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Abstract

Using micro-data from the Social Security Corporation (SSC), we analyze the dynamics of social security coverage in the Jordanian labor force. We characterize patterns of contribution densities, transition rates and duration and fit survival models for transitions. We compare patterns in the Jordanian SSC and in social security programs in three Latin American countries for which similar analysis has been conducted. We find comparatively low contribution densities and transition rates in Jordan, which is consistent with low coverage and low turnover rates.

\textbf{JEL Classification:} H55, J14, J26

\textbf{Keywords:} pensions, contribution history, density of contributions, transition rates, duration.

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Introduction

In most developing countries, pension programs currently cover only part of the working population (Alvaro Forteza et al., 2009b, Indermit Gill et al., 2003, Robert Holzmann and Richard Hinz, 2005, Rafael Rofman et al., 2008, Rafael Rofman and María Laura Oliveri, 2011). In many countries legal coverage is wide, but actual coverage is very limited: large swaths of the population remain apart from the system in practice. The other face of this coin is the extended informality prevalent in these countries.

Recent studies have shown that pension programs coverage is low not only because many individuals never contribute, but also because many others contribute only part of the time they are supposed to do so. Using panel datasets -usually administrative records of social security-, several analysts have shown that in some middle-income Latin American countries many workers tend to have frequent interruptions in their histories of contribution and exhibit considerable spells without contributions (Solange Berstein et al., 2006, Marisa Bucheli et al., 2010, Alvaro Forteza et al., 2011). The analysis of the transition flows in and out of pension programs has contributed to a better characterization and understanding of pension coverage in developing countries, with significant implications for policy design and implementation. Some recent reforms in Latin America, including the 2008 reforms in Chile and Uruguay, have been partially inspired by the findings emerging from this novel flow approach to pension coverage analysis.\(^3\)

In the present paper, we analyze the dynamics of old-age pension coverage in Jordan. Using administrative records from the Jordanian Social Security Corporation (SSC) that spans over thirty years, covering more than two million individuals, we compute

densities of contribution, transition rates and duration of the spells with and without contributions. We also fit duration models. Similar databases and methodologies have been used in Latin America so the results lend themselves for a comparative analysis. To the best of our knowledge, this is the first study of this sort in the Middle East.

We find that affiliates to the Social Security Corporation (SSC) contribute on average about one third of their working life. We do not find large differences between men and women. The densities of contribution in Jordan are considerably smaller than densities reported in the Latin American countries for which similar analysis have been conducted (Argentina, Chile and Uruguay). Like in Latin America, low coverage responds not only to individuals who never contribute to the system, but also to affiliates to social security contributing only part of the time. The rates of transition between contributing and not contributing are also much smaller in Jordan than in these three Latin American countries, save for relatively large spikes observed in Jordan at the normal retirement ages.\(^4\) These low transition rates indicate that turnover tends to be comparatively low in Jordan.

After this introduction, the paper continues as follows. In the next section, we present a brief description of the Jordanian pension program. In section three we describe the SSC database. In the following three sections, we present our computations of the densities of contribution, transition rates and duration of spells with and without contributions. We also present the results of a survival econometric model for the transition rates. The paper ends in section seven with a summary and conclusions. We discuss some issues regarding the database in appendix A and briefly introduce the survival models in appendix B.

**The Jordanian Social Security System**\(^5\)

The Jordanian social security system currently provides old-age, disability and survivors insurance, sickness insurance, maternity leave and unemployment insurance. As in most

\(^4\) These spikes, however, are not a peculiarity of Jordan reality, but something determined by data. While researchers in Latin America have focused on transitions conditional on not retiring, we could only compute unconditional transition rates in the case of Jordan because we had no information about retirement. See more on this below.

\(^5\) This section is to a large extent based on ISSA (2010).
countries, old-age, disability and survivors insurance is the main and oldest sub-group of programs. Nevertheless, by international standards, these are relatively young programs: the first law was passed in 1978 (ISSA, 2010). Maternity leave, unemployment insurance and health insurance for pensioners were initiated recently, as part of the social security reform law passed in 2010.

The Social Security Corporation (SSC) administers the main pension scheme. Until 1995, the SSC covered only private sector workers; civil servants and the military had independent schemes. In 1995 and 2003, reform laws were passed that closed the civil servants and military schemes to new entrants. From then on, new civil servants and military are covered by the SSC scheme, along with private sector workers. Jordan also has occupational plans and voluntary private pensions.

Legal coverage is wide, particularly so since 2010, when the self-employed and workers in agriculture were included in SSC. However, as in most developing countries, effective coverage is only partial. In the early 2000s, only about 30% of the labor force reported to household surveys that they were contributing to social security. This is low even by the regional standards (see Figure 1). Close to half of the employed population in Jordan were insured by the SSC in 2007.

Figure 1: Coverage of the Mandatory Pension System in Select Middle East and North African Countries.

6 The share of the labor force working in agriculture is nevertheless very small in Jordan (Robalino, 2005). The self-employed are covered on a voluntary basis (ISSA 2012).

