Pensions, Retirement, and the Disutility of Labor: Bunching in Brazil

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Abstract

Elderly workers in developing countries face certain frictions, such as credit constraints, in their retirement decisions that may not be as common among their counterparts in the developed world, and these concerns may lead workers to work more or less than their preferred number of years. In this study, I firstly use regression discontinuity methods to show that a large fraction of urban male heads of households in Brazil (roughly 45%) react contemporaneously to pension eligibility by retiring. Because retirement is not required to receive the pension and because the return to working does not change discontinuously at the eligibility cutoff, workers should not react contemporaneously unless optimization frictions, such as credit constraints, are at work. Secondly, I develop a model of retirement decisions that explores how pensions in the face of credit constraints can influence such decisions, and I discuss applications of this model to determine how the observed behavior in conjunction with the model can be used to make inferences about welfare and labor supply decisions in the face of different pension values.

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1 Introduction

Countries around the world are in the midst of, or just emerging from, social security reform as they face aging populations. In East Asia, China recently has dropped its famous one-child policy, in part to hopefully increase the ratio of working to retired individuals in order to help pay for its social security system, and South Korea has increased its minimum retirement age (SSA (2016)). In Latin America, Ecuador has recently passed legislation to cut direct government costs of social security, and in Chile, a recent report on the state of social security has shown that while progress has been made due to reforms within the last decade, more progress is still necessary for a more stable system (SSA (2015a), SSA (2015b)). In part, these reforms have been suggested in order to address the solvency of various retirement systems which are feared to be facing a steep elderly burden in coming years; however reforms have also pointed to a need to increase coverage and reduce old-age poverty.

Retirement incentives in the developing world demand examination for a number of reasons, and among these, I identify two that are of particular importance. First, compared to the number of studies done on developed countries, the number of studies examining financial incentives for retirement in emerging economies are relatively rare. We may expect reactions to be different, or at least more pronounced among individuals who would otherwise optimize consumption and labor according to a dynamic optimization process if such optimization is less likely in the context of an emerging economy. In particular, issues in developing countries may complicate the interaction between retirement benefits, such as pensions, and labor supply. Second, as many countries are facing situations in which they would like to keep elderly workers in the labor market, it is important to obtain some kind of idea of how much an additional year of working is worth to elderly workers. Such an estimate could be used to evaluate the welfare costs of policies such as a minimum retirement age.

In this paper, I examine labor supply reactions to retirement eligibility and the welfare cost of labor in the context of Brazil. Brazil is home to one of the world's largest and most generous social security systems, with around 28 million beneficiaries in 2010. In spite of the generosity of its social security system, Brazil's elderly labor force suffers from a number of frictions that could prevent them from proper optimization, and chief among them, a lack of access to credit enabling workers to effectively treat future anticipated income as part of their current budget constraint. Additionally, the size and generosity of the social security program has caused problems: disbursements in 2010 reached US$153 million, accounting for 6.9% of GDP (da Silva (2012)). Calls for reform include reductions in benefits and a minimum retirement age, however little is known about the welfare effects of the institution of these policy changes.

I find firstly that workers react contemporaneously to anticipated changes in income; upon receiving an old-age pension at the age 65, urban male household heads are over 40% more likely to leave the labor force. Secondly, I develop a novel dynamic model of optimal retirement and consumption. This model indicates that the response I find is generated not by borrowing constraints alone, but also by the excessive generosity of the pension: in short, borrowing constraints are a necessary, but not a sufficient condition to generate the observed reaction. Finally, I explore brief applications of my model first to the calculation of welfare and second to the estimation of the distribution of labor supply among elderly workers.

1.1 Prior Studies of Financial Incentives for Retirement

The majority of the existing literature has concluded that financial incentives themselves do matter in determining retirement. Stock and Wise (1990) set the stage in terms of modeling, showing that incorporating dynamic optimizing behavior into estimation can still result in substantial effects of social security retirement incentives at certain ages. Gustman and Steinmeier (1994) further show that retirement can be affected by the availability of Medicare, something further addressed in Rust and Phelan (1997). Belloni (2008) notes that a new generation of retirement studies have relaxed former assumptions and have utilized more up-to-date statistical techniques to estimate retirement effects. For instance, French (2005) relaxes the assumptions of certainty and perfect credit markets. Most of these studies focus on aspects of the United States' retirement system, however Gruber and Wise (1999) make a (seminal) foray into exploring international retirement incentives, also finding large disincentives to work in the countries such as Denmark and Japan.

1.2 Studies of Financial Incentives for Retirement in the Developing World

The evidence that financial incentives in the *developing* world matter is noticeably less copious, however it seems to indicate that they do. Studies examining retirement incentives around the world are far less common than those examining retirement incentives in the United States and Western Europe; there is no corresponding collection of studies rivaling Gruber and Wise (1999) focusing on the developing world. However, there are a few relatively isolated studies that examine incentives for labor force withdrawal among elderly workers. Ranchhod (2006) examines the famous South African Old Age Pension, finding labor force withdrawal among eligible workers; however, the author is unable to determine if the withdrawal is due to a pure "income" effect.[1] de Carvalho Filho (2008) studies the extension of pension benefits to rural workers in Brazil, finding sizable, negative estimates on labor supply: access to old age pension benefits are estimated to reduce the chance of not working by roughly 38 percentage points and total hours worked by over 22 hours per week.

1.3 Where my study fits in

The literature seems to be clear that financial incentives matter; however, it does not seem to be conclusive on how (or why). Certainly decision-makers in developing households face concerns that their developed counter-parts do not face, and credit/borrowing constraints are chief among these.

In spite of the fact that de Carvalho Filho (2008) examines part of the same program I study, I maintain that the studies most related to mine are Kahn (1988) and Ranchhod (2006). The distinction is that these two studies examine the effects of *anticipated* pension benefits on labor supply, whereas de Carvalho Filho (2008) studies a legal change that suddenly made a large fraction of rural workers eligible for benefits. In the context of dynamic optimizing behavior, expected future financial incentives to retire can and usually do have different effects than those that are unexpected.

My paper contributes to the literature on pensions and social support in developing countries in three main ways. Firstly, while my study focuses on an expected pension, and in this way examines

[1] In this paper, I use the term "income effect" somewhat loosely to refer to changes in economic behavior induced by an increase in income that is either anticipated or unanticipated. While it should not typically be expected that anticipated income changes have a contemporaneous effect, this is exactly the type of behavior I study in this paper.

the “long run” effect of pensions on labor supply, as do Ranchhod (2006) and Kahn (1988), I am able to identify a response within only a months of eligibility; prior studies find that individuals tend to retire at some point within the age of eligibility, lending credence to the possibility that social norms are at work; a contemporaneous response at the monthly level would seem to indicate otherwise. Secondly, I seek to quantify the welfare effects credit constraints and pension generosity have on workers with the use of a model. To my knowledge, no other paper examines pension generosity in conjunction with credit constraints to determine how changes in either credit constraints or pension generosity can change societal welfare. My results can thus inform policy makers concerned with incentivizing (or dis-incentivizing) labor force participation among the elderly. As such, I describe some brief applications taking into account the implications of my model.

2 The Brazilian Old Age Pension Program

The central source of variation in anticipated income I explore in this paper results from a publicly funded old age pension policy that has been in place for several decades. The program relies on an age cutoff, which provides the plausibly exogenous variation in anticipated income given that I have data on each respondent’s birthday (and hence, his date of eligibility). I use this variation to estimate the labor supply response to the reception of this anticipated income.

