2005

Asynchronous Risk: Unemployment, Equity Markets, and Retirement Savings

Jason S. Seligman
University of Georgia

Jeffrey Brian Wenger
University of Georgia

Upjohn Institute Working Paper No. 05-114

Asynchronous Risk:
Unemployment, Equity Markets, and Retirement Savings

Jason S. Seligman
seligman@cviog.uga.edu
Carl Vinson Institute of Government
University of Georgia

Jeffrey B. Wenger
School of Public and International Affairs
University of Georgia

Upjohn Institute Working Paper no. 05-114

Abstract:
The link between unemployment and pension accumulations is conceptually straightforward; periods of unemployment lead to lower pension contributions, and thus to lower accumulations. However, impacts on accumulation may differ as a result of the timing and frequency of unemployment spells. We hypothesize that unemployment is more likely during periods in which the equities market experiences greater than average returns, largely due to a lead/lag structure of the stock and labor markets, respectively. This would imply that workers may systematically miss opportunities to purchase equities through DC plans when prices are relatively low. To test this hypothesis, we match historic stock returns to stochastically generated unemployment spells for men and women across the earnings distribution. We find lower income workers suffer greater percentage losses in retirement savings as a result of more frequent spells of unemployment. Higher income worker losses are more greatly affected by the timing of unemployment relative to the equities market.

Keywords:
Unemployment, retirement, savings, defined contribution, pensions, earnings distribution

Acknowledgements:
The authors would like to thank seminar participants at the RAND Corporation, University of Georgia, UC Santa Cruz, and UC Berkeley for their contributions to this work. In particular, Alan Auerbach, Carlos Dobkin, Michael Hurd, Nicole Maestas, Frank Neuhauser, James Smith, and Art Snow provided helpful comments. Jason Seligman's also acknowledges supported for this work from the W. E. Upjohn Institute for Employment Research.

1.0 Introduction

Currently, the United States is in the midst of an ongoing pension revolution. Workers' pension savings once predominantly collected in Defined Benefit (DB) pension programs are increasingly saved in Defined Contribution (DC) structures. For younger workers the DB plan has gone the way of the LP record. The ongoing pension revolution has gained a toehold on the nation's public pension system, Social Security. Interest in moving Social Security toward a DC framework continues with many analysts and elected officials arguing that a move of this sort may reduce the risk of Social Security insolvency.

The new private pension structures have some positive and remarkable qualities. They allow workers greater labor force mobility, they potentially reduce single firm risks, they allow explicit ownership of pension assets, and they allow better contouring of investment and bequest allocations to individual preferences. All of these opportunities for choice have the potential to empower workers. From the perspective of unemployment, DC plans protect workers from complete or partial pension loss that typically occurs when job-loss happens prior to full DB vesting. Many predict that these changes will positively affect national savings. Poterba, Venti, Wise (1995, 1996, 1998a, 1998b, 2001) have documented the shift toward DC plans, and their work suggests that net retirement savings increased. Samwick and Skinner, (1998, 2003) Compare DB and

DC plans directly and predict that most future workers will do better with the average DC plan[1] in their sample.

Along with these positive and remarkable changes come risks inherent in managing account balances during working years, and in retirement. Without proper management and diversification, these DC programs expose workers to increased longevity risk (Brown, 1999; Hurd, 1989), portfolio risk (Benartzi and Thaler, 2001), market timing risk (Burtless, 1998), and inflation risk, all of which have been discussed at length in the literature. These many risks inherent to DC plans are diametrically opposed to the benefits of social insurance offered by large, well-diversified, and adequately funded DB plans.

The impact of unemployment on DC pension accumulations has not been investigated previously. We ask whether, and to what extent, missed contributions and the related timing of investment decisions may reduce retirement savings. In order to save adequately for retirement, workers must develop accurate expectations about lifetime workforce absences. Indeed, evidence that equity and labor market performance are correlated suggests that workers who save through DC-type plans may systematically miss opportunities to purchase when prices are lowest. This in turn increases the probability that workers may systematically under-save for retirement.

[1] Samwick and Skinner, (1998, 2003) Compare DB and DC plans directly and simulate returns from a range of plans documented in the SCF. They find that most workers do better with the average DC plan. Because of the nature of their exercise however they do not include periodic unemployment in their simulations.

We consider how much one might expect to lose as a function of unemployment spells, contingent on worker characteristics. We also investigate the distribution of these losses to see whether workers might more or less easily anticipate losses. After all, if losses are small enough, or easy enough to predict, than precautionary savings may afford adequate protection, whereas if either the loss or the variance surrounding expected loss is too great, the opportunity to self-insure with precautionary savings is more limited.

In the following sections we discuss the literature related to labor market risk and retirement savings. However this literature is somewhat imperfectly related to our topic as it focuses on issues of portfolio management in the context of employment income risk. We then focus on the specific aspects of labor market risk and its implications for retirement savings under a system of DC accounts. Following the literature review, we discuss our data, method, results, and policy implications in the context of employer, and public pension systems.

2.0 Review of literature and theory

A number of researchers have highlighted a risk inherent in defined contribution plans: unanticipated shocks to labor income due to business cycle fluctuations. This risk arises when labor income is considered a non-tradable implicit asset[2] that is balanced with other explicit assets to achieve a household's optimal portfolio allocation (Campbell et al., 1999; Storesletten et al., 1998; Viceira, 1999). For instance, if labor income is

[2] The value of this asset can be thought of as (PV(E(Labor Income Stream|X)), where X represents a set of worker attributes.

riskless, then it is reasonable for a young household's portfolio to contain mainly risky assets (Bodie et al., 1991). If labor income is risky but unrelated to financial market risks, the portfolio allocation in risky assets is projected to be reduced (Viceira, 1999). If labor income is risky and correlated with financial market returns, households should be more likely to invest in less risky assets (Campbell et al., 1999).

The relationship between equity and labor market volatility is not well described in the business cycle literature. One class of models links the equity and labor markets to inventory shocks and/or measures of corporate profits. As the GDP growth rate declines, inventories begin accumulating. This accumulation signals to employers their need to reduce production, and with it demand for inputs. This begins the process by which firms let go of workers. When the rate of GDP growth accelerates, inventories decline; this sends the opposite signal to the firm. With increased demand firms begin purchasing more inputs, including labor. (Marshall, 1890), Elsewhere in the business cycle literature, authors have considered why labor markets may adjust less rapidly than the markets for other inputs. Unionization, firm-specific human capital, and high or uncertain search costs for replacement workers have all been cited as reducing flexibility in the labor market. (Freeman, Farber, Mortenson, Akerlof & Yellen, respectively). All of these describe why firms may hesitate to either let go of workers when times are bad, or to begin hiring when times are good. With either the inventory cycle, or the labor market frictions model, (or both), similar lead-lad structures between the equities and the labor market result.

