up. The final effect on wages will be the net result of these two forces, which depends on the elasticities of demand and supply, and the extent to which employees discount their payroll tax payments and value employers' payments relative to cash income. Gruber (1998) points out three scenarios under which increased employer's social security contributions are fully transferred on to lower wages. One possibility is a very tight tax-benefit linkage where workers also value the benefits at their full cost. In that case contributions would be like a price paid for a privately supplied commodity. Another case is a perfectly inelastic labor supply, and a third scenario is a perfectly elastic labor demand. If labor demand is not perfectly elastic, or labor supply is not perfectly inelastic, and there exist a divergence between taxes paid

and benefits accrued, then a pure tax effect arises and only part of the higher payroll taxes will be transferred to lower wages. In such a case, the greater the elasticity of demand comparatively to the elasticity of supply, and the higher the valuation of the benefits received in exchange, the greater the effect of social security contributions on wages.

Although a great number of the empirical literature on the effect of social security reforms on wages has focused on Latin America, given that it is a region that experienced a series of large and exogenous social security reforms during the last two decades,⁴ there is also a great deal of related literature that focuses on the labor market effects of mandated employer-provided benefits in the United States.

One of the first empirical studies on the labor market effects of payroll taxation is Hamermesh (1979). Using data from the PSID he examines the degree to which workers' earnings are affected by the share of the tax paid by employers. He finds that 15-35% of any increase in the payroll tax is shifted by employers on to labor and that this occurs mostly within the first year after a tax increase becomes effective. Later on, however, Gruber and Krueger (1991) using CPS data find that higher employers' cost of workers compensation insurance are largely shifted to employees in the form of lower wages and do not have a statistically significant effect on employment. Subsequently, Gruber (1994) uses a differences-in-differences approach to analyze the effect of state and federal laws that mandated comprehensive coverage for childbirth in private health insurance policies; regulation that exogenously increased the cost of employing women of childbearing age and their husbands. The mandated tax differed across states at a point in time and within

⁴ In general, these reforms changed the rate of payroll taxes and affected the relationship between social security contributions and benefits, which had substantial effects on the region's labor market. See Heckman and Pages (2003) for a detailed survey of the literature on the cost of regulation in Latin America, which includes the cost of social security contributions.

states over time, which allow him to control for time-series trends, fixed state differences in wages, and state specific shocks that are correlated with the passage of the laws. He uses data from the Current Population Survey and finds that all the costs generated by the law are shifted to the wages of the target group with no effect on the net labor supply of that group.

Afterward, Gruber (1997) studies the wage effect of the Chilean social security reform of 1981 that exogenously reduced average payroll tax rates by 25%, and strengthened its benefit linkage. He uses data from a census of manufacturing firms to model the change in wages at a given plant as a function of the calculated average tax rate. He further controls for measurement error in the tax and wage bills, and finds that the reduction in the payroll tax burden of Chilean firms increased wages by the same amount, indicating full transfer of taxes to wages with little effect on the level of employment. Given these results he concludes that there is generally little efficiency cost from financing employee benefits through payroll taxation.

Contrary to what happened in Chile, in Colombia the payroll tax reform raised the contributions by 10.5 percentage points. It is interesting to compare the incidence of the reforms in both countries given that, if wages are flexible upward but not downward, there could be full shifting to wages as a result of a reduction in payroll taxes but not as a result of an increase. Kugler and Kugler (2003) address this issue by using a panel of manufacturing plants in the formal sector in Colombia for the period 1982-1996. They follow the estimation approach of Gruber (1997) by constructing tax rates for each plant and controlling for measurement error in the tax and wage bills. Their estimates indicate that a 10 percentage points increase in payroll taxes reduces formal wages between 1.4%

and 2.3% and formal employment between 4% and 5%. They explain this partial transfer to wages as a result of the weak bond between benefits and contributions and downward rigidities in wages due to the presence of a binding minimum wage. Kugler and Kugler (2003) also find less shifting and more unemployment effect for production than for non-production workers, which they explained by the fact that the minimum wage is more likely to be binding for the former group of workers.

It is important to point out that Gruber (1997) and Kugler and Kugler (2003) firm-level data only provide information on the average wage and tax rate, do not allow controlling for individual demographic characteristics, and only measure the aggregate effect of the reform on the manufacturing sector. By using the Colombian National Household Survey data set, I consider a broad set of economic activities and occupations, obtain the wage rate for each worker, and control for individual demographic characteristics.

In particular, the paper at hand contributes to the literature by estimating how the effect of social security contributions on the wages varies according to the workers valuation of the benefits. Although I cannot measure this valuation directly, I believe that marital and headship status and the presence of young children in the household are good proxies for this valuation.⁵ The differences-in-differences approach I follow in this paper also utilizes the gradual increase in the contributions generated by the reform and the fact that informal employment, or employment that does not comply with the social security regulations, has traditionally been a large component of total employment in Colombia. Consequently, I analyze the effect of the social security reform by categorizing agents

⁵ DeLeire and Levy (2004) use a similar strategy in their study of working sorting across occupations in response to the risk of death on the job.

according to their family structure type and evaluating for each category how the wage differential between formal and informal sectors varies from before to during and after the reform.

III. Empirical Specification

Closely related to the literature on the effect of social security reforms on the labor market, there exists a considerable amount work dealing with the estimation of the impact of health insurance on wages. Currie and Madrian (1999) provide a good survey of this literature and point out that one of the biggest concerns facing this area of research is an issue of identification, for it is difficult to distinguish between the effects of health insurance and the effects of other variables that are correlated with both health insurance and wages.

Suppose that $S_i = 1$ is an indicator of whether or not person i receives social security benefits through his/her job. In addition, denote $W_i(1)$ the wage they have if they work in the formal sector and $W_i(0)$ if they work in the informal sector. Holding everything else constant, the difference $W_i(1) - W_i(0)$ is the causal effect of belonging to the formal sector on their wage. A common assumption in the literature is that the fact that person i belongs to the formal sector does not affect any other person. Under this scenario we can estimate the effect of having social security benefits on wages using the following linear model:

$$\text{Log}(W_i) = \beta' X_i + \alpha' SS_i + \xi_{i1} \quad (1)$$

Equation (1) is a Mincerian wage equation that regresses the log of real hourly wages against a vector of traditional determinants of real wages, X . If X fully captures all the

factors that affect wages other than the social security benefits, then $\hat{\alpha}$ will be an unbiased estimate of the net effect of firm and workers' social security contributions on wages. The coefficient can be interpreted as a compensating wage differential for social security. If the employees value the benefits obtained through employer provided social security at their full cost, the workers are going to perceive the contributions as a payment for the received services and will accept a reduction in their wage compensation, and therefore $\hat{\alpha}$ will be negative. If there is only a partial valuation of the benefits, the magnitude and sign of the coefficient will depend on the elasticities of supply and demand, the employee's valuation of the benefits, and the statutory burden of the tax.⁶

Unfortunately, the econometrician rarely observes all the non-social security related factors that affect wages. In this case the error term ξ_{1i} in equation (1) contains all these omitted variables. If social security availability is correlated with these unobserved characteristics, then the bias of $\hat{\alpha}$ in the OLS estimation of equation (1) is given by:

$$E(\hat{\alpha}) - \alpha = \theta \frac{\text{cov}(SS_i, \delta_i)}{\text{var}(SS_i)} \quad (2)$$

Where δ_i is the vector of unobserved individual characteristics such as ability or productivity, and θ is the effect of this unobserved characteristic on wages.