7 These two figures are not directly comparable, for at least two reasons: (i) coverage of the labor force is different from coverage of the employed population; and (ii) data from social security administrations usually yield higher coverage rates than surveys (see Forteza, Alvaro; Leonardo Lucchetti and Montserrat Pallares-Miralles, 2009b. "Measuring the Coverage Gap," R. Holzmann, D. A. Robalino and N. Takayama, Closing the Coverage Gap. The Role of Social Pensions and Other Retirement Income Transfers. Washington DC: The World Bank, for a discussion on pros and cons of each data source). Coverage of the employed population was taken from the web site of the Social Security Corporation on May 2012. http://www.ssc.gov.jo.
The old-age, disability and survivors program administered by the SSC is currently a partially funded earnings related scheme. A professional body, the Social Security Investment Unit, administers the fund. However, because of the generosity of current rules, reserves are shrinking. In 2005, Robalino (2005) projected that reserves would be depleted by the middle of the next decade.

In the case of salaried workers, funding of the old-age pension system is done by employer and employee contributions. Employees contribute 5.5% of their monthly earnings while employers contribute 9% of the monthly payroll. Insured workers can also contribute for previous uncovered work periods. The 2010 law establishes a maximum wage to calculate contributions of 5 times the national average wage or 5,000 dinars per month (approximately USD 7,026, in June 2012). The self-employed and other voluntary contributors pay 14.5% of their monthly earnings between the minimum wage and five times the national average wage. The government finances any deficit the program may have.

Men aged 60 or women aged 55 with at least 15 years of coverage, including 7 years of paid contributions, can access a full old-age pension. An early pension can also be awarded to people over age 50, with at least 25 years of contributions for males and 22 years for females. Qualifying conditions for disability insurance include an assessment of incapacity to work and having at least 60 months of contributions with at least 36 consecutive months. Survivors benefits require 24 months of contributions, with at least 6 consecutive months.
The old-age monthly pension value corresponds to 2.5% of the insured's average monthly wage in the last 2 years before retirement multiplied by the number of years of paid contributions. There is a maximum of 75% of the average monthly earnings in the last 2 years. In the case of early retirement, pensions are reduced proportionally and based on the last 60 months of contributions and the person's age at application. It is also possible to work until age 65 and 60 (men and women respectively) so as to increase the value of the old-age pension or to meet the qualifying conditions. When not qualifying for an old-age pension at retirement age, a lump sum is paid based on the average annual earnings and the number of contribution years.

Disability insurance provides a basic pension of 50% of average monthly earnings in the last 36 months for the first 1,500 dinars (USD 2,108) of earnings, plus 30% for earnings above. The pension is incremented by 0.5% per year if the individual contributed between 60 and 119 months and 1% if the individual contributed at least 120 months. Similar parameters are used to compute benefits to survivors of active workers, but only the last year of contributions are used in the computation. Survivors of pensioners receive the full pension.

Pensions are indexed by inflation or by average wage growth, whichever is lower.

The old-age disability and survivors insurance program does not seem to provide the right incentives for individuals to contribute on a sustained basis. First, only the last two years of wages are used in the computation of pensions, generating strong incentives to underreporting during most of the working career and only raising contributions during the last two years. Second, replacement rates vary with the years of contribution and age of pension claim, but in a less than actuarially fair amount (David A. Robalino, 2005). Therefore, the program provides strong incentives to contribute as little and to retire as early as possible. These incentives enshrined in the benefit formula are compounded by generous qualifying conditions: the minimum age for pension claim is low by international standards, given the relatively high life expectancy of Jordanians, and the

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8 Robalino finds, for example, that “the SSC will pay a 25-year-old male who joins the system today and retires at age 55 an implicit real rate of return on contributions of 6 percent a year. The same individual retiring at age 65 will receive a 3.5 percent rate of return on contributions.”
requirement of having contributed only seven years to access an ordinary pension is very generous given the benefits that are promised. Minimum pensions are also high relative to average wages, in an international comparison (David A. Robalino, 2005). Minimum pensions further reduce incentives to contribute, since beneficiaries do not get higher pensions increasing contributions.\(^9\)

**The database**

We received three files from the SSC. The “Contributors main information table” contains some basic information about contributors, including the social security number, sex, nationality, and date of birth. The “Contributors Transactions table” contains the information about the monthly contribution status of individuals: the starting and stopping dates of each spell of contribution, the reason for stopping, and the firm number. The “Contributors salaries table” contains monthly salaries.

The database begins in March 1, 1980, and ends in April 1, 2010. There are 2,061,804 individuals (social security numbers) in the database.

We left out individuals born before 1930 or after 1980. At the older tail of the distribution, we observe a very irregular pattern of births that suggests important recording errors and/or a very incomplete process of registration with the SSC (Figure 2).\(^{10}\) At the younger tail, only few individuals are registered. The individuals registered at so young ages are not likely to adequately represent the whole cohort (see the appendix for an elaboration on this issue). Because of this, we decided to drop cohorts of individuals who were not yet 30 years old in 2010, when the window of observation ends.

**Figure 2: Distribution of the year of birth of the individuals in the SSC database**

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\(^9\) Worldwide social security systems reduce incentives for low income workers to contribute. It may be the cost that has to be paid to provide a social safety net in the context of asymmetric information (Diamond, 2005). However, the comparatively high level of minimum pensions in Jordan raises doubts on the adequacy of this benefit (Robalino, 2005).

\(^{10}\) There are, for example, about 50 thousand individuals whose recorded date of birth is 1,111 or before. There is also a large peak at cohort 1919 (Figure 2).
We only used data for the 1990-2010 period, for data gathered in the initial years of the system (1980-1989) look very incomplete. Having no information about the pattern of missing data, we decided to restrict our attention to a period in which records seem to be more complete. Therefore, we characterized the contribution patterns of cohorts born between 1930 and 1980 in the period spanning from 1990 to 2010.