Empirical consideration of the timing of equity and the labor market is not very prevalent in research to date. There are a few noteworthy exceptions however. Research by Domain and Louton (1995), estimate the relationship between US equity indices and the US unemployment rate. They find negative stock returns are followed by sharp increases in unemployment. Recoveries are followed by slower reductions in the unemployment rate; this leads to asymmetry in the onset and recovery of the labor market. Silvapulle and Silvapulle (1997) find additional evidence of these labor market and equities asymmetries. They find that negative stock returns have a more pronounced effect on the labor market than do positive returns.

The empirical relationship between stock market returns and the labor market has been accepted by those who track and forecast economic conditions. In general, an index of stock prices is considered a leading indicator. For example, both the Conference Board and the Bureau of Economic Analysis consider equities a leading indicator. Labor market indicators however are considered to be leading, coincident, or lagging indicators. For example, the Conference Board considers initial unemployment claims among its leading indicators, while the employment of non-agricultural workers is considered to be coincident, and the duration of unemployment to be a lagging indicator of economic conditions over the business cycle (Conference Board, 2004).

Previous research and theory make clear that financial and labor markets contain interrelated risks. However, the full effect of unemployment on savings remains unclear. From the paragraphs just above, equity markets can reasonably be considered a leading indicator of economic performance while labor markets may represent a lagging indicator. Thus ambiguity on the labor side makes the combined effect unclear a priori. The timing of unemployment may exacerbate or ameliorate shortfalls in retirement savings.

To illustrate the case where timing effects increase savings losses, consider a worker who invests her defined contribution pension exclusively in a broad based index fund comprising the S&P500 and loses her job shortly after equities decline in value. She has purchased expensive equities (relative to the drop) during her employment and during her unemployment spell cannot (does not have the resources to) purchase equities on the decline; opportunities for dollar-cost-averaging are somewhat muted for a worker in this situation. Figure 1 gives the reader a conceptual rendering of such a case. Alternative scenarios may be equally likely. For example, the effect of unemployment on such pension funds may be in part mitigated if spells of unemployment coincide with periods of below average investment performance. Thus workers' expected retirement income losses could be amplified via a loss of purchasing opportunities or mitigated with a serendipitous spell of unemployment.

Turnover, earnings and rollover

Workers who are displaced from their jobs have only a limited set of options: retire (exit the labor force) or seek re-employment. Those who remain in the labor force often have re-employment wages that are below their previous earnings. There is a large body of empirical work, including Baumol, Blinder and Wolff (2002), Farber (2003), and Schmitt (2004) that finds displaced workers typically experience real wage declines. Schmitt (2004) finds that 65.3 percent of workers who were displaced from full-time jobs and found new full-time jobs experienced real weekly earnings declines. Cases of downward mobility will exacerbate the difficulties in accumulating sufficient retirement savings.

Spells of unemployment reduce retirement contributions, reduce potential long term returns, and may lead to reductions in future earnings. For those who experience a downward spiral in labor market outcomes, tapping into retirement savings may be the only way to preserve a home or maintain a family. When considering rollover there are but two ways for balances to be affected, downward, or not at all. Several authors find that workers tend to reduce balances. In particular, (Burman, Coe and Gale, 2000) find that those with the smallest balances, younger, and lower earning workers are among the most likely to do so, in the face of tax penalties. For this paper we estimate wage mobility by quartile using CPS Displaced Worker surveys, from 1994 to 2004, in 2-year increments, as depicted in Appendix A. In our models, these transition probabilities are used to estimate switching quartiles after a spell of unemployment and represent wage mobility.

3.0 Data & Method

We examine the relationship between the probability of job loss and retirement savings and develop estimates of retirement savings based on simulations of the US economy.

Our simulations use monthly data from the Center for Research in Security Prices (CRSP) for the S&P 500 as a measure of investment returns, and data from the Current Population Survey for unemployment, earnings and demographics. The simulations hold constant, both the rates of return on investments and the underlying probability of unemployment, but allow exogenous shocks of varying sizes to impact the economy overall. Only when random shocks exceed underlying probabilities are specific worker-types laid off. We then calculate summary statistics for each simulated economy and record how each of up-to sixteen worker-types do in terms of retirement accumulation losses and effect of market timing. This exercise is iterated one hundred-thousand times, and we report the general trends which emerge.

In each period the worker's account grows or shrinks at a rate based on the total return of the S&P 500 (including dividends – which are assumed to be reinvested). Patterns of unemployment matter inasmuch as early spells lead to long periods of lost accumulation, and because stock returns are volatile.

Data

Throughout this paper we use two primary data sets: the Center for Research in Security Prices (CRSP) monthly data for the S&P500 returns including dividend reinvestment and the Current Population Survey – Outgoing Rotation Group (CPS-ORG) files. Both data sets cover the period from 1979 to 2002. We simulate worker savings in a defined contribution plan invested solely in a broad-based equity account (represented by the

S&P 500). Estimates of unemployment rates by wage quartiles and gender are calculated using the CPS-ORG files. All wages and returns are inflation adjusted using the Bureau of Economic Analysis' GDP Implicit Price Deflator to constant 2000 dollars.

CRSP data are monthly; we use end of month prices, as the basis for our calculations and include dividend returns. These data are accessible to researchers by agreement with the University of Pennsylvania.

The structure of the CPS data allows us to match individuals across years, effectively creating a one-year panel data sets (see Madrian and Lefgren 2000 for details on the matching of persons in CPS data). We measure unemployment as the one year hazard rate of the experienced unemployed. Only those who were initially employed and then became unemployed one year later are counted as unemployed in our sample. This allows us to examine not only the unemployment experience of these workers but also their earnings prior to a spell of unemployment. The CPS is the optimal data source for unemployment estimates since it forms the basis of the official unemployment rate estimates.

Workers are classified into quartiles based on their hourly wage rate prior to unemployment. Separate earnings quartiles are calculated for men and women. All quartiles have balanced age profiles, that is, one-fourth of each age group is classified in each quartile. (This prevents the lowest earnings quartile from being overweighted with young workers.) We then match each worker to their employment outcome in the following year and calculate the probability of being unemployed in each quartile for men and women. In this way, eight sets of monthly hazards are generated by the procedure for the period of January 1980 through December of 2002, yielding twenty-three years of data. Within this period there are two merges which are not possible 1984-85 and 1994-95 due to decennial changes in the CPS panel. For these periods (24 months) we impute a hazard rates using a series of labor market indicators such as the unemployment rate and employment-to-population ratios[3]. We also construct two age-earnings profiles for worker types ages 26-30 and 42-46 in 1980. We calculate these two age-earnings profiles for all sixteen worker types in our simulation model (four earnings quartiles, gender, cohort).