I begin this section by describing the policy that I am studying and its associated rules. In Brazil, there are currently two major routes to receiving a public pension, and so strictly speaking, the policy I study is actually one of two eligibility arms. The first is via length of contribution to the social security system, under the *aposentadoria por tempo de contribuiçao* (“retirement by length of contribution”). This first arm stipulates that upon contributing to the social security system (usually by holding a formal sector job) for 35/30 years for males/females, workers are eligible to receive a function based on their past earnings, which I will describe below. The other route, which is the focus of this paper, is via age, under the *aposentadoria por idade* (“retirement by age”) program, which stipulates that upon turning 65, males who have contributed to the public social security system for 15 years and who live in urban areas are eligible to receive a pension. Females who satisfy the contribution requirement of 15 years and live in urban areas are eligible to receive the pension at age 60. Rural male and female workers are eligible to receive the pension five years before the urban counterparts, at age 60/55 for males/females. Importantly, retirement is not required to receive these benefits. Individuals can continue to work and receive the benefits.

2.1 Incentives to Retire

These are defined benefit pensions; however, the calculation of benefits under the *aposentadoria por idade* is not unfortunately not straightforward and requires some careful explanation. There are two main time periods during which pension benefits were calculated in different ways. In many ways, the differences in the calculation of benefits over these periods revolve around an important pension reform during 1998-1999 that mostly affected the “time of contribution” pension, however did have some implications for the “retirement by age” program that I study. These pensions are subject to income taxation in that they are considered income; however, they are not subject to additional taxation by virtue of being benefits. Soares (2010) provides a thorough explanation of the system, I referred to his paper in the writing of this section.

2.1.1 Pre Reform (Pre-1999)

During the first period, before 1999, pension benefits (B) were calculated using a relatively straightforward formula. Pension benefits were paid out according to the formula

$$B = 0.7(BW_{pre1999}) + 0.01(BW)(j) \tag{1}$$

Where B represents the pension benefit, BWpre1999 represents the 'benefit wage', or the average of the 36 monthly earnings just before application for the pension, and j represents the number of years of contribution. The total benefit payout was capped at 100% of the benefit wage, so that men/women reaching age 65/60 with at least 30/25 years of contributions would have an incentive to delay retirement only so far as their wages were increasing and thus increasing the average toward the end of their working life. For those reaching age 65/60 with less than 30/25 years of contributions, benefits would continue to accrue with additional years of contributions. Because 15 years of contribution were required at age 65/60, the benefit pays out a minimum of 85% of the benefit wage. Additional years of contribution were included on top of this fraction – for instance, an urban male worker retiring at age 65 (as soon as he was eligible) who had a contribution history of 19 years would have received 89% of the benefit wage. Note further that while retirement was not required, if an individual works additional years after claiming the benefit, the benefit would not continue to increase with additional years of contribution. That is to say, every year an individual waits to claim the benefit while still remaining in the labor force and contributing, the benefit upon claiming increases by at least 1%, and benefits stop accruing upon retirement.

2.1.2 Post Reform (1999-Present))

Since 1999, there have actually been two formulas used to calculate potential pension benefits. For the most part, the first formula is used; however, the second formula can be used under certain conditions. The first formula is

$$B = 0.7(BW_{post1999}) + 0.01(BW)(j) \tag{2}$$

Where B represents the pension benefit, BW again represents the 'benefit wage' and j represents the number of years of contribution. This new benefit wage is calculated using the average of the top 80% of monthly contributions. The benefit paid out according to this formula is 70% of the benefit wage with an additional 1% added for every year of contribution up to a maximum of 100% of the benefit wage, which is similar to the pre-1999 formula. Again, this formula yields a minimum of 85% of the benefit wage for anyone meeting the criteria for the old age pension.

The second formula is

$$B = (BW)(FP) \tag{3}$$

Where B represents the pension benefit, BW represents the 'benefit wage' and FP represents an adjustment factor called the *fator previdenciario*. As in formula (1), the benefit wage is calculated using the average of the top 80% of monthly contributions. The *fator previdenciario* serves to adjust the benefit wage for demographic trends, age, and length of contribution. Upon eligibility for the old age pension, this second formula is used only if the *fator previdenciario* is greater than one. Generally speaking, this amounts to the *fator* being used "advantageously," i.e. only if it results in a larger calculated benefit than the first formula. The *fator* (FP) is released in table form every year based on population estimates of the previous year. It is calculated according to the formula

$$FP = \left(\frac{(tc)(tax)}{L}\right)\left(1 + \frac{age + tc + tax}{100}\right) \tag{4}$$

where tc indicates time of contribution, tax is the social security tax on labor income set at a constant 31%, age is the age of the beneficiary upon retirement, and L is the remaining life expectancy of the beneficiary, conditional on age. The following table shows the benefits one can expect to receive as a fraction of the benefit wage upon retiring at a given age and contribution period if one were to consider retirement in 2013, the last year of my data. Values over one indicate the use of the *fator* in the calculation of benefits.

When the *fator* was first introduced, the law allowed for a 5 year (60 month) transitional period; thus for the years 2000-2004, a weighted average of the *fator* was used, given by the following formula:

$$F_t = (FP)\left(\frac{t}{60}\right) + \left(\frac{60 - t}{60}\right) \tag{5}$$

where t represents the number of months that had passed since November 1999 at the time of application.

Under both ways of calculating pension benefits, the benefit wage BW is bounded above and below, meaning there's an effective upper bound on the pension benefit – Workers who have earnings profiles that are below this bound will experience high replacement rates, whereas workers who have earnings profiles that are above (or lie at least partially above) may not have such high replacement rates. I explore the implications of this policy in a later section of my paper.

2.1.3 Are Binding Credit Constraints Necessary to Explain the Behavior?

The pension stops accruing upon claiming, and does not increase in value after claimed. Given that it is in all conceivable cases rational to claim the pension as soon as one becomes eligible (as the accrual rates from working an additional year are far too low to compensate a worker with an average conditional life expectancy for a year's worth of eligible pension), this changes the rate of total compensation around the point of eligibility. In a standard model of labor supply, if workers were reacting by substituting away from this change in their effective wage and credit constraints were not at work, this would imply a participation of elasticity of over 22, which is by any measure implausibly large. I thus maintain that even in the face of the slight "kink" in the budget constraint at the age of eligibility, credit constraints are the most plausible candidate explanation.

In other words, suppose binding credit constraints are not present, and agents can smooth pension income over the course of their lifetime, borrowing against the pension benefit. If workers pick the age at which they will retire first and then make the decision of when to claim accordingly, it would be highly curious that all workers decided to pick an optimal retirement age that was the same down to the monthly level. Estimates of behavioral responses, even if they are on the margin of the amount of labor supplied, do not represent estimates of labor supply but rather of the "consumption" value of labor – how much employment would shift if individuals experienced a change in their non-labor income.

3 Data

My data comes from a widely-known, publicly available annual household labor force survey called the Pesquisa Nacional por Amostra de Domicílios (PNAD). Analogous in some ways, though not entirely, to the U.S. Current Population Survey, the survey provides a snapshot into the economic conditions of over 100,000 households on a yearly basis. Importantly, the survey provides a great deal of demographic information (most important of which is the birthday of the respondent) and household conditions such as income. I use the available survey years from 2001-2013, omitting one year of survey data (2010) during which the PNAD was not carried out. I focus on urban male heads of households in my analysis; I therefore only use variation around the cutoff of age 65 (for males).

I make several important restrictions to the PNAD samples for my analysis. Firstly, I exclude households with a per-capita income of less than 25% of the annual minimum wage, due to an overlap with a social assistance program intended to help the extreme poor which I will discuss in more detail in the section below. Secondly, for most of my analysis, I consider observations within 5 years of the date of pension eligibility. Thirdly, and finally, I exclude observations within 1 month post-eligibility, to allow for households to being receiving funds. My final sample includes 76,255 household heads from 16 cross-sections.

Table 1 shows a summary of the main sample I use for my analysis. Most of the household heads under consideration do not live alone – the average number of household members is 3.25. As I focus on geographically urban areas which include most major cities, my sample is not particularly low-income, either – the average head's monthly household income is a little more than R$1,400 (roughly $1300 in 2000). Slightly more than half of the heads in my sample are in the labor force or working, while their spouses participate in the labor market to a much lower extent. The majority of heads also have a secondary education or less. Unfortunately, not all respondents who answered the three main questions of interest (receipt of government pension, employment activities, and labor force participation) answered other questions pertaining to household status. Non-response rates for household income were relatively low; however education non-response rates were relatively high.