About one quarter of the recorded social security numbers pertain to women (Table 1). The participation of women in the labor force is smaller. Therefore, the proportion of active workers who are enrolled to the SSC is higher among women than men. This gap has been reducing over the decades: women represent an increasing proportion of the labor force, but a stable proportion of those enrolled to the SSC.

### Table 1: Composition of the SSC database and of the labor force by gender

<table>
<thead>
<tr>
<th></th>
<th>Labor Force</th>
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<th>SSC</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>84</td>
<td>16</td>
<td>100</td>
<td>76</td>
<td>24</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>79</td>
<td>21</td>
<td>100</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>77</td>
<td>23</td>
<td>100</td>
<td>76</td>
<td>25</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990-2009</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>76</td>
<td>24</td>
<td>100</td>
<td></td>
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</tr>
</tbody>
</table>

Note: Labor force data is available up to 2009. The year 2010 in the SSC database spans from January to April.
Jordan population is young, compared to other countries in the Middle East (Robalino, 2005), and the population registered in the SSC is even younger than the general population. In 2005, the population aged between 60 and 75 years represented 14.0 percent of the population aged between 25 and 59 in Jordan. The same ratio for the population registered with the SSC was only 7.8 percent. Population pyramids confirm these patterns (Figure 3). Both the total population and the SSC population pyramids are wide at the bottom and narrow at the top of the age distribution, and this pattern is sharper within the population affiliated with the SSC, specially so among women.

11 The rather unusual age ranges used for these computations are dictated by data issues with the social security database discussed in the appendix. We are working with cohorts 1930 to 1980, so in 2005 we cover ages 25 to 75.
Figure 3: Population pyramids (ages 25-75, year 2005)

Panel A: Total population pyramid

Panel B: SSC population pyramid

Note: Thousands of individuals.

Source: Authors’ computations based on United States Census Bureau\(^\text{12}\) and SSC database.

About three quarters of total social security numbers in the SSC database belong to Jordanians. The other quarter is split among several nationalities.

**Densities of contribution**

The density of contributions is one of the most widely used indicators of contributions performance. It measures the proportion of months that a worker contributed over the potential months he could have contributed within a certain age range. The potential months of contribution are all the months within the age range in which the individual was observed alive in the Social Security database.

Analysts are usually interested in the density of contributions conditional on not being retired. This conditional-on-retirement density is equal to or larger than the unconditional density, for it does not include as potential months of contribution months after retirement. In the Jordanian database, we do not have information about retirement, so we only computed the unconditional density.\(^\text{13}\)

\(^{12}\) [http://www.census.gov/population/international/data/idb/region.php](http://www.census.gov/population/international/data/idb/region.php)

\(^{13}\) There is a variable in the SSC database indicating reasons to stop contributing, but retirement is not one of them.
We show in Table 2 the average densities of contribution of individuals aged between 20 and 60 by sex both in Jordan and, for comparison purposes, in Uruguay. While individuals registered with the Jordan’s SSC contribute about one third of the time, individuals registered with the Uruguayan social security administration (BPS) contribute close to two thirds of the potential months of contribution. These figures are not far from the social security coverage of the labor force as reported to household surveys: about 30% in the case of Jordan and 57% in the case of Uruguay, middle 2000s (David A. Robalino, 2005, Rafael Rofman and María Laura Oliveri, 2011).

Table 2: Average density of contribution

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Female</td>
<td>33.37</td>
<td>63.80</td>
</tr>
<tr>
<td>Male</td>
<td>34.17</td>
<td>63.96</td>
</tr>
<tr>
<td>Total</td>
<td>33.99</td>
<td>63.88</td>
</tr>
</tbody>
</table>

Note: Ages between 20 and 60

Source: Authors’ computations based on Jordan’s SSC and Uruguay’s BPS.

The age profiles of the contribution densities exhibit hump shaped patterns (Figure 4). Average densities rise steadily at early ages and reach a maximum of about 38 percent at 28-29 years of age. Between ages 29 and 55 densities remain close to 35 percent, start declining at 55 and exhibit a sharp drop at 60.

Figure 4: Average densities of contribution by age (in %)

The age profiles of contribution densities are similar for men and women, the main difference being the age at which densities drop (Figure 5). Not surprisingly, densities
of contribution fall at the ordinary retirement age, which is 55 and 60, women and men respectively.

Figure 5: Densities of contribution by age and gender (in %)

Source: Authors’ computations based on the SSC database

The age profiles of contribution densities seem to have changed markedly between the nineties and the two-thousands (Figure 6). Contribution densities are lower in the 1990s than in the 2000s at early ages and higher at more advanced ages. Densities peak at around 50 years of age in the 1990s and between 25 and 30 years of age in the 2000s. These figures seem to point out towards some strong cohort effects: individuals who are 45-55 years old and show comparatively low densities in the two-thousands are the same who were 35-45 and also showed comparatively lower densities in the nineties.
However, we cannot rule out that these remarkable changes in the age profiles of contribution densities are at least partially spurious. As we show in the appendix, such changes could be partially driven by a selection mechanism imposed by the procedure individuals are first registered in social security. Suppose individuals are registered when they make their first contribution. Young cohorts have comparatively fewer chances of entering the database and only individuals with relatively high propensity to contribute will be captured. Hence, densities of contribution among young individuals might look unduly high at the end of the window of observation. In turn, older cohorts
will only appear if they contributed when they were old, so at the beginning of the
window of observation, densities of contribution among mature individuals might look
unduly high. We tried to reduce these biases focusing on intermediate cohorts and years,
but we cannot be sure the problem was fully avoided.

