# Public Pensions and the Strategic Timing of Formal Employment

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## Abstract

We study how public pension parameters impact life-cycle labor supply decisions about when to work formally versus informally. Our analysis centers on pension eligibility rules in Ecuador. First, we use administrative data to document and unpack spikes in retirement from formal jobs at pension eligibility ages. Next, we use survey data and a regression discontinuity design to investigate whether eligibility rules influence the timing of formal employment earlier in life. We find discontinuous increases in transitions to formal employment at age 50, consistent with forward-looking people timing their affiliations with social security to minimize contributions while still positioning themselves to unlock benefits at a later eligibility age. Additional evidence suggests that small and family firms, where employees and employers may readily coordinate, help facilitate these strategic transitions.

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# 1 Introduction

Contributory public pensions are among the largest social programs throughout the world. While the provision of retirement benefits might influence labor supply at older ages, pension eligibility parameters might also influence labor supply earlier in life. In the context of countries with large informal labor markets, a crucial life-cycle labor supply decision that pension rules might influence is whether—and when—to work formally or informally. On the one hand, requiring social insurance contributions might discourage formal employment during prime working years. On the other hand, requiring sufficiently long contribution histories might encourage formal employment. Despite the importance of understanding how people navigate these trade-offs, there is surprising little evidence on how pension program design influences the wedge between formal and informal sectors (Banerjee et al., 2024).

In this paper, we study how public pension parameters influence both retirement and earlier-in-life decisions about when to begin working formally. Our context is Ecuador, where roughly two out of three workers work informally, receiving under-the-table compensation without making contributions to social security. Our analysis focuses on pension eligibility rules. The public pension in Ecuador is a pay-as-you-go system that provides access to benefits for formal workers after they reach specified ages. Importantly, a worker's eligibility age depends on the number of years they have contributed to the system. Workers can claim benefits at 60 if they have 30 years of contributions, at 65 if they have 15 years of contributions, and at 70 if they have 10 years of contributions. We leverage both administrative data, which allow us to accurately track exits from formal employment, and detailed panel survey data, which allow us to track workers transitioning between informal and formal employment, to study responses to incentives from these age-based eligibility rules.

Our analysis proceeds in two steps. First, we use administrative data from the social security administration in Ecuador to confirm that pension eligibility ages impact retirement in our setting. Existing evidence from several other settings indicates that eligibility ages strongly influence exits from employment (de Carvalho Filho, 2008; Staubli and Zweimüller, 2013; Manoli and Weber, 2016; Seibold, 2021; Nakazawa, 2022; Dolls and Krolage, 2023; Deshpande et al., 2024; García-Miralles and Leganza, 2024). Our analysis in Ecuador corroborates this general takeaway. We first show large spikes in benefit claiming and retirement right at 60, 65, and 70, and we show large spikes in the number of contribution-years right at 30, 15, and 10. These spikes suggest that many people contribute the minimum number of years required to unlock pension benefits and then claim those benefits and retire when they are first eligible to do so.

We then unpack these spikes in retirement. Specifically, we use a regression discontinuity

design to estimate discontinuous increases in retirement at each of the eligibility ages for different groups of people. The combination of the eligibility ages and required contribution histories mean that people who begin contributing to social security earlier in life are more likely to unlock benefits earlier. Consistent with this idea, we show that people who began contributing to social security earlier drive the discontinuous increase in retirement at 60, whereas people who began contributing later drive the discontinuous increases at 65 and 70. We also highlight how these patterns are in line with economic incentives, as other rules create disincentives to work after becoming eligible for pension benefits: reductions in benefits for those who claim and continue to work lead to implicit taxes on earnings, and choosing to delay claiming after becoming eligible results in forfeited benefits.

In the second step, given this link between the timing of initial social security contributions and retirement, we study how the pension eligibility rules affect earlier-in-life decisions about *when* to work formally and affiliate with social security. The program creates incentives to contribute long enough to unlock benefits in retirement, especially because benefit replacement rates are rather generous. However, workers may value informal work and the ability to avoid social insurance contributions and taxes. We therefore investigate whether some workers time transitions to formal employment so that they minimize contributions to the system while still gaining access to benefits at one of the eligibility ages.

To test for this type of strategic behavior, we use survey data and another regression discontinuity design to estimate the causal effects of reaching critical ages earlier in life on the decision to affiliate with social security. Specifically, we estimate changes in the probability of transitioning to formal employment at 30 (which is 30 years before the eligibility age of 60) and at 50 (which is 15 years before the eligibility age of 65).[1] Crucially, our survey data allow us to track individuals across type of employment, which makes this analysis feasible.

We find clear and strong evidence of a discontinuous increase in the likelihood of transitioning to formal employment at 50. This evidence is consistent with forward-looking workers timing their affiliations with social security to contribute for the minimum 15 years before unlocking pension benefits at 65, and it supports the idea that some people do respond to pension-induced incentives before reaching retirement ages. Our baseline RD estimate indicates a 1.8 percentage point increase in the probability that a worker transitions from not working formally to working formally. While perhaps small in absolute terms, this estimate represents a 21% increase when compared to the baseline mean because transitions to formal employment around 50 are relatively uncommon. When compared to the baseline probability of being affiliated with social security just before 50, which is 38%, it corresponds to a

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[1]We also report results for age 60 (which is 10 years before the eligibility age of 70), but we do so with caution because 60 is also a pension eligibility age.

4.7% increase. We then show that this overall increase in transitions is primarily explained by people transitioning from informal to formal employment, as opposed to non-employed people obtaining new formal jobs.

In contrast, we find no evidence of increases in transitions to formal employment at 30. It could be that workers find it infeasible to plan for such a long period of continuous contributions. Many might expect to encounter a disruption that prevents them for contributing for some period over the course of three decades.

We then conclude the second step of our analysis by exploring mechanisms. How are some informal workers able to facilitate transitions to formal employment right at 50? Formal jobs may be difficult to obtain. Moreover, from the perspective of the firm, hiring a formal worker involves additional costs in the form of employer social insurance contributions. These factors can complicate the ability of workers to time transitions to formality.

We explore several possible channels and find evidence consistent with informal employees switching the status of their contracts at formal, registered firms to become formal employees. Specifically, we rule out transitions being explained primarily by workers changing occupations, the self-employed formalizing their businesses, and employees switching to formal employment from informal employment at informal firms not registered with the tax authorities. Instead, we find that transitions within registered firms explain 71% of the impacts on informal-to-formal employment transitions.

We therefore hypothesize that workers better situated to negotiate the terms of their contracts are driving the results, either due to bargaining power or alignment of interests. We show three pieces of evidence consistent with this hypothesis. First, we show larger responses by more-educated workers, who may be more productive or better informed about the pension system and therefore better positioned to negotiate with their employers. Second, we show that the impact on informal-to-formal transitions within registered firms is largely explained by transitions within small firms, with three or fewer employees. Third, we show meaningfully larger increases in transitions to formality for people who live with a family member who owns a registered firm, which we interpret as a proxy for working at a family firm. Due to family connections, employer and employee objectives at family firms are more likely to be aligned. In addition, we find suggestive evidence that employees in these settings may be willing to accept lower wages to formalize their contracts, albeit with low statistical precision. Taken together, these results suggest that the ability to coordinate with employers is important for strategically transitioning from informal to formal employment.

Our main contribution is to provide new evidence on how pension program design features influence the wedge between formal and informal work. Our results that show that key eligibility parameters can induce strategic, forward-looking transitions to formality earlier in

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life are novel, and so is our analysis providing insights on the mechanisms that make these transitions possible. Documenting behavioral responses like these is important, as evidence on how pension design in general interacts with large informal sectors is scarce (Banerjee et al., 2024) and eligibility ages and work history requirements in particular are some of the most salient and fundamental design features. A few related papers provide complementary evidence on other types of strategic arrangements that arise because of social insurance design, like reporting incomes to maximize pension benefits as workers approach retirement age (Dean et al., 2024; Kumler et al., 2020) or demand-side layoffs and recalls to extract rents from unemployment programs (Van Doornik et al., 2023). Other related papers study earlier-in-life employment responses to pensions, but focus on composite reforms that make it difficult to isolate responses to a specific design feature and do not study the type of strategic transitions to formality that we do (e.g. Becerra, 2023; Lauletta and Bergolo, 2023; Becerra, 2024; Khanna et al., 2025).[2]

Our results also contribute to a broader discussion in the literature on the determinants of informality (Ulyssea, 2020). While there is increasing evidence on firm choices regarding informality, the factors that drive worker choices are less understood (Ulyssea et al., 2025). We contribute to closing this gap by highlighting how contributory pension programs can lead workers to combine informal and formal work over the course of the life cycle, such that informality and formality are dynamic complements. This idea contrasts with other research on how government programs influence informality, which takes a static perspective and typically treats informal and formal employment as substitutes and analyzes workers switching sectors in response to contemporaneous changes in the relative price of working formally.[3] It also contrasts with a common view in the literature that individuals work informally while they queue for a formal job (Bosch and Maloney, 2010; Perry, 2007). Instead, our results emphasize how informal-to-formal transitions can be the result of pension incentives that encourage workers to delay entry to formality. This behavior may be relevant for quantitative assessments of pension systems (Joubert, 2015; McKiernan, 2021; Moreno, 2024), which typically do not allow for within-job informal-to-formal transitions, or for models of informality more generally (Meghir et al., 2015; Bobba et al., 2021).

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[2]Becerra (2023) and Becerra (2024) show that major reforms reducing benefit generosity led to more informal employment, and Lauletta and Bergolo (2023) find little evidence that partially privatizing social security in Uruguay impacted employment among younger workers. Finally, Khanna et al. (2025) study the expansion of a different type of pension, a non-contributory program in Brazil, and find that it led to increases in labor force participation (mostly through informal work) for newly-covered married females.

[3]See Bosch and Schady (2019), Garganta and Gasparini (2015), or Cruces and Bérgolo (2013) for evidence on cash transfer programs, Bosch and Esteban-Pretel (2015) or Gerard and Gonzaga (2021) for evidence on unemployment insurance, and Bosch and Campos-Vazquez (2014) or Hernandez (2024) for evidence on health insurance.

# 2 The Ecuadorian Setting and Policy Environment

## 2.1 Labor Markets

Ecuador is an upper middle-income country with roughly 17 million inhabitants. In 2023, per-capita income was USD 16,062 (adjusted for purchasing power). Its economy is diversified, with manufacturing, commerce, and oil extraction being the largest sectors (Central Bank of Ecuador, 2022).

Despite unemployment rates of around 4% over the past 10 years, informal jobs—those not complying with social security contributions—are widespread, accounting for about 60% of total employment (Elgin et al., 2021).[4] Throughout this paper, we define formal workers as those who contribute to Ecuador's Institute of Social Security (IESS). Conversely, we define informal workers as those who are working but do not make contributions to IESS. Data from employment surveys suggest that informality is more common among those with lower education levels, but even 15% of university graduates work either as informal salaried employees or as self-employed workers.

The labor market in Ecuador also consists of many micro firms (firms with less than 10 employees), which is common in settings with widespread informal work. Informality spans various sectors but is more prevalent in smaller firms (Canelas, 2019). In 2019, out of the 886,600 registered firms in Ecuador, 803,600 (90%) were micro firms (Instituto Nacional de Estadística y Censos, 2021).

## 2.2 The Social Security System

Ecuador's Institute of Social Security manages several programs, including a contributory pension and other social insurance schemes like health insurance, unemployment insurance, occupational hazard programs, and severance pay policies. Affiliation with social security is mandatory by law for workers. Employees are affiliated through their employers as dependent workers, while self-employed workers must self affiliate as independent workers. Informal workers or people not in the labor force may be able to self-enroll with social security as independents. However, in practice, only 30% of working-age adults are affiliated with IESS (see panel c of Appendix Table B1). Many people work informally, either off-the-books for firms registered with the tax authority or for unregistered firms.

Most people affiliated with IESS are dependent workers (roughly 89%, see panel a of Appendix Table B1). Required contributions for these workers, who are affiliated through their employers, amount to 20.6% of their earnings. Employees contribute 9.45%, and employ-

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[4]For reference, over 61% of the global employed population work informally (Bonnet and Chen, 2019).

ers contribute the other 11.15%. Individuals affiliated with social security as independent workers contribute 17.6% of their reported income.[5]

These contributions finance a bundle of social security benefits that vary throughout the life cycle. Some benefits are entitlements during working life (e.g., unemployment insurance), others are received in retirement (e.g., old-age pension payments), and still others are lifetime benefits (e.g., health insurance). We focus on old-age pension benefits.

## 2.3 The Old-Age Pension

Like in many countries, the old-age pension in Ecuador is a public, defined benefit, contributory program. It provides retirement benefits to former workers affiliated with social security and also survivorship, disability, and funeral benefits.

The contributions to the old-age pension scheme make up a large share of total contributions to social security. For workers affiliated through their employers, contributions to the old-age pension scheme amount to 10.96% of their income, representing more than half of their overall contributions to social security (20.6%). Employees contribute 6.64% of their earnings to the pension scheme and employers contribute 4.32%. For individuals self-affiliated with social security, contributions amount to 10.56% of their income, which also represents more than half of their overall contributions to social security (17.6%).

To be eligible to claim pension benefits, a retiree must have contributed to the system for a sufficient period and meet a corresponding age requirement. With 40 years of contributions, benefits can be claimed at any age. With 30 years of contributions, benefits can be claimed as early as 60. With 15 years of contributions, benefits can be claimed at 65, and with 10 years of contributions, benefits can be claimed at 70.

Monthly benefit amounts are determined by earnings histories. For the purposes of our study, a key takeaway is that benefits are generous. A retiree's monthly benefit is equal to a percentage of their average monthly earnings over their 5 highest years of earnings. This percentage, or replacement rate, is 43.75% for the first 5 years of contributions, and it increases by 1.25% for each of the next 30 years of contributions. For example, a worker with 35 years of contributions receives monthly benefits that amount to 43.75 + (1.25)(30) = 81.25% of their average monthly earnings. Additional contributions lead to additional increases in benefits.[6]

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[5]The difference in contributions reflects differences in the benefits to which independent workers have access. For example, while independent workers are entitled to pensions and health care in a similar way to dependent workers, independent workers are not entitled to severance payments or unemployment insurance.

[6]For the next 5 additional years of contributions (36 to 40), the replacement rate increases at a higher rate and not linearly. For 36 years of contributions, the rate is 83.25%. It is 86.05% for 37 years, 89.70% for 38 years, and 94.30% for 39 years. For 40 years of contributions, the replacement rate is 100%. For each extra year of contributions above 40, the rate increases linearly by 1.25%.

There are, however, limits to pension benefits. Specifically, monthly pension payments may not exceed 5.5 times the minimum monthly salary. This limit implies lower replacement rates for high-earnings individuals. Likewise, there is a minimum pension equal to 50% of the current minimum monthly salary. Benefits are paid monthly, and there are two bonus payments in each year: one in either April or September and one in December, so beneficiaries receive a total of 14 monthly payments.[7]

Importantly, beyond increases in the replacement rates due to additional contributions or salary increases, there are no additional adjustments to benefits for claiming later than one is eligible. For instance, if a person begins contributing to the system at 30 and contributes for 30 years, they will be eligible to claim benefits as early as 60. If they wait to claim until 62, their monthly benefits will be greater because of the two additional years of contributions (and perhaps even more so if those additional years are two of the person's five highest-earning years), but their pension wealth (the net present value of their pensions) can decrease because they are simply forgoing two years of benefits. Similarly, anyone who unlocks eligibility at 65 forgoes one year of benefits for each year that they delay claiming past 65. Note that this setup contrasts with social security systems like the one in the United States, where people experience increases in benefits for delaying claiming past their full retirement age.

Finally, while a person can continue to work formally after claiming pension benefits, during this time, their benefits are reduced by 40% and they must resume making contributions to the system. Moreover, a person cannot receive pension benefits and work for their previous employer during their first year of receiving benefits.

Overall, Ecuador's pension system is generous. The average replacement rates are among the highest in Latin America and are heavily subsidized: roughly 73 cents of each dollar paid to pensioners is financed by government spending instead of current contributions to IESS, placing the pension system among the three most generous systems in the region (Altamirano et al., 2025). This generosity is reflected in the high internal rates of return for individuals participating in the program. For example, in the case of an individual with average monthly earnings, who starts working at age 20 and contributes continuously until 60, the rate of return that equalizes the net-present value of the pension benefits after retirement to the net present value of their contributions would be 8.4% per year.[8]

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[7] Retirees living in the Sierra and Amazon regions receive an additional payment in September, whereas retirees living in the Coast and Insular regions receive an extra payment in April.

[8] For this calculation, we use the supplementary material of Bosch et al. (2018), which allows us to estimate the implied subsidy for the Ecuadorian system based on specific assumptions. We assume that individuals start working at 20, work continuously for 40 years, and claim their pensions at 60. We also assume an annuity rate of 4%, a real annual interest rate of 3.5%, and a salary growth rate of 2% per year.