4 Estimation and Results of Labor Supply Response

4.1 Validity of the Discontinuity

In order for a discontinuity to be usable as an identifier of a causal effect, certain assumptions must be made. These assumptions usually include (1) no manipulation of the running variable and (2) exogeneity of the cutoff value, and in fuzzy designs. This section addresses whether these assumptions are reasonable in the context of the policy I study.

The first assumption of no manipulation of the running variable in the context of the pension discontinuity is more than reasonable. Since actual age is not manipulable, the main concern would be with reported age; however, because the agency that conducts the annual PNAD (IBGE) does not keep track of or distribute pension funds, there is virtually no incentive to report different age values other than one's true value. The second assumption of the exogeneity of the cutoff is more concerning, since age 65 is an age at which we would expect some overlapping retirement policies in place. Indeed, there is another program that has an age cutoff of 65 – the *Benefício de Prestação Continuada* (BPA) program provides non-contributionary social assistance to the disabled and those over age 65 in households with a per-capita income of less than 25% of the minimum wage. The program provides a monthly payment of one monthly minimum wage to eligible individuals, and the eligibility of participants is periodically reviewed (Queiroz and Figoli (2010)). To address the concern that benefits paid out from this program might confound my results, I restrict my sample to those with monthly household income above 25% of the minimum wage in the given year. Note that this fraction of observations (as a fraction of the entire relevant sample) is a little over 5%, so accounting for the program does not substantially reduce the sample size. Aside from the BPA program, to my knowledge there are no other social assistance programs (or government programs in general) that use the age of 65 as a cutoff.

4.2 Estimation Strategy

My estimation of the effect of the pension on labor supply variables is based on a regression discontinuity design (RDD) in the vein of Hahn et al. (2001) that makes identification and estimation straightforward. As aforementioned, conditional on contribution time, all male workers in Brazil are eligible for the *aposentadoria por idade* pension benefit. Using this eligibility cutoff, I estimate "sharp" RD's in both the receipt of the pension and labor supply, and then proceed to estimate a "fuzzy" RD to determine the causal effect of pension receipt on labor supply. For robustness, I estimate models using both linear and quadratic polynomials on either side of the age cutoff for various bandwidths (the results of which are available in the appendix). The model I estimate is described by the following:

$$y_i = \alpha + \beta \mathbf{1}[age_i > 65] + \gamma f(age_i - 65) + \varepsilon_i \tag{6}$$

where y_i indicates the outcome for a household head, age_i indicates the age in months of the household head i, and $f(age_i - 65)$ indicates a polynomial of the running variable, which is the age in months of the respondent at the time of survey less the age in months at which the respondent will turn age 65. [2] β represents the RD estimate. The specification for the "fuzzy" RD estimate is identical, with the caveat that an additional OLS regression (for which I also include no additional fixed effects or regressors) provides the two stage least squares estimates. The OLS estimate is numerically equivalent to estimating two sharp RD estimates (one of the outcome and one of the instrumented variable) and taking their ratio. Because the RDD does not rely on fixed effects or covariates for proper estimation, I omit these for simplicity (Lee and Lemieux (2010)).

[2] Note here that actually take advantage of the day of eligibility. To compute "months from eligibility," I take groups of 30 days on either side of the cutoff, so that the "months" I refer to here are not calendar months but rather groups of 30 days.

4.3 Results

Tables 2, 3, and 4 show the main results. Table 2 shows results estimated using a flexible linear specification, 3 shows results estimated using a flexible quadratic polynomial specification, and Table 4 shows results estimated using Calonico et al. (2014)'s bandwidth selection procedure and local linear regression around the cutoff. Results using Calonico et al. (2014)'s procedure include a different sample than the others as the bandwidth selection does not rely on a given bandwidth. All three tables share the same set of columns, where each column represents a dependent variable.

According to the first column, eligible male heads are 8%-10% more likely to receive a government pension, and are roughly 4% less likely to be employed. The point estimates for labor force participation are similar to those for employment. These estimates represent "sharp" RD estimates and form the first stage and reduced form, respectively, for the "fuzzy" RD estimates presented in columns 4 and 5. These estimates assume that instead of eligibility, receipt of the government pension is the proper assignment variable and increases in probability on the right side of the age cutoff. The estimates are quite sizable: across all model specifications, they imply that those male heads receiving government pensions are about 45% more likely to report not working. Again, estimates for labor force participation are similar.

In addition to the numerical estimates shown in the above tables, I also show graphical evidence of the discontinuity in Figures 1, 2, and 3. Each figure shows monthly bin averages of the variable on the y-axis plotted against the relevant positive or negative age bin around the cutoff. Figure 1 displays the probability of receiving a government pension against age, and figures 2 and 3 display the probability of reporting employment and labor force participation, respectively. Linear and quadratic polynomials for both sides of the cutoff are also transposed, however they are not drastically different and virtually lie on top of each other in Figures 2 and 3. Overall, the discontinuity in the three main variables of interest appears visually evident.

5 Factors Determining the Behavioral Response

Based on the regression discontinuity estimates in the previous section, a large fraction of individuals seem to stop working based upon the timing of the receipt of a large income change. Without other information, this behavior seems peculiar since the results of Friedman (1957) and Macurdy (1981), in which the optimal response (in either labor supply, if leisure is part of the utility function, or material consumption) to an anticipated change in income (part of the unchanging "permanent income") should not be contemporaneous with the timing of the change in income.

In this section, I explore potential reasons for why this phenomenon might be happening. My analysis focuses heavily on the most obvious candidate: credit constraints. I also include a brief discussion on retirement savings behavior. In the final part of this section, I identify demographic groups most likely to be credit constrained via formal and informal channels, and I show labor supply responses to the pension receipt in these groups.

5.1 Credit Constraints

Perhaps the most obvious reason why individuals appear to retire upon receipt of the funds is that they are credit constrained. In the standard model of dynamic labor supply over the lifetime Macurdy (1981), changes in labor supply that are concurrent with changes in income must be due to either the change in income being unexpected or an ability to redistribute future income over previous time periods which is usually accomplished via credit constraints. Of course, I cannot rule out that some individuals may simply not know about the pension program ahead of time, but given that (1) the program has been publicly addressed several times by politicians and (2) that the average life expectancy of Brazilians is around 70 years and hence most rational agents would be aware of any means of old-age support within a decade of their expected death, I do not consider that the program represents an unexpected income "shock." Additionally, the policy application of my results intends to explore what could potentially happen in other old-age social insurance systems, and the incidence of elderly workers simply not knowing about generous government benefits is not widely considered.

It is worth discussing exactly what I mean by credit constraints. In this paper, I will refer to credit constraints as constraints on those who want to borrow but are excluded from borrowing at an interest rate they would be willing to pay. I do not assume that those who want to save are barred from doing so; however, I do not believe savings to be a complicating factor.

5.2 Differences in Labor Supply Responses

To determine if the response to pension eligibility differs by household composition, I group each household head according to his secondary education level and according to whether or not he lives alone. I then examine the behavior responses using methods similar to those I use above. Overall, my results are suggestive that those who live alone are more reactive to the pensions.

Tables 5 and 6 show separate results for both men who live alone and men who live in households with others. Men who live alone are over 80% likely to leave the workforce and labor force, upon receipt of the old age pension, compared to roughly 40% of men who live with at least one other individual. Both estimates are precisely estimated in all specifications, and are significantly different than each other.

Interestingly, Tables **??** and **??** seem to indicate that less-educated single males (those with less than a high school education) have much higher propensities to stop working upon receiving the pension than more highly-educated single males. Estimates indicate that nearly all single men without a secondary schooling leave employment before upon receipt of the pension, compared to around 50%-60% of single men with higher education levels. These results indicate that controlling for household size, education may yet be a determinant of borrowing constraints.

