The B.E. Journal of Macroeconomics

Contributions

Volume 10, *Issue* 1 2010 *Article* 36

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Recommended Citation
Karl Walentin (2010) "Earnings Inequality and the Equity Premium," *The B.E. Journal of Macroeconomics*: Vol. 10: Iss. 1 (Contributions), Article 36.
Available at: http://www.bepress.com/bejm/vol10/iss1/art36

Earnings Inequality and the Equity Premium*

Karl Walentin

Abstract

In this paper, we document a 75 percent increase in stockholders' share of aggregate labor income in the U.S. from 1962 to 2000 using data from Survey of Consumer Finances. Our decomposition of the increase in stockholders' share of aggregate labor income documents that one half is due to the equi-proportional increase in participation and one quarter each is due to the non-proportional part of the changes in stockmarket participation and changes in the income distribution, respectively. The change due to the labor income distribution is driven entirely by the increase in the share of labor income accounted for by the top labor income decile. Using a simple model with limited stockmarket participation, we present a mechanism for how the increase in stockholders' share of aggregate labor income has affected the *ex ante* equity premium (i.e. the discount rate applied to equity). The mechanism works through the composition of income of stockholders. The resulting decrease in the equity premium is 44 percent, which roughly coincides with the historical change in the post-1951 equity premium implied by the simple dividend growth model in Fama and French (2002).

KEYWORDS: labor income, earnings inequality, asset pricing, equity premium, limited participation, borrowing constraints

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*Thanks for useful comments go to the editor (Jonathan Heathcote) and two anonymous referees as well as Diego Comin, Mark Gertler, Paolo Giordani, Hui Guo, Jinyong Kim, Lars Ljungqvist, Sydney Ludvigson, Kevin Moore, Virginia Queijo von Heideken, Paolo Sodini, Ingvar Strid, Paul Söderlind, Gianluca Violante and seminar participants at New York University, Stockholm School of Economics, EEA Meetings 2006 (Vienna) and Sveriges Riksbank for helpful comments. The views expressed in this paper are solely the responsibility of the author and should not be interpreted as reflecting the views of the Executive Board of Sveriges Riksbank.

1 Introduction

Two important macroeconomic changes in the U.S. economy in the last few decades have been the increase in earnings (labor income) inequality and the long-term increase in stock prices.[1] Stock prices measured as the Price/Dividend (P/D) ratio of the Standard & Poor (S&P) index roughly tripled from its 1950-1980 average to its peak 2000 value and remain at a level roughly twice as high as in 1950-1980. The rising P/D ratio has arguably been caused by a fall in *ex ante* equity return, i.e. the equity discount rate. This interpretation is forcefully made by Fama and French (2002).[2] They calculate that the equity premium implied by a simple dividend growth model was 160 basis points lower in 1951-2000 than in 1872-1950, representing a 39% change. Furthermore, they show that the equity premium, calculated in this way, decreased monotonously decade by decade from 1950 and onwards. Fama and French conclude that the increase in stock prices in the last couple of decades must be interpreted as unexpected capital gains due to a fall in the equity discount rate. In this paper, we propose an answer to *why* the equity discount rate has declined.

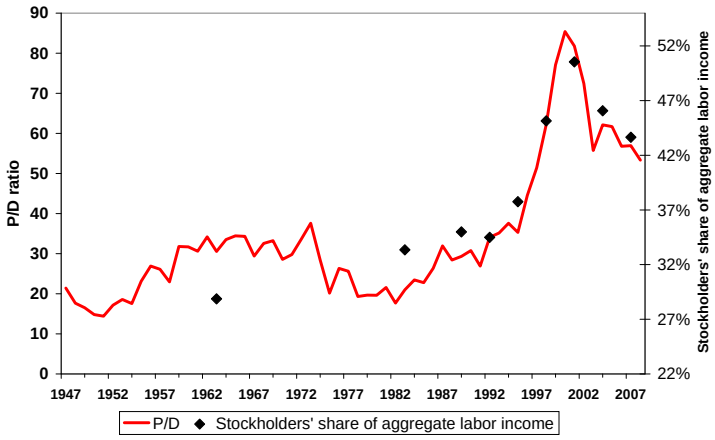
Our claim is that stockholders' share of aggregate labor income has increased over time, and that increased earnings inequality is an important factor for this increase. Furthermore, we claim that the increase in stockholders' share of aggregate labor income has contributed substantially to the decline in the equity discount rate. This increase led to a change in the income composition for stockholders, in particular a decrease in the fraction of their income accounted for by dividend income. This reduced the covariance between stockholders' total income growth and dividend growth, and thereby the *ex ante* equity premium. Figure 1 plots the time series for the S&P P/D ratio and stockholders' share of aggregate labor income.[3] Note the close relationship.

[1] The increasing wage and earnings inequality for the U.S. is well documented**;** see Katz and Autor (1999), Piketty and Saez (2003), Dew-Becker and Gordon (2005), Heathcote, Storesletten and Violante (2008). The phenomenon is not limited to the U.S., but has occurred generally in OECD countries. A large literature on what caused the increase in earnings inequality exists. The leading explanation is skill-biased technological change. An alternative explanation points towards increased international trade with low income countries.

[2] The falling equity premium has also been documented in Blanchard (1993), Cochrane (1997), Jagannathan, McGrattan and Scherbina (2000) and Campbell (2008).