The other major component of income loss related to spells of unemployment is the duration of the spell. Clearly, short spells of unemployment are less costly for worker's retirement savings. We model unemployment duration based on period-specific duration distributions using published Bureau of Labor Statistics (BLS) data. The BLS classifies unemployment duration into four categories: four weeks or less, five to 15 weeks, 16 to 26 weeks, and 27 weeks or more. We re-classify unemployment duration in terms of discrete weekly segments by using a piecewise linear spline of the durations and percentages in each category.

[3] Imputation results are available from authors upon request.

To estimate the probability of switching quartiles after a spell of unemployment we use the CPS displaced worker surveys from 1994 through 2002. These surveys allow us to determine the pre and post displacement earnings of workers over this time period. We aggregate all the surveys and calculate a single transition matrix. The matrix estimates the probability of starting in a particular quartile and ending in another quartile after re-employment. As with the CPS-ORG data, the quartiles are age-adjusted. Appendix A provides the reader information on income quartile switching in these data.

Finally BEA's Implicit GDP data are quarterly. These data are made monthly with a linear deconstruction of changes between observations. In spite of the original data being quarterly, we chose the GDP deflator since we are interested in controlling for economy-wide changes in prices (both stock and labor markets are adjusted). The Consumer Price Index (CPI) or the Producer Price Index (PPI) is too narrowly constructed for our purposes.

In summary the CRSP, CPS-ORG and CPS-DWS, BLS and BEA data provide five measures for our analysis. CRSP data provide monthly prices for the S&P500 which form the basis of our retirement investments. The CPS-ORG files allow us to estimate gender and earnings-specific unemployment hazard rates while the CPS-DWS allows us to estimate the wage transition after a spell of unemployment. The BLS provides information about the distribution of unemployment durations and the BEA provides the implicit price deflator.

Method

Our method is to use the underlying unemployment rates, unemployment durations, and rates of worker mobility between earnings quartile to simulate different earnings and savings histories for workers by gender, and entering quartile of earnings, over the 1980-2002 period. We generate a series of stochastic economy-wide shocks which are then fitted to time specific sensitivities to these shocks (relative probabilities of job loss) by gender and current earnings quartile. Under these conditions all workers face the same macro-economy, but differing unemployment hazards and durations generate unique employment outcomes in the economy.

We take random draws from a uniform distribution to generate the unemployment outcome. Each month, a new draw is taken and compared to the representative worker's baseline unemployment hazard. If the random draw is observed to be below the group and time specific hazard the worker becomes unemployed. Results are calibrated by adjusting the range of the uniform distribution so that the average unemployment rate generated by our simulation approximates the average rate of unemployment for men and women over 20 from 1980-2002. Once a period of unemployed commences, a second draw is made to determine the duration of unemployment. Again, the assignment is based on the published distribution of unemployment durations so that in general drawing smaller numbers leads to faster exits; however the same draw generates longer durations in periods when documented durations are longer, and is less damaging when the opposite is true. The worker is re-employed when the period specified by the second draw is completed. Periods are described in months to allow integration with our wage and stock data. Durations in our simulation are both top coded to be less than or equal to 6 months (26 weeks), and bottom coded to be greater than or equal to 1 month (4 weeks)[4]. Due to the nature of our sample of unemployment hazards over this period, while generally workers in lower earnings quartiles may find themselves more quickly unemployed during downturns; higher quartile earners sometimes face higher unemployment hazards. Over the period studied, we find that men in the first (lowest) earnings quartile experience greater hazard that second quartile men 78 percent of the time, while for the third and forth quartile the numbers are 88, and 95 percent, respectively. For women the situation is similar, but with a more pronounced hierarchy; lowest quartile female earners experiencing higher hazard than their second, third, and forth quartile contemporaries 94, 97, and 100 percent of time, respectively.

While our model allows unemployment incidence to be a measured function of wage quartile and gender, we take the underlying duration distribution in each month as constant across all gender and earner groups. This is due to limitations of the BLS duration data, which are not broken down by wage quartile, or gender. To the extent that lower-earnings workers have shorter (but more frequent) spells of unemployment this assumptions may overstate the earnings losses for low income workers while potentially understating losses for higher income workers.

[4] On average, our duration estimates are likely to under-report retirement savings losses. From 1979-2002, 15 percent of unemployment experiences lasted in excess of 26 weeks. When switching directly between firms, workers often must wait a month or more to join pension plans, and sometimes face transaction costs in moving DC pension balances. The bottom coded unemployment period in part substitutes for these types of technical issues affecting overall accumulations.

At the end of each unemployment period we simulate a final lottery to determine the earnings quartile he or she will enter. Our transition probabilities determine the likelihood of landing in a particular earnings quartile for men and women separately. For example, men previously in the first earnings quartile have a 56 percent chance of staying in the first quartile, and a 44 percent chance of moving up. For those who move up, a move to the second quartile is most likely. Conversely, men who become unemployed while holding a fourth earnings quartile job has a 4% chance of taking a job in the first earnings quartile, and a 62% chance of staying in their current earnings quartile. Earnings mobility is assumed fixed across the entire period, transition probabilities are not allowed to change over time. (These are the average rates reported in Appendix A.) To the extent that upward mobility is reduced and downward mobility increased during recessions, this will tend to reduce our measure of timing effects for losses over the period studied.

Once reemployed, workers again contribute to their DC balances and reenter the lottery for unemployment. If by chance they become unemployed before earning their first monthly check, contributions from the employment spell are determined to be zero. The process continues in this way for the whole period of study. Results reported in either dollars or time are amplified to make the 23 year (276 month) period of study represent a 40 year career.

There is no explicit process for a worker to switch quartiles without unemployment, however. This limitation is, arguably, not consequential for two reasons: first, the net effect of quartile switching is to damp inter-quartile variation, and not to change central tendencies; second, quartiles are age-contoured allowing for real wage growth over the life-cycle. We do not model the effect of plant closures, retooling, or other temporary layoffs on pension accumulations, which arguably are more important for certain sub categories of workers. We do not model this because of limitations in our data (for example we do not know enough about worker subtype, and firm characteristics). To the extent that we fail to record losses of contribution that may result, these data will under report the impact of involuntary unemployment on DC pension holdings.

A single economy is defined by three series of economy wide stochastic draws for unemployment onset, duration, and quartile of rehire. To get a sense of the underlying patterns of losses one hundred-thousand of these economies are generated. For each economy 16 generic workers are created, a male and a female worker representing each quartile, and eight direct counterparts who experience the same number of months of unemployment, and the same overall quartile mobility, but for whom the unemployment periods are randomly distributed across time. This allows us to estimate the losses from unemployment that are due to the particular timing of the calibrated unemployment probabilities and historic pattern of stock returns. For each worker type, in each economy, we record the lifetime percent and dollar losses from unemployment against a counterfactual of full employment. We also record the time unemployed in percent and in absolute terms, that is in number of months. Finally we report the average monthly return from the S&P 500 over the periods in which the worker is unemployed. Comparing the average in-spell rate with the average monthly rate over the period as a whole allows one to observe whether returns are systematically higher during periods in which workers are unemployed.

