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March 2008

WORKINGPAPER SERIES

Number 162

POLITICAL ECONOMY RESEARCH INSTITUTE

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Abstract

The relationship between earnings, savings and retirement is well-known, however the linkage between labor market outcomes and financial market performance is generally unacknowledged. We examine the implications of the link between labor markets and financial markets for workers who save money in individual retirement accounts. Specifically, differences in labor market outcomes across groups may imply differences in the timing of investments, which may reduce savings over time for these groups compared to their counterparts. Using monthly data from the Current Population Survey (1979-2002) we generate hypothetical investment portfolios using stock and bond indices. We exploit differences across demographic groups in unemployment and wage growth, and use these differences to examine each group's investment outcomes. We then disaggregate the total effects into short-term and long-term components. We find some evidence of short-term market timing effects on investment, but we find much larger long-term effects for some groups. Our findings suggest that, for many people, the retirement savings losses associated with the timing of markets are similar to the costs of annuitizing savings upon retirement. The differences are especially pronounced by education and sex.

Keywords: Individual accounts, retirement savings, earnings volatility

I. Introduction

Increasingly, workers save for retirement with defined contribution (DC) plans, of which §401(k) plans are the most popular variety. With DC plans, workers decide on the amount to save, their portfolio allocation, and the conversion of savings into retirement income, among other issues. In this paper we focus on whether workers with different characteristics amass systematically different retirement savings due to the interaction between 1) demographics (race, education, and sex) and short-term economic shocks and 2) demographics and long-term labor market trends.

Most researchers interested in modeling retirement savings have simplified their models by assuming a homogeneous, constantly employed worker, whose earnings, relative to his age, is constantly rising (Samwick and Skinner, 2004:11). In this research we allow for interruptions in employment and, more importantly, alternate age-earnings profiles for different demographic groups. These considerations are especially salient for workers who have historically fared poorly in the labor market (e.g. African-Americans and high-school dropouts), as well as those whose labor market outcomes have improved during our study period (e.g. women). For example, in the most recent recession[1] the unemployment rate for African-Americans increased from 7 to 11.5 (Oct-2000 to Jun-2003) percent, trough to peak. The unemployment rate for whites increased from 3.4 to 5.5 percent (Apr-2001 to Jun-2003). Not only did African-American unemployment rates increase more than white unemployment rates, unemployment began to rise earlier during the business cycle for African-Americans. These varying labor market outcomes clearly

[1] NBER recession dates March 2001 through November 2001. Labor market peaks and troughs late 2000 to mid-2003.

imply differences in retirement savings due to the level and timing of contributions to individual retirement accounts.

Changes in unemployment rates and the timing of unemployment may be correlated with financial market outcomes and rates of return, since each of them may be a reflection of broader economic trends. This potential interrelation of financial and labor markets could have varying retirement savings implications for different demographic groups. If financial market swings are followed by larger employment and wage fluctuations for some groups, but not others, the affected groups may experience worse slower retirement savings accumulations. We refer to this interrelated effect as “market timing.” These interactions between the labor market and financial market may be short-term due to a business cycle contraction or long-term due to structural changes, especially in the form of wage stagnation for some sectors of the labor force.

Because investment returns may be altered by the interaction between labor markets and financial markets, some demographic groups with greater employment and earnings volatility may systematically lose out on investment opportunities relative to other groups whose income is less volatile. The combined effects of market timing may leave some groups with less retirement savings than would have been the case had their spells of unemployment been timed differently relative to the financial markets.

We provide estimates of how market timing influences retirement savings for different demographic groups. Our work improves on previous studies by using monthly instead of annual data, employing individual instead of household earnings, focusing purely on wage and salary earnings, and distinguishing between short-term savings

effects associated with business cycle fluctuations and long-term effects associated with lifetime differences in earnings.

The rest of our paper proceeds as follows. In section II, we review the relevant literature on the role of labor and financial markets on retirement savings. We then review the evidence on labor market fluctuations by demographic characteristics in section III. Section IV offers evidence on the co-movements between earnings and employment and financial rates of return. In section V we provide simulations, based on actual earnings and financial market outcomes, to highlight the size of the savings impacts for different demographic groups. Section VI offers some concluding remarks and highlights the policy implications of our research.

II. The Role Financial and Labor Markets in Retirement Savings

Saving for retirement in individual accounts has become increasingly widespread in recent decades. From 1980 to 1999, the share of private sector workers with a defined contribution (DC) plan as their primary pension plan rose from eight to twenty-nine percent (Employee Benefit Security Administration, 2004). A significant share of workers are now responsible for managing their retirement savings. If returns from equities and bonds are less than expected over a long period, workers will end up with substantially less retirement savings, all else equal.[2]

Often, workers can insure against some bad financial market outcomes. For instance, workers can diversify their assets to insure against idiosyncratic losses – the losses that occur due to unlucky or unwise decisions. Also, workers can insure against running out of savings during retirement by purchasing an annuity. The cost of a lifetime annuity

[2] Because we are interested in isolating the coincident effects labor and financial market timing, we ignore behavioral responses, such as working longer or saving more, when financial markets do not deliver the expected rate of return.

averages approximately five percent of total accumulated savings, with smaller account balances accruing larger costs (Congressional Budget Office, 2004, 1998; Poterba and Warshawsky, 2000; Geanakoplos et al., 1998, 1999). Similarly, a saver could purchase a minimum investment guarantee to insure against poor market performance. To guarantee the rate of return on bonds with a balanced portfolio (50% stocks and 50% bonds) over 40 years, though, investors would have to spend 16.1% of their contributions to their retirement account on that guarantee (Lachance and Mitchell, 2003a, 2003b). This comparatively costly insurance still provides only limited protection and leaves investors exposed to large market fluctuations over the course of a lifetime.

While obtaining some insurance against market performance is expensive, obtaining insurance against market timing is not currently possible. If workers could sell a portion of their future labor income to purchase other assets, such as stocks and bonds (Campbell et al., 1999; Storesletten, Telmer & Yaron, 2001; Viceira, 1999; Bodie et al., 1991) they would be able to diversify away from such a heavy reliance on labor income. Even when workers can borrow against their future income stream, researchers still find that financial asset holdings tend to be lower than optimal (Haliassos & Michaelides, 2000; Gomes & Michaelides, 2003) and holdings of expected income too high. The primary reasons for the apparent lack of diversification are liquidity constraints (the funds available for borrowing against future labor income are inadequate for optimal diversification) and high costs of regularly rebalancing one's portfolio (Constantinides et al., 1998; Bertaut & Haliassos, 1997; Vissing-Jorgensen, 2002; Yaron & Zhang, 2000; Abel, 1998).

