Pension Reform and Self-Employment in Latin America

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Abstract

Public pension systems in Latin America have historically suffered from low coverage, with a relatively small percentage of the labor force eligible for benefits in retirement. In recent years, many governments have implemented reforms aimed at expanding the percentage of citizens that are benefit-eligible. In this paper, we classify and evaluate pension reforms in four Latin American countries, focusing specifically on policies aimed at expanding coverage among the large share of Latin Americans that operate as self-employed workers. The reforms that we examine range from those linked to simplified tax regimes to those that provide pension-specific subsidies. With the exception of a 2006 reform in Costa Rica that subsidized pension contributions at progressive rates, we find no evidence that any of these reforms increased coverage. Our results highlight the opportunity costs to low-income workers of paying into the system, which include foregoing eligibility for less generous, non-contributory pensions.

JEL Codes: J26, J46, I38

Keywords: public pensions, Latin America, poverty alleviation, savings rates

1 Introduction

Public pension systems in Latin America have historically suffered from low coverage, meaning that a relatively small percentage of the labor force pays into the system through regular contributions and is eligible for benefits in retirement. The best available estimates suggest that only 45% of active workers are enrolled in public pension plans, while in most countries in the region less than 50% of the elderly collect a pension from a contributory system[1] (OECD/IDB/The World Bank, 2014). With approximately 130 million workers without savings for their retirement (OECD/IDB/The World Bank, 2014), the low coverage of pension systems represents one of the most significant public policy challenges facing Latin America.

As public pension schemes are frequently among the largest government transfer programs and means of redistribution, the low levels of coverage represent a key missing link in efforts to combat inequality and alleviate poverty. Lack of pension coverage is especially pronounced among those with low-income and low educational attainment (Salazar-Xirinachs and Chacaltana, 2018; OECD/IDB/The World Bank, 2014). Pension coverage in the lowest income quintile has been below 10 percent for most countries in the region, but nearly 60 percent for those in the highest income quintile (Ribe, Robalino and Walker, 2010). Inequalities in pension coverage also exacerbate inequalities in other dimensions; urban workers are three times more likely to be covered than rural workers (Ribe, Robalino and Walker, 2010), while coverage rates of males in some countries range from 50 to 100 percent higher than those of females (Bosch, Melguizo and Pagés, 2013).

Part of the reason that coverage has remained a significant challenge for the region is that a large share of Latin America's labor force consists of self-employed workers. This category includes temporary and part-time laborers such as agricultural workers, food sellers, street vendors, domestic workers, and babysitters. Self-employed workers do not earn regular paychecks from an employer, which renders the traditional method of collecting pension contributions through payroll taxes an ineffective mechanism to ensure compliance. As a

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[1]Contributory systems are those that workers have paid into, usually through payroll deductions.

result, the issue of low pension coverage has historically been more acute for this group, further exacerbating income disparities (Bosch, Melguizo and Pagés, 2013; Cetrángolo et al., 2014; OECD/IDB/The World Bank, 2014).

In the last few decades, policymakers have addressed the issue of low coverage by engaging in several waves of reform. One line of reform has attempted to address the issue by implementing or expanding non-contributory pension systems (Kemmerling and Neugart, 2019). These systems provide urgent relief to the large number of retirees who neither earn regular income nor qualify for benefits under the contributory regime. However, benefits in the non-contributory systems tend to be low and do not fully mitigate lack of access to the contributory regime (Rofman, Apella and Vezza, 2015). An alternative line of reform has seen the creation of programs that incentivize self-employed workers to join contributory systems. This approach provides access to more generous retirement benefits than those available through non-contributory systems and has the potential to effect more systematic poverty alleviation. Our analysis focuses on the impact of these reforms, and in particular on the distribution of benefits across income groups.

In this study we begin by categorizing pension reforms that have occurred across the region. We classify the reforms into two groups. The first group involves reforms that link pension contributions with simplified tax regimes (STR). STR are alternative taxation mechanisms that allow taxpayers below certain income thresholds to submit a heavily subsidized monthly payment in lieu of most tax obligations. The second group consists of reforms that offer subsidies specifically intended to incentive workers to join contributory pension systems. While the two groups differ in their approach, both aim to expand coverage of the self-employed.

After discussing our classification scheme, we go on to analyze four reforms in detail. To our knowledge, we are the first to conduct a comprehensive analysis of multiple reforms from across the region. To do so, we draw on the Inter-American Development Bank's harmonized household surveys of Latin America, a database containing information on individual-level

pension coverage and more than 35 million observations. Using a series of difference-in-difference designs, we ask whether these different reforms have succeeded in increasing enrollment in contributory pension systems and thereby increasing savings rates. Our results indicate that reforms in Brazil and Uruguay involving simplified tax regimes have had no success in increasing coverage. Pension specific subsidies, on the other hand, show some evidence of success. A 2006 reform in Costa Rica involving a progressive subsidy increased coverage by 6-12 percentage points, an effect that persisted for at least three years. Chile too saw initial success with a pension-specific subsidy, increasing coverage by 5 percentage points one year after the reform, however the effect disappeared as the amount of the subsidy was reduced over time.

The results for Chile and for the reforms featuring simplified tax regimes highlight an important feature of public pension systems in Latin America: the large indirect costs that low-income workers incur when enrolling in contributory pension systems (Bosch and Campos-Vazquez, 2014; Bosch and Guajardo, 2012; Frölich et al., 2014; Montoya et al., 2018; Levy, 2010). In most cases, workers lose eligibility for non-contributory pensions when they enroll in the contributory ("formal") system. Despite the substantially lower benefits offered by non-contributory systems, for the poorest workers who face shorter life spans and a high marginal propensity to consume, the opportunity costs of enrolling in the contributory system likely factor heavily in the decision whether to enroll.

Although there exist a number of previous studies examining pension reforms targeting self-employed workers in Latin America, many of these studies are descriptive in nature, and to our knowledge none compare different types of reforms across the region. Several Spanish-language reports purport to show that millions of taxpayers have joined STR in Argentina, Brazil, and Uruguay (Amarante and Perazzo, 2013; Costanzi, Barbosa and Ribeiro, 2011; Cetrángolo et al., 2014). Other studies suggest a modest increase in pension enrollment after reforms in Chile and Colombia (López-Piñeros and Sarmiento, 2019; Mesa-Lago, 2015). However, as these works lack causal research designs, we approach their findings with caution.

The paper proceeds as follows. Section 2 provides an overview of public pension systems in Latin America and introduces a typology of reforms. Section 3 provides a simple conceptual framework for understanding the decision that workers face when they choose whether to participate in a contributory pension system. Sections 4 and 5 describe the data and methods respectively. Section 6 presents our empirical findings, heterogeneity results, and robustness tests. In section 7, we explain the models we draw on to make sense of our results and provide a discussion of possible mechanisms. Section 8 concludes.

