

## Empirical Article

# Institutional Design of Pension Systems Versus Labor Market Structure: What Matters Most?

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## Abstract

Since the 1980s, policy makers have favored Defined Contribution (DC) pension systems as the alternative to address the unsustainability of Defined Benefit systems. While DC schemes offer benefits and economic advantages, they also present challenges and limitations. We evaluate the mandatory DC pension system for workers in the private formal sector in Mexico, introduced in 1997. We intend to determine for which workers the design of the system is effective and for which workers it is not. The Mexican labor market has high levels of informality and workers constantly flow in and out of the formal sector. Our findings support the view that workers' personal characteristics place them in the structure of the labor market that in turn determines pension benefits. We analyze involvement with the formal sector and the pension system and identify 3 groups of pension participants that reflect the structure of the local labor market: occasional workers, frequent interruptions, and workers with high participation rates. We conclude that frictions in the labor market prevail over the good intentions of the pension design, like reducing informality and encouraging saving for retirement. Our results show that the system properly serves only 36% of affiliated workers. We explain why very few workers report behaviors consistent with high participation, and why most affiliates have insufficient participation to receive pension benefits. We shed light on the relationship between the structure of the labor market and the design of the pension system and their impact on workers' future pension benefits.

**Keywords:** pensions, pension policy, defined contribution, labor markets

Old-age insurance exists because of failures in the financial systems and as a protection against longevity risk or an individual's myopia (Cutler & Johnson, 2004). Today, social security and pension programs for the older population are the rule. According to the World Bank (2013), 171 countries have a pension plan or some sort of provision for the elderly population at retirement.

During the 1980s and 1990s, many countries in Latin America and Eastern Europe reformed their mandatory pension systems substituting unfunded Defined Benefit (DB)<sup>1</sup> schemes with fully funded Defined Contribution (DC)<sup>2</sup> schemes with private individual pension accounts (Barr & Diamond, 2008; Orenstein, 2013). The drivers for the reforms were the lack of fiscal sustainability of previous schemes, unfavorable demographic trends, and to link contributions with benefits (Aggarwal & Goodell, 2013; Melguizo et al., 2017; World Bank, 1994). There are benefits and economic gains of DC schemes, like reducing

distortions in the labor market (Feldstein, 2005), pension funds becoming key financial intermediaries (Aggarwal & Goodell, 2013), or increasing retirement wealth for lower-income workers (Aguila, 2011).

DC systems are a mandatory savings mechanism for retirement that place the responsibility for future retirement income on individuals. The success of DC schemes has been heavily questioned as evidence shows that they may not secure adequate retirement income. DC systems are not really pension schemes, unless they have a minimum guaranteed income. These schemes rely on high participation, a reasonable flow of savings, and the ability to make suitable financial decisions since households face all risks (Barr & Diamond, 2006; Ongena & Zalewska, 2018).

There is abundant literature documenting the challenges, limitations, and potential outcomes of private pension systems. Arza (2008) assesses the limits of the pension system in Argentina. Buchholz et al. (2008) evaluate the fairness and efficiency of the Chilean system. Some studies analyzing coverage and/or participation are Aguila et al. (2010) for Chile, Colombia, and Mexico; Sinha and Yañez (2008) for Mexico; Barr and Diamond (2008, 2010, 2016) for Chile and China; Forteza et al. (2011) for Argentina, Chile, and Uruguay; and Melguizo et al. (2017) for Latin America and the Caribbean.

<sup>1</sup>In DB systems, payments upon retirement are not tied up to pension savings, and depend on pension participation and workers' wages close to retirement. Pension plan sponsors bear all risks in DB systems.

<sup>2</sup>DC pension system refers to schemes where enrolled workers, or affiliates, know the amount of money contributed each period to their pension savings. Benefits depend on accumulated savings during their working life.

Examples of studies using administrative data are [Berstein et al. \(2006\)](#), who estimate the distribution of old-age benefits in Chile; [Bucheli et al. \(2010\)](#) and [Forteza and Mussio \(2017\)](#), who analyze determinants of pension participation and identify vulnerable groups in Uruguay and Jordan; and [de Melo et al. \(2019\)](#), who project levels of eligibility and gross replacement rates in Uruguay. [Grech \(2013\)](#) evaluates the sustainability of pension reforms in Europe. Conclusions are similar: low coverage, low pension participation, and inadequate pension benefits for most workers. [Ortiz et al. \(2018\)](#) affirm that the privatization experiment failed, and they analyze the reversals of pension privatizations in 18 countries.

Our study intends to provide a more balanced view of the challenges of DC systems, without claiming total failure or total success of these types of pension schemes. We use administrative microdata on workers' pension participation and historic income to analyze the mandatory DC pension system for workers in the private formal sector in Mexico introduced in 1997. The DC system replaced the prior DB system from 1973. A characteristic of Mexico's labor market is that informality rates are high and most workers experience periods of formality and informality during their working lives ([Bosch & Maloney, 2006](#); [Gong et al., 2004](#); [Levy, 2010](#)). We assert that the institutional design of the pension system and the structure of the labor market are key determinants of future pension benefits. Many studies analyze pension participation and provide projections on potential outcomes (e.g., [Alonso et al., 2015](#); [Bertranou & Sánchez, 2003](#); [Castañon-Ibarra & Ferreira-Blando, 2017](#); [Colín, 2019](#)), while others report labor market mobility (e.g., [Bosch & Maloney, 2006](#); [Levy, 2019](#)). We add to the literature by integrating what happens on both sides.

We contribute to the literature in four areas. First, we analyze pension participation rates and their determinants. We explain pension participation by assessing the attachment to the formal sector using the number of formal employers, length of participation, and transitions in and out of the system. [Bertranou and Sánchez \(2003\)](#) study the determinants of density of contribution in Argentina, but we add by providing a detailed analysis of the dynamics of participation. Second, we analyze the relationship between income and participation to test how workers' characteristics place them in the structure of the labor market. Third, based on the analysis of pension participation and income, we identify and characterize relevant segments of workers in the system. Compared with [Alonso et al. \(2015\)](#), [Forteza and Mussio \(2017\)](#), or [Colín \(2019\)](#), our characterization helps to understand the differences in behavior in the levels of participation and to determine which group of workers policy makers should focus on. Finally, we take advantage of the enrollment process to assess the involvement in the pension system. Affiliation is automatic, but a key feature in Mexico is that each worker must complete the process by choosing a pension manager. We use full enrollment as a proxy to measure knowledge and reliance on pension savings upon retirement. Data from the National Inclusion Survey/*Encuesta de Inclusion Financiera* (ENIF) show that fully enrolled workers with reasonable rates of participation rely on pension savings ([CNBV & INEGI, 2018](#)). Based on the same survey, we hypothesized that workers with low participation belong to the informal sector, have small savings in their account, and, therefore, they do not finish the enrollment process. Low participation workers distort analyses of

coverage and participation in pension systems. To the best of our knowledge, the enrollment process to select a pension manager and claim ownership of savings has not been previously documented.

Our findings confirm that pension participation reflects the structure of the labor market. The median worker enters and exits the system at least three times. Average rates of participation hide the constant transit in and out of the system and the extremes in participation. One-third of workers participate less than 10% of their labor trajectory, while 20% spend all their working lives in the formal sector. We show that workers with very low participation rates are not attached to the formal sector. We find that income is positively related to participation. High-income workers report twice the participation rates compared with low-income workers, similar to the findings of [Bucheli et al. \(2010\)](#) for Uruguay; [Bertranou and Sánchez \(2003\)](#) for Argentina; [Berstein et al. \(2006\)](#) for Chile; and [Alonso et al. \(2015\)](#) for Mexico. [Madero-Cabib et al. \(2019\)](#) study pension contribution histories and employment formality in Chile. They show that half of the workers report labor trajectories not consistent with the assumption of continuous pension contributions and formal employment. We add to their study by examining the involvement in the formal sector, the reliance on pension savings upon retirement, and by identifying workers' segmentation.

We argue that workers can be divided into three groups reflecting the structure of the labor market in Mexico. The first group is made up of occasional workers, representing 32% of affiliated workers. They have been in the system only once, participate less than 6 months on average and 70% have not completed the enrollment process. Their wages correspond to the low end of the income distribution. Based on our data and previous studies of informality in Mexico, we assert that they are nonstandard workers that occasionally take a temporary job in the formal sector and are naturally excluded from the system ([Bosch & Maloney, 2010](#); [Gong et al., 2004](#)). Survey data indicate that most of them receive weekly wages in cash,<sup>3</sup> and labor in the primary sector, retail micro business,<sup>4</sup> and construction. These activities represent the largest share of the informal economy and are the ones with the lowest participation in the formal market ([CNBV & INEGI, 2018](#); [INEGI, 2022b](#); [STPS, 2022](#)). Like other pension systems, the Mexican system excludes informal workers from pension benefits, but all of them will at least receive their accumulated savings ([Montoya et al., 2018](#)).