6 A Model of Retirement "Bunching" Under Credit Constraints

6.1 Brief Description

This section describes an intuitive model in which workers choose consumption and when to retire facing an expected pension against which they are unable to borrow[3]. The model provides a rational decision-making framework which predicts the bunching evident in the data. Specifically, even in the face of no explicit incentive to retire, retiring *at* the age of eligibility becomes the optimal choice for more and more individuals as the size of the pension increases.

Suppose workers differ in the dimension of how they value leisure, and are the same otherwise. Workers value leisure at $\nu_{it} = \alpha_i + \mu * age$ and retirement is assumed to be irreversible. Specifically, retiring at age X provides utility $\sum_{t=X}^{T} \alpha_i + \mu t$. Workers maximize lifetime (log) utility, choosing consumption c and retirement age N facing a pension eligibility age of $\bar{N}$. They earn y for every period of labor and receive d as a pension after age $\bar{N}$. They can choose to retire at age N **before**, **after**, or **at** the age of eligibility, $\bar{N}$, and pick the age which provides the highest lifetime utility. For simplicity and clarity, I assume no time-discounting, and an interest rate of 0 for all borrowing and lending.

The worker's general lifetime utility maximization problem can be thought of:

$$\max_{N, c_{pre}(t), c_{post}(t)} Nu(c_{pre}(t)) + (T - N)u(c_{post}(t)) + \sum_{t=N}^{T} \alpha_i + \mu t \tag{7}$$

where $c_{pre}(t)$ represents consumption before retirement, and $c_{post}(t)$ represents consumption after retirement.

Optimal consumption for workers results in an attempt to consume the same in every period. Maximizing lifetime utility with respect to retirement age N implies the following condition:

$$u'(c^*)y = \alpha_i + \mu N^* \tag{8}$$

This condition states that the marginal benefit of working one more period in the form of additional consumption must be equal to the value of one more time-unit of leisure. Note that the decision to work an additional period depends only on the return to working (i.e. income and the disutility of labor) and not on the size of the pension or other factors.

The model predicts that optimal retirement at $\bar{N}$ becomes the optimal choice for a range of disutility values as pension amount d increases. This is explained in more detail in the following section.

6.2 Maximization and Bunching

Recall that the worker's choices of when to retire can be classified into 3 "types": $N^* = \bar{N}$, $N^* < \bar{N}$ (bounded below by 0), and $N^* > \bar{N}$ (bounded above by T). $N^* > \bar{N}$ and $N^* < \bar{N}$ both satisfy

[3] The relaxation of the assumption of a total borrowing constraint to a parameterized borrowing constraint does not change the intuition behind or the conclusion of the model substantially.

maximums in their domains, and the worker picks the choice (either $\bar{N}$, $N|N > \bar{N}$, or $N|N < \bar{N}$) that provides the highest payoff.

Now, for notational clarity, if $N^* < \bar{N}$, then let $N^* = N^{*L}$, and if $N^* > \bar{N}$, then let $N^* = N^{*R}$; these can be thought of the pre-eligibility optimal retirement age and the post-eligibility optimal retirement age. Note that if the worker chooses to retire before $\bar{N}$, he will have to save for the gap of $(\bar{N} - N^{*L})$, and if he chooses to retire after $\bar{N}$, then he will smooth the additional income for the period that he is working and receiving the pension for a combined income of $y + d$.

Furthermore if $N^* = N^{*L}$, then it is the solution of the following problem

$$\max_{N, c_1^L, c_2^L} Nu(c_1) + (\bar{N} - N)u(c_2^L) + (T - \bar{N})u(c_3^L) + \sum_{t=N}^{T} \alpha_i + \mu t, \tag{9}$$

where

$$c_3^L = \frac{N(y - c_1^L) - (\bar{N} - N)c_2^L}{T - \bar{N}} + d \tag{10}$$

Also, if $N^* = N^{*R}$, then it follows that is the solution of the problem

$$\max_{N, c_1^R, c_2^R} \bar{N}u(c_1^R) + (N - \bar{N})u(c_2^R) + (T - N)u(c_3^R) + \sum_{t=N}^{T} \alpha_i + \mu t, \tag{11}$$

where

$$c_3^R = \frac{\bar{N}(y - c_1^R) - (N - \bar{N})(y + d - c_2^R)}{T - N} + d \tag{12}$$

In both cases, the necessary conditions for optimization remain the same: workers attempt to smooth consumption across all periods as much as possible, and equate the marginal value of working with the value of one time-unit of leisure, as in equation (8). Figures illustrating these problems are (4) and (5), for the pre-eligibility problem and the post-eligibility problem, respectively.

Payoffs are written below:

$$U(N^*) = \begin{cases} N^{*L}u(c_1^L) + (\bar{N} - N^{*L})u(c_2^L) + (T - \bar{N})u(c_3^L) + \sum_{t=N^{*L}}^{T} \alpha_i + \mu t \text{ if } 0 < N^* < \bar{N} \\ \bar{N}u(c_1^R) + (N^{*R} - \bar{N})u(c_2^R) + (T - \bar{N})u(c_3^R) + \sum_{t=N^{*R}}^{T} \alpha_i + \mu t \text{ if } \bar{N} < N^* < T \\ \bar{N}u(c_1^M) + (T - \bar{N})u(c_2^M) + \sum_{t=\bar{N}}^{T} \alpha_i + \mu t \text{ if } N^* = \bar{N} \end{cases} \tag{13}$$

The following theorem obtains in the solution to this problem.

Theorem 1. *As the value of the pension d increases, a choice of $N^* = \bar{N}$ is optimal for a larger range of values of leisure.*

The worker picks $N^* = \bar{N}$ as long as $U(N^* = \bar{N}) > U(N^* > \bar{N})$ and $U(N^* = \bar{N}) > U(N^* < \bar{N})$. This condition implies that α_i falls within certain bounds. Specifically, workers will pick $N^* = \bar{N}$ as long as:

$$\frac{T}{\bar{N} - N^{*L}} \left(u(\frac{\bar{N}y + (T - \bar{N})d}{T}) - u(\frac{N^{*L}y + (T - \bar{N})d}{T}) \right) - (\mu)(T)(0.5)$$

$$> \alpha_i >$$

$$\frac{T}{N^{*R} - \bar{N}} \left(u(\frac{N^{*R}y + (T - \bar{N})d}{T}) - u(\frac{\bar{N}y + (T - \bar{N})d}{T}) \right) - (\mu)(N^{*R})(0.5)$$

and these bounds *increase* in d, indicating that the larger the pension, the larger the range of α_i that satisfy this condition (hence, bunching occurs at larger d's). A proof is available in the appendix.

7 Brief Applications

The model I develop in the previous section is useful not only in explaining the bunching phenomenon, but also has applications in predicting economic behavior. In this section, I describe how the model I have developed can be used to firstly provide an estimate of the value of leisure (or the disutility of leisure) and secondly to provide an estimate of elderly aggregate labor supply.

7.1 Welfare Estimates

Note that a direct implication of this model is that the value of a year leisure for those who retire at the age of eligibility is bounded above and below by the aforementioned bounds. Therefore, given the value of pension d, the wage y along with institutional parameters such as $\bar{N}$ and life expectancy T, an individual (and aggregate) estimate of the value of leisure for elderly workers is available. The functions shown in figure 6 are correspondences between chosen retirement ages and the value of leisure, conditional on the value of the pension.

However, the degree of bunching at the age of eligibility taken in conjunction with estimates for the utility that should induce such bunching can be used to back out the underlying welfare function. Assuming a distribution of values of the disutility of labor across eligible workers and knowledge of average wages and pension payments, a bounding exercise (of aggregate welfare measures) can be performed.

Admittedly, any welfare exercise must take into account a considerable number of assumptions, and there are also not simple solutions for these bounds. I only seek to explain here that there *are* welfare implications to be drawn from this model, and a parameter of interest, specifically the disutility to an elderly worker of providing a year's worth of labor, can be estimated taking the model into account. Such a parameter may be of great interest to policy-makers attempting to incentivize the elderly to remain in the workforce.