If the effect of the unobserved characteristic on wages is positive ($\theta > 0$), and workers with high level of ability/productivity look for higher compensation both in wages and social security benefits ($\text{cov}(SS_i, \delta_i) > 0$), then $\hat{\alpha}$ will be positively biased, masking any tradeoff that the employees are willing to make to get access to social security benefits.

⁶ The reduce-form estimation approach does not allow sorting out either the structural sources of the wage change, or distinguishing the effects of employers and employees' social security contributions.

Because of this problem, most of the empirical literature has found that the estimated wage differential for health insurance tends to be positive, contrary to what the theory of compensating differential predicts.⁷

Nevertheless, if this bias is constant for all years in the sample, one can use a differences-in-differences estimation approach to difference out the omitted variable bias.

⁸ That is, by comparing the effect of social security contributions on wages from before to after the Colombian reform; I can eliminate the bias due to unobserved heterogeneity and leave only the effect of the increase in social security contributions on wages. This procedure can be summarized in the following reduced form wage equation:

$$\begin{aligned} \text{Log}(W_i) = & \beta_0' X_i + \beta_1' d_i + \beta_2' (d_i \times X_i) + \beta_3' S_i + \beta_4' R_i + \beta_5' Y_i \\ & + \beta_6' (S_i \times d_i) + \beta_7' (S_i \times R_i) + \beta_8' (S_i \times Y_i) + \nu_i \end{aligned} \quad (3)$$

Where W_i is the real hourly wage, X_i is a vector of traditional determinants of real wages comprising: education, experience, experience square, tenure, marital status, headship status, an indicator of whether the person is studying, the presence of kids under age 6, geographical location, migration status, occupation, industry, kind of contract, firm's size, and place of work. The business cycle variables are the deviation of real GDP from its trend, d_i , and its interactions with the city, industry, occupation, tenure and skill level variables, $(d_i \times X_i)$. In addition, S_i is a dummy equal to 1 if worker i receives social security benefits through his/her job, Y_i is a vector of year dummies for 1994 and 1996, and R_i is a dummy variable that equals 1 during the 1992-1996 period and zero

⁷ See Currie and Madrian (1999), Olson (2002), MaCurdy and Rapoport (2003)

⁸ This implies that the product of θ and $\frac{\text{cov}(SS_i, \delta_i)}{\text{var}(SS_i)}$ is constant over time.

otherwise and aims to control for the structural changes that occurred in Colombia in 1990. I also include the interaction $(S_i \times d_i)$ to control for sector specific cyclical effects, and the interaction $(S_i \times R_i)$ to control for sector specific effects of the 1990 reforms.

The coefficients of interest are given by the interactions of the social security dummy with the year fixed effects, $(S_i \times Y_i)$, which capture the effect of the social security reform on wages. The coefficient for the 1994 interaction measures mostly the effect of the pension reorganization, while the coefficient for the 1996 interaction represents the aggregate effect of the pension and health care reforms. It is important to point out, however, that the coefficient for the 1994 interaction identifies the effect of the pension reform only if the health care reorganization that followed was not anticipated by the agents. If the agents anticipated the future changes in the health care system and reacted to them before they were actually implemented, then I can only identify the cumulative effect of both reforms and its timing during the reorganization period.

This identification approach is similar to the one used by Kugler (2000) in her study of the incidence of job security regulations on the Colombian labor market. She uses the temporal change in the legislation introduced by the labor market reform of 1990, together with the regulation's coverage disparity, to control for self-selection and the difference in shocks across groups. However, she points out that this methodology only allows her to identify a lower bound for her parameter of interest.

Finally, to investigate how the valuation of the benefits affects the estimates of the impact of the reform, I define four family structure categories per gender group that I expect to vary on this valuation. These categories are: married agents with and without children, single head-of-household workers, and single dependants. I expect single head-

of-household workers to have the highest valuation of both pension and health care benefits. I anticipate this because they are the most risk averse group of them all⁹, under the new health care system they are able to cover their dependants, and as heads-of-household are less likely to be beneficiaries of someone else's insurance. The group that should come second in terms of their valuation of the benefits is married workers with children, followed closely by married workers without children. I predict married workers should have a lower valuation of the benefits than single head-of-household workers because they are less risk averse¹⁰, and they are more likely to rely on family systems as a form of insurance. I expect childless couples to have a lower valuation of the benefits than those with children since they have fewer dependants to cover. Finally, I anticipate single dependant workers to have the lowest valuation of both pension and health care benefits, given that they can be a beneficiary of someone else's insurance, are younger, and are less risk averse than the other demographic groups¹¹.

IV. Data and Descriptive Statistics

The data I use for the estimation are the June waves of the Colombian National Household Survey for the years 1984, 1986, 1988, 1992, 1994, and 1996. The year 1990 is not included in the sample due to data availability and because it is a period of deep structural transformations that affected the labor market.¹² The survey is a cross section administered in the ten most important metropolitan areas in the country. I use the June

⁹ Jianakoplos and Bernasek (1998), Deleire & Levy (2004)

