

The Effects of Unemployment Insurance Under High Informality: Evidence from Argentina

Martín González-Rozada

UTDT

Hernán Ruffo*

UTDT

October 2, 2014

Abstract

We evaluate the effects of unemployment insurance policy (UI) in Argentina using administrative data and exploiting policy reforms around 2006-2007. We find that the extension of UI eligibility increases significantly and substantially unemployment duration while reemployment wages are only modestly increased. On the other hand, a rise in UI transfers of the same expected cost affect reemployment wages more and unemployment duration less. Finally, using reforms to severance pay we show that liquidity provision generates a substantial effect. When we use the sufficient statistic approach calibrating optimality formulas derived from job search models we conclude that for the average worker UI transfers should increase but UI duration should be shortened.

Keywords: Unemployment Insurance, Severance Payments, Regression discontinuity.

JEL classification: C41, I38, J65, V2: J64.

*We would like to thank Robert Lalonde, Carmen Pages, Verónica Alaimo, and all the participants of the first and second "Protecting Workers Against Unemployment in Latin America and the Caribbean" seminars held in Washington for helpful comments on earlier drafts. We also thank Manuel Arellano, Claudio Michelacci, Stéphane Bonhomme, Enrique Kawamura and other seminar participants at CEMFI and at UDESA for their helpful comments. We thank the "Dirección Nacional de Estudios y Estadísticas Laborales" from the Ministry of Labor, Employment and Social Security of Argentina for allowing access to the data and processing our codes so that this work was possible. We are specially grateful to Diego Schleser and José Díaz Bereterbide. Cristian Alonso and Fernando Delbianco provided excellent research assistance. Authors gratefully acknowledge financial support of FONCyT (PICT/2588-2010).

1 Introduction

One established result from the empirical literature is that unemployment duration is extended if unemployment insurance (UI) becomes more generous.¹ This evidence has been usually interpreted as a way of addressing the relevance of “moral hazard” or the distortion of UI.

But UI cannot be interpreted exclusively as distortive; it also provides means to search for better jobs. In fact, some papers have emphasized that the quality of re-employment jobs improves with more generous UI. This effect has been frequently analyzed through the effect of UI on re-employment wages, finding a positive relationship. This result is less strong and significant, though.²

Measuring both, extensions in unemployment duration and changes in job quality, provides a more comprehensive assessment of the effects of UI. In fact, Shimer and Werning (2007) offer a strong argument to analyze the effects of UI on wages. They show that the utility of the unemployed is a monotone function of the after-tax *reservation wage*. Thus, they argue that welfare gains of a marginal change in unemployment insurance can be measured by the response of after-tax reservation wages; additionally, the elasticity of unemployment duration with respect to benefits is crucial to estimate the marginal costs of this change.

From another point of view, UI transfers not only affect workers behavior because of the “moral hazard effect” but also because of the “liquidity effect”. In other words, UI also finances the job search of the unemployed. This is the point clearly made by Chetty (2008), who exploits the fact that UI, a *conditional transfer* to the unemployed of amount b , can be decomposed in an *unconditional transfer* (whichever the search outcome) and a *conditional tax* to the employed, both of the same amount. Clearly, while the unconditional transfer is welfare improving, the tax is the price-distorting and welfare reducing component of UI. Distinguishing both of these effects is crucial to understand and estimate the welfare implications of UI changes. Chetty (2008) used the provision of severance pay (SP) to estimate the liquidity effect of UI in the US.³

It is important to note that, while both Chetty (2008) and Shimer and Werning (2007) derive their formulas from the first order condition of the planner that aims at providing the optimal UI level under unobserved search intensity, their models are based on different assumptions. For that reason, their assessments of UI depend on different estimates, which are in fact complementary.⁴

¹Meyer (1990) and Katz and Meyer (1990) are early references in this line. Also Bover, Arellano, and Bentolila (2002) deeply explore the effects of business cycles on this relationship. Centeno and Novo (2012) focus on the heterogeneity in the effects. Card and Levine (2000), van Ours and Vodopivec (2006a) and Lalive (2008) explore the effects of UI extension while Lalive, van Ours, and Zweimueller (2006) analyze the effects of both higher benefits and longer UI duration.

²Examples on this literature are Gangl (2002) and Schmieder, von Wachter, and Bender (2009). Additionally, Centeno (2004), Centeno and Novo (2006), and van Ours and Vodopivec (2006b) analyze the effect of UI on indicators of quality including duration of re-employment jobs, type of job and wages.

³Liquidity effects have been explored also by Card, Chetty, and Weber (2007), Uusitalo and Verho (2010) and Basten, Fagereng, and Telle (2012) among others.

⁴These papers extend the approach by Baily (1978). Other examples of this literature that calibrates formulas to evaluate the optimality of UI include Gruber (1994), Card, Chetty, and Weber (2007) and Schmieder, von Wachter, and Bender (2012a). See Tatsiramos and Ours (2012) for a survey about the labor market and welfare effects of UI design.

In spite of its importance, there is no much evidence of UI effects for developing countries. There are two main issues that could make developing countries especially interesting. First, they usually suffer stronger financial frictions and less developed financial markets (Rajan and Zingales 1998), which make liquidity effects potentially higher in these countries. Secondly, informal jobs, so prevalent in developing countries, posit additional constraints to the government aiming at providing the optimal UI because they generate unobservable re-employment states. To be explicit, when workers can accept jobs in the informal sector while receiving UI benefits without being detected by the government, a more generous UI would reduce the incentives to search for a formal job. Thus, in such a case, the moral hazard not only relates to the transitions to employment but also to the relative choice between formal and informal jobs.

Under high informality, the optimal provision of UI is typically of limited duration (Álvarez Parra and Sánchez 2009). This makes the trade-off between level and duration of UI especially important in developing economies.

Our paper estimates the impact of UI benefits and SP provision over the finding rate and reemployment wages of the unemployed using a newly constructed administrative Social Security database for Argentina, a country affected by high informality. The identification of these effects exploits time and cross sectional variation of the UI duration, benefit level and SP level. We argue that changes in legislation through 2006 to 2007 and heterogeneity in eligibility provide valid difference-in-differences and regression discontinuity designs to identify the effects of UI on duration and re-employment wages.

We find that an increase in UI generates both longer spells of unemployment and higher reemployment wages. Comparatively, an extension in UI provision increases unemployment duration in a stronger way and affects reemployment wages more modestly. Additionally, we find that SP transfers reduce the finding rate significantly, suggesting a relevant liquidity effect.

To measure the welfare effects of higher UI transfers we evaluate the optimality formulas in Chetty (2008) and Shimer and Werning (2007). Additionally, using these search models we derive optimality formulas to assess the welfare effects of longer UI provision. We find that increasing the level of UI benefits generates higher welfare gains than an equivalent amount used to extend UI provision for the average worker. Thus, we conclude that UI provision should be more generous in level but shorter in duration in Argentina.

Importantly, our appraisal is based on the derivation of formulas from different specifications of the search model. This implies that calibrations depend on different parameters and estimates. This allows us to compare the alternative methods and to analyze the robustness of our conclusions. Additionally, our estimates are based on the same source of data, exploiting reforms that are almost contemporaneous and that affect the same type of workers, which is important for using these measures in the same calibration.

Finally, our conclusion is in line with Álvarez Parra and Sánchez (2009) theoretical analysis, who show that with informal jobs, the optimal UI is limited in time due to the additional moral hazard that this unobservable jobs entail. Our data from Social Security allows for constructing large panels of UI beneficiaries, and to follow them in their formal jobs. It has the drawback that no informal activity can be observed. For that reason we are unable to provide estimates of the effect of UI on informality directly. Nevertheless, through the analysis of the search models we show

that a government aiming at providing a optimal UI policy should consider only the effects that we estimate and we argue that informality is important to the extent that it affects these behavioral responses. In any case, informality seems to be important to understand our results. Argentina has a large informal sector: in 2006, those not covered by social security were about 41% among employees in the private sector and about 65% among self-employed. In this sense, the findings in this paper are important for policy makers deciding about the implementation, or reform, of an unemployment insurance system in developing countries where the labor market is characterized, like the Argentine, by a large informal sector (see Mazza (2000)).

The rest of the paper is organized as follows. Next section presents the construction and characteristics of the administrative database used in the paper. Section 3 briefly describes the unemployment insurance (UI) and severance payments (SP) policies highlighting the changes in legislation and eligibility characteristics that allow us to evaluate the effects of these instruments over the duration of unemployment and re-employment wages. Section 4 presents the identification strategy and Section 5, our empirical results. In Section 6 we interpret the estimates using search models. Finally, Section 7 concludes.

2 Data

Our analysis bases on a newly constructed database that combines several sources of administrative information. These sources are (i) the employment records by firm in the Social Security (“Sistema Integrado Previsional Argentino”, SIPA database), (ii) the monthly payments of independent workers to the Social Security (the Self-employed database), and (iii) the monthly transfers to beneficiaries of the UI system (Unemployment Beneficiaries Database, UBd). All of them have two type of identification numbers: CUIL, which identifies the worker, and CUIT, which identifies the firm. Using the CUIL we were able to combine databases and follow the same worker in the different situations, as wage earner, self-employed or beneficiary of UI.

Combining all these sources we were able to generate a database for duration analysis. This database, the Administrative Unemployment Duration database (AUD), follows each spell of covered unemployment and gathers information about the last job, pre-unemployment work history and reemployment job. We computed completed durations per spell as the difference in months between the period of the layoff and the period in which we first observe the worker as reemployed (both as wage earner or self-employed). Using all the administrative sources, variables of characteristics of the workers were constructed, providing information such as age, gender, number of children, presence of spouse, etc.

For analyzing the effects of unemployment benefits and SP on duration and wages we concentrate on those beneficiaries of UI that we observe in 2005 through 2007. During this period several reforms were implemented, while economic prospects and job creation was quite stable.

In Table 1 we summarize the main characteristics of the observations in the database. The workers in our database are mostly young males, with relatively low wages. On average, workers are eligible for about 9 months of UI.

In the Appendix B we briefly describe each of the administrative datasets that we used.

Table 1: Main characteristics of beneficiaries - AUD

	Mean	Std
Total UI transfer	402.61	257.45
Family Allowance	94.68	159.29
UI basic transfer	292.88	154.87
Pre-unemployment wage	1919.34	604.18
Re-employment wage	1445.83	1369.59
UI duration (eligible)	9.44	3.47
Age	37.97	11.33
Children	0.84	1.28
Males (proportion)	71%	
Spouse (proportion)	51%	
Proportion of permanent wkrs.	85%	
Observations	461991	

Source: AUD.

Note: All observations.

3 Transfers to the unemployed in Argentina

This section describes the main policies that protect workers for the burden of job loss in Argentina: unemployment insurance and severance payments. Throughout this paper severance payment transfers will be used to identify the liquidity effect of the UI system. In our description we highlight the characteristics of these institutions driving our identification strategy.

In particular, during 2006-2007 the country experienced a number of reforms in the transfers to the unemployed that provide research designs that can be exploited to estimate the impact of UI on the duration of unemployment and on re-employment wages. These features make Argentina an ideal case for studying the effects of UI in labor markets characterized as having a large informal sector.

3.1 Unemployment Insurance

UI was introduced in 1991 and it is one component of the Argentine social security system. The program is financed by a 1.5 percent payroll tax on employers, and it is managed by both the Ministry of Labor and the National Social Security Administration (ANSES).

Eligibility requires that workers must have been laid off from their jobs due to no fault of their own. The program covers all private sector employees except rural, domestic workers, school teachers, and university professors. Public sector employees are also excluded. Construction workers were incorporated into the UI system in January 2001. For those who qualify in terms of the sector of activity, eligibility also requires that they should not be receiving either a pension or a workfare benefit, should not be receiving workers' compensation benefits, and must have con-

Table 2: Unemployment Insurance Eligibility and Duration

Panel A: Permanent workers			Panel B: Construction workers		
Months with contributions to UI during the last 36 months	Months of UI support if age < 45	Months of UI support if age ≥ 45	Months with contributions to UI during the last 24 months	Months of UI support if age < 45	Months of UI support if age ≥ 45
6 to 11	2	8	8 to 11	3	9
12 to 23	4	10	12 to 17	4	10
24 to 35	8	14	18 or more	8	14
36 or more	12	18	-	-	-

Note: Before March 2006, only workers with at least 12 months of contributions during the last 36 months were eligible.

tributed to the program during at least 6 out of the last 36 months. These monthly contributions can be either continuous or discontinuous.

Workers receive a monthly benefit starting the month immediately after dismissal, with the exception of construction workers, whose access starts two months after dismissal.

Workers are eligible for 2 to 18 months of support depending on: age, the type of labor contract they had, in which sector of activity they worked and on the number of months they had contributed to the system before dismissal, as Table 2 shows.⁵ The rules in panel A apply to all eligible workers in sectors other than construction who had an indefinite contract (that we will denote as “permanent workers”) and who have contributed to the system for 6 or more months during the last 36 months. The rules in panel B apply to construction workers who had contributed to the system for 8 or more months during the last 24 months.

The monthly benefit the worker receives is equal to half of her best salary during the last 6 months of employment, but should also fall within a minimum and maximum thresholds established by the National Council of Employment, Productivity and Minimum Wage. Since March 2006, these thresholds are 250 and 400 Argentine pesos (83 and 133 US dollars, respectively). Because the maximum threshold is set quite low, most beneficiaries actually receive that amount. Benefits also decrease over time. Beneficiaries receive the full amount of UI during the first 4 months, 85% of the full amount during months 5 to 8 and 70% of the full amount from the 9 to the 18 month.⁶

In March 2006 the National Council of Employment, Productivity and Minimum Wage increased the minimum and maximum thresholds within which the UI benefit falls. Before March

⁵In this paper we concentrate on permanent and construction contracts, leaving other type of contracts (temporary or seasonal contracts) that represent less than 1% of UI beneficiaries.

⁶UI beneficiaries receive not only the cash transfer described above, but also health insurance and family allowances. Health insurance is provided by the same company (usually a labor union) that covered the worker while employed. Family allowances provide the following monetary benefits: a lump sum per child born, per child adopted, and marriage; a monthly transfer per children and children with disabilities; and an annual transfer per children attending school.

2006, the thresholds were 150 and 300 pesos (50 and 100 US dollars, respectively), and since that date they are 250 and 400 pesos (83 and 133 US dollars, respectively). This rise took the ratio of UI to mean wages above 25%. It is important to emphasize that this reform did not affect the benefits of workers with low pre-unemployment wages, for which the threshold was not binding.

Also in the same month a second reform related to the eligibility requirement was introduced. Before March 2006, only the workers with at least 12 months of contributions during the last 36 months were eligible. But since March 2006 the requirement is less stringent: 6 months of contributions during the last 36 months for workers who had an indefinite contract.

3.2 Severance Payments

The Argentine labor code establishes that dismissed workers with indefinite contracts should receive one monthly salary per year of tenure (or fraction higher than three months) of severance pay. If the worker's salary has changed over time, then, severance pay has to be computed using the higher monthly salary received during the last year. Workers are not legally entitled to receive severance pay if they voluntarily leave the firm, if they retire, or if they are laid off from their jobs due to a fault of their own (this is determined by a judge). Workers do not receive severance pay if at the end of the trial period (i.e., the third month of employment) the employer decides to finish the relationship. These regulations apply to all permanent workers in the private sector except rural, construction and domestic workers.⁷ Construction workers have a particular program related to dismissal, the *Fondo de Cese Laboral*, which is justified in the high turnover of this sector. The *Fondo de Cese Laboral* works as follows: the employer makes a monthly contribution into a worker's individual account and the worker receives the accumulated benefits upon employment termination. The monthly contribution is equal to 12% of the worker's wage during the first year of tenure, and 8% of the wage afterwards. It is important to emphasize that these accounts are not related to the unemployment insurance system: the amount is available for the worker at the end of the job, whichever the type of separation, and regardless if the worker is unemployed or not.

During the last decade there were a number of changes to severance. In February 2002, law no. 25561 established a one hundred percent increase in severance pay, that is, the benefit was increased to 2 monthly salaries per year of tenure. It also established that the higher severance only applies to workers who were hired before February 2002. This reform was introduced in response to the deep economic crisis that Argentina faced in December 2001. In January 2005, the increment was reduced to 80 percent (i.e. 1.8 monthly salaries per year of tenure), and to 1.5 monthly salaries per year of tenure in November 2005. Law no. 25972, in December 2004, established that this higher level of severance will automatically end when the unemployment rate became lower than 10 percent. In September 2007 the unemployment rate effectively became lower than 10 percent, and hence, since that date the severance pay was back to its original level, that is, 1 monthly salary per year of tenure.