7.2 Pensions and (Aggregate) Elderly Labor Force Participation

Of interest to policy-makers is how elderly labor force participation may change in response to financial incentives to retire. If a significant portion of the funding for the pension program comes from payroll tax contributions, such information may be particularly useful to policy-makers concerned with pay-as-you-go (PAYG) funding situations.

Assuming uniform and normal distributions of the value of leisure across the elderly population, a plot of the fraction of workers working at or past age 65 shown against the generosity of the pension d in figures 7 and 8. These figures also include separate plots of the fraction of workers working *past* age 65 and the fraction of workers working *at* age 65. These are equivalent to the cumulative density of workers over age 65 as a function of the pension generosity. These plots serve to highlight the information communicated in figure 6 about the distribution of elderly employment.

Note that there is considerable reshuffling of the elderly workforce as a result of pension generosity – as shown in 6, the distribution of the elderly workforce tends to shift "right" toward the age of eligibility. Note that as the replacement rate grows, the elderly employment rate drops – a larger replacement pushes individuals toward picking N^{*L}. However, at a sufficiently high replacement rate, the elderly employment rate levels off after it becomes optimal for *all* workers to retire upon reaching eligibility (and not earlier).

This exercise is done to highlight a central mechanism I outline in this paper – the notion that pension generosity, over and above the existence of credit constraints, can substantially incentivize retirement, yet also generate predictable variation in retirement ages.

8 Conclusion

This paper identifies a large behavioral response to pension eligibility that is associated with an increase in an individual's flow income. Because the pension is anticipated, a contemporaneous behavioral response should only occur in the face of credit-constraints. I find that the effect is substantially larger among individuals more likely to be credit constrained, and in particular, single males who live without the availability of informal credit access through additional household members. While the results do necessitate credit constraints, I argue that credit constraints *alone* are not enough to explain the sharp degree of bunching evident in the data. Specifically, I provide a model whereby extreme pension generosity including replacement rates of more than 100%, as is common in Brazil, can result in a point mass of individuals choosing to retire upon reaching the age of eligibility.

My results are the first to document a contemporaneous behavioral response to pension eligibility at the monthly frequency – prior studies largely identify upticks in retirement at age groups but do not make finer distinctions than that. Moreover, I identify that the composition of households can affect the propensity to react to pension eligibility, which to my knowledge has not been documented in the literature. Finally, I propose a novel model which shows that the generosity of the pension can explain the bunching we see over and above the existence of credit constraints. I plan to use this model in future work to examine the welfare consequences in a more in-depth manner.

Tables and Figures

[Figure 1 about here.]

[Figure 2 about here.]

[Figure 3 about here.]

[Figure 4 about here.]

[Figure 5 about here.]

[Figure 6 about here.]

[Figure 7 about here.]

[Figure 8 about here.]

[Table 1 about here.]

[Table 2 about here.]

[Table 3 about here.]

[Table 4 about here.]

[Table 5 about here.]

[Table 6 about here.]

[Table 7 about here.]

A

Proof of Theorem 1

Proof. Consider the conditions under which $N^* = \bar{N}$. If $N = \bar{N}$ is an optimal choice, because

$$U(N|N > \bar{N}) = \bar{N}u(c_1^R) + (N^{*R} - \bar{N})u(c_2^R) + (T - \bar{N})u(c_3^R) + \sum_{t=N^{*R}}^{T} \alpha_i + \mu t$$

and

$$U(N|N < \bar{N}) = N^{*L}u(c_1^L) + (\bar{N} - N^{*L})u(c_2^L) + (T - \bar{N})u(c_3^L) + \sum_{t=N^{*L}}^{T} \alpha_i + \mu t$$

and the payoff to picking $N^* = \bar{N}$ is

$$U(N = \bar{N}) = \bar{N}u(c_1^M) + (T - \bar{N})u(c_2^M) + \sum_{t=\bar{N}}^{T} \alpha_i + \mu t,$$

it follows that

$$U(\bar{N}) > U(N|N > \bar{N})$$

$$\Longleftrightarrow$$

$$\bar{N}u(c_1^M) + (T - \bar{N})u(c_2^M) + \sum_{t=\bar{N}}^{T} \alpha_i + \mu t > \bar{N}u(c_1^R) + (N^{*R} - \bar{N})u(c_2^R) + (T - \bar{N})u(c_3^R) + \sum_{t=N^{*R}}^{T} \alpha_i + \mu t$$

and also that

$$U(\bar{N}) > U(N|N < \bar{N})$$

$$\Longleftrightarrow$$

$$\bar{N}u(c_1^M) + (T - \bar{N})u(c_2^M) + \sum_{t=\bar{N}}^{T} \alpha_i + \mu t > N^{*L}u(c_1^L) + (\bar{N} - N^{*L})u(c_2^L) + (T - \bar{N})u(c_3^L) + \sum_{t=N^{*L}}^{T} \alpha_i + \mu t$$

These statements are also equivalent, respectively, to

$$(\bar{N} - N^{*L})(\alpha_i + \mu\bar{N}(0.5)) < N^{*L}\ln\left(\frac{c_1^M}{c_1^L}\right) + (\bar{N} - N^{*L})\ln\left(\frac{c_1^M}{c_2^L}\right) + (T - \bar{N})\ln\left(\frac{c_2^M}{c_3^L}\right)$$

and

$$(N^{*R} - \bar{N})(\alpha_i + \mu N^{*R}(0.5)) > \bar{N}\ln\left(\frac{c_1^R}{c_1^M}\right) + (N^{*R} - \bar{N})\ln\left(\frac{c_2^R}{c_1^M}\right) + (T - N^R)\ln\left(\frac{c_3^R}{c_2^M}\right)$$

Intuitively, in order for the choice of $\bar{N}$ to be optimal, the value of leisure must be high enough to compensate the worker for the increase in lifetime consumption he will gain from working for additional periods, however, it must not be so high as to prevent him from picking $\bar{N}$ over retiring earlier.

These two inequalities result in the bound

$$UB \equiv \left(N^{*L}\ln\left(\frac{c_1^M}{c_1^L}\right) + (\bar{N}-N^{*L})\ln\left(\frac{c_1^M}{c_2^L}\right) + (T-\bar{N})\ln\left(\frac{c_2^M}{c_3^L}\right)\right)\left(\frac{1}{(\bar{N}-N^{*L})}\right) - \mu\bar{N}(0.5)$$

$$> \alpha_i >$$

$$\left(\bar{N}\ln\left(\frac{c_1^R}{c_1^M}\right) + (N^{*R}-\bar{N})\ln\left(\frac{c_2^R}{c_1^M}\right) + (T-N^R)\ln\left(\frac{c_3^R}{c_2^M}\right)\right)\left(\frac{1}{N^{*R}-\bar{N}}\right) - \mu N^{*R}(0.5) \equiv LB$$

The task now is to show that $\frac{\partial UB}{\partial d} >= 0$ and $\frac{\partial LB}{\partial d} < 0$. First note that by consumption smoothing, c_1^M and c_2^M depend completely on parameters. Specifically,

$$c_1^M = c_2^M = \frac{\bar{N}y + (T-\bar{N})d}{T} \text{ if } d < y$$

and

$$c_1^M = y \text{ and } c_2^M = d \text{ if } d > y$$

Intuitively, if the pension is outweighed by the wage, then workers are able and willing to completely smooth consumption by consuming a weighed average of the pension and the wage, with weights corresponding to the fraction of their lives spent "earning" each. However, if the pension outweighs the wage, then a worker is unable to smooth, however he comes as close as possible by consuming the most he can prior to eligibility – his wage.

Case 1 (d<y): If $d < y$, then $c_1^L = c_2^L = c_3^L = c^L$ and $c_1^M = c_2^M = c^M$. Furthermore, $c^L = \frac{N^{*L}y + d(T-\bar{N})}{T}$ and $c^M = \frac{\bar{N}y + d(T-\bar{N})}{T}$ by virtue of the budget constraint. Now, consider that N^{*L} satisfies the equality

$$N^{*L} = \frac{1}{\mu}\left(\frac{yT}{N^{*L}y + d(T-\bar{N})} - \alpha_i\right)$$

It follows that $\frac{\partial N^{*L}}{\partial d} < 0$ [4].