These returns can be higher when individuals delay their contributions. For individuals who contribute continuously starting at age 50 until they turn 65, a similar calculation implies an internal rate of return of 24% per year, above and beyond the annual returns that traditional defined contribution retirement savings accounts in other settings typically provide.[9]

## 2.4  Other Programs

*Social Security Health Care.* Part of the contributions to IESS finance health care. To be eligible for health care provided by IESS before retirement, individuals must contribute to IESS for at least two months in a given year. Importantly, before retirement, eligibility for health care is neither a function of age nor of work history. After claiming the old-age pension, individuals continue to have access to social security health care.

*Non-contributory Health Care.* Individuals who are not affiliated with IESS, either because they work informally or are unemployed, can affiliate with Ecuador's non-contributory health care regime. To receive benefits, individuals must not be affiliated with IESS. There are no age thresholds determining eligibility.

*Non-contributory Pension.* There is a non-contributory pension program that delivers payments of USD 100 per month. Eligibility for this non-contributory benefit requires that individuals are 65 or older, qualify as poor or extreme poor based on their proxy-means-test score in Ecuador's social registry, and do not receive the contributory pension from IESS. Note that the minimum monthly public pension payment (USD 183 for 2016) is substantially more generous than the monthly benefit of USD 100 obtained by beneficiaries of the non-contributory pension.

## 3  Data

We use three datasets to conduct our analyses. Two consist of administrative records obtained from the social security administration in Ecuador. The other dataset consists of nationally representative household survey data. The advantage of the administrative data is large sample sizes and accurate information about pension contributions and benefits for formal workers. The disadvantage is that the data do not contain information on informal workers. The advantage of the survey data is that we can observe both formal and informal workers, which is necessary for our analysis of earlier-in-life labor supply.

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[9]For example, in the United States, Vanguard (2024) suggests an average annual return for 401(k) accounts of 9.7% between 2019 and 2023, and 17.6% for 2023, a year with unusually high returns.

## 3.1 Administrative Records on Current Pension Beneficiaries

One of our administrative datasets contains anonymized records on the universe of individuals receiving benefits from IESS as of December 2022. This cross-sectional dataset includes information on 738,021 individuals who received either old-age pensions, disability benefits, or family benefits due to a deceased pensioner. We exclude from the dataset records of individuals who receive either of the latter two benefits and do not receive old-age pension benefits. The resulting sample contains 531,258 individuals. We also exclude the 12% of pensioners covered by special pension programs for members of the military, public school teachers, and some rural organizations. This additional restriction results in an analysis sample of 460,041 individuals receiving IESS old-age pension benefits. We use these data to document how many people claimed their benefits at various ages.

## 3.2 Administrative Records on Current and Former Workers

Our second administrative dataset contains anonymized records on the universe of people who have ever contributed to the social security system, starting in 2001 and ending in 2022. This includes individuals who were currently working or who may have already retired. Our sample consists of 6,323,252 non-deceased individuals. This cross-sectional dataset includes information about social security contributions for formal workers, both those who contributed in the past and are currently retired as well as those who are still working and contributing. For each individual, we observe the date they made their first contribution, the date they made their final contribution, the cumulative number of contributions made to the system, and demographic characteristics like gender and date of birth. We use these data to analyze retirements from the formal sector.

## 3.3 Nationally Representative Survey Data

The administrative records provide high-quality information on people who worked formally and contributed to the pension system. However, as discussed above, informal work is widespread in Ecuador and is not captured by these administrative records.

We therefore complement the administrative data with nine years of nationally representative employment surveys, which allow us to study formal and informal workers. We use data from the Ecuadorian National Survey of Employment and Unemployment (ENEMDU) that span 2008 to 2016. For this period, the survey contains a good deal of information on demographic characteristics for all members of the household and on their employment status, including information on whether an individual is affiliated with the social security system. The ability to measure affiliation with social security—whether a person has ever

contributed—as opposed to current contributions is crucial for our analysis of the impacts of the pension program on the timing of an individual's entrance to formal employment. In addition, the survey includes self-reported information about the employers of individuals, such as whether the employer is registered with the tax authority.

The survey is conducted quarterly in a rotating panel format with up to four observations per household. A household is initially interviewed for two consecutive quarters, then leaves the sample for two quarters, and finally reenters the sample for two more consecutive quarters.

### 3.4 Summary Statistics

Appendix Table B1 reports summary statistics for each of these three datasets. Panel (a) reports statistics for people who ever contributed to the pension system. It shows that 41% of these people are women and that 89% of affiliates contribute to IESS through their employers as salaried employees, whereas the remaining individuals contribute as independent workers (e.g., self-employed workers or contractors). Panel (b) reports statistics for people who have claimed their pension benefits. It shows that the average age of benefit eligibility is 64, the average claiming age is 66, and the average pensioner retired after contributing for 332 months (27 years). Finally, panel (c) reports statistics for people in our survey data. It shows that 30% of working-age adults are affiliated with IESS, mostly as salaried workers. The employment rate is 61%. Most workers work informally without being affiliated with IESS, and most workers work for firms that are not registered with the tax authority.

## 4 Pension Eligibility Ages, Minimum Contribution Thresholds, and Retirement Choices

We begin by analyzing the relationship between pension eligibility ages, minimum contribution thresholds, and pension claiming and retirement. The pension program creates incentives to work and contribute long enough to become eligible for benefits. However, it disincentivizes working and delaying claiming past pension eligibility because (i) claiming after eligibility means forfeiting benefits and (ii) benefits are reduced for people who continue to work after claiming. The statutory eligibility ages of 60, 65, and 70 thus create discontinuous changes in claiming and retirement incentives at these ages.

Figure 1 illustrates the influence of pension eligibility rules on pension benefit claiming, retirement, and years of contributions. Panel (a) plots the empirical distribution of pension claiming ages. The underlying sample consists of people in our administrative dataset covering the universe of pensioners as of December 2022. The graph shows the share of people

who received their first pension benefits at various ages. The spikes at 60, 65, and 70 are striking. Many people claim their pension benefits right at the statutory eligibility ages. Specifically, 19% of pensioners claimed benefits at 60, 17% did so at 65, and 6% did so at 70.

Panel (b) plots the empirical distribution of retirement ages. The underlying sample consists of people in our administrative dataset on current and former workers, those who made a contribution to IESS between 2001 and 2022. We use information on the date of a person's final contribution to IESS to define retirement. The final contribution date should correspond to the retirement date for people who are retired, but for people still working in December 2022, their age when they make their final contribution in the data will be their age as of December 2022. Therefore, to try to isolate retirement ages for potential retirees, we define an individual in these data to be retired if they i) were at least 55 years-old by December 2022 and ii) did not make a contribution during the two years preceding December 2022. Consistent with a tight link between claiming pension benefits and retiring, we also observe large spikes in retirement right at 60, 65, and 70.[10]

In addition to the existence of the spikes, their relative magnitudes are noteworthy. There are almost as many people who claim benefits at 65 as who claim at 60. Given the strong work disincentives after reaching pension eligibility, a natural question is whether the workers who claim benefits later delayed claiming after becoming eligible, or if they claimed at later ages because that is when they first unlocked eligibility.

Panel (c) sheds some light on this question. The sample underlying the figure consists of people in our administrative dataset on pensioners. The graph plots the empirical distribution of contribution-years, defined as the total number of years a person has contributed to IESS. It shows large spikes in contribution-years at 10, 15, and 30, which are the number of years of contributions required to unlock pension benefits at 70, 65, and 60, respectively. This pattern is consistent with the idea that many people contribute just enough years to become eligible to claim benefits at the eligibility ages. It also might suggest that the people who make up the spikes in claiming at 65 and 70 are not people who were eligible earlier and forfeited benefits by delaying claiming, but are instead people with shorter work histories who become eligible right at 65 or 70.

Panel (d) further shows how pension claiming ages and the number of contributions are

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[10]We use an age-55 threshold for potential retirees because 55 would be the pension eligibility age for someone who started working formally at 15 (the minimum working age) and worked continuously for 40 years. One limitation of our approach is that it classifies people who may not consider themselves retired, but who have not been formally employed for two years, as retired. In Appendix Figure B1, we plot the distribution of retirement ages dropping the 55-year-old requirement. Doing so increases the share of individuals that appear retired at younger ages, but we still see prominent spikes at 60, 65, and 70.

related. It plots the distribution of the total number of contributions for three groups, defined by claiming age. For retirees who claim pension benefits at 60, we observe a clear spike at 30 years of contributions. For retirees who claim at 65, we observe a clear spike at 15 years of contributions, but no spike at 30 years of contributions. Finally, for retirees who claimed at 70, we observe a spike at 10 years of contributions, but not at 15 or 30 years.

Taken together, these histograms suggest that pension eligibility rules influence years of contributions, the timing of benefit claiming, and the timing of retirement. The patterns point to some individuals claiming benefits and retiring as soon as they satisfy the minimum number of contributions required to unlock eligibility at a statutory age.

# 5    The Link between Retirement Timing and Earlier Labor Supply

To provide a deeper analysis of the effects of pension eligibility ages, we assess how retirement responses are linked to earlier-in-life labor supply. The key idea is that a person's eligibility age depends on how long they have contributed to the system and is therefore likely influenced by when they begin their formal career. All else equal, an individual who begins their career earlier in life unlocks benefits earlier and therefore experiences the accompanying disincentives to work earlier.

Consider, for example, people who begin their formal careers at different ages and then make continuous contributions to social security until they claim benefits and retire at some later age. Those who begin their careers early enough, by age 30, will unlock benefits—and encounter the accompanying disincentives to work—at 60. In contrast, those who begin their formal careers later will not experience work disincentives at 60 because they will not have sufficient contribution histories to unlock benefits at that age. Some of these individuals, namely those who begin their careers between 35 and 50, will unlock benefits and encounter incentives to retire at the eligibility age of 65. Others, those who begin their careers between 55 and 60 will unlock benefits and encounter work disincentives at the latest statutory eligibility age, 70.[11]

Because of the disincentives to work after becoming eligible for benefits, we expect people who begin working earlier in life to drive the sharp increases in retirement at the earlier eligibility age, and people who begin working later to drive the sharp increases at the later eligibility ages. In Appendix A, we present a simple model of retirement to formalize this idea. Appendix Figure A1 plots stylized pension-wealth profiles for individuals who begin their formal careers at different ages. It shows sharp increases in pension wealth from working long

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[11]Note that people starting at ages not in these ranges unlock benefits at non-statutory eligibility ages. For example, people who start contributing at 31 and contribute for 30 consecutive years unlock benefits at 61. These people would not face the same retirement incentives at the statutory eligibility ages.

enough to unlock benefits and sharp declines in pension wealth from working past eligibility ages, which depend on the age at which the person begins their formal career.

To investigate this idea empirically, we use a regression discontinuity design to estimate discontinuous increases in retirement at each of the three eligibility ages, and we do so separately for three different groups. First, we study individuals who started contributing to social security between 20 and 30, for whom we expect to see larger retirement responses when they reach 60. Second, we study individuals who started contributing between 35 and 50, for whom we expect to see larger responses at 65. Third, we study individuals who started contributing between 55 and 60, for whom we expect to see larger responses at 70.

## 5.1 Analysis Sample

To construct our analysis sample, we begin with all individuals in our administrative data on people who have ever contributed to social security as of December 2022. We exclude observations of deceased individuals for two reasons. First, we cannot compute current age for these individuals, which is a key input in our RD design. Second, including deceased individuals would overestimate our definition of retirement in the case of individuals who died at least two years before December 2022. Our resulting analysis sample contains observations on 6,323,252 unique individuals. We then categorize people into our three subgroups of interest, detailed above, according to when they began contributing to social security.

## 5.2 Identification Strategy

For each of these subgroups, we estimate equations of the following form:

$$Retirement_i = \alpha + \beta \cdot 1[Age_i \geq c] + \gamma \cdot f(Age_i - c) + \delta \cdot 1[Age_i \geq c] \cdot f(Age_i - c) + \epsilon_i, \quad (1)$$

where $Retirement_i$ is the probability that individual $i$ did not contribute to social security for at least 2 years as of December 2022, $Age_i$ is the running variable, age in months of the individual in December 2020 (which is 2 years before the records in our data stop), $c$ is the eligibility age cutoff with $c \in \{60, 65, 70\}$, $f(Age_i - c)$ is a flexible function of the distance between the running variable and the cutoff, and $\epsilon_i$ is an error term. The coefficient of interest is $\beta$, which captures the average impact of reaching pension eligibility ages on retirement decisions for individuals around the cutoffs. In our baseline regression specification, we use triangular weights, a quadratic polynomial in the running variable, and a 60-month bandwidth on each side of each cutoff. We assess the robustness of our estimates to these choices after presenting the results.

The identifying assumption is that other factors that influence retirement do so smoothly as people reach pension eligibility ages. To provide some assessment on the validity of this assumption, we carry out two standard analyses. First, we analyze the density of the running variable, age in months. Because people cannot change their age, we anticipate traditional concerns about manipulation to be unlikely. Still, for each group, Appendix Figure B2 plots the histogram of the running variable and density estimates based on second-order polynomials around each cutoff. We conclude that there is no evidence of problematic discontinuities in the density of the running variable. Second, we test for discontinuities in gender, the only covariate in our administrative data, which should not change discontinuously as people reach pension eligibility age. Reassuringly, we estimate equation (1) using gender as the outcome and find no evidence that reaching pension eligibility ages impacts gender (see Appendix Figure B3).

Another potential concern is the presence of a confounding policy. If some other policy creates incentives for people to retire around one of the old-age pension eligibility ages, then it would be difficult to interpret any estimated discontinuities in outcomes as due to pension eligibility. To our knowledge, the only potential threat along these lines is that the non-contributory pension also has an eligibility age of 65. While one might worry about our age-65 estimates also picking up impacts of the non-contributory pension, in practice these coinciding eligibility ages are not too concerning because individuals are only eligible for the non-contributory pension if they do not receive the contributory pension. Still, some older workers with some contributions might acknowledge that they will not be able to achieve the minimum number of contributions to retire at 65 and may thus opt for claiming the non-contributory pension. In this case, we would expect to observe an increase in retirement probabilities for individuals who start contributing too late to claim benefits at 65. We test for this possibility in our analysis.

## 5.3   Results: Heterogeneous Effects of Reaching Pension Eligibility Ages

We begin with a standard RD graphical analysis. For each subgroup and for each pension eligibility age cutoff, we plot binned means of the outcome variable (retirement) against the running variable (age in months) for people around the cutoffs. We then superimpose on these graphs regression lines from estimating separate quadratic trends in the running variable for observations on either side of the cutoffs.

Figure 2 presents these graphs. Panel (a) corresponds to the age-60 cutoff, panel (b) corresponds to the age-65 cutoff, and panel (c) corresponds to the age-70 cutoff. Within each panel, the left-hand-side graph is for people who began contributing to IESS between 20 and 30, the middle graph is for people who began contributing between 35 and 50, and

the right-hand side graph is for people who began contributing between 55 and 60.

First, consider the age-60 cutoff in panel (a). There is a clear and discontinuous increase in the probability of retiring for individuals who entered the formal workforce and started contributing to IESS between 20 and 30. In contrast, the other graphs show that the probability of retirement evolves smoothly through the age-60 cutoff for people who began working formally later in life and who therefore are not eligible for pension benefits at 60.

Next, consider the age-65 cutoff in panel (b). The graphs show discontinuous increases in retirement for both people who started working between 20 and 30 and for people who started working between 35 and 50. These groups of workers began working formally early enough to accumulate long enough contribution histories to be eligible for pension benefits at 65. Note that our discussion often focuses on individuals working continuously until retirement, which is what delivers the clear prediction for increases in retirement at 65 for the workers who begin contributing between 35 and 50. However, in practice, workers may not work continuously for a number of reasons, and therefore some of the workers who begin contributing even earlier may not have enough contributions to retire at 60, which could explain the increase in retirement at 65 for those who begin their formal careers between 20 and 30. In addition, note that the retirement probabilities among individuals who started contributing after age 55 appear to follow a smooth trajectory through the 65-year-old cutoff. If our results were driven by people retiring at 65 through the non-contributory pension, we would have expected to find discontinuities in retirement for this subgroup.

Finally, consider the age-70 cutoff in panel (c). The graphs reveal smaller increases in retirement at 70 for those who began their formal careers earlier and strong evidence of an increase in retirement for those who began their formal careers later. The discontinuity is particularly stark for those who made their first contribution to IESS between 55 and 60.

To quantify these effects and assess the statistical significance of the findings, we turn to the regression analysis. Table 1 displays results from estimating equation (1). Each panel in the table corresponds to a different cutoff, and each column corresponds to a different subgroup. Consistent with the RD figures, panel (a) shows that there is a statistically significant, 11.3 percentage point increase in the probability of retiring at 60 for people who began working in the formal sector between 20 and 30. This estimate represents a 37.3% increase when compared to the mean for those who are just under 60. In contrast, we find no evidence of increases in retirement at 60 for those who started their formal careers later. Panel (b) shows statistically significant increases in the probability of retiring at 65 that amount to 12.9 percentage points (22.9%) for those who began formal work between 20 and 30 and 14.1 percentage points (28.1%) for those who began formal work between 35 and 50. Finally, panel (c) shows greater increases in retirement at 70 for those who began formal

work later in life. The point estimates indicate 3.6 percentage point (4.3%), 9.1 percentage point (12.9%), and 20.4 percentage point (45.4%) increases in retirement at 70 for those who began formal work between 20 and 30, 35 and 50, and 55 and 60, respectively.