We structure DC accounts as follows: we assume that there are no retirement savings account-related transaction costs of unemployment. Second, the employer pays the administrative costs of retirement savings program. Third, we assume that the unemployed do not withdraw from these accounts prematurely[5]. Forth and finally we assume that all workers invest the same percentage of their pay in the S&P500 with full reinvestment of dividends, regardless of age, and earnings quartile. With respect to the patterns of wages and contributions we assume that there is inter-quartile mobility which follows from the process of unemployment and reemployment as described above. We assume that once re-employed s/he earns the real median wage of his or her now current earnings quartile.

At the end of each simulation we compare the balances of workers' retirement savings with the retirement balance of a consistently employed worker with similar characteristics (earnings quartile pattern, basic age-earnings profile, and gender). The difference of savings and resulting accumulations is attributed to periods of unemployment. After simulating the twenty-three year economy 100,000 times we generate descriptive statistics for the universe of outcomes for each initial worker type.

---

[5] We thus assume either that workers finance consumption entirely from their unemployment benefit, or the existence of other precautionary savings, keeping balances in the DC accounts higher than they might be in actual job loss situations.

With this structure we are able to assess real market returns for periods in which workers are out of the labor force and to compare these to average returns across the entire observed period, thus we observe any "market timing effects" which might aggravate or reduce DC pension losses. Finally, we check the outcome of average unemployment rate across quartiles, and compare that to historic unemployment rates to make sure that our results do not stem from implausibly large, or small unemployment as observed after the simulation.

4.0 Results

In our first set of simulations we allow only the unemployment rate in each earnings quartile to vary. We assume that each worker, regardless of earnings quartile, saves $333 each month. While this assumption is not realistic, it allows us to isolate the effects of unemployment on retirement savings. Overall, saving $333 per month over 40 years and investing that sum in the S&P500 with reinvestment of dividends, yields a total retirement savings greater than that attained by lower income workers who save ten percent of their wages. Table 1 presents our estimates of the income and percentage losses associated with spells of unemployment.

For male workers in the lowest quartile of earnings, retirement losses resulting from spells of unemployment averaged $50,784 across our simulations. For men in the highest earnings quartile, these losses averaged $28,995. This implies, holding contributions constant, the lowest quartile of earners would experience retirement savings losses that are nearly 60 percent larger then their top quartile male counterparts. For women a similar picture emerges. Women's retirement income losses for the bottom earnings quartile averaged $45,715 while income losses in the top quartile averaged $19,085 – the smallest for any group. Perhaps even more interesting is the relationship between percentage losses of retirement savings and time spent unemployed. In every case, the percentage of retirement income lost exceeds the time spent unemployed. This is likely an artifact of the time period we analyze. Since unemployment was the highest in the early 1980s (early in these workers' careers) workers' lower initial savings were compounded over time. This result may be considerably different for workers who began employment and saving for retirement in the mid-1990s. Importantly, this illustrates that early patterns of unemployment create cohort savings effects in much the same way as long periods of below average equities returns creates replacement rate effects for retirees (Burtless, 1998).

Our second set of simulations allows for differential savings contributions based on earnings. We separate workers into two groups based on age: a young cohort aged 26 in 1980 and an older cohort aged 42 in 1980. As expected, allowing for differential contribution rates changes the totals lost by each earnings group considerably. Tables 2 and 3 show our results for the young and old cohort simulations. For the young cohort, retirement savings ranged from an average of $260,000 to $793,000 for the lowest- and highest-earnings quartiles of men. Women saved considerably less, owing to their lower wages and contributions; savings ranged from $196,000 to $600,000 for the lowest- and highest-earning female quartiles. Total losses averaged $17,878 older women, $35,752 for older men. Despite the changes in dollar losses due to the differential contribution amounts by quartile, the percentage losses by group remain relatively constant. An average, low earning men (young and old) still lose approximately 8 percent of income relative to a baseline of no unemployment.

The simulation results presented thus far are largely determined by the unemployment rate of each group. We calibrated the stochastic component of the simulation so that it would produce aggregate unemployment rates similar to the United States over the period of 1980 to 2002. In general, the men's and women's average unemployment rate in our simulation, (5.5 and 4.6 percent, respectively) are near the US averages of 4.8 for men and women over age 20 and 6.3 percent for men and women over age 16. In general, men in the lowest earnings quartile of our simulation spend 35.4 months unemployed, while men in the top quartile spend 19.6 months unemployed (table 4). Overall, women spend less time unemployed; in our simulations women in the lowest earning quartile spend an average of 31.8 months unemployed while women in the highest earning quartile average 13.4 months of unemployment.

The retirement income losses illustrated from Tables 1-3 are largely a result of the foregone contributions to retirement savings resulting from periods of unemployment. However, these losses are not solely the result of foregone contributions. As previously discussed part of these losses is due the *timing* of unemployment spells. To determine the size of the timing effect we generated a separate but otherwise identical set of 100,000 economies. In this alternate set of economies we require that the same number of months a person was unemployed be randomly distributed throughout the worker's lifetime. Thus we have a systematic set of losses (partly due to market timing) and a random set of losses (where the market timing effect has been randomized). By comparing the difference directly, we can isolate the timing effect. Table 4 presents these results.

Ex ante, it is unclear whether the market timing effect should be positive or negative. The timing effect could be negative if retirement losses were ameliorated with fortuitous spell-timing, or conversely, losses could be exacerbated by unfortunate spell timing. In general, we find that income losses are exacerbated by spell timing. However, we do find that for those with small losses due to unemployment (30^{th} percentile in the loss distribution) the timing effect ameliorated some of the unemployment loss. However, on average spell timing accounts for 9-12 percent of the total losses related to unemployment.

Table 4 shows the decomposition of the total loss in retirement savings. The timing column represents the difference between the systematic and random losses. All estimates are for the younger cohort of workers. A male worker in the first quartile is expected to lose $1,828 due to the unfortunate timing of his unemployment spells, while a fourth quartile male worker should expect to lose $3,584 in addition to his $31,974 in foregone contributions and associated returns. In general, timing losses represent, *on average*, a 10 percent added loss to the unemployment contribution loss. As we discuss later in the paper concentrating on the average loss masques the full distributional effect of income losses due to unemployment.

During the period covered by our data, 1980-2002, important changes in the demographics of the labor force occurred, especially changes in the labor force participation of women. From January 1979 to December 2002 the female labor force participation rate for women over 20 years old, increased from 50.1 percent to 60.6 percent. This large increase in the number of women working outside the home created many new economic opportunities for women. Table 5 illustrates the cohort effects of women in our sample. These new economic opportunities also created new retirement savings opportunities. In general, the younger women cohort earned more than the older women cohort and had more retirement savings as a result.