The second group consists of workers that constantly transition in and out of the system (47%). They work in the formal sector less than 50% of their working life, and only 31% of them are entitled to pension benefits. However, they seem to be attached to the formal sector, reporting five employers on average. The labor trajectories of workers in the second group are not compatible with a DC pension system requiring long-term stable careers in the formal sector. They may be individuals working independently or setting up businesses, but they do not affiliate themselves with the pension system. They are our main concern to assess the suitability of the institutional design of the system relative to the vesting period.

<sup>3</sup>According to [CNBV and INEGI \(2018\)](#), 60% of low-income workers receive weekly wages, while 60% of high-income earners receive biweekly wages.

<sup>4</sup>Censos Económicos ([INEGI, 2019](#)) define this group as businesses with five or fewer workers that pay no taxes and do not have formal business names.

The third group is composed of high-income individuals reporting continuous participation and almost no interruptions (21% of the sample). In terms of job characteristics, workers in the second and third groups are similar. Most formal jobs are in urban areas, paying biweekly wages in payroll accounts. The manufacturing industry, followed by the service and retail sectors, constitutes the largest fraction of workers affiliated with the National Social Security Institute/*Instituto Mexicano del Seguro Social* (IMSS; CNBV & INEGI, 2018; INEGI, 2022b; STPS, 2022). Most workers in the third group will comply with vesting periods, but the relevant issue is the low rate of savings accumulation, which implies low replacement rates (OECD, 2020).

The microanalysis of participation helps us to understand the frictions in the labor market and to explain the success and flaws of the pension system. We explain why very few workers in the Mexican pension system report behaviors consistent with high participation, and why, for most affiliates, participation is not sufficient to receive pension benefits. Our findings show that 97% of workers in the third group could receive pension benefits, compared with only 36% in the second group, and no one from the first group. This implies that the Mexican pension system properly functions for only 36% of affiliated individuals. The rest of workers will receive accumulated savings as a lump sum upon retirement, putting them at risk of outliving their wealth (longevity risk). The consequences in the future will be more poverty and income inequality in the older population. We conclude that frictions in the labor market prevail over the good intentions of pension design, like reducing informality and encouraging workers to save for retirement.

## THE LABOR MARKET IN MEXICO

Mexico has high rates of informal labor. The active labor force at the end of June 2022 was 57.4 million employed persons, 55.4% of whom worked in the informal segment (INEGI, 2022a). Informal self-employment in Latin America generally constitutes the largest source of employment among men, sometimes exceeding 40% of the workforce (Maloney, 2004). Sales-Sarrapy et al. (1998) mention that around the time of the pension reform in 1995, only 35% of the employed were affiliated with the IMSS, which serves private-sector workers. Since 1995 the percentage of employees affiliated with the IMSS has been fluctuating between 35% and 38% of total employment (INEGI, 2022b). Public sector workers are a small fraction of the formal labor market, historically representing on average less than 8% of total formal employment (INEGI, 2022b).

Schneider and Buehn (2018) identify variables that affect informality, such as social security costs, taxes, quality of institutions, corruption, rule of law, regulation of economic activity, growth of the formal segment, ease of self-employment, size of the agricultural labor force, and use of cash. Mexico has the characteristics of an economy with large informality. For instance, Mexico's ranking in terms of corruption was 124 out of 180 countries in 2021, 180 being the country with the highest level of corruption (Transparency International, 2022). In rule of law, the ranking was 113 out of 130 countries in 2021; that is, Mexico was among the 20 countries with the lowest rule of law in the world (The World Justice Project, 2021), and was 60th out of 190 countries in

regulation (World Bank Group, 2020). The survey of financial inclusion (CNBV & INEGI, 2018) shows that 94% of the adult population prefer to use cash for transactions of less than 500 pesos (25 USD).

There are two views about informality and labor market dynamics: (a) formal and informal markets are segmented so there is no mobility between the two segments of the market, or (b) there is mobility between the two segments. The evidence for Mexico supports the latter view. Bosch and Maloney (2006) document mobility between the formal and informal segments of the economy. They explain that the transition from one to the other depends on factors such as the normal behavior of job-to-job mobility, or the economic situation, since the informal economy is a countercyclical buffer. Levy (2019) reports that mobility is a characteristic of the labor market in Mexico. Between 1Q 2018 and 1Q 2019, 15% of the workers in the formal market moved to the informal market and 16% of informal workers moved to the formal market. Levy (2019) also shows that among unemployed workers, 30% entered the formal market and 40% entered the informal market.

In our study, high informality and mobility are important characteristics of the labor market to understand behavior in the pension system. Both determine lower pension participation and constant interruptions.

## THE MEXICAN PENSION SYSTEM

The OECD (2020) argues that pension systems typically have three pillars: the first includes some kind of basic income funded by the government, the second is related to work in the formal sector, and the third is voluntary savings. The Mexican pension system has these three pillars.

The first pillar is a universal noncontributory minimum pension funded by the federal government (OECD, 2016). The only requirements are a minimum age of 65 and Mexican nationality or permanent residence. The second pillar is additional to the universal pension. Formal workers are eligible subject to participation requirements, and it includes workers in the private sector, federal government, state-owned enterprises, universities, and state and local governments. For private-sector workers, there is the old DB system (before the 1997 reform) and the new DC scheme. For federal government workers, there are also two systems because of a reform in 2007. Vásquez-Colmenares (2012) and Villareal and Macias (2020) argue that the system is highly fragmented. There are over 1,000 different systems, models, and/or pension schemes for government workers. Each one has its own rules, benefits, contribution rates, and replacement rates. The third pillar is voluntary savings and it is practically negligible in Mexico.<sup>5</sup>

### Pension system for private-sector workers

Mexico replaced the unfunded DB system with a DC pension system in 1997 for private-sector workers.<sup>6</sup> The system

<sup>5</sup>Voluntary savings represent around 1.5% of total pension savings (CONSAR, 2022b). ENIF survey (CNBV & INEGI, 2018) indicates that the main reasons for not making voluntary contributions is not having spare money to save (47%), not knowing how to do it (15%), and not knowing the advantages (3%). Supplementary Figure 1 shows these figures dividing survey respondents by income quartiles and analyses of the results.

<sup>6</sup>Grandolini and Cerda (1998) assert that the rationale for the reform was to avoid the bankruptcy of the Social Security Institute (IMSS) and to reduce fiscal pressures, tax evasion, and informality.

is part of the social security regime in Mexico that also includes health services provided by IMSS, and the right to receive a mortgage loan from National Housing Institute (INFONAVIT). Sales-Sarrapy et al. (1998) and Sinha and Yañez (2008) provide detailed descriptions of the new system and the motives behind the reform. The reform provided grandfather rights to workers who participated in the pension system before June 1997. These workers can choose under which regime they will retire.

Every person working in a tax-paying private firm (formal sector) is entitled by law to social security. The system is mandatory (no opt out) for all formal workers and requires contributions every 2 months. The reform did not change the rate of contribution, of 6.5% of a worker's salary (5.15% paid by the employer, 0.225% by the government, and the rest by the worker; Valdés-Prieto, 2007). Each worker has an individual account to receive pension contributions. Pension savings are invested in Specialized Retirement Mutual Funds (SIEFOREs), exclusively administered by Retirement-Specialized Fund Managers (AFOREs). Contributions stop if workers leave the formal sector, but they keep ownership of their accounts and accumulated savings. The rate of contribution in Mexico is one of the lowest in the world and the estimated replacement rate is around 25% of the last income.<sup>7</sup> Pension benefits in Mexico, measured by replacement rates and resulting from the expected accumulated savings, are half of the mean of OECD countries, assuming that individuals participate fully, irrespective of their income level (OECD, 2020). The system contemplates voluntary contributions in which workers can make tax-deductible deposits into their individual accounts.

The reform changed the minimum vesting period to be entitled to pension benefits. The required time of participation increased from 10 years (500 weeks) to 24 years (1,250 weeks). On retirement, workers complying with the vesting period have the option to annuitize their savings or receive savings through annual installments. There is the provision of a minimum guaranteed pension (MGP), securing a lifetime monthly payment of at least one minimum salary for workers complying with the vesting period. In this case, IMSS receives workers' savings and pays the lifetime MGP (Montoya et al., 2018; Valdés-Prieto, 2007). The minimum benefit is fixed and does not change with salary (Alonso et al., 2015). Workers not reaching the vesting period are only allowed to claim savings as a lump sum upon retirement.

An important feature of the system is the enrollment process. Employers enroll and open individual pension accounts when the employee enters the formal labor market for the first time. Once affiliated, workers must complete the process by choosing a pension manager and by providing personal information. Workers have 1 year to complete the process, otherwise the regulator assigns them to a pension manager, becoming an "assigned worker" (Article 75 of the Mexican Retirement Savings Systems Law; Cámara de Diputados del H. Congreso de la Unión, 2014).<sup>8</sup> Workers

who complete the enrollment process are known as "registered." A third of workers in the system do not complete the process and do not choose a pension manager (CONSAR, 2022a). Finally, workers have very limited power over their investment's allocation. The only choice they have over their pension account is to select the fund manager, which they can change once a year.