## 5.4 Robustness Checks

These regression results are robust to alternative specifications. In Appendix Figure B4, we show robustness to bandwidth and polynomial choices. For each polynomial choice (1st to 3rd order) we plot coefficients estimated using different bandwidths. In Appendix Table B2, we assess the robustness of the estimates to including gender and month-of-birth as controls, to dropping triangular weights, and to using an MSE-optimal bandwidth following Calonico et al. (2019). Our baseline point estimates are reasonably stable and our takeaways do not appear sensitive to these specification choices.

Overall, our RD analysis indicates that the pension eligibility ages in Ecuador are key drivers of retirement. Moreover, it underscores the impact of the incentives built in to the system that link retirement decisions later in life to when individuals entered the formal workforce earlier in life.

# 6    The Effects of Pension Eligibility Rules on Earlier Labor Supply

Next, we analyze whether the pension eligibility rules impact earlier labor supply decisions about *when* to work in the formal sector. The key idea is that because workers face incentives to retire as soon as they meet the eligibility requirements and these incentives vary with contribution histories, individuals may strategically time when they begin their formal careers and first affiliate with IESS.

The eligibility rules require a sufficient number of contributions to the system. If individuals value the ability to claim benefits when they retire, then the rules create incentives to work at least as many years as required for eligibility. However, if individuals value informal work (e.g., because it may offer flexibility (Berniell et al., 2021)) or the ability to avoid income taxes and social insurance contributions, then they might face disincentives to work formally longer than required for eligibility.

We therefore investigate whether people strategically time formal employment and their affiliations with social security to minimize contributions to the system while still positioning themselves to unlock benefits at an eligibility age later. We propose a test for this strategic affiliation with IESS based on discontinuities. Specifically, we study whether people are discontinuously more likely to begin formal employment at age (i) 30, in anticipation of contributing 30 years before unlocking benefits at 60, (ii) 50, in anticipation of contributing

15 years before unlocking benefits at 65, or (iii) 60, in anticipation of contributing for 10 years before unlocking benefits at 70.

This discontinuity-based test has advantages and disadvantages. A key disadvantage is that frictions can make it challenging for individuals to precisely time formal employment. In this case, our focus on changes in behaviors right at these critical ages will fail to detect some strategic affiliations, like those that happen with delay. We thus view our test as providing a lower bound on strategic affiliations due to pension eligibility rules. However, a key advantage of this test is that we can be more confident in interpreting any discontinuous changes in affiliations as due to the pension rules and not other factors that might influence affiliations at older ages in general. Moreover, after presenting our main results, we conduct additional analyses on mechanisms that address frictions and potential pathways to formality.

## 6.1 Analysis Sample and Key Variables

To carry out this analysis, we use survey data, which have two advantages. First, crucially, the data contain information on the formally employed, informally employed, and non-employed. Second, the survey is a rotating panel that follows individuals over time. These two features allow us to study individual-level transitions in work status.

To construct our analysis sample, we begin with all person-wave observations in our survey data between 2008 and 2016. Then, because household and person identifiers in the data are sometimes reused after many survey waves, we take a few data cleaning steps to ensure that we can accurately identify observations of unique individuals over time.

First, we construct unique individual-level identifiers by concatenating region, household, and person identifiers. This step yields 2,116,850 observations corresponding to 1,382,227 individuals. Next, because people are surveyed for a maximum of four waves (i.e., quarters) by design, we check whether there are any individual identifiers for which we appear to have more than four observations. In these cases, we assign new individual identifiers to observations that appear in the subsequent survey waves. Then, to reduce the likelihood that an individual identifier is erroneously assigned to more than one person, we drop observations of people whose age appears to decrease over time or whose sex assigned at birth changes over time. These restrictions yield a sample of 2,072,495 observations on 1,364,433 unique individuals. Finally, we exclude observations of individuals younger than 15, who cannot legally work for a formal firm. The sample contains 1,469,795 observations on 967,451 working-age individuals.

We then leverage the panel dimension of the survey data to construct our variables of interest, and we collapse the data to a person-level cross section. Specifically, for each person in our analysis sample, we define age as their age during the first survey wave that they are

present in the data, and we define various outcome variables that capture transitions to formality. We define a person as being formal if they are affiliated with IESS. Our primary outcome of interest is an indicator variable for transitioning to formal employment. It equals one if the individual was not affiliated with IESS during their initial survey wave but was affiliated in one of their subsequent survey waves.

Note that our main outcome includes multiple transition origins: from non-employment, self-employment, or work as an employee. It also includes different types of affiliations with IESS: affiliated through an employer, in the case of employees, or independently affiliated, in the case of the self-employed or non-employed. We also study additional transition outcomes that are similarly defined, but that capture these different types of transitions. Because our variables of interest are transitions across survey waves, our final analysis focuses on the 423,935 individuals who appeared at least twice in the panel, for whom we can compute transitions.

## 6.2 Identification Strategy

We implement our test by estimating a standard regression discontinuity (RD) equation:

$$Transition_i = \alpha + \theta \cdot 1[Age_i \geq c] + \gamma \cdot f(Age_i - c) + \delta \cdot 1[Age_i \geq c] \cdot f(Age_i - c) + \mu_t + \epsilon_i, \quad (2)$$

where $Transition_i$ is an outcome variable for transitioning to formality, $Age_i$ is the age in years of person $i$ during their initial survey wave, $1[Age_i \geq c]$ is an indicator variable for being older than the age cutoff of interest, $c$, $f(Age_i - c)$ is a flexible function of the distance between the running variable and the age cutoff, $\mu_t$ denotes survey-year fixed effects, and $\epsilon$ is an error term. The coefficient of interest is $\theta$, which captures discontinuous changes in transitions to formality for individuals around the critical age cutoffs that would minimize contributions while ensuring access to pension benefits upon reaching a statutory eligibility age.

The idea is that strategic timing of transitions to the formal sector could occur when people turn 30, 50, and 60. Because our running variable is age during a person's initial survey wave and our outcomes are defined using the subsequent survey waves, we define the age-at-initial-survey-wave cutoffs as 29, 49, and 59. We are thus testing for discontinuous changes in transitions to formality for people who reach the critical ages during the subsequent survey waves used to define the transition outcomes. In our baseline specification, we estimate equation (2) using triangular kernels and the survey sampling weights for each person's initial survey wave. We include a quadratic polynomial in age, use a 10 year bandwidth on each side of the cutoff, and use robust standard errors. As before, we assess the

robustness of our estimates to these choices after presenting the results.

Similar to our previous RD design, the identifying assumption is that other factors that influence transitions to formality do so smoothly as people reach these early critical age cutoffs. To assess the validity of this assumption, we carry out three analyses.

First, we analyze the density of the running variable, age in years. Appendix Figure B5 presents a histogram of age and density estimates using quadratic polynomials around each cutoff. The density of the running variable appears to evolve smoothly through the cutoffs. Second, we test for discontinuities in covariates. Compared to the administrative data, the survey data contain more information on demographics and thus allow us to look at more covariates. Appendix Table B3 reports differences in demographic characteristics around the age cutoffs. Only 2 out of 30 comparisons are statistically significant at the 5% level. In both cases, the differences are small and relate to the probability of having completed university education. To ensure that our results are not driven by these differences, we conduct a robustness check that includes controls and report the results in Appendix Table B4. Third, we test for differences in survey attrition around each cutoff, with results reported in the bottom row of each panel in Appendix Table B3. We do not observe evidence of differential attrition around the early age cutoffs.

Again another threat to consider is the presence of a confounding policy. To the best of our knowledge, there are no other policies that discontinuously change incentives to transition to formal employment right at 30, 50, or 60. However, individuals who started working earlier in life can claim their pension benefits as early as 60. As such, our ability to draw strong conclusions from our analysis of transitions to formal employment around the 60 year-old-cutoff may be limited. We nonetheless report results for completeness.

We also note that while access to IESS health-care benefits could be an important incentive to contribute to social security in general, there are no age-based thresholds affecting healthcare benefits, and people working informally also have access to public health care, albeit through the non-contributory system.

## 6.3   The Effects of Reaching Critical Ages on Transitions to Formality

We begin with a graphical analysis. Figure 3 plots RD graphs that show how the probability of transitioning to formal employment evolves around each of the early critical ages. Panels (a), (b), and (c) correspond to transitions at 30, 50, and 60, respectively.

Panel (b) shows a visually clear, discontinuous increase in the probability of transitioning to formality at 50. To the left of the cutoff, the probability of transitioning hovers around 9 percent, but this probability increases at the cutoff and then continues to rise afterwards. In contrast, panels (a) and (c) show little to no evidence of discontinuous changes in the

probability of transitioning at 30 and 60.[12]

Table 2 presents the corresponding regression results. Column (2) indicates a 1.8 percentage point increase in the probability of transitioning to formality at age 50. The estimate is statistically significant at the 5 percent level, and it translates to a large, 21% increase compared to the mean of the outcome variable for individuals just below the cutoff. It also represent a 4.7% increase when compared to the overall probability of being affiliated with social security, which is 38%, just below the cutoff. Consistent with the graphical evidence, the point estimates for transitions at 30 and 60, in columns (1) and (3), respectively, are small and not statistically distinguishable from zero.

These results indicate that the pension program induces some people to time their transitions to working in the formal labor market. The findings are consistent with contribution-minimizing incentives influencing transitions to formality at 50, but not much earlier (at 30) or later (at 60). While there could, of course, be many possible explanations for these patterns, one potential reason for the lack of discontinuities at 30 could be because of greater uncertainty about the ability to work continuously for 30 years in the formal sector. As for the lack of evidence supporting increases in transitions at 60, it could be that older ages bring more uncertainty regarding the ability to contribute enough years. For instance, increasing health risks may make people less confident that they can work and contribute until 70.

Next, we unpack the transitions to formality at age 50 by investigating whether workers tend to transition to formal employment from non-employment or informal employment. To do so, we study two additional outcomes: i) an indicator variable that takes the value of one for individuals who were working informally (defined as working, either as employees or self-employed, but not affiliated with IESS) during their initial survey wave and being affiliated with IESS during a subsequent survey wave, and ii) an indicator variable that takes the value of one for individuals who were not working or affiliated with IESS during their initial survey wave and working formally during a subsequent wave.

Table 3 displays the point estimates and Appendix Figure B6 presents the RD graphs. The results suggest the transitions to formality are primarily explained by transitions out of informal employment and not from non-employment. The point estimates in columns (1) and (2) indicate a statistically significant 1.4 percentage point increase in the likelihood of transitioning from informal work to formal employment and a 0.3 percentage point increase

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[12]Note that panels (b) and (c) show an upward trend in transitions to formality at older ages, a pattern that differs from other studies (e.g., Narita, 2020). The upward trend might be explained by health care incentives. Individuals can access IESS health care by contributing to IESS for as little as two months per year. As individuals age, the incentives to affiliate to IESS for health care reasons may increase. This idea is consistent with other evidence suggesting that individuals transition to formality to obtain health insurance coverage in Ecuador (Molina-Vera, 2021).

in the likelihood of transitioning from non-employment to formal employment that is not statistically significant. The point estimate for informal-to-formal transitions thus accounts for 77% of the overall increase in the probability of transitioning to formality at age 50. Thus, the results largely reflect changes in types of employment as opposed to changes in employment status. Moreover, in columns (3) to (5), we find no statistical evidence that these transitions are accompanied by discontinuous changes in monthly labor market earnings or weekly hours worked.

## 6.4 Potential Pathways from Informality to Formality

Our results support the idea that some individuals strategically time informal-to-formal transitions at 50. These results are consistent with previous studies emphasizing that individuals often switch in and out of informality (Bosch and Maloney, 2010). However, not all individuals may be able to time transitions. Formal jobs may scarce and difficult to obtain (Ulyssea, 2020). Moreover, firms must make contributions to social security on behalf of their formal employees, which increases the costs of hiring a formal worker compared to an informal worker. We next study potential pathways from informal to formal employment.

One possibility is that people make these transitions by switching occupations. Some occupations may be more accommodating of switches to formal employment than others. To investigate this hypothesis, we use a variable in the survey that records the number of years an individual has performed their current occupation as an outcome. We compute average tenure excluding data from the first survey wave. One caveat is that we only observe tenure for individuals employed at baseline. With this caveat in mind, column (1) in Table 4 shows no evidence of a discontinuity in occupational tenure, which provides one piece of evidence against the idea that the transitions are facilitated by changing occupations.

The evidence thus suggests that people are performing the same job, but formally instead of informally. There are three ways in which this can happen. First, entrepreneurs or self-employed individuals may formalize their activities by starting to contribute to social security as independent workers. Second, workers may continue to perform the same occupation at the same firm, switching their contractual status from informal to formal. Third, workers from unregistered firms may perform the same occupation but at a different registered firm.

We can test the first path directly. We leverage information on the type of affiliation with IESS to create two different types of outcomes: i) indicators for transitioning to formality as a salaried worker (through IESS general regime) and ii) indicators for transitioning to formal employment as a self-employed worker who is self-affiliated with IESS. If the overall transitions are driven by the formalization of existing businesses, we would expect the impacts on the transitions as self-employed to account for most of the informal-to-formal transitions.

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Columns (2) and (4) in Table 4 report the effects of reaching age 50 on these transition outcomes, and Appendix Figure B8 displays the corresponding RD graphs. Column (2) of the table shows a statistically significant effect for transitions as a salaried worker. Column (3) shows that the transitions as a salaried worker are almost entirely explained by individuals who were also initially employed as salaried workers. Column (4) shows a positive, but not statistically significant, effect for transitions as a self-employed worker, and Column (5) shows significant impacts when we look at transitions from informal self-employment to formal self-employment. However, the point estimates are roughly 40% smaller than those in columns (2) or (3). The point estimate in column (2) suggests that transitions to formality as employees account for 64% of the total effect on transitions from informal to formal employment at age 50. Therefore, these results do not support the idea that the main effect is primarily driven by entrepreneurs formalizing their businesses activities, but rather that employees are able to change their formality status.

We next analyze the extent to which strategic transitions occur through workers switching their mode of contract within the same firm or workers switching firms. While we are unable to test these two pathways directly because we cannot identify the specific firms at which people work, we can analyze effects based on the types of firms that workers transitioning to formal employment were at previously.

Specifically, we use self-reported information on whether the firms at which individuals work are registered with the tax authorities and test for discontinuous changes in the probability of transitioning to the formal sector for informal workers who worked initially at unregistered versus registered firms. Columns (1) and (2) of Table 5 present the point estimates, and Appendix Figure B9 presents the RD graphs. The results indicate that the probability of transitioning to formal employment from informal work at a registered firm increases by 1 percentage point at age 50. This estimate thus accounts for 71% of the overall effect on informal-to-formal transitions. In contrast, we find no evidence of a discontinuous change in the probability of transitioning to formal employment from working informally at an unregistered firm.

## 6.5   Who Strategically Transitions to Formality?

The patterns thus far indicate that workers transition to the formal sector by continuing to work in the same occupation and by continuing to work at registered firms, but formally instead of informally. While this type of switch may help workers minimize contributions to the social security system, it requires firms to be willing to facilitate these switches and make additional social security contributions on behalf of their workers as well. We therefore suspect that workers who are better situated to negotiate the terms of their contracts with

their employers will be more able to time transitions. We investigate this idea by examining response heterogeneity along several margins.

### 6.5.1 Response Heterogeneity

First, we explore whether responses vary by education. Employers may be more likely to agree to absorb the additional costs of formalization for higher educated workers if those workers are more productive, or if they are more aware of pension rules and thus more likely to negotiate with their employers. Figure 4 shows the heterogeneous impacts of reaching age 50 on informal-to-formal transitions at registered firms, by education. We find larger increases in these strategic transitions for individuals with college degrees. Note this result is also consistent with evidence that individuals with higher educational attainment are more likely to eventually land a formal job (Perry, 2007).

Next, we examine transitions by workers in small registered firms, where employees are perhaps more likely to create stronger bonds with their employers. Column (3) of Table 5 reports impacts on the probability of working informally at a small registered firm at baseline and working formally later. We define a firm to be small if the number of employees at the firm is below the median for registered firms (which is 3 employees). We find a 0.8 percentage point effect on this type of transition, which represents 80% of the effect on transitions within registered firms displayed in column (2).

Finally, we explore the role of family firms, where closer relationships between workers and employers may increase worker bargaining power and where incentives of workers maximizing utility and incentives of employers maximizing profits may be more aligned. To proxy for whether a person works at a family firm, we use information in the survey on whether an individual lives in the same household of the owner of a registered or unregistered firm. We then examine heterogeneous responses along these dimensions.

Figure 5 presents the results. Panel (a) displays RD estimates from estimating equation (2) where the outcome is the probability of transitioning from informal work at a registered firm to formal employment. Each point estimate corresponds to a different subsample, either i) people who live in the same household as an owner of a registered business, ii) people who live in the same household as an owner of an unregistered business, or iii) people who do not live in the same household as an owner of a business. The results indicate substantially larger effects for individuals who live with owners of registered firms. The point estimate for this subsample is statistically different from the one corresponding to individuals who live with owners of unregistered businesses ($p$-value $= 0.036$) and from the one for individuals who do not live with business owners ($p$-value $= 0.027$). Interestingly, we find no statistical evidence of effects for individuals who live with owners of unregistered businesses. These

estimates suggest that the main results are unlikely to be explained by households owning businesses per se. Instead, strategic transitions to formal employment seem to occur within firms where employers and employees have incentives to cooperate.