2 Background on pension systems and pension reforms in Latin America

2.1 Overview of pension systems

Since the first public pension systems in Latin America were established almost a century ago, governments followed what is often described as the Bismarckian approach. Bismarckian systems are those with a strong linkage between earnings and benefits, which consequently lead to higher inequalities and lower coverage (Schludi et al., 2005). These reforms were introduced with an operational emphasis on payroll deduction at a time when the proportion of wage-earners - as compared to agricultural or self-employed workers - was low in Latin American economies. The resulting low coverage was not considered a key issue as "policy makers assumed that, as the region's economies developed, the majority of the labor force would come to be working in formal salaried jobs so that contributions could be enforced" (Ribe, Robalino and Walker, 2010).[2]

During the 1980s and 1990s, however, coverage remained persistently low. Low enroll-

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[2]Workers who are not enrolled in public pension systems are often defined as informal workers. However, definitions of informality vary, and some authors use the term to refer to workers who do not receive a regular salary or who do not have a contract with an employer. See Bosch, Melguizo and Pagés (2013) and OECD/IDB/The World Bank (2014) for a more detailed discussion of the competing definitions of informality. To avoid confusion, we refrain from referring to workers as "formal" or "informal" , except when referencing the findings of other authors or economic models that describe broad features of the labor market.

ment, as well as fiscal pressures resulting from the aging of the labor force, were the catalyst for a wave of reforms (Rofman, Apella and Vezza, 2015). Chile was the pioneer with a 1981 reform that transformed its pensions from a defined benefit to a defined contribution system in which resources were to be administered by private fund managers (Mitchell and Barreto, 1997). During the 1980s and 1990s more than half of all Latin American countries - Argentina, Bolivia, Colombia, Costa Rica, El Salvador, Ecuador, Mexico, Nicaragua, Panama, Peru, and Uruguay - followed the Chilean approach and approved reforms that moved pensions from defined benefit to defined contribution systems[3]. The expectation was that defined contribution systems would lead to higher enrollment by encouraging individuals to take ownership over their retirement accounts (De la Torre and Rudolph, 2018).

Unfortunately the series of reforms during the 1980s and 1990s failed to increase coverage. In fact, due to a multitude of factors including economic downturns and the loosening of labor laws, pension coverage fell in almost all countries in the region during the following two decades (Rofman, Apella and Vezza, 2015).

The issue of low coverage is particularly predominant among the self-employed. Figure 1a shows that while only one out of every three adults in Latin America contribute to public pension systems, that number drops to one out of every ten adults for those earning less than the minimum wage, a proxy for the number of self-employed. Moreover, coverage increased only slightly between 1998 and 2016. When we limit our observations to only those countries that report on self-employment, we see similar patterns.

Given the failure of this first wave of reforms to increase enrollment, a subsequent wave of reforms resulted in the creation or expansion of non-contributory pension systems. These systems provide limited retirement income to old-age adults who do not qualify for a pension under the contributory regime. The first countries in the region to establish modern non-contributory systems were Brazil and Bolivia in the 1990s, but these systems have expanded to at least ten other countries since 2001 (De la Torre and Rudolph, 2018). Non-

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[3]Reforms were approved but stopped before implementation in Ecuador and Nicaragua, and they have been reversed in Argentina, Bolivia, and Venezuela.

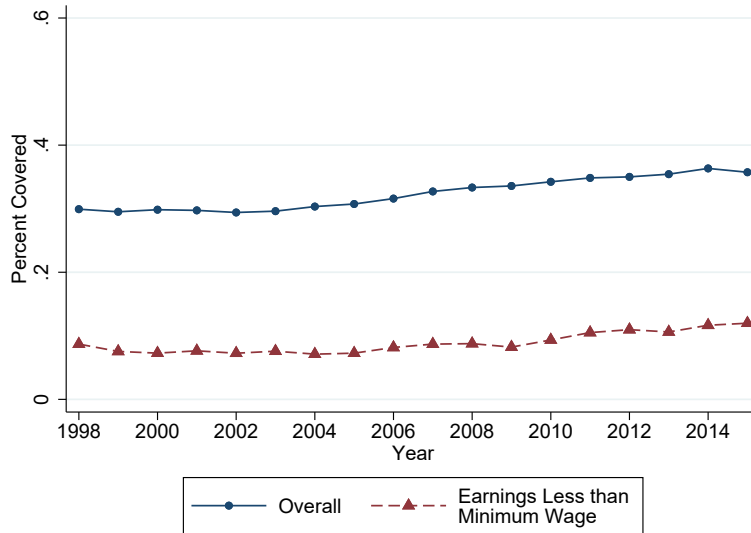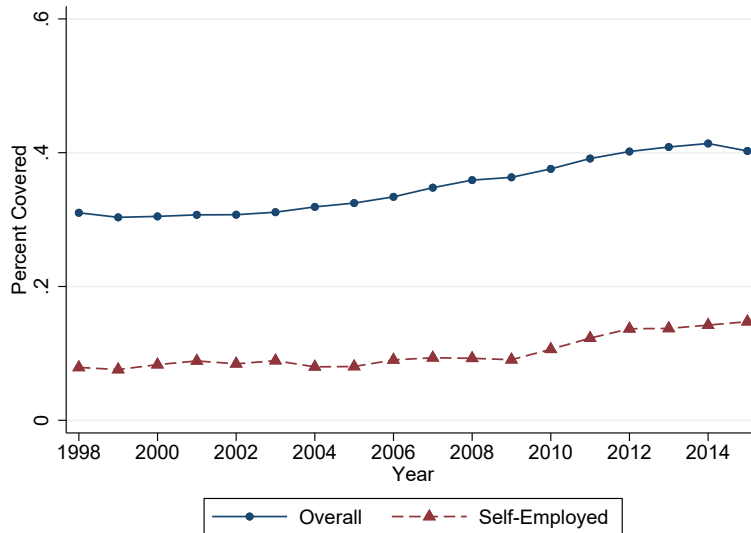**Figure 1a: Pension Coverage in Latin America - All Countries**

Figure 1b: Pension Coverage in Latin America - Countries that Report Self-Employment

Note: Covers survey respondents aged 16-65. The annual means are calculated first using within-country sample weights to determine the average coverage for each country, and then weighting each country by population size to determine the aggregate mean. To rectangularize the data, we impute missing values using linear interpolation. The data in Figure 1a reflect pooled survey respondents from the following 17 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, Paraguay, El Salvador, Uruguay, and Venezuela. The data in Figure 1b reflect pooled respondents from the following 9 countries that report on self-employment: Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Panama, El Salvador, and Uruguay.

contributory schemes provide relief to those who reach retirement without access to other pensions, but are not intended to replace contributory systems. For one thing, benefits are significantly lower than those from contributory systems, typically equivalent to less than half of the income needed to reach the poverty line (Rofman, Apella and Vezza, 2015). Second, non-contributory systems are a more significant drain on state finances, and as such, governments have a strong incentive to enroll workers in the contributory system. Nevertheless, as non-contributory benefits are only available to those who do not qualify for benefits under contributory schemes, there is an opportunity cost to workers - particularly those at the bottom of the income scale - to enrolling in contributory systems. Previous studies show that this trade-off between contributory and non-contributory systems is significant. For example, non-contributory programs have been linked to reductions in enrollment in contributory systems in Argentina (Bosch and Guajardo, 2012) and Mexico (Levy, 2010).

2.2   Typology of pension reforms

In the past 20 years, multiple Latin American countries have introduced a wide range of reforms. Some of those reforms have a narrow scope (such as those targeting only housemaids or agricultural workers), while others target a broader group of self-employed individuals. This study focuses on broad reforms that have encompassed all types of self-employed workers and categorizes those reforms into two groups: those where pension contributions are linked to simplified tax regimes (STR) and those with pension-specific subsidies. In this section, we classify reforms from across Latin America. In the following sections, we narrow our focus to four specific reforms.

Contributions linked to simplified tax regimes

Multiple countries in Latin America have introduced simplified tax regimes to encourage small businesses and self-employed workers to join the formal economy by complying with their tax obligations. STR often operate by allowing taxpayers who lie below an income threshold to submit one fixed monthly payment that meets their obligations for multiple taxes. For example, the Ecuadorian STR allows retailers who earn less than US$5,000 annually to submit a monthly payment of US$1.32 to cover their obligations for income and value-added taxes at the same time (Azuara Herrera et al., 2019).

