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The Stock Market, Labor-Income Risk and Unemployment in the US: Empirical Findings and Policy Implications

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Summary: This study looks into the linkages between rates of return in stock markets – and stock market volatility – and labor income risk and the unemployment rate, respectively, in the United States. After considering basic theoretical links between labor income risk plus unemployment and stock market dynamics, an empirical analysis is conducted which follows two earlier papers by FAMA/FRENCH and FAMA/MACBETH in terms of their empirical approaches. The new approach presented here includes additional variables while interesting results regarding Granger causality analysis are also derived. We find that rate of return development is Granger causal for labor income risk and unemployment in the US. Labor income and unemployment significantly affect the stock market rates of return and the volatility of such returns. There are several key policy conclusions based on the empirical findings presented herein; the results indicate that stocks provide a rather good hedge against labor income declines. Crucial conclusions could be drawn in particular by the US Administration, in particular the new Biden Administration.

Zusammenfassung: Diese Studie untersucht die Zusammenhänge zwischen den Renditen an den Aktienmärkten - und der Aktienmarktvolatilität - und dem Arbeitseinkommensrisiko bzw. der Arbeitslosenquote in den Vereinigten Staaten. Nach der Betrachtung grundlegender theoretischer Zusammenhänge zwischen dem Arbeitseinkommensrisiko sowie der Arbeitslosigkeit und der Aktienmarktdynamik wird eine empirische Analyse durchgeführt, die in ihrem empirischen Ansatz zwei früheren Arbeiten von FAMA/FRENCH und FAMA/MACBETH folgt. Der hier vorgestellte neue Ansatz bezieht zusätzliche Variablen mit ein und es werden auch interessante Ergebnisse zur Granger-Kausalitätsanalyse abgeleitet. Wir finden, dass die Entwicklung der Rendite Granger-kausal für das Risiko des Arbeitseinkommens und der Arbeitslosigkeit in den USA ist. Arbeitseinkommen und Arbeitslosigkeit beeinflussen signifikant die Aktienmarktrenditen und die Volatilität dieser Renditen. Aus den hier vorgestellten empirischen Befunden ergeben sich mehrere wichtige politische Schlussfolgerungen; die Ergebnisse deuten darauf hin, dass Aktien eine recht gute Absicherung gegen einen Rückgang des Arbeitseinkommens darstellen. Entscheidende Schlussfolgerungen könnten vor allem von der US-Regierung gezogen werden, insbesondere von der neuen Biden-Regierung.

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1. Introduction

Yield and risk are two key dimensions of rational investment behavior and financial market analysis has emphasized various models for examining the linkages between risk and the rate of return, whereby the Capital Asset Pricing Model (CAPM) is one of the standard approaches. In the CAPM of asset markets, the stock market-related stock index return factor $ß := (COV(Rit/RMt)/VAR(RMt))$ – with Rit standing for the rate of return of asset i, at point of time t, and RMt the rate of return of the market portfolio - is an indicator of the respective asset's volatility relative to overall market volatility and the basic idea is that the yield of each asset i will adequately reflect $ßi$ – the higher $ßi$ is, the higher one could expect the yield of asset i to be. To the extent that many firms are listed on the stock market, the stock market price volatility of company i – relative to the overall stock market volatility – should indicate the relative risk premium which rational investors require to hold the respective equity. Research on the standard CAPM has found little empirical evidence, including consumption-based intertemporal asset pricing approaches which date back to BREEDEN (1979) and LUCAS (1978). There are also linear factor models which owe their origins to ROSS (1976) and dynamic CAPM approaches based on MERTON (1973). A rather prominent linear factor model – with application to the US – was the specification proposed by FAMA/FRENCH (1993) who use a three-factor model which includes the standard ß, a size factor plus a book-to-price effect typically found in the data of Western stock market pricing. It is not fully clear why the two additional factors are significant drivers of the rate of return, one possible element reinforcing one or both of these additional drivers of the rate of return could be the risk of future labor market income. An important contribution concerning a multi-beta asset pricing approach was that of JAGANNATHAN/WANG (1996) which concerns the growth rate of labor income.

Labor income is likely to be rather volatile for relatively unskilled workers who tend to face rather long and frequent spells of unemployment during their lifetime. Some aspects of training and retraining naturally will enter the policy equation in the subsequent analysis. This is a particularly important aspect in the US where government expenditures on training and retraining has traditionally been extremely low in comparison to other OECD countries (WELFENS, 2019). To the extent that tax policy and income redistribution could affect net income and labor income risk, respectively, new perspectives on taxation and social securities might have to be considered – thus possibly making the case for the US to consider reforms related to some institutional elements similar to those in some Western European and indeed other OECD countries, respectively.