We exploit these time and cross sectional variation in the severance payment regulations to

⁷Workers with fixed-term contracts receive the same severance as workers with indefinite jobs if dismissed during the contract, and receive half of the severance pay at the end of the term if the length of the contract was one year or more.

measure up to what extent search behavior can be affected by these kinds of transfers as explained in Section 4.

4 Estimation strategy

In this section we describe our empirical strategy to isolate the effects of the UI and SP policies on job search outcomes. Our identification strategy rests on exploiting the time and cross sectional variations in UI benefits and SP transfers described above.

This strategy connects to a particular branch of literature that has focused on analyzing UI reforms. Examples of this are Schmiuder, von Wachter, and Bender (2009), Lalive, van Ours, and Zweimueller (2006) and Card, Chetty, and Weber (2007) among others.

4.1 Identification

4.1.1 Time variation: rise in UI transfers

As explained in Section 3, there is a sharp change in the level of UI benefits in April 2006. This was an increase of about 30% of benefits thresholds unrelated to labor market conditions: unemployment level was in a continuous downward trend and job creation and job destruction were also steady. The reform was based on the fact that the maximum and minimum values of the unemployment insurance benefit needed an update. The high inflation in prices and wages after the 2001 crisis⁸ generated a progressive decline in replacement rates forcing the government to increase these maximum and minimum thresholds, which finally happened in March 2006.

We use this sharp change in UI level to measure its impact on unemployment duration and wages. We do this by analyzing the outcome variables before and after the increase in benefits.

Additionally, using a Dif-in-Dif method, we also analyze the effect of UI change over those for which UI threshold is binding (those that received AR\$300 of benefits because of pre-unemployment wages higher than AR\$ 600) and use those with lower benefits as a control group: for this last there was no change in their benefit level.

4.1.2 Cross sectional variation: eligibility for UI benefits

Our strategy for identifying the effect of *longer* UI provision exploits two independent sharp discontinuities in the eligibility for different schemes of unemployment insurance.

First, workers with more than 45 years of age are benefited by an extension of UI of six months. This extension affects all displaced workers eligible for UI with no exceptions after July 2006.⁹

Second, the extension of UI presents jumps at particular number of past contributions. For example, young permanent workers with 12 to 23 months of contributions in the last three years

⁸The average annual inflation rate in Argentina between 1991 and 2001 was 4% while after the 2001 crisis, in 2002 and 2003, this figure grew up to about 20% per year. During the recovery years, between 2004 and 2005, the annual inflation rate was back at single digits, 7% on average.

⁹While this extension was first implemented in 2002, before this date it was restricted to those with children attending school, or children less than six years old, or children with a disability.

are eligible for 4 months of UI while those with 24 contributions are entitled with 8 months of UI transfers. (Other jumps are also present at 12 and 36 contributions; see Table 2.)

It is important to emphasize that we consider that these jumps are valid for regression discontinuity analysis. First, in both eligibility conditions, the potential duration of UI changes with probability one, allowing for a sharp analysis. Secondly, this change can be directly observed from the database that provides the total number of transfers that the individual is eligible for. Thirdly, the eligibility conditions are implemented automatically and both agency and worker are unable to change the running variable (age or number of contributions). In this sense, there is no chance of manipulation. Moreover, it is implausible that these changes in eligibility conditions could modify the separations from firms. We performed a series of tests to analyze the regression discontinuity assumptions. In the first set of tests we analyze whether covariates jump at the cutoff point, to make sure that there are not confounding factors in the estimation of the effect (to ensure that the characteristics of workers do not change discontinuously on the cutoff value) and we do not reject the null of no discontinuity. Secondly, we ensure that the UI duration change discontinuously at the cutoff point. (See Figures 1, 4 and 5.) Third, we show that the density of the distribution does not jump at cutoff points, an analysis that follows McCrary (2008) and that shows no evidence of manipulation in the running variable (see Figure 2). Finally, as a robustness check, we analyzed the regression discontinuity estimates for alternative cutoff points and we find that the effect disappears or loses significance.

For our empirical analysis we are implicitly assuming that all variables (including age and the number of past contributions) affect outcome variables continuously. In the regressions, thus, we include a quadratic function of the running variable while the effect of the extension of UI would be captured by a dummy variable. It is important to emphasize that we include other variables as controls so that any remaining differences on covariates at both sides of the threshold are controlled for in our estimates (see Card, Chetty, and Weber (2007) for a similar approach).

4.1.3 Time and cross sectional variation: eligibility for SP increments

Severance pay also presents a sharp discontinuity: those workers benefited by the increase in severance pay are the ones that were hired before February 2002. Thus, the impact of severance pay can be identified by using this variation. In particular, we use a difference-in-difference type of approach: we observe the outcomes before and after the change for workers in the “treatment” and the “control” groups, where the first group is composed by workers for which SP is doubled in February 2002 and in the control group we pool all workers that received ordinary severance pay with no change. We also control for any continuous effect of tenure on duration.

In this implementation, we use as treatment the *reduction* of SP multiplier that changed from 1.5 to 1 in September 2007. Thus, we expect a positive coefficient in duration, given that lower transfer would increase the urgency to find a job quickly.

One potential concern about this exercise could be that it is possible that displaced workers after the reform could be different from those displaced previously. We found no evidence that could sustain this concern: there is no change in the observable characteristics of new beneficiaries of UI and also no jump in separation rate in September 2007 (see Figure 8 and the discussion there).

4.2 Empirical models

4.2.1 Unemployment duration

The first and most obvious outcome is the impact of UI and SP on the duration of unemployment. Consider the following Cox proportional hazard model of the duration of unemployment

$$\theta(t_u|x) = \lambda(t_u) \exp(x\beta + y\gamma) \quad (1)$$

where θ is the hazard at t_u unemployment duration, and where $\lambda(t_u)$ is the baseline hazard (the exit probability from unemployment to employment) that can take any form.¹⁰

Covariates, x , include a polynomial on age, tenure, the number of pre-unemployment contributions, pre-unemployment wage; a series of dummies of gender, occupation and industry of past job among other variables.

Policy variables, y , are defined to exploit sharp changes in UI and SP parameters. In this sense, and depending on the particular exercise, we use indicator variables to identify those workers eligible for UI extension or eligible for higher severance pay and time dummies to identify the periods upon which the UI and SP changed.¹¹

4.2.2 Reemployment wages

The other relevant outcome of the search process of the unemployed is the quality of re-employment jobs. Unemployment insurance, severance pay or any other employment protection transfer, can at the same time produce a reduction in finding rate (which is costly) and improve the matching quality of the reemployment job. In this paper we concentrate on reemployment wages, among other variables of quality.

The estimation of reemployment wages is analyzed through regression analysis of reemployment wages using OLS. Lets consider the following regression model:

$$\log(w_i) = \alpha + x_i\beta + y_i\gamma + \epsilon_i \quad (2)$$

where $\log(w_i)$ is the log of reemployment wage of the workers, which will be the mean of the wages of the first year at the new job. In this case, we use one observation per spell and select only those workers for which we observe the reemployment job (non censored spells).

As in the previous case, we have covariates, x , that will include a polynomial on age, number of pre-unemployment contributions, tenure and dummies concerning sex, occupation and industry of past job, among others. We also add a quadratic of total duration of unemployment as an additional control.

Policy variables, y , are mainly indicator variables that identify eligibility of severance pay and unemployment insurance duration, as explained above.

¹⁰Transitions to inactivity will be censored spells. In administrative data we are not able to identify these cases.

¹¹This estimation strategy is related to both Card, Chetty, and Weber (2007) and to Lalive, van Ours, and Zweimueller (2006).

5 Results

We now turn to the empirical results using the Administrative Unemployment Duration database (AUD), which comprises all the UI beneficiaries laid-off between 2005 and up to 2007. We implement the different estimation strategies for evaluating the impact of UI and SP. We will first present the effects of UI and SP on unemployment duration and then we will focus on the effects on wages.

5.1 Duration analysis

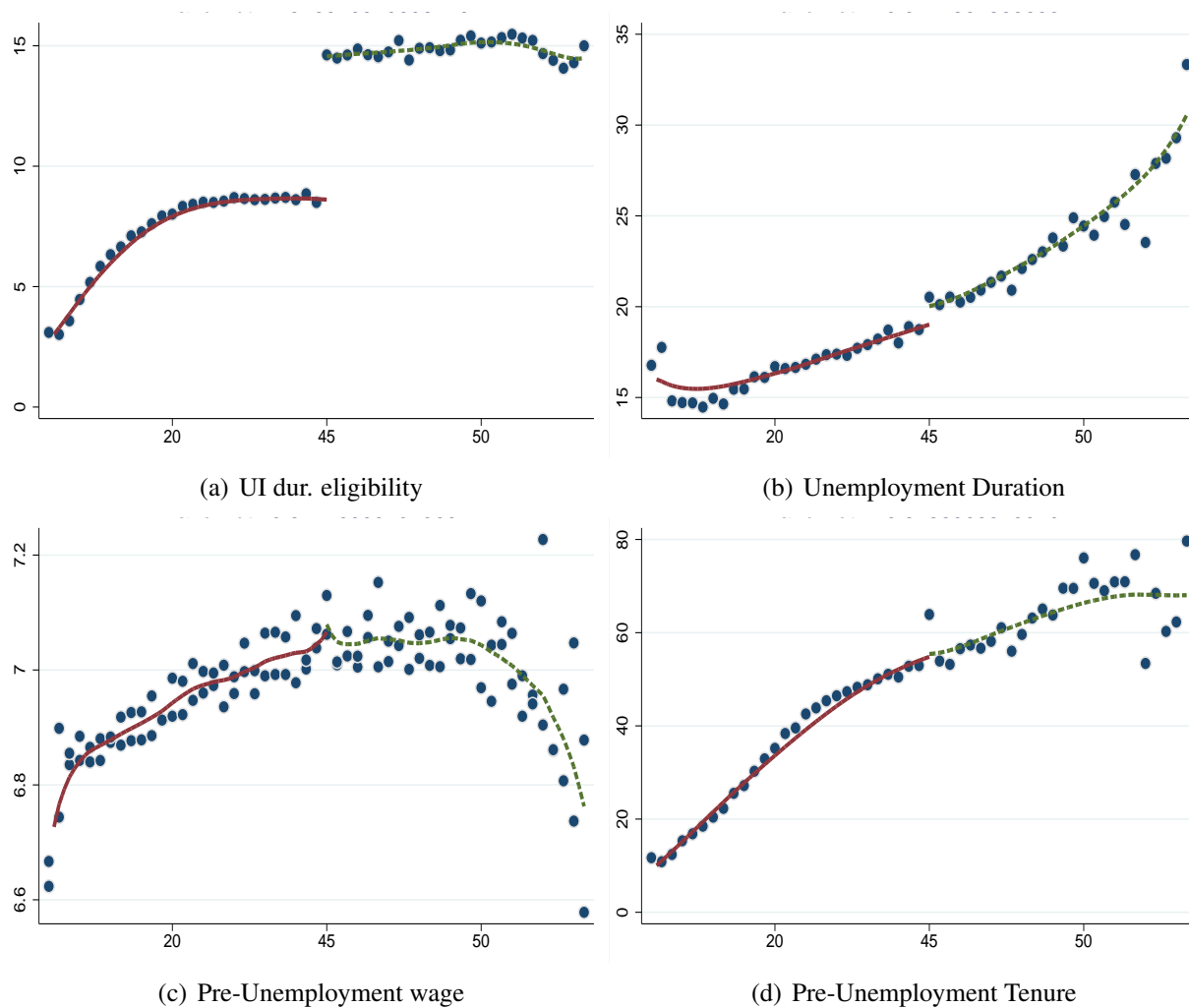
5.1.1 Extension of the UI duration for older workers

As explained in Section 3 those workers older than 45 years of age are eligible for an extension of six months of benefits. Thus, our first exercise consists on analyzing the impact of an extension of UI duration using this discontinuity. The main assumption behind the analysis is that any effect of age on finding rate would be continuous and that can be controlled by a function of age. The discontinuous effect at age 45 would capture the extension in UI. We will first show a graphical overview of the effect of UI extension on unemployment duration and we will then estimate proportional hazard models to obtain a numerical measure of its impact on finding rates.

In Figure 1 we show several aspects of the discontinuity that we exploit. First, in panel (a) we show that the eligibility for UI duration jumps discontinuously at exact age 45, providing us for the main identification source for our analysis. Secondly, in panel (b) we show that mean actual unemployment duration jumps at that age, providing a preliminary non-parametric evidence of the existence of an effect of UI eligibility on unemployment duration. We confirm with the Wald estimate that the difference at both sides of the cutoff is statistically significant. (Notice that this plot includes both censored and uncensored observations. This aspect is corrected below by using a proportional hazard model.) Thirdly, in panels (c) and (d) we show two examples that test the continuity of covariates. We plot pre-unemployment wages and pre-unemployment tenure and we find no significant jump of these variables at the cutoff points. We performed a similar analysis on other variables with the same conclusion. For some variables and for smaller bandwidths we observe some significant jump at cutoff points. For example, tenure goes up at 45 years of age. Nevertheless, it should be noticed that our results also control for any change in these variables by including these as covariates in the regressions.

Finally, regression discontinuity rests on the idea that the cutoff point is exogenous and cannot be manipulated by the agents. A main aspect of the rules that we use is that they are applied automatically using the data of Social Security records. In particular, this discontinuity is based on the date of birth, which cannot be manipulated. For completeness, we follow McCrary (2008) and we analyze the distribution of the running variable. The main objective of this analysis is to test whether there is a jump in the distribution of workers in the running variable to account for possible manipulation in the eligibility criteria. The intuition is that, if it were some possibility of manipulation of the running variable by the agents, the density would jump at the cutoff point. (Notice that a jump in density does not imply necessarily a manipulation, but the lack of jump discards it.) In Figure 2 we show the kernel density estimation of the distribution of observations

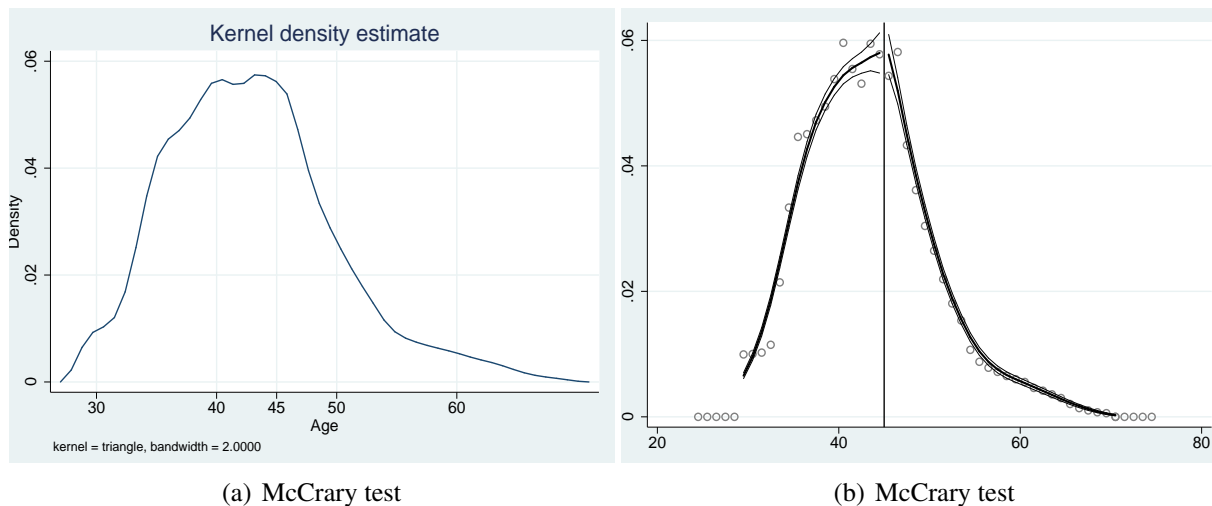
Figure 1: Regression Discontinuity analysis in age at displacement



Notes: Regression discontinuity analysis using local linear regressions. Each point in the data is the mean of outcome by age. The sample is restricted to permanent workers. Source: AUD.

by age and the graphical result of the McCrary test at optimal bandwidths. From both graphs it is clear that there is no jump in the density and manipulation can be discarded.

Figure 2: Density and McCrary Test



Notes: Kernel density distribution of the spells by age. Source: UB database.