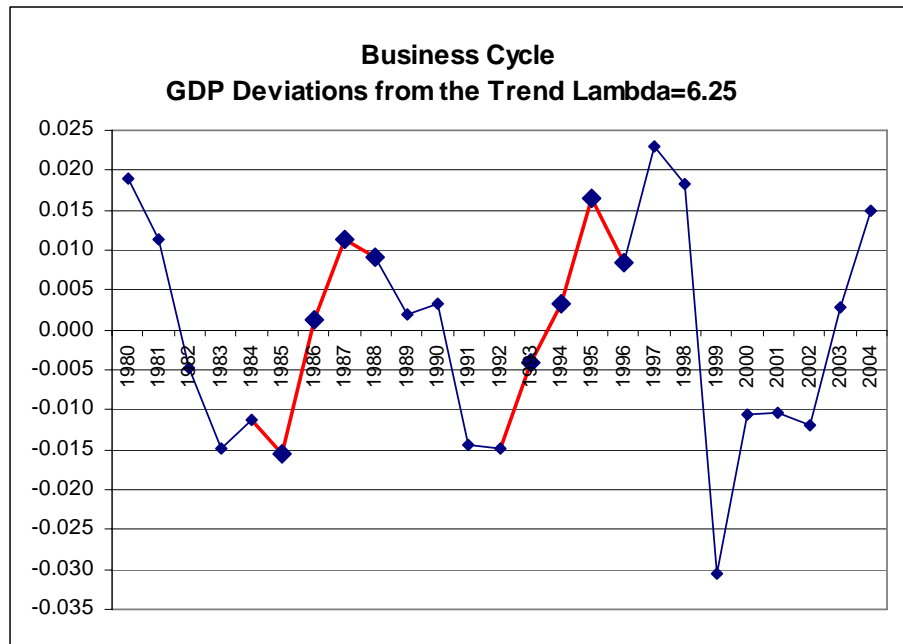
¹⁰ Ibid

¹¹ Ibid

¹² These changes include the approval of a new constitution, key reforms to the labor market, a major trade reform, and the liberalization in direct foreign investment. It is important to point out, however, that these changes occurred almost three years before the implementation of the social security reform in early 1994.

waves because every two years they include a special module on informality that has information on whether the individual receives social security benefits through his/her job. As seen in Figure 2, the year 1992 is a year of economic contraction while 1994 and 1996 are years of economic expansion that precede the big recession the country experienced in 1999.¹³ Hence, it is important to control for the business cycle in order to identify the effect of the 1993 social security reform on wages. To do so, I include in my estimation sample an earlier period that is similar in terms of the cycle but did not experience any reform that affected the labor market. The corresponding control period comprises the years 1984, 1986 and 1988.

Figure 2



Source: Estimated by the author applying the Hodrick-Prescott (1997) filter to GDP data from the DANE - Banco de la República, Colombia.

I make use of the availability of health social security benefits through the job, the individual's employment status, and his/her occupation to sort salaried workers into two

¹³ I estimated the business cycle using the Hodrick-Prescott (1997) filter with lambda=6.25

employment sectors. I classify agents in the wage-and-salary formal sector (WSF) if they work as a salaried or domestic service worker and have access to social security benefits through their jobs, and I categorize agents in the wage-and-salary informal sector (WSI) if they have a salaried job that does not provide health care social security benefits. I use only the availability of health benefits to classify workers into sectors because the question regarding the affiliation to the pension system only appears in the survey after 1996. However, these two measures are highly correlated. Before the reform the affiliations to health and pensions perfectly coincide since the public Social Security Institute managed both of them. The 1993 reform introduced different private insurance administrators for the health and pension part of the system altering this match, however. In 1996 for example, 56% of all workers has access to health care benefits, while only 47% has access to pension benefits. The higher coverage the health social security has, relative to its pension counterpart, is explained by the fact that the law requires proof of affiliation to the health care regime in order to affiliate a worker to the pension part of the system, but not the other way around.

Previous studies of the informal sector in Colombia, that use a different characterization of the informal sector based on firm size, have found that more than 50% of the total working population belong to this sector, comprised mainly by the self-employed, unpaid family workers, domestic service, salaried workers employed in small firms, and micro enterprise owners. According to the official figures of the Colombian National Department of Statistics, in 1992 informal employment represented 54% of total urban employment, proportion that decreased to 52.3% in 1996.

In my estimation sample, however, I include only prime age salaried workers that are employed full-time in the private sector. I exclude self-employed workers because their earnings reports have large measurement errors given that they confound salary with the returns from capital investments and the earnings of unpaid family workers, and because they may misreport their earnings for tax evasion purposes. I exclude government employees in view of the fact that they receive fringe benefits obtained in collective conventions of labor, and some of them, such as the military, the teachers, and the Colombian Oil Company's employees, have their own social security entities that are unaltered by the reform. In addition, I exclude female workers over 55 years of age and male workers over 60 years of age in view of the fact that they are beyond the legal retirement age in Colombia. My final sample has on average 9.700 men and 5.700 women per year.

In this resulting sample, a higher fraction of workers has access to social security benefits and this proportion increases after the reform. Table 2 shows that formal employment among salaried females expands from 70% in 1992 to 77% in 1996, while formality rises from 66% to 71% among male workers. Table 2 also shows that the increase in salaried formality, although of varying magnitude, holds across all family structure groups considered.

The increase in salaried formality might be explained by the higher benefits and stronger tax-benefit linkages brought along by the reform, which increased the incentives for workers with high valuation of those benefits to comply with the regulation. Furthermore, the reform introduced special insurance promoter institutions whose main goal is to promote enrollment and hire the services of providers for the case of health, or

promote enrollment and manage the funds collected for the case of pensions. An evidence of these factors is the grow in the proportion of workers enrolled in the pension system, which rises from 23% in 1993 to 40% in 1996, with almost all the increase explained by new affiliations to the individual capitalization system managed by the private insurance promoter institutions.¹⁴

Table 2
Distribution of Agents Across Employment Sectors
By Year and Family Structure Group

Family Structure	Empl. Sector	Females						Males					
		1992		1994		1996		1992		1994		1996	
		mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.
All	WSF	70%	0.6%	74%	0.6%	77%	0.6%	66%	0.5%	69%	0.5%	71%	0.5%
	WSI	30%	0.6%	26%	0.6%	23%	0.6%	34%	0.5%	31%	0.5%	29%	0.5%
Married No Children	WSF	73%	1.4%	78%	1.3%	82%	1.1%	74%	0.9%	74%	0.9%	79%	0.8%
	WSI	27%	1.4%	22%	1.3%	18%	1.1%	26%	0.9%	26%	0.9%	21%	0.8%
Married With Children	WSF	72%	1.7%	80%	1.5%	80%	1.4%	69%	0.9%	69%	0.9%	71%	0.9%
	WSI	28%	1.7%	20%	1.5%	20%	1.4%	31%	0.9%	31%	0.9%	29%	0.9%
Single Head	WSF	76%	2.9%	80%	2.4%	76%	2.5%	67%	3.0%	72%	2.7%	75%	2.6%
	WSI	24%	2.9%	20%	2.4%	24%	2.5%	33%	3.0%	28%	2.7%	26%	2.6%
Single Dependant	WSF	76%	1.1%	78%	1.0%	79%	1.0%	60%	1.0%	65%	1.0%	66%	1.0%
	WSI	24%	1.1%	22%	1.0%	21%	1.0%	40%	1.0%	35%	1.0%	34%	1.0%

WSF= Wage-and-Salary Formal; WSI= Wage-and-Salary Informal;

The differences-in-differences estimation approach basically compares the wage differential between the formal and the informal sectors from before to during and after the reform. Consequently, it is important to identify the job and demographic characteristics of these sectors and how they changed over time. Regarding the demographic characteristics, Table 3 shows that in 1992 formal sector workers are on average older, with 31 years of age for females and 33.5 years of age for males, compared to salaried informal workers with average ages of 29 and 30.6 years for females and males, respectively. Although the average age increases for both

¹⁴ Asofondos (2001)

employment sectors after the reform, the increase is higher in the formal sector, which widens the age gap.