One alternative possibility is that workers switch from some other unregistered firm to a relative's formal firm. Panel (b) of Figure 5 suggests that this pathway is unlikely. It displays point estimates for the same three groups, but where the outcome is the probability of transitioning from informal employment at an unregistered firm to formal employment. We find no evidence of increases in these transitions for any of the groups.

We also analyze whether, perhaps as a part of negotiations on strategic transitions, employers shift some of the costs of formalization to workers by paying them lower wages (see, e.g., Kugler, 2005). Appendix Figure B10 shows the heterogeneous impacts of reaching age 50 on changes in wages, by type of firm. Consistent with cost shifting, we find suggestive evidence of wage decreases in the family firm setting, where we find the strongest evidence of strategic transitions. The point estimate would indicate a reduction in wages of roughly USD 0.76 for individuals living with owners of registered businesses. The estimate is not statistically different from zero, but it is economically meaningful: it would imply a 26% reduction relative to the average hourly wage around the 50 year-old cutoff (USD 2.86) and, assuming individuals work 40 hours per week, would translate to approximately USD 128 per month.

### 6.5.2 Who Are the Workers at Family Firms?

The results indicate that some, but not all, types of workers are able to time forward-looking transitions to formal employment in response to pension incentives. Here we take a closer look at workers at family firms, who we have found to be particularly responsive.

Appendix Table B6 reports summary statistics for individuals around age 50. Column (1) reports statistics for all individuals, columns (2) and (3) focus on individuals who live with owners of registered and unregistered businesses, respectively, and column (4) focuses on individuals who do not live with business owners. We note three interesting patterns.

First, individuals living with owners of registered businesses are more likely to be women, married, and married to a business owner, compared to the other groups. These statistics suggest that the large effects that we find for individuals living with owners of registered businesses are driven by women. This pattern is thus broadly consistent with findings like the added worker effect (Lundberg, 1985), in the sense that we appear to find evidence consistent with the labor supply of married women being relatively more sensitive to their economic circumstances. It is also consistent with other studies documenting that women tend to drive the labor market impacts of social programs (e.g., Bosch and Campos-Vazquez,

2014; Bergolo and Cruces, 2021; Khanna et al., 2025).

Second, individuals living with owners of registered businesses are more likely to have a university degree. This statistic might underscore the importance of being able to learn and understand the intricacies of the public pension system before being able to respond to the resulting incentives. Third, these individuals have higher household incomes. This statistic suggests that these people may be the ones facing higher income tax rates and thus stronger incentives to time their entrance to formality to avoid income taxes.[13]

Overall, these patterns suggest that the costs and benefits of timing formal employment in response to pension incentives are heterogeneous, and they emphasize that some subgroups may exhibit more forward-looking behavior than others.

## 6.6  Robustness Checks

Before concluding, we conduct several robustness checks. First, in Appendix Figure B7, we show that our main results on transitions to formality are generally robust to a combination of alternative polynomial degrees and different bandwidths, in particular to narrower ones.

Second, In Appendix Tables B4 and B5, we report results from additional specification checks. Specifically, we assess the sensitivity of our main estimates to including a rich set of demographic controls, dropping the triangular kernels, dropping the survey weights, using the MSE-optimal bandwidth from Calonico et al. (2019), and clustering standard errors at either the household or birth cohort level. As the tables show, the main estimates for each of the three cutoffs (in Appendix Table B4) and the estimates that unpack effects at age 50 (in Appendix Table B5) are largely robust to these choices.

The magnitudes and statistical significance of the estimates are similar across most specifications, though the results appear sensitive to the use of survey weights (see column (4) in the tables). One potential explanation for this pattern could be that, without survey weights, the subgroups more likely to transition at 50 represent relatively smaller shares of the sample. To investigate this idea, column (4) in panel (e) of Appendix Table B5 reports results without survey weights for the subsample who live with owners of registered businesses, those who contribute significantly to the overall effects. Importantly, we find statistically significant results for this subgroup even when we do not use survey weights. Moreover, Appendix Figure B11 replicates the subgroup analysis in Figure 5 with and without using weights. Reassuringly, we find the same patterns with either approach.

Finally, we report results from a placebo test in Appendix Table B7. Specifically, we test for formal-to-informal and formal-to-non-employed transitions around age 50. Consis-

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[13]In addition, people living with owners of registered firms live in households with a lower demand for care, suggesting that they may face fewer additional frictions that can limit the ability to respond to incentives.

tent with the idea that there are no economic incentives to transition away from formal employment upon reaching this critical age, we find no discontinuities in these outcomes.

# 7 Conclusion

In this paper, we use data from Ecuador to provide new evidence on how pensions impact retirement and earlier labor market outcomes. First, we document spikes in retirement at the pension eligibility ages of 60, 65, and 70. Next, consistent with incentives, we show that the discontinuous increases in retirement at the eligibility ages are driven by different groups of people who began working formally at different ages. Finally, we study how pension eligibility rules impact earlier-in-life transitions to the formal sector. We find clear evidence of a discontinuous increase in informal-to-formal transitions at 50, consistent with people timing their participation in social security to minimize contributions while still becoming eligible for benefits at a later eligibility age. Additional evidence on mechanisms highlights roles for small and family firms in helping workers facilitate these transitions.

Our paper provides insights relevant for public pension policy in developing countries. First, our retirement analysis reinforces a key takeaway from the literature that eligibility ages influence labor market exits, and our heterogeneity analysis supports the idea that retirements at eligibility ages can be linked to disincentives to work from rules that limit the gains from delaying benefit claiming. Weakening these types of disincentives may encourage working at older ages. Second, our analysis of earlier-in-life labor market outcomes uncovers an additional way that eligibility rules can influence behaviors. Our finding of strategic transitions to the formal sector indicates that the work history requirements attached to pension eligibility can influence not just the timing of when formal careers end, but also when they begin. More generally, our results highlight how pension programs can indeed influence labor supply decisions of forward-looking people before they reach typical retirement ages.

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# Figures and Tables



(a) Pension Claiming

(b) Retirement

(c) Years of Contributions

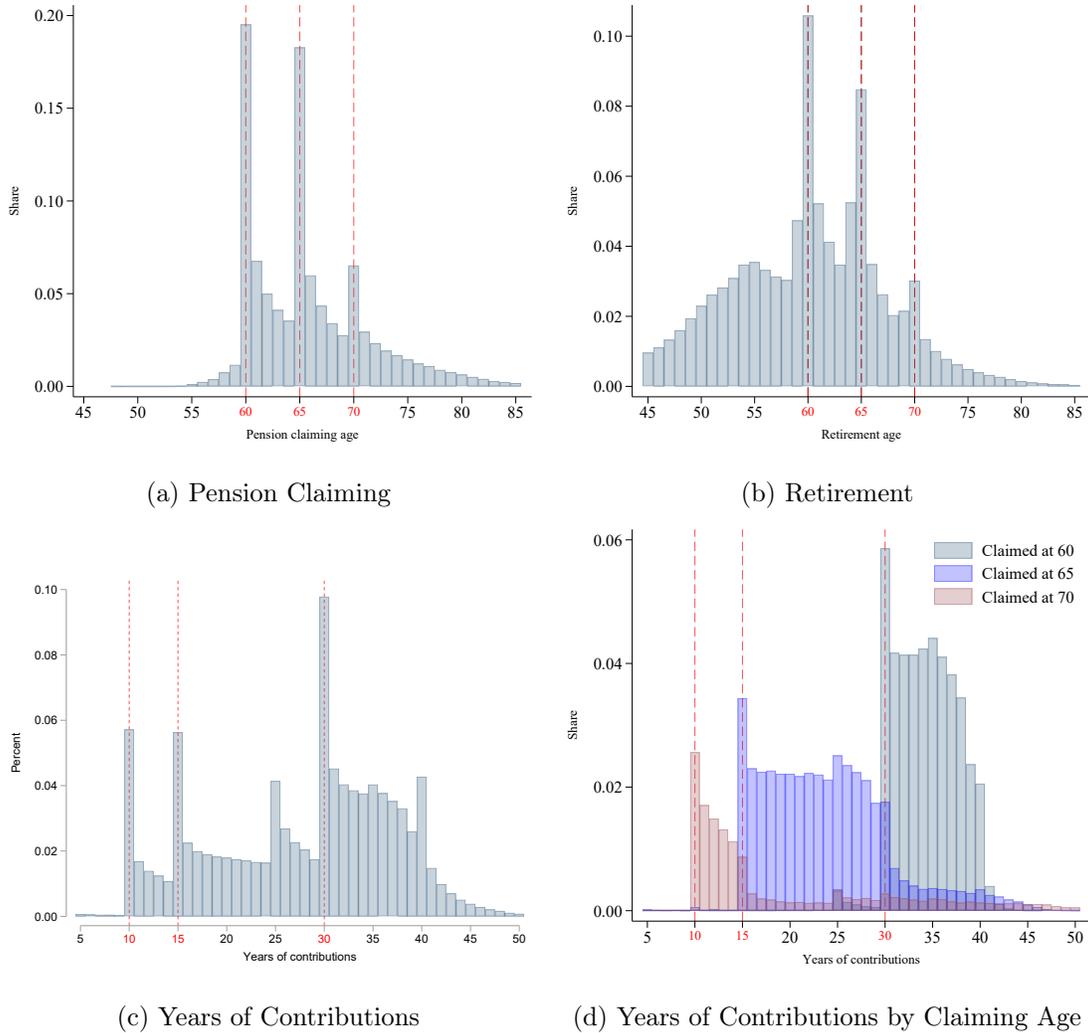(d) Years of Contributions by Claiming Age

**Figure 1: Distributions of Pension Claiming Ages, Retirement Ages, and Contribution-Years**

*Notes*: This figure plots the distributions of pension claiming ages, retirement ages, and contribution-years. Panel (a) plots pension claiming ages. The underlying sample consists of people in our administrative records covering the universe of pensioners as of December 2022. Panel (b) plots retirement ages. The underlying sample consists of people in our administrative records covering the universe of contributors to the social security system between 2001 and 2022 who were 55 or older in December 2022. We define one of these older individuals as retired if they did not make a contribution to the system for the two years preceding December 2022. Panel (c) plots the distribution of the number of contributions to the social security system (in years) for individuals receiving old-age pension benefits. The underlying sample consists of people in our administrative records covering the universe of pensioners as of December 2022. Panel (d) plots the distribution of the number of contributions to the social security system (in years) for individuals claiming old-age pension benefits at ages 60, 65 or 70.
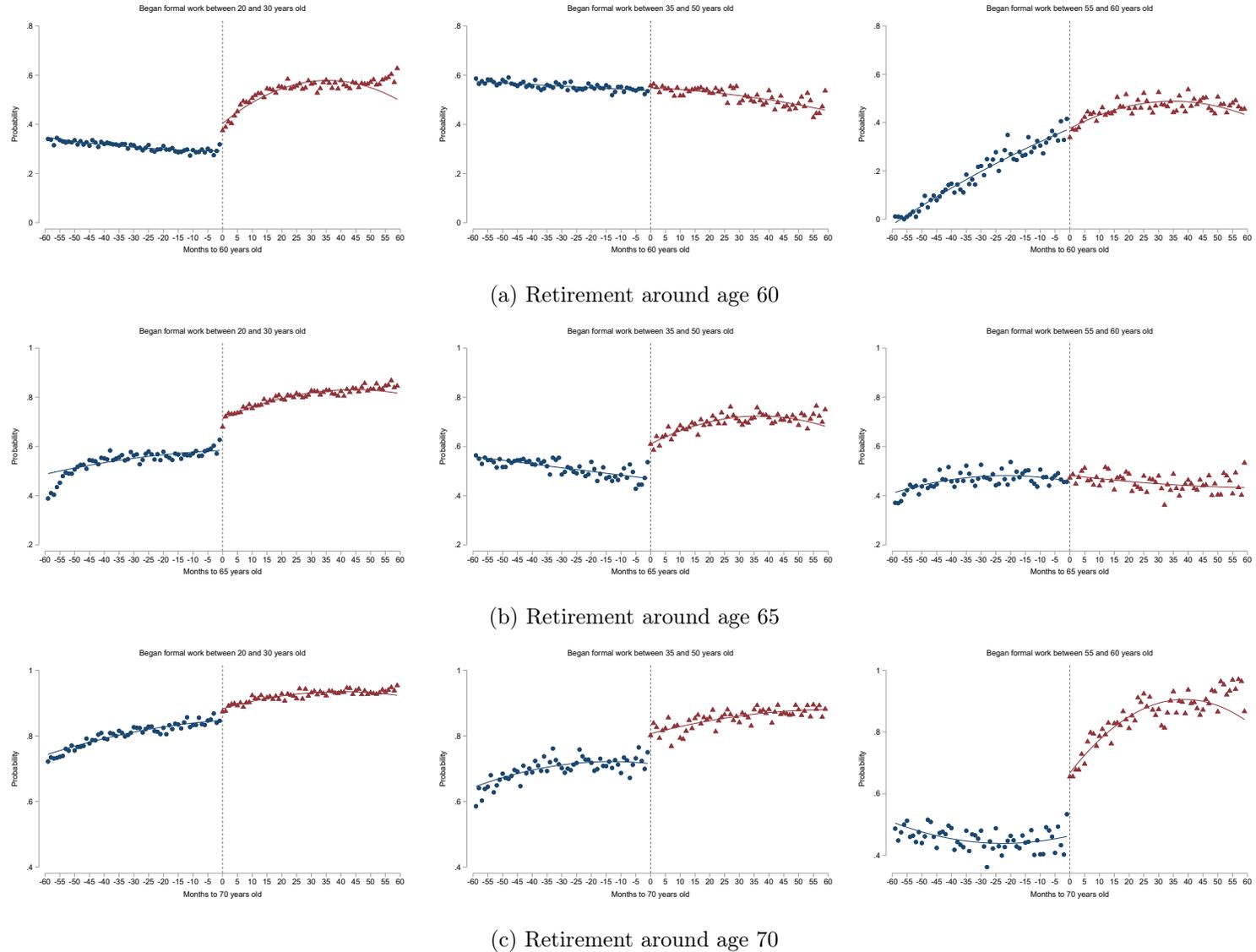
(a) Retirement around age 60

(b) Retirement around age 65

(c) Retirement around age 70

Figure 2: Effects of Reaching Pension Eligibility Ages on Retirement, by Age of Initial Contribution

*Notes*: This figure reports means of the probability of retiring by distance (in months) to each pension eligibility age cutoff and by age of entry into the formal labor force. Panels (a), (b), and (c) correspond to the different eligibility ages. Within a panel, each graph corresponds to a different group of people who began formal employment at different ages. The solid lines represent quadratic fits of the outcome as a function of the distance to the cutoff.
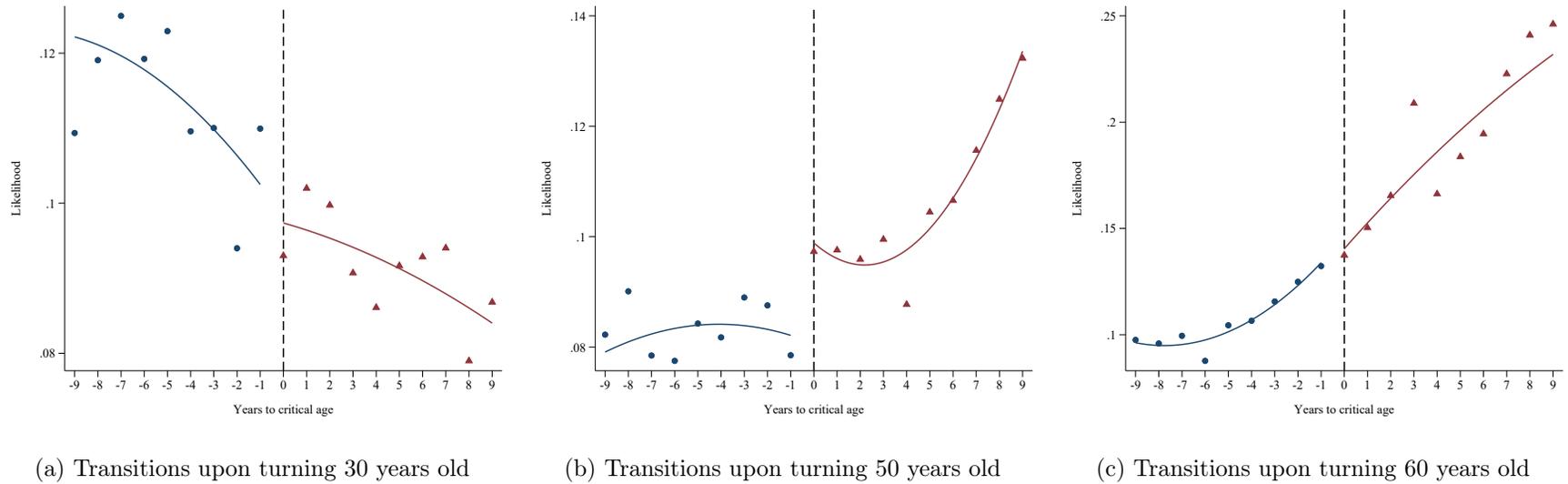
(a) Transitions upon turning 30 years old　　(b) Transitions upon turning 50 years old　　(c) Transitions upon turning 60 years old