Rather than diversifying their expected labor income early in their careers, when they have few other assets and the need to diversify is greatest, workers will have to diversify gradually by saving out of their current earnings. This gradual saving for retirement implies that labor earnings and financial returns are likely to be linked. In the long run, if earnings fall significantly below a worker's expectations, she will not have saved enough for retirement (since a large portion of lifetime earnings was realized early in the career). The opposite can also happen. Workers realize late in their career that earnings were much better than they anticipated when younger, thereby resulting in over-saving for retirement when they were younger. It would appear clear that a worker's earnings path would have direct consequences on retirement savings. Indeed, nearly all researchers who have examined retirement savings mechanisms, such as comparing DB and DC plans (Samwick and Skinner, 2004), retirement portfolio analysis (Campbell et al.. 1999, Munnell, Sunden & Taylor, 2002), and those examining retirement income adequacy (Hurd and Rohwedder, 2004) have had to make assumptions about the earnings and savings decisions of workers.

Since earnings paths over the lifecycle are an important factor in determining retirement savings, it is important to model the differences between groups of workers adequately. Typically researchers have used the earnings paths of full-time, full-year, white males, who are assumed to be employed without interruption during their careers (Samwick and Skinner, 2004:332 especially footnote 7). Unfortunately, this earnings path represents only 36% of the working population in the 1983 CPS and an even smaller fraction in later years (authors' analysis of CPS-ORG data). Importantly, this earnings path is not representative of the remainder of the labor force. Secondly, many authors use

a single cross-section to estimate a worker's earnings path and then assume a rate of wage and productivity growth. However, wage growth has diverged for different demographic groups, especially by education. Failing to take these factors into account is likely to provide unrealistic estimates of workers' earnings profiles.

III. Labor Market Experiences by Race, Sex and Education

Importantly, labor market outcomes vary not only with the business cycle, and thus with financial returns, but also by demographic characteristics (Clark & Summers, 1981). Groups with larger labor market fluctuations – greater volatility of earnings and larger swings in employment – are likely to be more exposed to the timing of financial markets. This holds true over both short-term and long-term.

a. Short-term Earnings Variation: Business Cycles and Unemployment

The literature on the relationship between demographics and labor markets consistently finds that women and African-Americans have more volatile labor market outcomes over the course of the business cycle than men and whites. Hoynes (1999) shows that both earnings and employment vary more for low-skilled women than for high-skilled men during the expansions phase of the business cycle. Countering this, Blank (1989) finds that women's earnings are "remarkably" non- responsive to changes in macro economy. She finds that among wives, earnings are procyclical but hours show little change over the business cycle. Goodman et al. (1993) find that men are typically more likely to lose their jobs in an economic downturn than women, however, the gap appears to be narrowing as women saw net job losses for the first time in the recession of the early 1990s. Finally, Abraham and Shimer (2001) find that the unemployment rate for women has fallen, while their duration of unemployment has increased as a result of

higher sustained labor force participation. On balance, we expect women to experience larger retirement savings effect due to short-term labor market shocks relative to men.

Previous research also identifies differences in labor market fluctuations by race. Hoynes (1999) suggests that nonwhites are likely to see greater variations in employment and earnings than whites in line with the business cycle, while Stratton (1993), among others, finds substantial and persistent unemployment differences between blacks and whites. African-Americans thus may experience larger retirement savings effects due to greater unemployment and earnings volatility relative to white males.

Education levels also matter for short-term labor market outcomes. Ashenfelter and Ham (1979) find that adult male workers with more education were less likely to experience unemployment than their less-educated counterparts. Murphy and Welch (1992) also find that the wage differential by schooling was sensitive to business cycle shocks. Hoynes (1999) finds that over the business cycle, workers with lower education levels experience larger fluctuations in employment and earnings relative to high-skilled men. However, Gardner (1995) suggests that job losses among workers with higher education levels and more skills were greater in the 1990s than during the recession of the 1980s. This implies that employment differences may be more important than earnings differences across educational groups. However workers with less educational attainment are still likely to experience considerably more labor market volatility.

Summary statistics on unemployment rates and monthly earnings show clear differences by race, education and gender (Table 1).[3] African-Americans and those who have less education had much higher probabilities of being unemployed from 1979 to

[3] Unemployment rates are estimated separately for each group (i.e. they are defined as (group_i unemployment count)/(group_i unemployment count + group_i employment count)) and are weighted using the outgoing rotation group weight in order to be representative of each subpopulation as a whole.

2002 than their counterparts. Unemployment rates for men and women did not differ much over the period from 1979 to 2002. In comparison, women had lower earnings than men, blacks had lower earnings than whites and those with less education had lower earnings than those with more education.

The differences in relative standard deviations can serve as rough indicators of short-term labor market differences in volatility. Specifically, women had greater wage volatility than men, but similar employment fluctuations. By comparison, the variation in unemployment rates was significantly larger for blacks than for whites, while the variation of earnings was relatively similar for both groups. This suggests that employment was a more important source of short-term earnings volatility than variations in hourly wages were for African-Americans while the opposite was true for women. Finally, unemployment volatility tended to decline with more education. The earnings results are more mixed, with high income volatility for both less educated and more educated workers.

[Table 1 – about here]

b. Long-term Trends in Earnings and Equities

Market timing is a long-run phenomenon. Individual account accumulations are linked to earnings in the long run because contributions to retirement accounts are primarily a function of earnings and because earnings by education have diverged over time. The labor market returns to college have increased substantially and real earnings for workers who fail to complete high school declined (see Figure 1). For many men, especially those earning at or below the median wage, real earnings have failed to increase since 1979. In particular, the lowest earning forty percent of male workers saw

their real wages decline over the period from 1979 to 2001. Many authors have documented this decline in both wages and employment in the manufacturing sector (Murphy & Welch, 1992, 1993; Bound & Johnson, 1992: Katz & Murphy, 1992), attributing much of the change to skill-biased technological change.

The trends in wages for women differed from those of men. For all but the lowest ten percent of women workers, real wages in 2001 were higher than wages in 1979 (Mishel et al., 2003). Figure 2 shows women's earnings increasing relative to men's (however, this trend fails to control for the general increase in skills and education, as well as the improved job opportunities women experienced over time). Finally, Blank (1989) finds that earnings differentials across man and women shrank with economic growth; however, women saw smaller benefits from economic growth than men. These long terms trends in the earning of U.S. workers are likely to interact with financial market trends in ways that may preferentially treat higher earnings early in a career.