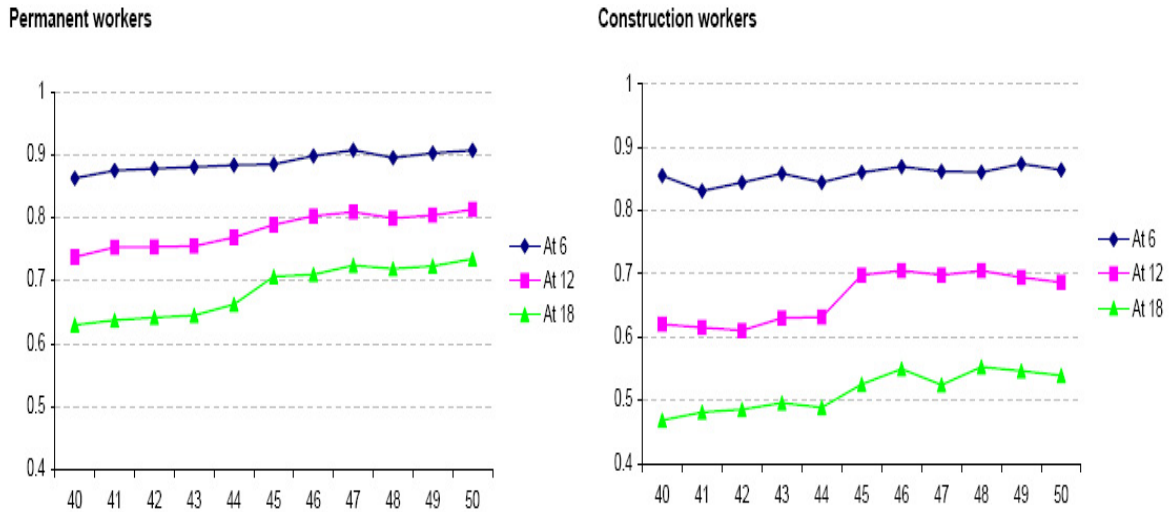
Figure 3 concentrates on the survival probability at 6, 12 and 18 months for workers between 40 and 50 years of age. This plot reduces the importance of censoring and of long spells that could affect the mean duration presented in Figure 1 panel (b). From the graph it is clear that age has a positive correlation with survival probability at unemployment, so that older workers spend more time without a job. Notably, at 45 years of age the survival probability jumps up at some durations, implying that the extension of UI reduces finding rates.

To provide estimates we run a Cox duration model as specified in equation (1). In particular, we use the indicator variable $I(\text{Age} \geq 45)$, which is 1 if the worker is eligible for and extension and zero otherwise. The coefficient associated to the indicator variable would be the estimate of the impact of UI extension at age 45. We control for a quadratic function of age to capture any continuous effect of age on duration, for number of children, gender of the worker, presence of spouse and the log of previous unemployment wage. We also include the number of pre-unemployment contributions, tenure, tenure square, and fixed effects for year, region and industry. We restrict the sample to those workers between 35 to 55 years and to those spells that began after July 2006.

The results are shown in Table 3. We observe that finding rate is reduced more than 30% by the extension of UI benefits for older workers. This effect is significant for both permanent and construction workers, while for these last the effect reaches 36%.

We then restrict the sample to those workers with less than 17 contributions, trying to analyze the effects for those workers for which the extension is more relevant (for these workers UI duration jumps from 2 to 8 months). The results are even stronger: finding rate reduces 47% for permanent workers and 61% for construction workers.

Figure 3: Effect of UI Duration - Discontinuity at 45 years of age - Survival probability at particular durations by age - 40 to 50 years



Source: AUD.

Note: Survival probability in unemployment by years of age at the beginning of the spell. Each line is the probability that the worker is still unemployed after a given number of months by age.

Results allow us to conclude that UI extension due to age reduces finding rate significantly. We found that this impact is stronger and more significant for construction workers rather than for permanent workers. This could be related to the lower duration of UI benefits for construction workers, what makes them more responsive to an extension, and also to the fact that the replacement rate of UI is higher (wages tend to be lower than for permanent workers).

Table 3: Effect of UI Duration - Discontinuity at 45 years of age - Cox duration model - Workers between 35 and 55 years of age

	Workers between 35 to 55 years of age						Less than 17 contributions					
	Total		Permanent		Construction		Total		Permanent		Construction	
I($age \geq 45$)	-0.2997	***	-0.2782	***	-0.3603	***	-0.5475	***	-0.4683	***	-0.6107	***
	(0.0257)		(0.0323)		(0.0427)		(0.0581)		(0.0889)		(0.0778)	
age	-0.0661	***	-0.0505	**	-0.0711	**	-0.0482		0.0151		-0.0861	*
	(0.0165)		(0.0207)		(0.0279)		(0.0376)		(0.0581)		(0.0503)	
age square	0.0005	***	0.0003		0.0006	**	0.0004		-0.0004		0.0008	
	(0.0002)		(0.0002)		(0.0003)		(0.0004)		(0.0007)		(0.0006)	
gender	0.3446	***	0.3558	***	0.375		0.2013	***	0.2632	***	0.2929	
	(0.0195)		(0.0201)		(0.2508)		(0.0462)		(0.049)		(0.3187)	
spouse	0.0363	**	0.004		0.1123	***	0.0925	***	0.0633		0.111	***
	(0.0147)		(0.018)		(0.0259)		(0.03)		(0.0428)		(0.0425)	
children	0.0577	***	0.0738	***	0.0339	***	0.015	*	0.0124		0.0224	**
	(0.0038)		(0.0054)		(0.0054)		(0.0077)		(0.0142)		(0.0093)	
log of p.u.wage	0.4462	***	0.3985	***	0.5536	***	0.4159	***	0.2919	***	0.4982	***
	(0.0191)		(0.0248)		(0.0279)		(0.0407)		(0.0667)		(0.0475)	
log of imputed SP	0.0209		0.0452	**	0.1023	***	0.1438	***	0.1504	**	0.2249	***
	(0.0168)		(0.0207)		(0.0293)		(0.0404)		(0.061)		(0.0556)	
past contributions	0.0043	***	-0.0045	***	0.0168	***	0.0314	***	0.0285	***	0.038	***
	(0.001)		(0.0012)		(0.0016)		(0.0058)		(0.0086)		(0.0081)	
tenure	-0.0145	***	-0.0162	***	-0.019	***	-0.0598	***	-0.0589	**	-0.053	*
	(0.0011)		(0.0014)		(0.0021)		(0.0199)		(0.0295)		(0.0275)	
tenure square	0.0001	***	0.0001	***	0.0001	***	0.0004		0		-0.0001	
	(0.0000)		(0.0000)		(0.0000)		(0.0010)		(0.0015)		(0.0014)	
Fixed effects	yes		yes		yes		yes		yes		yes	
Observations	48089		33595		14450		10631		5096		5524	

Source: AUD.

Note: Coefficients are the result of estimating a Cox PH model of unemployment duration on the indicator variable that identifies those workers older than 45 years of age and controls. Fixed effects by region, year and industry. Sample is restricted to workers between 35 and 55 years of age, whose displacement was after August 2006. Numbers in parentheses are standard deviations of the coefficients. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

5.1.2 Extension of the UI duration for longer contributions

The UI duration also depends on the number of contributions in the 36 months previous to layoff. In particular, it changes in a non-continuous way, jumping at particular number of contributions (see Table 2). In this exercise we will exploit this discontinuity in duration. Again, the main assumption for implementing this estimation is that any effect of contributions over unemployment duration is continuous and can be captured by a linear or quadratic function, and that any jump in outcomes at both sides of the threshold is due to UI duration.

An important point to emphasize is that this additional discontinuity allows us to estimate the effect of UI duration on different age groups. This analysis by age is relevant because incentives of reemployment and UI effects are different for young and old workers. For example, Michelacci and Ruffo (2011) study the effect of life cycle aspects on the UI provision, making the observation that young workers would be less affected by moral hazard than older workers, and suggesting that benefits should be different for the young than for the old.

In Figures 4 and 5 we show that discontinuity on the UI duration eligibility is relevant at the thresholds (see panel (a).) Additionally, panel (b) of those figures show that actual mean unemployment duration jumps up at thresholds of the running variable. The Wald test rejects the null of equality at both sides of the threshold. In this sense, this non-parametric analysis suggests an important and significant effect of the UI extension. Additionally, we plot the mean of pre-unemployment wages and tenure and show that no relevant jump is observed at the cutoff points (see panels (c) and (d)).

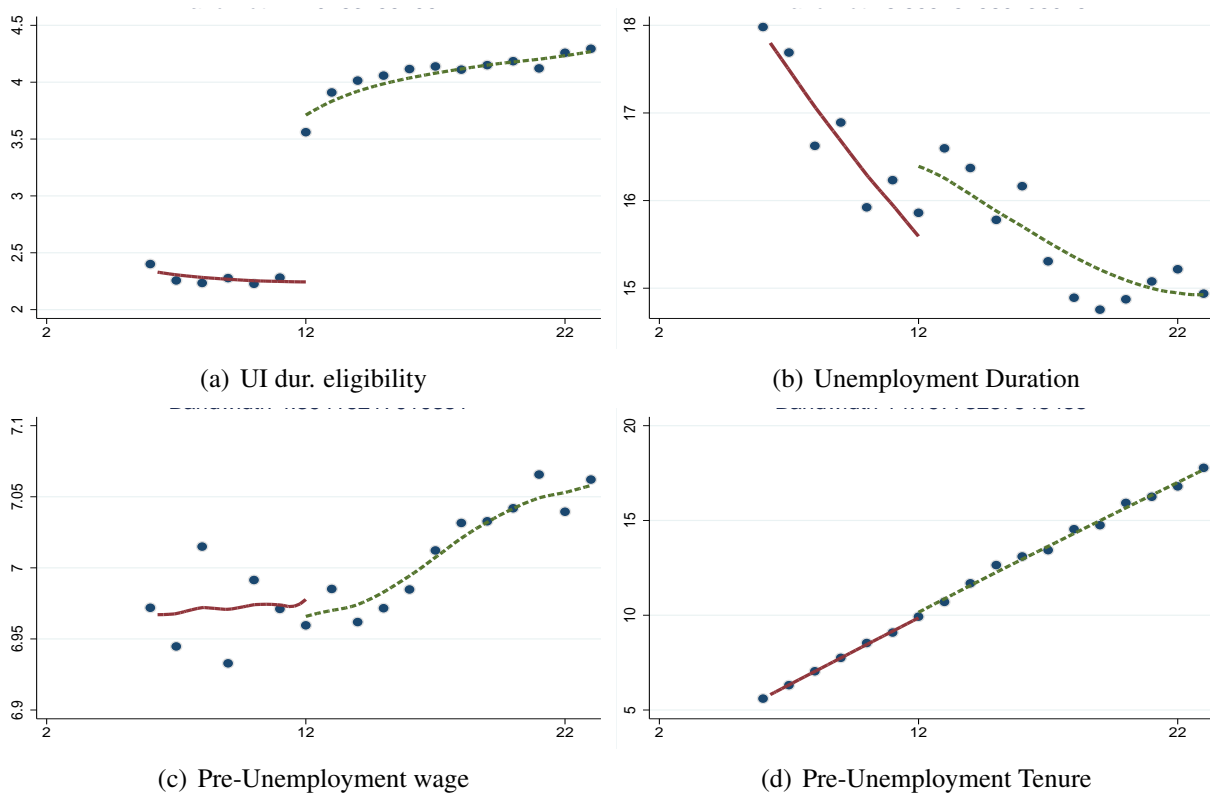
To estimate the effect of an extension of UI on finding rates we run a Cox duration model on an indicator variable that identify the eligibility to the extension of UI (for example, a variable that is zero for workers eligible to 4 months of UI and takes the value one for workers eligible to 8 months, constructed using the indicator function $I(\text{UI duration} = 8)$). The controls are the same as in the previous estimation, including a quadratic function of the number of past contributions. Thus, any change in UI duration is related to the discontinuity at a particular number of contributions and will be considered the effect of UI duration. For estimating this model we restricted the sample to those displaced after the 2006 reform.

Table 4 shows the estimates of the effect of the extension of unemployment according to type of worker (permanent or construction), number of past contributions and age. In the first column we present the estimate of the effect for those permanent workers that had accumulated between 7 and 16 contributions in the 36 months previous to layoff, and with less than 45 years of age at the beginning of the spell. Those with less than 12 contributions would be eligible for 2 months of UI and those with 12 contributions or more would be eligible for 4 months of contributions. We find that the extension of UI duration reduces finding rate by 24%. When we consider older workers we find that the effect is much higher (39%) which is notable because the extension in that case is from 8 to 10 months, implying that older workers have higher response to UI extensions.

Column (3) of Table 4 stands for the subsample of young workers that had accumulated between 19 and 28 contributions in the 36 months previous to layoff. We find that the extension of 4 to 8 months of UI reduces finding rate in almost 50% for young workers; the extension of UI from 10 to 14 months over old workers is again higher (60%).

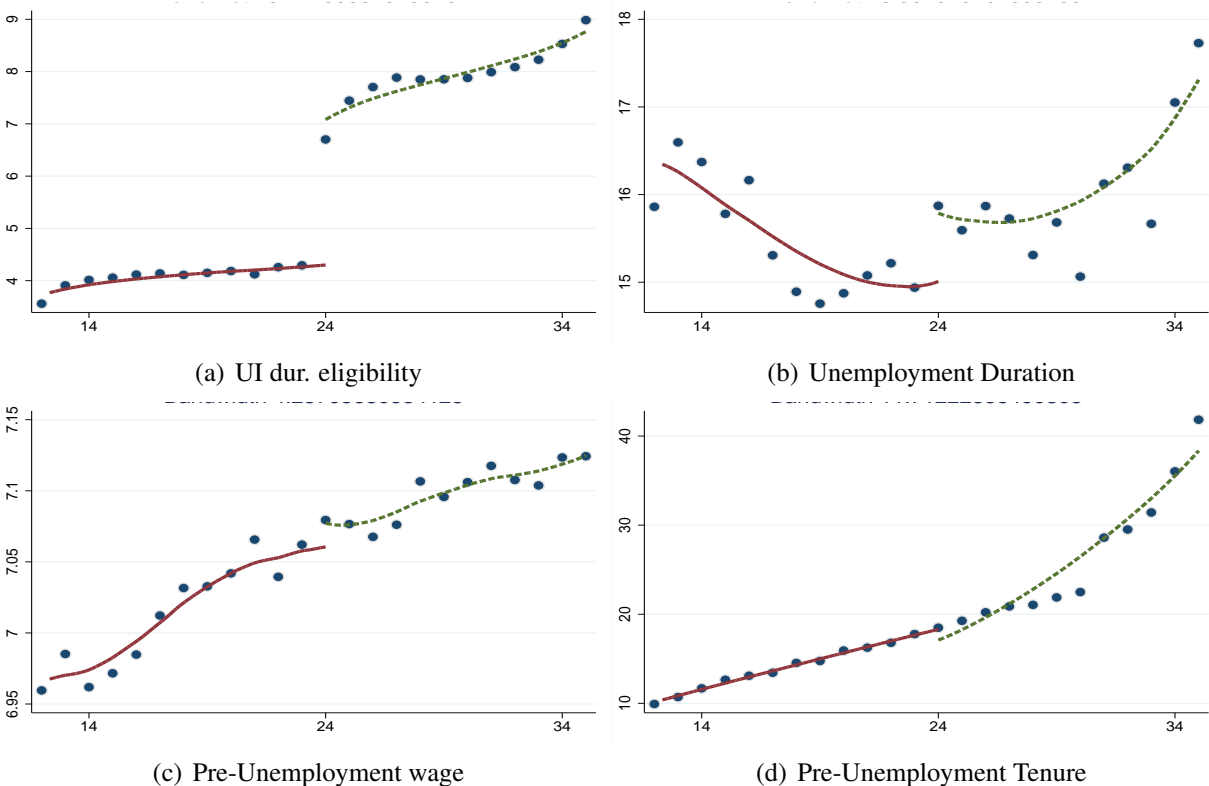
The effects over construction workers are always lower and significant. For example 1 addi-

Figure 4: Regression Discontinuity analysis in pre-unemployment contributions (12 contributions)



Notes: Regression discontinuity analysis using local linear regressions. Each point in the data is the mean of outcome by past contributions. The sample comprises permanent workers younger than 45 years of age. Source: AUD.

Figure 5: Regression Discontinuity analysis in pre-unemployment contributions (24 contributions)



Notes: Regression discontinuity analysis using local linear regressions. Each point in the data is the mean of outcome by past contributions. The sample comprises permanent workers younger than 45 years of age. Source: AUD.

tional month of UI reduces finding rate in 15% for young construction workers while it affects in 32% the finding rate of older workers.