### Public pension system for federal government workers

In 2007, Mexico reformed the pension scheme for federal government employees. OECD (2016) explains that the reform is like the one for private-sector workers: a DC model with individual accounts. Like private-sector reform, there are grandfather rights for workers who participated in the system before 2008. The new rules are applicable to workers entering the market in 2008 and after. The government has an AFORE to manage their savings, but the rules allow all public workers to choose other pension managers. Also, the time spent working either in the public or the private-sector counts in terms of vesting periods to receive pension benefits. Public-sector workers are a minor fraction of formal employment, and their behavior is different to private-sector workers. Workers like teachers or those in government-sponsored companies (e.g., Petroleos Mexicanos [PEMEX] or Comisión Federal de Electricidad [CFE]) have low mobility because of favorable labor conditions for unionized workers.

### Estimated cost of pension systems' grandfather rights

Vásquez-Colmenares (2012) estimates that the cost of all pension systems in Mexico in 2010 was 104% of GDP. He estimates that the fiscal cost of the old DB system for private-sector workers was around 30% of GDP, and for federal government workers was 31%. The other 43% includes other government regimes like PEMEX, CFE, states, and public universities. The Ministry of Finance in Mexico reports the yearly cost of grandfather rights for workers participating in the pension systems before the reforms. In 2004, pensions represented 11.2% of government spending, and in 2021 the cost increased to 20.4% (SHCP, 2022).

### THE DATASET

We use a proprietary dataset of longitudinal administrative data provided by the regulator (CONSAR) containing a stratified random sample of 40,000 workers. The sample is representative of the population affiliated to the pension system in terms of year of affiliation, gender, geographic location, and assigned and registered workers. Workers in the sample entered the system between 1997 and 2007 and all of them will retire under the rules of the DC scheme. Our dataset does not consider workers affiliated before the reform; therefore, our analysis does not include the transition generation.

Compared with the old DB system, workers did not need to enroll because IMSS administered all accounts, and upon retirement, individuals notify and claim pension benefits directly with the IMSS. It is not difficult to complete the enrollment in the new system and the process is working well for most workers, but the design does not consider a systematic procedure to inform individuals about their pension benefits (CONSAR, 2020).

<sup>7</sup>The replacement rate assumes that the worker starts at 22, retires at 65, has a mean income, and works in the formal sector all the time (OECD, 2020). The OECD estimates replacement rates for all countries with the same assumptions, except for the age of retirement, which depends on local regulations.

<sup>8</sup>Survey data show that 20% of workers with pension account do not know who their pension manager is (CNBV & INEGI, 2018). To fully enroll in the system, the worker needs to contact a sales agent of a pension fund manager.

Retirement income for workers in our sample will be determined by accumulated savings during working life, portfolio returns, and management fees (Cámara de Diputados del H. Congreso de la Unión, 2014).<sup>9</sup> The dataset reports the daily wage in each bimester for each worker in the sample between the third of 1997 and the sixth of 2011 if they actively contribute to the pension system. If the worker is not in a formal job, the data report a wage equal to zero in the corresponding bimester. The result is a panel of 40,000 workers and 88 bimesters. The data contain additional cross-sectional information as of December 2011, including the year of birth, year of enrollment, total number of employers, a dummy equal to 1 if the worker is assigned, and a dummy equal to 1 if the worker has a mortgage with INFONAVIT. We compute the age of incorporation to the pension system using year of birth. Information on gender and municipality is only for registered workers.

Table 1 reports the composition of the sample by type of affiliation and gender, and the amount of accumulated savings for each group. Accumulated savings are outstanding balances as of December 2011 in workers' accounts, which include mandatory and voluntary contributions plus accumulated investment returns. By type of affiliation, 33% of workers did not complete the enrollment process (assigned) and most registered workers are men (55%). The numbers are in line with the data of the whole system.<sup>10</sup> Accumulated savings of assigned workers represent 6.8% of total savings, showing the very low level of contributions of those not choosing AFORE.

Among registered workers, women only own 40% of total pension savings. Our data show that women report lower rates of participation and savings and are less likely to be entitled to pension benefits (similar to the findings of Dion, 2006; James et al., 2003). The analysis of gender differences is out of the scope of our study, given that the data do not report gender for assigned workers. In fact, the regulator does not have information on gender until the worker completes the enrollment.

### MEASURES OF PARTICIPATION AND INCOME

We create several measures to evaluate the pension system from the perspective of the structure of the labor market. The intention of these measures is to understand the dynamics of participation and income across time, and to assess who may receive pension benefits and who will be left out.

<sup>9</sup>Aguila et al. (2014) analyze the negative impact of fees on pension savings in Mexico. They focus on the 2008 regulation that eliminated load-factor fees and show that average fund manager fees could reduce retirement wealth by almost 6%, compared with potential accumulation with the lowest fee manager in the market. The most recent reform in 2022 imposes a maximum management fee of 0.57% of the outstanding balance.

<sup>10</sup>As of December 2021, 18.5 million of the 70.4 million workers affiliated to the system had not selected a pension manager (26.3%; CONSAR, 2022a). There is potential concern regarding duplicated pension accounts because workers could be enrolled by different employers without knowing it. Currently, it is impossible to determine the percentage of duplicated accounts, since the authority does not keep statistics on workers claiming pension benefits for multiple accounts. The bulk of duplicate accounts should be among occasional workers not completing the enrollment process. Considering the very low rates of participation of occasional workers, even having several pension accounts, and doing the paperwork to unify them to claim pension rights, it is highly unlikely that they could reach vesting periods to obtain pension benefits. Our conclusions should remain qualitative all the same.

Table 1. Sample distribution.

	Workers		Pension savings, outstanding balance	
	Number	%	Millions (MXN)	%
Assigned	13,190	33	\$79	7
Registered	26,810	67	\$1,090	93
Men	14,736	55	\$659	61
Women	12,074	45	\$431	39
Total	40,000		\$1,169	

Note. The table reports the sample composition by number and percentage of workers, grouped by type of affiliation (registered and assigned workers). Registered workers are those who complete the enrollment to the pension system by choosing a pension manager, and assigned workers are those who do not complete the process. We report the composition of the sample by gender. Information on gender is only available for registered workers. The second columns report outstanding balance of accumulated savings and the distribution in percentage as of December 2011. Outstanding balances include compulsory and voluntary contributions.

We first estimate the number of entrances to the pension system by determining how many times a worker interrupts participation and comes back to the formal labor market. Second, we compute how long workers are active each time they contribute to the system by working in the formal sector (duration of participation spell). Third, we use workers' total time enrolled in the system and total time actively participating to estimate density of contribution with (1).

$$\text{Density of contribution (\%)} = \frac{\text{Number of periods contributed}}{\text{Number of periods in the system}} \times 100 \quad (1)$$

Density of contribution is a useful parameter because it provides a standardized measure to assess and forecast participation.

We compute the expected time of active participation ( $E(\text{Time}_i)$ ) by multiplying total expected time of enrollment by historic density of contribution in (2). We assume that workers will continue participating at similar rates.<sup>11</sup> Expected total time of enrollment is the number of years between the year of first contribution ( $\text{Year}_{\text{enroll}}$ ) and a worker's 65th birthday ( $\text{Year}_{65\text{th}}$ ).

$$E(\text{Time}_i) = (\text{Year}_{65\text{th}} - \text{Year}_{\text{enroll}}) \times \text{density of contribution} \quad (2)$$

Finally, we define a dummy variable that takes the value of 1 if the worker is expected to actively participate for 24 years or more (vesting period). A dummy equal to 1 implies that workers have the alternative to annuitize savings and that they could be entitled to the MGP if needed. This dummy is useful to evaluate for which workers the Mexican pension system is serving its purpose. Compared with Alonso et al. (2015), we use the past history of each individual in our sample to project participation and eligibility, while they characterized 60 types of individuals to project participation and pension benefits.

<sup>11</sup>We also estimate expected time of active participation considering average density of contribution by age. All our results remain qualitative all the same.

