Aggregate Risk and Wage Dispersion

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Abstract

Integrating elements of finance and labor theory, I quantify the degree to which aggregate risk affects wage premia for high-income earners. In the model, wages are stochastic, covary with the state of the economy, and command a risk premium. Using asset price data, I develop a lower bound on this premium and show that it is quantitatively large for highly cyclical jobs with volatile labor compensation.

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1 Introduction

Underlying the well-documented rise in inequality are widening differentials in labor compensation. Especially among high income earners—even among those with similar education levels—income disparities have widened markedly since the early 1980s. In the United States, for example, the wage income share of the top .1 percent increased almost fourfold from 1 percent in 1970 to 4 percent in 1998 (Piketty and Saez, 2003).

Among existing explanations for rising inequality are the superstar effect, changing social norms, globalization, and skill-biased technological change. Except for the superstar theory, however, these explanations focus on broad trends in inequality over time. Yet rather than incomes rising uniformly across the upper half of the income distribution, in recent decades a disproportionate share of income has accrued to the top 1 percent of income earners. Focusing on the degree of aggregate, nondiversifiable risk faced by workers, this paper explores another factor contributing to rising inequality—one especially relevant for explaining disparate trends *within* the top one percent of income earners.

The paper addresses a simple question: to what extent does wage dispersion represent a risk premium for aggregate risk borne by high-income workers? In recent decades, labor income risk faced by these workers has become more aggregate in nature, with upper incomes becoming more aligned with aggregate fluctuations. Being more human capital-oriented, output fluctuations in advanced economies increasingly parallel changes in the return to human capital. Originating in the financial sector, the Great Recession is a prominent example. The early 2000s recession, associated with technological innovation, is another.

The paper complements existing explanations for wage inequality and integrates two themes in the literature. First is the theory of compensating differentials, which predicts that risky occupations command a risk premium. Second is financial theory, which predicts that income subject to aggregate risk commands a risk premium. While labor economics focuses largely on idiosyncratic risk—such as accidents in the workplace—the role of aggregate risk has attracted relatively little attention.

To evaluate the quantitative importance of this channel, I use financial data. Financial data provide a convenient and model-free way to infer risk premia and attitudes toward risk. Moreover, this approach provides an internally consistent approach to quantifying risk premia across labor and capital markets. Especially relevant here is the existence of a sizable equity premium of around six percent per year, reflecting a strong aversion to aggregate risk.

I proceed as follows. Section 2 outlines a stylized model showing how aggregate risk affects labor compensation. Section 3 presents a quantitative analysis. Calibrating the model, I show that the framework predicts the existence of significant wage differentials among workers with identical levels of human capital. Following this, I review some suggestive empirical evidence. Finally, Section 4 concludes.

2 Model of Wage Dispersion

The agent lives for two periods and has lifetime utility of

$$\mathcal{U} = u(c_t) + \beta \mathbb{E}_t u(c_{t+1}),$$

where $u_c > 0$, $u_{cc} < 0$, and $\beta > 0$ is the constant discount factor. In period t, the agent works for wage $\overline{w}$, and at the end of the period, faces a choice of two jobs in period $t+1$: a safe one paying the same wage $\overline{w}$ or a risky one paying an *uncertain* wage of w. The distribution of the risky wage is known, and the standard deviation of wage growth is σ. At the end of period $t+1$, the agent receives the wage and consumes. Broadly, this is similar to the choice faced by professionals as they progress in their careers. Most are already in well-paid positions and possess significant assets, and then choose whether to remain in their existing position or move to another with greater compensation.

Competition in the labor market ensures that the risk-free and risky jobs are equally attractive in equilibrium:

$$\mathbb{E}_t \overline{w} u'(c_{t+1}) = \mathbb{E}_t w_{t+1} u'(c_{t+1}),$$

i.e., the expected marginal utility gain is equal across jobs. This implies that

$$\mathbb{E}_t m_{t+1} \left(w_{t+1} - \overline{w} \right) = 0, \tag{1}$$

where $m_{t+1} = \beta \frac{u'(c_{t+1})}{u'(c_t)}$ denotes the stochastic discount factor (SDF). A high value of m_{t+1} reflects relatively low consumption in period $t+1$ and hence a greater value accruing to additional income. Given the initial wage $\overline{w}$, we can write (1) in terms of growth rates:

$$\mathbb{E}_t \left(m_{t+1} g_{w_{t+1}} \right) = 0,$$

where in general $g_{w_{t+1}}$ denotes the wage growth premium (henceforth *premium*) in the risky job. Expanding this expression yields