While many Latin American countries have introduced simplified tax regimes, only Argentina, Brazil, Mexico, and Uruguay have linked the pension contributions of self-employed workers to their STR [4]. Table 1 summarizes the main characteristics of the reforms in these four countries. The most common model is to embed pension contributions within the recurrent, often monthly, obligations of the STR. This means that taxpayers who comply with their monthly obligation for the STR do not need to submit any additional payment to the social security system. Uruguay's Monotributo serves as an example of this approach. In order to qualify for the Monotributo one must be a self-employed worker selling goods exclusively to final consumers that total no more than $737,033 Uruguay Pesos annually. The self-employed individual must submit a monthly payment of $1,574 Uruguay Pesos that accounts for income taxes, the value-added tax, and a pension contribution. Payments under the Monotributo are heavily subsidized: in 2011, those enrolled in the Monotributo paid somewhere between 8-49% of the amount they would pay under regular tax and pension rules (Amarante and Perazzo, 2013).

The reforms in Argentina and Brazil, - known as Monotributo and SIMPLES Nacional, respectively - are similar to that of Uruguay, as pension contributions are embedded within the STR payment in all of them. In Brazil's case, self-employed workers may choose an

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[4]While some of those enrolled in Ecuador's STR are eligible for a subsidy, the subsidy is not available to the self-employed.

Table 1: Reforms that Link Pension Contributions to Simplified Tax Regimes

Country	Year	Simplified Tax Regime	Pension Contributions
Argentina	2004	Available for self-employed workers and micro- and small-businesses under certain income thresholds and meeting additional criteria. Covers income and value-added taxes.	Embedded within STR payment.
Brazil	2007	Available for self-employed workers and micro- and small-businesses under certain income thresholds and meeting additional criteria. Covers federal income tax and federal, state, and municipal sales taxes. Self-employed workers may choose an alternate system that lowers pension contributions but does not subsidize other taxes.	Embedded within STR payment.
Mexico	2014	Available for self-employed workers under certain income thresholds and meeting additional criteria. Provides a discounted tax rate for certain taxes, such as value-added and corporate taxes.	Gradually decreasing subsidy for those enrolled in the STR. Starts at 50% of the pension contribution and decreases by 10 percentage points every other year (lasts for 10 years).
Uruguay	2008	Available for self-employed workers, small partnerships, and small family businesses under certain income thresholds and meeting additional criteria. Covers all national taxes.	Embedded within STR payment.

Table 2: Reforms that Subsidize Pension Contributions

Country	Year	Reform
Chile	2009	Available for self-employed workers regardless of income. Makes contributions mandatory for self-employed workers (after a transition period) and provides a subsidy that reduces the percentage of income that is used for calculating pension contributions.
Colombia	2013	Available for self-employed workers earning less than the minimum salary. Provides a matching contribution to self-employed individuals who earn less than the minimum salary. This defined contribution scheme is independent from the one used by regular employees.
Costa Rica	2006	Available for self-employed workers regardless of income. Makes contribution mandatory for self-employed individuals (after a transition period) and provides a progressive subsidy that reduces the percentage of income that must be paid for pension contributions.
Peru	2013	Available for self-employed workers regardless of income. Makes contribution mandatory for self-employed individuals and provides a subsidy that reduces the percentage of income that must be paid for pension contributions. This was a transitory system that lasted for three years.

alternate program, the Plano Simplificado de Previdência Social, which became functional the same year as the SIMPLES Nacional, and consequently we analyze the combined affect of the two reforms.[5] Pension contributions in Mexico are not embedded within the monthly STR payment, but the Mexican government provides a subsidy to those enrolled in the STR to incentivize them to contribute to their pensions.

Subsidized contributions

A total of four Latin American countries have implemented reforms that provide pension-specific subsidies for the self-employed. The reforms vary according to the progressivity of the contribution rates as well as whether or not enrollment in the system was mandated. Table 2 summarizes the main characteristics for each.

Reforms in Chile, Costa Rica, and Peru introduced subsidies that reduced nominal contributions at the same time as they made it unlawful for the self-employed not to enroll and

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[5]Unlike the SIMPLES Nacional, the PSPS does not subsidize tax obligations, but only allows the self-employed to pay a lower pension contribution rate. All self-employed workers are allowed to join the PSPS, regardless of income.

contribute to the public pension system[6]. Despite making pension contributions mandatory for self-employed workers, previous evidence from Latin American countries suggests that governments have a very limited capacity to enforce this type of mandate (Bertranou, 2007). In Peru and Chile, the reforms *temporarily* lowered the contribution rate for all self-employed workers. In Costa Rica, the contribution schedule was altered permanently and made more progressive whereby lower-income self-employed workers had a lower contribution rate than salaried workers. The reform in Colombia, known as Beneficios Económicos Periódicos, was the only one of the four reforms not to come with a mandate.

3   Conceptual Model

Self-employed workers considering whether to participate in a contributory pension system must decide whether the increase in lifetime utility they expect to receive from participating in the pension system exceeds the decreased utility from the loss in current income. Since pensions can be considered long-life insurance, the demand for pension benefits can be thought of as a demand for insurance (Fitzpatrick, 2015). To formalize the decision problem that workers face, we define a vector ξ to include the characteristics of individuals that are associated with their demand for pension benefits. For example, individuals differ in their risk preferences, financial resources, and expectations about retirement timing, mortality, future earnings, and the health of the pension system. The distribution of these characteristics in the population is $G(\zeta)$. The utility to worker i of paying into the pension system is $v^y(\zeta_i, p)$, while the utility associated with not paying into the pension system is $v^n(\zeta_i)$. A worker will pay into the system if $v^y(\zeta_i, p) > v^n(\zeta_i)$.

To simplify further, assume that a worker expects to be n years away from retirement, and n+ r years away from death. In this case, the worker compares the present discounted

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[6]In Chile, contributions by the self-employed were set to become mandatory in 2015, but the requirement was postponed multiple times. Self-employed workers earning less than the monthly minimum salary were not required to contribute.

value of the pension benefits she can expect to receive with the present discounted value of the contributions she pays into the system:

$$NPV_i = \sum_{t=0}^{n} \frac{B_{it}}{(1 + \partial_i)^t} - \sum_{t=n+1}^{n+r} \frac{C_{it}}{(1 + \partial_i)} \tag{1}$$

where B represents the expected increase in pension benefits in retirement, C represents the expected contributions (along with any additional indirect costs, such as foregoing eligibility for other benefits), and ∂ is the private, risk-adjusted discount rate.

Under a simple two period consumption model, we can express a worker's budget constraint as

$$C_1 + \frac{C_2}{1 + \partial} = Y_1 \tag{2}$$

where C_1 represents consumption during the working years, C_2 represents consumption in retirement, and Y_1 is a workers lifetime income, earned entirely during the working years. Rearranging terms, we can express the discount rate as:

$$\partial = \frac{Y_1 - C_2}{C_1} - 1 \tag{3}$$

where a worker's private discount rate will be a function of their willingness to trade off consumption during their working years for consumption in retirement.

The model highlights the challenge facing policymakers. For workers at or near the poverty line, their marginal utility of consumption – and consequently their discount rate – is high. Hence, the present discounted value of the pension benefits they could accrue will only exceed the present discounted value of the costs if the value of those benefits is high and/or the time horizon of their working years is short.

4   Data

To evaluate these various reforms, we draw on household survey data that have been harmonized and made available by the Inter-American Development Bank (IADB). The data consist of individual-level responses drawn from household surveys conducted annually by each national government. The IADB collects the data directly from the national statistics office in each country and harmonizes it with the aim of facilitating cross-country comparisons. The data consist of more than 35 million observations and include 150 variables that cover demographic, educational, labor, income, and housing characteristics, providing a unique opportunity to analyze public pension reforms across all of Latin America.

The use of household survey data has become increasingly common in studies of Latin American public pension systems. Recent examples include Abramo, Cecchini and Morales (2019), Amarante and Perazzo (2013), Castelao Caruana (2016), Da Costa et al. (2011), and Rofman, Apella and Vezza (2015). The main advantage of the surveys is that they allow researchers to link pension enrollment with individual-level demographic and economic characteristics that are otherwise unavailable in fragmented administrative records (Rofman, Lucchetti and Ourens (2010); Bertranou (2007)). The disadvantage is that surveys inevitably differ from country to country and some do not properly cover non-salaried workers. In addition, the surveys are repeated cross-sections and do not follow the same individuals over time.