**Table 2.** Descriptive statistics.

	Mean	25th perc.	Median	75th perc.	Std. Dev.
Density of contribution (percentage)	42.2	8.1	33.3	75.0	35.1
Entrances to the system (times)	2.3	1.0	2.0	3.0	1.5
Spell duration (bimesters)	12.0	2.4	6.0	15.0	15.3
Entitled to pension	0.36				
Age of first enrollment (years)	22.9	18.0	20.0	25.0	9.1
Average wage (times min. wage)	2.8	1.4	2.0	2.9	3.0
Mean income decile	4.7	2.8	4.5	6.4	2.4
Income decile slope	0.016	-0.040	0.000	0.056	0.454
Employers	4.1	2.0	3.0	6.0	3.1
House credit	0.13				

*Note.* The table reports summary statistics for all workers in the sample. Density of contribution is the ratio of the number of periods that the worker contributes to the pension system relative to the total number of periods enrolled in it. Entrances to the system refer to the number of times a worker returns to the system. Spell duration is the average number of bimesters actively participating during each entrance. Entitled to pension is a dummy that takes the value of 1 if the expected time of participation is 24 years or more, and, therefore, the worker could be entitled to the MGP. Average wage is the mean of workers' reported wages in terms of minimum wage across all bimesters with active participation. Each bimester, we group active workers in the pension system in 10 groups according to their reported wage, and we estimate the average and the slope (growth rate) of income deciles for each worker across bimesters. Employers refer to the total number of different employers for each worker between their first enrollment date and December 2011 (within the analyzed period). House credit is a dummy that takes the value of 1 if the worker has a mortgage with the National Housing Institute. MGP = minimum guaranteed pension.

## Measures of income

The panel structure of the data allows us to analyze income trajectories through time. To make the data comparable across time and across individuals, we standardize daily wages in terms of the national minimum wage, converting wages from pesos to a multiple of the official minimum wage. Then, each bimester, we sort all active workers according to their reported standardized wage and create 10 groups of workers based on income (income deciles). We know the corresponding income decile for all workers every time they participated in the system. The result is a time series of standardized wages and income deciles by worker that captures income trajectory relative to other workers in the system. We create two cross-section indicators for each worker: the average and the slope of income deciles. The slope of standardized income decile is a proxy for income growth rate. We analyze the relationship of our income measures with pension participation.

Table 2 reports descriptive statistics of all measures of participation, pension benefits, and income, and the results are discussed in the following section.

## RESULTS

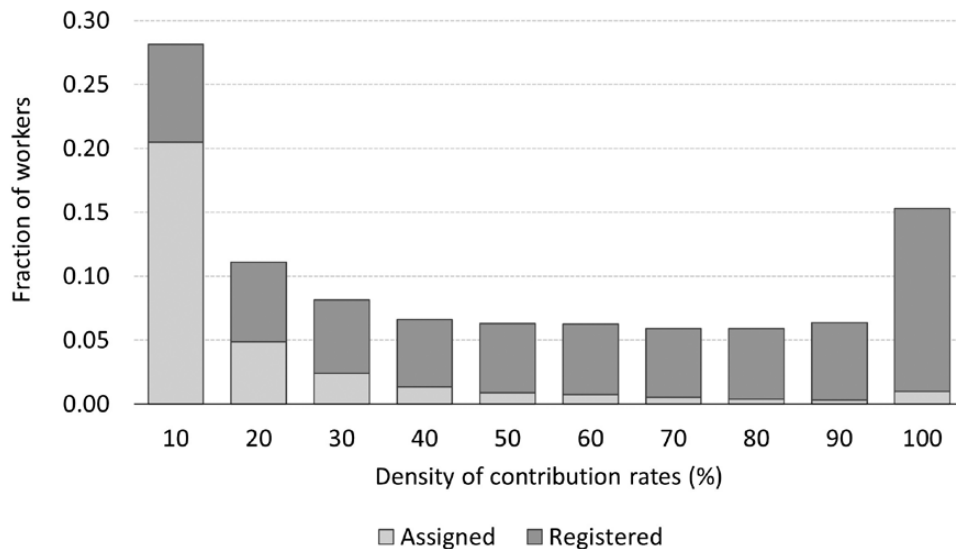
In this section, we present our findings. First, we analyze the distribution and dynamics of participation, including entrances and spell duration, and income. The intention is to identify common patterns among workers. Next, we study the relationship between income and participation, and we identify three segments of workers. To further understand participation rates and which factors explain them, we implement regression analysis where dependent variables are measures of participation—entrances, spell duration, density of contribution, and entitled to pension dummy. For this analysis, we use the segment of workers with frequent interruptions as they are the most vulnerable to low pension savings. Finally, we analyze the enrollment process to distinguish between formal and informal workers.

## Pension participation

We extend previous findings in the literature by understanding the dynamics of pension participation, the relationship between the characteristics of the labor market and the status in the pension system. Table 2 shows that average density of contribution is 42%, but half of the participants report density of contribution below 33%. In Figure 1, we divide workers by whether they are fully enrolled or not (registered or assigned) to further analyze the distribution of participation measured by density of contribution. Figure 1 shows a bimodal distribution in which 28% participate 10% or less of the time, and 15% participate more than 90% of the time. Also, close to 40% of participants report density of contribution below 20%, 80.6% of which have not completed the enrollment process (assigned). The proportion of workers completing the enrollment process rises as the degree of participation increases. This distribution is similar to the one reported by Forteza et al. (2011) and Forteza and Mussio (2017) for Jordan and other Latin America countries. However, in the case of Mexico, a key difference is that most workers in the low end of participation are assigned with almost no involvement in the formal sector.

Regarding age, Table 2 shows that first enrollment in the pension system is between 20 and 23 years old. The median worker affiliates for the first time at age 20; however, 25% of workers affiliate to the pension system for the first time at age 25 or higher. Age of enrollment is an important determinant of available time to accumulate pension savings.

Almost all workers have interruptions in pension participation. In Table 2, we observe that individuals enter the pension system by working in the formal sector 2.3 times on average and the median worker enters twice. There are two behaviors that explain low rates of participation: (a) the continuous flow in and out of formal jobs, possibly combined with short stays in the formal labor market; and (b) when a worker leaves a formal job and does not return at all.



**Figure 1.** The figure reports the distribution of workers by density of contribution rates, grouped by type of affiliation, which refers to registered and assigned (incomplete enrollment process) workers. Density of contribution rates refer to the time of active participation as a percentage of total time since enrollment.

In [Figure 2](#), we analyze the distribution of entrances (interruptions) to the formal labor market. Panel A shows the fraction of workers by the number of entrances to the system, grouped by assigned and registered. Forty percent of workers in the system report only one entrance and half of them are assigned. Entering once in the system has two possible behaviors: one entrance implies either no interruptions (100% density of contribution), or that the individual left the formal sector and did not come back during our observation window. In [Figure 2](#), Panel B, we compute the average number of entrances, grouping workers by rates of density of contribution and type of enrollment, to understand the relationship between interruptions and the degree of participation. Most workers with one entrance have very low rates of participation. At the other extreme, individuals with high levels of participation have fewer interruptions compared with those in the middle of the distribution. Registered workers contributing between 30% and 90% of the time report at least three entrances on average.

[Figure 3](#) reports the average number of employers by density of contributions rates and type of enrollment, to complement the analysis of interruptions. Workers with very low rates of participation report on average, less than two different employers. The figure is even smaller for assigned workers, confirming the notion that they worked once or twice in the formal sector but have not returned. In general, the average number of employers is higher than the number of entrances to the system, which implies that many workers transition between jobs without periods of unemployment of informal labor. In sum, for many workers, low levels of density of contribution are the result of constant interruptions in their formal labor trajectory, but there is also a significant number of workers that never returned to the formal sector. Density of contribution increases as individuals keep taking jobs in the formal sector.

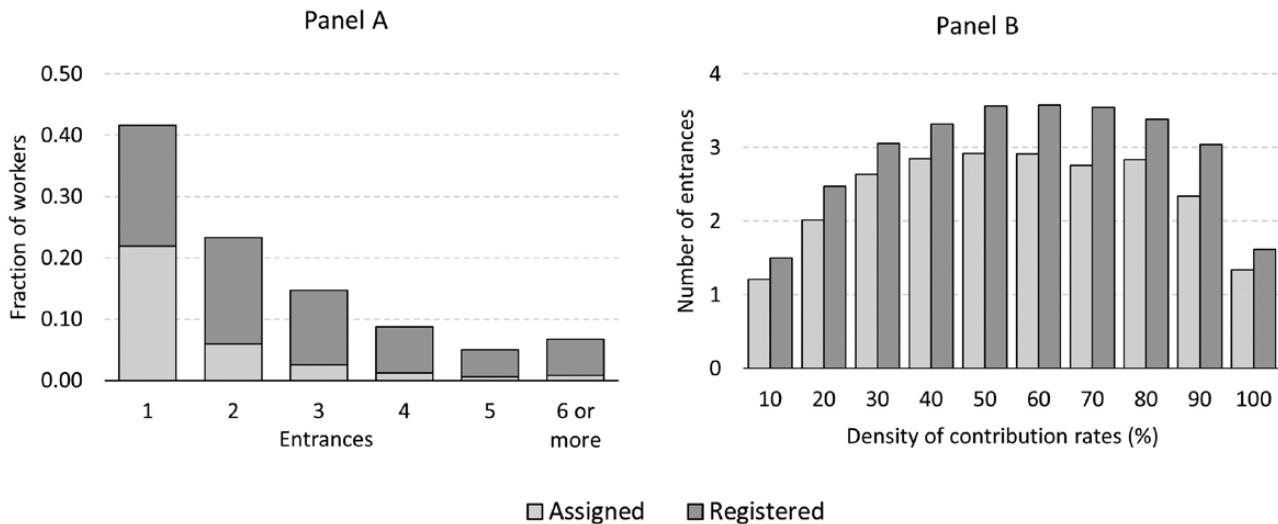
In [Figure 4](#), we analyze the average number of bimesters of active participation (spell duration), grouping workers by rates of density of contribution and type of enrollment (assigned or registered). In [Table 2](#), we observe that the average

spell duration is twelve bimesters each time individuals are in a formal job, but half of them stay in formal jobs for six bimesters or less. [Figure 4](#) confirms that workers with low rates of participation enter once, do not come back, and stay over very short periods of time. Workers contributing 20% or less of the time spend less than 1 year in the system. The spell of active participation increases monotonically with density of contribution. Workers with high rates of participation stay over longer periods and report fewer interruptions. The jump in the average number of bimesters of active participation between 90% and 100% density of contribution is because workers with 100% density of contribution do not report interruptions. We conclude from [Figure 2](#), Panel B, and [Figure 4](#) that workers with participation rates close to 100% have almost no interruptions and long spells of participation in the formal labor market. These workers report four employers on average, implying that they transition from job to job without periods of unemployment ([Figure 3](#)).