**Figure 3: Effects of Reaching Earlier Critical Ages on Transitions to Formal Employment**

*Notes*: This figure depicts the mean probability of transitioning to formal employment by distance (in years) to the earlier critical age cutoffs. Panel (a) depicts transitions to formal employment around age 30, panel (b) depicts transitions around age 50, and panel (c) depicts transitions around age 60. The solid lines represent quadratic fits of the outcome as a function of the distance to the cutoff.
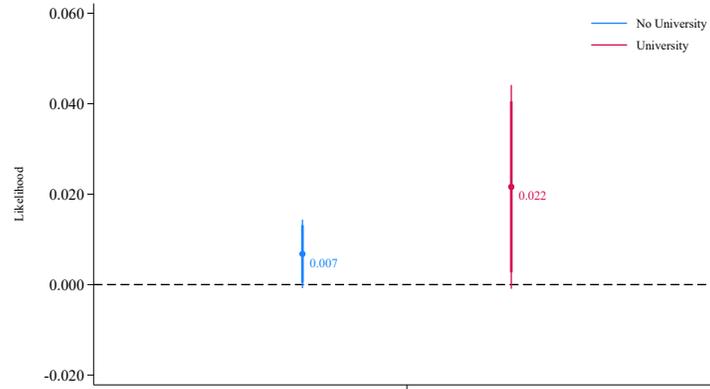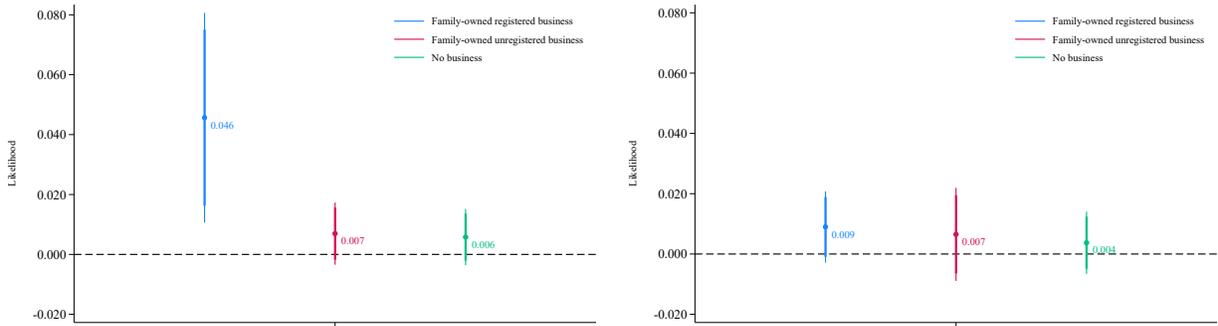
**Figure 4: Effects of Transitioning to Formal Employment from Informal Employment at a Registered Firm at Age 50, by Educational Attainment**

*Notes*: This figure depicts RD estimates from estimating equation (2) for individuals with and without a university degree. The outcome is the probability of transitioning from informal work at a formal firm to formal work. The vertical lines display confidence intervals at the 90% level (the thicker lines) and the 95% level (the narrower lines), based on robust standard errors.

(a) Effects of transitioning to formal employment from informal employment at a registered firm

(b) Effects of transitioning to formal employment from informal employment at an unregistered firm

**Figure 5: Heterogeneous Effects of Reaching Age 50 on Transitions to Formal Employment by Family Business Ownership**

*Notes*: This figure depicts RD estimates from estimating equation (2) for different groups of people. In panel (a), the outcome is the probability of transitioning from informal work at a formal firm to formal work. In panel (b), the outcome is the probability of transitioning from informal work at an informal firm to formal work. Within each panel, we plot RD estimates for three different groups: i) individuals who live in the same household as an owner of a formal business registered with the tax authorities, ii) individuals who live in the same household as an owner of an informal business not registered with the tax authorities, and iii) individuals who do not live in the same household as a business owner. The vertical lines display confidence intervals at the 90% level (the thicker lines) and the 95% level (the narrower lines), based on robust standard errors.

**Table 1: Effects of Reaching Pension Eligibility Ages on Retirement by Age of Entrance to the Formal Workforce**

|  | (1) Began formal work between 20 and 30 | (2) Began formal work between 35 and 50 | (3) Began formal work between 55 and 60 |
|---|---|---|---|
| *Panel a. Age 60 cutoff* | | | |
| Above cutoff | 0.113*** | 0.012 | 0.001 |
|  | (0.006) | (0.009) | (0.018) |
|  | | | |
| Obs. | 308,544 | 143,230 | 29,958 |
| Mean below cutoff | 0.303 | 0.551 | 0.271 |
| Effect size (%) | 37.30 | 2.14 | 0.29 |
|  | | | |
| *Panel b. Age 65 cutoff* | | | |
| Above cutoff | 0.129*** | 0.141*** | 0.025* |
|  | (0.006) | (0.012) | (0.015) |
|  | | | |
| Obs. | 229,876 | 72,010 | 40,717 |
| Mean below cutoff | 0.562 | 0.502 | 0.472 |
| Effect size (%) | 22.93 | 28.12 | 5.21 |
|  | | | |
| *Panel c. Age 70 cutoff* | | | |
| Above cutoff | 0.036*** | 0.091*** | 0.204*** |
|  | (0.005) | (0.012) | (0.019) |
|  | | | |
| Obs. | 155,763 | 47,138 | 27,799 |
| Mean below cutoff | 0.821 | 0.711 | 0.449 |
| Effect size (%) | 4.33 | 12.86 | 45.39 |

*Notes*: This table reports RD estimates for the effects of reaching pension eligibility ages on retirement. The point estimates come from estimating equation (1). Each panel corresponds to a different cutoff, and each column corresponds to a different group who entered the formal labor force at different ages. Robust standard errors are reported in parentheses.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

**Table 2: Effects of Reaching Earlier Critical Ages on Transitions to Formal Employment**

|  | (1)<br>Age 30 cutoff | (2)<br>Age 50 cutoff | (3)<br>Age 60 cutoff |
|---|---|---|---|
| Above cutoff | -0.001 | 0.018** | -0.005 |
|  | (0.009) | (0.008) | (0.013) |
|  |  |  |  |
| Obs. | 107,663 | 84,841 | 63,527 |
| Mean below cutoff | 0.111 | 0.083 | 0.112 |
| Effect size (%) | -1.01 | 21.33 | -4.83 |

*Notes*: This table reports RD estimates for the effect of reaching earlier critical ages on transitioning to formal employment. The estimates come from estimating equation (2). Each column corresponds to a different critical age cutoff. Robust standard errors are reported in parentheses.
\* $p<0.1$, \*\* $p<0.05$, \*\*\* $p<0.01$.

**Table 3: Unpacking the Transitions to Formal Employment at Age 50**

|  | (1)<br>Transition from<br>informal employment | (2)<br>Transition from<br>non-employment | (3)<br>Changes in monthly<br>income (USD) | (4)<br>Changes in weekly<br>work hours |
|---|---|---|---|---|
| Above cutoff | 0.014** | 0.003 | 10.798 | 0.700 |
|  | (0.006) | (0.006) | (9.015) | (0.503) |
| Obs. | 84,841 | 84,841 | 84,841 | 84,841 |
| Mean below cutoff | 0.044 | 0.039 | 9.963 | -0.380 |
| Effect size (%) | 32.82 | 8.40 | 108.38 | -184.12 |

*Notes*: This table reports RD estimates for the effect of reaching critical age 50 on additional outcomes. The point estimates come from estimating equation (2). Each column corresponds to a different outcome. Column (1) is for transitioning to formal employment from informal employment. Column (2) is for transitioning to formal employment from non-employment. Column (3) is for the difference in monthly labor income, and column (4) is for the difference in the number of worked hours per week, between the pre-period and the average of the post-periods. Robust standard errors are reported in parentheses.
\* $p<0.1$, \*\* $p<0.05$, \*\*\* $p<0.01$.

**Table 4: Paths to Formality: Effects of Reaching Age 50 on Different Types of Transitions from Informal to Formal Employment**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | | *General affiliation* | | *Self-affiliation* | |
| | Occupational tenure | Transition from informal work | Transition from salaried, informal work | Transition from informal work | Transition from informal self-employment |
| Above cutoff | 0.454 | 0.009* | 0.008** | 0.005 | 0.005* |
| | (0.364) | (0.005) | (0.003) | (0.003) | (0.003) |
| | | | | | |
| Obs. | 68,165 | 84,841 | 84,841 | 84,841 | 84,841 |
| Mean below cutoff | 13.923 | 0.030 | 0.014 | 0.015 | 0.010 |
| Effect size (%) | 3.262 | 31.067 | 59.127 | 30.235 | 50.010 |

*Notes*: This table reports RD estimates for the effects of reaching age 50 on additional outcomes that capture informal-to-formal employment transitions. The point estimates come from estimating equation (2). Each column corresponds to a different outcome variable. Column (1) is for occupational tenure. Column (2) is for transitions from informality to formal employment as a salaried worker, column (3) is for transitions from salaried informal work to salaried formal work, column (4) is for transitions to formal employment as a self-affiliated worker. Column (5) is for transitions from informal work as self-employed to formal work as a self-affiliated. Robust standard errors are reported in parentheses.
* p<0.1, ** p<0.05, *** p<0.01.

**Table 5: Effects of Reaching Age 50 on Different Types of Transitions from Informal to Formal Employment by Firm Type**

|  | (1)<br>Transition from an<br>unregistered firm | (2)<br>Transition from a<br>registered firm | (3)<br>Transition from a<br>small registered firm |
|---|---|---|---|
| Above cutoff | 0.004 | 0.010*** | 0.008*** |
|  | (0.004) | (0.004) | (0.003) |
|  |  |  |  |
| Obs. | 84,841 | 84,841 | 84,841 |
| Mean below cutoff | 0.018 | 0.018 | 0.010 |
| Effect size (%) | 24.287 | 57.289 | 78.736 |

*Notes*: This table reports RD estimates for the effects of reaching age 50 on additional outcomes that capture informal-to-formal employment transitions, by firm type. The point estimates come from estimating equation (2). Each column corresponds to a different outcome variable. Column (1) is for transitions to formal employment from firms that are not registered with the tax authorities, and column (2) is for transitions to formal employment from firms that are registered with the tax authority. Column (3) is for transitions to formal employment from firms that are registered with the tax authorities and small (three employees or less). Robust standard errors are reported in parentheses.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$.

# Appendix

## A  Benchmark Model of Retirement

**Model.**  We consider a static model of lifetime consumption and retirement that abstracts from uncertainty, from discount and interest rates, and from the informal sector. The basics of the model are standard and follow previous papers in the retirement literature (e.g., Brown, 2013; Manoli and Weber, 2016); what is notable about our approach is that we write down the model in a way that emphasizes that formal careers may begin at different times for different workers.

Consider people who begin formal work at $t = S$ and live until $t = T$. For now, suppose that $S$ is exogenous. For a given $S$, people maximize lifetime utility by choosing lifetime consumption, $C$, and when they retire, $t = R$. Let lifetime utility be

$$U(C, R) = u(C) - \Gamma R, \tag{3}$$

where $u$ is concave and $\Gamma$ is a constant that reflects disutility of work. People earn an exogenous wage ($w_F$) that is subject to social insurance contributions from working in the formal sector ($\kappa$) and income taxes ($\tau$). They also receive old-age benefits, $B(S, R)$, after they retire, which depend on how many contributions they make to the system and therefore on when they begin working and when they retire. The lifetime budget constraint is thus

$$C = w_F(1 - \tau)(1 - \kappa)(R - S) + B(S, R). \tag{4}$$

Lifetime consumption is the sum of lifetime wages and public pension wealth.

Individuals choose their retirement age R taking S as given to maximize (3) subject to (4). The first-order conditions yield the following familiar result for optimal retirement:

$$u'(C)(w_F(1 - \tau)(1 - \kappa) + B'(S, R)) = \Gamma, \tag{5}$$

where $B'(S, R)$ is the derivative of $B$ with respect to $R$.

Equation (5) shows that people should work until the marginal benefit of doing so equals the marginal cost. The left-hand side is the marginal benefit of retiring later: additional earnings plus the change pension wealth from retiring later, converted to utility units. The right-hand side is the marginal cost of retiring later: additional disutility from work.

**Retirement Incentives.** This simple model helps us understand incentives. Suppose people have different preferences for leisure and that $\Gamma$ is smoothly distributed across people. Then, if the return to work, $w_F(1-\tau)(1-\kappa) + B'(S,R)$, is linear, we would expect to see a smooth distribution of retirement ages. However, the pension rules above highlight how $B'(S,R)$ is nonlinear.

To illustrate this point, Figure A1 plots stylized pension wealth profiles. Importantly, pension wealth in practice depends on $R$ and $S$. The graph therefore plots pension wealth against retirement ages for the same worker with different values of $S$.[14]
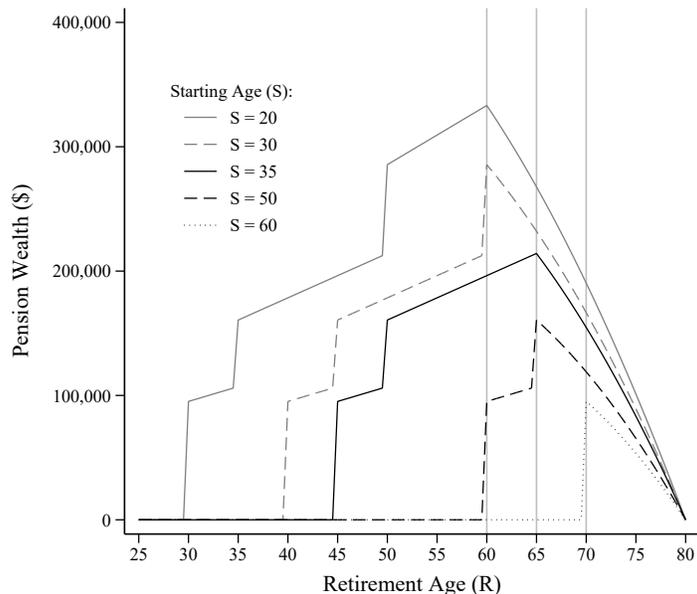


**Figure A1: Pension Wealth Profiles by Age of Initial Contribution**

*Notes*: This figure plots stylized pension wealth profiles by the age at which one begins their formal career. The x-axis is retirement age, $R$. The y-axis is pension wealth, measured in U.S. dollars. The various lines correspond to a person who starts working in the formal sector at different ages, $S$.

The spikes in pension wealth are due to the person working formally long enough such that they reach the minimum number of contribution-years required to unlock pension benefits starting at either 60, 65, or 70. The smooth increases in pension wealth as R increases are due to increases in the replacement rate from working longer and contributing more years. The declines in pension wealth after the eligibility ages are due to the person working past

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[14]To make the dollar amounts somewhat informative, we calculate pension wealth for a worker with a monthly wage of \$1,360 (roughly the average) who will die with certainty at $T = 80$ (roughly equal to life expectancy). We also use a simplified version of the replacement rate formula that accounts for the initial 43.75% replacement rate for contributing at least 5 years and the 1.25% increases for working additional years, but that ignores the non-linear increases in the replacement rate between 35 and 40 years of contributions.

the age they are first eligible for the pension and thus forfeiting benefits.

First, consider the solid gray line, which depicts pension wealth if the person begins formal work at 20. Working 10 years and retiring at 30 discontinuously increases pension wealth because it results in benefits from 70 until $T$. Likewise, there are discontinuous increases at 35 and 50 because working 15 years unlocks benefits starting at 65 and working 30 years unlocks benefits starting at 60. Pension wealth is maximized by retiring at 60. Working additional years results in additional increases in the replacement rate, as discussed in Section 2, but it also means forfeiting years of benefits for which the worker is eligible.

The dashed gray line reveals a similar pension wealth profile if the person begins formal work at 30, but the location of the spikes is different because the worker started working formally later. Notably, people who begin formal work between 20 and 30 maximize pension benefits by retiring at 60 because these people will have contributed for 30 years and will have thus unlocked benefits when they reach 60.

Next, consider the solid black line, which corresponds to the person beginning formal work at 35. There is a spike in pension wealth at 45 for unlocking benefits at 70 and a spike at 50 for unlocking benefits at 65, but there is no third spike due to unlocking benefits at 60 because this person would have to work past 60 to satisfy the requirement of contributing for 30 years. The earliest this person can become eligible for benefits is thus 65, which is also the retirement age that maximizes their pension wealth. If they work until 65, they will have contributed for 15 years and will be eligible for benefits, so working longer translates to forgone benefits and decreases in pension wealth.

Likewise, the dashed black line depicts the case for the worker beginning formal work at 50, which also leads to maximum pension benefits by retiring at 65. Similar to the logic above, all people who begin working formally between 35 and 50 maximize pension wealth by retiring at 65. They will have started contributing early enough to be eligible for benefits at 65 (and thus working past 65 results in decreases in pension wealth), but they will have started late enough such that they are not eligible at 60 (and thus working before 65 results in increases in pension wealth through the replacement rate channel without the decreases due to forgoing years of benefits).