[3] It should be noted that stock prices measured as Price/Earnings ratios have behaved very similarly to the P/D ratio. Nor is the pattern limited to the S&P index.

Figure 1: Standard & Poor Price/Dividend ratio 1947-2008 and stockholders' share of aggregate labor income 1962-2006. Source: Robert Shiller's website and Survey of Consumer Finances, author's calculations.



To the best of our knowledge, this paper is the first to document and decompose the changes in stockholders' and non-stockholders' labor incomes. An important inspiration was Mankiw and Zeldes' (1991) work on the consumption of these two groups. We perform this exercise using data from Survey of Consumer Finances (SCF). As can be seen in Figure 1 and Table 1, between 1962 and 2000, stockholders' share of aggregate labor income increased from 29% to 51%, and then decreased in 2003 and 2006. The stockmarket participation rate is documented together with stockholders' share of aggregate labor income, η^s, in Table 1.

The changes in stockholders' share of aggregate labor income can be decomposed into the effects of three economically meaningful factors:
i) the equi-proportional change in stockmarket participation, ii) the non-proportional part of the changes in stockmarket participation and iii) the changes in the distribution of labor income. The 21.7% increase in η^s can be decomposed into the three factors as follows: 10.9% due to the equi-proportional increase in participation, 5.5% due to the disproportionately large increase in participation for high income groups, and 5.3% due to changes in the labor income distribution. In other words, a quarter of the increase in stockholders' share of aggregate labor income is due to changes in the labor income distribution. This increase is driven entirely by the increase in the fraction of labor income that goes to the top labor income decile.

We explore the impact of the increase in stockholders' share of aggregate labor income on equity premia in a model with limited stockmarket participation,

Table 1: Stockmarket participation rate (P) and stockholders' share of aggregate labor income, η^s, in percent. Source: The Survey of Consumer Finances, author's calculations.

Year	P	η^s
1962	19.0	28.9
1982	19.7	33.4
1988	19.7	35.0
1991	21.2	34.5
1994	22.5	37.8
1997	27.3	45.1
2000	29.9	50.5
2003	27.5	46.1
2006	23.8	43.6

hand-to-mouth consumption and constant relative risk-aversion (CRRA) preferences. Note that in settings with CRRA, what is of importance is stockholders' share of aggregate labor income, not the stockmarket participation rate or the labor income distribution *per se*. The model is kept simple, without any trade in bonds, to isolate the main mechanism of changes in stockholder income composition on the equity premium.

Our key experiment is to calculate steady state equity premia for two different levels of stockholders' share of aggregate labor income. As mentioned above, an increase in stockholders' share of aggregate labor income leads to a change in the income composition for stockholders that reduces the covariance between stockholders' total income growth and dividend growth. The equity premium falls accordingly. The quantitative effect is substantial: The observed increase of $(50.5-28.9)/28.9 = 75\%$ in stockholders' share of aggregate labor income 1962-2000 generates a decrease in the equity premium of 44%. This change is close to the 39% calculated by Fama and French. The decomposition we perform shows that one quarter of this change is due to changes in the labor income distribution and it accordingly accounts for an 11% decrease in the equity premium.

Obviously, the quantitative effect of the increase in stockholders' share of aggregate labor income on the equity premium depends on the specification of the model and its parameters. Still, these quantitative results remain approximately unchanged when we extend the model with trade in bonds and occasionally binding borrowing constraints, in the spirit of Heaton and Lucas (1996) and Guo (2004). Furthermore, the qualitative result, that the *ex ante* equity premium decreases, is extremely robust. Our equity premium results are also quantitatively robust with

respect to the exact measure of stockmarket participation. If anything, alternative measures of participation indicates larger changes in stockholders' share of aggregate labor income and thereby in the equity premium.

The effects of two factors that affect the labor income of stockholders have been explored in the existing asset pricing literature. The first factor is an equi-proportional increase in stockmarket participation. Several authors have documented the implications of equi-proportional changes in participation rates in models that incorporate labor income. Heaton and Lucas (1999) and Polkovnichenko (2004) both show that increased participation only has a limited quantitative impact on the equity premium. Basak and Cuoco (1998), on the other hand, show that participation rates can have large quantitative effects on both the stock return and the risk-free return. Guvenen (2009) shows that limited participation is very important for generating a large equity premium. The second factor is changes in the aggregate labor share. Santos and Veronesi (2006) used the labor share of total consumption in the economy to make a similar covariance analysis to the one made in this paper, but for short time horizons. They showed that the labor share predicts equity returns 1-4 years ahead.

We are not aware of any other paper that explores the impact of stockholders' share of aggregate labor income, including the increased earnings inequality, on the equity premium.[4] Gollier (2001) and Hatchondo (2005) study the relationship between wealth inequality and the equity premium, but in an Arrow-Debreu setting analyzing the effect of absolute risk-aversion that is concave in wealth (DARA). The effect of increased wealth inequality on the equity premium is negative in the DARA setting. Our model generates this effect endogenously using extreme borrowing constraints in the form of hand-to-mouth consumption and limited participation, while Gollier's result directly follows from the assumption of DARA.