So far, we focused on average densities by age. In Table 3 we present some information
about the distribution of densities at three specific ages in the SSC database (panel A)
and, for the sake of comparison, in the Uruguayan social security (panel B). The zero
medians reported in the second column mean that at least half of total observed
densities (by age and individual) at the indicated age are zero. This is in sharp contrast
with what we have seen in Latin America, where median densities are above mean
densities.

Table 3: Distribution of the densities of contribution by individual and age (in %). Jordan and
Uruguay.

<table>
<thead>
<tr>
<th>Age</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>11.3</td>
<td>0.0</td>
</tr>
<tr>
<td>35</td>
<td>37.5</td>
<td>0.0</td>
</tr>
<tr>
<td>50</td>
<td>35.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 3 also suggests that the distribution of contribution densities is bimodal with the
two modes at or close to the extremes. Between 59 and 85% of individuals aged 35 and
20 years, respectively, lie at the bottom quarter of the SSC distribution (forth column,
“d<25%”). The proportion of individuals at the following quarters is much smaller, but
there is a second peak at just 100%. Figure 7 also illustrates this pattern.
The bimodal distribution with the two modes at (or close to) the extreme of the range has also been reported in Latin American countries for which this analysis has been conducted (Alvaro Forteza et al., 2009a). But in the Jordanian case, the highest mode is with zero density, while in Latin America the highest mode is usually at 100.

**Transition rates**

A second indicator that has been used in the literature to characterize contribution patterns is the transition or hazard rates. The transition rate is the probability that an individual changes his contribution status in a certain period, for example within the next month. It can also be interpreted as a frequency: the proportion of individuals who change contribution status within a month. We computed transition rates as the proportion of months in which an individual may experience a transition that he actually experiences it. This is a descriptive, non-parametric computation of transition rates. We also fitted parametric survival models of transitions.

The age profiles of transition rates into and out of contribution show some distinctive patterns (Figure 8). Transition rates into contributing are low at early ages, increase in the early twenties, peak at 23 years and decrease from 26 on. This age profile suggests
that finding a formal job is relatively easier when individuals are in their mid twenties, and becomes increasingly difficult as individuals age. On the other hand, transition rates out of contributing are very high when individuals are in their early twenties and decline as they age. Hence, keeping a formal job seems to be more difficult at early ages and becomes less so as individuals age.

Figure 8: Monthly transition rates by age

![Graph showing transitions into and out of contributing by age](image)

Source: Authors’ computations based on the SSC databases.

Transition rates out of contributing exhibit spikes at 55 and 60 years of age, coinciding with social security retirement ages. These rates reach almost 12% per month at 55, among women, and almost 13% at 60, among men.\textsuperscript{14}

The patterns in Figure 8 are similar to the ones described in Latin America (Alvaro Forteza, Ignacio Apella, Eduardo Fajnzylber, Carlos O. Grushka, Ianina Rossi and Graciela Sanroman, 2009a). The spike at 60 in the transitions out of contributing in Jordan is much more pronounced than anything described before, though. But this is probably due to the fact that transitions out of contributing include in this case transitions into retirement, while in Latin American countries analysts have focused on transitions into a non-contributing state before retirement.\textsuperscript{15} Apart from that spike,

\textsuperscript{14} We did not include these peaks in Figure 8, because they would have obscured the age profiles of transition rates described above, without adding to the understanding of transitions before retirement.

\textsuperscript{15} In order to simulate contribution histories before retirement, analysts have usually focused on transition rates conditional on not retiring. In the case of Jordan, we estimated unconditional transition rates because we had no information about retirement.
transition rates into and out of contributing are smaller in Jordan than in the three Latin American countries for which similar analysis has been conducted (Argentina, Chile and Uruguay). As an example, we provide in Table 4 the average transition rates at several age ranges for Jordan and Uruguay. The turnover rate is therefore smaller in Jordan than in these Latin American countries.

Table 4: Average transition rates by age and gender. Jordan and Uruguay.

<table>
<thead>
<tr>
<th></th>
<th>Jordan</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Mean transition in</td>
<td>Mean transition out</td>
<td>Mean transition in</td>
</tr>
<tr>
<td>25-29</td>
<td>0.013</td>
<td>0.018</td>
<td>0.013</td>
</tr>
<tr>
<td>30-34</td>
<td>0.009</td>
<td>0.020</td>
<td>0.010</td>
</tr>
<tr>
<td>35-39</td>
<td>0.007</td>
<td>0.018</td>
<td>0.008</td>
</tr>
<tr>
<td>40-44</td>
<td>0.006</td>
<td>0.016</td>
<td>0.007</td>
</tr>
<tr>
<td>45-49</td>
<td>0.005</td>
<td>0.017</td>
<td>0.004</td>
</tr>
<tr>
<td>50-54</td>
<td>0.005</td>
<td>0.015</td>
<td>0.002</td>
</tr>
<tr>
<td>55-59</td>
<td>0.004</td>
<td>0.017</td>
<td>0.001</td>
</tr>
<tr>
<td>60-64</td>
<td>0.000</td>
<td>0.074</td>
<td>0.000</td>
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<tr>
<td></td>
<td>Uruguay</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Mean transition in</td>
<td>Mean transition out</td>
<td>Mean transition in</td>
</tr>
<tr>
<td>25-29</td>
<td>0.055</td>
<td>0.034</td>
<td>0.043</td>
</tr>
<tr>
<td>30-34</td>
<td>0.058</td>
<td>0.031</td>
<td>0.046</td>
</tr>
<tr>
<td>35-39</td>
<td>0.062</td>
<td>0.029</td>
<td>0.049</td>
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<tr>
<td>40-44</td>
<td>0.061</td>
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<td>0.029</td>
<td>0.051</td>
</tr>
<tr>
<td>50-54</td>
<td>0.059</td>
<td>0.029</td>
<td>0.051</td>
</tr>
<tr>
<td>55-59</td>
<td>0.058</td>
<td>0.030</td>
<td>0.052</td>
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<tr>
<td>60-64</td>
<td>0.057</td>
<td>0.033</td>
<td>0.049</td>
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</table>