Table 4: Effect of UI duration - Discontinuity in past contributions - Cox duration model

(A) Permanent workers								
	Between 7 to 16 contributions				Between 19 to 28 contributions			
	Age<45		Age≥45		Age<45		Age≥45	
	(1)		(2)		(3)		(4)	
UI Extension	-0.2415	***	-0.3852	***	-0.4899	***	-0.6184	***
	(0.039)		(0.1263)		(0.0373)		(0.1095)	
past contrib.	0.1000	**	-0.2524	*	-0.0162		-0.1462	***
	(0.044)		(0.1508)		(0.0743)		(0.2314)	
past contrib. Sq	-0.0028		0.0152	**	0.0013		0.0044	
	(0.0019)		(0.0066)		(0.0016)		(0.005)	
age	0.0282	*	0.2338		-0.0633	***	0.2039	*
	(0.0169)		(0.1614)		(0.018)		(0.1229)	
age square	-0.0007	**	-0.0026	*	0.0007	**	-0.0021	*
	(0.0003)		(0.0015)		(0.0003)		(0.0011)	
controls	yes		yes		yes		yes	
fixed effects	yes		yes		yes		yes	
Observations	12254		1596		12627		1859	

(B) Construction workers								
	Between 8 to 16 contributions				Between 13 to 22 contributions			
	Age<45		Age≥45		Age<45		Age≥45	
	(1)		(2)		(3)		(4)	
UI extension	-0.1463	***	-0.3230	***	-0.4272	***	-0.3676	***
	(0.041)		(0.0864)		(0.0417)		(0.0808)	
controls	yes		yes		yes		yes	
fixed effects	yes		yes		yes		yes	
Observations	8130		2642		7549		2706	

Source: AUD.

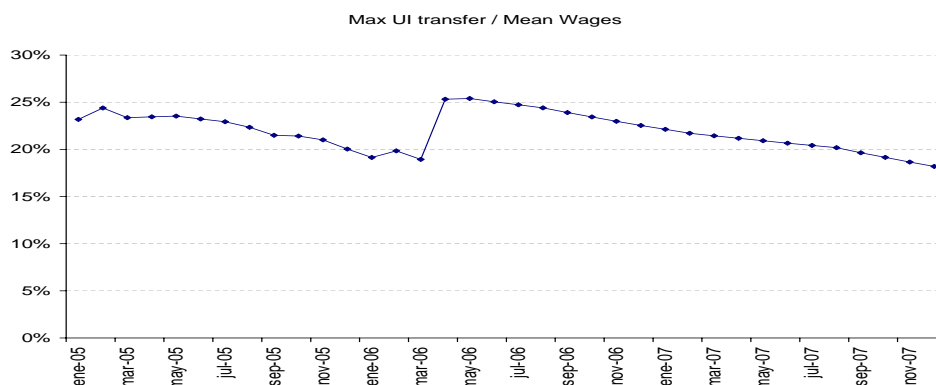
Note: Coefficients are the result of estimating a Cox PH model of unemployment duration on an indicator variable that identifies jumps in UI eligibility and controls that include a quadratic in past contributions. Numbers in parentheses are standard deviations of the coefficients. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

5.1.3 Higher UI transfers

We now turn to the estimation of the effect of the level of benefits on unemployment duration. For doing so we exploit the UI reform in 2006. As explained in Section 3 UI transfers increased in April 2006. This change was significant: mean and median transfers increased 30%, while mean private formal wage rose 3% between January and July of 2006. Additionally, as emphasized before, no changes in macroeconomic conditions occurred during this period. In this sense, the change in UI level can be seen as exogenous: it was not based in recent economic development but on the fact that UI amounts had not been updated since the 90's. These updates in UI are only sporadically implemented; as an example, there has not been any change since 2006 to 2014.

Figure 6 shows the evolution of maximum benefits over mean private wages over time. Notice that these are aggregate variables independent of the composition of workers and their replacement rate. The change in April 2006 implies a much higher UI transfer. Given the rising trend in wages, the potential impact of this higher maximum benefits is then reduced. For this reason, we will concentrate our analysis around the change: in the estimation of the duration model we will consider displacements between July 2005 and December 2006.

Figure 6: Maximum benefits over mean private declared wages - 2005 to 2007

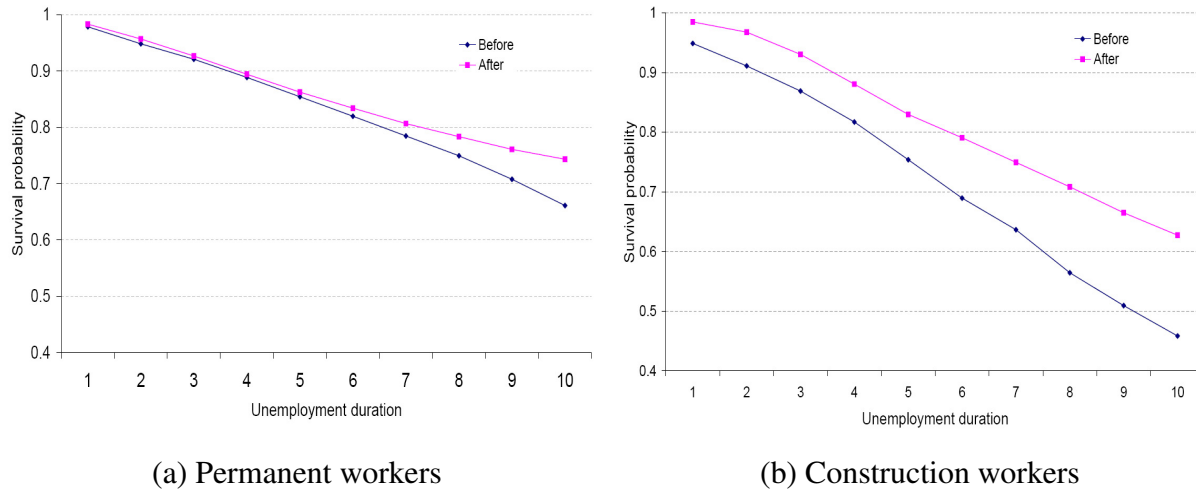


We will first show through a non-parametric approach that the higher level of transfers affects unemployment duration and next we measure its impact over finding rate through the estimation of proportional hazard models.

Figure 7 shows the survival functions, comparing UI spells that begin before and after the change. More concretely, we restrict the sample to those unemployment spells that begin after a separation between January and March 2005, before the change, and unemployment spells that begin between April and June 2006, after the change. The left panel shows only permanent work-

ers. For these workers the differences are apparent after eight months of duration: for the sample before the change, 75% of workers did not find a job in the first 8 months of unemployment; for the sample after the change, 79% of workers were still unemployed. Differences amplify for longer durations. In the case of construction workers, differences are even more relevant: the survival rate after six periods of unemployment duration was 56% and 71% for the sample before and after the change, respectively.

Figure 7: Effect of UI transfer level - Survival probability before and after the change



Source: AUD.

Note: Survival probability in unemployment before and after the change in UI level of transfers. Sample before change comprises all separations between Jan.2005 and Mar.2005; sample after change comprise all separations between Apr.2006 and Jun.2006.

We now turn to the impact estimates using a Cox duration model. We first estimate the impact of the rise in UI transfer using just an identification variable which is one for periods after April 2006, and zero otherwise ($I(t > \text{March } 2006)$).

From March 2006 on workers between 6 and 11 contributions in the last three years are eligible for receiving transfers (two months in the case of workers younger than 45 years of age and 8 months for the older). This change is important and increased the number of UI recipients. In our estimation we will be considering the subsample of those workers with more than a year of past contributions to avoid any change in the characteristics of UI recipients affect the analysis.

Using this sample, we find that the increase in benefits reduced finding rate. Finding rate decreases both for permanent workers and for construction workers, and young and old workers. The effect goes from 22% for young permanent workers to 47% for young construction workers. (See Table 5.)

When we impose censoring at 8 months the estimates of the effect of higher benefits on durations do not change substantially.

In all, results show that the increase in UI transfer levels reduces significantly the finding rate with an elasticity of around -0.7 in the case of permanent workers. Again, an increase in 10% in UI level would lead to a reduction in finding rate of 7%.

As a robustness, we also performed a Dif-in-Dif analysis. Given that replacement rates were unaffected, the only effect of the rise in UI is on those for which the maximum threshold of UI was binding. Exploiting this fact, we use those workers with pre-unemployment wages lower than AR\$ 600 as a control group and considered the effect of the change in UI thresholds on those with higher wages. We find that the effect is a significant -26% for young and -18% for the old permanent workers.

5.1.4 Changes in Severance Pay

Up to now we have evaluated two parameters of UI: the level of transfer and its duration. The following analysis is related to the impact of severance pay level on finding rate. This is important for understanding and measuring the effect of the provision of liquidity on the behavior of the unemployed (the “liquidity effect”).

As described in Section 3, SP changed in September 2007: jobs created after February 2002 had only ordinary level of severance, while severance pay was reduced to the ordinary level (from 1.5 times ordinary level) for jobs created before February 2002. This change allows us to perform a kind of difference in difference analysis. The assumption is that workers that begun their jobs before or after February 2002 are affected in the same way by shocks in the economy other than severance payment change. Additionally, we assume that any effect of tenure on duration is continuous, so we can control for this by a particular function (quadratic) of tenure.

One concern would be that severance pay reduction could have triggered a high layoff rate from firms, changing the characteristics of displaced. Using the same methods as in regression discontinuity we found no evidence of jump in the separation rate in September 2007, both with and without seasonal adjustment. On the other hand, the layoff rate is also stable and, if something, it dropped (see Figure 8). Additionally, we checked whether the characteristics of workers displaced immediately before and after the change in severance pay differ and found no evidence of change in any observable characteristic (age, tenure, pre-unemployment wages, gender, etc.). While the identification rests on the assumption that both groups of workers (“treated” and “control” group) are affected equally by other shocks rather than SP, the evidence presented here is reassuring in that both groups do not change in composition and observable characteristics.

We estimate the following Cox duration model:

$$\theta(t_u|x) = \lambda(t_u) \exp(y\gamma + x\beta) \tag{3}$$

where $y\gamma = \gamma_1 I(t_s \geq \text{Sep2007}) + \gamma_2 I(t_i \leq \text{Feb2002}) + \gamma_3 I(t_s \geq \text{Sep2007}) * I(t_i \leq \text{Feb2002})$

where t_s is the period of the separation, t_i is the period in which the job initiated and the $I()$ are indicator functions. The control variables x are the same as in previous estimations.¹²

¹²Notice that construction workers do not have acces to severance pay so we concentrate on permanent workers

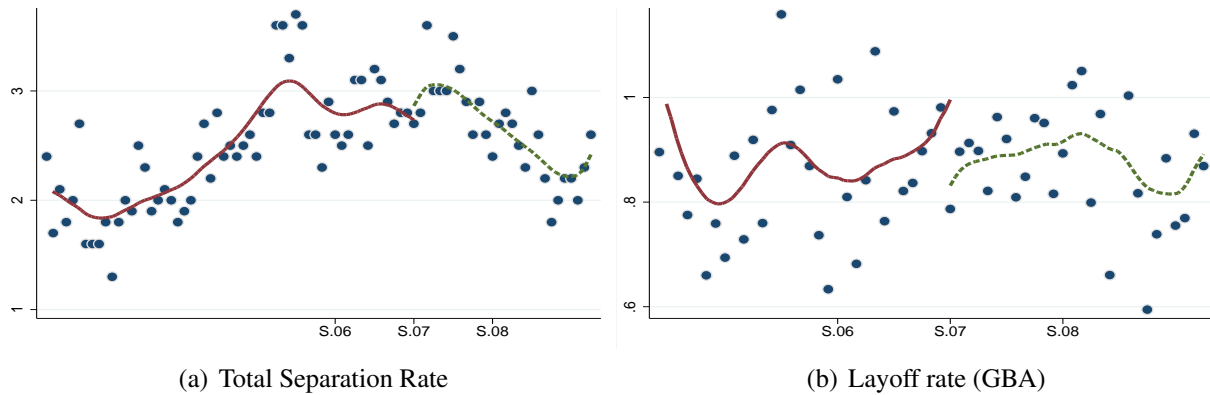
Table 5: Effect of UI transfer level - Cox duration model

	Permanent workers		Construction workers	
	Age<45	Age≥45	Age<45	Age≥45
I(t≥March 2006)	-0.2213 *** (0.0372)	-0.1036 (0.0977)	-0.4681 *** (0.0767)	-0.3802 *** (0.1221)
age	-0.0106 (0.01)	0.0037 (0.0529)	-0.0144 (0.0181)	0.0876 (0.0568)
age square	-0.0001 (0.0002)	-0.0004 (0.0005)	0.0001 (0.0003)	-0.001 * (0.0005)
gender	0.2633 *** (0.0141)	0.3816 *** (0.0396)	0.3151 (0.219)	1.1618 ** (0.5785)
spouse	-0.0007 (0.0138)	0.0039 (0.0336)	0.0443 * (0.0261)	0.0292 (0.0418)
children	0.0297 *** (0.0053)	0.0615 *** (0.0134)	0.0245 *** (0.007)	0.0667 *** (0.0108)
log of p.u.wage	0.3945 *** (0.0196)	0.3291 *** (0.0481)	0.4357 *** (0.0425)	0.3187 *** (0.0442)
log of imputed SP	0.069 *** (0.0167)	0.0546 (0.0397)	-0.0305 (0.0353)	0.106 ** (0.045)
past contributions	-0.0113 *** (0.0011)	-0.0247 *** (0.0028)	0.0087 *** (0.002)	0.015 *** (0.0032)
tenure	-0.0173 *** (0.0012)	-0.0123 *** (0.0028)	-0.0101 *** (0.0026)	-0.0156 *** (0.0035)
tenure square	0.0001 *** (0.0000)	0.0000 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)
Fixed effects	Yes	Yes	Yes	Yes
Observations	46824	12189	10679	5255

Source: AUD.

Note: Coefficients are the result of estimating a Cox PH model of unemployment duration on the indicator variable that identifies those periods after UI transfer level change and controls, including fixed effects (see main text). Sample is restricted to workers who were displaced between July 2005 and December 2006 and who had at least 12 months of contributions. Numbers in parentheses are standard deviations of the coefficients. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Figure 8: Separation rate before and after SP change



Notes: Regression discontinuity analysis using local linear regressions of separation rate and lay-off rate on time variable. Source: *Encuesta de Indicadores Laborales*. Survey to firms implemented by the Ministry of Labor. Separation rate is the proportion of the workers that separate from the firms in main cities. Lay-off rate is the proportion of workers that are displaced by the firm (excludes quits and temporary contracts) in Greater Buenos Aires.

Table 6 presents the results of the estimation of a Cox duration model. From this source we observe that there is a positive impact of the reduction in severance pay. In particular, the reduction in severance pay increases the finding rate in about 50%.

only for this exercise.

Table 6: Effect of SP - Cox duration model

	Permanent workers	
I(layoff period \geq Sep 2007)*I(entry<Feb 2002)	0.5161	***
	(0.0284)	
I(entry<Feb 2002)	-0.1373	***
	(0.0072)	
I(layoff period \geq Sep 2007)	-0.6977	***
	(0.0110)	
I(age \geq 45)	0.1451	***
	(0.0152)	
I(period \geq Mar 2006)	-0.2956	***
	(0.0101)	
age	0.0218	***
	(0.0023)	
age square	-0.0007	***
	(0.0000)	
gender	0.4752	***
	(0.0064)	
spouse	0.0630	***
	(0.0063)	
children	0.0456	***
	(0.0025)	
log of p.u.wage	0.1712	***
	(0.0055)	
Observations	247819	

Source: AUD.

Note: Coefficients are the result of estimating a Cox PH model of unemployment duration on a set of indicator variables that identify the effect of the change in severance pay (SP) as a Dif-in-Dif method and controls. The set of indicator variables are: I(entry<Feb 2002) that identify those workers for which severance pay can change (those that began their employment before February 2002); I(layoff period \geq Sep 2007) those periods of layoffs for which SP can change; and the interaction of the two, which identifies those spells for which SP effectively was reduced after September 2007. Numbers in parentheses are standard deviations of the coefficients. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

5.2 Impact on reemployment wages

We now turn to the estimation of the impact of insurance policies on reemployment wages. As discussed before, the UI and SP policies should aim at increasing the quality of reemployment jobs, financing unemployed workers a better search and an improved match.

As explained in Section 4, we apply the same identification strategy that was presented above, using OLS regressions as in equation (2). Provided that the identification strategy was already introduced, we present the results in a more concise way.

5.2.1 Extension of the UI duration for older workers

We first analyze the effect of the extension of UI at 45 year of age on reemployment wages. As before, we use the indicator variable $I(Age \geq 45)$, which is 1 if the worker is eligible for and extension and zero otherwise.

Table 7 presents the results of these estimations. We find that wages tend to increase due to the UI extension. This rise is of about 8%, but this effect is present only in construction workers (11%) while for permanent workers the effect is lower (6%) and marginally significant.