As a result of data quality issues, we are limited to analyzing reforms from four countries. From the first group of reforms, those that link pension contributions to STR (Table 1), we analyze the cases of Brazil and Uruguay. We exclude Argentina and Mexico as surveys in both countries do not ask the self-employed whether they contribute to the public pension system. From the second group of reforms, those that subsidize pension contributions, we analyze Chile and Costa Rica. We are forced to exclude Colombia because of limitations in its survey question about pensions and Peru because of a lack of data on self-employment.

Table 3: Description of Treatment and Comparison Groups

Policy Type	Country	Year of Reform	Treatment Group	Comparison Group
Simplified Tax Regime	Brazil	2007	The self-employed.	Salaried employees in medium or large businesses.
	Uruguay	2008	The self-employed	All salaried employees.
Pension-Specific Subsidies	Chile	2009	The self-employed.	All salaried employees, excluding workers aged 18-35 and earning no more than 150% of minimum wage.
	Costa Rica	2006	The self-employed	All salaried employees.

Note: In Brazil the reform was passed late in 2006 and went into effect on January 1, 2007. In Uruguay, the reform took effect in mid-2007, and consequently we drop 2007 and use 2008 as the first post-treatment year. In Chile, the reform went into effect on January 1, 2009. In Costa Rica, the reform passed in 2000, but took several years to go into effect. Based on subsidy rates published by the social security administration, we treat October 1, 2005 as the start-date, and consequently we drop 2005 from the analysis and use 2006 as the first post-treatment year.

5 Methods

Because our time-series cross-sectional data includes observations from before and after each reform, and because there are subgroups within each country that are unaffected by the reforms, our empirical approach is to estimate a series of difference-in-differences designs. Table 3 summarizes the details of our analysis for each country, including the choice of treatment and comparison groups, as well as year of the reform.[7] In each country the treatment group consists of the self-employed, which in almost every case was the intended target of the reforms.[8] The comparison group consists of a subgroup unaffected by the reform, usually salaried employees.

For each country, we estimate a model of the following form:

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[7] We drop country-years in which a reform was implemented mid-way through the year. This includes Costa Rica in 2005 and Uruguay in 2007.

[8] In the case of Brazil, the reform also affected salaried workers in small businesses. However, an alternative definition of the treatment group that includes these workers yields results that are very similar to those that we report in the next section.

$$Y_{it} = \beta_0 + \beta_1 treat_i + \alpha post_t + \theta(treat * post)_{it} + \gamma Z_{it} + \phi_i + \varepsilon_{it} \qquad (4)$$

where *treat* indicates that an individual was part of the group targeted by the reform (self-employed), *post* represents a vector of indicator variables for each post-treatment year, Z represents a vector of time-varying coefficients, ϕ represents regional fixed effects, and θ is a vector representing the coefficients of interest, the interaction between the treatment group and the post-treatment period, as measured one, two, and three years post-reform. The main identification assumption is that the treatment and comparison groups follow parallel trends.

To account for any potential differences in pre-treatment trends, we pursue two other modeling approaches. First, we estimate specifications that model pre-treatment trends separately for the treatment and comparison groups. These models take the form:

$$Y_{it} = \beta_0 + \beta_1 treat_i + \alpha post_t + \theta(treat * post)_{it} + \beta_2 time_t + \beta_3 (treat * time)_{it} + \gamma Z_{it} + \phi_i + \varepsilon_{it} \quad (5)$$

where *time* represents a linear time trend. This specification accounts for any bias arising from pre-trend differences so long as those pre-trend differences can be modeled linearly. Once again, the coefficients of interest are contained in θ, which represent the treatment effect as measured separately for the three years post-reform.

We also pursue a matching strategy. Equating the treatment and comparison groups in observables should reduce any pre-treatment imbalance. To match observations, we use coarsened exact matching, in which each treatment observation is paired with corresponding comparison observation that are perfect matches within certain strata of a set of matching variables (Blackwell et al., 2009; Iacus, King and Porro, 2012). In addition to the time period, we match on education and age, two variables that should be highly correlated with the decision to engage in self-employment.

Table 4: Summary Statistics

	Brazil			Uruguay			Chile			Costa Rica		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Enrolled in Pension System (Yes = 1)	0.24	0	0.43	0.49	0	0.50	0.60	0	0.49	0.62	1	0.48
Self-Employed (Yes = 1)	0.22	0	0.41	0.22	0	0.42	0.20	0	0.40	0.19	0	0.39
Gender (Male = 1)	0.49	0	0.50	0.47	0	0.50	0.48	0	0.50	0.49	0	0.50
Age	30	27	21	36	34	23	32	29	21	30	26	21
Marital Status (Married = 1)	0.51	1	0.50	0.47	0	0.50	0.42	0	0.49	0.47	0	0.50
Years of Education	5.7	5	4.8	7.8	7	4.5	8.2	8	5.1	6.6	6	4.8

Note: Data come from the Inter-American Development Bank's Harmonized Household Surveys of Latin America and the Caribbean, 1990-2016. N = 7,978,747 (Brazil), 2,483,390 (Uruguay), 2,460,745 (Chile), 1,109,343 (Costa Rica). Summary stats use sample weights.

One challenge for difference-in-difference estimation is constructing the appropriate standard errors for inference (Bertrand, Duflo and Mullainathan, 2004). In this case, we do not have a true panel in which the same units are sampled repeatedly, but instead random samples of the population over time. To account for potential serial correlation, we cluster over the political-administrative regions in each country, which are used as a basis for sampling frequency.[9]

6   Results

Table 4 present summary statistics for the four countries we analyze.In Figure 2, we plot pension coverage for each country over time. The figure breaks down workers into four different categories: employer, (salaried) employee, self-employed, and unemployed. We use these categories to form the treatment and comparison groups, which we plot separately in Figure 3. The treatment groups, consisting of the self-employed, have significantly lower coverage than the comparison groups, in some cases by as much as 50 percentage points. Nevertheless, all four countries show reasonably parallel trends prior to the reforms, which are indicated by the vertical line. Statistical tests confirm that there are no statistically significant pre-trend differences in the three years prior to the reform.[10]

6.1   Placebo Tests

Before we present our main results, we conduct various tests to validate our empirical strategy. One concern with estimating a difference-in-differences model using time-series cross-sectional data rather than true panel data is that the composition of the treatment and

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[9]There are 27 regions in Brazil, 15 in Chile, 7 in Costa Rica, and 19 in Uruguay. Costa Rica builds its sampling from six socioeconomic regions that do no precisely match the provinces, however there is substantial overlap.

[10]The p-values are as follows: 0.50 (Brazil), 0.45 (Uruguay), 0.46 (Chile), 0.44 (Costa Rica).