Source: Authors’ computations based on Jordan’s SSC and Uruguayan’s BPS databases.

We also fitted survival models of transitions. The methodology is explained in the appendix. With the estimated models, we run Monte Carlo simulations of the contribution status within the sample and computed the percentage of correct predictions. The results in Table 6 indicate that the models do a good job at predicting the contribution patterns.

We summarize the results of the survival models in Table 5. As it is usually the case, duration in any state is a significant explanatory variable of the probability of making a transition. The probability of leaving a spell without contributions is lower the longer
the individual has been in that state. Finding a formal job turns increasingly challenging as individuals spend time out of the system. This finding is well in line with results reported for Latin American countries. More intriguing is the positive and highly significant coefficient for duration in the model for transitions out of contributing. According to this result, the longer individuals stay contributing, the higher the probability of quitting.

Table 5: Survival models for transitions between spells with and without contributions.

<table>
<thead>
<tr>
<th></th>
<th>Out of Contributing</th>
<th>Into Contributing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>0.166***</td>
<td>-0.124***</td>
</tr>
<tr>
<td></td>
<td>[0.039]</td>
<td>[0.025]</td>
</tr>
<tr>
<td>Age</td>
<td>0.246</td>
<td>3.970***</td>
</tr>
<tr>
<td></td>
<td>[1.137]</td>
<td>[0.997]</td>
</tr>
<tr>
<td>Age2</td>
<td>-1.583</td>
<td>-15.788***</td>
</tr>
<tr>
<td></td>
<td>[4.766]</td>
<td>[4.522]</td>
</tr>
<tr>
<td>Age3</td>
<td>0.346</td>
<td>2.746***</td>
</tr>
<tr>
<td></td>
<td>[0.871]</td>
<td>[0.882]</td>
</tr>
<tr>
<td>Age4</td>
<td>-0.246</td>
<td>-1.787***</td>
</tr>
<tr>
<td></td>
<td>[0.584]</td>
<td>[0.626]</td>
</tr>
<tr>
<td>Dummy age a/</td>
<td>0.405*</td>
<td>-0.170*</td>
</tr>
<tr>
<td></td>
<td>[0.213]</td>
<td>[0.099]</td>
</tr>
<tr>
<td>Salary (mean)</td>
<td>-0.001**</td>
<td>-0.001***</td>
</tr>
<tr>
<td></td>
<td>[0.000]</td>
<td>[0.000]</td>
</tr>
<tr>
<td>Propensity to contribute b/</td>
<td>-3.653***</td>
<td>3.253***</td>
</tr>
<tr>
<td></td>
<td>[0.170]</td>
<td>[0.126]</td>
</tr>
<tr>
<td>Jordanian</td>
<td>-0.974***</td>
<td>0.860***</td>
</tr>
<tr>
<td></td>
<td>[0.084]</td>
<td>[0.072]</td>
</tr>
<tr>
<td>Male</td>
<td>-0.166**</td>
<td>0.363***</td>
</tr>
<tr>
<td></td>
<td>[0.073]</td>
<td>[0.070]</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>-0.274***</td>
<td>-0.088***</td>
</tr>
<tr>
<td></td>
<td>[0.024]</td>
<td>[0.017]</td>
</tr>
<tr>
<td>Constant</td>
<td>0.486</td>
<td>-39.716***</td>
</tr>
<tr>
<td></td>
<td>[9.968]</td>
<td>[7.980]</td>
</tr>
<tr>
<td>Observations</td>
<td>66605</td>
<td>122771</td>
</tr>
<tr>
<td>Number of individuals</td>
<td>833</td>
<td>958</td>
</tr>
</tbody>
</table>

Standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

a/ Dummy age = 1 if 18<=age<=23 or 31<=age<=35, in the models for transitions out and into contributing, respectively; = 0 otherwise.

b/ Propensity to contribute is the estimated individual effect in a linear probability model for the density of contributions.
Table 6: Percentage of correct predictions of the survival models (within sample)

<table>
<thead>
<tr>
<th>Predicted status</th>
<th>Actual status</th>
<th>Contributes</th>
<th>Does not contribute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>87</td>
<td>29</td>
</tr>
<tr>
<td>Contributes</td>
<td>13</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The average wage is also a significant explanatory variable for transitions: individuals with higher wages have on average fewer transitions.

The “propensity to contribute” is the computed individual effects in a linear probability model for the density of contributions. It is meant to proxy a series of individual characteristics that we could not capture with the explanatory variables. As expected, this regressor is highly significant and with opposite sign in both models. The higher the “propensity to contribute” the higher is the probability that the individual leaves a spell without contributions and the lower the probability that the individual leaves a spell with contributions.