There is a positive relationship between the level of schooling and formality. As shown in Table 3, the formal sector is more skill intensive with an average of 2.6 more years of schooling for females and 2.2 more years of education for males. Although the skill level rises in all sectors after the reform, the increase is especially significant among salaried informal females, which narrows women's skill gap between sectors. The differences in the average age and schooling attainment across employment sectors replicate in differences in the average potential experience. Table 3 shows that males in the wage-and-salary formal sector have the highest potential experience with an average of 18.3 years, followed by salaried informal males and females with 17.7 years and 16 years of experience, correspondingly. Females with access to social security benefits have the lowest potential experience with an average of 15.5 years. The years of experience across sectors do not change significantly after the reform. Only for females in the formal sector the potential experience increases by 1 year, which reduces the gap with the salaried informal sector.

Regarding job stability, Table 3 shows that 30% of men and 24% of women in the salaried informal sector are temporary workers, while only 10% of men and women in the formal sector hold a short-term job. This reflects in the higher years of tenure for formal workers, with an average of 2.6 years, compared to only 2 years of tenure for salaried informal workers. Apart from a transitory jump of 5 percentage points in the proportion of formal workers with short-term jobs in 1994, these figures stay roughly constant over the period of study.

Table 3 shows that before the reform, female workers not covered by the social security system work on average 51 hours per week, two and a half hours more than females in the compliant sector of the economy. However, this gap narrowed through time due to a 1 hour reduction in the amount of time worked by women in the salaried informal sector. Men in the non-compliant sector, on the other hand, work 51.5 hours per week throughout the sample period, one more than the hours worked by those in the wage-and-salary formal sector.

Table 3
Workers and Job Characteristics Across Sectors
Wage-and-Salary Workers

	Empl. Sector	Females						Males					
		1992		1994		1996		1992		1994		1996	
		mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.
Age	WSF	31.1	0.1	31.6	0.1	32.1	0.1	33.5	0.1	33.1	0.1	34.1	0.1
	WSI	29.1	0.2	29.5	0.2	29.7	0.2	30.6	0.2	30.9	0.2	30.9	0.2
Schooling	WSF	9.9	0.1	10.0	0.1	10.2	0.1	9.2	0.1	9.3	0.0	9.4	0.0
	WSI	7.1	0.1	7.4	0.1	7.7	0.1	6.9	0.1	7.0	0.1	7.2	0.1
Potential Experience	WSF	15.1	0.2	15.6	0.2	15.9	0.2	18.3	0.2	17.9	0.1	18.6	0.1
	WSI	16.1	0.2	16.0	0.3	16.0	0.3	17.6	0.2	17.8	0.2	17.7	0.2
Hours Worked	WSF	48.5	0.1	47.9	0.1	48.4	0.1	50.3	0.1	50.1	0.1	50.6	0.1
	WSI	51.1	0.2	50.0	0.2	50.2	0.2	51.5	0.2	51.3	0.2	51.5	0.2
Tenure	WSF	2.5	0.0	2.6	0.0	2.6	0.0	2.7	0.0	2.6	0.0	2.7	0.0
	WSI	1.9	0.0	1.9	0.0	2.0	0.0	2.1	0.0	2.1	0.0	2.1	0.0
Proportion of Temp Workers	WSF	0.10	0.01	0.14	0.01	0.09	0.00	0.10	0.00	0.15	0.00	0.11	0.00
	WSI	0.24	0.01	0.24	0.01	0.23	0.01	0.30	0.01	0.29	0.01	0.30	0.01
Firm Size	WSF	3.5	0.0	3.4	0.0	3.4	0.0	3.5	0.0	3.5	0.0	3.4	0.0
	WSI	2.3	0.0	2.4	0.0	2.5	0.0	2.8	0.0	2.9	0.0	2.8	0.0
Proportion of Office/Factory Jobs	WSF	0.90	0.01	0.88	0.01	0.87	0.01	0.78	0.01	0.77	0.01	0.74	0.01
	WSI	0.58	0.01	0.59	0.01	0.68	0.01	0.59	0.01	0.57	0.01	0.59	0.01

WSF=Wage-and-Salary Formal; WSI= Wage-and-Salary Informal.

On the subject of job's characteristics, before the reform 90% of women and 78% of men in the formal sector work in a fix place such as a factory or an office, while only 58% of the workers in the salaried-informal sector did. After the reform, however, the

proportion of salaried informal women that work in a fixed place increases by 10 percentage points, while the corresponding fraction for women in the formal sector decreases 3 percentage points. Finally, firms in the formal sector are bigger with an average of 3.5 employees, one more than the firms in the wage-and-salary informal sector. As seen in Table 3, these numbers remained rather stable after the reform. The above figures reflect that most of the firms in the informal sector have to restrict their size and location in order to avoid detection and maintain their informal status. In fact, 60% of the firms in the salaried-informal sector have 5 workers or less.

Table 4 shows an initial examination of the relationship between earnings and social security benefits across family structure groups. The comparison is made taking into account not only monetary income, but also an alternative measure of earnings that includes non-pecuniary retributions such as food or housing. The results are similar for both measures; hence, I only report the first one. I find that, before the reform, the mean real hourly wage is on average 49% higher for female workers covered by the social security than for females in the non-compliant sector. Men in the formal sector, on the other hand, earn just 34% more than their counterparts in the wage-and-salary informal sector do. These earning gaps narrowed through time, especially for women, whose earning gap decreases by 10 percentage points.

The wage differential, although always positive, varies across family structure groups throughout the sample period. Single head-of-household women is the group with the highest wage differential, followed by married women with children, married women without children, and single dependent women, in that order. Among males, however, the wage differential does not vary much. Single dependants have a slightly higher earning

gap than the other demographic groups before the reform, but by the end of the sample period the wage differential is very similar for all demographic groups.