Several potential explanations for the decrease in the equity discount rate (*ex ante* equity return) have been proposed. We are not claiming that the mechanism of the present paper is the only explanation for the decrease in the equity discount rate, but merely quantify the importance of a previously omitted mechanism that contributed to this decrease - changes in stockholders' share of aggregate labor income beyond what is indicated by unweighted stockmarket participation rates. The dominant theory, at least until recently, is that a decline in macroeconomic volatility, "The Great Moderation", caused the decrease in the equity discount rate (Lettau, Ludvigson and Wachter, 2008). Other explanations prominent in the literature for the fall in the equity premium are: structural decrease in market volatility (Pástor and Stambaugh, 2001, and Kim, Morley and Nelson, 2004, 2005) or a reduction in transaction costs (Heaton and Lucas, 1999). As in the present paper, Freeman

[4]Favilukis (2007) addresses similar questions, but is more recent than this paper.

(2006) focuses on limited participation and high income households. Freeman's point is that the decline in the volatility of income of these households led to a fall of the equity premium.

Our exercise would be less relevant if the increase in earnings inequality only applied to annual cross-sectional inequality and not to lifetime earnings, but this is not the case. Bowlus and Robin (2004) document that for their period of study, 1977-1997, the increase in inequality in lifetime earnings and annual earnings is the same. Primiceri and van Rens (2009) show that the increase in inequality in the 1980s was predominately permanent.[5] The increase in earnings inequality is also robust to different measurement methods. It is evident both in tax records, as documented by Piketty and Saez (2003), and in all major household surveys (CES, CPS, PSID and SCF).[6]

The paper proceeds as follows. In the next section, we describe the model. Section 3 documents the decomposition of stockholders' share of aggregate labor income over time and describes the model parameterization with a focus on the income processes. In Section 4 we present the results and Section 5 concludes the paper.

2 Theory

2.1 Overview

To explore the effect of changes in stockholders' share of aggregate labor income on the equity premium, we set up a model with limited participation and risk averse agents that face stochastic dividend and labor income processes.[7] For simplicity, we abstract from idiosyncratic labor income risk by letting each agent's share of aggregate labor income be fixed over time. We also abstract from income heterogeneity within the group of stockholders. In particular, equity is priced using the labor income to total income ratio of the mean stockholder, implicitly assuming

[5] The results in Krueger and Perri (2003) point in a different direction. Their estimates indicate that most of the "within-group" inequality increase is transitory.

[6] CES: Krueger and Perri (2003). CPS: Katz and Autor (1999). PSID: Heathcote, Storesletten and Violante (2008). SCF: Author's own calculations.

[7] To endogenously get limited participation, we could introduce fixed participation costs for the stockmarket. Given the fixed cost and the larger benefit of participation as a function of wealth, there is a cut-off in total wealth (including expected future labor income) above which participation is optimal; see Gomes and Michaelides (2008) and Polkovnichenko (2004). Vissing-Jørgensen (2002) performs an exercise along those lines and calculates the size of the participation cost that is needed to explain half of the empirically observed non-participation to 50 dollars annually.

that all stockholders have the same ratio or at least that heterogeneity in this dimension have no effect on aggregate prices. The aim of our model is to be a stylized illustration of the main mechanism proposed in this paper – how an increase in stockholders' share of aggregate labor income leads to a reduction of the equity premium.

2.2 Model

There are two representative infinitively lived households: One stockholder (denoted by superscript s) and one non-stockholder (denoted by superscript n). Household i's preferences are represented by

$$E\sum_{t=0}^{\infty}\beta^t u(C_t^i),\ \ i=\{s,n\},$$

where β is the subjective discount factor, C_t^i denotes consumption of the perishable good and

$$u(C_t^i)=\frac{\left(C_t^i\right)^{1-\gamma}}{1-\gamma},$$

where γ is the coefficient of relative risk aversion.

No trade in financial assets is allowed and**,** accordingly, no actual consumption/saving decision is made. Instead, each agent consumes his total income, Y_t^i, period by period, i.e. "hand-to-mouth consumption". For the stockholder:

$$C_t^s=Y_t^s=W_t^s+D_t \tag{1}$$

where W^s denotes stockholder labor income and D denotes dividend income. For the quantitative exercise performed below, it is useful to write stockholder labor income as a product of the stockholder's share of aggregate labor income, η^s, and aggregate labor income, W^a. In turn, W^a can be written as a function of the dividend share D/Y^a and GDP, Y^a :

$$W_t^s=\eta^s W_t^a=\eta^s\left(1-\left(\frac{D}{Y^a}\right)_t\right)Y_t^a. \tag{2}$$

We could define measures for each of the two agents, but these measures are irrelevant; only the agents' respective income shares are of importance, as long as preferences are CRRA. Further, note that in this model, the non-stockholder plays no role except to create a time-varying difference between stockholder income and GDP.

Despite the absence of financial markets, we can price hypothetical assets using the stockholder stochastic discount factor. The risk-free rate can be calculated using the Euler equation:

$$1 = R_t^f \beta E_t \left\{ \frac{u'(C_{t+1}^s)}{u'(C_t^s)} \right\}.$$

For equity, the Euler equation is:

$$1 = E_t \left\{ R_{t+1}^e \beta \frac{u'(C_{t+1}^s)}{u'(C_t^s)} \right\}. \tag{3}$$

We assume log-normality of shocks. Taking unconditional expectations, linearizing by taking logs, and rearranging terms, equation (3) can then be rewritten as:

$$EP \equiv E(r^e) - E(r^f) = \gamma Cov(r^e, \Delta\hat{C}^s), \tag{4}$$

where we denote log returns by lower case, and other log variables by "hats". The difference in returns between equity and the risk-free asset is the equity premium, EP.