$$\mathbb{E}_t m_{t+1} \mathbb{E}_t g_{w_{t+1}} + Cov(m_{t+1}, g_{w_{t+1}}) = 0,$$

implying

$$\mathbb{E}_t m_{t+1} \mathbb{E}_t g_{w_{t+1}} + \rho \sigma_m \sigma = 0 \Rightarrow \mathbb{E}_t m_{t+1} \mathbb{E}_t g_{w_{t+1}} = -\rho \sigma_m \sigma, \tag{2}$$

where σ_m is the standard deviation of the SDF, and $-1 \leq \rho \leq 1$ denotes the correlation between the SDF and wage growth in the risky job.

At this point, I draw on standard results from the asset pricing literature regarding empirical properties of the SDF: $\mathbb{E}_t m_{t+1} \approx 1$ and $\sigma_m \geq .5$. The first follows from the Euler equation for the risk-free rate, while the second is the bound of Hansen and Jagannathan (1991) applied to the aggregate U.S. equity market. Dropping the approximation sign, the first relation combined with (2) implies that the expected premium is

$$\mathbb{E}_t g_{w_{t+1}} = -\rho \sigma_m \sigma. \tag{3}$$

Table 1: **Calibration of Wage Growth Premia** (%)

σ (%)	$\rho=-1$	$\rho=-.75$	$\rho=-.5$	$\rho=0$	$\rho=.25$
5	3	2	1	0	-.6
10	5	4	3	0	-1
20	10	8	5	0	-3
30	15	11	8	0	-4
50	25	19	13	0	-6
80	40	30	20	0	-10

Using the equation, $\mathbb{E}_t g_{w_{t+1}} = -\rho\sigma_m\sigma$, and the condition, $\sigma_m \geq .5$, the table reports lower bounds for the wage growth premium (in percentage points) for risky jobs above risk-free ones. The table presents premia in a given year for various values of the standard deviation of wage growth in the risky occupation, σ, and the correlation of the stochastic discount factor with wage growth in the risky job, ρ.

As a result, the expected premium in the risky sector is higher if: i) the correlation of risky wage growth with the SDF is negative (i.e., the risky job pays poorly in downturns); ii) the SDF is more volatile (i.e., the economy is riskier); or iii) wage growth in the risky job is more volatile. Combining (3) with the inequality, $\sigma_m \geq .5$, places a lower bound on the premium.

3 Calibration of Model and Discussion

Table 1 displays the predicted premium, g_w, for a variety of parameter values. Examining the table, it is possible to generate a wide range of wage disparities for *ex ante* identical workers. For example, if the standard deviation of wage growth in the risky sector is 30 percent and the correlation of wage growth with the SDF is $-.5$, then wage growth in the risky profession will be at least 8 percentage points higher than in the risk-free job.[1] Compounded over time, this leads to significant wage dispersion.

[1] As a result of a rising skill premium in recent decades, the growth of the risk-free wage has also been relatively high.

Meanwhile, a worker whose wage is uncorrelated with the economy commands the baseline reward for human capital and no risk premium. Being gradual, predictable, and largely acyclical, wage variation associated with skill-biased technological change and globalization does not generate risk premia in this setting. Because wage disparities can arise even in the face of identical levels of human capital, the model can rationalize the existence of residual inequality.

Driving the increased income share of the top 1 percent has been marked increases in labor income. Most important, this component has become increasingly cyclical in recent decades (Parker and Vissing-Jorgensen, 2010).[2] Evident from Figures 1 and 2 is the increasing instability of upper incomes over postwar U.S. business cycles after 1982. Significantly, this rise in instability coincides with the rise in wage inequality since the early 1980s. Examining micro data, Guvenen et al. (2017) find that males at the 99.9th percentile of the earnings distribution face the highest degree of aggregate risk. These observations provide suggestive evidence for the mechanism outlined here.

According to Bakija et al. (2008), executives, managers, supervisors, and financial professionals account for 70 percent of the increase in the share of national income accruing to the top 0.1 percent of the U.S. income distribution between 1979 and 2005. As evidenced by greater firm churn rates and shorter CEO turnover, these groups face an increasing amount of aggregate risk. Focusing on these workers, Peters and Wagner (2014) document a significant executive turnover premium and find that a one percent increase in turnover risk is associated with a ten percent increase in compensation. Further amplifying wage uncertainty is the evolving nature of wage contracts, which increasingly tie labor compensation to firm performance and the state of the economy. Chief among these are stock options, which lead to a positive covariance between labor income and equity returns.