In every case women who were 26-30 years old in 1980 (young cohort) outperformed the older cohort, those 42-46 in 1980. Their unemployment experiences are identical (by construct) so we can attribute all of the differences to earnings. By contrast men in these cohorts experienced a decline in labor force participation during this time, from 80.1 to 75.9 percent participation from January 1979 to December 2002. We also see that the older cohort has considerably more retirement income than the younger cohort. In general, women have considerably less retirement income than men. The estimated gender ratio in retirement income by quartile is much higher for the younger cohort relative to the older cohort. However, despite this narrowing gap, younger women in our model accrue 73 cents for every dollar that men accrue in retirement savings – approximately equal to the unadjusted gender pay gap.

The effect of unemployment on retirement savings losses is inadequately described by the average. Since the losses are bounded by zero the loss distribution is right-skewed, the result of which is to raise the average relative to the median. While average losses are approximately 10 percent, median losses in retirement savings for first quartile men (women) is 5.6 (5.9) percent and for fourth quartile men (women) this loss is 4.2 (4.5) percent.

While losses are modest for those in the middle of the loss distribution, our model shows considerable losses for those at the tail ends of the loss distribution. At the 95th percentile of losses, five percent of workers will experience retirement savings losses between 12 and 15 percent. At the tail end of the distribution, the 99th percentile of losses represents reductions in retirement savings ranging from 18-20 percent. We also note that percentage losses are greatest for those in the 3rd quartile of earnings. This is largely due to the downward wage mobility some workers experience after a spell of unemployment. A combination of moderate unemployment incidence and wage decline lead these workers to be the potentially biggest losers under a DC type pension plan.

We extend our distributional analysis to the timing effects discussed previously. We find rather stark differences in the timing effects for winners and losers. Workers with small losses typically have positive timing effects. That is, if the spells of unemployment were randomly distributed losses would have been larger, so that the timing of unemployment helped ameliorate the losses. However, for workers with losses above the 40th percentile have negative timing effects. Of particular interest is our finding that the timing effect grows as the unemployment losses mount. Graph 4 illustrates the timing losses relative to the loss due to unemployment. For each quartile the trend is nearly the same, a timing effect that helps ameliorate losses for the first 3 deciles followed by increasingly large losses. While there are a couple of data points that fail to fit this scenario the overall trend is too strong to ignore. In general, winners win in both the total losses and timing of the losses; while losers lose. We should note that this finding is not an artifact of our analysis; it is just as likely that timing effects could have consistently hurt small losers while helping those that lose a lot. Our analysis indicates that fortune is not so fair.

Finally, table 6 shows the total accumulation and annuity payments a worker would receive based on our savings rates and return. For simplicity, we return to the average losses for each quartile. Young men in the lowest earning quartile would receive a reduction in their annuity payment of $152 per month, for similarly situated women the reduction in $104. We present these numbers to illustrate that most workers would do very well in their retirement under the assumption set out in our simulation. This is particularly true for those with unemployment and timing losses near the median of the loss distribution. However, the right tail of this distribution represents considerable savings losses on the order of 15 percent. Under these conditions and coupled with other risks that may coalesce around an unlucky individuals savings losses could be considerable.

5.0 Conclusions

Our simulations of retirement savings find that lower income workers' unemployment experiences and timing of unemployment spells (especially for low income men) result in considerable savings losses relative to a baseline case of no unemployment. Lower income workers experience the largest percentage declines of retirement savings ranging from 8.0 and 7.2 percent for men and women in the lowest quartile of earnings, while workers in the highest quartile of earnings experienced losses of 4.6 percent (men) and 3.0 percent (women). Equally important we find that the timing of unemployment spells amplified income losses by forcing workers out of the labor market during periods of relatively low equity prices. In the absence of these timing effects, retirement savings losses would have been 8-12 percent larger.

We believe our estimates understate the true retirement savings losses associated with unemployment. In our simulations we assume that workers in all quartiles of earnings have equal facility in managing their retirement portfolio, that workers experiencing unemployment do not "raid" their retirement savings, spells of unemployment cannot exceed 26 weeks. All of these assumptions are likely to result in an understatement of retirement income losses; this is especially true for the lowest earning workers who experience more unemployment. Of equal importance is the effect at the tail end of the loss distribution. While the average effect hovers at six percent or so, losses for some workers will exceed 12 percent.

Our model has a number of shortcomings, the effects of which are unclear, *ex ante*. We assume that while unemployment probabilities are a function of earnings quartiles, unemployment duration is not. If higher income workers experience longer but less frequent spells of unemployment our results would show larger losses for higher earnings workers. Finally, we do not allow workers to alter their portfolios in order to diversify away some of their employment income risk. However, it is unclear to us that allowing workers with risky income streams to balance their portfolio with less risky assets would raise overall retirement savings.

This research has a number of important policy implications. The increasing prominence of defined contribution plans and continued debate about privatizing Social Security impose new risks on workers. It is true that unemployment-risk exists in both defined benefit plans and with Social Security but both have mechanisms that protect vested workers retirement savings. For DB plans, once a person is fully vested, benefits are more or less guaranteed. In the case of Social Security, only a subset of quarters of earnings is used in calculating benefits, and the benefit formula is strongly progressive. This has the effect of compensating for lower earnings and not counting many periods of zero income (like unemployment). Of particular note, the Social Security Administration allows workers to drop the lowest five years of earnings from their lifetime earnings before calculating benefits. Our results show that all worker types are unemployed for periods which are much less than this provided allowance. No such assurances are available in DC plans; our research implies that workers in the lowest earnings quartiles are likely to need these types of consideration the most.

References:

Baumol, W.J., A.S. Blinder, E.N. Wolff. 2003. *Downsizing in America: Reality, Causes, and Consequences*. New York: Russell Sage Foundation.

Burtless, G., 1998. Financial Market Risks of Individual Accounts: The Twentieth Century Record, unpublished manuscript, Washington, D.C.: Brookings Institution.

Burman, L.E, N.B. Coe & W.G. Gale. 1999. "Lump Sum Distributions from Pension Plans: Recent Evidence and Issues for Policy and Research." *National Tax Journal* 52(3), 553-562.

Madrian, B.C. and L.J. Lefgren. 2000. An Approach to Longitudinally Matching the Current Population Survey. *Journal of Economic and Social Measurement* 26: 31-62.

Schmitt, J. 2004. Job Displacement Over the Business Cycle, 1991-2001. Washington DC: CEPR Working Paper.