[Figures 1 & 2 about here]

Putting this in the context of long-term relationship between earnings and financial markets, we find that women's earnings relative to men's were lower in the late 1970s, when financial asset prices were comparatively low and when women should have bought more financial assets than they could afford at the time, given their earnings. Given the aforementioned liquidity constraints, women likely had to delay asset purchases until their relative earnings had risen, but by that time financial asset prices also had risen. As a result, women may have paid higher asset prices than men, over the course of their career, thereby reducing their rates of return on their savings.

The literature has recognized the possibility of the interrelated timing of labor and financial markets, but existing research suffers from several shortcomings, which we attempt to address. First, earnings often tend to be smoothed so that important variations in income and unemployment are likely to be ignored (Campbell et al., 1999). Specifically, annual data are typically used and short-term spells of unemployment are typically ignored. Similarly, because household data (rather than individual data) are often used, a common lifetime savings horizon for all household members is assumed. However, retirement consumption patterns tend to be dominated by men's life expectancies (Burkhauser et al., 1991). The use of household data also ignores the rising chance of divorce in the future (Butrica & Iams, 2000). Labor income is further smoothed by including non-wage income and transfer payments.[4] Furthermore, age-earnings profiles are developed using regression analyses, which assume that households are continuously employed (Samwick & Skinner, 2004). Finally, prior research has ignored the possibility of long-term earnings volatility and focused almost exclusively on short-term unemployment and earnings volatility (Seligman & Wenger, 2006). Instead, we focus on individual monthly wages for different demographic groups and consider the short-term and long-term timing of labor and financial markets.

IV. The Empirical Link between the Labor Market and Financial Markets

In this section, we test our main hypothesis that short-term linkages exist between labor and financial markets. In our calculations we use data from the Current Population Survey (CPS) outgoing rotation groups from 1979 to 2002. The CPS is a household

[4] If transfer payments become more dependent on working in order to qualify for benefits, then older models that smooth income underestimate the effects of earnings variation due to unemployment. This over-smoothing will also occur if take-up rates for TANF and unemployment insurance are lower in the future, or if these benefits are replaced with an increased reliance on the earned income tax credit.

survey conducted monthly consisting of approximately 60,000 households with approximately 220,000 individual observations; the outgoing rotation groups represent one-fourth of the total sample. While the basic monthly CPS data contain information about each member of the household's labor force status and demographic characteristics, only those workers in the outgoing rotation groups are asked about their earnings. The CPS-ORG files provide cross-sectional data on labor force participation, employment, earnings, as well as demographic characteristics such as age, education, race, ethnicity and sex. These data have been used in hundreds of studies examining labor force participation and wage determination and serve as the basis for the national and state level estimates of the unemployment rate[5]. The uniform data files used in this analysis are publicly available from the Center for Economic and Policy Research (2003).

In the empirical results that follow, we consider three demographic characteristics – race, gender, and education – and assume that each of these groups faces the same set of financial markets for investing in individual accounts. This implies that the variation in retirement savings outcomes that we report is solely attributable to each group's labor market experience. Specifically, we consider labor market outcomes for men and women, for blacks and whites, and for those with less than a high school education, high school graduates, and some college experience or more.[6]

To test for systematic short-term links between earnings and financial markets we follow Campbell et al. (1999), and regress the change in average earnings on excess

[5] See Bregger & Dippo (1993) for a general discussion of the CPS, and its usefulness in labor market research in the U.S.

[6] Including other characteristics would reduce the number of observations in each cell and would likely generate unreliable estimates of labor market outcomes.

returns, net of the average difference between stock market returns and "risk-free" returns, in this case the 10-year U.S. Treasury bond yield.[7]

$$\frac{\Delta w_{i,t}}{w_{i,t}} = \sum_{j=1}^{6} \beta_{1j} (R_{t+1-j} - r_{t-j} - \overline{\mu}) + \varepsilon_{1it} \qquad (1a)$$

where $\frac{\Delta w_{i,t}}{w_{i,t}}$ is the percent change in real monthly earnings for group *i* in month *t*. The real monthly earnings is obtained by multiplying average weekly earnings by four and deflating it by the CPI-RS. R_t is the total real rate of return of stocks based on the S&P500's capital appreciation and dividend yield in a given month. r_t is the real interest rate on 10-year treasury bonds, and $\overline{\mu}$ is the average difference between the real rate of returns on stocks and on treasury bonds. We include six months of lags to control for the time it takes for labor markets to respond to financial markets (Domian & Louton, 1995; Silvapulle & Silvapulle, 1999). Equation (1a) provides a direct test of how well short-term variations in excess equities returns (equity premia) predict variations in earnings over time. We combine the $\beta_{1,t}$ through $\beta_{1,t-6}$ and report their joint significance in Table 2. If these variables are jointly statistically significant, then short term financial variations (up to six months) systematically precede fluctuations in worker earnings.

We also extend Campbell et al.'s (1999) approach by examining how short-term variations in excess returns predict variations in unemployment.

$$\Delta UR_{i,t} = \sum_{j=1}^{6} \beta_{2j} (R_{t+1-j} - r_{t-j} - \overline{\mu}) + \varepsilon_{2it} \qquad (1b)$$

[7] We use the 10-year treasury bond yield since the treasury did not issue 30-year bonds for the entire period under investigation.

In equation (1b) $\Delta UR_{i,t}$ represents the percent change in the group-specific unemployment rate from time *t-1* to *t*. Equation (1c) is similar to equations (1a) and (1b) but allows us to test for the combined effects of variation in excess returns on earnings and unemployment. In equation (1c) the dependent variable represents the unemployment probability weighted earnings change. This adjusts the earnings changes by the overall probability of remaining employed for each group in each period.

$$\frac{(1-UR_{i,t})w_{i,t}-(1-UR_{i,t-1})w_{i,t-1}}{(1-UR_{i,t-1})w_{i,t-1}}=\sum_{j=1}^{6}\beta_{3j}(R_{t+1-j}-r_{t-j}-\bar{\mu})+\varepsilon_{3it} \qquad (1c)$$

Our results show some evidence of co-movements between wage growth and unemployment and deviations in excess returns, if we allow for lags. Table 2 shows the combined effects of all six lags (representing the short-run combined effect of 6 months) from our estimates of equations 1a, 1b, and 1c for all workers and by gender, race and education. In general, we find a positive relationship between excess returns in the equity market and changes in earnings. That is, an increase in excess returns leads to increased earnings; a one-percent increase in the equity premium yields a .05 percent increase in above monthly trend wage growth. We also find a weak negative relationship between excess returns and the unemployment rate, implying that as equity returns decline, unemployment increases. This result is statistically significant only for black workers, where we have already identified a difference in employment volatility relative to whites. Lastly, the effect of excess returns on our combined measure is somewhat larger than the effect on earnings, indicating that excess returns play a part in both the price and quantity of labor. Overall, it appears that financial and labor markets experience some measure of systematic the timing of market. What is less clear from this set of findings is the overall

effect of this timing on overall retirement savings. In the next section of the paper we simulate worker savings by demographic group and estimate the effect size of the timing of changes in earnings, unemployment and retirement savings.