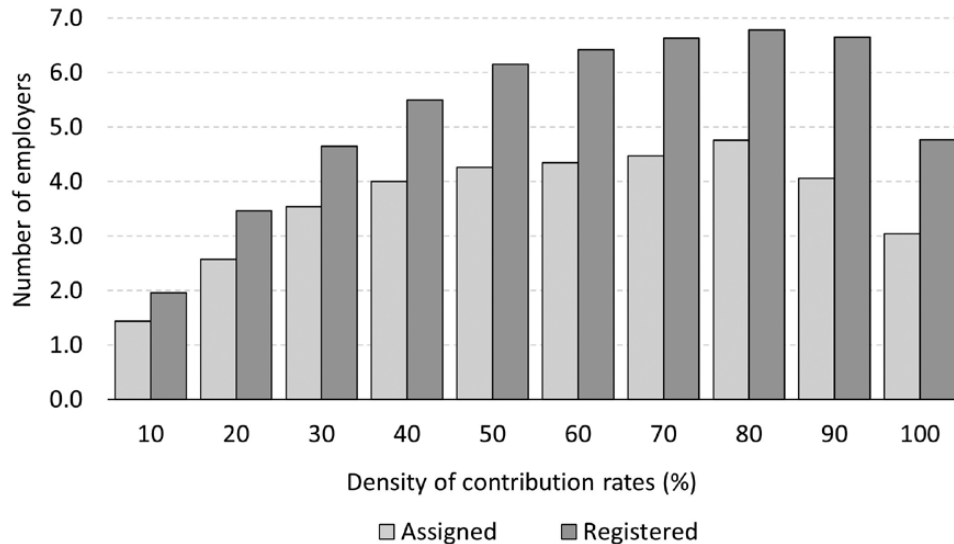
[Table 2](#) shows that the consequence of low rates of participation is that only 36% of workers in our sample are expected to actively contribute 24 years or more to be entitled to annuitize savings.<sup>12</sup> The rest of the workers (64%) will not be entitled to pension benefits or to annuitize pension savings upon retirement because expected time of active participation is less than 24 years. However, all of them will receive their accumulated pension savings as a lump sum.

The length of our analysis is restricted to the time span of the database. In our case, the data are only limited by the end of the observation window (December 2011) because workers in our sample were not affiliated and did not participate in the pension system before July 1997 (start date). The distribution of age of affiliation of our sample shows a bias toward the younger population. However, the observation window is adequate to capture the age span when individuals

<sup>12</sup>This figure compares to the 47% reported by [Alonso et al. \(2015\)](#). However, their database includes workers affiliated under the old DB system (1973 law). The vesting period in the 1973 DB system is 500 weeks. Therefore, under the old pension rules, more workers would receive pension benefits.



**Figure 2.** Panel A reports the distribution of workers by the number of times they enter and exit the pension system grouped by type of affiliation, which refers to registered and assigned (incomplete enrollment process) workers. Panel B reports the average number of entrances for workers grouped by rates of density of contribution (time of active participation as percentage of total time since enrollment) and type of affiliation.



**Figure 3.** The figure reports the average number of employers by workers grouped by density of contribution rates (time of active participation as a percentage of total time since enrollment) and by type of affiliation, which refers to registered and assigned (incomplete enrollment process) workers. Employers refer to the total number of different employers for each worker between their first enrollment date and December 2011.

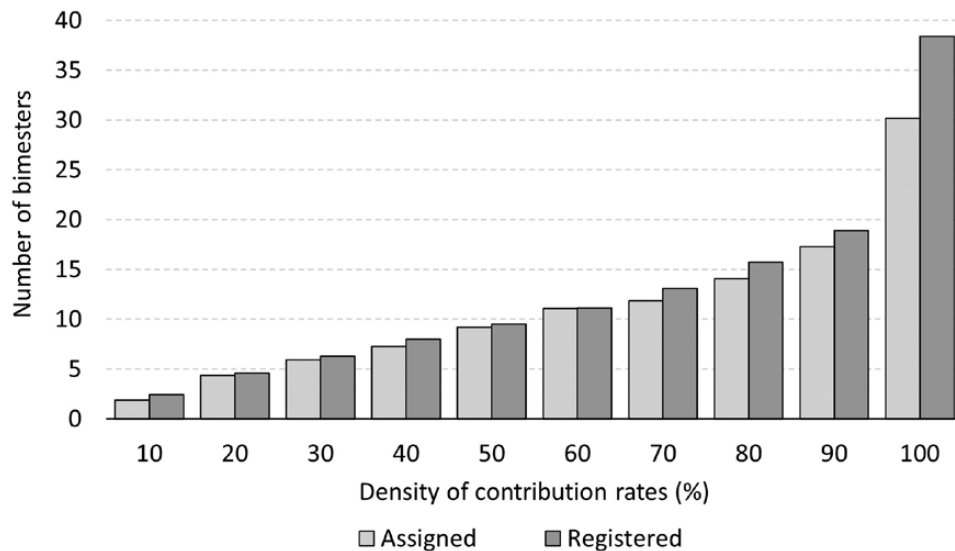
should report high rates of participation (between 20 and 50 years old). In any case, 5.2% of workers in our sample were above 50 years old at the end of 2011, which allow us to learn something about pension participation rates at older age (Supplementary Figure II).

Evidence of the relationship between participation rates and age is mixed across countries. Alonso et al. (2015) report declining pension participation of men after 50 years of age in Mexico, but participation increases with age in the case of women. In Forteza et al. (2011), density of contribution increases with age for Argentina, Chile, and Uruguay. Forteza, and Mussio (2017) show that density of contribution declines after 55 years of age in Jordan. Estimations of density rates of contribution by age using our sample show that after 50 years, the average density of contribution slightly decreases, but it remains between 50% and 60% for registered workers,

and close to 30% for assigned workers (Supplementary Figure III). This implies that our results regarding the fraction of workers complying with vesting periods to obtain pension benefits could be overestimated as we use the historic density of contribution. In any case, our conclusions remain qualitative the same, but the situation of many workers in the pension system could be worse.

#### Relationship between pension participation and income

Table 2 shows that the average income is 2.8 times the minimum wage, median is 2, and only 25% of workers in the sample report an average income above three times the minimum wage. Income is a proxy for human capital, which, in turn, is an indicator of how likely an individual naturally belongs to the formal sector. Here, we investigate the



**Figure 4.** The figure reports the average number of bimesters that workers stay active each time they enter the pension system grouped by rates of density of contribution (time of active participation as percentage of total time since enrollment) and by type of affiliation, which refers to registered and assigned (incomplete enrollment process) workers.

relationship between income and the dynamics of participation. We consider density of contribution, number of entrances, duration of participation spell, number of employers, and the fraction of workers expected to be entitled to a pension as a measurement of participation. We use mean income decile and income decile growth as income indicators.

Figure 5 reports the 25th percentile, median, and 75th percentile of the income indicator for workers grouped by density of contribution rates. We observe that average relative income increases monotonically with density of contribution. Half of the workers with low participation rates report mean income decile below the third decile, while half of the workers with high rates of participation are above the sixth income decile.

To further understand the relationship between income and pension participation, we group workers by mean income decile. We estimate for each group the average density of contribution, number of entrances, duration of participation spell, number of employers, and the fraction of workers potentially entitled to pension benefits. The results are in Table 3.