Finally, consider the dotted black line, which depicts the case for a person who begins working formally at 60. Working 10 years, until 70, leads to a discontinuous increase in pension wealth and unlocks immediate eligibility for benefits, and working past 70 translates to reductions in pension wealth. People who begin working formally between 55 and 60 also experience disincentives to work past 70, as these people would not have worked long enough to be eligible for benefits at 60 or 65, but would unlock benefits at 70.

Of course, there are other cases not depicted in the figure. Different starting ages translate

to similar-shaped pension wealth profiles, but with spikes and declines in pension wealth at different eligibility ages. For instance, $S = 31$ translates to spikes in pension wealth at 41 (from contributing 10 years), 46 (from contributing 15 years), and 62 (from contributing 30 years), and pension wealth is maximized at 62 (when the worker first becomes eligible to claim benefits). The same logic applies to cases with $S \in [32, 34]$. Similarly, $S = 51$ translates to spikes at 61 and 66 and pension wealth that is maximized by retiring at 66.

Overall, the figure emphasizes a key feature of the pension program. The specified eligibility ages and contribution-years requirements make it such that many workers will obtain maximum benefits by retiring right at 60, 65, or 70, and that the disincentives to work past these ages depend on how long a person has worked in the formal sector.
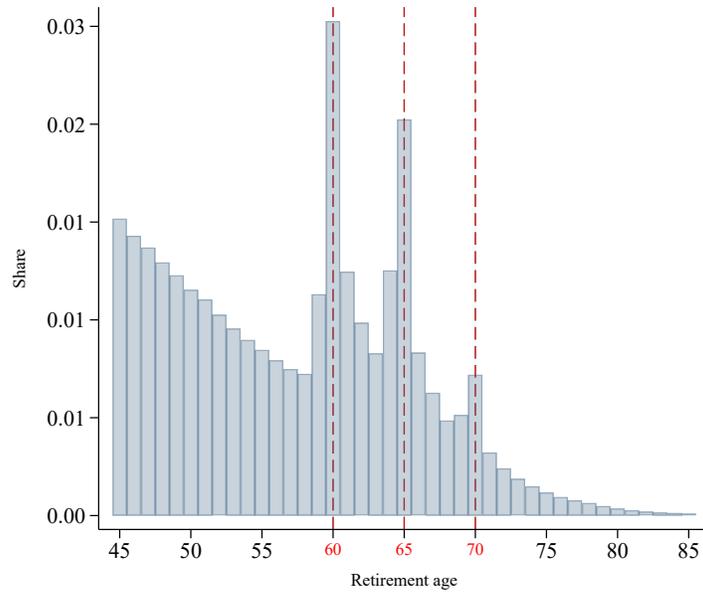
# B   Additional Figures and Tables



**Figure B1: Distribution of Retirement Ages for Individuals who Did Not Contribute for at Least 2 Years Since December 2020**

*Notes*: This figure plots the distribution of retirement ages for individuals who did not contribute to the social security system in 2021 and 2022. Unlike the corresponding figure in our main analysis, this figure is not limited to people who are at least 55 years old in December 2022.

(a) Began formal work between 20 and 30    (b) Began formal work between 35 and 50    (c) Began formal work between 55 and 60
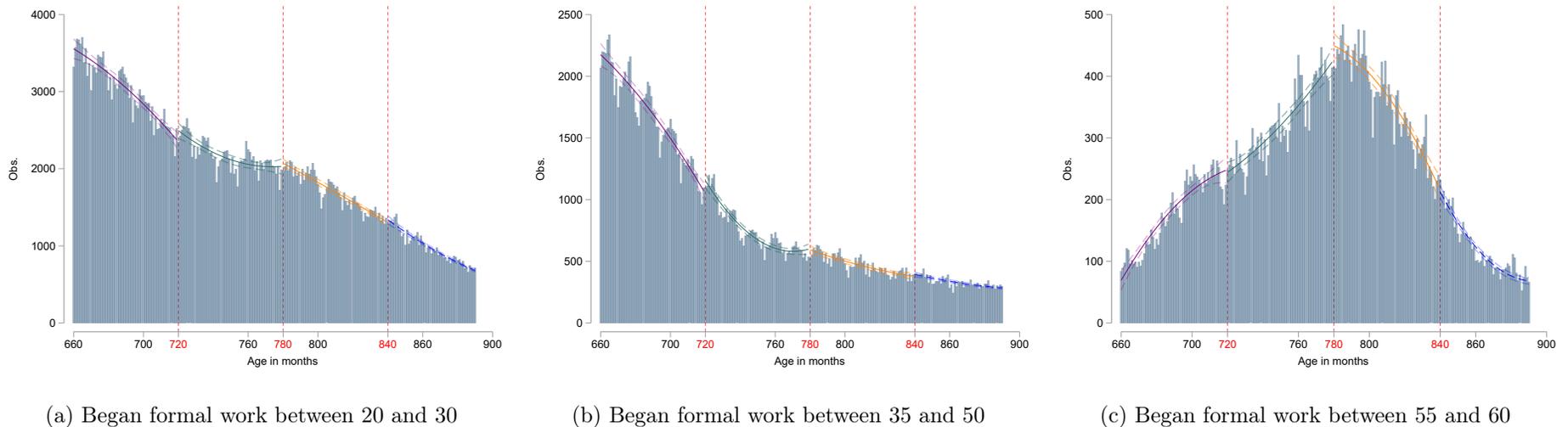
**Figure B2: Density Test for the Effects of Pension Eligibility Ages on Retirement**

*Note*: This figure depicts the distribution of current ages (in months) by age of entry to formal employment using our administrative data. Each panel corresponds to a different group of people who entered the formal workforce a different ages. The solid lines represent a quadratic fit of the outcome, the number of observations per current-age bin as a function of current age (in months). The dotted lines represent confidence intervals at the 95% confidence levels, based on robust standard errors. In each panel, we use a 60-month bandwidth to estimate the polynomials to the right and left of the first and last cutoffs, respectively. We use all the observations in between cutoffs to estimate the remaining two polynomials.
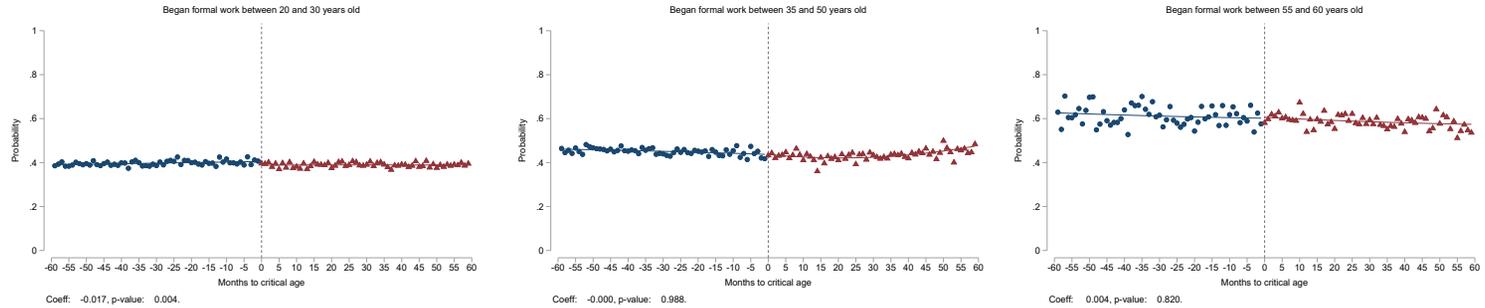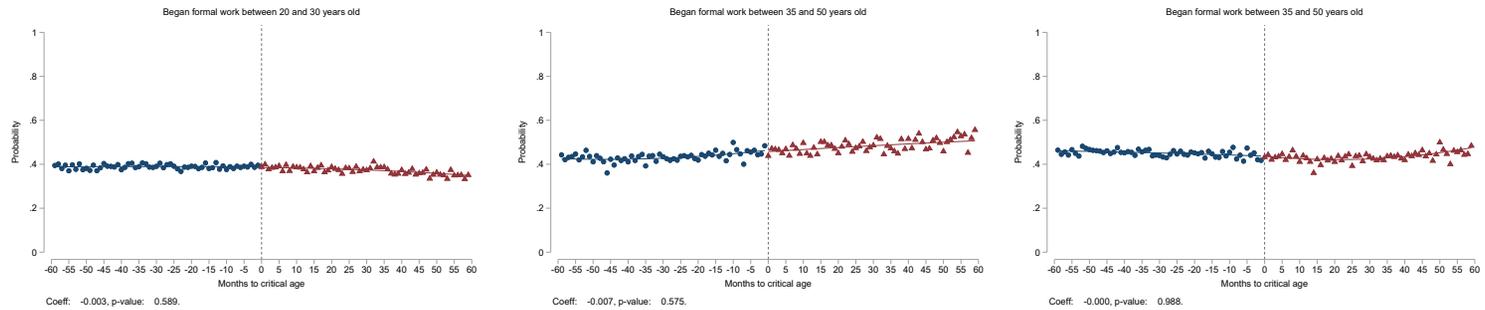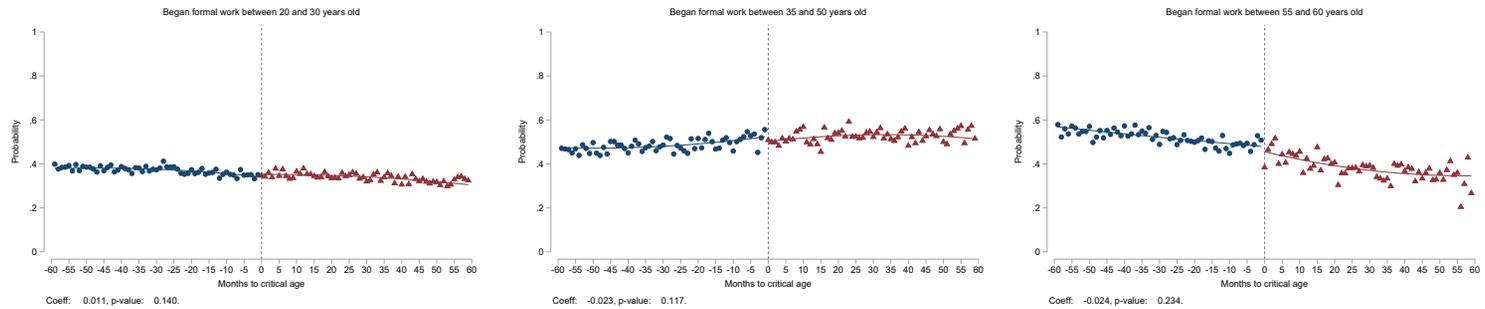
**Figure B3: Effects of Reaching Pension Eligibility Ages on Gender, by Age of Initial Contribution**

*Note*: This figure reports the means of the probability of being a woman by distance (in months) to each retirement eligibility cutoff and by age of entry into the formal labor force. Panels (a), (b), and (c) correspond to the different eligibility ages. Within a panel, each graph corresponds to a different group of people who began formal employment at different ages. The solid lines represent a quadratic fit of the outcome as a function of distance to the threshold on either side of each cutoff.
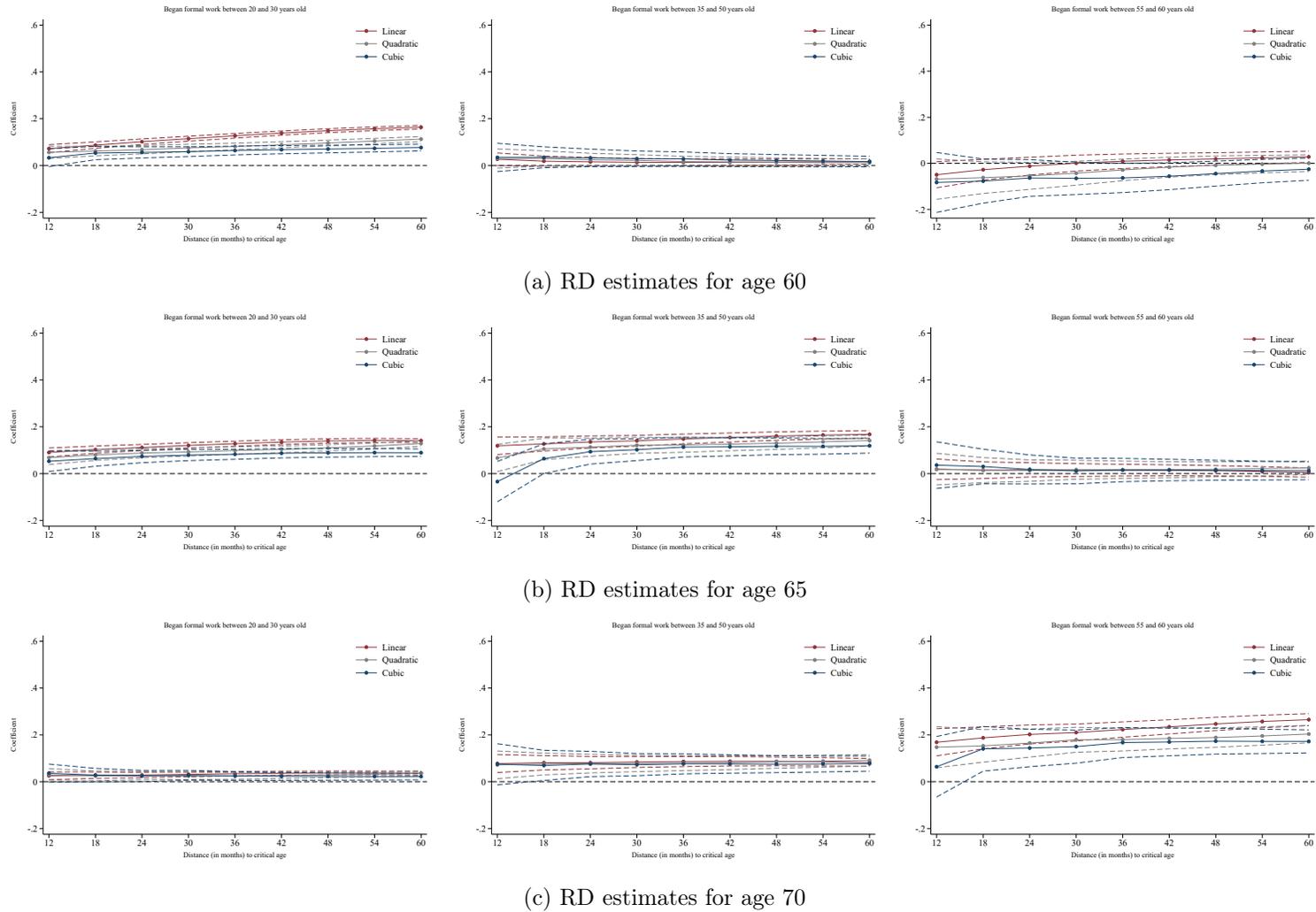
(a) RD estimates for age 60

(b) RD estimates for age 65

(c) RD estimates for age 70

**Figure B4: Robustness of Retirement Estimates to Alternative Polynomials and Bandwidths**

*Notes*: This figure plots RD coefficients from estimating equation (1) as we vary the bandwidth and polynomial in the running variable. Panels (a), (b), and (c) correspond to the different eligibility ages. Within a panel, each graph corresponds to a different group of people who began formal employment at different ages. The graphs plot point estimates from several different bandwidths using using linear, quadratic and cubic polynomials. Dashed lines depict 95% confidence intervals.
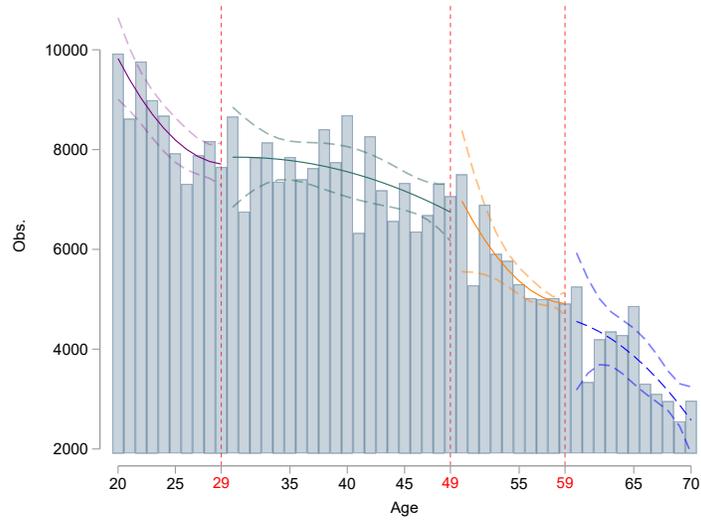
**Figure B5: Density Test for the Effects of Earlier Critical Ages on Formal Employment**