[Table 2 – about here]

V. Simulation Results

In this section, we develop simulation models that allow us to measure the size of short-term and long-term earnings variations and the underlying effects of these variations on retirement savings.

a. Approach to Simulation

To test the implications of the relationship between financial market returns and wage and unemployment for individual retirement account accumulations (discussed above), we create two age-earnings profiles for each group of workers in our sample. The first allows for continuous employment but adjusts earnings based on the group's unemployment probability. This can be thought of as a group profile that simply reflects the expected value of earnings given a non-zero unemployment probability. For example, if group A had average monthly earnings of $5,000 and an average unemployment rate of five percent then the expected value of earnings would be $4,750 per month.

We calculate these earnings profiles for each subgroup using age-specific unemployment rates and earnings. We use ten-year age ranges to maintain robust unemployment rate estimates for each group. The profile, a synthetic cohort, is aged each year by one year, so that by 2002, the age group under consideration contains people between 55 and 65. We define this age-group specific, unemployment-adjusted, average monthly earnings as:

$$AME_{it} \equiv (1 - UR_{it}) * wage_{it} \quad (2)$$

Where AME_{it} are real average monthly earnings for age-group *i* in month *t.* This equals the age-specific share of the labor force that is employed $(1 - UR_{it})$ multiplied by the real average weekly earnings of group *i* in period *t* ($wage_{it}$), where UR_{it} is the unemployment rate for group *i* at time *t.* All real variables are indexed to 2002 using the CPI-RS.

This profile type allows us to capture the overall impact of the unemployment rate and wage changes over time. However, it does not comport well with an individual worker's experience. For the individual, unemployment is a dichotomous outcome and its effects are distributionally and qualitatively different for those who experience it compared to the average effect captured in the AME_{it}.

Our second age-earnings profile alleviates some of these problems. This second measure leaves earnings intact, but assumes earnings fall to zero during spells of unemployment. We create hypothetical individuals who are either employed or unemployed in each period. When employed, their wage is equal to the average earnings of their group. When unemployed, their wage equals zero. We assume that these individuals will lose their job between a labor market peak and a labor market trough and regain employment between the labor market trough and peak for their demographic group. We first determine the cyclical labor market peaks and troughs for each group and then calculate the periods when each individual is employed or unemployed. The average number of months of unemployment for a hypothetical individual is assumed to be equal to the average unemployment duration for that group from 1979 to 2002. This second set of earnings profiles captures the typical experience of unemployment: average within-

group earnings during employment, job loss during a recession, earnings loss following job loss and unemployment duration equal to the group's mean.

We overlay the age earnings profiles with a hypothetical savings pattern, and assume individuals save ten percent of their earnings.[8] All savings are allocated in a balanced portfolio. Equities are assumed to increase at the rate of the S&P500 and to receive the S&P500 dividend yield. Bonds are assumed to earn interest equal to the interest paid on Moody's AAA corporate bonds. All calculations are in 2002 dollars.

b. Summary of Baseline Simulation Findings

Our main focus in conducting these simulations is the differential performance of individual retirement accounts over time, holding investment returns constant but allowing contributions to vary based on each group's unemployment and earnings experiences. We focus on each hypothetical worker's accumulation per dollar invested, which highlights the importance of the timing of investments, since the rates of return for each worker's investments are identical[9]. For illustrative purposes, we also report the amount of total savings in real 2002 dollars (Table 3).

[Table 3 – about here]

Our results, based on age-specific, age-earnings profiles with weighted average earnings in each month (table 3) highlight three issues.

- total accumulated savings vary substantially across demographic groups.
- accumulations per dollar invested vary considerably.

[8] The savings rate is somewhat irrelevant in our results since we report nearly all our results as per-dollar return rates. However, since currently policy discussion has centered on the privatization of Social Security accounts, individual savings accounts (net of SSDI) would be approximately 10 percent.

[9] In essence, our per-dollar accumulation is a real compound rate of interest. Since the investment horizon is held constant for all simulations, we can use compound rates of interest instead of translating them into annualized rates of return. This also has the advantage of allowing for quick conversions of differences in the compound rate of interest into hypothetical losses of savings.

- differences in per dollar accumulations vary systematically with demographic characteristics.

That saving varies by demographic group is unsurprising given the differences in labor market experiences and education levels of each group. On the low end, black women with less than a high school education could expect to have accumulated $65,546 in inflation-adjusted dollars after 24 years of saving ten percent of their earnings. In comparison, white women with less than a high school education could expect savings of $71,163 or $5,617 more than similarly educated black women. Black, college-educated men could expect to accumulate $205,939 as compared to white college educated men who could expect to save $264,106.

In comparison, the per-dollar invested measures of savings provide some striking differences. Black and white college-educated women experienced the lowest per dollar accumulations receiving an additional $0.85 for each dollar invested, while Black and white college-educated men received a per-dollar return of $0.96 and $0.99 respectively. Overall, for each dollar invested, men accumulated $0.05 more than women did. Over a span of 24 years, this amounts to more than $2,900 dollars[10] in foregone savings for women, or a 2.6% loss due solely to market timing. We note again that all per-dollar differences arise solely due to the labor market experiences faced by each worker group. The only source of variation is the labor market and worker earnings having an interrelated effect with financial markets since we require all worker groups to face the same financial market opportunities. In this case we find that the interplay of labor markets and financial markets differed by demographic group.

[10] Women invested approximately $58,247 over this period ($109,506/1.88) (table 3, column 1). Five percent of this is $2,912.