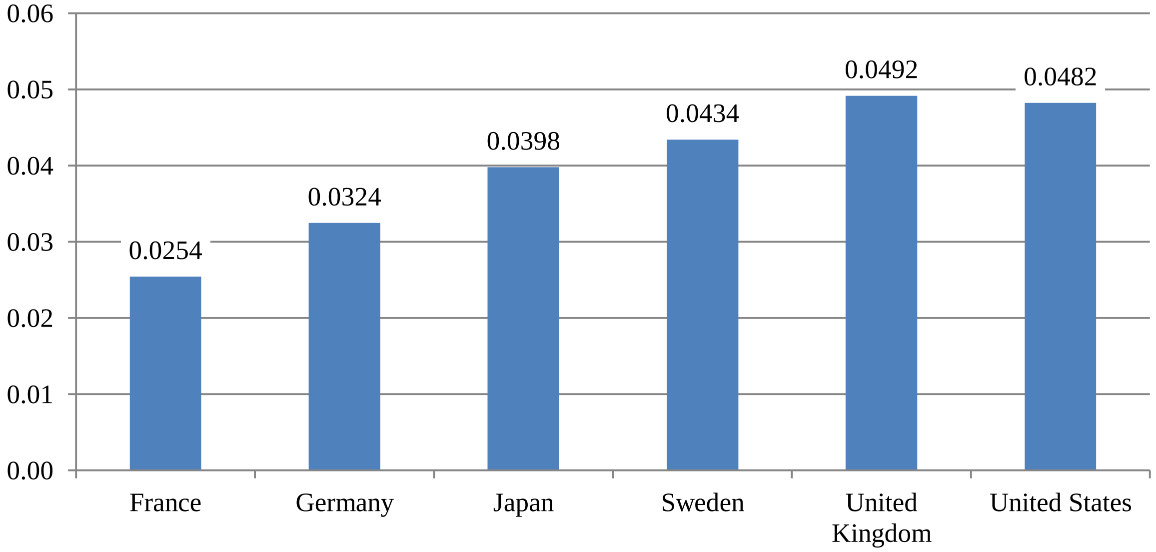
The accumulation of capital plays a considerable, and possibly increasingly important, role in OECD countries, not least since life expectancies are increasing over time in the US and the EU countries plus the United Kingdom. The growing role of stocks in overall wealth in many OECD countries – and certainly in the US – raises the issue as to the extent to which certain influences, particular labor income risk and the unemployment rate, affect the rate of return of stocks and the volatility of rates of return in the stock market; or, in a different perspective, the extent to which stock market dynamics could affect labor income risk and the unemployment rate. As regards the latter perspective, it is obvious that rising rates of return in the stock market, and hence rising equity prices, could stimulate investment directly and thus reduce labor income risk as well as bring about a lower unemployment rate. Here, the subsequent analysis will offer Granger causality analysis.

As regards financial markets in OECD countries, there are contributions to the literature which sheds light on the linkages between risk and yields on investment in a given asset class – for example, corporate bonds or government bonds, particularly in the context of BREXIT (see, for example, KADIRIC/KORUS (2019) and KADIRIC (2020)). Financial assets are rather liquid compared to real estate or human capital. However, beyond these liquidity aspects, one can study the links between relevant human capital income volatility and the risk of equity yields in financial markets - as has been done, amongst others, by JAGANNATHAN/KUBOTA/TAKEHARA (1998) for the case of Japan. The findings for Japan are quite interesting where one should emphasize that over time, real wage income growth instability in Japan compared to the US, the UK and Germany – but not for Sweden - is rather small. As regards international stock market spillovers, it is fairly obvious that the dominant US stock market contributes significantly to the volatility of stock markets in the UK, the Eurozone, Switzerland, Japan and other countries; from this perspective, the assumption of JAGANNATHAN/KUBOTA/TAKEHARA (1998, p. 324) that Japanese equity markets are not integrated with the rest of the world is somewhat doubtful.