Nationals and men have higher probability of making transitions into contributing and lower probability of transiting out of contributing than workers from other nationalities and women.

Unemployment also impacts on transitions: periods of high unemployment seem to be periods with lower probability of making a transition. According to this result, turnover rates are lower in periods of high unemployment.

**Duration of spells**

A third set of indicators of contribution status that has been used in the literature is the distribution of the duration of the spells with and without contributions. It should be noticed that these distributions are sensitive to the duration of the window of observation, since no observed spell can last longer than the window of observation. Therefore, we cannot analyze long durations and we should be particularly cautious...
when analyzing average durations in these databases. Median durations and the proportion of spells lasting less than some given (not too long relative to the window span) thresholds are more robust. The sample of the SSC database we worked with lasts 243 months.

On average, the spells with contributions last 23 months and the spells without contributions last 44 months in this database (Table 7). Median durations are also shorter in the contributing than in the non-contributing state: the median spell with contributions lasts 11 months and the median spell without contributions lasts 23 months. The proportion of spells with long durations is much higher in the non-contributing than in the contributing state. Therefore, by any of these indicators, spells with contributions are considerably shorter than spells without contributions in the case of Jordan. This pattern contrasts with the patterns found in some Latin American countries, where spells with contributions tend to last almost the same (Argentina) if not more (Chile and Uruguay) than the spells without contributions (Alvaro Forteza, Ignacio Apella, Eduardo Fajnzylber, Carlos O. Grushka, Ianina Rossi and Graciela Sanroman, 2011).

Table 7: Duration of the spells with and without contributions in the SSC database

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean (months)</th>
<th>Median (months)</th>
<th>&lt; 6 Months</th>
<th>6-12 Months</th>
<th>12-24 Months</th>
<th>24-36 Months</th>
<th>&gt;36 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spells with contributions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>11</td>
<td>26</td>
<td>25</td>
<td>20</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>Men</td>
<td>22</td>
<td>11</td>
<td>28</td>
<td>23</td>
<td>21</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Women</td>
<td>24</td>
<td>11</td>
<td>19</td>
<td>33</td>
<td>16</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td><strong>Spells without contributions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>23</td>
<td>25</td>
<td>12</td>
<td>13</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td>Men</td>
<td>43</td>
<td>22</td>
<td>25</td>
<td>14</td>
<td>13</td>
<td>9</td>
<td>40</td>
</tr>
<tr>
<td>Women</td>
<td>47</td>
<td>29</td>
<td>27</td>
<td>8</td>
<td>11</td>
<td>9</td>
<td>45</td>
</tr>
</tbody>
</table>

Note: The sample window is 243 months. Only spells within the observation window were computed. Source: Authors’ computations based on the SSC database.

Average duration is slightly larger among women than men.

Censored spells are not considered for these computations, since in those cases we only know the lower bound of the spell. So we provide estimations of the distribution of the spells conditional on not being censored.
For the sake of comparison, we reproduce in Table 8 the results of a similar analysis performed for Chile. On average, the spells with contributions last more and the spells without contributions last less in Chile than in Jordan. Median durations are considerably smaller in Chile than in Jordan and the proportion of short spells is much higher in the Chilean than in the Jordanian database.

Table 8: Duration of the spells with and without contributions in the Chilean social security database

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean (months)</th>
<th>Median (months)</th>
<th>Percentage of Spells in Sample with Durations...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 6 Months</td>
<td>6-12 Months</td>
<td>12-24 Months</td>
</tr>
<tr>
<td>Spells with contributions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>28.3</td>
<td>7.0</td>
<td>42.6</td>
</tr>
<tr>
<td>Men</td>
<td>28.4</td>
<td>8.0</td>
<td>42.0</td>
</tr>
<tr>
<td>Women</td>
<td>28.0</td>
<td>7.0</td>
<td>43.7</td>
</tr>
<tr>
<td>Spells without contributions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22.7</td>
<td>8.0</td>
<td>36.8</td>
</tr>
<tr>
<td>Men</td>
<td>17.8</td>
<td>7.0</td>
<td>40.8</td>
</tr>
<tr>
<td>Women</td>
<td>30.6</td>
<td>11.0</td>
<td>30.4</td>
</tr>
</tbody>
</table>

Note: The sample window is 288 months, beginning in 1981 and ending in 2006. Only spells within the observation window were computed.

Source: (Alvaro Forteza, Ignacio Apella, Eduardo Fajnzylber, Carlos O. Grushka, Ianina Rossi and Graciela Sanroman, 2009a)

Summary and conclusions

Affiliates to Jordan’s Social Security Corporation contribute on average about one third of their working life. There are no large differences between men and women on average. The age profile of the contribution densities is also similar between sexes, save for the sharp drop observed at 55 among women and at 60 among men, which coincide with the normal retirement ages. The densities in the SSC are considerably smaller than densities reported in the Latin American countries for which similar analysis have been conducted (Argentina, Chile and Uruguay).

Transition rates in Jordan’s SSC are low compared to the above mentioned Latin American countries, indicating that turnover is on average lower in Jordan. The age patterns of transition rates have the usual shapes. Transitions into contributing are low

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17 Forteza, Alvaro; Ignacio Apella; Eduardo Fajnzylber; Carlos O. Grushka; Ianina Rossi and Graciela Sanroman. 2009a. “Work Histories and Pension Entitlements in Argentina, Chile and Uruguay," Social Protection Discussion Papers. Washington D.C.: The World Bank, present results for Argentina, Chile and Uruguay, but we focus on the Chilean case for this comparison because the Jordanian and Chilean databases span over a period of similar length (243 and 288 months, respectively), while the Argentinian and Uruguayan databases are much shorter.
at early ages and grow quickly to reach a peak already at 23 years of age and start declining gradually at 25-26. As expected, mature workers exhibit very low transition rates into contributing. In turn, transition rates out of contributing are high at early ages and decline steadily as individuals age.