More generally, the theory has implications for changes in income shares over time. As structural change occurs, individual sectors' performance correlates in a chang-

[2] Notably, the top one percent of income earners have existing exposure to the capital market and private business assets, and cyclical labor income compounds this aggregate risk exposure.

ing way with the overall economy. As a result, wage premia evolve over time and parallel sectoral shifts in the economy. In particular, as high-skilled sectors increase as a share of the economy, the confluence of a skill and risk premium causes a disproportionate increase in high-skilled wages. Finance is a case in point. According to Greenwood and Scharfstein (2013), the growth of financial services since 1980 accounts for more than a quarter of the growth of the services sector as a whole. Consistent with a rising risk premium, Philippon and Reshef (2012) report that bonuses and salaries in finance increased 70 percent more than average pay in other industries between 1980 and 2005. Moreover, countries with the largest financial sectors have experienced the most marked rises in inequality, with the United Kingdom and United States being prominent examples.[3]

Mirroring the long-run evolution of U.S. income inequality, Figure 3 depicts a relation between the top .1 percent income share and its volatility over time. Income volatility was relatively high in the early twentieth century, declined between 1950-1980, and subsequently rose again. Yet despite this apparent symmetry, the figure masks significant differences in income composition over time. While capital income was the main income source for the top .1 percent in the early twentieth century, by 1980 it was displaced by labor income. Piketty and Saez (2003) report that the top .1 percent derived on average of 55 percent of their income from capital between 1900-50, but this declined to 26 percent between 1980-2000. The coincidence of higher labor income and higher labor income risk after 1980 is consistent with the framework outlined here. Yet the earlier income volatility was primarily driven by fluctuations in equity income, and between 1900 and 1950 equities commanded an average annual return of 7.7 percent. Thus while risk premia amplified higher incomes for much of the twentieth century, the main source of the risk premia changed from capital to labor over time.

[3]For example, the U.K. financial sector trebled in size between 1964 and 2009. Similarly, the U.S. financial sector grew from 2.4 percent of GDP in 1947 to 7.6 percent in 2019.

4 Conclusion

While a large body of recent research has highlighted the importance of declining norms, deregulation, and the increasing scale of firms, the role of aggregate risk has received comparatively little attention. Yet as economies become more skill-oriented, wages of high-skilled workers command a proportional risk premium on top of a relatively high existing wage. While the model presented here is highly stylized, it shows how the interaction of skill and risk premia, coupled with new forms of labor compensation, leads to widening income differentials.

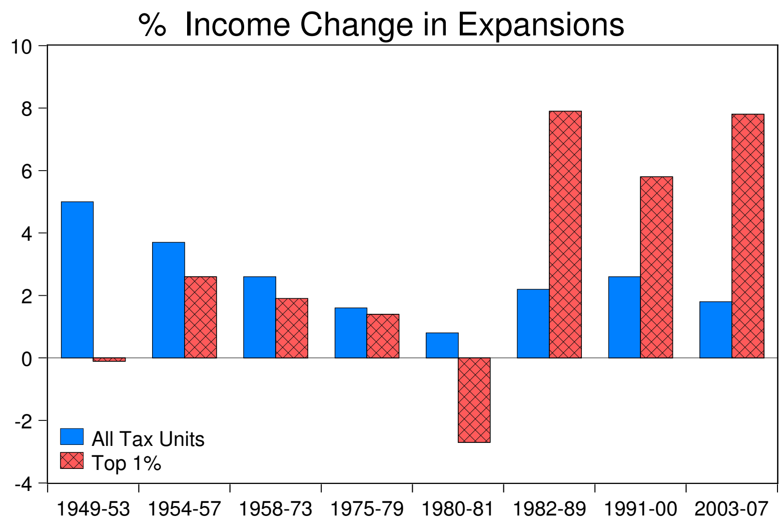

Figure 1: % Real Income Changes during U.S. Expansions. Income is Real Pre-Tax, Pre-Transfer Income Excluding Capital Gains and Per Tax Unit.
Source: Parker and Vissing-Jorgensen (2010).