Table 4
Wage Differential Across Family Structure Groups

Family Structure	Empl. Sector	Females						Males					
		1992		1994		1996		1992		1994		1996	
		mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.
All	WSF	7.19	0.01	7.27	0.01	7.28	0.01	7.33	0.01	7.37	0.01	7.40	0.01
	WSI	6.69	0.01	6.79	0.01	6.90	0.01	6.99	0.01	7.07	0.01	7.09	0.01
	First Dif.	0.49	0.02	0.47	0.01	0.38	0.01	0.34	0.01	0.30	0.01	0.31	0.01
Married w/o Children	WSF	7.31	0.02	7.30	0.02	7.30	0.02	7.42	0.01	7.50	0.01	7.46	0.01
	WSI	6.88	0.03	6.86	0.03	6.99	0.03	7.09	0.02	7.15	0.02	7.20	0.02
	First Dif.	0.43	0.04	0.44	0.03	0.31	0.03	0.33	0.02	0.35	0.02	0.27	0.02
Married w/ Children	WSF	7.25	0.02	7.33	0.02	7.33	0.02	7.34	0.01	7.37	0.01	7.40	0.01
	WSI	6.78	0.03	6.88	0.03	7.00	0.04	7.02	0.02	7.14	0.02	7.13	0.02
	First Dif.	0.47	0.04	0.45	0.04	0.33	0.04	0.32	0.02	0.23	0.02	0.27	0.02
Single Head	WSF	7.34	0.05	7.34	0.04	7.34	0.04	7.42	0.05	7.41	0.04	7.45	0.04
	WSI	6.85	0.07	6.88	0.05	6.92	0.04	7.03	0.05	7.14	0.05	7.14	0.05
	First Dif.	0.49	0.08	0.46	0.06	0.42	0.05	0.38	0.07	0.27	0.07	0.32	0.06
Single Dependant	WSF	7.20	0.01	7.31	0.02	7.35	0.01	7.22	0.01	7.26	0.01	7.34	0.01
	WSI	6.81	0.02	6.96	0.02	6.99	0.02	6.89	0.01	6.97	0.01	7.02	0.01
	First Dif.	0.39	0.03	0.35	0.03	0.37	0.03	0.33	0.02	0.30	0.02	0.32	0.02

WSF=Wage-and-Salary Formal; WSI= Wage-and-Salary Informal.

As mentioned in section III, the positive association between wages and social security benefits highlight the role of self-selection into sectors according to the unobserved productivity or ability of the worker. Workers with high demand for social security benefits also have high levels of ability/productivity that will influence their compensation, making the coefficient of the formal sector dummy in equation (1) positively biased, and masking any tradeoff that the employees are willing to make to get access to social security benefits.

V. Results of the Differences-in-differences Estimation.

Table 5 shows the OLS estimation of equation (3) for males and females, using Eicker White robust standard errors to account for common random effects at the sector level.¹⁵ The differences-in-differences equation regresses the log of the hourly real wage on a constant, education, experience, experience square, tenure, marital status, headship status, indicators of whether the person is studying, the presence of kids under age 6, geographical location, migration status, industry, occupation, kind of contract, firm's size, place of work, the availability of social security benefits, a set of business cycle variables, a dummy for the post 1990 period, a vector of year dummies for 1994 and 1996, and interactions of the social security dummy with the business cycle and post 1990 dummy that controls for sector specific effects of the business cycle and the 1990 reforms. Finally, the coefficients that measure the effect of the pension and health care reforms on wages are those of the interaction of the social security dummy with the 1994 and 1996 year dummies.

To illustrate the effect of including controls on the differences-in-differences estimation, I added them gradually to the regression equation. Column 1 in Table 5 includes no controls; column 2 controls for demographic characteristics; column 3 adds controls for occupation and industry fixed effects and so forth. Each cell contains the OLS coefficient and standard errors of the differences-in-differences estimation of the

¹⁵ This regression was run including and excluding self-employed workers from the estimation sample. The estimated effect of the reform on the wage differential between the wage-and-salary formal and informal sectors is not affected by the sample selection rule. However, the estimated effect of the reform on the earnings differential between the wage-and-salary informal and the self employment sectors is suspiciously large. As mentioned earlier, the earnings reports of self-employed workers have large measurement errors given that they confound salary with the returns from capital investment and the earnings of unpaid family workers. Furthermore, self-employed workers have high incentives to misreport earnings for tax evasion purposes. For all these reasons I do not present the estimates for the self employment sector in the results that follow.

effect of social security contributions on wages. On each panel, the first two rows compare the wage gap between sectors for the years 1996 and 1994 to the corresponding difference in wages in 1992, and measure the net effect of the increment in social security contributions on the relative wages of formal sector workers. In addition, row 3 shows the effect of the 1990 reforms on the wage differential and row 4 shows the time invariant effect of social security contributions on wages. Finally, rows 5, 6, and 7 show the time series changes on wages and the effects of the 1990 reforms that are common to both sectors.

First of all, it is important to notice that as anticipated in section III and contrary to the predictions of the compensating differential theory, the estimate of the time invariant effect of social security on wages in row 4 is positive for all specifications, confirming the existence of an omitted variable bias. Note also that the bias declines with more detailed controls. Furthermore, note that gradually adding controls to equation (3) also reduces the differences-in-differences coefficients that measure the effect of the 1993 social security reform.

Column 5 is the specification that contains the full set of controls, thus is the one that I discuss in more detail. These results with their significance level are also displayed on the first column of Table 6. In this regression, the omitted category are unskilled married head-of-household workers, who have a rural origin, are not attending school, and work without social security benefits in the service sector at firms that have only one employee and no fixed location. Although the differences-in-differences coefficients at this level of aggregation are not statistically significant, the point estimates give an idea of the differential effect of the reform between males and females. In both regressions, most of

the coefficients for demographic, industry, city, occupation and firm characteristics are statistically different from zero and have the expected signs. Furthermore, the variables that control for cyclical effects at the sector, city, industry, occupation, tenure, and skill level also have jointly statistically significant coefficients.