We fitted some very simple survival models for the transitions. Even though the database does not contain some variables that are probably important to explain transition patterns –like education-, the models fitted the data quite well. We found that duration in the spell significantly impact on the probability of making a transition. As expected, the probability of leaving a spell without contributions decreases as individuals spend time not contributing. However, rather surprisingly, the probability of leaving a spell with contributions increases with duration in the spell. Higher salaries are associated with lower transition rates, i.e. with lower turnover rates. Individuals with higher propensity to contribute exhibit both lower probability of leaving a spell with contributions and higher probability of leaving a spell without contributions. Jordanians and men exhibit lower probabilities of leaving a spell with contributions and higher probabilities of leaving a spell without contributions than foreigners and women, respectively.

The findings in this paper show that low coverage in Jordan is partly due to the fact that many individuals affiliated to the SSC contribute only part of their working life. So, like in other developing countries, low coverage in Jordan is not just a problem associated with permanent exclusion from social security. At the same time, transition rates in Jordan seem to be lower than in the Latin American countries for which we have similar analysis (Argentina, Chile and Uruguay). Our findings do not seem to support a dualistic view of labor markets in Jordan, but the comparatively low transition rates found among affiliates to the SSC suggest that Jordan is closer to that paradigm than the above mentioned middle-income Latin American countries.
APPENDIX A: Data handling

As indicated in the body of the text, because of some apparent “anomalies” in the work history records database, we limited our analysis to cohorts 1930 to 1980. In this appendix, we explain in more detail how we handled data to solve these and related problems.

Missing individuals

We drew population pyramids for different years, basically to check the data and to see whether there has been any significant trend that might impact on our indicators of contribution behavior. We found something that looked like an aging process. However, this aging process might be more apparent than real, caused by the way individuals are registered in the SSC database. Suppose individuals are registered only when they are adults, for example, when they turn 18. If so, it would not be possible to see children at the end of the window of observation: those who are children at that moment are not registered and those who are registered are no longer children. In 2010 we would see no one below 18. A pyramid truncated at this age would be more useful in this case.

We also drew the age-profiles of the densities of contribution in different years. We observed an apparent increase in the densities of contribution of young workers and a decrease of the densities of contribution of old workers registered in the database. These changes might be indicating some strong cohort effects, but it may also be the result of a selection process. Social Security administrations register individuals when they first get in touch with them, either because they start contributing or receiving a benefit. Different individuals enter the social security database at different ages, depending on their life circumstances. Individuals who enter later in life will be underrepresented in the last years of the window of observation. If becoming a contributor is the main reason to entering the database, young individuals registered in the database to the end of the window of observation will necessarily be contributing at these early ages. Therefore, densities of contribution among young individuals will tend to be higher to
the end of the window of observation than in previous periods. This is precisely what
we saw when we analyzed the age profiles of the densities of contribution by decade.

The SSC database begins in 1980 and finishes in 2010. Suppose that, to be registered in
the SSC database, an individual must have contributed at least once. If this is the case,
individuals who were close to retirement in the 80s must have been contributing in
those years to be recorded in the SSC database, for in the following decades they would
already be retired. Therefore, densities of contribution among mature workers would
look unduly high in the 80s. This effect would not be present in the 2000s for those who
are mature by the end of the window of observation had the opportunity to show up
when they were younger. Densities of contribution among mature workers would
therefore be lower in the 2000s. We also observed this pattern.

A simple example that exhibits these features is as follows. Consider a two-period-
overlapping-generations environment. Assume there are four types of individuals: (i)
(1,0) meaning that this individual contributes in period 1 but not in period 2; (ii) (1,1),
contributes in both periods; (iii) (0,1); (iv) (0,0). These four types are equally numerous.
Individuals are registered in the database if they contribute at least once in a window of
observation that lasts two periods. Individuals of type (0,0) are never observed so they
are not registered in the database. In this example, we will be interested in densities or
probabilities of contribution of individuals registered in the database, so we will
disregard individuals who never contribute. The idea is to compute densities directly,
without taking care of the way individuals are registered in the database, and show that
densities of the young will be increasing, and densities of the mature individuals will be
decreasing. These trends must be totally spurious since cohorts are identical. Therefore,
this form of computing densities across time is biased.

A graphical representation may help to understand the example:
Periods 1 and 2 in the above figure represent the window of observation. Each row represents a type of individual. The first three rows represent individuals of the cohort born in period 0, the second three rows represent individuals born in period 1 and the last three represent individuals born in period 2.

a) The first and last individuals are never registered in the SS database.

b) Average densities by age are: \( d_Y = d_O = \frac{4}{5} \)

c) Densities by age and period are: \( d_{1Y} = \frac{2}{3} \); \( d_{2Y} = 1 \); \( d_{1O} = 1 \); \( d_{2O} = \frac{2}{3} \);

where \( d_{tY} \) and \( d_{tO} \) are the contribution densities of young and old individuals, respectively, in period \( t \in \{1,2\} \).