That workers with more education had *lower* per-dollar accumulations highlights the long-term timing effects that are mostly due to the increasing returns to education over time. Campbell et al. (1999) note that households with more education faced greater retirement savings impacts. Workers with more than high school education had relatively lower real earnings when real stock prices were comparatively low and it would have been beneficial for them to invest.[11] Thus, overall retirement savings by workers with more education were impeded. While this is both a cohort-specific education and financial market effect, it highlights the role of the interplay between labor and financial markets for some groups of workers. It does not, however, allow us to make any prediction about future effects from the timing of these markets.

When we compare the relative retirement savings impacts of the long-term trends and short-term variations, we find that the long-term trends overwhelm the effects of the short-term fluctuations we model. In fact, the standard deviation of real earnings declined from 5.7 percent of average earnings between 1979 to 1990, to 5.0 percent between 1991 and 2002, while the correlation between real earnings of workers with less than a high school education and the real S&P 500 remained largely unchanged. Consequently, short-term effects of market timing remained constant for less-than-high-school educated men, but this group saw greater long-term earnings declines relative to college-educated men. The opposite was true for women, whose real earnings relative to men's rose over time (figure 2). Men's per-dollar accumulations were higher than those for women because women's earnings relative to men's were greater when stock prices were higher.

Our results so far have been based on group averages arrived at by calculating unemployment-adjusted, expected earnings in any given month for a specific

[11] The depicted earnings show the age specific real earnings from 1979 to 2002.

demographic group. This implies that individuals can accurately take into consideration their unemployment probability and save enough to smooth consumption during periods of unemployment. The expected earnings model allows us to study variations in per-dollar accumulations by demographic characteristics, but it does not represent the experience of individual workers. To see how unemployment impacts an individual worker, we simulate hypothetical workers as alternately employed and unemployed. During periods of employment we assume that a worker receives her full income; during spells of unemployment we assume earnings fall to zero. We summarize the results for the unemployment simulation in table 4.

[Table 4 – about here]

The results based on the unemployment simulation are similar to those based on expected group averages. Again, we find large variations in total account accumulations. Also, per-dollar accumulation differences vary systematically with demographic characteristics. Furthermore, workers with less than a high school education still have higher per-dollar accumulations than workers with more education.

One difference from the previous results is noticeable when we compare per dollar accumulations. In particular, the difference in per dollar accumulations for women versus men is larger than in the prior results. For example, white women with a high school diploma accumulate about $0.09 less per dollar invested than do white men with a high school diploma. Over a period of 24 years, this amounted to $4,400 in foregone savings, or the equivalent of 4.7 percent of their total savings.

Our results so far show considerable differences in per-dollar accumulation – not just in total accumulations – by demographic characteristics. This is especially true for

our results by gender and education. Using group averages, women accumulate $0.05 less per dollar invested than men, and using the unemployed hypothetical, the difference between men and women increases to $0.06. In dollar terms, if women had the same per dollar accumulations as men they would have an additional $2,912 dollars or 2.6 percent of their total savings, based on group averages, and $3,487 or 3.2 percent of their savings based on the unemployment simulations. These differences are even larger when we compare across education groups. For instance, women with some college education experienced a $0.07 lower per dollar accumulation than men with some college. Women who graduated high school had per dollar accumulations that were $0.09 less than similarly educated men. To put this in perspective, these differences in accumulated savings approach the cost equivalent of converting total savings into lifetime annuities.

c. Unemployment and Earnings Decompositions

While the retirement savings differentials across gender and educational groups appear non-trivial, it is not clear whether they are driven by fluctuations in earnings or employment. To analyze the underlying determinants, we re-simulate our results first holding unemployment rates fixed across all groups (but letting earnings take the group mean) then holding earning constant for all groups (but letting unemployment take the group mean). Given our previous discussions, we would expect that unemployment plays has a larger impact on retirement savings for blacks relative to whites, while earnings volatility should have a larger effect on retirement savings for women relative to men.

Our initial results are summarized in table 5. When we eliminate differences in unemployment probabilities by holding the unemployment rates constant across groups, per-dollar accumulation differences remain. In comparison, though, when we eliminate

differences in earnings volatility by holding wages across groups constant, the differences in per-dollar accumulations shrink.

By gender, we observe a clear positive effect from reducing earnings differentials but not from reducing unemployment differentials. While women accumulated $0.06 less than men for each dollar invested (table 4), they accumulated $0.05 less when men and women experienced the same unemployment rate (table 5, top panel). Once earnings differences are eliminated, though, the per-dollar accumulation difference by gender drops from $0.06 to $0.00, implying that the entire accumulation difference between men and women was due to earnings differentials (table 5, bottom panel).

[Table 5 about here]

Our results show some indication that unemployment rates may be more important than earnings volatility for the retirement savings differentials between blacks and whites. The accumulation difference by race shrinks from $0.01 for each dollar invested to $0.00 when unemployment rate differential between the groups are eliminated. Per-dollar returns remain constant at $0.01 when earnings differences are eliminated. This is in line with our earlier results that there were differences by race in short-term employment volatility, but not necessarily in short-term earnings volatility.

Instead of focusing on differences in the timing between labor and financial markets, we can also focus on the role of employment and earnings variability for each group. To do so, we compare the group averages to cases with no unemployment or earnings variability. First, we eliminate unemployment variability by simply comparing a worker with particular demographic characteristics and corresponding earnings and unemployment histories to workers who are constantly employed but who experience the

same earnings variations. Next, we eliminate earnings volatility by estimating the average trend earnings for all workers and using these for all workers, regardless of demographic characteristics. The resulting differences in per-dollar accumulations provide us with an estimate of the size of unemployment and earnings effects for each group.

Eliminating unemployment improves the per-dollar accumulations for women, Blacks, and those with less education (table 6). For instance, women's per dollar accumulations now are $0.01 higher than in a situation with no unemployment. The biggest changes occur for women with less than a high school diploma, where the elimination of unemployment results in an increase of the per-dollar accumulation of $0.03 (table 6). Men with less than a high school education also see their per-dollar accumulation improve, by a total of $0.02.

[Table 6 – about here]

The elimination of earnings volatility shows somewhat larger improvements in the per-dollar accumulation for women, but few changes elsewhere. Specifically, by eliminating earnings volatility, women's per-dollar accumulations increase by $0.04 (Table 6, bottom panel). Again, the fact that women experience more earnings volatility, than men is consistent with our summary statistics and the literature that shows that higher earnings volatility for women, but not necessarily greater employment volatility.