Table 5
Effect of Social Security of Wages
Difference in Difference Estimation

Females	1	2	3	4	5
WSF x Year96	-0.115	-0.103	-0.081	-0.064	-0.049
	0.025	0.022	0.022	0.023	0.035
WSF x Year94	-0.022	-0.032	-0.027	-0.021	-0.008
	0.016	0.013	0.010	0.011	0.019
WSF x Post 1990	-0.108	-0.107	-0.093	-0.077	-0.090
	0.022	0.016	0.017	0.016	0.017
WSF	0.600	0.349	0.272	0.180	0.181
	0.048	0.017	0.015	0.016	0.016
year94	0.101	0.097	0.089	0.091	0.176
	0.014	0.012	0.008	0.008	0.012
year96	0.207	0.162	0.149	0.138	0.250
	0.017	0.009	0.010	0.013	0.011
Post 1990	0.082	-0.007	-0.001	-0.004	-0.077
	0.017	0.012	0.014	0.013	0.013
Males					
WSF x Year96	-0.025	-0.014	-0.011	-0.008	0.013
	0.046	0.046	0.047	0.044	0.035
WSF x Year94	-0.034	-0.014	-0.010	-0.002	0.015
	0.025	0.021	0.022	0.021	0.029
WSF x Post 1990	0.018	-0.023	-0.027	-0.018	-0.029
	0.024	0.027	0.027	0.026	0.022
WSF	0.319	0.161	0.155	0.098	0.097
	0.039	0.023	0.024	0.025	0.024
year94	0.081	0.063	0.061	0.058	0.158
	0.016	0.013	0.015	0.015	0.022
year96	0.098	0.066	0.066	0.065	0.195
	0.039	0.037	0.039	0.036	0.020
Post 1990	-0.029	-0.053	-0.049	-0.055	-0.142
	0.024	0.027	0.026	0.026	0.021
Controls					
Demographic Characteristics	N	Y	Y	Y	Y
Occupation & Industry	N	N	Y	Y	Y
Job Characteristics	N	N	N	Y	Y
Business Cycle	N	N	N	N	Y

WSF=Wage-and-Salary Formal dummy

As previously mentioned, during the first part of the reform the increase in payroll taxes is mainly due to pensions, whereas during the second part is mostly explained by higher health care contributions. However, I can isolate the effect of the pension reform only if the health care reorganization that followed was not anticipated by the agents. If the agents anticipated the future changes in the health care system and reacted to them before they were actually implemented, I can only identify the cumulative effect of both reforms and its timing during the reorganization period.

For females, the differences-in-differences coefficient for the year 1994 tell us that during the first part of the reform, a period of time during which social security contributions increase by 4.5 percentage points, there is not a significant drop in the wages of women in the formal sector of the economy relative to the wages of those in the informal sector. However, by the year 1996 social security contributions rise by 10.5 percentage points and the corresponding differences-in-differences coefficient increases to 4.9%. This implies that, when considering all females in the sample, about half of the higher contributions are passed on to formal females as lower wages. The effect of the social security reorganization is much lower for males; however, with a 1.3% relative reduction in the wages of men in the formal sector that occurs mostly during the first part of the reform. As mentioned before, the effect of the higher contributions on wages depends partly on the extent to which employees discount their payroll tax payments and value employers' payments relative to cash income. Consequently, a higher valuation of the benefits by females explains why employers are able to transfer half of the increased social security contributions to females and a much lower fraction to male workers.

Two possible explanations of the differential valuation of the benefits are that women are more risk averse than men and that they face a higher probability of being unemployed. The first factor is documented in a number of financial studies that confirm that women are more risk averse than men, even after controlling for the effects of other individual characteristics.¹⁶ Furthermore, there is evidence that suggests that women tend towards lesser risk taking in labor markets than men, and are paid a higher compensating wage differential for accepting a given job-injury risk.¹⁷ Regarding the second factor, during 1994-1996 period the unemployment rate for women is more than 5 percentage points higher than that for men, explained by an increase in the participation rate of women.¹⁸

A third possible source of the greater effect of the pension reform on female wages is the seemingly preferential treatment they receive. Women might have a higher valuation of the benefits received through the pension system due to their lower retirement age and longer life expectancy.¹⁹ It is important to clarify, however, that this may possibly be only the product of a poor understanding of how their pension benefits are computed. As Uribe (2002) points out, a factor rarely known by the workers is that due to their lower wages and years contributing to the system, women will be penalized in the individual capitalization system where the benefits at the time of retirement are a function of the savings made and the life expectancy of the worker.

¹⁶ See Bajtelsmit and Bernasek (1996) for a review of the literature on gender differences in risk taking that pays particular attention to risk taking and investing for retirement.

¹⁷ Hersch (1998), Jianakoplos and Bernasek (1998), Deleire and Levy (2004)

¹⁸ According to the Colombian National Department of Statistics the average unemployment rate for the 1994-1996 period is 10%. The participation rate of women is still lower than that of men.

¹⁹ The estimated life expectancy in the country is 69 years for men and 75 for women, while their retirement age is 60 and 55 years for men and women, respectively.

It is important to mention that the greater effect on female wages diverges from the findings of Mondino and Montoya (2000), who estimate hedonic wage functions using Argentinean PHS data for the 1990-1996 period. They find that male workers in the formal sector earn 8% less than their counterparts in the informal sector, while female workers sacrifice only 2.8% to get a job in the formal sector.²⁰ However, they fail to correct for unobserved heterogeneity, and their results depend heavily on the parametric assumption about the sample selectivity.

I also investigate how variations on the valuation of the benefits across family structure groups affect the estimates of the effect of the reform. Table 6 shows the results of the separate estimation of equation (3) for married workers with and without children, single head-of-household workers, and single dependants.

Married mothers and single head-of-household women are the demographic categories that experience the largest effects. For both of these groups the wages of formal sector workers decrease approximately 10% between 1992 and 1996, relative to the wages of those in the informal sector of the economy. This implies a full transfer of the higher social security contributions in the form of lower wages. For married mothers the effect occurs mostly during the first part of the reform, while for single head-of household women the effect concentrates on the second part of the reorganization period. On the other hand, the relative wages of married women without children in the formal sector increase by 10% during the first part of the reform, but decrease by 5% during the second part, for a cumulative effect that is not significantly different from zero. The opposite occurs for single dependent females. For this group, formal wages decrease by 4.5% between 1992 and 1994, but this effect is counterbalanced by a 1% increase between

²⁰ The later coefficient is not statistically different from zero.

1994 and 1996, for a cumulative effect that is not statically significant. Although of a smaller magnitude than women, married men without children and single head-of-household males are the groups that experience the largest effects among men, with a 5% reduction in the wages of individuals in the formal sector relative to the wages of those in the informal sector. The effect, however, is not statistically significant for these or any of the other demographic groups of men.