Now, note that $\frac{\partial c^M}{\partial d} = \frac{T-\bar{N}}{T}$ and that $0 < \frac{dc^L}{dd} < \frac{T-\bar{N}}{T}$. Therefore, it follows that $\frac{d\ln\left(\frac{c^M}{c^L}\right)}{dd} > 0$. Because UB is an increasing function of both N^{*L} and $\ln\left(\frac{c^M}{c^L}\right)$, it follows that $\frac{\delta dUB}{\delta d} > 0$ [5].

Now, consider that $c^R = \frac{\bar{N}y + (N^{*R}-\bar{N})(y+d) + (T-N^{*R})d}{T}$ by virtue of the budget constraint, and also that N^{*R} satisfies the equality

$$N^{*R} = \frac{1}{\mu}\left(\frac{yT}{\bar{N}y + (N^{*R}-\bar{N})(y+d) + (T-N^{*R})d} - \alpha_i\right)$$

It follows that $\frac{\partial N^{*R}}{\partial d} < 0$ as above.

[4] To see this, consider that equation can be reorganized to form an equation in which the left side of the equation is increasing in both d and N^{*L}, and the right side is constant.

[5] To see this, consider that UB can be simplified to $T\ln\left(\frac{c^M}{c^L}\right)\left(\frac{1}{\bar{N}-N^{*L}}\right) - \mu\bar{N}(0.5)$, as the same amount is consumed in every period.

Further, note that $\frac{\partial c^M}{\partial d} = \frac{T-\bar{N}}{T}$ as above, and that $0 < \frac{dc^R}{dd} < \frac{T-\bar{N}}{T} = \frac{\partial c^M}{\partial d}$, so that $\frac{d \ln\left(\frac{c^R}{c^M}\right)}{dd} < 0$ – the denominator grows faster than the numerator as d increases, whereas before the numerator grew faster than the denominator. Now, LB is a *decreasing* function of N^{*R} *and* $\ln\left(\frac{c^R}{c^M}\right)$, so it follows that as d increases, LB decreases, expanding the bounds.

Case 2 (d>y): In the case of a larger pension value, the worker will be willing, but not able to consume the same amount in every period. In this sense, he reaches a "corner" solution as his consumption either pre-eligibility or post-eligibility is determined by either the wage or the pension amount. If he chooses to retire before eligibility, it follows that $c_1^L = c_2^L = c_{pre}^L$ and $c_3^L = d$. If he chooses to retire after eligibility, it follows that $c_1^R = y$ and $c_2^R = c_3^R = c_{post}^R$. However, the first order condition with respect to N does not change and instead becomes

$$\mu N^{*R} + \alpha_i = \frac{y}{c_{post}^R} \text{ if } N = N^{*R}$$

and

$$\mu N^{*L} + \alpha_i = \frac{y}{c_{pre}^R} \text{ if } N = N^{*L}$$

Because $c_{post}^R = \frac{(N^{*R}-\bar{N})y+(T-\bar{N})d}{T-\bar{N}}$ and $c_{pre}^L = \frac{N^{*L}y}{\bar{N}}$ these conditions then become

$$\mu N^{*R} + \alpha_i = \frac{y(T-\bar{N})}{(N^{*R}-\bar{N})y+(T-\bar{N})d} \text{ if } N = N^{*R}$$

and

$$\mu N^{*L} + \alpha_i = \frac{y\bar{N}}{N^{*L}} \text{ if } N = N^{*L}$$

Now, it follows that $\frac{\partial N^{*R}}{\partial d} < 0$ and that $\frac{\partial N^{*L}}{\partial d} = 0$. Additionally, by definition of c_{post}^R and c_{pre}^L, $\frac{dc_{post}^R}{dd} > 0$ and $\frac{dc_{pre}^L}{dd} = 0$. Hence, when d increases, the upper bound UB, being an increasing function of both c_{pre}^L and N^{*L}, does not change, where as the lower bound LB, being an increasing function of both c_{post}^R and N^{*R}, decreases. Therefore, in all cases, when d increases, the distance $UB - LB$ increases.