Under the assumption of a joint process for $\Delta\hat{D}$ and $\Delta\hat{C}^s$ that is i.i.d. over time, it follows that $r_t^e = \Delta\hat{D}_t$ (see Abel (2008)). Then, equation (4) can be written as

$$EP = \gamma Cov(\Delta\hat{D}, \Delta\hat{C}^s). \tag{5}$$

Using equation (1)**,** stockholder income growth, and accordingly stockholder consumption growth, can be approximated as:

$$\Delta\hat{C}_t^s = \frac{W^s}{W^s + D}\Delta\hat{W}_t^s + \frac{D}{W^s + D}\Delta\hat{D}_t,$$

where W^s and D denote the respective steady state values. We can then write the covariance as:

$$Cov(\Delta\hat{D}, \Delta\hat{C}^s) = \frac{W^s}{W^s + D}\left[corr\left(\Delta\hat{D}, \Delta\hat{W}^s\right)\sigma_{\Delta\hat{D}}\sigma_{\Delta\hat{W}^s} - \sigma_{\Delta\hat{D}}^2\right] + \sigma_{\Delta\hat{D}}^2 \tag{6}$$

where we have used $\frac{D}{W^s+D} = 1 - \frac{W^s}{W^s+D}$ and $\sigma_{\Delta\hat{W}}$ and $\sigma_{\Delta\hat{D}}$ denotes the standard deviations of wage and dividend growth, respectively.

Equation (6) is the key equation of the present paper. It is central for the quantification of the changes in the EP performed in Section 4. It also implies the main qualitative result: If $corr\left(\Delta\hat{D}, \Delta\hat{W}^s\right)\sigma_{\Delta\hat{W}^s} < \sigma_{\Delta\hat{D}}$, or equivalently $Cov(\Delta\hat{D}, \Delta\hat{W}^s) < Var(\Delta\hat{D})$, then $Cov(\Delta\hat{D}, \Delta\hat{C}^s)$, and thereby the EP, is decreasing in $\frac{W^s}{W^s+D}$, the fraction of stockholders' income that comes from labor. Note that

$\frac{W^s}{W^s+D}$ is monotonously increasing in W^s. We conclude that if the above inequality holds, an increase in steady state stockholder labor income W^s leads to a decrease in the EP.

3 Data

3.1 Data sources and definitions

For dividends, we use CRSP dividends and for labor income we use Bureau of Economic Analysis NIPA after-tax labor income, both converted to real per capita values using the total expenditure deflator and population data. Our sample is annual frequency and spans 1948-2001. As we are studying returns to publicly traded stocks, CRSP data, as opposed to NIPA data, is the relevant measure of dividends. Exactly the same dataset was used in Lettau and Ludvigson (2005). We define GDP, Y^a, as in the model, i.e. as the sum of dividends and aggregate labor income. For an alternative calibration, we use the gross share repurchase data from Grullon and Michaely (2002) to calculate a more inclusive measure of payouts as the sum of dividends and share repurchases.[8]

The details of the Survey of Consumer Finances data are as follows. We use the triennial SCF data from 1983-2007. Labor income in the survey refers to labor income in the previous calendar year. We let "labor income" also include any unemployment compensation. The 1986 wave of the SCF is not useful for our purposes. In particular, it does not contain information about labor income in a way comparable to the other survey waves. We complement the SCF by its predecessor, the Survey of Financial Characteristics of Consumers (SFCC), to get the 1962 labor income of stockholders and non-stockholders. All aggregate SCF based values are generated using the SCF population weights. The SCF contains information that allows us to classify each household as a stockholder or a non-stockholder. This is done using an inclusive definition of stockholding, following Poterba and Samwick (1995), including both direct stock holdings and indirect holdings of stocks in mutual funds, but not defined contribution retirement accounts. In a robustness exercise we document the results for an alternative measure of participation defined including stockholding contribution retirement accounts.

[8]Grullon and Michaely only report data for 1972-2000. Before 1972 share repurchases were approximately non-existent so the absence of detailed repurchase data for that period is not a limitation. But, at the end of the sample, we are forced to drop the observation for 2001 from the data series for total payouts due to the missing share repurchase observation.

3.2 Decomposing changes in stockholder labor income

The changes in stockholders' share of aggregate labor income, η^s, can be decomposed into the additive effects of three economically meaningful factors:

1. The equi-proportional change in stockmarket participation, $\Delta\eta^s_P$,
2. The non-proportional part of the changes in stockmarket participation, $\Delta\eta^s_D$, and
3. The changes in the distribution of labor income, $\Delta\eta^s_L$.

The effect of the first of these factors, an equal increase in participation in all income groups, affect η^s 1-for-1:

$$\Delta\eta^s_P = \Delta P$$

The total (factor 1+ factor 2) change in η^s generated by changes in participation rates is a weighted average of the change in participation, across income groups:

$$\Delta\eta^s_P + \Delta\eta^s_D = \sum_{i=1}^{N} \omega_{i,old}\Delta P_i \tag{7}$$

where $\omega_{i,old}$ is the labor income of group i as a fraction of total labor income at the initial point in time and P_i denotes the stockmarket participation rate of group i. N is the number of income groups. Eq. (7) can then trivially be rearranged to compute the effect of the second factor, $\Delta\eta^s_D$.