Table 6
Difference-in-Difference Estimation of the Effect of Social Security on Wages

	All	Married w/o Children	Married w/ Children	Single Head	Single Dependant
Females					
WSF x Year96	-0.049	0.046	-0.104 **	-0.116 *	-0.036
	0.035	0.030	0.046	0.057	0.057
WSF x Year94	-0.008	0.101 *	-0.062	-0.039	-0.045
	0.019	0.056	0.045	0.079	0.059
WSF x Post 1990	-0.090 ***	-0.111 ***	-0.032	0.001	-0.012
	0.017	0.024	0.047	0.080	0.032
WSF	0.181 ***	0.156 ***	0.148 ***	0.149 ***	0.130 ***
	0.016	0.023	0.029	0.034	0.019
WSF x GDP	0.431	-3.842 **	2.451	2.284	-0.114
	1.264	1.437	2.033	2.673	2.065
year94	0.176 ***	0.041	0.207 ***	0.249 ***	0.232 ***
	0.012	0.051	0.019	0.067	0.058
year96	0.250 ***	0.133 ***	0.274 ***	0.324 ***	0.245 ***
	0.011	0.025	0.017	0.048	0.041
Post 1990	-0.077 ***	-0.072 ***	-0.123 ***	-0.166 **	-0.146 ***
	0.013	0.017	0.040	0.068	0.032
Males					
WSF x Year96	0.013	-0.041	-0.014	-0.052	0.006
	0.035	0.045	0.038	0.085	0.053
WSF x Year94	0.015	0.010	-0.024	0.023	0.014
	0.029	0.035	0.032	0.077	0.052
WSF x Post 1990	-0.029	0.005	-0.005	-0.049	-0.013
	0.022	0.034	0.034	0.091	0.022
WSF	0.097 ***	0.096 ***	0.091 ***	0.071 ***	0.093 ***
	0.024	0.022	0.026	0.023	0.020
WSF x GDP	0.420	2.174 *	0.859	-0.311	-0.714
	1.059	1.256	0.808	2.807	1.612
year94	0.158 ***	0.162 ***	0.229 ***	0.182 **	0.120 **
	0.022	0.030	0.025	0.067	0.042
year96	0.195 ***	0.215 ***	0.272 ***	0.293 ***	0.172 ***
	0.020	0.040	0.016	0.072	0.041
Post 1990	-0.142 ***	-0.173 ***	-0.198 ***	-0.141	-0.116 ***
	0.021	0.030	0.033	0.089	0.017

WSF=Wage-and-Salary Formal dummy; * p<.1; ** p<.05; *** p<.01

I find similar patterns across family structure groups in Vargas (2006), where I analyze the simultaneous effects of pension and health care social security contributions on the employment sector choice of workers and their hours of work decisions. Furthermore, I examine how the effects vary according to the workers' valuation of the benefits approximated by the worker's headship, parenthood, and marital status. I estimate a multinomial logit model of the probability that a worker belongs to any of four employment sectors that also allows for three levels of hours of work within each sector. Preliminary results indicate that the social security reform generates a substitution of increased number of workers for fewer hours per employee in the formal sector of the economy. This effect is particularly important among married mothers and single head-of-household women, whereas for married women without children, single dependent women, and men in any family structure group the effect is not statistically significant. The reform makes married mothers and single head-of-household women that would otherwise be working part-time in the informal sector or not participating in the market, to work full-time in the formal sector in order to get access to social security benefits for them and their families. This generates a reduction in the proportion of part-time workers in the informal sector among women in these two family structure groups. At the same time, it makes the pool of workers with social security benefits increasingly concentrated among those who work just enough hours to get access to the benefits.

As previously mentioned, the differential effect of the social security reform across family structure groups reflects their different degrees of risk aversion. This statement is supported by a study by Jianakoplos and Bernasek (1998). They use data from the U.S. Federal Reserve's Survey of Consumer Finances (1989) to estimate relative risk aversion

by gender in financial investment markets and find that single men and married couples are relatively less risk averse than single women. Therefore, I expect single women to have the highest valuation of the benefits of them all. Furthermore, a recent study by DeLeire and Levy (2004) that examines worker sorting across occupations in response to risk of death on the job, finds that single moms and single dads are more averse to risk than married men and women with children and people without children. They also find, similar to what I find here, that the effect of parenthood for those who are married is much larger for women than for men.

The patterns of how these effects vary across family structure groups are also consistent with the theoretical link between the magnitude of the impacts and the workers' valuation of the social security benefits. The health reform replaced the existing affiliation system that covered only the worker, with one that covers also the spouse and children or the parents of the worker. Consequently, after the reform, single dependent workers are able to get access to health care benefits through their parents, which attenuate their valuation of these benefits. For single dependent females, this smoothes the increase in formality with the corresponding small reduction in the relative wages of formal sector workers. For single dependent males, it generates a reduction in formal employment and an associated increase in the relative wages of those in the compliant sector of the economy. On the other hand, married and single head-of-household women, especially those with young children, are now able to cover their dependants, which strengthen their valuation of health care benefits. Consequently, they are the demographic groups that give up a higher fraction of their wages in order to get access to the social

security benefits and, consequently, the groups where the probability of formal employment increases the most.

The previous findings on employment and wages are theoretically consistent with a theoretical model of employment sector choice (Vargas 2006), corresponding to the case where the effect of the higher valuation of social security benefits and the tighter link between benefits and contributions dominate the impact of the augmented contributions.

VI. Summary and Conclusions

In December of 1993 Colombia implemented a Social Security reorganization that transformed the institutional framework for pension funds and health care provision. The reform not only meant an increase in the contributions, but also an improvement in the quality of the benefits and an increase in the contribution-benefit linkage. The theory of compensating differentials predicts that, under full valuation of the benefits, an increase in a benefit-linked payroll tax will result in lower wages but no change in the level employment. In this paper, I estimate the effect of social security contributions on wages and how it varies according to the workers valuation of the benefits. To do this, I employ a differences-in-differences approach that exploits the exogenous increase in the contributions generated by the reform and the existence of a large fraction of employment in Colombia that does not comply with the social security regulation.

Given that social security availability is correlated with individual characteristics unobserved by the econometrician, such as ability or productivity, the OLS estimates of the effect of social security on wages are positively biased. Consequently, the literature has regularly found positive estimates of the effect of social security on wages, which

contradict the predictions of the compensating differential theory. Nevertheless, if the correlation between the unobserved individual characteristics and the availability of social security benefits is constant for all the years in the sample, then, by comparing the effect of social security on wages for two different years one could eliminate the bias and leave only the effect of the augmented social security contributions on wages.

My results show that a 10.5 percentage point increase in payroll taxes, accompanied by an improvement in the quality and quantity of the benefits, reduce the hourly wages of female workers with access to social security benefits by 5% relative to the hourly wages of those without access to the benefits. On the other hand, the hourly earnings of male workers in the wage-and-salary formal sector decrease by only 1.3% relative to the earnings of those in the wage-and-salary informal sector. Among females, the impact is greater for married mothers and single head-of-household females, whereas it is not significantly different from zero for single dependent women and married women without young children. Among men, the effect is not statistically significant for any of the family structure groups considered. The patterns of how these estimated effects vary across demographic groups are consistent with the theoretical link between the magnitude of the effects and the workers' valuation of the social security benefits. These findings have important policy implications for they reveal who would pay for an expansion in social security benefits, or an extension in its coverage.