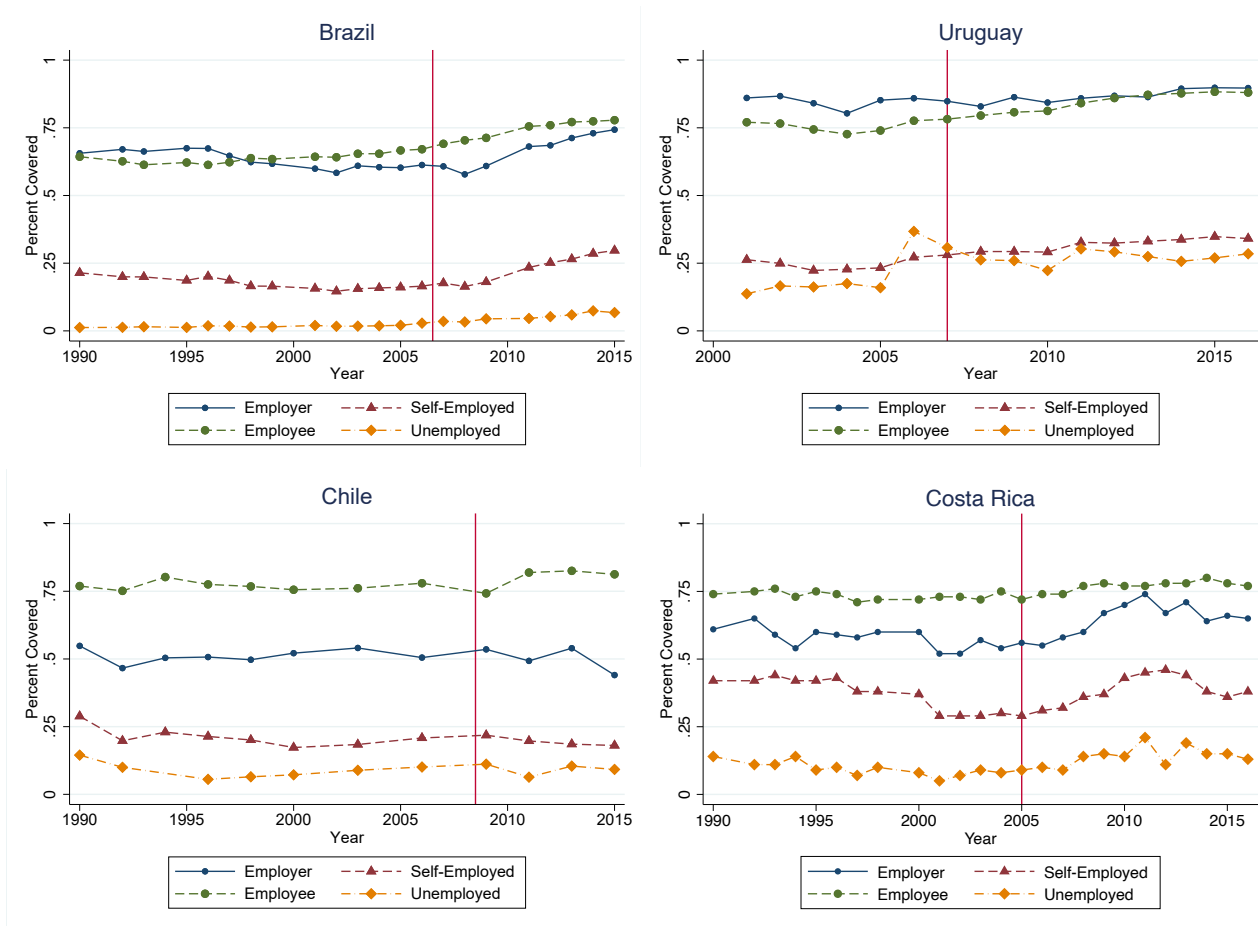# Figure 2: Coverage by Employment Categories

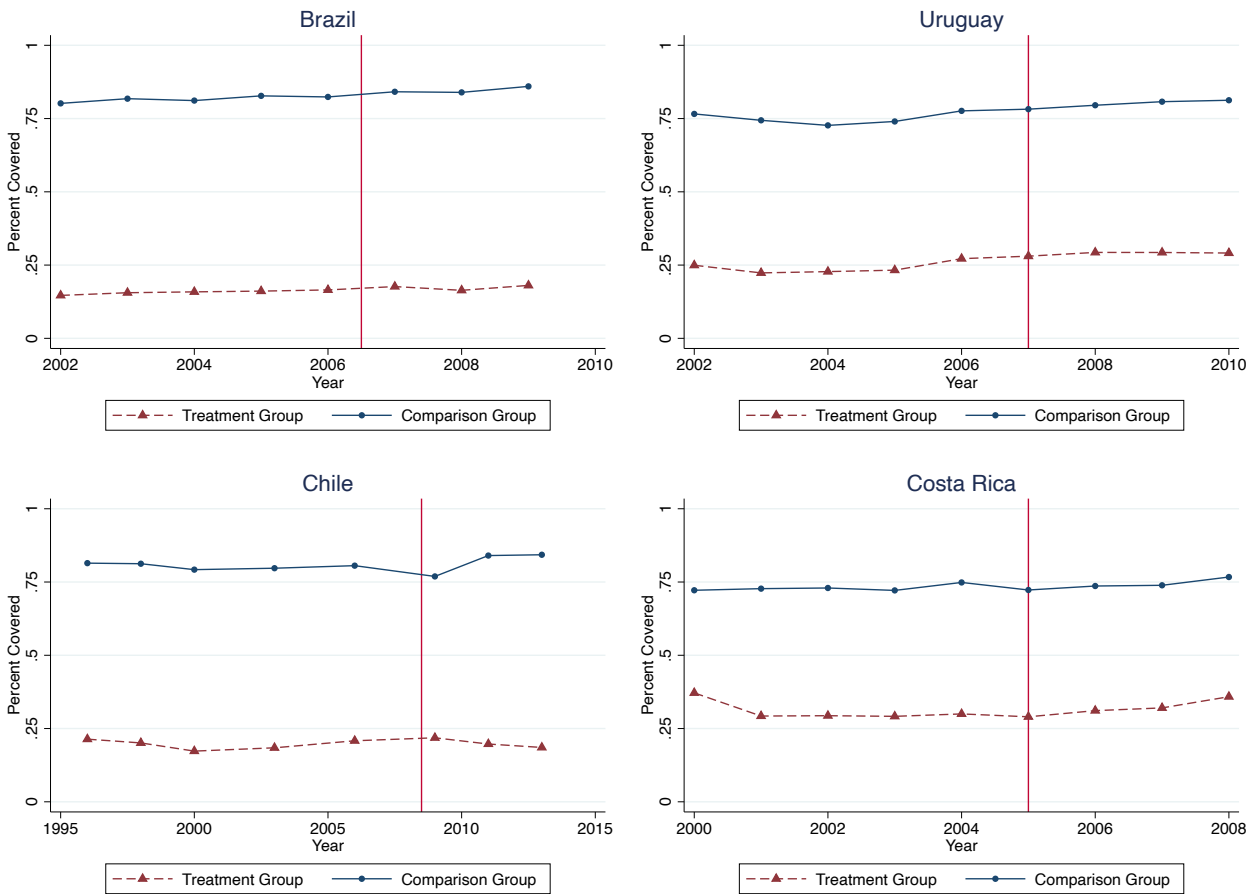# Figure 3: Treatment and Comparison Groups Over Time

Table 5: Placebo Tests

Policy Type	Country	(1) Time Placebo	(3) Treatment Placebo
Simplified	Brazil	0.004	-0.022
Tax Regimes		(0.006)	(0.013)
	Uruguay	0.000	-0.058**
		(0.017)	(0.020)
Pension-Specific	Chile	0.010	0.041
Subsidies		(0.022)	(0.021)
	Costa Rica	0.015	0.021
		(0.012)	(0.015)

Note: **$p < 0.01$, *$p < 0.05$. Columns 1-2 show the results from a placebo test in which t-1 is treated as the treatment year. Columns 3-4 shows the results from a placebo test where survey respondents who identify as "employers" are labeled as the treatment group instead of those affected by the reform. The treatment placebo shows results for year t+1. The dependent variable is a binary variable indicating whether or not a worker is enrolled in the pension system. All specifications include regional fixed effects, linear time trends, and five periods of pre-treatment observations. Covariates include gender, marital status, age, and education level. Regressions use samples weights. Standard errors clustered by region.

comparison groups may not be stable, i.e. individuals may shift between groups. For example, if a large number of workers in the formal sector decide to become self-employed as a result of a pension reform, our estimates would overstate the treatment effects. Although the historical record suggests that a shift of this kind is unlikely, we investigate the possibility by first plotting in Figure A1 the percentage of the workforce that consists of self-employed and employed (i.e. salaried) workers. The two excluded categories are unemployed and employers, which constitute between 5-15% of the workforce. The figure shows a remarkable degree of stability in the two groups, with no indication of shifts corresponding to the dates of reform, indicating that our results are unlikely to be biased by compositional shifts.