Farber, H.S. 2003 Job Loss in the United States, 1981-2001. Industrial Relations Section, Princeton University: Working Paper no. 471

Gomes, F. and A. Michaelides. 2003. Portfolio Choice with Internal Habit Formation: A Life-Cycle Model with Uninsurable Labor Income Risk. Unpublished manuscript. London: London Business School.

Campbell, J.Y., J.F. Cocco, F.J. Gomes, and P.J. Maenhout. 1999. Investing Retirement Wealth? A Life-Cycle Model. Harvard Institute of Economic Research Discussion Paper no. 1896, Cambridge, MA: Harvard University.

Brown, J.R. 1999. Are the Elderly Really Over-Annuitized? New Evidence on Life Insurance and Bequests. NBER Working Paper no. 7193. Cambridge, MA: National Bureau of Economic Research.

Hurd, M.D. 1989. Mortality Risk and Bequests. *Econometrica* 57(4): 779-813.

Michael D. Hurd, Constantijn W.A. Panis, Lee A. Lillard. 1998. "An Analysis of the Choice to Cash Out Pension Rights at Job Change or Retirement". DRU-1979-DOL. Santa Monica, CA: Rand Corporation.

Silvapulle, P. and M. J. Silvapulle. 1997. Business Cycle Asymmetry and the Stock Market. School of Business discussion paper A97.22. Bundoora, Australia: La Trobe University School of Business.

Conference Board. 2004. Methodology. http://www.tcb-indicators.org/US/Data/component_description.cfm

Poterba, James M. and Steven F. Venti, and David A. Wise. 1995. “Do 401(k) Contributions Crowd Out Other Private Saving?” *Journal of Public Economics* 58, 1-32.

———. 1996 “How Retirement Saving Programs Increase Saving,” *Journal of Economic Perspectives*, Fall.

———. 1998a. “Personal Retirement Savings Programs and Asset Accumulation: Reconciling the Evidence,” in D. Wise, ed., *Frontiers in the Economics of Aging*. Chicago: University of Chicago Press.

———. 1998b. “Implications of Rising Personal Retirement Saving,” in D. Wise, ed., *Frontiers in the Economics of Aging*. Chicago: University of Chicago Press.

———. 2001. “Pre-retirement Cashouts and Foregone Retirement Saving: Implications for 401(k) Asset Accumulation,” forthcoming in D. Wise, ed., *Themes in the Economics of Aging*. Chicago: University of Chicago Press.

Table 1: Average Loss in Retirement Accumulation by Earnings Quartile & Gender
Contributions Fixed at $333 per month.

		Avg Monthly Contribution	Dollar Loss	Percentage Loss	Unemployment Over Career
Male	Quartile 1	*constant*	$50,784	8.0%	7.3%
	Quartile 2	*"*	$40,160	6.4%	5.6%
	Quartile 3		$34,585	5.5%	4.8%
	Quartile 4		$28,995	4.6%	4.1%
Female	Quartile 1	*constant*	$45,715	7.2%	6.6%
	Quartile 2	*"*	$33,955	5.4%	4.8%
	Quartile 3		$27,342	4.3%	3.8%
	Quartile 4		$19,085	3.0%	2.8%

Dollar values amplified to show 40 year career equivalents in year 2000 dollars.

Table 2: Average Loss in Retirement Accumulation by Earnings Quartile & Gender

Proportional Contributions at 10% of Observed Earnings - Workers Remain in Quartile Throughout Career

		Avg Monthly Contribution	Avg Dollar Loss	Percentage Loss	Unemployment Over Career	Total Savings
Male	Quartile 1	$140.23	$20,746	8.0%	7.4%	$260,036
	Quartile 2	$222.64	$25,377	6.3%	5.6%	$404,434
	Quartile 3	$309.00	$29,776	5.4%	4.8%	$551,085
	Quartile 4	$462.18	$35,752	4.5%	4.1%	$793,163
Female	Quartile 1	$106.26	$14,126	7.2%	6.6%	$196,200
	Quartile 2	$159.32	$15,336	5.3%	4.8%	$287,249
	Quartile 3	$226.27	$17,078	4.3%	3.8%	$398,432
	Quartile 4	$350.99	$17,878	3.0%	2.8%	$599,709

Earnings derived from CPS ORG for workers ages: 26 - 30 in 1980.
Dollar values amplified to show 40 year career equivalents in year 2000 dollars.

Table 3: Average Loss in Retirement Accumulation by Beginning Earnings Quartile & Gender
Proportional Contributions at 10% of Worker Specific Earnings- Allowing for Quartile Switching

		Median Dollar Loss	Average Dollar Loss	Percentage Loss	Unemployment Over Career	Full-Employment Savings
Male	Quartile 1	$21,802	$24,471	6.1%	5.8%	$400,574
	Quartile 2	$23,734	$26,354	5.9%	5.5%	$446,049
	Quartile 3	$25,971	$28,979	5.0%	4.8%	$582,123
	Quartile 4	$28,722	$32,548	5.1%	4.6%	$632,943
Female	Quartile 1	$16,333	$18,370	6.1%	5.8%	$301,559
	Quartile 2	$17,244	$19,200	5.9%	5.5%	$325,725
	Quartile 3	$18,861	$21,040	5.7%	5.2%	$372,032
	Quartile 4	$21,404	$24,281	5.2%	4.7%	$466,796

Heterogeneous individual earnings derived from CPS ORG for workers ages: 26 - 30 in 1980.
Dollar values amplified to show 40 year career equivalents in year 2000 dollars.

Table 4: Unemployment Spells, Marginal Investment Losses During Unemployment Spells

		Time	Average Losses Unemployment	Total	Timing as a Percent of Total Loss
Male	Quartile 1	27.8	$23,095	$24,471	6.0%
	Quartile 2	26.4	$24,413	$26,354	8.0%
	Quartile 3	24.8	$26,429	$28,979	9.6%
	Quartile 4	22.3	$29,621	$32,548	9.9%
Female	Quartile 1	27.6	$17,298	$18,370	6.2%
	Quartile 2	26.4	$17,841	$19,200	7.6%
	Quartile 3	24.8	$19,237	$21,040	9.4%
	Quartile 4	22.5	$22,104	$24,281	9.8%