An extension of 6 months of UI duration would be more substantial if workers have short UI eligibility; for that reason we restrict the sample to those workers with less than 17 contributions. The typical young worker would be eligible for 4 months of UI while those workers older than 45 years of age would be eligible for 10 months, more than doubling UI extension. The results are stronger increasing reemployment wages in almost 10% for permanent workers but the estimates have larger standard errors.

Table 7: Effect of UI Duration on wages - Discontinuity at 45 years of age - OLS

	Workers between 35 to 55 years of age			Work. 35-55 years, less than 17 contributions		
	Total	Permanent	Construction	Total	Permanent	Construction
I(age \geq 45)	0.0781 *** (0.0030)	0.0624 * (0.0820)	0.1095 *** (0.0020)	0.0877 * (0.0810)	0.1027 (0.2160)	0.0941 (0.1310)
age	-0.0215 (0.2120)	-0.0143 (0.5470)	-0.037 (0.1130)	0.0259 (0.4350)	0.1039 * (0.0620)	-0.0334 (0.4160)
age square	0.0002 (0.2760)	0.0001 (0.5910)	0.0004 (0.1720)	-0.0004 (0.3330)	-0.0013 ** (0.0460)	0.0003 (0.4990)
gender	0.085 *** (0.0000)	0.0946 *** (0.0000)	0.2 (0.3320)	0.0163 (0.6950)	0.0395 (0.4110)	0.3928 (0.1300)
spouse	0.0132 (0.3840)	0.0183 (0.3670)	0.0124 (0.5570)	0.0191 (0.4750)	0.0115 (0.7830)	0.0286 (0.4110)
children	-0.0103 ** (0.0100)	-0.0163 ** (0.0100)	-0.0058 (0.2040)	-0.0091 (0.1860)	-0.0025 (0.8550)	-0.0122 (0.1120)
tenure	-0.0156 *** (0.0000)	-0.0159 *** (0.0000)	-0.0171 *** (0.0000)	0.0444 ** (0.0100)	0.07 ** (0.0110)	0.023 (0.2960)
tenure squared	0.0001 *** (0.0000)	0.0001 *** (0.0000)	0.0001 *** (0.0000)	-0.0034 *** (0.0000)	-0.0053 *** (0.0000)	-0.0019 * (0.0840)
log of imputed SP	0.3468 *** (0.0000)	0.3415 *** (0.0000)	0.3828 *** (0.0000)	0.3467 *** (0.0000)	0.3502 *** (0.0000)	0.3435 *** (0.0000)
past contributions	0.0011 (0.2830)	0.0001 (0.9140)	0.0022 * (0.0990)	0.0003 (0.9610)	0.0131 (0.1200)	-0.0051 (0.4470)
final u. duration	0.0073 *** (0.0060)	0.0099 *** (0.0040)	0.0016 (0.6920)	0.0117 ** (0.0210)	0.0184 ** (0.0190)	0.0045 (0.5040)
final u. duration sq	-0.0002 ** (0.0180)	-0.0003 *** (0.0020)	0.0001 (0.3090)	-0.0001 (0.6380)	-0.0002 (0.4450)	0.0001 (0.6490)
Observations	27513	17437	10056	6197	2737	3454

Source: AUD.

Note: Coefficients are the result of estimating an OLS of the log of reemployment wages on the indicator variable that identifies those workers older than 45 years of age and controls. Fixed effects by region, year and industry. Sample is restricted to workers between 35 and 55 years of age displaced after July 2006. Numbers in parentheses are standard deviations of the coefficients. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

5.2.2 Extension of the UI duration for longer contributions

We now exploit the UI duration defined by past contributions. This allows us to analyze the effect of extension not just for the workers around 45 years of age but for any age group. We take advantage of this by subdividing the sample in different age groups.

For that purpose we run an OLS model of the log reemployment wages on a dummy variable that identifies those workers with extended UI benefits, controlling for past contributions using a quadratic function and including additional controls. As in the duration analysis, we restrict the sample to those workers around a given cutoff. For example, in the first column of Table 8 we consider young permanent workers that had contributed between 7 and 16 months in the previous 3 years. We find that the effect of extending the UI duration from 2 to 4 months significantly increases reemployment wages by 10%. For older workers this effect seems to be higher but not statistically significant. We then analyze the effects of extending UI for workers that contributed between 19 and 28 months in the last 3 years and we find no statistically significant effect on wages both for younger and older workers.

In panel (B) of the table we repeat the same analysis for construction workers. For this group we find that extending UI increases reemployment wages between 8% and 21%.

Table 8: Effect of UI duration on wages - Discontinuity in past contributions - OLS

(A) Permanent workers											
Age:	Contributions: 7 to 16				Contributions: 19 to 28						
	<45	≥45	20-30	50-60	<45	≥45	20-30	50-60			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
UI extension	0.0912 ** (0.0170)	0.1321 (0.3060)	0.1083 ** (0.0240)	0.4499 ** (0.0190)	0.0208 (0.5770)	-0.1692 (0.1390)	-0.0057 (0.9020)	-0.0887 (0.6130)			
past contrib.	0.0446 (0.3110)	0.1768 (0.2430)	0.0420 (0.4430)	0.1751 (0.4200)	0.1244 (0.1060)	0.5392 ** (0.0410)	0.0883 (0.3540)	0.1896 (0.6440)			
past contrib.sq	-0.0022 (0.2560)	-0.0081 (0.2250)	-0.0023 (0.3240)	-0.0092 (0.3350)	-0.0028 * (0.0900)	-0.0110 * (0.0510)	-0.0020 (0.3240)	-0.0042 (0.6370)			
age	-0.0033 (0.8470)	0.0103 (0.9470)	0.1482 * (0.0870)	-0.3280 (0.6600)	0.0437 ** (0.0210)	-0.0324 (0.8260)	0.1077 (0.2540)	0.5655 (0.4610)			
age square	0.0001 (0.6390)	-0.0003 (0.8210)	-0.0031 * (0.0770)	0.0025 (0.7180)	-0.0006 ** (0.0330)	0.0002 (0.8690)	-0.0019 (0.3090)	-0.0051 (0.4660)			
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Observations	7732	716	5091	358	8437	837	5488	381			

(B) Construction workers											
Age:	Contributions: 8 to 16				Contributions: 13 to 22						
	<45	≥45	20-30	50-60	<45	≥45	20-30	50-60			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
UI extension	0.0778 ** (0.0270)	0.0217 (0.7310)	0.0153 (0.7490)	0.0407 (0.6330)	0.0905 *** (0.0080)	0.2081 *** (0.0010)	0.106 ** (0.0220)	0.2592 *** (0.0020)			
past contrib.	0.0493 (0.3670)	0.0809 (0.4250)	0.1364 * (0.0620)	0.2185 (0.1110)	-0.0845 (0.1330)	0.273 ** (0.0100)	-0.0887 (0.2460)	0.2648 * (0.0650)			
past contrib.sq	-0.0025 (0.2540)	-0.0031 (0.4550)	-0.0056 * (0.0580)	-0.0084 (0.1300)	0.0023 (0.1640)	-0.0084 *** (0.0060)	0.0023 (0.3040)	-0.0084 ** (0.0440)			
age	0.0269 (0.1090)	-0.1131 (0.1560)	0.0244 (0.7960)	-0.4001 (0.2910)	0.0378 ** (0.0340)	-0.0974 (0.1740)	0.1017 (0.3020)	0.6928 * (0.0660)			
age square	-0.0004 (0.1400)	0.001 (0.1550)	-0.0003 (0.8760)	0.0037 (0.2870)	-0.0006 ** (0.0480)	0.0009 (0.1740)	-0.0019 (0.3350)	-0.0064 * (0.0630)			
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Observations	5829	1368	3038	767	6228	1645	3042	887			

Source: AUD.

Note: Coefficients are the result of estimating an OLS model of the log of reemployment wage on an indicator variable that identifies the UI duration eligibility and controls that include a quadratic in past contributions. Numbers in parentheses are standard deviations of the coefficients. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

5.2.3 Higher UI transfers

Finally, we consider the effects of higher UI transfers on reemployment wages. We estimate the impact of the rise in UI transfer using just an identification variable which is one for periods after April 2006, and zero otherwise ($I(t > \text{March 2006})$).

Table 9 shows the results of an OLS model of wages on these variables and controls. We find from these estimations that rising UI transfers improves re-employment wages of permanent young workers by about 10%. This effect is significant. The effect over workers older than 45 years of age is of the same magnitude, but not significant.

On the other hand, the effect of UI level on re-employment wage is higher for construction workers, and about 20%.

5.3 Summary of results

In Table 10 we present a summary of our empirical findings by presenting elasticities, computed by rescaling the relevant coefficients reported before. We concentrate on permanent workers, because for them we do the welfare analysis.

We computed a weighted average of elasticities to concentrate on an unique point estimate for each type of worker. We present elasticities, ε , of finding rate, ϕ , and re-employment wages, w , with respect to UI level, b , UI duration, B , and severance pay, S .

Elasticities of unemployment duration on UI level are relatively high compared to estimates from other countries. This is reasonable on the grounds that we observe only formal re-employment and that unemployment insurance will imply higher incentives to search for informal jobs, inducing a higher response to UI level. In other words, under high informality moral hazard effect is stronger. Additionally, the response to severance pay is also very important, implying that liquidity seems a crucial aspect behind the effects of UI. The fact that Argentina has a less developed financial market could be behind the high impact of SP on duration. Finally, elasticity of the extension of benefits is quite large and close to one, implying that if UI is extended in 10%, unemployment duration would be longer in about 10%.

Table 9: Effect of UI level on wages - OLS

	(A) Permanent workers				(B) Construction workers			
	Age <45		Age ≥45		Age <45		Age ≥45	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I(t>March 2006)	0.1006	***	0.0990		0.1947	***	0.2300	***
	(0.0020)		(0.2870)		(0.0000)		(0.0010)	
age	0.0330	***	0.0645		0.0447	***	0.0429	
	(0.0010)		(0.2910)		(0.0010)		(0.2740)	
age square	-0.0004	***	-0.0006		-0.0006	***	-0.0004	
	(0.0030)		(0.2930)		(0.0030)		(0.2540)	
gender	0.0953	***	0.1358	***	0.1977		-0.2035	
	(0.0000)		(0.0030)		(0.2100)		(0.5300)	
spouse	0.0440	***	0.0759	**	0.0070		0.0451	
	(0.0010)		(0.0450)		(0.7290)		(0.1140)	
children	-0.0208	***	-0.0014		-0.0084		-0.0155	**
	(0.0000)		(0.9310)		(0.1250)		(0.0420)	
tenure	-0.0129	***	-0.0174	***	-0.0164	***	-0.0220	***
	(0.0000)		(0.0000)		(0.0000)		(0.0000)	
tenure squared	0.0001	***	0.0001	***	0.0001	***	0.0001	***
	(0.0000)		(0.0000)		(0.0000)		(0.0000)	
log of imputed SP	0.2586	***	0.3317	***	0.2975	***	0.4331	***
	(0.0000)		(0.0000)		(0.0000)		(0.0000)	
final u. duration	0.0072	***	0.0147	**	0.0153	***	0.0220	***
	(0.0030)		(0.0290)		(0.0000)		(0.0000)	
final u. duration sq	-0.0002	**	-0.0005	***	-0.0003	**	-0.0005	***
	(0.0170)		(0.0020)		(0.0110)		(0.0020)	
Observations	31062		5140		8868		3531	

Source: AUD.

Note: OLS model of wages on policy variables and controls. Policy variables are related to UI level. Standard errors in brackets. Statistical significance: * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 10: Summary of empirical results: elasticities

	All	<45 years	45 years	>45 years
Finding rate				
$\varepsilon_{\phi,b}$	-0.589	-0.671	-0.421	-0.314
$\varepsilon_{\phi,B}$	-0.946	-0.597	-0.572	-1.800
$\varepsilon_{\phi,S}$	-1.032	-1.032	-1.032	-1.032
Reemployment wages				
$\varepsilon_{w,b}$	0.304	0.305	0.301	0.300
$\varepsilon_{w,B}$	0.053	0.070	0.127	-0.010

Notes: Each cell of the table represent an elasticity derived from the results presented in Section 5, by computing the weighted average of different estimates. Total average (all workers) were constructed by averaging results by age, considering the proportion of UI beneficiaries by age. (See Appendix C.1.)

6 Welfare implications

In the previous Section we presented our estimates, evidence of the response of workers to UI and SP. While these are themselves suggestive, a model is required for a more conclusive analysis about the welfare gains of a policy reform. In this Section we use and extend the search models in Chetty (2008) and Shimer and Werning (2007) to interpret our empirical results. Importantly, we explore these two setups to show whether our normative conclusions are robust to alternative assumptions, modelling choices and calibration procedures.

Throughout this section we will concentrate on permanent workers because for construction workers we do not have any estimate of the liquidity effect (they do not receive any severance pay that would allow us to measure its impact).

6.1 Optimality conditions for UI provision in a job search context

Our formulas for welfare gains base on a job search setup. We first present a general setup that includes the two specifications as particular cases. We then reproduce the formulas provided by Chetty (2008) and Shimer and Werning (2007). Next, we extend their models to analyze the case of limited UI duration and present new formulas for this case, leaving the derivations to the Appendix A.

Consider a risk averse unemployed worker that has to search actively for a job. In particular, he faces a cost of search of $\psi(\pi)$ each period, where $\pi \in (0, 1]$ is the search effort. At each period the unemployed worker receives a wage offer at a rate $\pi\lambda$. The wage offer is distributed according to the cumulative distribution function F and can be accepted or rejected by the worker. If accepted the worker collects wages, w , net of taxes, τ , each period in employment. We will consider the case of a constant separation rate, δ , from employment to covered unemployment.

With both search effort and random wage offers, the solution to the problem of an unemployed worker consists on setting search effort, π^* , and a reservation wage, w^* , that maximize his utility. Given these policies, his finding rate (the probability of receiving and accepting a wage offer) is $\phi^* = \pi^*\lambda[1 - F(w^*)]$.

An eligible unemployed worker receives an UI transfer of b units of consumption per unit of time. We will consider two cases. In the first one, benefits are provided with no limit in duration, while in the second we let benefits to exhaust. Thus, the worker can be employed, unemployed receiving UI benefits (eligible) or with no transfer.

We let workers to begin their unemployment spell with assets, a . We also consider that those workers without a formal job can have access to an income y that is generated from informal labor. We still consider a worker with an informal income as unemployed because these two employment states are indistinguishable from the point of view of the government (and of our data).

The problem of the planner is to set UI and taxes so as to maximize the welfare of the unemployed, satisfying the constraint that the policy should be actuarially fair (all benefits should be financed by future taxes). It is important to note that the government does not observe or control the consumption, search effort or reservation wage of the agent. In this sense, the government has to deal with the moral hazard problem of affecting decisions of the worker whenever changing the

policy.

The UI policy reduces incentives to search by two main mechanisms. First, increasing b reduces the utility gains of getting a job given that increases the consumption of the unemployed. Second, a rise in taxes is required to finance higher benefits and longer unemployment spells. This reduces utility gains by decreasing consumption while employed. The problem of a planner that aims at providing the optimal level of UI must deal with this trade-off: providing insurance and liquidity at the same time that generates disincentives to re-employment. The existence of an informal labor income, y , changes this problem in several ways.

First, an additional income as unemployed reduces the welfare gain of providing UI, given that informal income is a source of consumption for the unemployed. Second, finding a job implies net income gains of $w - \tau - y - b$, as employed workers have to give up benefits and informal income. This impose a clear threshold to b to maintain income gains at re-employment. On the whole, informality would tend to reduce the generosity of UI.

A main question in practice is in what way should UI be designed when informality is prevalent. Should benefits be lower or should the provision of UI be shorter? This depends on the behavioral response of workers to higher benefits and to an extension of UI eligibility. In what follows we intend to exploit search models to evaluate this trade-off in a formal way. We will then show that the estimations summarized in Table 10 provide the relevant information to conclude about the optimal UI design.

6.1.1 Moral hazard and liquidity

Let first restrict the attention to the case in which benefits are continuously provided, in which $\lambda = 1$, $\delta = 0$ and wage offer distribution is degenerate in a unique value, w . We are in Chetty (2008) setup in which labor market frictions are modeled through search effort only.