The effect of the third factor, changes in the distribution of labor income, is computed residually using the data on $\Delta\eta^s$.

$$\Delta\eta^s_L = \Delta\eta^s - (\Delta\eta^s_P + \Delta\eta^s_D)$$

We apply the above method and use $N = 10$, i.e. labor income deciles, to decompose changes in η^s from 1962 to 2000.[9] The 21.7% increase in η^s can be decomposed into the three factors as follows: 10.9% due to the equi-proportional increase in participation, $\Delta\eta^s_P$, 5.5% due to the disproportionately large increase in participation for high income groups, $\Delta\eta^s_D$, and 5.3% due to changes in the labor income distribution, $\Delta\eta^s_L$. In other words, the increase in stockholders' share of aggregate labor income was one half due to the equi-proportional increase in participation, and one quarter each due to the non-proportional part of the changes in stockmarket participation and changes in the income distribution, respectively.

[9] Ten income groups were chosen to facilitate comparison within the inequality literature and also to balance sampling uncertainty (which is increasing in the number of groups) against a wish to capture the income and participation distributions as detailed as possible.

Table 2 documents the underlying factors for the changes in η^s both for the full period 1962-2000 and the subperiods 1962-2006.[10] Looking at the subperiods, we note that unweighted participation contributed substantially and positively only in the 1990's; that the effects of a disproportionately large increase in participation in high labor income groups was substantial for the 1990's, and reversed in the 2000's when participation fell; and that changes in the labor income distribution mainly played a positive role in three subperiods: 1962-1982, 1997-2000 and 2003-2006.

Table 2: Changes in stockholders' share of aggregate labor income, η^s, decomposed. $\Delta\eta^s_P$ denotes the unweighted stockmarket participation rate, $\Delta\eta^s_D$ the distributional changes in participation, and $\Delta\eta^s_L$ the changes in labor income distribution. All units are in percent.

Time period	$\Delta\eta^s$	$\Delta\eta^s_P$	$\Delta\eta^s_D$	$\Delta\eta^s_L$
1962-2000	21.7	10.9	5.5	5.3
1962-1982	4.5	0.7	0.0	3.8
1982-1988	1.6	0.0	2.9	-1.3
1988-1991	-0.5	1.4	-2.7	0.7
1991-1994	3.3	1.3	2.0	-0.1
1994-1997	7.4	4.9	2.0	0.4
1997-2000	5.4	2.6	1.7	1.1
2000-2003	-4.5	-2.4	-2.3	0.3
2003-2006	-2.4	-3.8	-1.8	3.1

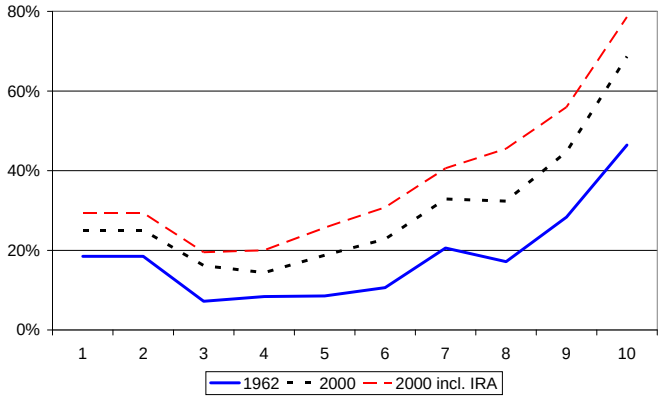
3.2.1 Distributional changes and their effects

We document the participation rates across labor income deciles in 1962 and 2000 in Figure 2. Participation rates are almost monotonically increasing in labor income. The only substantial exception is the high participation in the two lowest income deciles, which have no labor income. These deciles are dominated by retirees, which explains their high participation rates.[11] The disproportionately large increase in participation for high income groups is evident in the figure, although all income groups considerably increased their participation.

[10] The subperiod values for $\Delta\eta^s_D$ and $\Delta\eta^s_L$ only approximately add up to the total 1962-2000 change. This is because they are affected by each initial year labor income distribution and participation distribution, respectively.

[11] Plausibly, participation is an increasing function of financial wealth**,** and that is not well proxied by (correlated with) labor income for retirees.

Figure 2: Stockmarket participation rates per labor income decile.



Finally, in Table 3, we document the contributions of each income decile to $\Delta\eta^s$ for the period 1962-2000 and decompose these changes into the three underlying factors using the same method as for Table 2. Note that the change in η^s accounted for by decile i is

$$\Delta\eta_i^s = \omega_{i,new}P_{i,new} - \omega_{i,old}P_{i,old} \qquad i = \{1,2,3,...,10\}.$$

Table 3: Income decile decomposition of changes in stockholders' share of aggregate labor income, η^s, 1962-2000. All units are in percent.

Income decile	$\Delta\eta_i^s$	$\Delta\eta_{P,i}^s$	$\Delta\eta_{D,i}^s$	$\Delta\eta_{L,i}^s$
Total	21.7	10.9	5.5	5.3
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.1	0.0	0.0	0.1
4	0.2	0.2	-0.2	0.0
5	0.4	0.7	0.0	-0.3
6	0.7	1.2	0.1	-0.5
7	0.7	1.6	0.2	-0.9
8	1.6	2.4	0.7	-0.8
9	2.5	3.2	1.1	-0.8
10	15.8	7.1	3.6	8.7

The importance of the top labor income decile is clear from Table 3 – roughly two-thirds of the increase in η^s (and its contribution from $\Delta\eta^s_P$ and $\Delta\eta^s_D$) comes from the top decile alone. In terms of changed labor distribution, $\Delta\eta^s_L$, the result is similar: it is the increase in the labor income of the top decile, at the expense of decile 5-9, given the higher participation rate in the top decile, that is the reason why η^s increased. This is why we label the changes in the labor income distribution as increased labor income inequality. Table 3 also illustrates that the lower half of the labor income distribution is approximately irrelevant when calculating changes in η^s, as indicated by the fact that in spite of a substantial increase in participation of this group (see Figure 2), it only accounts for a 0.7% increase in η^s.