□

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List of Figures

Figure 1: Discontinuity in Probability of Receiving a Positive Pension Amount

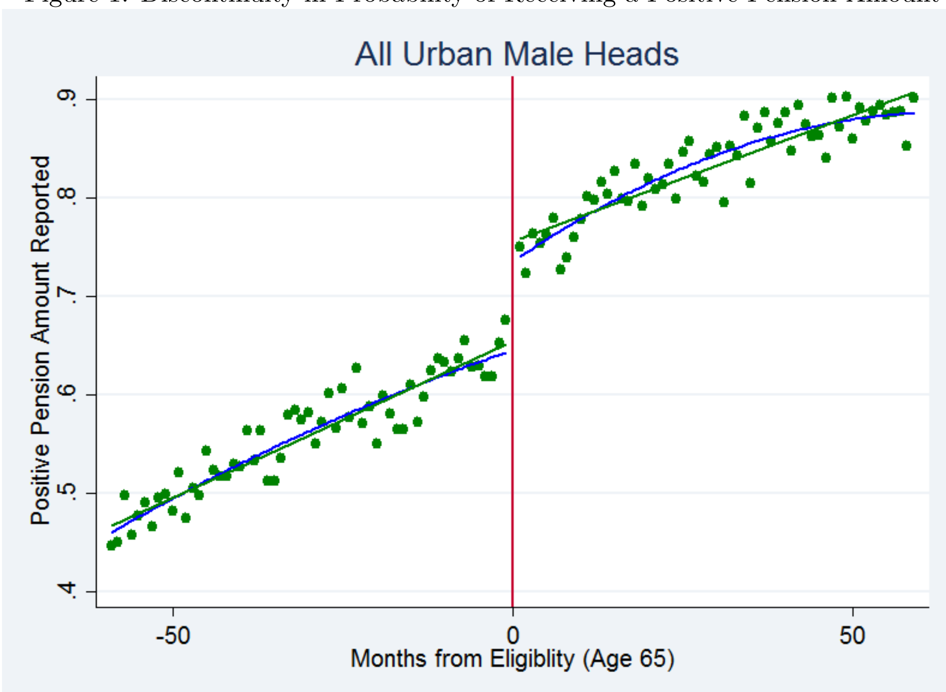


Figure 2: Discontinuity in Probability of Employment

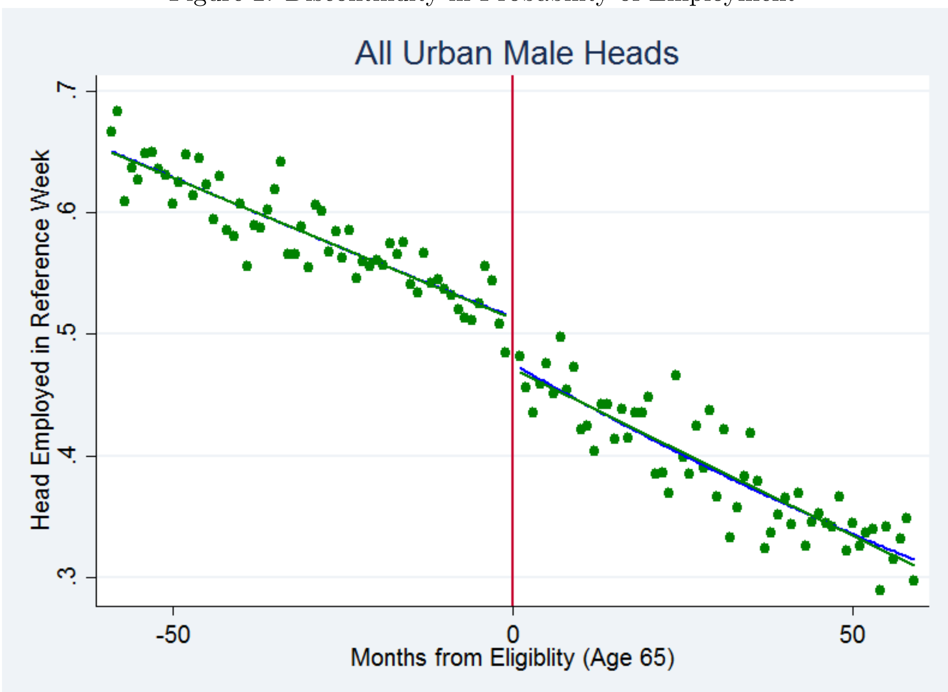
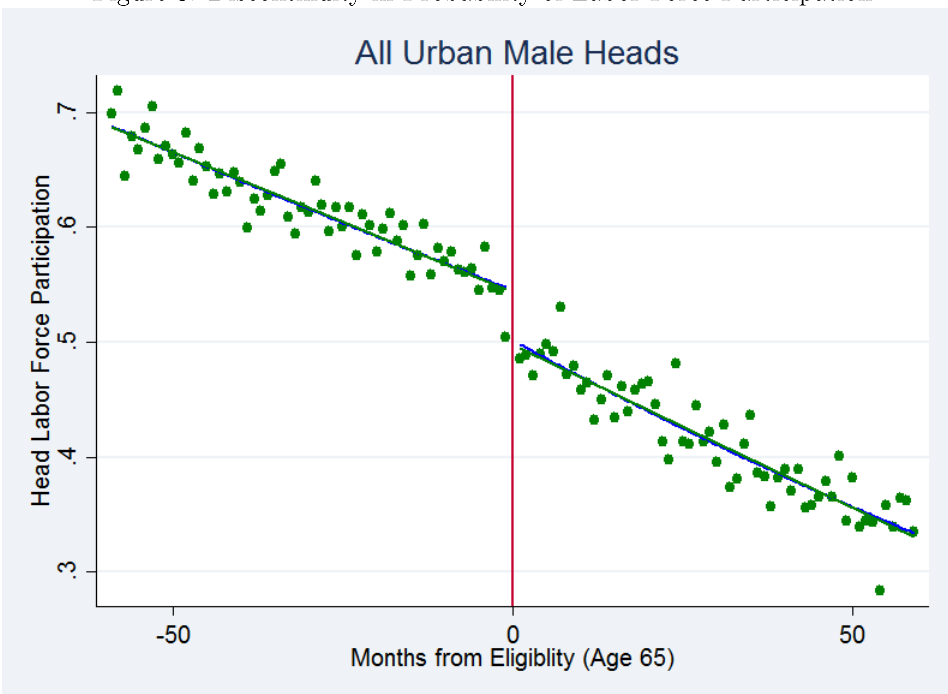


Figure 3: Discontinuity in Probability of Labor Force Participation



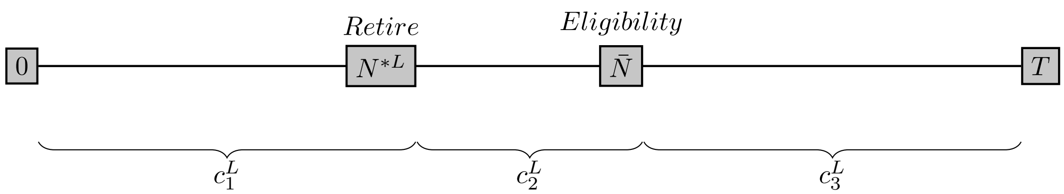


Figure 4: Pre-Eligibility Problem

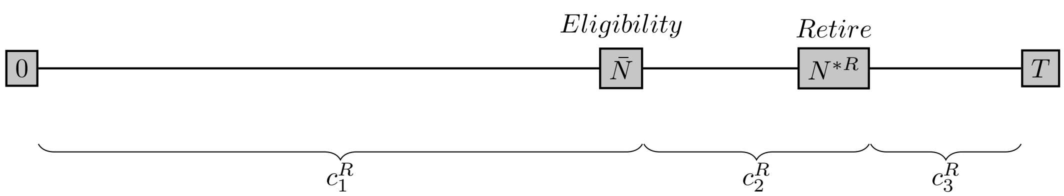
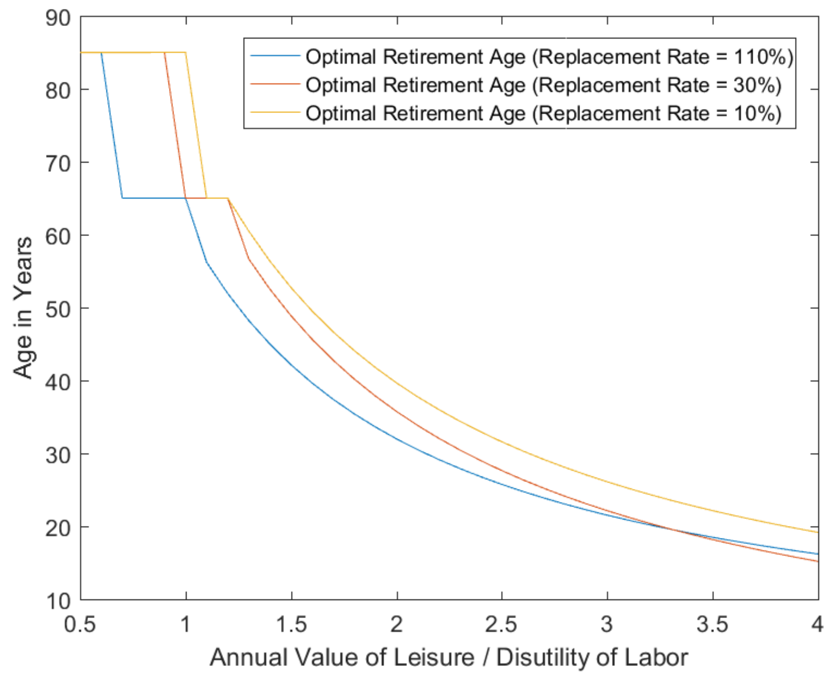