*Notes*: This figure depicts the distribution of current ages (in years) using survey data. The solid lines represent a quadratic fit of the outcome, the number of observations per age bin as a function of age (in years). The dotted lines represent confidence intervals at the 95% confidence levels, based on robust standard errors. In each panel, we use a 10 year bandwidth to estimate the polynomials to the right and left of the first and last cutoffs, respectively. We use all the observations in between cutoffs to estimate the remaining two polynomials.
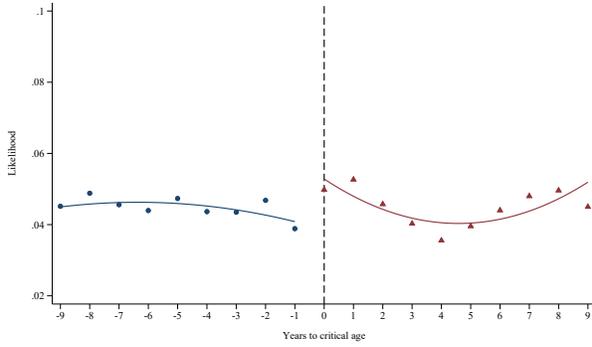
(a) Transitions from informal employment
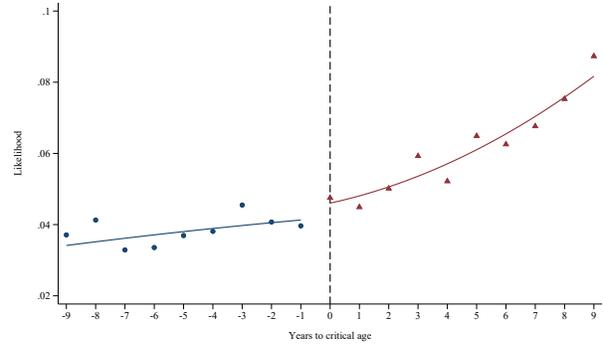
(b) Transitions from non-employment

**Figure B6: Effects of Reaching Age 50 on Transitions from Informal Work and Non-Employment to Formal Employment**

*Notes*: This figure depicts means of the probability of transitioning to formal employment from informal employment (panel a) and non-employment (panel b), around the age-50 cutoff. Solid lines represent fitted quadratic polynomials on either side of the cutoff.
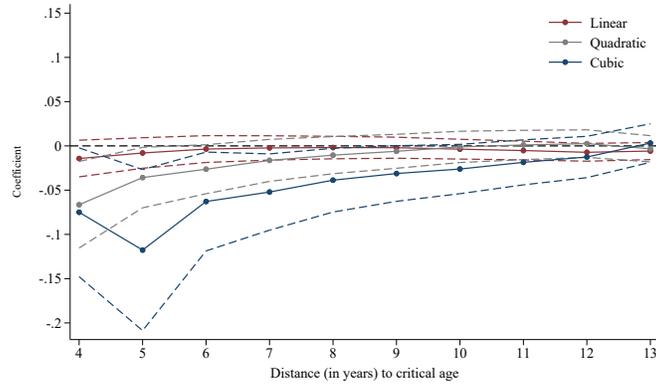
(a) RD estimates for age 30
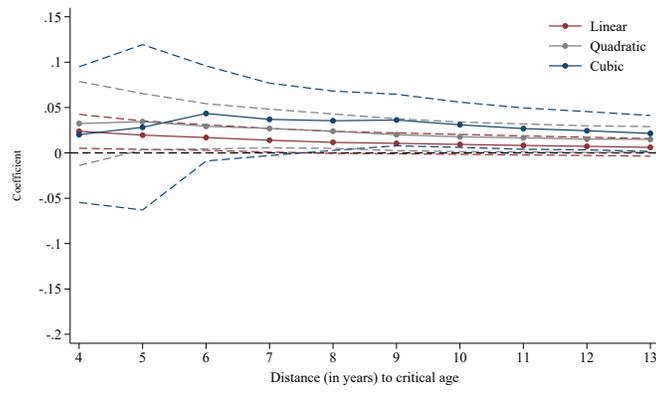


(b) RD estimates for age 50
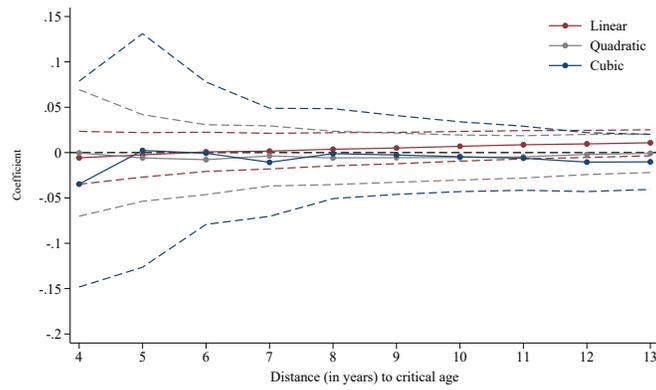


(c) RD estimates for age 60

**Figure B7: Robustness of Estimates for Transitions to Formal Employment to Alternative Polynomials and Bandwidths**

*Notes*: This figure plots RD coefficients from estimating equation (2) as we vary the bandwidth and polynomial in the running variable. Each panel corresponds to a different earlier critical age cutoff. The graphs plot point estimates from several different bandwidths using linear, quadratic and cubic polynomials. Dashed lines depict 95% confidence intervals.
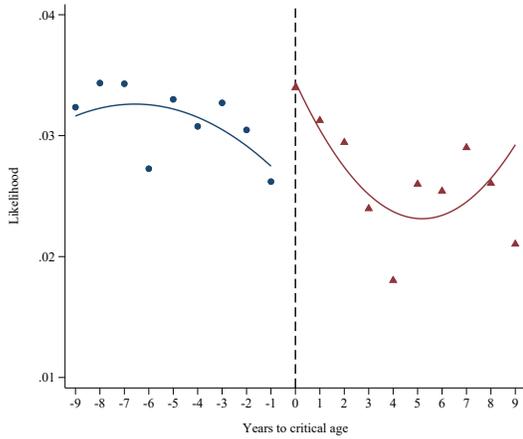
(a) Transitions to formal employment as a
salaried worker
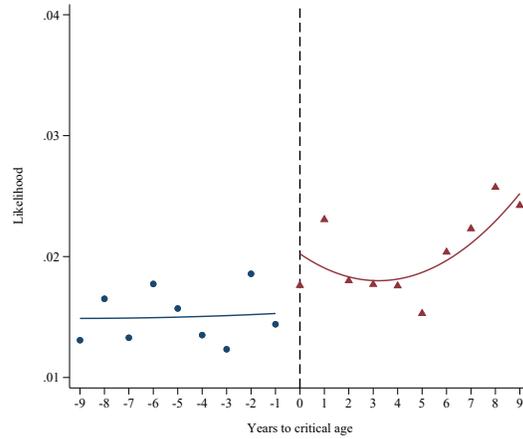
(b) Transitions to formal employment as a
self-employed worker

**Figure B8: Effects of Reaching Age 50 on Transitions to Formal Employment
as a Salaried, Dependent Worker and as a Self-Employed Worker**

*Notes*: This figure depicts means of the probability of transitioning to formal employment and contributing
to social security as a dependent worker (panel a) and as an independent worker (panel b) around the age-50
cutoff. Solid lines represent fitted quadratic polynomials on either side of the cutoff.
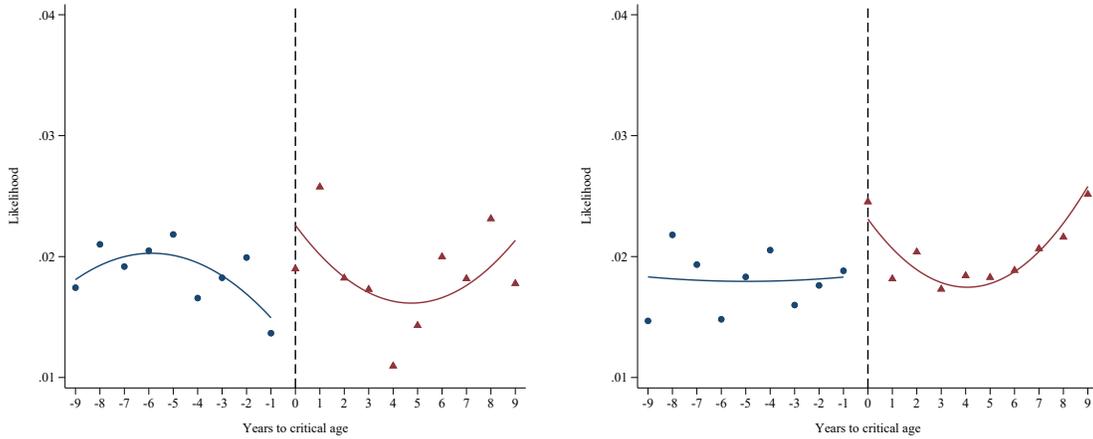
(a) Transitions to formal employment from registered firms

(b) Transitions to formal employment from unregistered firms

**Figure B9: Effects of Reaching Age 50 on Transitions to Formal Employment from Registered Firms and from Unregistered Firms**

*Notes*: This figure depicts means of the probability of transitioning to formal employment from informal employment in a registered firm (panel a) and from informal employment in an unregistered firm (panel b) around the age-50 cutoff. Solid lines represent fitted quadratic polynomials on either side of the cutoff.
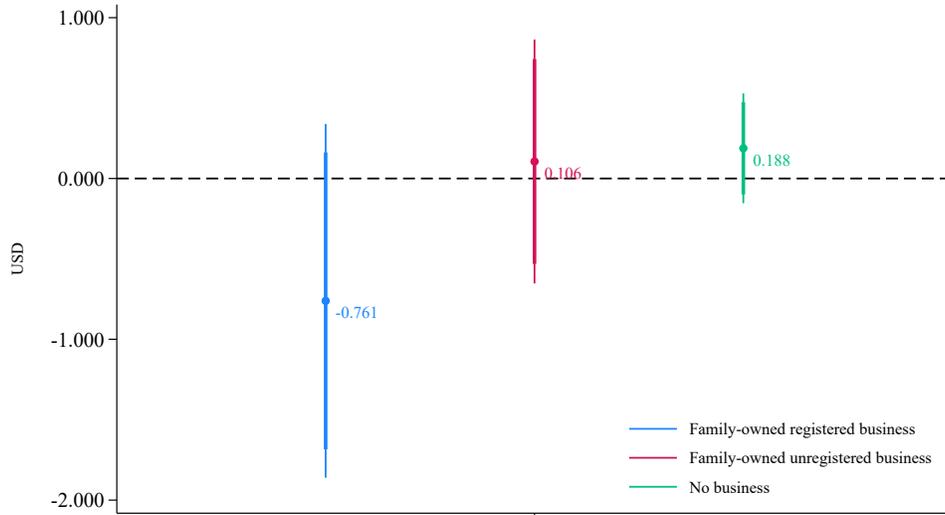
**Figure B10: Heterogeneous Effects of Reaching Age 50 on Wage Changes by Family Business Ownership**

*Notes*: This figure depicts RD estimates from estimating equation (2) for different groups of people. The outcome is the difference in hourly wages between the first time an individual is observed in the panel and the post-period hourly wage. The figure plots RD estimates for three different groups: i) individuals who live in the same household as an owner of a formal business registered with the tax authorities, ii) individuals who live in the same household as an owner of an informal business not registered with the tax authorities, and iii) individuals who do not live in the same household as a business owner. The vertical lines display confidence intervals at the 90% level (the thicker lines) and the 95% level (the narrower lines), based on robust standard errors.
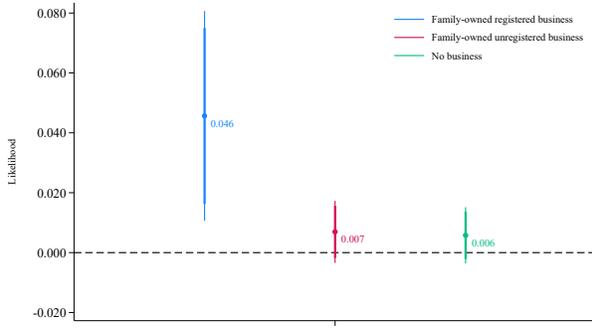
(a) With weights: effects of transitioning to formal employment from informal employment at a registered firm
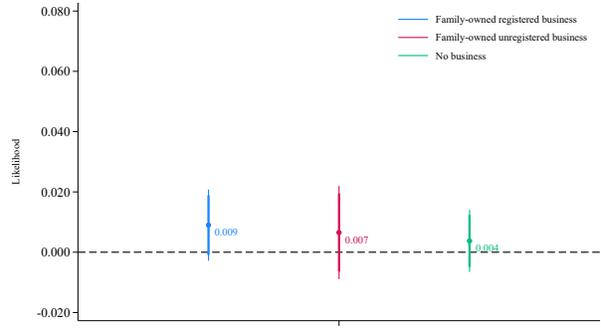
(b) With weights: effects of transitioning to formal employment from informal employment at an unregistered firm
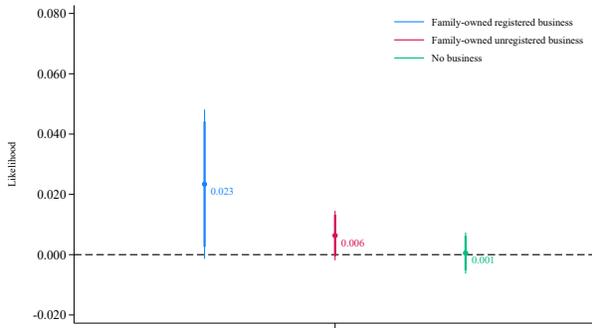
(c) Without weights: effects of transitioning to formal employment from informal employment at a registered firm
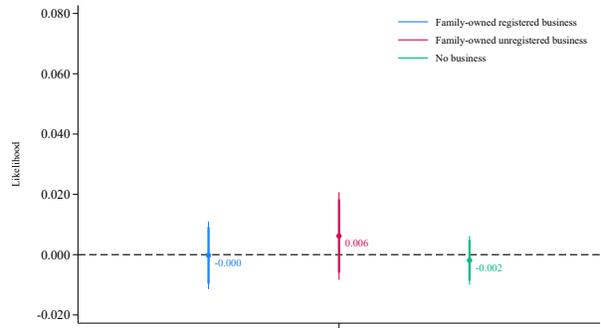
(d) Without weights: effects of transitioning to formal employment from informal employment at an unregistered firm

**Figure B11: Heterogeneous Effects of Reaching Age 50 on Transitions to Formal Employment by Family Business Ownership with and without Using Survey Weights**

*Notes*: This figure depicts RD estimates from estimating equation (2) with and without using survey weights, where the outcome is the probability of transitioning from informal work at a formal firm to formal work in panels (a) and (c), and the probability of transitioning from informal work at an informal firm to formal work in panels (b) and (d). Each point estimate corresponds to a different subsample: i) individuals who live in the same household as an owner of a formal business registered with the tax authorities, ii) individuals who live in the same household as an owner of an informal business not registered with the tax authorities, or iii) individuals who do not live in the same household as a business owner. All regressions are estimated within a 10-year bandwidth around each cutoff and include survey-wave fixed effects, quadratic polynomials on both sides of the cutoff, and triangular kernels. Vertical lines represent confidence intervals at the 90% (thicker lines) and 95% (narrower lines) confidence levels, based on robust standard errors.

## Table B1: Summary Statistics

|  | (1) Mean | (2) Std. Dev. |
|---|---|---|
| *Panel a. Administrative data on workers* | | |
| Prob. of being a woman | 0.41 | 0.49 |
| Age when joined IESS | 25.53 | 9.03 |
| Dependent worker (%) | 0.89 | 0.32 |
| Elegible for retirement (%) | 0.07 | 0.00 |
| | | |
| Obs. | 6,323,252 | |
| | | |
| *Panel b. Administrative data on beneficiaries* | | |
| Pension eligibility age | 63.61 | 5.84 |
| Pension claiming age | 65.74 | 5.58 |
| Number of contributions | 332.06 | 119.31 |
| | | |
| Obs. | 460,041 | |
| | | |
| *Panel c. Survey data on working-age adults* | | |
| Prob. of being a woman | 0.52 | 0.50 |
| Age | 39.44 | 18.55 |
| Completed elementary school | 0.10 | 0.31 |
| Completed middle school | 0.28 | 0.45 |
| Completed high school | 0.37 | 0.48 |
| Completed university education | 0.19 | 0.39 |
| Affiliated to IESS | 0.30 | 0.46 |
| Affiliated to IESS as an employee | 0.23 | 0.42 |
| Affiliated to IESS as self-employed | 0.07 | 0.26 |
| Prob. of being employed | 0.61 | 0.49 |
| Prob. of being an employee | 0.32 | 0.47 |
| Prob. of being self-employed | 0.19 | 0.39 |
| Prob. of working and affiliated to IESS | 0.25 | 0.43 |
| Prob. of working and not affiliated to IESS | 0.36 | 0.48 |
| Prob. of working for a registered firm | 0.18 | 0.38 |
| Prob. of working for an unregistered firm | 0.25 | 0.43 |
| | | |
| Obs. | 967,451 | |

*Notes*: This table reports sample means and standard deviations based on administrative records on contributors to IESS (panel a), administrative records on current pensioners (panel b), and survey data corresponding to the 2008 to 2016 period (panel c).