From a broader perspective, Table 3 illustrates one of the main messages of the paper: simply considering the impact of unweighted (i.e. equi-proportional) participation rates on stockholders' share of aggregate labor income, and thereby on asset prices, is misleading. Only if the changes in the distributions of participation rates and labor income are also taken into account do we get the correct effect on η^s.[12]

3.3 Parameterization

3.3.1 Income processes

For the parametrization of the income processes in our model, we simply calculate and use moments of the data described in Section 3.1. We thereby implicitly assume that the joint process for aggregate labor income growth and dividend income growth is stationary over the entire post-war period. In other words, we do not take into account any reduction or other variation in macro volatility that might have occurred within the sample period. Our exercise is in this sense orthogonal to exploring asset pricing implications of "The Great Moderation". We consider it beneficial to keep the quantitative effect of the mechanism emphasized in this paper separate from any such effects. Table 4 reports the sample moments that are used in the model, both for the baseline dataset and the alternative definition of payouts that includes both dividends and share repurchases.

Heaton and Lucas (1996) report a substantially different value for the standard deviation of dividend income growth, $\sigma\left(\Delta\hat{D}\right) = 5.36\%$. The main reason for the difference is that they use data on dividends from NIPA.

[12] To be clear: We have direct observations of stockholders' labor income. The problem mentioned here occurs when there are no such observations and one extrapolates from participation rate data, as has often been done in the literature.

Table 4: Moments of empirical income processes, in percent. σ denotes standard deviation and *Corr* denotes correlation.

Moment	Baseline	With repurchases
$\sigma(\Delta\hat{D})$	12.2	13.5
$\sigma(\Delta\hat{W}^a)$	1.83	unchanged
$Corr(\Delta\hat{D},\Delta\hat{W}^a)$	-0.10	-0.15

3.3.2 Other parameters

We use the sample average in our aggregate dataset to set the capital share $E(D/Y^a) = 0.046$. This implies a labor share of 0.954. In the alternative calibration**,** which includes share repurchases, the corresponding numbers are 0.057 and 0.943.

From the SCF, we get stockholders' share of aggregate labor income, η^s, as displayed in Table 1, i.e. $\eta^s_{1962} = 0.289$ and $\eta^s_{2000} = 0.505$.

4 Results

4.1 Quantitative results

Our key experiment is to study the effects on the EP of an exogenous redistribution of labor income from non-stockholders to stockholders, as observed in the last couple of decades. This is done using the model presented in Section 2. We analyze two different economies (i.e. two steady states). By studying two separate economies instead of the transition from one endowment process to another**,** we abstract from all the transition dynamics and implicitly assume that the change in stockholders' share of aggregate labor income, η^s, was unexpected and permanent.

The only parameter we change between our two economies is stockholders' share of aggregate labor income, η^s. As argued earlier, an increase in η^s reduces the covariance between growth of stockholder total income $\Delta\hat{Y}^s_{t+1}$ and dividend income $\Delta\hat{D}_{t+1}$. Inserting the 1962 and 2000 parameter values into equation (2) to obtain the corresponding W^s and inserting this into (6) yields an increase in the fraction of stockholders' income that is attributed to labor, $\frac{W^s}{W^s+D}$, from 0.86 to 0.91 and a 44% decrease in $Cov(\Delta\hat{D},\Delta\hat{C}^s)$. Recall from equation (5) that the EP is proportional to this covariance. The increase in stockholders' share of aggregate labor income that took place between 1962 and 2000 accordingly implies a decrease in the *ex ante EP* of 44%. This is the main quantitative asset pricing result of the paper.

The corresponding result for the alternative calibration, where payouts include both dividends and share repurchases, is 39%.

4.2 Robustness

4.2.1 Sensitivity to parameter values

The decrease in the EP is monotonously decreasing in the capital share, $E(D/Y^a)$. If we follow e.g. Heaton and Lucas (1996) and, instead of using the sample average, assume that $E(D/Y^a) = 15\%$, then the decrease in the EP implied by the model is smaller, only 33%.

An exercise that is less relevant for understanding this time period of the U.S. economy, but may be helpful for understanding the mechanism, is to vary the initial level of stockholders' share of aggregate labor income, η^s. We note that changes in the EP (both in level and percent) are monotonously decreasing in the initial η^s. Changing η^s by the same amount as above, but starting at $\eta^s_{1962}/2 = 0.145$, would have yielded a decrease in the EP of 56%, instead of 44%.