VI. Conclusion

In this paper we examine how the inter-related variation of financial and labor markets affect the accumulated retirement savings of workers who use individual accounts, such as IRAs or §401(k) plans. The literature has recognized for some time the potential that variations in labor income will have on asset accumulation (Campbell,

2000). However, the existing literature often eliminates the long-term and short-term variations in earnings by smoothing age-earnings profiles to estimate investment returns (Samwick and Skinner, 2004). We find that this practice both eliminates some potentially important short-term earnings fluctuations and masks long-term effects of timing on financial market returns. Additionally, while considerable theoretical work has been done examining the optimal portfolio allocation, little attention has been paid to the magnitude of the likely differences in total accumulations between different demographic groups based on their different age-earnings profiles.

By using monthly data on earnings and by testing for both short-term and long-term effects we provide a more complete understanding of the importance of earnings fluctuations and their associated timing on retirement savings. We find considerable evidence that per dollar retirement accumulations differ by education, race and gender and these differences are largely due to a structural relationship between the financial and labor markets. Our analysis indicates that nearly all of the market timing effects on savings faced by black men (relative to whites) can be explained by the timing and frequency of unemployment relative to the financial markets. While these unemployment effects explain most of the per-dollar accumulations for Blacks (relative to whites) we find that long-term changes in wages are the primary cause of different per-dollar retirement accumulations of most groups. These long-term effects lead us to some unexpected conclusions. In particular, women in the sample received much lower per-dollar accumulations largely because their earnings power has increased over the time when prices in the financial markets were relatively high. In general, women and the well-educated experienced considerably lower rates of return per dollar saved for

retirement. Also surprising was our finding that less educated workers received *higher* per dollar rates of return owing largely to the fortuitous timing of their relatively higher earnings (and simulated investment) during a period of moribund financial returns.

It is clear that our findings reflect broad changes in the labor force and financial markets from 1979-2002, that are not likely to be replicated. Still, they lead to two important policy conclusions. First, while individual accounts can offer some advantages over other retirement savings vehicles, it is critical that workers and policymakers understand that there appears to be a systematic interplay between labor and financial markets that may be difficult to mitigate against. This suggests that a wholesale replacement of retirement savings plans, such as DB plans and Social Security, with individual accounts may be more costly for some groups of workers than previously recognized. Instead, a balanced mix between different forms of retirement savings may increase the retirement income security of workers, while allowing them to take advantage of the most valuable opportunities to save for retirement. Second, retirement savings policy cannot only focus on financial markets. It also needs to encompass labor market policy. Reducing the differentials in employment and wage volatility and providing some long term wage protections (such as wage insurance) would go a long way in limiting the combined effects of earnings volatility and financial market timing on retirement savings.

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Figure 1: Real Earnings by Education and the Stock Market