Next, we further validate our methods by conducting two placebo tests. In the first test, we treat t-1 as the first post-treatment year and keep all other aspects of our analysis the same. If the test indicates statistically significant treatment effects in year t-1, it would suggest bias in our empirical approach. In the second test, we replace our treatment group with an alternative treatment group consisting of survey respondents that identify as employers ("patrones"), a group that would not have been affected by the reform. As in the first test, a statistically significant result would indicate potential bias in our approach.

The results are presented in Table 5. The first column presents the results of the first test,

using a full set of covariates and five years of pre-treatment observations, while the second column presents the results of the second test. Out of the 8 tests (2 tests for each country), only one produces statistically significant estimates: the second placebo test for Uruguay, in which employers are treated as the treatment group.[11] Although this causes us to approach any findings for Uruguay with some caution, in general the tests give us confidence that our empirical strategy is valid.

6.2 Main Results

We present the results of our difference-in-differences analyses in Table 6. Table A1 presents the results of the matching analysis; as the results for the matched treatment and comparison groups are extremely similar to our main estimates, we confine our discussion to the results without matching. Table 6 presents results for three different specifications: the baseline specification (equation 4) without covariates, the specification with linear pre-trends (equation 5), and the specification with linear pre-trends and a full set of covariates. The covariates include gender, marital status, age, and education level.[12] Results are presented separately for one, two, and three years post-treatment (t+1, t+2, and t+3).

According to Table 6, there is no indication that simplified tax regimes had any effect on coverage in Brazil or Uruguay, with the exception of a small (2 percentage point) negative effect on Brazil in year t+3. On the other hand, pension subsidies did appear to have effects on Chile and Costa Rica. In the case of Chile, the reform increased coverage by 5-6 percentage points in t+1, had no effect in t+2, and decreased coverage by 5-6 percentage points in t+3. In Costa Rica, there is evidence of a more sustained positive effect, with positive and statistically significant coefficients in each of the three years.

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[11]Further analysis shows that there are differential pre-trends in the alternative treatment and comparison groups, suggesting that this placebo test may not be suitable for Uruguay. If we instead use an alternative treatment group consisting of employees that work in medium-size firms and an alternative comparison group of employees that work in large firms, we obtain a (positive and) statistically insignificant coefficient of 0.016.

[12]The specifications for Brazil do not include marriage status as that variable is missing for several years of the country's surveys.

Table 6: Difference-in-Difference Results

Policy Type	Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			t+1			t+2			t+3	
Simplified Tax Regimes	Brazil	-0.006	-0.004	-0.007	-0.017	-0.014	-0.020*	-0.021**	-0.017**	-0.024**
		(0.006)	(0.005)	(0.005)	(0.010)	(0.010)	(0.010)	(0.007)	(0.005)	(0.005)
	Uruguay	0.004	-0.003	0.001	-0.009	-0.018*	-0.008	-0.014	-0.026	-0.019
		(0.005)	(0.009)	(0.008)	(0.009)	(0.007)	(0.008)	(0.010)	(0.016)	(0.014)
Pension-Specific Subsidies	Chile	0.058**	0.052**	0.051**	-0.034	-0.041	-0.045	-0.049**	-0.057**	-0.051**
		(0.013)	(0.010)	(0.010)	(0.016)	(0.026)	(0.023)	(0.008)	(0.016)	(0.014)
	Costa Rica	0.014	0.069**	0.058**	0.020	0.094**	0.062*	0.029*	0.122**	0.097**
		(0.011)	(0.014)	(0.013)	(0.012)	(0.015)	(0.015)	(0.011)	(0.016)	(0.019)
	Time Trends	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
	Covariates	No	No	Yes	No	No	Yes	No	No	Yes
	# Pre-Treat Obs	3	5	5	3	5	5	3	5	5

Note: **p $<$ 0.01, *p $<$ 0.05. Dependent variable is a binary variable indicating whether or not a worker is enrolled in the pension system. All specifications include regional fixed effects. Covariates include gender, marital status, age, and education level. Number of pre-treatment observations represents the number of pre/post-treatment years, except for Chile which only reports data every 2-3 years. Regressions use samples weights. Standard errors clustered by region.

While the magnitude of the effect is somewhat sensitive to the choice of specification, in the regressions that include both covariates and time trends, the coefficients range from an increase of 6 percentage points in years t+1 and t+2 to 10 percentage points in year t+3. The results are visible in the upwardly trending treatment group visible in Figure 3.

6.3   Heterogeneity

To understand whether the reforms had a differential impact on certain segments of the population, and as a guide to possible mechanisms, we divide the sample into various sub-groups. First, we divide the sample according to age, gender, marital status, and years of education. Younger workers are farther from retirement and so may be less likely to react to inducements to save relative to older workers. Women live longer and face a greater role in child-rearing and thus may have a higher propensity to save. Workers who are married may be less likely to enroll in a pension if their partner is already enrolled or the household has some alternative means of saving. More educated workers are more likely to be able to navigate paperwork requirements.

The results are presented in Table 7 for t+1. Although Chile shows numerous significant coefficients, consistent with the overall positive effect for that year, there are no large differences across subgroups. In Costa Rica, however, there are some significant differences according to marital status and education. Coverage increases by 7.6 percentage points among those who are married, while there is no statistically significant increase among the unmarried. Those with more education (> 4 years) also see an increase of 5.5 percentage points, while there is no statistically significant effect among those with less education. In both cases, the difference between the subgroups is statistically significant at the 1 percent level.

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Table 7: Heterogeneity

Policy Type	Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Age		Gender		Marital Status		Years of Education	
		< 30	> 30	M	F	No	Yes	< 4	> 4
Simplified	Brazil	-0.011	-0.004	-0.002	-0.017	n/a	n/a	-0.009	0.001
Tax Regimes		(0.007)	(0.007)	(0.005)	(0.008)	n/a	n/a	(0.009)	(0.008)
	Uruguay	-0.010	0.010	0.018	-0.011	-0.016	0.014	0.026	-0.005
		(0.013)	(0.009)	(0.013)	(0.013)	(0.011)	(0.008)	(0.027)	(0.012)
Pension-Specific	Chile	0.030	0.055**	0.051**	0.050**	0.044*	0.050**	0.051	0.055**
Subsidies		(0.026)	(0.010)	(0.010)	(0.014)	(0.020)	(0.009)	(0.032)	(0.010)
	Costa Rica	0.079*	0.055**	0.055**	0.040	0.015	0.076**	0.018	0.055**
		(0.032)	(0.012)	(0.014)	(0.024)	(0.027)	(0.019)	(0.030)	(0.009)

Note: **$p < 0.01$, *$p < 0.05$. Dependent variable is a binary variable indicating whether or not a worker is enrolled in the pension system in year t+1. All specifications include regional fixed effects, linear time trends, and five periods of pre-treatment observations. All specifications include the following covariates, except where used to split the sample: gender, marital status, age, and education level. Regressions use sample weights. Standard errors clustered by region.

Table 8: Heterogeneity by Income Quartile

Policy Type	Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Income Quartiles				Income Quartiles				Income Quartiles			
		t+1				t+2				t+3			
		Lowest			Highest	Lowest			Highest	Lowest			Highest
Pension-Specific	Chile	0.006	0.085**	0.036*	0.042	-0.108**	-0.008	-0.054*	-0.027	-0.127**	-0.044	-0.046*	-0.025
Subsidies		(0.018)	(0.020)	(0.016)	(0.021)	(0.020)	(0.027)	(0.024)	(0.033)	(0.036)	(0.034)	(0.016)	(0.014)
	Costa Rica	0.004	0.089	0.084	-0.029	-0.011	0.074	0.066	0.058	0.016	0.054	0.082	0.129**
		(0.021)	(0.044)	(0.052)	(0.025)	(0.023)	(0.033)	(0.048)	(0.040)	(0.024)	(0.061)	(0.052)	(0.046)

Note: **$p < 0.01$, *$p < 0.05$. Dependent variable is a binary variable indicating whether or not a worker is enrolled in the pension system. All specifications include regional fixed effects, linear time trends, and five periods of pre-treatment observations. All specifications include the following covariates: gender, marital status, age, and education level. Regressions use sample weights. Standard errors clustered by region.