Results in Table 3 indicate that density of contribution, spell duration, and the fraction of workers entitled to pension increase with income. High-income workers report a density of contribution above 60%, stay on average more than 20 bimesters, and almost 60% are expected to be entitled to a pension. In contrast, low earners report an average density of contribution lower than 30%, mean spell duration of eight bimesters, and around 20% are expected to comply with vesting periods to obtain pension. The possibility of being entitled to the MGP is highly related to income. Regarding the number of entrances, the relationship is an inverted “U” shape, where workers in the extremes of the distribution report a low number of entrances, and individuals in the middle of the distribution report the highest number of entrances. The relationship between income and number of employers is also “U” shaped. Workers in the middle of income distribution report a higher number of employers than workers in the extremes of the distribution. Workers in the bottom

of the distribution are the ones with the lowest number of employers.

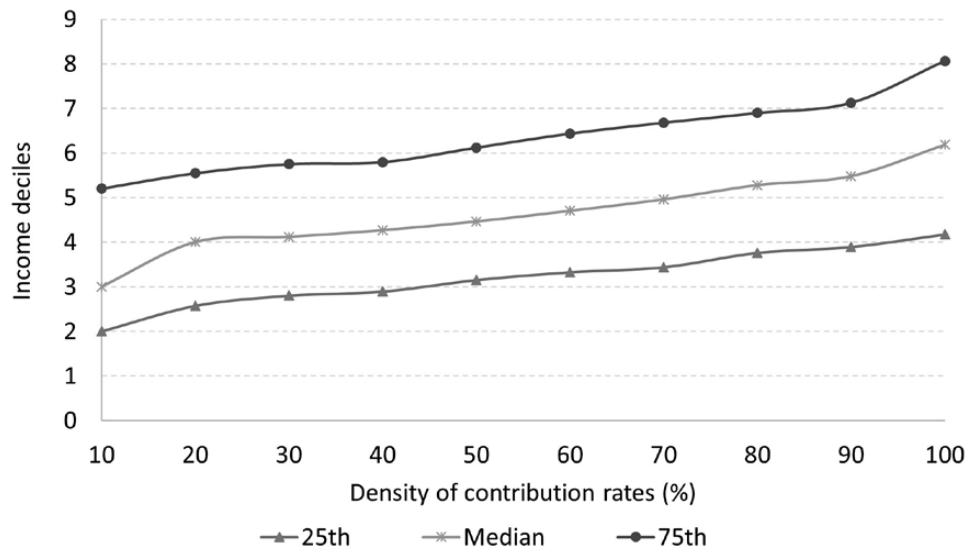
In sum, workers with very low income are the ones entering a formal job once or twice and report very short spells of participation. In contrast, individuals at the top end of income distribution report a lower number of interruptions, more employers, and longer periods of active participation. These figures confirm that income is related to measures of pension participation and being part of the formal sector. Our results are consistent with Alonso et al. (2015), who show that regular contribution is closely related to the socioeconomic characteristics increasing the probability of obtaining a better pension. We add to the literature by studying the involvement in the formal sector.

### Workers' segmentation

Based on the results above, we argue that individuals affiliated to the pension system in Mexico are segmented into three groups with differentiated behavior that reflects the labor market. The three groups are as follows:

- i) *Occasional workers* who report active participation of 1 year or less in the system.
- ii) *Workers with frequent interruptions* in their formal labor trajectory who report participation of at least 1 year, density of contribution is less than 80%, or they have been in the system less than 5 years.
- iii) *High participation formal workers* who have been in the system more than 5 years and report 80% density of contribution or more.

To define each segment, we follow an approach closely based on institutional rules in which we distinguish those with almost no participation, those with a long and stable formal labor market trajectory, and leave the rest of the workers in the middle group. Therefore, in the first group are low-income workers that barely participate in the formal labor market, and in the high-activity group are those with high income



**Figure 5.** The figure reports the 25th percentile, median, and 75th percentile of workers' average income decile by density of contribution rates (time of active participation as percentage of total time since enrollment). Workers' income decile is the average of income decile trajectory in time per worker. Each bimester, we group active workers in the pension system into 10 groups according to their reported wage and we estimate the average of income deciles for each worker across bimesters.

**Table 3.** Income deciles and participation metrics.

Income decile	Density of contribution	Entrances	Spell duration	Employers	Fraction entitled to pension
1	25.7	1.6	7.9	2.0	0.15
2	26.2	1.9	7.0	2.7	0.17
3	34.1	2.5	8.2	3.9	0.25
4	40.3	2.7	9.4	4.7	0.33
5	44.3	2.7	10.8	5.0	0.39
6	49.5	2.6	13.5	5.0	0.46
7	54.0	2.4	16.5	4.9	0.52
8	58.5	2.1	20.2	4.5	0.57
9	60.6	1.9	22.4	4.1	0.58
10	58.1	1.5	24.8	3.4	0.52

*Note.* The table reports mean values of participation metrics and employers for workers grouped by mean income decile. Each bimester, we group active workers in the pension system into 10 groups according to their reported wage and we estimate the average of income deciles for each worker across bimesters. Density of contribution is the percentage time of active participation with respect to total time since enrollment; entrances is the number of times a worker joins the system; spell duration is the average number of bimesters of active participation each time the worker joins the system; employers refer to the total number of different employers for each worker between their first enrollment date and December 2011; and entitled to pension is the fraction of workers who are expected to comply with at least 24 years of active participation (vesting period) and will be entitled to the minimum guaranteed pension.

and almost no labor market interruptions. Based on the institutional context, we set 80% density of contribution and at least 5 years tenure as the cutoffs between the middle group and the group with high participation. The 80% rate of participation implies fewer interruptions, unlikely transitions to informal jobs, and helps to guarantee that those in the third group are the ones who fully belong to the formal sector. We obtain similar results when moving the cutoff to alternative values like 75% or 85%. We eliminated workers with tenure lower than 3 years in groups 1 and 2 (235 workers). Table 4 shows the fraction of workers in the sample that corresponds to each group and some metrics to characterize each one of them.

Workers in the first group represent 32% of the sample (Table 4). Most of them participate only once, report 1.6 employers, and stay 4 months on average in a formal job. They tend to affiliate with the system for the first time at an

older age (25 years), and only 28% complete the enrollment process. The median worker in this group corresponds to the third decile of income and earns two minimum wages. Survey data from IMSS and INEGI indicate that most of these workers receive weekly wages in cash, and work in activities like agriculture, retail micro business, and construction.

The second group is almost half of the sample and includes individuals who are part of the formal labor market most of the time. Participation spells are longer than 1 year, 81% complete the enrollment process, and they keep taking jobs in the formal sector, reporting more than five different employers. Median income is between deciles four and five, and 10% of them have a mortgage. Their participation rates are lower than required by the rules, and only 36% of them are expected to be entitled to the MGP. This group is our main concern, and we are interested in understanding the characteristics of these workers.

**Table 4.** Segments of workers enrolled in the Mexican pension system.

	Occasional workers 1	Frequent interruptions 2	High participation 3
Observations	12,786	19,568	7,411
Percentage of sample	32.2	49.2	18.6
Density of contribution	5.7	45.9	94.1
Entrances	1.3	3.1	2.1
Spell duration (bimesters)	2.2	10.0	34.6
Number of employers	1.63	5.21	5.56
Fraction entitled to MGP	0	0.36	0.97
Fraction registered	0.28	0.81	0.96
Age of affiliation	24.8	22.1	22.2
Median income decile	3.0	4.4	5.9
Median standardized wage	2.0	2.7s	3.9
Fraction with housing credit	0.00	0.10	0.43

*Note.* The table reports mean values of selected metrics for workers grouped by segments of participation. Occasional workers report active participation of 1 year or less. Workers with frequent interruptions who report participation of at least 1 year, density of contribution is less than 80%, or they have been in the system less than 5 years. High participation workers report 80% density of contribution or more and have been in the system for at least 5 years. Density of contribution is the percentage time of active participation with respect to total time since enrollment; entrances is the number of times a worker joins the pension system; spell duration is the average number of bimesters of active participation each time the worker is in the system; employers refer to the total number of different employers for each worker between their first enrollment date and December 2011. Entitled to pension is a dummy that takes the value of 1 if the expected time of participation is 24 years or more, and, therefore, the worker could receive the minimum guaranteed pension. Fully enrolled are workers who complete the enrollment process and select a pension manager. Each bimester, we group active workers in the pension system into 10 groups according to their reported wage and we estimate the average of income deciles for each worker across bimesters. House credit refers to workers who have a mortgage with the National Housing Institute. MGP = minimum guaranteed pension.

The third group (19% of the sample) are formal workers that report active participation for at least 5 years and an average density of contribution of 94%. They enter the system twice and report 5.6 employers on average, implying that they transition between jobs without interrupting pension participation. Ninety-six percent of them completed the enrollment process, their median income corresponds to the sixth decile, 43% have a mortgage, and 97% could be entitled to pension benefits. Those not reaching 24 years of active participation may have entered the system at a later stage of their working life.

Workers with frequent interruptions and high participation have similar labor characteristics. The average formal occupation is in urban areas, and pays wages fortnightly through deposits in payroll accounts. The manufacturing sector, followed by services and retail sectors, represents the largest fraction of affiliated workers to IMSS (CNBV & INEGI, 2018; INEGI, 2022b; STPS, 2022).