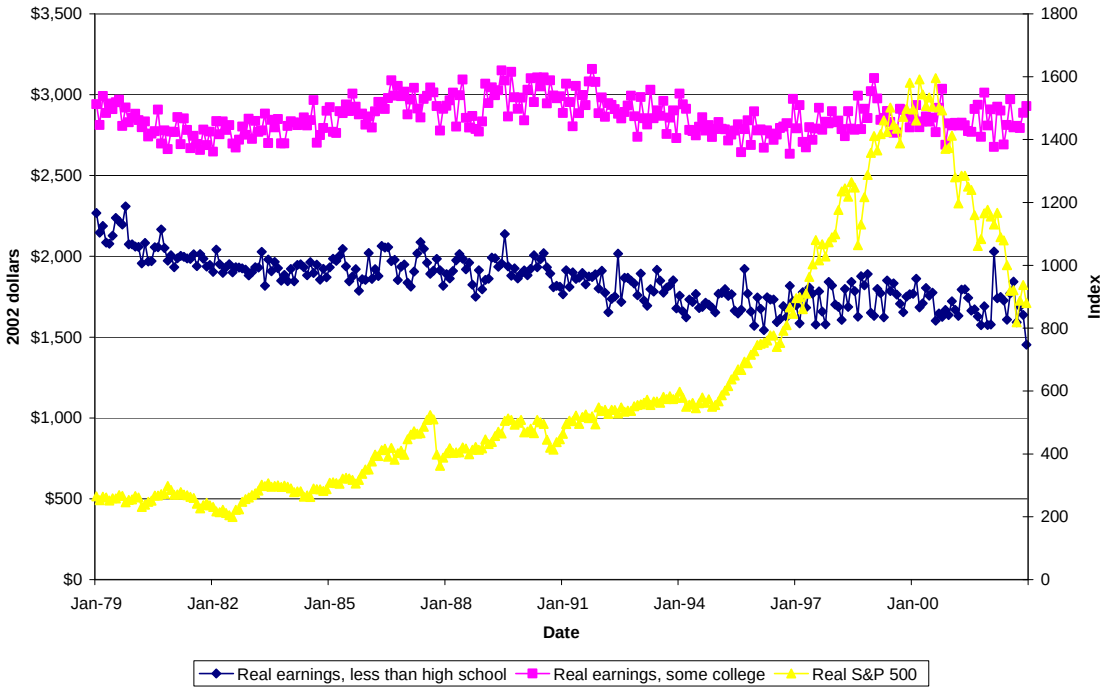

Figure 2: Ratio of Women's Real Earnings to Men's, 1979 to 2002

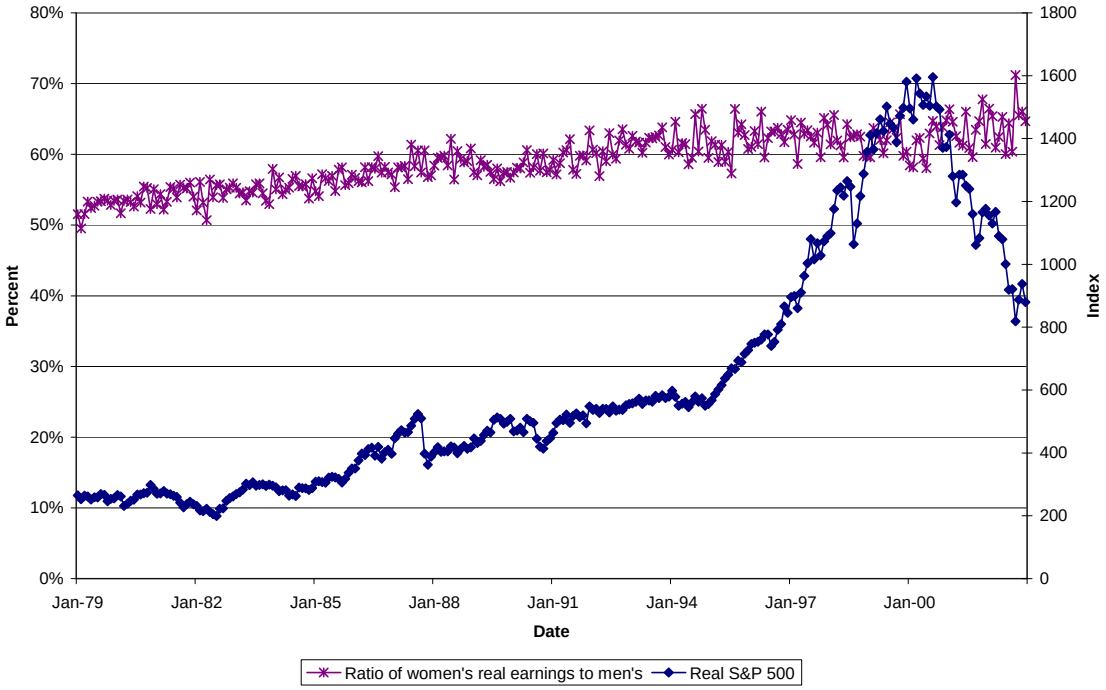

Table 1
Average Unemployment Rates and Monthly Earnings, by Demographic Characteristics, 1979-2002

		Total	Less than High school	High school	Some college	College
Unemployment rate						
Total		6.3	13.1	6.6	5.1	2.3
		(1.6)	(2.4)	(1.6)	(1.3)	(0.6)
Men		6.4	12.5	6.8	5.1	2.5
		(1.7)	(2.7)	(2.0)	(1.5)	(1.3)
Women		6.4	13.8	6.5	5.2	2.1
		(1.5)	(2.2)	(1.4)	(1.4)	(0.8)
White	Total	5.2	11.4	5.5	4.3	2.1
		(1.4)	(2.3)	(1.6)	(1.2)	(0.7)
	Men	5.2	11.3	5.7	4.4	2
		(1.6)	(2.7)	(1.9)	(1.3)	(0.9)
	Women	5.1	11.7	5.2	4.3	2.4
		(1.4)	(2.3)	(1.3)	(1.2)	(1.3)
Black	Total	12.6	21.2	13.1	10	3.2
		(3.2)	(3.4)	(3.4)	(3.7)	(3.3)
	Men	13	21.2	13.1	10	3.7
		(3.5)	(4.3)	(3.9)	(4.2)	(5.9)
	Women	12.2	21.2	13	10	2.3
		(3.2)	(4.1)	(3.6)	(3.9)	(1.7)
Average monthly earnings						
Total		2,408	1,462	2,078	2,283	4,104
		(124)	(157)	(71)	(78)	(315)
Men		2,871	1,738	2,525	2,752	4,533
		(120)	(213)	(129)	(96)	(289)
Women		1,878	1,048	1,607	1,804	3,833
		(169)	(72)	(57)	(108)	(389)
White	Total	2,524	1,479	2,150	2,340	4,181
		(158)	(184)	(71)	(90)	(331)
	Men	3,053	1,801	2,647	2,851	4,918
		(159)	(236)	(114)	(106)	(395)
	Women	1,920	1,010	1,626	1,809	3,063
		(197)	(89)	(68)	(121)	(398)
Black	Total	1,985	1,362	1,794	2,042	3,535
		(102)	(140)	(92)	(94)	(414)
	Men	2,211	1,583	2,044	2,316	3,875
		(118)	(192)	(143)	(151)	(597)
	Women	1,772	1,095	1,553	1,818	3,460
		(127)	(93)	(79)	(102)	(449)

Notes: Unemployment rates are in percent and earnings are in 2002 dollars. Standard deviations in parentheses. All estimates of unemployment rates are calculated separately for each group (i.e. (group_i unemployment count)/(group_i labor force count)) and are weighted using the outgoing rotation group weight. Source is the Current Population Survey, various years, and the Bureau of Labor Statistics, Consumer Price Index-Research Series.

Table 2
Changes in Earnings and Unemployment Rates and Excess Stock Market Returns

Regression No.	Group	Dependent Variable: Pct. Change in Weekly Earnings	Pct. Change in Unemployment Rate	Pct. Change in Weighted Avg. Earnings
(1)	Total	0.05**	-0.002	0.06**
		(2.21)	(1.09)	(2.35)
(2)	Men	0.05	-0.002	0.06*
		(1.44)	(1.23)	(1.76)
(3)	Women	0.03*	-0.001	0.04*
		(1.76)	(0.28)	(1.89)
(4)	Whites	0.06	-0.001	0.06*
		(1.71)	(1.05)	(1.91)
(5)	Blacks	0.03*	-0.003**	0.04*
		(1.99)	(2.20)	(1.95)
(6)	Less than high school	0.04	-0.004	0.06
		(0.94)	(1.14)	(0.84)
(7)	High school	0.04*	-0.002	0.05
		(1.74)	(0.42)	(1.47)
(8)	Some college	0.05	-0.002	0.06
		(0.47)	(0.65)	(0.46)
(9)	College	0.06***	0.0002	0.05***
		(3.21)	(0.63)	(3.16)

Notes: Each regression is based on monthly data from 1979 through 2002 and includes 280 observations, due to the various lags. * denotes significance at the 10%-level, ** denotes significance at the 5%-level, and *** denotes significance at the 1%-level. F-statistic for the null hypothesis that all lags are simultaneously equal to zero are presented in parentheses. All regressions include 6 monthly lags of deviated excess earnings (see equation 1a-1c in text). All regressions are estimated using OLS. Interpretation: Column1, Row 1: the combined effect of a 10 percent increase in excess stock market returns over six months yields a 0.5 percent increase in wages for workers as a whole.