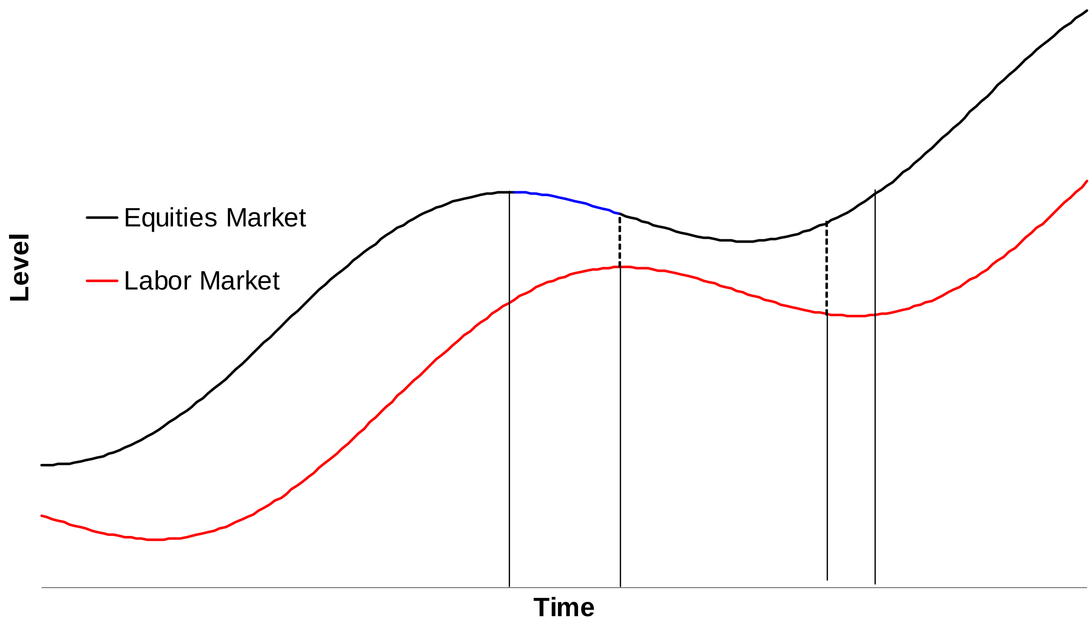
Heterogeneous individual earnings derived from CPS ORG for workers ages: 26 - 30 in 1980.
Dollar and time values amplified to show 40 year career equivalents.
Year 2000 dollars.

Table 5: Losses in Context of Annuitization of Balances

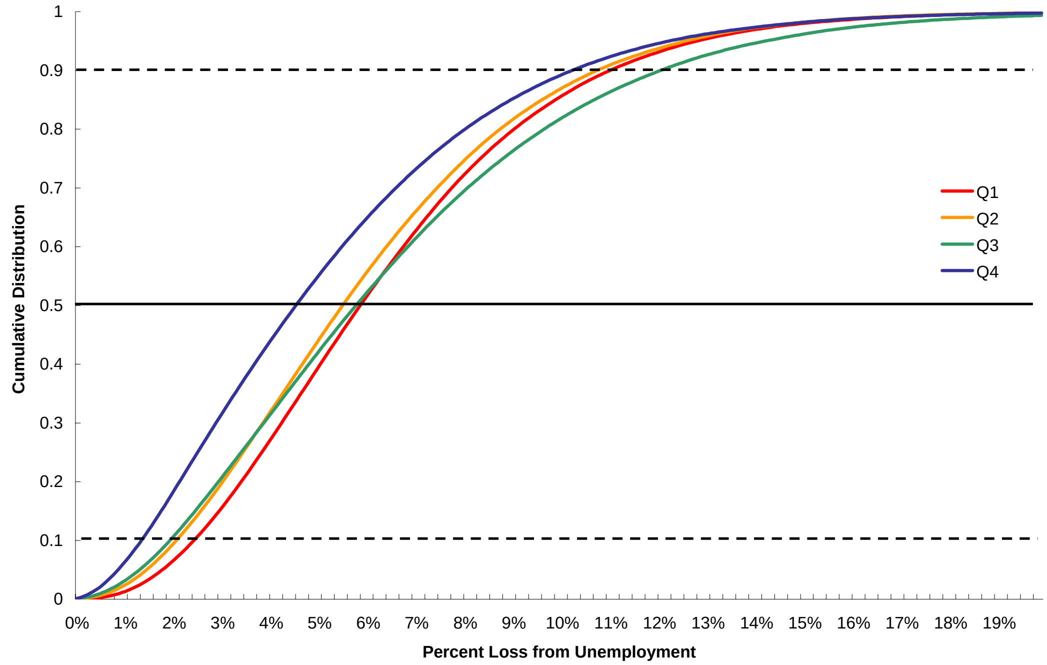
		Full Employment Savings	Monthly Annuity Payment	Observed Average Losses	Monthly Net Payment	Monthly Annuitized Loss	Average Percent Loss
Male	Quartile 1	$400,574	$2,902	$24,471	$2,725	$177	6.1%
	Quartile 2	$446,049	$3,231	$26,354	$3,040	$191	5.9%
	Quartile 3	$582,123	$4,217	$28,979	$4,007	$210	5.0%
	Quartile 4	$632,943	$4,585	$32,548	$4,349	$236	5.1%
Female	Quartile 1	$301,559	$2,185	$18,370	$2,052	$133	6.1%
	Quartile 2	$325,725	$2,360	$19,200	$2,221	$139	5.9%
	Quartile 3	$372,032	$2,695	$21,040	$2,543	$152	5.6%
	Quartile 4	$466,796	$3,382	$24,281	$3,206	$176	5.2%

Younger workers were aged 26-30 in 1980
Duration hazards constant across cohorts, contributions proportional to income
Annuity calculations based on Federal Thrift Savings Plan at:
age 65, 4.125% return, single life, level payment.

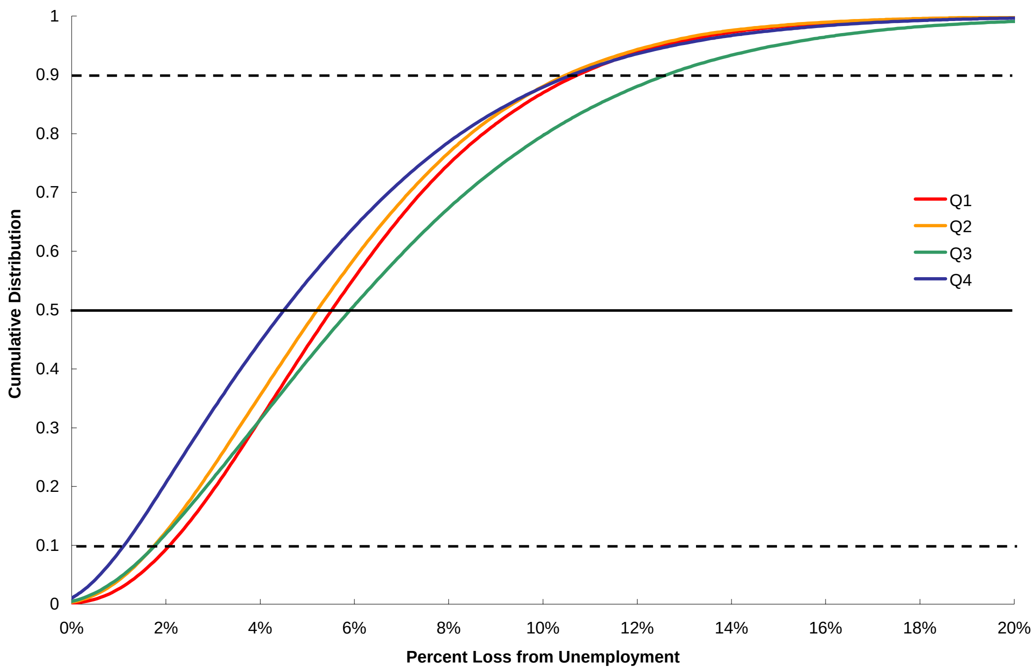
Chart 1: Asynchronous Equities & Labor Markets (stylized example)