Regarding the robustness to changing the parameters of the exogenous income processes, the sufficient condition for an increase in stockholders' share of aggregate labor income, η^s, to generate a decrease in the EP was presented in subsection 2.2, equation (6) and amounts to:

$$corr\left(\Delta\hat{D}, \Delta\hat{W}^s\right)\sigma_{\Delta\hat{W}^s} < \sigma_{\Delta\hat{D}}.$$

We note that even if the income processes were substantially different than indicated by the sample moments, i.e. $corr\left(\Delta\hat{D}, \Delta\hat{W}^s\right) = -0.10$ and $\sigma_{\Delta\hat{W}} = 0.018$, the above inequality, and thereby the qualitative result, would still hold. In Table 5, we document the EP implications quantitatively for varying the calibration in these two dimensions of the labor income process. Note that the change in EP is decreasing in the correlation, but not dramatically. For negative $corr\left(\Delta\hat{D}, \Delta\hat{W}^s\right)$ the change in EP is increasing in $\sigma_{\Delta\hat{W}}$.

4.2.2 Further robustness

In this subsection, we discuss the robustness of the main result beyond the parameter values. We start by recalling that the increase in stockholders' share of aggregate labor income from 1962 to 2000 amounted to a 75% increase. This means that minor violations of the assumption that the dividend share, or more generally the payout share, of GDP is stationary will not change the results; the fraction of

Table 5: Percentage change in equity premium for various income process parameter values. The correlation values vary column-wise, and labor income volatility row-wise. N/A indicates that the implied equity premium is negative and its change therefore is not meaningful.

$corr\left(\Delta\hat{D},\Delta\hat{W}^s\right)$	-0.7	-0.5	-0.3	-0.1	0.1	0.3	0.5	0.7
$\sigma_{\Delta\hat{W}}=0.009$	-59	-52	-46	-41	-37	-34	-31	-28
$\sigma_{\Delta\hat{W}}=0.018$	N/A	-76	-56	-44	-35	-29	-25	-21
$\sigma_{\Delta\hat{W}}=0.036$	N/A	N/A	-90	-49	-32	-23	-18	-14
$\sigma_{\Delta\hat{W}}=0.072$	N/A	N/A	N/A	-64	-27	-16	-10	-7
$\sigma_{\Delta\hat{W}}=0.108$	N/A	N/A	N/A	-90	-23	-11	-6	-3

stockholders' total income that is attributed to labor increased unambiguously in this time period.

Let us point out one assumption that might plausibly cause an overstatement of the quantitative result. We have assumed that the labor income of stockholders vary proportionally with aggregate labor income, i.e. $W_t^s=\eta^s W_t^a$ which implies $corr\left(\Delta\hat{D},\Delta\hat{W}^s\right)=corr\left(\Delta\hat{D},\Delta\hat{W}^a\right)$ and $\sigma\left(\hat{W}^s\right)=\sigma\left(\hat{W}^a\right)$. It might be that stockholders' labor income is more correlated than aggregate labor income with dividends, i.e. $corr\left(\Delta\hat{D},\Delta\hat{W}^s\right)>corr\left(\Delta\hat{D},\Delta\hat{W}^a\right)$. For example, this would be the case if stockholders are over-represented among employees with wages tied to dividends and these**,** in turn, are positively correlated with the corresponding aggregates. In a more general framework on concentration of fluctuations to a subset of agents in downturns, this mechanism was suggested by Mankiw (1986) as an explanation for the level (not the change) of the EP. We leave it to future research to fully evaluate the potential deviation from the assumption that stockholders' labor income vary proportionally with aggregate labor income. This would require data, ideally panel data, on the labor income of stockholders at a suitable frequency that could be used to directly estimate the specific dynamics of their labor income.[13][14]

Finally, our result – in terms of the percentage change in the covariance and thereby also in the equity premium – is approximately replicated in a full-fledged model where we allow trade in bonds, but impose borrowing constraints that bind

[13]Given the concentration of stockholdings and labor income it is crucial for this type of exercise to capture the dynamics of households with extremely high labor income. This makes top-coded datasets like the PSID unsuitable.

[14]Parker and Vissing-Jorgensen (2009) show that the labor income of high-income households do covary more with aggregate income than for other households. Given that high income households have higher participation rates than others, this indicates that stockholder labor income probably have a higher volatility and different correlations than aggregate labor income.

occasionally, in the spirit of Heaton and Lucas (1996) and Guo (2004).[15] The main difference in such a model is that the level of $Cov(\Delta\hat{D}, \Delta\hat{C}^s)$, and thereby the equity premium, is lower as the stockholder can smooth part of the variation in his income by using the bond market.

4.2.3 Alternative measures of stockmarket participation

Including defined contribution retirement accounts In an alternative measure of stockmarket participation we include stockholdings in retirement accounts.[16] In general these are not withdrawable and can therefore not be used to smooth consumption, which is why we let this be merely an alternative measure. Table 6 replicates Table 1, using this alternative participation measure. Obviously participation is higher in all years using this measure (except 1962 when no data on retirement accounts exist).[17] Compared to Table 1, we also note that stockholders' share of aggregate labor income, η^s, is higher, by slightly larger amounts than the participation rate P. The total change in η^s is 30.8% instead of the baseline increase of 21.7% and the increase in P is 18.3% which can be compared to the baseline value 10.9%. As a fraction the increase in stockholders' share of aggregate labor income is 30.8%/28.9%=107%, i.e. substantially higher than the baseline 75%.

In Table 7 we document the decomposition of the changes in the alternative measure of η^s 1962-2000. Compared to our preferred measure unweighted changes in participation and distributional changes in participation are now more important while changes in the labor income distribution are less important. The latter account for 15% of the change compared to a quarter for the baseline. The participation across income deciles for the alternative measure are documented in Figure 2 and display the same pattern as the baseline measure.