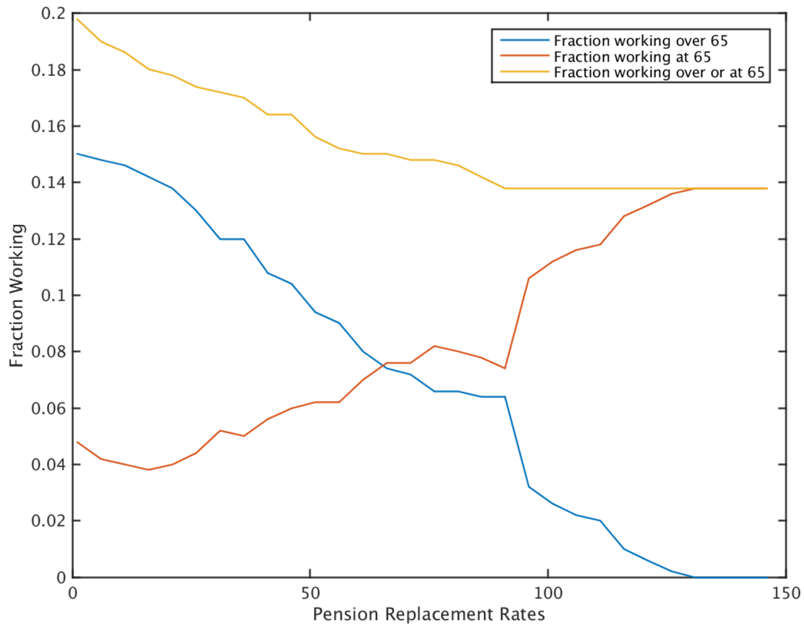
Figure 5: Post-Eligibility Problem

Figure 6: Optimal Retirement Ages for Pensions of Various Sizes



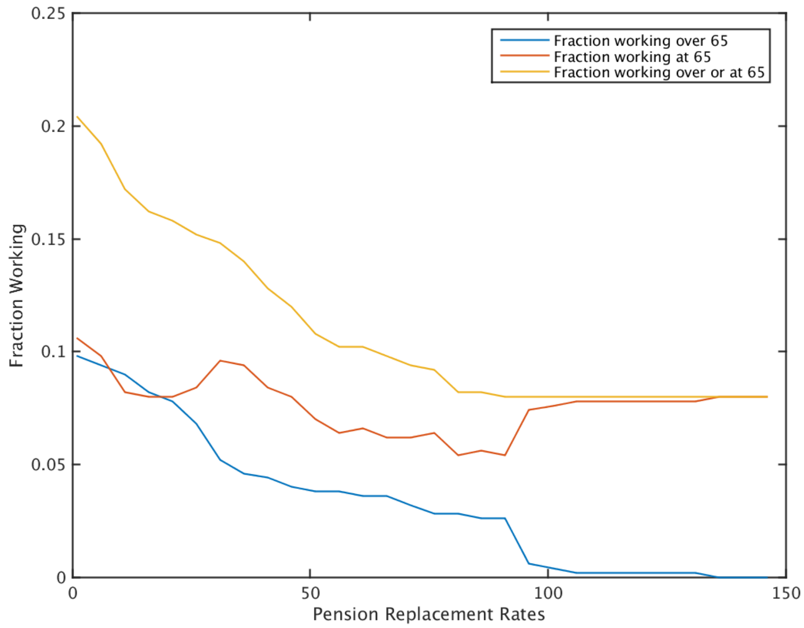
The model used to produce these optimal choices assumes log utility and that workers are unable to borrow any of the pension before becoming eligible. As mentioned, the future is not discounted and a real interest rate of 0 is used.

Figure 7: Employment Rates among Elderly Workers vs. Pension Replacement Rates (Uniform Distribution)



The model used to produce these optimal choices assumes log utility and that workers are unable to borrow any of the pension before becoming eligible. As mentioned, the future is not discounted and a real interest rate of 0 is used.

Figure 8: Employment Rates among Elderly Workers vs. Pension Replacement Rates (Normal Distribution)



The model used to produce these optimal choices assumes log utility and that workers are unable to borrow any of the pension before becoming eligible. As mentioned, the future is not discounted and a real interest rate of 0 is used.

List of Tables

Table 1: Descriptive Statistics of Analytical Sample (Dollar values in Year 2000 BRL)

	mean	sd
Number of People in Household	3.25	1.73
Household Monthly Income (Among Respondents)	1437.42	2231.08
Head's Personal Monthly Income (Among Respondents)	898.39	1745.01
Missing Household Monthly Income	0.04	0.20
Missing Head's Personal Monthly Income	0.03	0.16
Head with at least HS Education	0.13	0.34
Head with Less than HS Education	0.71	0.45
Head has More than Secondary Education	0.11	0.32
Head Literate	0.83	0.37
Spouse Literate	0.85	0.36
Head Received Government Pension >0	0.67	0.47
Total Weekly Hours Worked	41.63	15.92
Head in Labor Force	0.53	0.50
Spouse in Labor Force	0.37	0.48
Head Employed	0.51	0.50
Spouse Employed	0.35	0.48
Missing Head's Education	0.14	0.35
Missing Head Hours Worked	0.49	0.50
Observations	76255	

Table 2: RD Estimates using a Linear Flexible Polynomial Specification

All Urban Male Heads

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Pension >0	Employed	LFP	Employed	LFP
RD Estimate	0.106***	-0.0457***	-0.0466***		
	(0.00654)	(0.00718)	(0.00717)		
Pension >0				-0.430***	-0.438***
				(0.0621)	(0.0617)
Constant	0.641***	0.524***	0.544***	0.799***	0.825***
	(0.00516)	(0.00518)	(0.00513)	(0.0429)	(0.0425)
Observations	76,255	76,255	76,255	76,255	76,255
R-squared	0.097	0.045	0.049	0.196	0.206
idstat				253.5	253.5

Robust standard errors in parentheses

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

Table 3: RD Estimates using a Quadratic Flexible Polynomial Specification

All Urban Male Heads

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Pension >0	Employed	LFP	Employed	LFP
RD Estimate	0.0950***	-0.0436***	-0.0434***		
	(0.0101)	(0.0110)	(0.0110)		
Pension >0				-0.458***	-0.456***
				(0.106)	(0.105)
Constant	0.631***	0.525***	0.545***	0.815***	0.832***
	(0.00770)	(0.00792)	(0.00788)	(0.0720)	(0.0711)
Observations	76,255	76,255	76,255	76,255	76,255
R-squared	0.097	0.045	0.049	0.196	0.205
idstat				87.45	87.45

Robust standard errors in parentheses

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

Table 4: RD Estimate using Bandwidth Selection via CCT (2014)
All Urban Male Heads

VARIABLES	(1) Pension >0	(2) Employed	(3) LFP	(4) Employed	(5) LFP
RD_Estimate	0.0858***	-0.0420***	-0.0415***	-0.471***	-0.461***
	(0.0109)	(0.0109)	(0.0108)	(0.116)	(0.117)
Observations	173,802	173,802	173,802	173,802	173,802
Robust SE	0.0122	0.0129	0.0129	0.134	0.135
Eff. Obs to Left	19423	23032	23032	21577	20823
Eff. Obs. to Right	17714	20501	20501	19402	18851
LBW	29.39	34.49	34.72	32.28	31.73
RBW	29.39	34.49	34.72	32.28	31.73

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Fuzzy RD Estimates: Single Heads

Single Male Head = 1

VARIABLES	(1) Employed	(2) LFP	(3) Employed	(4) LFP
Pension >0	-0.818***	-0.802***	-0.806***	-0.857***
	(0.197)	(0.198)	(0.270)	(0.276)
Constant	0.986***	0.990***	0.951***	0.995***
	(0.129)	(0.129)	(0.169)	(0.173)
Observations	7,643	7,643	7,643	7,643
R-squared	0.161	0.163	0.168	0.133
Linear Flexible Polynomial	yes	yes	no	no
Quadratic Flexible Polynomial	no	no	yes	yes
idstat	25.69	25.69	13.39	13.39

Robust standard errors in parentheses

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

Table 6: Fuzzy RD Estimates: Heads with Other HH Members

Single Male Head = 0

VARIABLES	(1) Employed	(2) LFP	(3) Employed	(4) LFP
Pension >0	-0.378***	-0.389***	-0.397***	-0.386***
	(0.0658)	(0.0653)	(0.115)	(0.114)
Constant	0.771***	0.799***	0.782***	0.794***
	(0.0457)	(0.0453)	(0.0785)	(0.0775)
Observations	68,612	68,612	68,612	68,612
R-squared	0.189	0.200	0.190	0.199
Linear Flexible Polynomial	yes	yes	no	no
Quadratic Flexible Polynomial	no	no	yes	yes
idstat	229.1	229.1	76.20	76.20

Robust standard errors in parentheses

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

Table 7: RD Estimates among select sample using a Quadratic Flexible Polynomial Specification

Low Wage Workers

VARIABLES	(1) Pension >0	(2) Employed	(3) LFP	(4) Employed	(5) LFP
RD Estimate	0.0945***	-0.0399***	-0.0399***		
	(0.0102)	(0.0112)	(0.0112)		
Pension >0				-0.423***	-0.423***
				(0.108)	(0.107)
Constant	0.634***	0.511***	0.530***	0.779***	0.799***
	(0.00780)	(0.00807)	(0.00803)	(0.0736)	(0.0729)
Observations	74,299	74,299	74,299	74,299	74,299
R-squared	0.098	0.044	0.049	0.198	0.208
idstat				84.33	84.33

Robust standard errors in parentheses

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

Sample restricted to those that fall below the median real monthly wage (in year 2000 BRL) of the PNAD.