The implications upon retirement are very different for each group. Pension outcomes for workers in the extremes of participation distribution are evident. Occasional workers are not part of the formal labor market and thus they are naturally excluded from pension benefits. Most workers with high rates of participation will comply with vesting periods to be entitled to pension benefits, but the MGP is not meaningful for them because they also have higher income and higher amounts of savings. The group in the middle with frequent interruptions is the most vulnerable to low pension savings.

### Regression analysis of pension participation for workers with frequent interruptions

Workers in the second group or formal workers with frequent interruptions are the ones more vulnerable to not receiving

pension benefits. They belong to the formal sector as they keep taking formal jobs, but their accumulation rates are low because of interruptions. They may not reach vesting periods to be entitled to pension benefits. We analyze which characteristics of workers in this group are related to higher pension participation and the relative importance of each characteristic. We use regression analysis according to cross-section model (3),

$$P_{yi} = \alpha + \beta_1 Enroll_i + \beta_2 Age_i + \beta_4 Inc_i + \beta_5 IncGr_i + \beta_6 HouCre_i + \beta_3 Empl_i + u_i \tag{3}$$

where  $P_{yi}$  is the dependent variable  $y$  for individual  $i$ . Dependent variables are the number of entrances to the system, average duration of participation spell, density of contribution, and the entitled to pension dummy. Independent variables are a dummy indicating if the worker is fully enrolled ( $Enroll$ ), age of affiliation ( $Age$ ), mean income decile ( $Inc$ ), income decile growth ( $IncGr$ ), a dummy equal to 1 if the worker has a mortgage with INFONAVIT ( $HouCre$ ), and the number of employers ( $Empl$ ). We exclude the number of employers in the estimation for number of entrances because the two variables are highly correlated. Housing credit is a relevant control variable as mortgage payments are tight to workers' payroll. Therefore, workers with a credit should have more stable labor trajectories. We use standard OLS regressions if dependent variables are the number of entries or spell duration, a TOBIT regression to model density of contribution, and a Probit model for the probability of being entitled to a pension. All models include dummies for the year of affiliation to control for tenure. The results are shown in Table 5.

Number of entrances indicates how many times the worker transition in and out of the formal labor market.

Column 1 in Table 5 shows that fully enrolled workers enter and exit the system more, which implies that assigned workers are less likely to return to the system. Age of affiliation and relative income measures deliver negative and significant coefficients, while having a mortgage does not explain the number of entrances. The results imply that workers affiliating at younger age and workers with better income trajectory will have fewer interruptions to their formal labor trajectory. Regarding the duration of spell (column 2), registered workers with higher income and a mortgage tend to participate over longer periods when they are in the formal sector. Age of affiliation is positively and significantly related to participation spell. Regarding the number of employers, individuals who change jobs more spend less time in each job.

Density of contribution is the combined effect of spell duration and interruptions. Results in Table 5, column 3, indicate that fully enrolled workers with higher income and house credit report higher rates of density of contribution. The rate of participation increases as the worker enters the formal market at an older age. There is a positive relationship between the number of employers and density of contribution, indicating that changing jobs is related to higher pension participation rates.

The last dependent variable, column 4 in Table 5, is the entitled to pension dummy that takes the value of 1 when the worker is expected to comply with the vesting period to obtain pension benefits. Workers completing the enrollment process, with better income trajectory and house credit, are more likely to be entitled to a pension. Workers entering at younger age have more possibilities to annuitize pension savings as they have more time to spend in the system. Marginal effects from the Probit model show that completing the enrollment process, number of employers, and having a mortgage are the most relevant determinants of the probability of being entitled to pension.

In all cases, having a mortgage is a very strong predictor of participation and the probability of obtaining pension benefits. Workers with house credit enter and exit the system less, participate on average for longer periods of time, and are more likely to comply with vesting periods for the MGP. To obtain a mortgage in the first place, workers must be employed in a tax-paying company and enrolled in the social security system, because mortgage payments are tied to workers' payroll.<sup>13</sup> We conclude that credit origination models of INFONAVIT are good at forecasting stable labor trajectories.

In sum, within the group of workers with frequent interruptions, the ones with more pension participation have higher levels of income, have a mortgage, and joined the formal sector at a younger age. Choosing a pension manager, which reflects ownership and knowledge of their pension account, is also a predictor of higher rates of participation and the likelihood of obtaining pension benefits. Attachment to the formal labor market, and therefore to active pension

participation, is dependent on better labor conditions like income or being able to move between formal employers.

### The enrollment process and informality

Figure 1 shows that most assigned workers participate less than 10% of the time, while registered workers have much higher participation rates. To complement the analysis of whether the structure of the labor market prevails over any incentive the pension system may offer, we test the hypothesis that workers naturally belonging to the formal labor market are more likely to complete the enrollment process. The analysis provides information about workers' knowledge and involvement in the system. For more active workers, full enrollment indicates that the pension system is relevant for them and that they may count on pension savings for retirement income. For workers with very low participation, completing the enrollment process provides evidence that at least they know about the existence of the pension system and their pension savings.<sup>14</sup> In contrast, individuals who belong to the informal sector are less likely to finish the process. The reason for not completing the process may be the low involvement in the formal labor market and the insignificant amount of pension savings. To test the hypothesis that formal workers are more likely to complete the enrollment process, we use model (4):

$$R_i = \alpha + \beta_1 Age_i + \beta_2 Inc_i + \beta_3 Empl_i + u_i \quad (4)$$

where  $R_i$  is a dummy equal to 1 if the worker completes the enrollment process (registered). Independent variables are age of affiliation ( $Age$ ), average relative income ( $Inc$ ), and the number of employers ( $Empl$ ). We separately evaluate the probability of full enrollment for each segment of workers (occasional, frequent interruptions, and high participation). Results are in Table 6. The sign and significance of regression coefficients are similar for all three groups. Age of enrollment is negatively related to the probability of completing the process, and relative income and the number of employers deliver positive and significant coefficients. Negative coefficients for age of enrollment imply that workers joining the formal workforce at a later age are less likely to complete the enrollment process. Individuals entering the formal labor market at an older age may indicate that some of them spend part of their careers in the informal sector and eventually enter the formal market at a later age. In line with these results, more employers imply that the worker is more attached to the formal sector, and more likely to complete the enrollment process and to count on pension savings for retirement.

The analysis of marginal effects shows that for occasional workers (column 1, Table 6), the number of employers is the most relevant factor explaining who completes the enrollment process. This confirms the hypothesis that those individuals who perceive more opportunities to be part of the formal sector are the ones selecting a pension manager. Number of employers is also the most relevant factor in the decision of full enrollment for workers with frequent interruptions (column 2). However, for this group, the level of income becomes an important determinant for completing the process. For workers with high levels of participation, the

<sup>13</sup>If at some point workers leave their formal job, they can renegotiate the terms of their mortgages with INFONAVIT to reduce the amount of the monthly payment, but they remain liable for the outstanding balance of the mortgage. If workers just transition between formal jobs, they notify INFONAVIT, and payments through the payroll account continue normally. In fact, having the commitment of a mortgage is a strong incentive for workers to remain in the formal job.

<sup>14</sup>According to survey evidence (CNBV & INEGI, 2018), 77% of fully enrolled workers count on their pension account for retirement income.

**Table 5.** Regression analysis of participation—workers with frequent interruptions.

	Dependent variables				
	Entrances OLS 1	Spell duration OLS 2	Density of contribution TOBIT 3	Entitled to pension 4 PROBIT	Marginal effects
Fully enrolled	0.287*** (0.0288)	2.608*** (0.126)	9.752*** (0.372)	0.540*** (0.0324)	0.146*** (0.00860)
Age of affiliation	-0.0435*** (0.00147)	0.124*** (0.00820)	0.115*** (0.0203)	-0.0668*** (0.00221)	-0.0181*** (0.000564)
Income decile	-0.104*** (0.00476)	0.622*** (0.0275)	1.142*** (0.0688)	0.0845*** (0.00542)	0.0229*** (0.00143)
Income decile growth	-0.326*** (0.0466)	-0.207 (0.218)	-1.408* (0.724)	-0.141*** (0.0489)	-0.0381*** (0.0132)
House credit	0.0436 (0.0354)	4.472*** (0.181)	19.96*** (0.419)	1.173*** (0.0374)	0.317*** (0.00933)
Employers		-0.629*** (0.0154)	1.997*** (0.0441)	0.114*** (0.00374)	0.0309*** (0.000936)
Constant	4.746*** (0.0683)	5.809*** (0.359)	7.157*** (0.896)	-1.168*** (0.0750)	
Sigma			18.60*** (0.104)	-1.168*** (0.0750)	
Observations	18,634	18,634	18,634	18,634	18,634
Adjusted R-squared	0.163	0.182			
Pseudo R <sup>2</sup>			0.0534	0.247	
Log likelihood			-79,166	-8,945	

*Note.* The table reports results from regression models of participation for workers with frequent interruptions (group 2) who report participation of at least 1 year, density of contribution is less than 80%, or they have been in the system less than 5 years. Dependent variables are: 1 entrances, that is, the number of times a worker joins the pension system (OLS regression); 2 spell duration is the average number of bimesters of active participation each time the worker joins the system (OLS regression); 3 density of contribution is the percentage time of active participation with respect to total time since enrollment (Tobit); and 4 entitled to pension is the fraction of workers that are expected to comply with the vesting period of 24 years of active participation and will be entitled to annuitize savings and the minimum guaranteed pension (Probit). Fully enrolled is a dummy that takes the value of 1 if the worker completes the enrollment process. Each bimester, we group active workers in the pension system in 10 groups according to their reported wage and we estimate the average and the slope (growth rate) of income deciles for each worker across bimesters. House credit refers to workers with a mortgage from the National Housing Institute. Employers refer to the total number of different employers for each worker between their first enrollment date and December 2011. All models control for heteroskedasticity. Robust standard errors are in parenthesis; \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

level of income is the most relevant factor explaining full enrollment (column 3). In the case of workers with high participation, the probability of completing the enrollment process is more related to human capital and financial literacy, and not necessarily to labor informality.