The implication of the alternative measure of participation for the change in the EP is a decrease of 53%, slightly larger than the baseline change of 44%.

Requiring substantial stockholdings A second alternative definition of stockholder participation takes into account that the equity pricing model we use implicitly assumes that the ratio of labor income to total income is the same for all stockholders. We therefore create a measure of participation that requires the value

[15] For details of that model and its nonlinear solution method, see the working paper version of this article.

[16] For 1982 we impute the fraction of households whose defined contribution accounts contain stocks, as this information is not in the survey. We use the 1989 fraction (0.43, rounded to one half) to perform this imputation.

[17] We consider the lack of information about defined contribution retirement accounts in 1962 to be a neglible problem - that type of pension accounts was extremely unusual at that time.

Table 6: Stockmarket participation rate (P) and stockholders' share of aggregate labor income, η^s, in percent, using an alternative participation measure that includes stockholdings in defined contribution retirement accounts: IRAs and Keoghs.

Year	P	η^s
1962	19.0	28.9
1982	23.7	39.3
1988	24.3	42.1
1991	29.2	45.4
1994	28.4	45.7
1997	35.4	55.2
2000	37.3	59.7
2003	36.9	59.7
2006	36.3	59.9

Table 7: Changes in stockholders' share of aggregate labor income, η^s, 1962-2000 decomposed. $\Delta\eta^s_P$ denotes the unweighted stockmarket participation rate, $\Delta\eta^s_D$ the distributional changes in participation, and $\Delta\eta^s_L$ the changes in labor income distribution. All units are in percent. The first alternative measure includes stockholdings in defined contribution retirement accounts: IRAs and Keoghs. The second alternative measure requires stockholdings to exceed 50% of total annual income.

	$\Delta\eta^s$	$\Delta\eta^s_P$	$\Delta\eta^s_D$	$\Delta\eta^s_L$
baseline	21.7	10.9	5.5	5.3
alternative, incl. IRAs	30.8	18.3	7.9	4.5
alternative, only major stockh.	12.5	6.8	2.3	3.4

We presented a mechanism for how the increase in stockholders' share of aggregate labor income has affected the *ex ante* equity premium (i.e. the equity of stockholdings to be at least 50% of total annual income, with the intention to exclude stockholders for whom stock income only affect total income marginally. Table 8 replicates Table 1 for this alternative participation measure. The level of participation according to this measure is, not surprisingly, much lower. The increase for the time period 1962-2000 in η^s and P are 12.5% and 6.8% respectively. As a fraction the increase in stockholders' share of aggregate labor income is $12.5\%/9.1\% = 137\%$. As for the first alternative measure, we report the decomposition of the increase in η^s in Table 7. As for our preferred participation measure changes in labor income, $\Delta\eta^s_L$, account for a quarter of the change in η^s. The implication of this measure of participation for the change in the EP is a decrease of 49%.

To sum up, the results of the alternative participation measures are similar to the preferred measure regarding changes in stockholders' share of aggregate labor income and thereby the equity premium. If anything, alternative measures of participation indicates larger changes. As documented in Table 7 all three measures also indicate that changes in participation in isolation is not a good proxy for changes in stockholders share of aggregate labor income, η^s.

Table 8: Stockmarket participation rate (P) and stockholders' share of aggregate labor income, η^s, in percent, using a second alternative participation measure that requires the value of stockholdings to exceed 50% of total annual income.

Year	P	η^s
1962	7.6	9.1
1982	6.0	10.1
1988	6.5	8.1
1991	7.3	8.0
1994	8.5	11.2
1997	12.3	17.6
2000	14.4	21.7
2003	12.8	21.2
2006	10.8	20.0

5 Summary

In this paper, we have documented a 75% increase in stockholders' share of aggregate labor income in the U.S. from 1962 to 2000, due to both increased stockmarket participation and increased inequality in labor income. Our decomposition of the changes in stockholders' share of aggregate labor income documents that a quarter of the increase that took place 1962-2000 was due to changes in the labor income distribution. This increase was entirely driven by the increase in the share of labor income accounted for by the top labor income decile. More generally, we have shown that it is misleading to simply use unweighted changes in stockmarket participation rates to calculate changes in stockholders' share of aggregate labor income, and thereby in asset prices. Only if the changes in the distributions of participation rates and labor income are also taken into account are the correct implications for stockholders' share of aggregate labor income obtained.

We presented a mechanism for how the increase in stockholders' share of aggregate labor income has affected the *ex ante* equity premium (i.e. the equity

discount rate). The mechanism works through the composition of income of stockholders. The increase in the fraction of stockholders' income that is attributed to labor decreases the covariance between stockholder income growth and dividend growth. We show in an asset pricing model with limited stockmarket participation and labor income that this implies a substantial decrease in the ex ante equity premium, and that this result is robust with respect to the calibration of the model and the exact measurement of stockmarket participation. When we feed stockholders' share of aggregate labor income for 1962 and 2000 into our model, the *ex ante* equity premium decreases by 44% over this time period. This number roughly coincides with the historically observed decrease of 39% (160 basis points) in the post-1951 equity premium implied by the simple dividend growth model in Fama and French (2002). We conclude that the increase in stockholders' share of aggregate labor income is an important factor in explaining the decrease in the long-term level of the equity premium.

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