Lets first consider the following one period problem:

$$\begin{aligned} \max_b \widetilde{W}(b) &= u(c_u)(1 - \pi(b)) + u(c_e)\pi(b) - \psi(\pi) \\ c_u &= a(1 + r) + b + y \\ c_e &= a(1 + r) + w - \tau(b) \end{aligned}$$

The optimal policy for the unemployed is then $\psi'(\pi^*) = u(c_e) - u(c_u)$. Notice that finding rate in this case is $\phi^* = \pi^*$. Lets consider shocks to benefits, taxes and assets of period t . The change in job finding probability would be

$$\begin{aligned} \partial\phi^*/\partial b &= -u'(c_u)/\psi''(\phi^*), \\ \partial\phi^*/\partial\tau &= -u'(c_e)/\psi''(\phi^*), \\ \partial\phi^*/\partial a &= (u'(c_e) - u'(c_u))/\psi''(\phi^*), \end{aligned} \tag{4}$$

respectively. It is clear that $\frac{\partial\phi}{\partial b} = \frac{\partial\phi}{\partial a} + \frac{\partial\phi}{\partial\tau}$: one dollar provided under the condition of being unemployed should have the same effect as one dollar provided unconditionally minus one dollar if the worker is not unemployed. Thus, the total effect of an increase in benefits is equivalent to a

provision of liquidity (equal to the first term, $\frac{\partial \phi}{\partial a}$) plus the effect of the increase in taxes, the moral hazard effect (the second term, $\frac{\partial \phi}{\partial \tau}$). This last is a reduction of the incentives to search due to the fact that benefits reduce the gain that the worker would get from a job, this being $w - \tau - b - y$. Notice that both b and τ tend to rise with more generous UI.

In this setup, the objective of the planner would be to maximize \widetilde{W} subject to the incentive compatibility constraint, $\psi'(\pi) = u(c_e) - u(c_u)$, and budget constraint $(1 - \phi) b_t = \tau_t \phi$. The impact on welfare of an increase in b_t compensated by a rise in τ_t , is $\frac{d\widetilde{W}}{db} = (1 - \phi) u'(c_u) - \phi u'(c_e) \frac{d\tau_t}{db_t}$.

From the budget constraint, $\frac{d\tau_t}{db_t} = \frac{1}{\phi} (1 - \phi - \epsilon_{\phi,b})$, where ϵ is the total elasticity of finding rate to changes in benefits (including the effect of taxes). Finally, the welfare gains are

$$\frac{d\widetilde{W}(a)/db}{\pi u'(c_e)} = \frac{1 - \pi}{\pi} \left[\frac{L}{1 - L} - \frac{\epsilon_{1-\pi,b}}{\pi} \right] \quad (5)$$

where $L = \frac{\partial \pi / \partial a}{\partial \pi / \partial b}$ is the relative importance of liquidity effect, and where the denominator in the left hand side is the utility gain of rising wages so that the equation represents the welfare gains in monetary units. Importantly, optimality depends on two behavioral responses: the elasticity of finding rate to changes in benefits and to changes in assets.

This is a static condition. If benefits were to be provided from period 0 to B, the formula is less direct. Chetty (2008) derives an approximation formula for the welfare gain of the increase in UI benefit level. The formula depends on the elasticity of finding rate to benefits and the response of finding rate to an increase in assets at the beginning of the unemployment spell in the following way:

$$\frac{u}{1 - u} \frac{D_B}{D} \left(\frac{L}{1 - L} + \frac{\epsilon_{\phi_0,b}}{1 - u} \right) = 0 \quad (6)$$

$$L \equiv B \frac{\partial \phi_0}{\partial a_0} / \frac{\partial \phi_0}{\partial b},$$

where B is the UI duration, D and D_B are the expected durations of unemployment spell and the covered unemployment spell, respectively, u is the unemployment rate, and $\epsilon_{\phi_0,b}$ is the total elasticity of finding rate at the beginning of the unemployment spell, ϕ_0 , with respect to benefits level b , taking into account the effect of an increase in taxes needed to finance the increase in b . Finally, the proportion of the liquidity effect over the total effect, L , is estimated through comparing the effect of liquidity provision (a change in assets) and of benefit level on finding rate ($\frac{\partial \phi}{\partial a_0}$ and $\frac{\partial \phi}{\partial b}$, respectively).

It is important to note that the stronger the proportion of liquidity effect the higher are the welfare gains of an increase in UI benefits. We estimate it using the response of finding rate to severance pay, so that $L = (Bb/S) (\epsilon_{\phi,S} / \epsilon_{\phi,b})$, where S is the mean amount of severance pay. We will calibrate the formula using the elasticities of Table 10.

We now turn to consider the welfare gains of the extension of UI benefits.¹³ Let E be the

¹³In this analysis we relate to Card, Chetty, and Weber (2007).

additional number of periods of UI extension. Let e be the level of benefits provided in this period, so that ordinary UI provision is the same as setting $e = 0$. To analyze the welfare gains of UI extension we compute the change the lifetime value of being unemployed when e increases. We then rescale this result. First, we compare this welfare gain with the one of providing one unit of money to employed workers. This converts the result to monetary units in the same way as in equations (5) and (6). Second, we correct the result to take into account that each additional unit of money spent in b is equivalent (in expected terms) to $D_B/p_{0B}D_E$ units of money spent in e , where p_{0B} is the probability that unemployment duration is longer than B , and D_E is the expected duration of UI extension. As we derive in the Appendix, the rescaled welfare gain is:

$$\frac{u}{1-u} \frac{D_B}{D} \left(\frac{L_E}{1-L_E} + \frac{\eta_{\phi,e}}{1-u} \frac{bD_B}{p_{0B}D_E} \right) = 0 \quad (7)$$

$$L_E \equiv p_{0B}E \frac{\partial \phi_0}{\partial a_0} / \frac{\partial \phi_0}{\partial e},$$

where $\eta_{\phi,e} = \frac{d\phi_0}{de} / \phi_0$ is the partial elasticity of finding rate with respect to benefits at the extension periods. Again, the proportion of liquidity effect, L_E is of crucial relevance for this assessment. In the calibration of this formula we use $L_E = \frac{p_{0B}b_B E}{S} \frac{\varepsilon_{\phi,S}}{b_B \eta_{\phi,e}}$, where we identify the liquidity effect through the response of workers to severance pay, S , and where we take into account the fact that the level of extended benefits would change from zero to b_B , the level of benefits at B (i.e., our estimate in regressions is $b_B \eta_{\phi,e}$).

Finally, note that both equations represent the increase in welfare gains in monetary units. For example, equation (6) is the monetary value of the increase in welfare due to one additional unit of money spent in b . Analogously, equation (7) is the monetary value of the increase in welfare due to the same amount invested in extending UI by E periods. Thus, both formulas are comparable and can be used to assess whether it is convenient to increase benefits or to extend them.

6.1.2 Reservation wage

A main assumption for the search effort analysis exploited by Chetty is that there is no impact of UI on re-employment wages. Nevertheless, some of our regressions show a significant rise in wages when UI is more generous. To include this effect we base on Shimer and Werning (2007) analysis. In their setup, unemployed workers face random wage offers and they decide whether they accept or reject the offer by setting a reservation wage, w^* , such that the worker is indifferent between being employed at that wage or being unemployed. This is equivalent to considering a setup in which $\psi(\cdot) = 0$ (ie. $\pi = 1$). In such a case, the reservation wage characterizes the search process of the unemployed, so that the finding rate is $\phi^* = \lambda[1 - F(w^*)]$.¹⁴

The main intuition for their test is that unemployed worker's utility is a monotone function of his after-tax reservation wage. Thus, the objective for a planner would be to maximize after-tax

¹⁴Other important difference between both setups is that the first one is modelled in discrete time while the second one is in continuous time. But this is a more technical than substantial difference.

reservation wage. They use this idea to derive an optimality formula:

$$\frac{\partial w^*}{\partial b} - (1 - \varepsilon_{\phi,b}) u = 0,$$

where the first term measures the welfare gains of higher benefits and the right hand side measures its costs, which depends on unemployment rate, u , and elasticity of finding rate with respect to benefits, $\varepsilon_{\phi,b}$. Given that we do not observe reservation wages we exploit the definition of mean re-employment wages, $\bar{w} = \int_{w^*} w dF(w)$, and the assumption of log-normal wage offers to derive a different formula:

$$\varepsilon_{w,b} \frac{\bar{w}}{b} \Lambda - (1 - \varepsilon_{\phi,b}) u = 0, \quad (8)$$

$$\Lambda = \frac{\sigma^2}{\sigma^2 - v_W} \rho \quad (9)$$

where $\varepsilon_{w,b}$ is the elasticity of re-employment wages with respect to b , $\rho = \frac{w^*}{\bar{w}}$ is an indicator of wage dispersion, and Λ rescales this effect. Importantly, σ and v_W are the variances of wage offers and of reemployment wages, respectively. We derive this formula in Appendix A and we explain how we approximate the ratio Λ in Appendix C.1.

Exploiting the same idea we analyze the welfare gains of an UI extension in a setup in which we model limited UI duration by considering that each period the unemployed worker face a probability γ of UI exhaustion. In this case, the government can provide alternative (b, γ) combinations with the same cost (i.e., without changing taxes). We exploit this to derive the welfare gain of an increase in benefits compensated by shorter duration (higher γ). We find that welfare gains depend on the response of reemployment wages to both benefits level and benefits duration:

$$\left(\varepsilon_{w,b} - \varepsilon_{w,B} \frac{B}{D_B} \frac{1 + B/D\varepsilon_{\phi,B}}{1 + D_B/D\varepsilon_{\phi,b}} \right) \frac{\bar{w}}{b} \Lambda = 0. \quad (10)$$

The first term shows the welfare gains of using increasing the level of benefits. The second term in the brackets shows the welfare losses of a reduction in UI duration ($\partial w / \partial B > 0$). Notice that if this formula gives a positive value, it would be convenient to increase the level of UI benefits and reduce the UI duration. The higher the ratio $|\varepsilon_{w,b} / \varepsilon_{w,B}|$ the more likely would be that this occurs. Finally, in this last formula the fact the wage offers are not observable is less important, because the sign of the welfare gain does not depend on the distribution of wages. In other words, the only role of Λ is to rescale the result, but it does not affect its sign.

6.2 Calibration of the formulas

We now consider the calibration of these formulas. Table 11 report all the parameter values that are used in the calibration of the formulas. They all come from our best estimate from the database or complementary information when needed.

Table 12 reports the calibration of the formulas for each type of worker. The first line of the table indicates that increasing benefits in AR\$1 would raise welfare by the equivalent of AR\$ 0.05

Table 11: Parameters for welfare analysis

	All	<45 years	45 years	>45 years
Finding rate (ϕ)	0.035	0.040	0.026	0.021
Separation rate (δ)	0.010	0.015	0.009	0.005
Unemployment rate (u)	0.153	0.290	0.201	0.133
Benefit level (b)	300.0	300.0	300.0	300.0
Benefit level at B (b_B)	282.0	300.0	255.0	255.0
UI Exhaustion rate (γ)	0.167	0.255	0.126	0.089
UI level/Severance Pay (b/S)	0.084	0.101	0.052	0.059
Wage inequality (w^*/\bar{w})	0.83	0.84	0.83	0.80
Replacement rate (b/\bar{w})	0.27	0.27	0.27	0.27
Variance adjustment (Λ)	1.50	1.50	1.50	1.50
Duration of benefits (B)	4.95	3.26	6.70	9.10
Expected duration of benefits (D_B)	3.80	2.84	4.66	6.17
Duration of UI extension (E)	3.21	3.26	6.00	3.10
Expected duration of UI extension (D_E)	2.44	2.46	3.75	2.40
Survival up to B ($p_{0,B}$)	0.80	0.88	0.69	0.62
Unemployment duration (D)	28.2	24.9	39.1	47.9

Source: AUD.

Note: Each cell in the table represent our best point estimate for the parameter that will be used in the calibration of the formulas. The period is assumed to be a month. See Appendix C.1.

Table 12: Welfare analysis

	All	<45 years	45 years	>45 years
UI transfer level				
(1) Search effort	0.048	0.004	0.151	0.171
<i>proportion of liquidity effect:</i>	<i>0.727</i>	<i>0.506</i>	<i>0.848</i>	<i>0.900</i>
(2) Reservation wage	0.835	0.466	0.875	1.156
UI duration				
(3) Search effort	-0.003	0.104	-0.001	-0.053
Increase in benefits compensated by less duration				
(4) Reservation wage	0.812	0.665	0.559	1.233

Note: Each cell in the table represent an indicator of the welfare gain of modifying the UI system.

Line (1) evaluates the equation (6) and line (2) evaluates equation (8).

Line (3) evaluates the equation (7) and line (2) evaluates equation (10).

increase in monthly wage for the average permanent worker, which implies about AR\$0.6 a year. The result is different considering different types of workers, being higher for older ones.

The second line evaluates the welfare gain of rising UI level using the elasticity of wages. We find a much higher value: a balanced-budget increase of AR\$ 1 in benefits would yield a welfare gain equivalent to an increase in net wages of AR\$ 0.8. According to this method and our calibration this welfare gains are substantial for all workers, being even higher for older workers.

We now discuss the results of evaluating welfare gains of extending UI duration. Line (3) of Table 12 shows the calibration of equation (7). Remember that the formula is rescaled so that it represents an expenditure in extending benefits with a cost equivalent to an increase in regular benefits of AR\$ 1. Thus, the values of line (3) are comparable to those in line (1) of the table. The results show that, for the average worker, there is no welfare gain in extending UI. The exception is the group of younger workers; for them the calibration of the formula gives a positive value, suggesting that a balanced-budget extension in benefits would generate a rise in welfare similar to an increase in wages of AR\$ 0.1 for the young.

Finally, the fourth line in the table evaluates formula (10). All values of the line are positive, emphasizing that a rise in benefits of AR\$ 1 compensated by a shorter UI duration rises welfare substantially, an equivalent of a rise in wages of AR\$0.8.

Thus, our assessment of UI suggests that benefits should be increased. In particular, our estimations show that the rise of benefits should have been higher than the one implemented in 2006.

On the other hand, we can conclude that benefits should not be extended, and that the optimal profile of benefits implies higher level and shorter duration. This is the result of both analyzing the welfare gain of extending benefits and the balanced-budget increase in monthly transfer compensated by a reduction in duration.

Notably, both approaches suggest the same conclusion. The only inconsistency arises when evaluating UI extension for the young. For them, and only according to formula (7), seems better to extend UI rather than increasing benefits. Nevertheless, it is important to notice that the evaluations for these workers consider the extensions from 2 to 4 months and from 4 to 8 months of benefits. Thus, the duration of UI is already short for them.

7 Conclusions

Government policies aimed at protecting workers against unemployment risks usually face important trade-offs. For example, unemployment insurance allows for consumption smoothing in the presence of imperfect financial markets, but it can also reduce search effort and increase unemployment duration. This incentive problem is exacerbated in labor markets with a large informal sector, a characteristic of developing economies. Furthermore, in developing countries with weak enforcement, these policies can contribute to noncompliance and segmented labor markets. In the absence of solid empirical evidence, it is unclear how policy makers should react.

In this paper we exploited a number of reforms and discontinuities in policies in Argentina with the objective to provide an estimation of the impact of unemployment insurance over unemployment duration and reemployment wages that can be used by policy makers in the design of an UI system or in the reform of an existing one.

We find that the extension of UI eligibility increases significantly and substantially unemployment duration while reemployment wages are only modestly increased. On the other hand, a higher level of UI transfers affect reemployment wages more and unemployment duration less. Finally, we use changes in severance pay provision to identify the effect of a lump sum transfer and show that a relevant proportion of total effect of UI is due to liquidity.

With these estimates we calibrated optimality formulas derived from two different search models. Using this structure we are able to evaluate the welfare gains of changing UI policy and to conclude that UI benefits should be higher and relatively short.

Some remarks are in order to put our estimates and conclusions in context. Our estimates are around 2006, when benefit over pre-unemployment wages had a median of about 30% in our sample of beneficiaries. Thus, our conclusion suggests that the replacement rate could be larger than that ratio in Argentina. On the other hand, UI is provided for more than 8 months for workers older than 45 years of age; for these workers both models suggest that UI should be shortened. But for the younger workers the two formulas provide different results. While search effort model suggests that there is a welfare gain in providing longer UI, the reservation wage approach indicates that it would be better to increase benefits lowering the duration. Notably, our estimates for these workers are based in UI always shorter than 8 months. Finally, the literature has shown that UI should change in the business cycle (see for example Landais, Michailat, and Saez (2013), Schmieder, von Wachter, and Bender (2012b) among others). Importantly, during the 2005-2009 period Argentina experienced a continuous expansion in private formal jobs (of about 7% per year). Probably, during recession UI should be more generous; more research should be done to analyze the optimal profile of UI on recessions under high informality.

On the whole, the main conclusion is that, if a reform were to be implemented in Argentina or a new UI system were to be introduced in a developing country with high informality, it should consider providing short UI. This conclusion is related to Álvarez Parra and Sánchez (2009), where the optimal unemployment insurance provision under hidden labor markets is analyzed. The point of that paper, consistent with our empirical findings, is that, when informality is prevalent, benefits should be relatively short. The intuition is that long UI benefits distorts the decision of workers making them to accept hidden jobs (of lower quality) to keep benefits and at the same time complement their earnings with some labor income. For this reason, it is important to provide liquidity for the unemployed that, at the same time, limits the impact of moral hazard that distorts finding rate and that reduce the search for formal “good” jobs. A simple way of doing this is by providing short UI transfers.