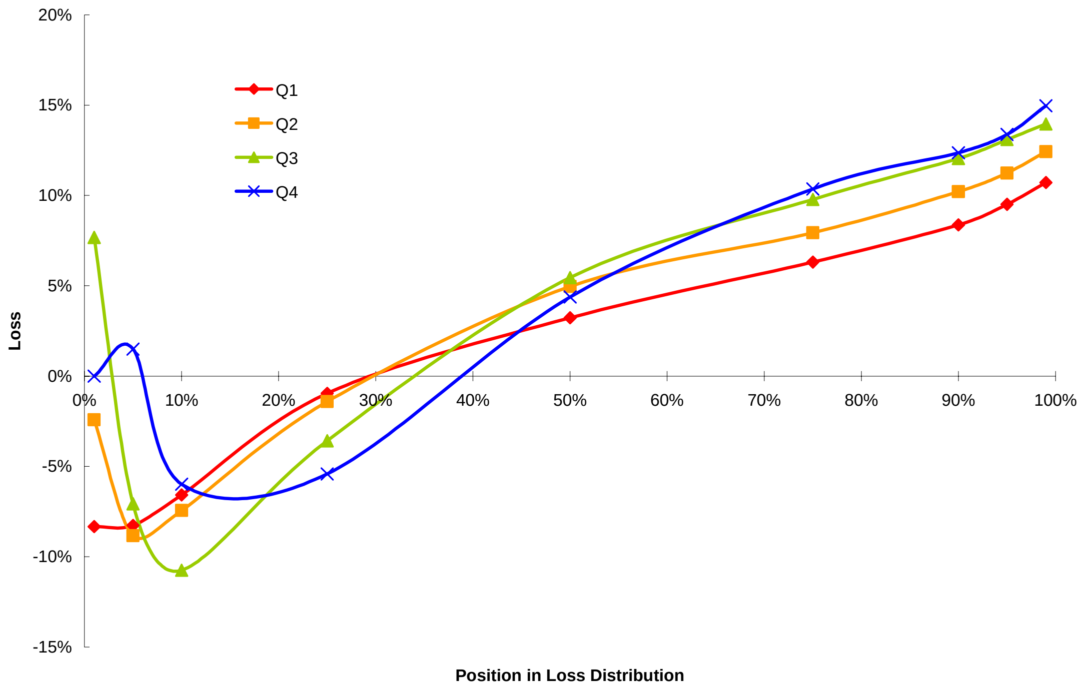
Graph 2: Simulated Retirement Savings Losses, Men
Constant Portfolio, Stochastic Unemployment, Quartile Switching



Graph 3: Simulated Retirement Savings Losses, Women
Constant Portfolio, Stochastic Unemployment, Quartile Switching



Graph 4: Timing Losses as a Percent of Unemployment Losses, Men



Appendix A: Labor Mobility by Earnings Quartile from Matched CPS ORG files

Men

Starting Quartile =1

		1994	1996	1998	2000	2002	2004	Average
	1	52.7	54.4	56.6	51.2	59.8	52.6	54.54
Transition	2	24.8	20.9	25.4	23.1	22.4	22.8	23.23
Quartile	3	15.0	12.0	8.1	8.1	13.8	12.7	11.62
	4	9.7	9.4	5.8	6.0	6.2	8.8	7.65

Starting Quartile =2		1994	1996	1998	2000	2002	2004	
	1	29.4	34.3	29.5	29.0	28.7	32.6	30.60
Transition	2	34.2	36.7	42.2	41.8	39.7	38.5	38.82
Quartile	3	20.7	23.0	24.2	25.3	19.1	20.0	22.06
	4	10.8	9.7	5.9	8.6	8.9	7.9	8.64

Starting Quartile =3		1994	1996	1998	2000	2002	2004	
	1	14.0	7.3	9.3	14.5	9.0	12.4	11.09
Transition	2	31.9	32.0	28.3	25.9	29.2	30.6	29.64
Quartile	3	35.6	35.3	41.6	41.2	40.9	40.5	39.19
	4	20.9	21.3	18.7	16.8	19.8	16.6	19.04

Starting Quartile =4		1994	1996	1998	2000	2002	2004	
	1	3.9	4.0	4.6	5.3	2.6	2.3	3.77
Transition	2	9.2	10.4	4.2	9.2	8.7	8.2	8.31
Quartile	3	28.7	29.7	26.1	25.5	26.2	26.8	27.14
	4	58.6	59.7	69.6	68.6	65.1	66.6	64.68

Women

Starting Quartile =1

		1994	1996	1998	2000	2002	2004	
	1	47.1	50.6	55.2	49.8	46.8	46.6	49.35
Transition	2	24.7	17.9	22.1	25.7	30.2	24.6	24.19
Quartile	3	13.7	14.1	10.1	11.3	12.3	12.9	12.40
	4	9.2	10.1	7.7	6.7	6.9	10.0	8.44

Starting Quartile =2		1994	1996	1998	2000	2002	2004	
	1	30.2	33.9	31.2	30.4	33.3	34.4	32.25
Transition	2	37.4	42.9	43.1	43.7	35.3	38.9	40.22
Quartile	3	22.3	18.2	15.6	18.8	27.6	22.1	20.77
	4	13.5	9.4	8.0	5.9	9.7	9.4	9.31

Starting Quartile =3		1994	1996	1998	2000	2002	2004	
	1	15.0	12.4	10.5	13.6	16.2	12.8	13.43
Transition	2	25.3	24.2	24.4	20.8	26.0	27.9	24.75
Quartile	3	37.3	43.7	45.4	45.3	33.3	40.0	40.81
	4	18.4	16.6	17.7	19.1	13.6	20.0	17.57

Starting Quartile =4		1994	1996	1998	2000	2002	2004	
	1	7.7	3.0	3.1	6.2	3.7	6.2	4.98
Transition	2	12.7	15.1	10.4	9.9	8.4	8.6	10.85
Quartile	3	26.8	24.0	28.9	24.6	26.9	25.0	26.02
	4	58.9	63.9	66.6	68.3	69.7	60.6	64.68

Average values (derived above) are used to predict labor mobility from last previous quartile just prior to most recent unemployment spell.