The increase in the densities of the young and decrease in the densities of the old is spurious in this example, since all cohorts are alike. These trends are artifacts stemming from the way individuals are registered.

The moral in this example is that we need to learn how individuals are registered in the SS database to use it properly. With this information, we can identify the most important biases in this specific database and try to correct them. A simple procedure we have used before, when individuals are registered when they first contribute, is to drop some cohorts. In the example above, that would mean dropping cohorts born in periods 0 and 2. Working only with cohort born in period 1 we would get the correct densities, i.e. \( \frac{2}{3} \).
Problems similar to the ones just described have been extensively analyzed in the statistical literature on missing data (James R. Carpenter et al., 2006, Shaun R. Seaman and Ian R. White, 2011, Shaun Seaman and Ian White, 2008). However, we could not find a straightforward solution to the specific type of missing data we encounter. The usual methods proposed to avoid biases stemming from data that is missing not totally at random are (i) inverse probability weighting and (ii) multiple imputation. Both methods use information about individuals who have missing data to model the missing mechanism. Equipped with these models, individuals with relatively low probability of being observed receive an extra-weight in the estimation, if the first approach is chosen. The model is used to impute the missing data in the second approach. Unfortunately, we do not have this kind of information. We do not even know how many individuals are missing. Because of this, we decided to drop cohorts that are likely to face this problem to a larger extent.

In the case of the SSC database, we chose to work with cohorts 1930 to 1980. With this choice, the oldest individuals in the database were 50 years old in 1980, when the work history record keeping began, and the youngest individuals were 30 years old in 2010, which is the last year in the window of observation. Individuals in this range of cohorts had many opportunities to show up in the SSC database. At the younger tail of the distribution, only individuals who never contributed below age 30 would be missing. At the older tail, only individuals who never contributed after age 50 would be missing. With this choice of cohorts, we expect to have significantly reduced the bias stemming from the way individuals are registered in the social security database.

**Death**

The databases we received from the SSC do not have complete information about deceases. There is a variable called “WHYSTOP” that indicates why a spell of contribution comes to an end. “Death” is one of the codes of WHYSTOP. This information is partial, though, for it does not inform about deaths occurring when the individual is not contributing. This is an issue for it introduces a bias: contributing
individuals may die but individuals who are not contributing do not die in this database.
In order to reduce this source of error, we simulated deaths of the individuals in the
database using Jordanian gender specific mortality tables taken from the World Health
Organization (WHO 2008).

**APPENDIX B: The Survival Models**

Survival models are tools designed to analyze the time individuals are expected to stay
in a state. Alternatively, they can be seen as models of transitions, i.e. models of the
probability of switching between states. We specifically model transitions using the
complementary-log-log model, recommended by Jenkins (2005) for situations in which
time is intrinsically discrete, as it is our case. This model assumes proportional hazard
rates, meaning that, other things equal, hazard rates of different individuals maintain
their ratio as individuals spend time in the spell. The model looks as follows:

\[
\log(-\log(1 - h_i)) = x_i' \beta_i + \gamma_i + u_i
\]

(1)

Where \( h_i \) is the interval t hazard rate of individual i; \( x_i \) are the covariates; \( \gamma_i \) is the
cloglog transformation of the baseline hazard; \( \gamma_i = \log(-\log(1 - h_{0i})) \); and \( u_i \) is the
unobserved individual effect (“frailty”).

The contribution of individual i to the sample likelihood is:

\[
\Gamma(u_i) = \begin{cases} 
\prod_{t=1}^{T_i} (1 - h_i) & \text{if i makes no transition} \\
\frac{h_{ti}}{1 - h_{ti}} \prod_{t=1}^{T_i} (1 - h_i) & \text{if i makes a transition}
\end{cases}
\]

(2)

Let \( \gamma_i = 1 \) if individual i makes a transition in period t and 0 otherwise. Then, the
contribution of individual i to the sample likelihood can be written as:

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18 This section is based on the appendix in ibid..
19 See Jenkins, Stephen. 2005. “Survival Analysis,” University of Essex, 133. and van den Berg,
and E. Leamer, Handbook of Econometrics. for surveys of this literature.
Assuming that $u_i$ is normally distributed with zero mean and variance $\sigma_u^2$, the total likelihood is:

$$
\Gamma(u_i) = \left[ \frac{h_{ij}}{1-h_{ij}} \right]^{y_{ij}} \prod_{i=1}^{r} (1-h_{ii})
$$

(3)

This can be seen as a latent variable model where $y_{it} \in \{0,1\}$, with $y_{it}=1$ if and only if $e_{it} < x_{it}^{'} \beta + \gamma_i + u_i$, and $e_{it}$ is distributed according to the Gumbel$(0,1)$ distribution, i.e. its cumulative distribution function is $D(e) = 1 - \exp(-\exp(e))$. With these assumptions, the hazard rate can be expressed as:

$$
\Gamma = \int_{\mu - \sqrt{2\pi} \sigma_u}^{\mu + \sqrt{2\pi} \sigma_u} \Gamma(u_i) du_i
$$

(4)

We separately estimate duration models for contribution and non-contribution spells. This amounts to assuming that the two processes are independent, which is admittedly a strong assumption. Ideally, the distribution of random effects should be estimated jointly as in (Ann Huff Stevens, 1999).
References


Http://Www.Issa.Int/Observatory/Country-Profiles/Regions/Asia-and-the-Pacific/Jordan/Scheme-Description (Last Issa Update: 01 July 2010)."