We confirm the hypothesis that individuals less likely to complete the enrollment process are the ones who naturally belong to the informal sector and are not involved in the pension system. They do not take ownership of their pension account and may not consider it as a viable option for retirement income. Pension regulation forces tax-paying firms to affiliate workers to the system even if they are temporary (Aguila et al., 2010). For this reason, the number of affiliated workers overstates measures of coverage and understates measures of participation. The empirical analysis of the enrollment process helps to disentangle for whom pension savings are relevant and are vulnerable to not receiving pension benefits.

**DISCUSSION AND CONCLUSIONS**

We evaluate the newly DC pension system in Mexico at the micro level. We determine for which workers the design is

well suited and for which ones the system does not work. Our evidence supports the view that the personal characteristics of workers, and their position within the structure of the Mexican labor market determine pension benefits.

Our findings lead us to conclude that patterns in pension participation in Mexico reflect the structure of the local labor market, where half of the labor force is in the informal sector and there is constant transition in and out of the formal sector. The consequence is that the system properly serves to 36% of affiliated workers, leaving the rest exposed to the risk of longevity, and increasing the likelihood of poverty and income inequality among the elderly population in the future.

We identify three segments of participants in the pension system in Mexico, reflecting the structure of the labor market: occasional workers who belong to the informal sector, workers who have a closer attachment to the formal labor market and frequently move in and out of the formal sector, and workers with high participation rates who are also at the upper end of the income distribution. Only the latter group of workers, whose labor trajectories are characterized by high participation rates, are appropriate for a pension system that requires high participation to be successful.

**Table 6.** Probability of completing the enrollment process.

	Occasional workers 1		Frequent interruptions 2		High participation 3	
	Probit	Marginal effects	Probit	Marginal effects	Probit	Marginal effects
Age of enrollment	-0.0178*** (0.00134)	-0.00557*** (0.000414)	-0.0267*** (0.00134)	-0.00658*** (0.000321)	-0.0252*** (0.00291)	-0.00188*** (0.000222)
Income decile	0.0310*** (0.00527)	0.00970*** (0.00164)	0.0891*** (0.00501)	0.0219*** (0.00121)	0.148*** (0.0116)	0.0111*** (0.000935)
Employers	0.327*** (0.0127)	0.103*** (0.00367)	0.115*** (0.00438)	0.0284*** (0.00105)	0.0763*** (0.0102)	0.00572*** (0.000792)
Constant	-0.835*** (0.0443)		0.542*** (0.0465)		1.196*** (0.117)	
Observations	12,786	12,786	18,634	18,634	8,345	8,345
Pseudo <i>R</i> -squared	0.0631		0.103		0.153	
Log likelihood	-7,088		-8,220		-1,198	

*Note.* The table reports cross-section Probit models and marginal effects. The dependent variable is a dummy equal to 1 if the worker completes the enrollment process and chooses a pension manager. Occasional workers are those reporting total participation in the system of 1 year or less (column 1). Frequent interruptions (column 2) report participation of at least 1 year, density of contribution is less than 80%, or they have been in the system less than 5 years. High participation (column 3) refers to tenured workers, with more than 5 years of affiliation and density of contribution above 80%. Each bimester, we group active workers in the pension system into 10 groups according to their reported wage and we estimate the average of income deciles for each worker across bimesters. Employers refer to the total number of different employers for each worker between their first enrollment date and December 2011. All models control for heteroskedasticity. Robust standard errors are in parenthesis; \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10%, respectively.

One-third of individuals are one-time occasional workers in the formal sector, participating over a few months. This group of occasional workers with negligible participation are individuals excluded from any pension benefit under the official system. Their only entitlement is to claim their savings back.

At the top end of participation (21%) are tenured workers who report long spells and almost no interruptions and spend almost all their careers in the formal sector. They are formal workers who do not migrate to the informal market, or do not spend much time outside the system. Almost all of them will comply with the vesting period and will have the choice to annuitize their savings. These individuals are also at the top end of the income distribution and the majority have a mortgage. The size of this group seems to be limited by the labor market structure rather than by the institutional design of the system, because higher participation is related to higher income, which is correlated with skills. The behavior of this group is the most compatible with the design of the pension system in terms of the vesting period. However, there are three problems with the institutional design for this group. First, the low rate of contribution will give limited savings for retirement. Second, the problem of low savings is reinforced by unsound financial decisions. In general, individuals do not compensate for low rates of contribution with higher voluntary savings.<sup>15</sup> Third, most of the workers in this group will not benefit from the government subsidy because their accumulated savings will be above the MGP. Finally, the behavior of assigned workers with high rates of participation puzzles us. Why do they not claim ownership of their savings? The answer may be related to procrastination, lack of information, or low financial education.

<sup>15</sup>Our data show that only 175 workers out of 40,000 report voluntary contributions.

Between extremes in participation lies half of the affiliated workers who constantly transition in and out of the formal labor market. They are the ones facing more uncertainty to comply with vesting periods. The patterns in participation reveal that these individuals do not want, or are not able, to join the formal labor market for longer periods. Despite constant interruptions, they report several employers; therefore, they belong in some way to the formal labor market. The rigidities of the labor market are stronger than the potential incentives of pension reform like accumulating savings without reducing current spending. The institutional design of the system is not adequate for them because vesting periods are too strict, and the probability of obtaining pension benefits is low. The behavior of this group is not compatible with the design of the pension system because of the labor market conditions. The most likely outcome is that they will receive their accumulated savings as a lump sum because current regulation does not allow them to be eligible to annuitize savings. These workers will be exposed to longevity risk or the risk of outliving their own savings.

The institutional design seems to be inadequate because labor market conditions impose restrictions on pension participation. Our view is that pension policy design should consider the structure of local labor markets as a restriction and be designed in such a way that can provide benefits to most of the workers in the economy.

Our findings can be extended to countries that have similar DC systems and labor market conditions, such as Chile, Peru, and Colombia. Informality rates in these countries are high as in Mexico. Also, there is a segment of the labor market with mobility between informality and formality, which is consistent with low participation. For example, [Li and Olivera \(2005\)](#) claim that in Peru a way to increase pension coverage would be the creation of more formal jobs.

We identified two limitations to our work and some areas where future research is needed. The first limitation

is that we use the first years of the system, and we project expected behavior based on past participation. New data can provide additional evidence on the relationship between age and pension participation. The second is that we only have data on voluntary savings, but we do not know if workers have savings outside the system. Understanding better savings behavior is important. Extensions to our work can be in three areas that are relevant to better understanding pension systems. One is to compare workers that are eligible under the old DB system with workers that are only eligible in the DC system to test whether the change in public policy induced changes in the dynamics of the labor market. Second, our data allow us to analyze how the gender gap in the labor market affects benefits in the pension system. The third is to assess the adequacy of pension benefits.

Our results support four policies to improve the institutional design intended to benefit more workers: (a) increase contribution rates to help all groups, particularly the group with stable labor trajectories; (b) reduce the vesting periods to improve conditions for the group with frequent interruptions; (c) increase the MGP as a function of time of contribution, age, and wages, which will benefit eligible workers with lower incomes; and (d) design incentives to increase voluntary savings, which will help all workers. All changes can be implemented without making the system fiscally unsustainable as the old DB system was. The changes to the Mexican pension system of December 2020 are consistent with the first three policies we suggest to improve the institutional design.

## SUPPLEMENTARY MATERIAL

Supplementary material is available online at *Work, Aging, and Retirement*.

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## AUTHOR CONTRIBUTIONS

Renata Herrerias (Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing) and Guillermo Zamarripa (Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – review & editing)

## DATA AVAILABILITY

The dataset is available to download at <https://bit.ly/350oHmi>.

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