In table 8, we present results by income quartile, focusing only on Chile and Costa Rica, and we show results for all three post-treatment years. In almost every case, the effect on the highest income quartile is more positive than the effect on the lowest income quartile. For example, in Costa Rica the effect on the highest income quartile in t+3 is 12.9 percentage points, while the effect is 1.6 percentage points for the lowest income quartile. In Chile, the effect on the highest income quartile in t+3 is -2.5, while the effect is -12.7 percentage points for the lowest income quartile. Insofar as the pension reform was successful in Costa Rica, it succeeded in increasing coverage among higher income workers. Meanwhile, to the extent that the reform in Chile lowered coverage three years after the reform, coverage decreased the most among the lowest income workers.

7 Discussion

Our results suggest that pension reforms in Latin America have had limited success in increasing coverage of the self-employed. We find no evidence that reforms linking pension contributions to simplified tax regimes were successful in increasing coverage. Our findings for reforms involving pension-specific subsidies are mixed. In Chile, which offered a flat subsidy across income groups that faded out over time, coverage increased by 5 percentage points in the immediate wake of the reform before declining in the second and third years. In Costa Rica, which offered a progressive and more permanent subsidy, coverage increased by 10 percentage points three years after the reform. However, even in Costa Rica, which was the only country to see a sustained increase in coverage, the success of the reform can only be considered modest; more than 60% of self-employed-workers remained outside of the contributory system, and the reform succeeded only to the extent that contribution rates returned to the levels of the early 1990s.

In this section we draw from previous literature and our heterogeneity results to better explain and understand the relative failure of these reforms. Previous work has cited nu-

merous factors to explain the persistence of low savings rates in Latin America, foremost among which is the high discount rates of the self-employed. Workers with a higher marginal propensity to consume are less likely to enroll in a contributory system. As of 2015, the median salary of the self-employed in Brazil, Uruguay, Chile, and Costa Rica, was between 17 and 61% lower than that of salaried workers, suggesting that pension reforms face a high hurdle to overcome the low marginal propensity to save of self-employed workers.

Lower life expectancy may also decrease the present discounted value of benefits. Many countries pay benefits as an annuity rather than a lump sum, which is more costly for disadvantaged groups who may not live long enough to sufficiently realize the income flow (Gill et al., 2004).

In addition to factors that shrink the expected value of the benefits are the relatively high costs – both direct and indirect – of paying into the system. For low-income workers, contributions to a pension fund represent a non-trivial percentage of their earnings. For example, as of 2019 and after accounting for subsidies, a self-employed individual earning the minimum salary would have to contribute 5% of their income in Brazil, 9.6% in Chile and Uruguay, and 6.56% in Costa Rica. In contrast, that same individual would pay no income taxes in any of the four countries.

In addition to the direct costs of paying into the system, there are at least two significant indirect costs. One is the cost of complying with direct taxes (Loayza, Servén and Sugawara, 2009; Ulyssea, 2010; Slonimczyk, 2014). The most relevant tax is the value-added tax (VAT) which ranges from 13 to 22% in the four countries and which is estimated to have a 26% evasion rate throughout Latin America (Comisión Económica para América Latina y el Caribe , CEPAL). Even as the reforms in Brazil and Uruguay subsidized VAT and income tax payments, joining the simplified tax regime may have made it more difficult to under-report income and evade the VAT.

Another key indirect cost is foregoing eligibility for non-contributory pension systems. In all four countries, receiving a pension from the contributory system makes the retiree

Table 9: Estimated Monthly Pension Benefits for the Self-Employed, 2010

Policy Type	Country		Contributory	Non-Contributory
Simplified	Brazil	Minimum salary R$ 510	R$ 510	R$ 510
Tax Regimes		Average earnings R$ 1,375	R$ 881	R$ 510*
	Uruguay	Minimum salary $ 4,799	$ 5,000	$ 5,000
		Average earnings $ 18,850	$ 12,422	$ 5,000*
Pension-Specific	Chile	Minimum salary $ 172,000	$ 130,376	$ 75,840
Subsidies		Average earnings $ 459,167	$ 231,879	$ 75,840*
	Costa Rica	Minimum salary ₡ 187,029	₡ 154,299	₡ 70,125
		Average earnings ₡ 322,650	₡ 272,639	₡ 70,125*

Note: *Might not qualify due to means testing. Author's calculations based on OECD/IDB/The World Bank (2014). All values are monthly and expressed in local currency. Expected contributory benefits were calculated using net replacement rates, except when that value was below the minimum benefit.

ineligible for the non-contributory benefits.[13] We explore this issue further by calculating the monthly benefits received by self-employed workers in 2010 earning 1) the minimum salary, and 2) the average salary. The results are presented in Table 9. For a self-employed worker earning the minimum salary in Brazil and Uruguay, there was no incentive to enroll in the contributory system. For the median self-employed worker, benefits under the contributory system were 75% and 148% higher in Brazil and Uruguay respectively. For Chile and Costa Rica, the difference between the two systems was greater, even for the lower-income workers. Self-employed workers earning the minimum wage received benefits that were 72% and 120% higher. For the median self-employed worker, the increase in expected benefits was 206% and 289%.

To what extent are our results explained by these various factors? The two reforms linked to simplified tax regimes show no evidence of success. The calculations in Table 9 suggest that the high indirect costs of enrolling in the system are the most likely explanation for the failure of these reforms. Not only was it more difficult for self-employed workers to evade the VAT when they enrolled in the contributory system, but for workers at the low end of the income distribution, the benefits that they would have earned under the non-contributory

[13]In Uruguay, a retiree can receive benefits from both systems, but any contributory benefits get subtracted from the non-contributory benefits.

system were equivalent to those under the contributory system, giving them no incentive to enroll.

For the two reforms that provided pension-specific subsidies, we observe some evidence of positive effects. In the case of Chile, the effect decreased as the subsidy declined over time. This decline was not evident in Costa Rica, where subsidy rates were permanent and more progressive. These two results suggest that workers are highly sensitive to the subsidy rate and the direct cost of contributions. While the subsidy was extremely generous in Chile in t+1, with self-employed workers only required to contribute 3.84 percent of income, down from 11 percent in the prior year, it spurred a temporary increase in coverage. As the generosity of the subsidy subsided, and the contribution rate rose back to almost 10 percent of income, coverage declined accordingly.[14]

The results in Tables 8 and 9 suggest that the relative difference in benefits between the contributory and non-contributory system may have also played a role in the outcomes for the pension-specific subsidies. In each of the three post-reform years in Costa Rica, there was little to no increase in coverage among the lowest income quartile, possibly because the difference in benefits between the contributory and non-contributory systems was not as great as for those at higher incomes.

The results from our heterogeneity analysis in Table 7 further support the notion that the direct and indirect costs of enrollment present a significant barrier for the underprivileged. The reform in Costa Rica was more successful among married workers and those with more education. As married workers are able to pool their resources within a household, they are likely to have a higher marginal propensity to save. The results for education indicate that paperwork and bureaucratic hurdles may have also posed a hurdle for workers with little formal education.