An identification issue is present here, however. It could be the case that because of the tighter contribution-benefit linkage generated by the reform, more workers with high levels of ability and earnings look also for a higher compensation in social security benefits. If this happens, the unobserved ability bias increases with the reform and the

differences-in-differences methodology used in this paper only identifies the lower bound of the effect of social security on wages.

Moreover, the work of Kugler (2000) highlights two assumptions that lie behind the identification strategy used in the differences-in-differences estimation.²¹ First, this procedure ignores the general equilibrium effects of the reform on the wages and composition of each sector, assuming that aggregate shocks affect both sectors equally. Second, it assumes that the composition of workers is constant over time. My findings in Vargas (2006) suggest that this is not the case. Therefore, it is important to explore this issue further, which is a topic of ongoing research.

References

- Alm, J., Lopez, H., 2002. Payroll Taxes in Colombia. *Mission of Public Income. Fedesarrollo*, Bogotá.
- Asofondos , 2001. Siete Años del Régimen de Ahorro Individual con Solidaridad. Boletín No. 012, July.
- Bajtelsmit, V., Bernasek, A., 1996. Why Do Women Invest Differently Than Men?. *Financial Counseling and Planning*, Vol. 7.
- Bell, L. 1997. The impact of Minimum Wages in Mexico and Colombia. *Journal of Labor Economics*, Vol.15, pp. S103-135.
- Currie, J., Madrian. B., 1999. Health, Health Insurance and the Labor Market, in: Orley Ashenfelter and David Card, (eds.), *Handbook of Labor Economics*, Volume 3C, Amsterdam: Elsevier Science, 3309-3416.
- DeLeire, T. Levy, H., 2004. Worker Sorting and the Risk of Death on the Job. *The Journal of Labor Economics*, Vol. 22, No. 4, October.

²¹ Marrufo (2001)

- Farne, S., 2003. Empleo y Seguridad Social en Colombia. in: Carrasco E. (Ed.), *Diez años del sistema de seguridad social colombiano: evaluación y perspectivas*, Universidad Externado de Colombia, Bogotá.
- Fullerton, D., Metcalf, G., 2002. Tax Incidence, in: *Handbook of Public Economics*, North-Holland, Amsterdam. V4, Ch 26.
- Gruber, J., Krueger, A. 1991. The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers' Compensation Insurance. In David Bradford, ed., *Tax Policy and the Economy*. Cambridge: MIT Press.
- Gruber, J., 1994. The Incidence of mandated Maternity Benefits. *American Economic Review*, Vol. 84, No 3, June.
- Gruber, J., 1997. The incidence from Payroll taxation: Evidence From Chile. *Journal Of Labor Economics*, Vol. 15, No 3.
- Gruber, J., 1999. Public Health Insurance and Private Savings. *Journal of Political Economy*. Vol. 107, No. 6, part 1, December.
- Gruber, J., 2000. Payroll Taxation, Employer Mandates, and the Labor Market: Theory, Evidence and Unanswered Questions, in: W. Alpert and Woodbury S. (Eds.), *Employee Benefits and Labor Markets in Canada and the Unites States*. W.E. Upjohn Institute of Employment Research.
- Gruber, J., Madrian. B., 2002. Health Insurance, Labor Supply, and Job Mobility: A critical review of the literature. *NBER Working Paper* 8817, March.
- Hamermesh, D., 1979. New Estimates of the Incidence of the Payroll Tax. *Southern Economic Journal*, Vol 45, No. 4
- Heckman, J., Pages C., 2004. Law and Employment: Lessons from Latin America and the Caribbean. Chicago: University of Chicago Press.
- Hersch, J., 1998. Compensating Differentials for Gender Specific Job Injury Risks, *American Economic Review*, Vol. 88, No. 3, June.
- Hodrick, R., Prescott E., 1997. Postwar US Business Cycles: An Empirical Investigation, *Journal of Money, Credit and Banking*, 29.
- Jianakoplos, N., Bernasek, A., 1998. Are Women More Risk Averse?. *Economic Inquiry*, Vol. 36, No 4, October.

- Kesselman, J. 1997. *General Payroll Taxes: Economics, Politics, and Design*. Canadian Tax Foundation, Toronto.
- Kugler, A., 2000. *The Incidence of Job Security Regulations on Labor Market Flexibility and Compliance in Colombia: Evidence from the 1990 Reform*. Inter-American Development bank, Research Network Working Paper No R-393.
- Kugler, A., Kugler, M. 2003. *The Labor Market Effects of Payroll Taxes in a Middle-Income Country: Evidence From Colombia*. IZA Discussion Paper No. 852.
- Lopez, H., 2003. *Contribuciones e Impuestos Sobre la Nomina en Colombia*, in *Mision de Ingreso Publico*. Enero.
- Lora, E., Henao, M., 1997. *Colombia: The Evolution and Reform of the Labor Market*. *Labor Market in Latin America: Combining Social Protection with Market flexibility*, Brookings Institution Press.
- MaCurdy, T., Rapoport, D., 2003. *Understanding Health-Insurance Coverage of Low-Skilled Workers in the US and in California: Trading Wages for Insurance*. Sphere Institute, Study realized for the California HealthCare Foundation, January.
- Maloney, W., Nunez, J., 2001. *Measuring the Impact of Minimum Wages: Evidence from Latin America*. World Bank Policy Research Working Paper No. 2597, April.
- Marrufo, G. 2001. *The Incidence of Social Security Regulation: Evidence from the Reform in Mexico*. Ph.D Dissertation. University of Chicago.
- Ministerio del Trabajo y Seguridad Social 1997. *La no Afiliación y la Evasión en el Sistema General de Riesgos Profesionales por la Forma de Contratación y Propuesta para un Régimen Sancionatorio*. Informe Tecnico, Marzo.
- Mondino, G., Montoya, S., 2000. *The Effects of Labor Market Regulations on Employment Decisions by Firms: Empirical Evidence for Argentina*. Inter American development Bank, Research Network Working Paper No R-391.
- Olson, C. 2002. *Do workers Accept Lower Wages in Exchange for health Benefits?*. *Journal of Labor Economics*, Vol. 20, No. 2, pt. 2.
- Plaza, B. 1999. *Afiliación de población pobre al sistema de salud: el caso Colombiano*, Fundación Corona. Bogotá
- Summers, L. 1989. *Some Simple Economics of Mandated Benefits*. *American Economic Review* Vol. 79, No 2.

Uribe, C. 2002. La Reforma de Pensiones en Colombia y la Equidad de Genero. Serie Mujer y Desarrollo No. 41, CEPAL, Octubre.

Vargas, A., 2006. The Impact of Social Security Contributions on Employment Sector Choice and Hours Worked: Lessons from Colombia. Working Paper, University of Texas at Austin.