Table 3
Total Accumulations and Per-Dollar Accumulations, Based on Group Averages

		Total	Less than High school	High school	Some college	College
Per-dollar accumulation						
Total		1.92	1.99	1.96	1.95	1.90
Men		1.93	**2.01**	1.97	1.96	1.92
Women		1.88	1.96	1.92	1.91	1.88
White	Total	1.92	1.98	1.95	1.95	1.90
	Men	1.93	1.99	1.97	1.96	1.90
	Women	1.87	1.95	1.92	1.90	**1.85**
Black	Total	1.91	1.95	1.95	1.95	1.90
	Men	1.93	1.96	1.95	1.96	1.91
	Women	1.89	1.95	1.94	1.92	**1.85**
Total accumulations						
Total		$152,685	$97,611	$126,500	$155,122	$219,535
Men		190,316	118,921	163,206	192,871	244,759
Women		109,506	68,274	92,525	114,203	202,944
White	Total	160,253	106,690	130,073	158,819	223,746
	Men	201,765	131,718	169,749	199,245	**264,106**
	Women	111,683	71,163	93,152	114,043	159,305
Black	Total	119,206	83,300	108,574	132,883	187,078
	Men	136,522	98,845	129,394	153,083	205,939
	Women	103,480	**65,546**	90,808	115,891	180,576

Notes: Calculations are based on age-specific earnings profiles. Age-earnings profiles are based on 10-year age groups that are aged by one year each year. All figures are in 2002 dollars. A balanced portfolio – half in bonds and half in stocks – over the period from 1979 to 2002 is assumed. Figures in bold are maxima and minima. Total accumulations assume each group saves 10 percent of group average earnings. Per-dollar accumulations are the real (inflation adjusted) returns for each dollar invested over the 24 years from 1979-2002.

Table 4
Total Accumulations and Per-Dollar Accumulations, Hypothetical Worker Base

		Total	Less than High school	High school	Some college	College
Per-dollar accumulation						
Total		1.94	2.00	1.99	1.97	1.90
Men		1.95	**2.03**	2.01	1.98	1.94
Women		1.89	1.98	1.92	1.91	1.91
White	Total	1.93	**2.03**	1.98	1.97	1.91
	Men	1.96	**2.03**	2.00	1.97	1.92
	Women	1.89	2.01	1.91	1.91	**1.86**
Black	Total	1.92	**2.03**	1.95	1.96	1.93
	Men	1.95	1.99	2.01	2.00	1.94
	Women	1.92	1.96	1.97	1.96	**1.86**
Total accumulations						
Total		$154,037	$97,428	$128,200	$155,710	$219,655
Men		192,458	120,366	166,294	194,935	246,277
Women		109,842	68,602	92,383	114,022	195,165
White	Total	160,947	109,039	131,651	160,007	224,195
	Men	204,303	134,346	172,715	199,960	**264,118**
	Women	112,324	73,587	93,022	114,014	157,456
Black	Total	119,235	85,721	108,153	133,729	189,393
	Men	138,039	100,020	132,890	156,339	209,426
	Women	105,092	**65,706**	92,167	117,937	179,986

Notes: Calculations are based on hypothetical workers, instead of age specific earnings profiles (see discussion in the text). All figures are in 2002 dollars. A balanced portfolio – half in bonds and half in stocks – over the period from 1979 to 2002 is assumed. Figures in bold are maxima and minima. Total accumulations assume each group saves 10 percent of group average earnings. Per-dollar accumulations are the real (inflation adjusted) returns for each dollar invested over the 24 years from 1979-2002.

Table 5
Per-Dollar Accumulations
Holding Unemployment Rates or Earnings Constant

		Total	Less than High school	High school	Some college	College
		Per-dollar accumulation, constant unemployment rate				
Total		1.92	2.01	1.99	1.95	1.89
Men		1.93	2.01	1.97	1.96	1.91
Women		1.88	1.98	1.92	1.90	1.87
White	Total	1.92	2.00	1.95	1.95	1.89
	Men	1.92	2.00	1.97	1.95	1.89
	Women	1.87	1.97	1.91	1.90	1.85
Black	Total	1.92	1.97	1.96	1.95	1.89
	Men	1.94	1.98	1.96	1.97	1.91
	Women	1.90	1.97	1.96	1.92	1.85
		Per-dollar accumulation, holding earnings constant				
Total		1.92	1.91	1.92	1.92	1.93
Men		1.92	1.91	1.92	1.93	1.93
Women		1.92	1.90	1.92	1.92	1.93
White	Total	1.92	1.91	1.92	1.93	1.93
	Men	1.92	1.91	1.92	1.93	1.93
	Women	1.92	1.90	1.92	1.92	1.92
Black	Total	1.91	1.90	1.91	1.91	1.92
	Men	1.91	1.90	1.91	1.91	1.92
	Women	1.91	1.90	1.91	1.92	1.92

Notes: Calculations are based on age specific earnings profiles using group averages. All figures are in 2002 dollars. A balanced portfolio over the period from 1979 to 2002 is assumed. Estimates represent calculations based on simulations where unemployment rate (upper panel) or earnings (lower panel) do not vary. In general, when unemployment rates or earnings vary, the per-dollar accumulations are larger. This indicates that short-run fluctuations disproportionately advantage some groups over others (e.g. white v. black).

Table 6
Differences in Per-Dollar Accumulations Assuming No Unemployment or Earning Volatility Relative to Average Unemployment and Earnings Volatility

		Total	Less than High school	High school	Some college	College
<u>No unemployment</u>						
		0.01	0.02	0.01	0.01	0.00
Total		0.01	0.01	0.01	0.00	0.00
Men		0.01	0.02	0.01	0.00	0.00
Women		0.00	0.02	0.01	0.01	0.00
White	Total	0.00	0.02	0.01	0.00	0.00
	Men	0.01	0.03	0.00	0.01	0.00
	Women	0.02	0.03	0.02	0.01	0.00
Black	Total	0.02	0.03	0.02	0.02	0.00
	Men	0.02	0.03	0.02	0.01	0.00
	Women	0.01	0.02	0.01	0.01	0.00
<u>No earnings volatility</u>						
Total		0.00	-0.08	-0.04	-0.02	0.03
Men		0.00	**-0.09**	-0.05	-0.03	0.01
Women		0.04	-0.05	0.00	0.02	0.05
White	Total	0.01	-0.07	-0.03	-0.02	0.03
	Men	0.00	-0.08	-0.05	-0.03	0.03
	Women	0.05	-0.04	0.00	0.03	0.07
Black	Total	0.00	-0.05	-0.04	-0.03	0.03
	Men	-0.02	-0.06	-0.04	-0.04	0.02
	Women	0.02	-0.05	-0.03	0.00	0.07

Notes: Calculations are based on age specific earnings profiles using group averages. All figures are in 2002 dollars. A balanced portfolio over the period from 1979 to 2002 is assumed. Estimates represent calculations based on simulations where unemployment rate (upper panel) or earnings (lower panel) do not vary. In general, when unemployment rates or earnings vary, the per-dollar accumulations are larger. This indicates that short-run fluctuations disproportionately advantage some groups over others (e.g. white v. black).