References

- Álvarez Parra, F. and J. M. Sánchez (2009, October). Unemployment insurance with a hidden labor market. *Journal of Monetary Economics* 56(7), 954–967.
- Baily, M. N. (1978). Some aspects of optimal unemployment insurance. *Journal of Public Economics* 10(3), 379–402.
- Basten, C., A. Fagereng, and K. Telle (2012). Cash-on-Hand and the duration of job search. Quasi-experimental evidence from Norway. Discussion Papers 679, Research Department of Statistics Norway.
- Bover, O., M. Arellano, and S. Bentolila (2002). Unemployment duration, benefit duration and the business cycle. *Economic Journal* 112(479), 223–265.
- Card, D., R. Chetty, and A. Weber (2007). Cash-on-hand and competing models of intertemporal behavior: New evidence from the labor market. *The Quarterly Journal of Economics* 122(4), 1511–1560.
- Card, D. and P. B. Levine (2000). Extended benefits and the duration of UI spells: evidence from the New Jersey extended benefit program. *Journal of Public Economics* 78(1-2), 107–138.
- Centeno, M. (2004). The Match Quality Gains from Unemployment Insurance. *Journal of Human Resources* 39(3).
- Centeno, M. and A. Novo (2006). The Impact of Unemployment Insurance on the Job Match Quality: A Quantile Regression Approach. *Empirical Economics* 31(4), 905–919.
- Centeno, M. and A. A. Novo (2012). Do low-wage workers react less to longer unemployment benefits? quasi-experimental evidence. IZA Discussion Papers 6992, Institute for the Study of Labor (IZA).
- Chetty, R. (2008). Moral hazard versus liquidity and optimal unemployment insurance. *Journal of Political Economy* 116(2), 173–234.
- Gangl, M. (2002). Unemployment benefits as a search subsidy: New evidence on duration and wage effects of unemployment insurance. Discussion Paper 02- 208, FS.
- Gruber, J. (1994). The consumption smoothing benefits of unemployment insurance. NBER Working Papers 4750, National Bureau of Economic Research, Inc.
- Katz, L. F. and B. D. Meyer (1990). The impact of the potential duration of unemployment benefits on the duration of unemployment. *Journal of Public Economics* 41(1), 45–72.
- Lalive, R. (2008). How do extended benefits affect unemployment duration A regression discontinuity approach. *Journal of Econometrics* 142(2), 785–806.
- Lalive, R., J. C. van Ours, and J. Zweimueller (2006). How changes in financial incentives affect the duration of unemployment. Technical Report 4.
- Landais, C., P. Michailat, and E. Saez (2013, October). Optimal Unemployment Insurance over the Business Cycle. Discussion Papers 1303, Centre for Macroeconomics (CFM).

- Mazza, J. (2000). Unemployment insurance: Case studies and lessons for latin america and the caribbean. RES Working Papers 4192, Inter-American Development Bank, Research Department.
- McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics* 142(2), 698–714.
- Meyer, B. (1990). Unemployment insurance and unemployment spells. *Econometrica* 58(4).
- Michelacci, C. and H. Ruffo (2011). Optimal life cycle unemployment insurance. mimeo.
- Rajan, R. G. and L. Zingales (1998). Financial dependence and growth. *The American Economic Review* 88(3), pp. 559–586.
- Schmieder, J. F., T. von Wachter, and S. Bender (2009). The effects of unemployment insurance on labor supply and search outcomes: Regression discontinuity estimates from germany. Discussion Papers 0910-08, Columbia University, Department of Economics.
- Schmieder, J. F., T. von Wachter, and S. Bender (2012a). The long-term effects of ui extensions on employment. *American Economic Review* 102(3), 514–19.
- Schmieder, J. F., T. von Wachter, and S. Bender (2012b). The Effects of Extended Unemployment Insurance Over the Business Cycle: Evidence from Regression Discontinuity Estimates Over 20 Years. *The Quarterly Journal of Economics* 127(2), 701–752.
- Shimer, R. and I. Werning (2007). Reservation wages and unemployment insurance. *The Quarterly Journal of Economics* 122(3), 1145–1185.
- Tatsiramos, K. and J. v. Ours (2012). Labor market effects of unemployment insurance design. Discussion Paper 2012-082, Tilburg University, Center for Economic Research.
- Uusitalo, R. and J. Verho (2010). The effect of unemployment benefits on re-employment rates: Evidence from the finnish unemployment insurance reform. *Labour Economics* 17(4), 643–654.
- van Ours, J. C. and M. Vodopivec (2006a). How Shortening the Potential Duration of Unemployment Benefits Affects the Duration of Unemployment: Evidence from a Natural Experiment. *Journal of Labor Economics* 24(2), 351–378.
- van Ours, J. C. and M. Vodopivec (2006b). Shortening the Potential Duration of Unemployment Benefits Does Not Affect the Quality of Post-Unemployment Jobs: Evidence from a Natural Experiment. IZA Discussion Papers 2171, Institute for the Study of Labor (IZA).

Appendix

A Search models

A.1 Search effort

Let J_t be the lifetime expected utility of an unemployed worker that begins period t without a job and has to search actively to find a job for that period with probability ϕ_t at an utility cost $\psi(\phi_t)$. Search intensity would be chosen to solve:

$$J_0(a_0) = \max_{\phi_0} \phi_0 V_0(a_0) + (1 - \phi_0) U_0(a_0) - \psi(\phi_0),$$

where V_0 is the lifetime utility value of being employed in period 0 until period T (receiving net wages $w - \tau$) and U_0 is the value of spending that period without a job, collecting unemployment benefits, b , and searching for a job in the beginning of the following period. The lifetime utility of a worker collecting UI is

$$U_t(a_t) = \max_{a_{t+1} \in A} u(a_t - a_{t+1} + m_t) + J_{t+1}(a_{t+1}),$$

where m_t is his income as unemployed and where the condition $a_{t+1} \in A$ implicitly accounts for the case in which there are liquidity constraints. The value function of being employed is

$$V_t(a_t) = \max_{a_{t+1} \in A} u(a_t - a_{t+1} + w - \tau) + V_{t+1}(a_{t+1}).$$

In writing these value functions we assume no discounting. We assume that unemployment insurance is provided by a limited duration of B periods; we consider also an additional E periods in which workers receive another type of transfer of amount e . We will use this additional transfer to analyze the extension of UI benefits, by increasing this value from zero. After period $B + E$, no other public transfer is considered. Furthermore, we assume that informal labor income, y can be earned if the worker does not have a formal job. These conditions imply that the income for the unemployed is $m = b + y$ up to period B , $m = e + y$ up to period $B + E$ and $m = y$ afterwards.

The problem of the planner would be to maximize J_0 subject to the budget constraint

$$\tau(T - D) = bD_B + ep_{0B}D_E,$$

where D is the expected duration of unemployment spell, D_B is the expected duration of unemployment benefits, D_E is the expected duration of the extension of UI benefits and $p_{t,i} = \prod_{j=t}^i (1 - \phi_j)$ is the survival probability in unemployment up to i given survival up to t .

Given that once employed there is no uncertainty, the worker chooses a constant level of consumption equal to net wages and the annuity of assets at the beginning of the employment spell. Moreover, following the literature, we will assume that wealth effect of unemployment duration is

mild and we will assume that re-employment consumption, c_e , does not depend on the length of unemployment.

Following Chetty (2008), I will define $\frac{\partial z}{\partial x}|_s = \sum_{t=0}^s \frac{\partial z}{\partial x_t}$. For the case of b , $\frac{\partial z_0}{\partial b} = \frac{\partial z_0}{\partial b}|_B$, because UI lasts for B periods.

A.1.1 Optimal UI level

The planner's problem of setting the optimal level of benefits of fixed duration B consists of maximizing

$$J_0 = (1 - \phi_0(b, \tau)) U_0(b, \tau) + \phi_0 V_0(b, \tau) - \psi(\phi_0(b, \tau))$$

subject to $\tau(T - D) = bD_B$, where we assume for now that there is no UI extension ($e = 0$).¹⁵ Thus,

$$\frac{dJ_0}{db} = (1 - \phi_0) \left[\frac{\partial U_0}{\partial b} - \frac{\partial U_0}{\partial w} \frac{d\tau}{db} \right] - \phi_0 \frac{\partial V_0}{\partial w} \frac{d\tau}{db}$$

Using that $\frac{\partial \phi_0}{\partial x}|_B = \frac{1}{\psi''(s_0)} \left[\frac{\partial V_0}{\partial x}|_B - \frac{\partial U_0}{\partial x}|_B \right]$, and that $\frac{\partial V_0}{\partial b} = 0$, we obtain $\frac{dJ_0}{db} = -(1 - \phi_0) \psi''(\phi_0) \frac{\partial s_0}{\partial b} - (1 - \phi_0) \frac{\partial U_0}{\partial w} \frac{d\tau}{db} - \phi_0 \frac{\partial V_0}{\partial w} \frac{d\tau}{db}$.

Let's consider an increase in welfare due to a rise of \$1 in wages from period 0. This would be equivalent to $\frac{dJ_0}{dw} = (1 - \phi_0) \frac{\partial U_0}{\partial w} + \phi_0 \frac{\partial V_0}{\partial w} = (T - D) v'(c_e)$. Thus,

$$\frac{dW}{db} = \frac{\frac{dJ_0}{db}}{\frac{dJ_0}{dw}} = -\frac{(1 - \phi_0) \psi''(\phi_0) \frac{\partial \phi_0}{\partial b} - \frac{d\tau}{db}}{T - D} \frac{d\tau}{dw} \quad (\text{A.1})$$

Furthermore, it can be shown that $\frac{\partial \phi_0}{\partial w} = \frac{1}{\psi''(\phi_0)} \frac{1}{(1 - \phi_0)} [D v'(c_e)]$. On the other hand, $\frac{d\tau}{db} = \frac{D_B}{T - D} (1 + \varepsilon_{D_B, b} + \varepsilon_{D, b} \frac{D}{T - D})$, and assuming $\varepsilon_{D_B, b} = \varepsilon_{D, b} \frac{d\tau}{db} = \frac{D_B}{T - D} (1 + \varepsilon_{D, b} \frac{T}{T - D})$. After replacing these in equation (A.1) we get:

$$\frac{dW}{db} = \frac{D_B}{T - D} \left[-\frac{B \frac{\partial \phi_0}{\partial a}}{B \frac{\partial \phi_0}{\partial a} - \frac{\partial \phi_0}{\partial b}} - \frac{\varepsilon_{D_B, b}}{T} \right]$$

where we use that $\frac{\partial \phi_0}{\partial w}|_B = \frac{1}{\psi''} \frac{1}{1 - \phi_0} [D_B v'(c_e)] = \frac{D_B}{D} \frac{\partial \phi_0}{\partial w}$ and the fact that $\frac{\partial \phi_0}{\partial b} = \frac{\partial \phi_0}{\partial a}|_B - \frac{\partial \phi_0}{\partial w}|_B$. Finally, following Chetty, we assume that $\frac{\partial \phi_0}{\partial a}|_B \approx B \frac{\partial \phi_0}{\partial a}$. To get equation (6) we assume that the unemployment rate, u , is an approximation of D/T , so that

$$\frac{dW}{db} = \frac{u}{1 - u} \frac{D_B}{D} \left(\frac{L}{1 - L} + \frac{\varepsilon_{\phi_0, b}}{1 - u} \right),$$

where L is the proportion of liquidity effect compared to total effect, $L = B \frac{\partial \phi_0}{\partial a_0} / \frac{\partial \phi_0}{\partial b}$. Notably, the higher the liquidity effect compared to total effect the higher the welfare gain of an increase in benefits.

¹⁵This problem is exactly the one derived in Chetty (2008) and this part follows closely that paper.

A.1.2 Extension of UI benefit

We now turn to analyze the effect of an extension in UI. We consider increasing the value e , which are benefits paid from period B for E consecutive periods. Consider that

$$\frac{dJ_0}{de} = (1 - \phi_0) \left[\frac{\partial U_0}{\partial e} - \frac{\partial U_0}{\partial w} \frac{d\tau}{de} \right] - \phi_0 \frac{\partial V_0}{\partial w} \frac{d\tau}{de}$$

Again, $\frac{\partial \phi_0}{\partial e} = -\frac{1}{\psi''} \frac{\partial U_0}{\partial e}$. Additionally, $\frac{dJ_0}{dw} = (1 - \phi_0) \frac{\partial U_0}{\partial w} + \phi_0 \frac{\partial V_0}{\partial w} = (T - D) v'(c_e)$, and $\frac{\partial \phi_0}{\partial w} = \frac{1}{\psi''(\phi_0)} \frac{1}{(1 - \phi_0)} [Dv'(c_e)]$.

On the other hand, increasing e in \$1 has a direct effect in τ of $\frac{p_{0,B} D_E}{T - D}$, but also affects both D, D_B . Thus, $\tau' = \frac{D_B}{T - D} \left(p_{0,B} \frac{D_E}{D_B} + \frac{T}{T - D} \eta_{D,e} b \right)$, where we use the assumption that $\eta_{D_B,e} = \eta_{D,e}$. Thus,

$$\frac{dW}{de} = \frac{dJ_0}{de} / \frac{dJ_0}{dw} = -\frac{D}{T - D} \frac{\frac{\partial \phi_0}{\partial e}}{\frac{\partial \phi_0}{\partial w}} - \frac{D_B}{T - D} \left(p_{0,B} \frac{D_E}{D_B} + \frac{T}{T - D} \eta_{D,e} b \right),$$

where we use $\frac{\partial \phi_0}{\partial w} = \frac{1}{\psi''(\phi_0)} \frac{1}{(1 - \phi_0)} [Dv'(c_e)]$. Furthermore, $\frac{\partial \phi_0}{\partial w_E} = \frac{1}{\psi''} \frac{1}{1 - \phi_0} [p_{0,B} D_E v'(c_e)] = \frac{p_{0,B} D_E}{D} \frac{\partial s_0}{\partial w}$. Additionally, we use the equivalence $\frac{\partial \phi_0}{\partial e} = \frac{\partial \phi_0}{\partial a_E} - \frac{\partial \phi_0}{\partial w_E}$, and assume that $p_{0,B} E \frac{\partial \phi_0}{\partial a_0} = \frac{\partial \phi_0}{\partial a_B}$ to get

$$\frac{dW}{de} = \frac{D}{T - D} \frac{p_{0,B} D_E}{D} \left(\frac{-p_{0,B} E \frac{\partial \phi_0}{\partial a_0}}{p_{0,B} E \frac{\partial \phi_0}{\partial a_0} - \frac{\partial \phi_0}{\partial e}} - \frac{D_B}{p_{0,B} D_E} \frac{T}{T - D} \eta_{D,e} b \right).$$

By using the approximations $u = D/T$, defining $L_E = p_{0,B} E \frac{\partial \phi_0}{\partial a_0} / \frac{\partial \phi_0}{\partial e}$, and assuming that $\eta_{D,e} = -\eta_{\phi,e}$, we have that

$$\frac{dW}{de} = \frac{u}{1 - u} \frac{p_{0,B} D_E}{D} \left(\frac{L_E}{1 - L_E} + \frac{b D_B}{p_{0,B} D_E} \frac{\eta_{\phi,e}}{1 - u} \right).$$

Finally, we use the elasticities to get $L_E = \frac{p_{0,B} E \frac{\phi_0}{S} \frac{\partial \phi_0}{\partial a_0}}{\frac{\phi_0}{\partial_0} \frac{\partial \phi_0}{\partial e}} = \frac{p_{0,B} E \varepsilon_{\phi,S}}{S \eta_{\phi,e}}$. Additionally, our estimate on UI extension is equivalent to $\frac{\partial \phi}{\partial e} \frac{de}{\phi} = b_B \eta_{\phi,e}$. Thus, we calibrate the formula using

$$\begin{aligned} \frac{dW}{de} &= \frac{u}{1 - u} \frac{p_{0,B} D_E}{D} \left(\frac{L_E}{1 - L_E} + \frac{b}{b_B} \frac{D_B}{p_{0,B} D_E} \frac{b_B \eta_{\phi,e}}{1 - u} \right), \\ L_E &= \frac{p_{0,B} b_B E}{S} \frac{\varepsilon_{\phi,S}}{b_B \eta_{\phi,e}}. \end{aligned}$$

A.2 Reservation wage

We now turn to analyze another type of setup in which the unemployed worker faces random wage offers. Any change in policies will affect not only unemployment duration but also mean

reemployment wages. In what follows we first derive the main formula in Shimer and Werning (2007) and we then extend the analysis to derive the welfare gains of changing UI duration.