## Table B2: Robustness of Retirement Estimates to Alternative Regression Specifications

| | Began formal work between 20 and 30 | | | Began formal work between 35 and 50 | | | Began formal work between 55 and 60 | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Panel a. Age 60 cutoff* | | | | | | | | | |
| Above cutoff | 0.117*** | 0.140*** | 0.066*** | 0.008 | 0.019** | 0.022 | 0.009 | 0.009 | -0.059** |
| | (0.006) | (0.005) | (0.009) | (0.009) | (0.008) | (0.014) | (0.018) | (0.017) | (0.029) |
| Obs. | 308,544 | 313,843 | 96,722 | 143,230 | 145,823 | 50,526 | 29,958 | 30,457 | 11,319 |
| Specificiation | Controls | w/o Kernel | MSE-Optimal BW | Controls | w/o Kernel | MSE-Optimal BW | Controls | w/o Kernel | MSE-Optimal BW |
| Bandwidth | 60 | 60 | 19 | 60 | 60 | 22 | 60 | 60 | 22 |
| *Panel b. Age 65 cutoff* | | | | | | | | | |
| Above cutoff | 0.133*** | 0.161*** | 0.090*** | 0.138*** | 0.156*** | 0.126*** | 0.021 | 0.045*** | 0.020 |
| | (0.006) | (0.006) | (0.010) | (0.012) | (0.011) | (0.017) | (0.015) | (0.014) | (0.020) |
| Obs. | 229,876 | 233,507 | 90,078 | 72,010 | 73,511 | 31,124 | 40,717 | 41,197 | 23,336 |
| Specificiation | Controls | w/o Kernel | MSE-Optimal BW | Controls | w/o Kernel | MSE-Optimal BW | Controls | w/o Kernel | MSE-Optimal BW |
| Bandwidth | 60 | 60 | 22 | 60 | 60 | 27 | 60 | 60 | 29 |
| *Panel c. Age 70 cutoff* | | | | | | | | | |
| Above cutoff | 0.037*** | 0.047*** | 0.025*** | 0.085*** | 0.101*** | 0.073*** | 0.208*** | 0.228*** | 0.189*** |
| | (0.006) | (0.005) | (0.008) | (0.013) | (0.012) | (0.019) | (0.019) | (0.017) | (0.026) |
| Obs. | 155,763 | 158,282 | 63,886 | 47,138 | 47,945 | 17,872 | 27,799 | 28,273 | 12,998 |
| Specificiation | Controls | w/o Kernel | MSE-Optimal BW | Controls | w/o Kernel | MSE-Optimal BW | Controls | w/o Kernel | MSE-Optimal BW |
| Bandwidth | 60 | 60 | 24 | 60 | 60 | 23 | 60 | 60 | 29 |

*Note*: This table reports RD estimates from estimating equation (1) using alternative specifications. Each panel corresponds to a different eligibility age cutoff. Each grouping of columns corresponds to a different group of people who entered the formal labor force at different ages. Columns (1), (4), and (7) report coefficients from specifications that include sex and month-of-birth fixed effects as controls. Columns (2), (5), and (8) report coefficients estimated without using a triangular kernel. Columns (3), (6), and (9) report coefficients estimated using an MSE-optimal bandwidth. All regressions include quadratic polynomials on either side of each cutoff. Robust standard errors are reported in parentheses.

* p<0.1, ** p<0.05, *** p<0.01.

## Table B3: Differences in Individual Characteristics for Individuals Around the Earlier Critical Age Cutoffs

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | Below cutoff | | Above cutoff | | | | |
| | Obs. | Mean | Obs. | Mean | Mean diff. | Sd. | p-value |
| **Panel a. Around age 30 cutoff** | | | | | | | |
| Prob. of being a woman | 54,223 | 0.52 | 53,440 | 0.54 | 0.00 | 0.01 | 0.791 |
| Prob. of living in a urban area | 54,223 | 0.81 | 53,440 | 0.79 | 0.00 | 0.01 | 0.912 |
| Prob. of being married | 54,223 | 0.48 | 53,440 | 0.69 | -0.02 | 0.01 | 0.199 |
| Numb. of household members | 54,223 | 4.52 | 53,440 | 4.52 | 0.03 | 0.05 | 0.534 |
| Completed elementary school | 54,223 | 0.04 | 53,440 | 0.05 | -0.01 | 0.01 | 0.086 |
| Completed middle school | 54,223 | 0.20 | 53,440 | 0.28 | -0.00 | 0.01 | 0.756 |
| Completed high school | 54,223 | 0.40 | 53,440 | 0.37 | -0.03 | 0.01 | 0.031 |
| Completed non-university tertiary education | 54,223 | 0.02 | 53,440 | 0.02 | 0.00 | 0.00 | 0.195 |
| Completed university education | 54,223 | 0.34 | 53,440 | 0.27 | 0.04 | 0.01 | 0.003 |
| Numb. of survey waves | 54,223 | 2.51 | 53,440 | 2.54 | -0.00 | 0.02 | 0.961 |
| | | | | | | | |
| **Panel b. Around age 50 cutoff** | | | | | | | |
| Prob. of being a woman | 44,441 | 0.54 | 40,400 | 0.53 | -0.01 | 0.02 | 0.721 |
| Prob. of living in a urban area | 44,441 | 0.79 | 40,400 | 0.80 | -0.00 | 0.01 | 0.859 |
| Prob. of being married | 44,441 | 0.77 | 40,400 | 0.76 | 0.00 | 0.01 | 0.887 |
| Numb. of household members | 44,441 | 4.51 | 40,400 | 4.21 | 0.00 | 0.06 | 0.950 |
| Completed elementary school | 44,441 | 0.09 | 40,400 | 0.13 | -0.00 | 0.01 | 0.634 |
| Completed middle school | 44,441 | 0.32 | 40,400 | 0.33 | -0.00 | 0.01 | 0.936 |
| Completed high school | 44,441 | 0.33 | 40,400 | 0.27 | 0.01 | 0.01 | 0.334 |
| Completed non-university tertiary education | 44,441 | 0.01 | 40,400 | 0.01 | -0.00 | 0.00 | 0.266 |
| Completed university education | 44,441 | 0.22 | 40,400 | 0.22 | 0.01 | 0.01 | 0.677 |
| Numb. of survey waves | 44,441 | 2.56 | 40,400 | 2.56 | 0.02 | 0.02 | 0.389 |
| | | | | | | | |
| **Panel c. Around age 60 cutoff** | | | | | | | |
| Prob. of being a woman | 35,670 | 0.52 | 27,857 | 0.51 | -0.00 | 0.02 | 0.948 |
| Prob. of living in a urban area | 35,670 | 0.80 | 27,857 | 0.77 | 0.01 | 0.01 | 0.523 |
| Prob. of being married | 35,670 | 0.75 | 27,857 | 0.71 | -0.01 | 0.02 | 0.660 |
| Numb. of household members | 35,670 | 4.03 | 27,857 | 3.68 | -0.07 | 0.08 | 0.352 |
| Completed elementary school | 35,670 | 0.15 | 27,857 | 0.20 | -0.01 | 0.01 | 0.579 |
| Completed middle school | 35,670 | 0.34 | 27,857 | 0.35 | -0.01 | 0.02 | 0.461 |
| Completed high school | 35,670 | 0.23 | 27,857 | 0.19 | 0.01 | 0.02 | 0.406 |
| Completed non-university tertiary education | 35,670 | 0.01 | 27,857 | 0.01 | 0.00 | 0.00 | 0.362 |
| Completed university education | 35,670 | 0.21 | 27,857 | 0.15 | -0.01 | 0.02 | 0.714 |
| Numb. of survey waves | 35,670 | 2.55 | 27,857 | 2.59 | 0.02 | 0.02 | 0.418 |

*Note*: This table reports sample means, mean differences, standard deviations, and p-values of the differences for sociodemographic characteristics of individuals around 30 years old (panel a), 50 years old (panel b), and 60 years old (panel c). A 10-year bandwidth is used to compare individuals above and below each cutoff.

**Table B4: Robustness of Estimates for Transitions to Formal Employment to Alternative Regression Specifications**

| | | | | Transition to formality | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *Panel a. Around age 30 cutoff* | | | | | | | |
| Above cutoff | -0.001 | -0.002 | 0.006 | 0.006 | -0.023* | -0.001 | -0.001 |
| | (0.009) | (0.009) | (0.009) | (0.006) | (0.014) | (0.009) | (0.008) |
| | | | | | | | |
| Obs. | 107,663 | 107,663 | 107,663 | 107,663 | 59,914 | 107,663 | 107,663 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 5 | 10 | 10 |
| Mean below cutoff | 0.111 | 0.111 | 0.111 | 0.111 | 0.108 | 0.111 | 0.111 |
| Effect size (%) | -1.01 | -2.16 | 5.40 | 5.27 | -21.34 | -1.01 | -1.01 |
| *Panel b. Around age 50 cutoff* | | | | | | | |
| Above cutoff | 0.018** | 0.017** | 0.015* | 0.005 | 0.026** | 0.018** | 0.018 |
| | (0.008) | (0.008) | (0.008) | (0.006) | (0.011) | (0.008) | (0.011) |
| | | | | | | | |
| Obs. | 84,841 | 84,841 | 84,841 | 84,841 | 58,559 | 84,841 | 84,841 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 6 | 10 | 10 |
| Mean below cutoff | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 |
| Effect size (%) | 21.33 | 20.36 | 17.62 | 6.35 | 31.38 | 21.33 | 21.33 |
| *Panel c. Around age 60 cutoff* | | | | | | | |
| Above cutoff | -0.005 | -0.006 | -0.004 | -0.002 | -0.002 | -0.005 | -0.005 |
| | (0.013) | (0.012) | (0.012) | (0.009) | (0.016) | (0.013) | (0.013) |
| | | | | | | | |
| Obs. | 63,527 | 63,527 | 63,527 | 63,527 | 43,556 | 63,527 | 63,527 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 6 | 10 | 10 |
| Mean below cutoff | 0.112 | 0.112 | 0.112 | 0.112 | 0.115 | 0.112 | 0.112 |
| Effect size (%) | -4.83 | -5.15 | -3.70 | -1.42 | -1.77 | -4.83 | -4.83 |

*Notes*: This table reports estimates of the effect of reaching earlier critical ages on transitions to formal work, using variations of equation (2). Each panel corresponds to a different cutoff. Column (1) reports results from our main specification. Column (2) reports results from using a vector of controls that includes gender, area of residence, marital status, number of household members, number of survey waves, and dummies for educational level. Column (3) exclude triangular kernels, column (4) excludes survey weights, and column (5) uses an MSE-optimal bandwidth. Finally, columns (6) and (7) use standard errors clustered at the household and birth cohort levels, respectively. All estimates include a quadratic polynomial on either side of the cutoff and time (survey wave) fixed effects. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

## Table B5: Robustness of Estimates for Different Types of Transitions to Formal Employment at Age 50 to Alternative Regression Specifications

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| *Panel a. Transition from informal employment* | | | | | | | |
| Above cutoff | 0.014** | 0.014** | 0.013** | 0.004 | 0.017** | 0.014** | 0.014*** |
| | (0.006) | (0.006) | (0.006) | (0.005) | (0.008) | (0.006) | (0.005) |
| | | | | | | | |
| Obs. | 84,841 | 84,841 | 84,841 | 84,841 | 58,559 | 84,841 | 84,841 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 6 | 10 | 10 |
| Mean below cutoff | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 |
| Effect size (%) | 32.82 | 31.52 | 29.95 | 9.47 | 38.93 | 32.82 | 32.82 |
| *Panel b. Transition from informal employment to formal employee* | | | | | | | |
| Above cutoff | 0.009* | 0.009* | 0.008 | 0.004 | 0.015** | 0.009* | 0.009*** |
| | (0.005) | (0.005) | (0.005) | (0.004) | (0.006) | (0.005) | (0.003) |
| | | | | | | | |
| Obs. | 84,841 | 84,841 | 84,841 | 84,841 | 58,559 | 84,841 | 84,841 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 6 | 10 | 10 |
| Mean below cutoff | 0.030 | 0.030 | 0.030 | 0.030 | 0.030 | 0.030 | 0.030 |
| Effect size (%) | 31.07 | 29.59 | 24.88 | 12.29 | 48.78 | 31.07 | 31.07 |
| *Panel c. Transition from informal employment in a registered firm* | | | | | | | |
| Above cutoff | 0.010*** | 0.010** | 0.010*** | 0.004 | 0.010** | 0.010*** | 0.010** |
| | (0.004) | (0.004) | (0.004) | (0.003) | (0.005) | (0.004) | (0.004) |
| | | | | | | | |
| Obs. | 84,841 | 84,841 | 84,841 | 84,841 | 58,559 | 84,841 | 84,841 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 6 | 10 | 10 |
| Mean below cutoff | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 |
| Effect size (%) | 57.29 | 54.86 | 57.01 | 23.16 | 57.03 | 57.29 | 57.29 |
| *Panel d. Transition from informal employment in a small registered firm* | | | | | | | |
| Above cutoff | 0.008*** | 0.008*** | 0.008*** | 0.004* | 0.007* | 0.008*** | 0.008* |
| | (0.003) | (0.003) | (0.003) | (0.002) | (0.004) | (0.003) | (0.004) |
| | | | | | | | |
| Obs. | 84,841 | 84,841 | 84,841 | 84,841 | 58,559 | 84,841 | 84,841 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 6 | 10 | 10 |
| Mean below cutoff | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| Effect size (%) | 78.74 | 76.06 | 75.11 | 37.81 | 67.52 | 78.74 | 78.74 |
| *Panel e. Transition from informal employment in a registered firm - living with owners of registered firms* | | | | | | | |
| Above cutoff | 0.046** | 0.047*** | 0.052*** | 0.023* | 0.036 | 0.046** | 0.046* |
| | (0.018) | (0.018) | (0.018) | (0.013) | (0.023) | (0.018) | (0.024) |
| | | | | | | | |
| Obs. | 8,931 | 8,931 | 8,931 | 8,931 | 5,343 | 8,931 | 8,931 |
| Specification | Main | Controls | w/o kernel | w/o weights | Opt. BW | Cluster: HH | Cluster: Cohort |
| Bandwidth | 10 | 10 | 10 | 10 | 5 | 10 | 10 |
| Mean below cutoff | 0.030 | 0.030 | 0.030 | 0.030 | 0.028 | 0.030 | 0.030 |
| Effect size (%) | 151.21 | 155.92 | 170.67 | 77.45 | 126.78 | 151.21 | 151.21 |

*Notes*: This table reports estimates of the effect of reaching earlier critical ages on different outcomes and subsamples around the age-50 cutoff, using variations of equation (2). Each panel corresponds to a different outcome. Column (1) reports results from our main specification. Column (2) reports results from using a vector of controls that includes gender, area of residence, marital status, number of household members, number of survey waves, and dummies for educational level. Column (3) excludes triangular kernels, column (4) excludes survey weights, and column (5) uses an MSE-optimal bandwidth. Finally, columns (6) and (7) use standard errors clustered at the household and birth cohort levels, respectively. All estimates include a quadratic polynomial on either side of the cutoff and time (survey wave) fixed effects. p<0.1, ** p<0.05, *** p<0.01.

## Table B6: Descriptive Statistics around Age 50

| | (1)<br>All | (2)<br>Lives with owner<br>of registered bus. | (3)<br>Lives with owner<br>of unregistered bus. | (4)<br>Does not live<br>with bus. owner |
|---|---|---|---|---|
| Prob. of being a woman | 0.53 | 0.67 | 0.58 | 0.49 |
| Prob. of being married | 0.73 | 0.83 | 0.77 | 0.70 |
| Prob. of being married to business owner | 0.28 | 0.77 | 0.70 | |
| High demand for care in the household | 0.34 | 0.28 | 0.39 | 0.34 |
| Prob. of having completed tertiary education | 0.21 | 0.33 | 0.11 | 0.22 |
| Household income | 778.34 | 1360.24 | 643.18 | 737.60 |
| Prob. of being employed | 0.79 | 0.79 | 0.75 | 0.80 |
| Prob. of being a formal worker | 0.34 | 0.39 | 0.25 | 0.37 |
| Prob. of being an informal worker | 0.45 | 0.40 | 0.51 | 0.44 |
| Median firm size (cond. on being employed) | 2.00 | 2.00 | 2.00 | 2.00 |
| | | | | |
| Obs. | 137,328 | 13,987 | 30,972 | 92,369 |
| Share (%) | 100.00 | 10.19 | 22.55 | 67.26 |

*Notes*: The table reports summary statistics using data on individuals between ages 40 and 48 at baseline, that is, nine years below the age-50 cutoff. Column (1) reports statistics for all individuals. Columns (2) and (3) report statistics for individuals who live with owners of registered and unregistered businesses, respectively. Column (4) reports statistics for individuals who do not live with a business owner. High demand for care in the households is computed as an indicator taking the value of 1 if the individual lives with either a child age 5 or younger or a person with disabilities.

**Table B7: Placebo test: Effects of Reaching Age 50 on Transitions to Informal Employment and Non-employment**

|  | (1) Transition to informal employment | (2) Transition to non-employment |
|---|---|---|
| Above cutoff | -0.004 | 0.004 |
|  | (0.006) | (0.003) |
|  |  |  |
| Obs. | 84,841 | 84,841 |
| Mean below cutoff | 0.039 | 0.014 |
| Effect size (%) | -11.10 | 26.21 |

*Notes*: This table reports placebo RD estimates for the effect of reaching age 50 on transitions away from formal employment. The point estimates come from estimating equation (2). Each column corresponds to a different outcome. Column (1) is for transitioning to informal employment. Column (2) is for transitioning to non-employment. Robust standard errors are reported in parentheses.

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01.