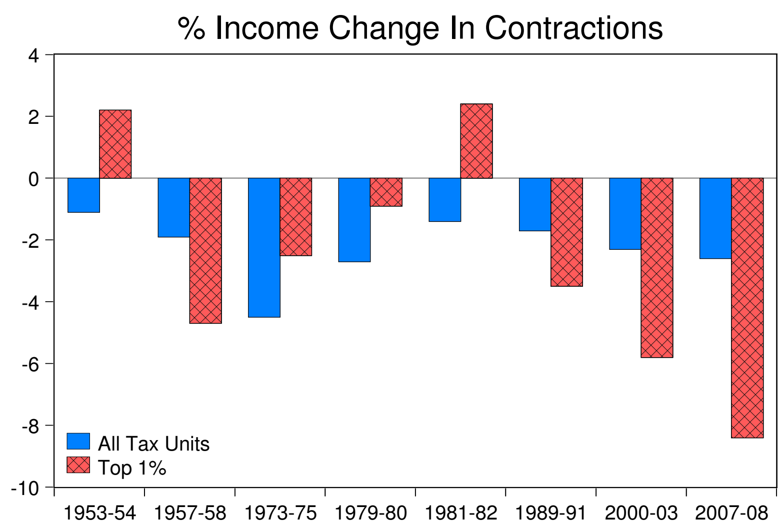

Figure 2: % Real Income Changes during U.S. Contractions. Income is Real Pre-Tax, Pre-Transfer Income Excluding Capital Gains and Per Tax Unit.
Source: Parker and Vissing-Jorgensen (2010).

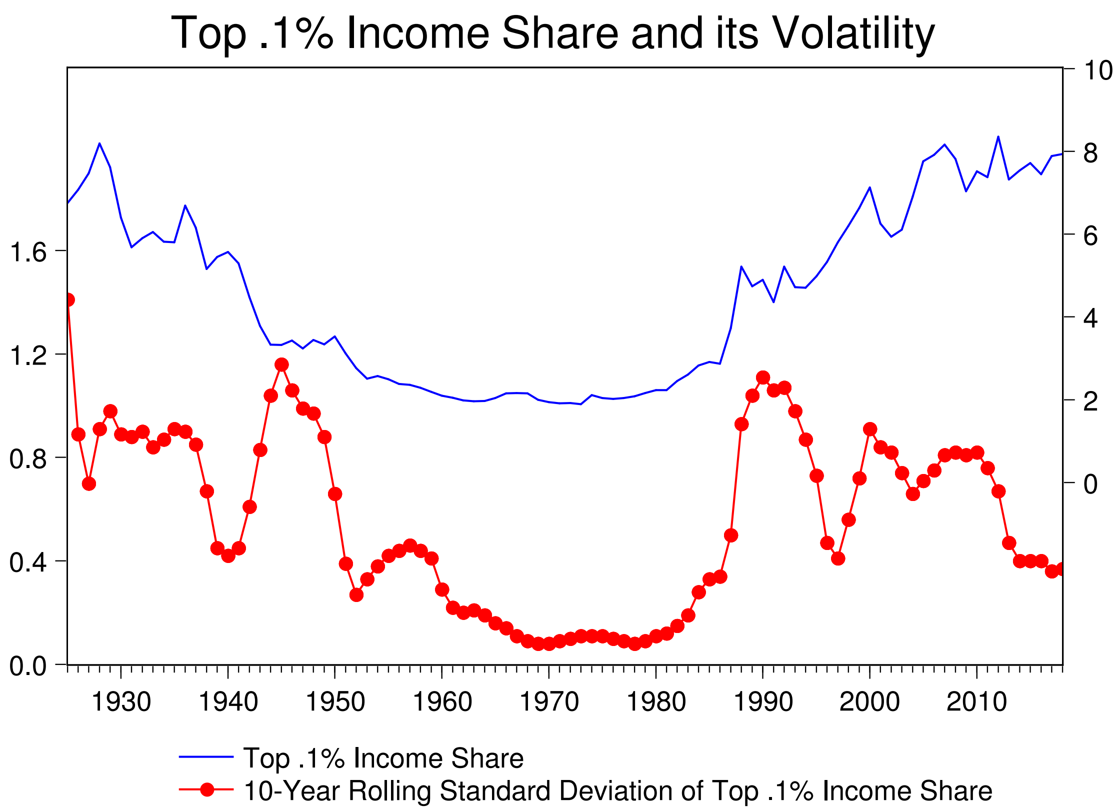

Figure 3: TOP .1% U.S. INCOME SHARE AND VOLATILITY. VOLATILITY REFERS TO TEN-YEAR ROLLING STANDARD DEVIATION. INCOME IS REAL PRE-TAX, PRE-TRANSFER INCOME EXCLUDING CAPITAL GAINS.
SOURCE: UPDATED TABLES FROM PIKETTY AND SAEZ (2003).

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