There may be additional, country-specific factors that have also influenced the effective-

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[14]One puzzling aspect of our results is that the effects of the reform in Chile not only subsided over time, but actually became *negative*. However, Chile's reform included a simultaneous increase in the generosity of non-contributory pensions that increased the opportunity cost of remaining in the contributory system. Thus, it appears that once the subsidy rate declined, the effect of this increase in indirect costs dominated.

ness of these reforms, but which we are unable to consider in detail here due to limitations in our household survey data and the challenge of conducting cross-country comparisons. For example, we have not considered the role that complementary policies, such as labor inspections, play in the enforcement of new regulations (Bosch, Melguizo and Pagés, 2013).

8 Conclusion

In this paper, we categorize pension reforms across Latin America, and we evaluate four of these reforms, which varied in their features. We classify reforms into two groups - those linked to simplified tax regimes and those that offered pension-specific subsidies. We find that the reforms linked to simplified tax regimes were unsuccessful in increasing coverage. The reforms linked to pension-specific subsidies showed mixed results. A 2009 reform in Chile that featured a flat and gradually decreasing subsidy showed an increase in coverage of 5 percentage points one year post-reform, but a decrease in coverage of 5 percentage points three years post-reform. Only Costa Rica's 2006 reform, which involved a more lasting and progressive subsidy, showed a persistent increase of coverage; in our preferred specification, coverage was 10 percentage points higher three years after the reform.

We draw several conclusions from these results. First, even in those instances where reforms have been successful, they have nevertheless failed to increase coverage among self-employed workers with the lowest levels of earnings and educational attainment, leaving the most vulnerable share of the population with low levels of savings. Second, reforms have not addressed the large indirect costs of enrolling in the pension system. This policy failure is evident in the absence of any integration between the non-contributory and contributory systems and by the lack of progressiveness in the subsidy schedules of some countries. Finally, our results suggest that targeted interventions aimed at increasing coverage may at best produce small positive effects, while still leaving a large majority of self-employed workers outside of the system. Despite the positive effects we find in Costa Rica, more than 60% of

self-employed-workers in that country remained outside of the contributory system, underscoring the difficulty that even successful reforms have had in overcoming Latin's America's long history of low savings rates. For workers at the low end of the income spectrum, with high marginal utility from consumption and lower life expectancy, the direct and indirect costs of paying into the system remain sufficiently high such that small inducements, like those offered through these reforms, have little effect.

Addressing the region's long-standing problem of low coverage will require bolder approaches than those discussed here. Possibilities include more progressive contribution rate schedules or offering non-contributory and contributory plans side-by-side as complements rather than as substitutes, similar to the hybrid approach used by some U.S. states. We leave further exploration of these more comprehensive approaches as a matter of future research.

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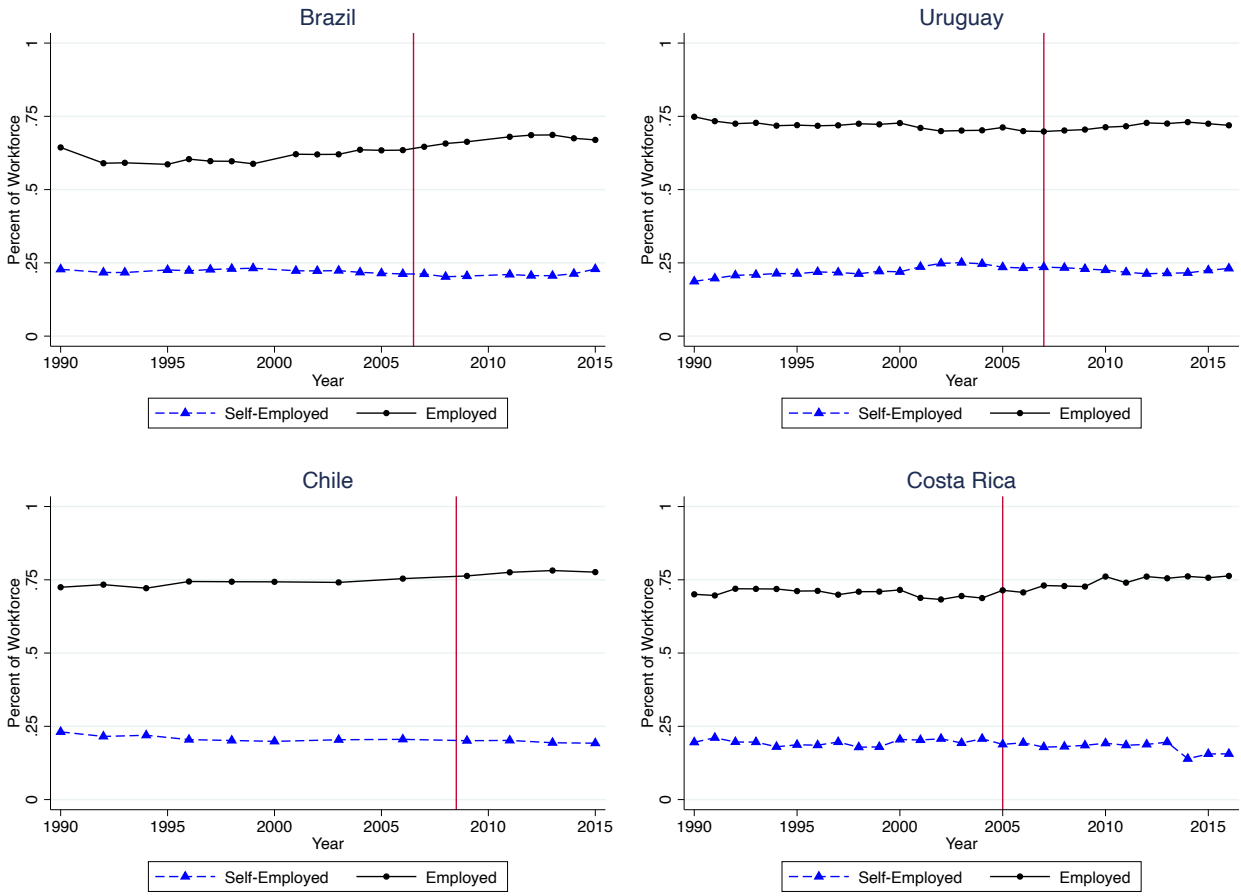# Figure A1: Composition of Workforce

Table A1: Difference-in-Difference Results with Matching

Policy Type	Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			t+1			t+2			t+3	
Simplified	Brazil	-0.009	-0.011	-0.011	-0.021*	-0.024*	-0.025*	-0.028**	-0.032**	-0.032**
Tax		(0.007)	(0.006)	(0.006)	(0.009)	(0.010)	(0.010)	(0.007)	(0.008)	(0.008)
Regimes										
	Uruguay	0.012*	0.019*	0.013	0.005	0.015	0.010	-0.002	0.010	0.001
		(0.005)	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)	(0.010)	(0.016)	(0.013)
Pension-	Chile	0.048**	0.045**	0.051**	-0.050*	-0.052	-0.049	-0.062**	-0.063**	-0.057*
Specific		(0.014)	(0.012)	(0.013)	(0.018)	(0.029)	(0.028)	(0.010)	(0.021)	(0.020)
Subsidies										
	Costa Rica	0.023	0.076**	0.057**	0.025	0.095**	0.065**	0.041*	0.130**	0.099**
		(0.011)	(0.011)	(0.010)	(0.014)	(0.012)	(0.015)	(0.013)	(0.016)	(0.019)
	Time Trends	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
	Covariates	No	No	Yes	No	No	Yes	No	No	Yes
	# Pre-Treat Obs	3	5	5	3	5	5	3	5	5

Note: **p < 0.01, *p < 0.05. Dependent variable is a binary variable indicating whether or not a worker is enrolled in the pension system. All specifications include regional fixed effect. Covariates include gender, marital status, age, and education level. Number of pre/post-treatment observations represents the number of pre/post-treatment years, except for Chile which only reports data every 2-3 years. Regressions use samples weights. Standard errors clustered by region.