Consider a risk averse worker that discounts the future at rate r and perceives utility from an increasing and concave function $u(c)$, where c represents the instant consumption flow. In each period, the worker can be employed, unemployed receiving UI benefits (eligible) or with no transfer. An eligible unemployed worker receives an UI transfer of b units of consumption per unit of time. The worker faces a probability γ of losing this benefit. As before, workers without a formal job have access to y units of consumption from informal labor income. At each instant the unemployed worker receives a wage offer from the cumulative distribution function F according to a Poisson arrival rate λ . The worker can choose to accept or reject the wage offer. A worker employed perceives w units of consumption per unit of time and pays taxes τ . We assume that the worker can be laid-off with an instant probability δ , in which case he becomes eligible unemployed. We assume that workers have financial assets, a , and have access to a riskless borrowing and lending market satisfying the standard no-Ponzi condition. At some point, for simplifying the derivation, we will also consider the case in which $a = 0$ for all periods, i.e. hand-to-mouth consumers.

The expected lifetime utility of a worker employed at a wage w and with assets a , denoted by $V(w, a)$, satisfies

$$rV(w, a) = \max_c \left(u(c) + \frac{\partial V(w, a)}{\partial a} (ra + w - \tau - c) \right) + \delta [U(a) - V(w, a)] \quad (\text{A.2})$$

where $U(a)$ is the lifetime utility of an unemployed worker with assets a . This last value satisfies

$$rU(a) = \max_c \{ (u(c) + U'(a)(ra + b + y - c)) + \lambda \int \max \{ V(w, a) - U(a), 0 \} dF(w) + \gamma [S(a) - U(a)] \}. \quad (\text{A.3})$$

where U' denotes the derivative of the value function with respect to assets and where S is the lifetime utility of an unemployed after UI exhaustion, which satisfies

$$rS(a) = \max_c \{ (u(c) + S'(a)(ra + y - c)) + \lambda \int \max \{ V(w, a) - S(a), 0 \} dF(w) \}. \quad (\text{A.4})$$

The first parenthesis of right hand side of these equations represents the intertemporal consumption problem of the worker. The second term in (A.3) and (A.4) describes the gain associated to the arrival of a wage offer, that will be accepted only when the new job is better than being unemployed. Finally, the last term in equation (A.2) measures the loss associated to layoff, and the last term of equation (A.4) stands for the utility losses of UI exhaustion.

The problem for the worker is to set consumption and a reservation wage, w^* . The consumption

decision is governed by an Euler equation. The reservation wage is the solution to

$$V(w^*, a) = U(a). \quad (\text{A.5})$$

Finally, it is convenient to define $\phi = \lambda [1 - F(w^*)]$ as the finding rate and

$$\bar{w} = \int_{w^*} w dF(w) \quad (\text{A.6})$$

as the mean reemployment wage.

A.2.1 Planner's problem

The problem of the government is to set the UI policy and taxes so as to maximize the welfare of the unemployed, satisfying the resource constraint. We restrict the analysis to constant benefit policies under limited duration (such as the one described above). Also, we consider the case of hand-to-mouth agents in which the problem is recursive and reservation wages (and thus ϕ_u and ϕ_s) are constant. Alternatively, as shown by Shimer and Werning, assuming CARA preferences also translates in constant finding rates.

Under an actuarially fair policy the government budget constraint is

$$\begin{aligned} rC &= b + \phi_u (C_e - C) + \gamma [C_s - C] \\ rC_e &= -\tau + \delta [C - C_e] \\ rC_s &= \phi_s [C_e - C_s] \end{aligned}$$

where C , C_s and C_e are the net present value of the cost of providing the policy for newly unemployed, non-eligible unemployed and employed workers, respectively. An actuarially fair policy implies $C = 0$, so that

$$b = \phi_u \frac{\tau}{r + \delta} + \frac{\gamma \phi_s}{r + \phi_s} \frac{\tau}{r + \delta}. \quad (\text{A.7})$$

In the limit as r converges to zero this expression becomes

$$b = \tau \frac{\phi_u + \gamma}{\delta}. \quad (\text{A.8})$$

If we additionally assume that finding rates are constant and compute steady state unemployment rates we find that this condition is equivalent to $ub = l\tau$, where u is the proportion of eligible unemployed workers and l is the proportion of employed workers.¹⁶

The problem of the government that aims to provide unemployment insurance for a worker of asset a consists of maximizing $U(a)$, under the budget constraint (A.7) and incentive compatibility constraint defined by equation (A.5).

¹⁶To see this, consider the law of motion of the proportion of the unemployed workers, $\dot{u} = \delta l - \phi_u u - \gamma u$. In steady state, $\dot{u} = 0$ and $\delta l = (\phi_u + \gamma) u$.

A.2.2 Optimal UI level

We will first concentrate on the case in which there is no limit in eligibility, $\gamma = 0$. For ease of the exposition, we will concentrate on the hand-to-mouth workers case (assets are zero for all periods), but the main features of the derivation applies to workers that have access to financial markets as in Shimer and Werning. Reservation wage policy, equation (A.5), implies that:

$$rU(0) = u(w^* - \tau), \quad (\text{A.9})$$

so that the problem of the government is equivalent to maximize after tax reservation wages, $w^* - \tau$. The main intuition is that the net reservation wage is a monetary counterpart of the utility of the unemployed. The first order condition for the planner's problem is then

$$\frac{\partial w^*}{\partial b} + \frac{\partial w^*}{\partial \tau} \tau' = \tau'.$$

To analyze the change in taxes, we consider the budget constraint specified in equation (A.7). Additionally, we follow Shimer and Werning in assuming CARA utility, to get $\frac{\partial w^*}{\partial b} = \frac{\partial w^*}{\partial \tau}$ and thus $\frac{\partial \phi}{\partial b} = \frac{\partial \phi}{\partial \tau}$. In such a case, $\tau' = \frac{\frac{r+\delta}{\phi} - \frac{r+\delta}{\phi} \varepsilon_{\phi,b}}{1 + \frac{r+\delta}{\phi} \varepsilon_{\phi,b}}$. To simplify the formula we focus on the limit as r converges to zero to get $\tau' = \frac{\frac{u}{1-u}(1-\varepsilon_{\phi,b})}{1 + \frac{u}{1-u} \varepsilon_{\phi,b}}$. Thus, we have that optimal UI in this context should satisfy

$$\frac{\partial w^*}{\partial b} = (1 - \varepsilon_{\phi,b}) u$$

A.2.3 Optimal duration of UI provision

We will now extend the analysis to consider the problem of a limited duration in UI. In this case, the planner should define the level of benefits (b) and the probability at which the benefits are exhausted (γ). For analyzing this problem we will consider a rise in b complemented by an increase in γ to balance government's budget (leaving taxes constant). The problem of the planner as maximizing the net reservation wage, $w^* - \tau$, subject to (A.7). The first order condition is

$$\frac{\partial w^*}{\partial b} + \frac{\partial w^*}{\partial \gamma} \gamma' = 0.$$

Differentiating the budget constraint and assuming that $r \rightarrow 0$, we get $\gamma' = \delta/\tau (1 - \tau/\delta \frac{\partial \phi_u}{\partial b}) / (1 + \frac{\partial \phi_u}{\partial \gamma})$, which implies that whenever γ increases (the provision of UI is shortened), benefits should increase to balance the budget. Next, use (A.8) and the definition of elasticity $\varepsilon_{\phi,x} = \partial \ln \phi / \partial \ln x$ to get

$$\frac{\partial w^*}{\partial b} + \frac{\partial w^*}{\partial \gamma} \frac{1}{D_B b} \frac{1 - \varepsilon_{\phi_u,b} \frac{D_B}{D}}{1 + \varepsilon_{\phi_u,\gamma} \frac{B}{D}} = 0, \quad (\text{A.10})$$

where we use the approximations $D = \frac{1}{\phi_u}$, $B = \frac{1}{\gamma}$ and $D_B = \frac{1}{\phi_u + \gamma}$.

The first term of this equation evaluates the welfare losses of reducing UI duration (notice that

$\frac{\partial w^*}{\partial \gamma} < 0$); the second term evaluates the welfare gain of an increase in benefits that compensates the savings of shortening UI. If this equality is satisfied, then the balance between level and extension is optimized. If this equation is positive, the welfare would be increased with an increase in benefits compensated by a reduction in UI extension.

A.2.4 From reservation wages to mean wages

From our empirical analysis we observe realized accepted wages while reservation wages are unobservable. Concretely, we have estimates of $\frac{\partial \bar{w}}{\partial b}$ rather than $\frac{\partial w^*}{\partial b}$. How do these differ? Using the definition of mean reemployment wages in equation (A.6), we get that $\frac{\partial \bar{w}}{\partial b} = \frac{\partial w^*}{\partial b} \frac{f(w^*)}{[1-F(w^*)]} [\bar{w} - w^*]$. Additionally, if we assume that w is normally distributed with mean μ and variance σ^2 , then $v_w \equiv Var[w|w \geq w^*] = \sigma^2 - \sigma \frac{f(\frac{w^*-\mu}{\sigma})}{1-F(\frac{w^*-\mu}{\sigma})} [\bar{w} - w^*]$. Given that $\frac{f(\frac{w^*-\mu}{\sigma})}{1-F(\frac{w^*-\mu}{\sigma})} \frac{1}{\sigma} = \frac{f(w^*)}{1-F(w^*)}$, this implies that $\frac{\partial w^*}{\partial b} = \frac{\partial \bar{w}}{\partial b} \frac{\sigma^2}{\sigma^2 - v_w}$. Notice that the ratio $\frac{\sigma^2 - v_w}{\sigma^2}$ is bounded between zero and one. In the particular case in which $w^* = \mu$, the rate equals the hazard of a normal distribution at the mode, $\simeq .6366$ (to see this just use the formula for the mean of a truncated normal). An analogous derivation can be used if w is log-normal: $\frac{\partial w^*}{\partial b} = \frac{\partial \log(w)}{\partial b} w^* \frac{\sigma^2}{\sigma^2 - v_w}$. Thus, the optimality of UI can be analyzed through

$$\varepsilon_{w,b} \frac{\bar{w}}{b} \frac{\sigma^2}{\sigma^2 - v_w} \rho - (1 - \varepsilon_{\phi,b}) u = 0, \quad (\text{A.11})$$

where $\varepsilon_{w,b}$ is the elasticity of wages with respect to benefit level, a behavioral response that we estimate, and where ρ varies from 1 with the assumption of normal distribution and $\frac{w^*}{\bar{w}}$ when wages are lognormal. Additionally, we assume that $\varepsilon_{D,b} = -\varepsilon_{\phi,b}$. We will estimate v_w and of σ , the variances of observed and offered wages, respectively, using Heckman selection models in reemployment wages.

Additionally, we use the same condition to rewrite (A.10)

$$\left(\varepsilon_{w,\gamma} B + \varepsilon_{w,b} D_B \frac{1 + \frac{\phi_u}{\gamma} \varepsilon_{\phi_u,\gamma}}{1 - \frac{\phi_u}{\phi_u + \gamma} \varepsilon_{\phi_u,b}} \right) \bar{w} \rho \frac{\sigma^2}{\sigma^2 - v_w} = 0,$$

where we use that $B = 1/\gamma$. Notice that, in this case, the wage offer distribution does not affect the sign of the welfare gain: if the term in the brackets is positive one can conclude that increasing benefits and reducing duration would be welfare improving.

B A brief description of databases

SIPA A main source for our work was the administrative databases from the Social Security (“Sistema Integrado Previsional Argentino”, SIPA). These are social security records of all firms-worker links at monthly basis. We used a particular version of SIPA database, which follows the jobs (worker in a firm) providing the level of wages for that job at monthly level. From this source we were able to construct a full working history of the workers, month by month, from January

1995 to December 2009. This allowed us to generate variables related to the jobs previous to UI, and to identify declared reemployment jobs.

Self employed The Self employed database has only an identification variable by month (from 1995 to 2009) which is 1 if the worker has declared himself as self-employed in that month and paid the contributions. This source is important for analyzing reemployment: if worker is observed as self-employed in any period after the beginning of UI, he is considered reemployed.

UI beneficiaries The UI Beneficiaries database (UBd) is used for administrative purposes. It has information of all the monthly UI transfers for each worker. It also records additional variables, such as pre-unemployment wages, age of the worker, gender, UI eligibility duration and others.

B.1 The Unemployment Duration database

Combining SIPA, self-employed database and UBd we construct our database. It consists of all the UI covered spells that began after layoffs between 2005 and 2007. We collected all the information of these workers in SIPA and Self-employed databases. We finally summarized the information including the relevant variables from previous jobs (pre-unemployment contributions, last job tenure, last job wages, industry and location) and from the re-employment job (wage, duration, industry and location). We also identified whether the worker reemploys as a self-employed. In that case, we only observe employment status and we do not use these observations for wage analysis.

In this way, we constructed the Unemployment Duration database that was used for duration analysis and impact evaluation of policies. Particular variables are described below.

cuil Identification number of the worker

spell Number of UI spell

ntransfer Number of UI transfer of each spell (months in UI)

period Year and month of the UI transfer

age Age of the worker at the moment of the beginning of UI

gender Gender of the worker

type Whether the worker is a permanent worker or a construction worker

spouse Whether the worker has a spouse

children Number of children of the worker

payment Type of payment (in particular if it is regular payment or the lump sum transfer)

totaltransfers Entitlement of UI duration (number of transfers that the worker is entitled to receive)

maxWage Wage used to compute the UI transfer (best wage of the last 6 months previous to UI)

basictransfer Amount of basic UI transfer

family Amount of family allowances

totaltransfer Amount of total UI transfer

contributions Number of contributions in the three years previous to layoff

tenure Tenure in the last job

tenure_cens Whether tenure is censored

meanWage Mean of wages in the last six months previous to layoff (from SIPA)

maxWage Max of wages in the last six months previous to layoff (from SIPA)

lastWage Wage at the moment of layoff

lastCUIT Last job firm identification number

begining_lastjob Period of the beginning of the last job

end_lastjob Identification number of the worker

location Location of the last job

size Size of the firm of the last job

industry Industry of the firm of the last job

layoff Layoff period

beg_self Period of the first declaration as self-employed after UI

contr_self Number of contributions in the first year of reemployment job as wage earner

beg_wage Period of the first declaration as wage earner after UI

firstWage First wage of reemployment job as wage earner

mean1yearWage Mean of wage in the first year of reemployment job as wage earner

location_reemployment Location of reemployment job

size_reemployment Size of the firm of reemployment job

industry_reemployment Industry of the firm of reemployment job

imputedSP Imputation of severance pay

FirstReemployment Period of the first reemployment job (both as wage earner or self-employed)

C Parameters for calibration

In this section we will describe how we compute the parameters of Table 11.

Finding rate, ϕ Computed through survival analysis applied to the unemployment durations in AUD.

Separation rate, δ Computed through separation rates from the “Encuesta de Indicadores Laborales”, a survey to firms hirings and separations.

Unemployment rate, u Computed through finding and separation rates, as the steady state unemployment rate, $u = \delta/(\delta + \phi)$.

Benefit level, b Maximum level of benefit at 2006.

Benefit level at UI extension, b_B Level of benefit after B periods. It changes according to the exercise.

Unemployment benefits exhaustion probability, γ Computed as $\gamma = 1/B$, where B is UI eligibility.

Level of severance pay, b/S Severance pay is computed using SP rules over average worker (tenure, pre-unemployment wage).

Wage inequality, w^*/\hat{w} We approximate w^* as the unemployment income ($b + y$).

Duration of UI benefits, B Mean duration of UI benefits.

Expected duration of UI benefits, D_B We approximate this as $D_B = 1/(\phi + \gamma)$, where we compute ϕ as the mean finding rate in B periods.

Duration of UI benefits extension, E Number of months of UI extension, weighted by the proportion of workers considered in each exercise.

Expected duration of UI extension, D_E We approximate it as a weighted average of $1/(\phi_E + 1/E)$, where ϕ_E is the mean finding rate for the periods considered in E .

Survival up to B, $p_{0,B}$ Proportion of workers that exhaust UI at its ordinary duration.

Unemployment duration, D Computed as $1/\phi$.

C.1 Estimation of the variance of wage offers

The computation of Λ depends on the variance of wage offers and of re-employment wages. We use the Heckman selection model to compute these estimates. We first estimate the variance of the residuals of a regression of the log of wages on observables. Secondly, we compute a Heckman selection model that gives an estimate of σ once controlling for the same covariates. Finally, we compute Λ using these estimates.