One may argue that the lower income strata in society are not especially directly exposed to links between stock market dynamics and labor income risk so that a personal reflection on the two factor markets, namely labor markets and capital markets, will not be perceived as crucial to many. The situation is, however, rather different to the extent that workers and employees, either directly or indirectly (for example, through a pension plan) hold equities which is a middle-class phenomenon in the US. The situation looks different for high wage earners (who are typically college graduates) and people in high income brackets where some form of investment in the stock market will be normal. The following analysis sheds some light on the linkages between labor income risk - plus unemployment – and stock market developments which could basically be understood as a broader portfolio selection problem to the extent that employees could consider separate income streams from working and from the stock market in a broad perspective: This hypothesis may be stated as individuals holding wealth in the form of stocks will typically have a higher reservation wage in periods of a medium-term increase of relative stock market prices which, in turn, could raise productivity in the economy and hence the profitability of firms; as employees holding wealth in the form of stocks can afford to invest more search time into finding a better job(moreover, as regards labor market wage dynamics in OECD countries, a panel data analysis might consider including a variable which indicates the strength of national labor market regulations, since the volatility of wage income growth is likely to be related to the ruling wage-setting regime in the respective country).

Nominal wage income volatility is rather strong in the US, the UK and Sweden, namely those three countries in which households' ownership in stocks is rather strong (see Fig. 1.1). Labor income volatility – in terms of the standard deviation – is much smaller in France and Germany. In a standard portfolio view, one may state: To the extent that the volatility of labor income and stock market income (dividends, rates of return) are negatively correlated, the interest of stock-holders in stocks should be much larger in the US, the UK and Sweden than in France and Germany; in terms of labor income volatility, Japan is between the two country groups considered in the graph.

Fig. 1.1 Annual nominal wage income growth volatility in France, Germany, Japan, Sweden, the UK and the US for the period 1995Q1-2019Q4.



Note: The figures (standard deviations) are calculated using year-on-year quarterly growth rates of wage income.
Source**:** OECD Quarterly National Accounts, own calculations

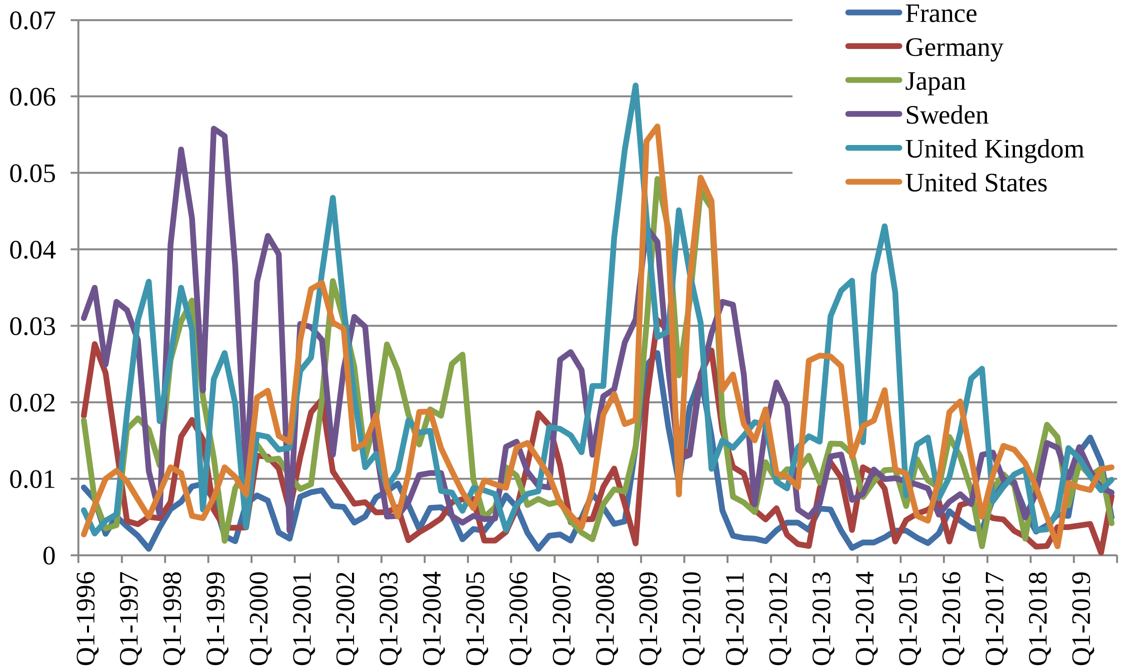
The key issues covered in the subsequent analysis concern the linkages between stock market dynamics and labor income risk as well as the unemployment rate and other selected variables. Analyzing the links between labor markets and capital markets – here stock markets – is crucial to gaining a better understanding both stabilization issues as well as key challenges in economic institutional reforms. The analysis presented herein is based on a theoretical section (Section 2), the empirical section about factor analysis (Section 3), a section about data (Section 4), a section about factor analysis results (Section 5), a section about Granger causality analysis (Section 6) followed by a section with selected economic policy conclusions (Section 7); some possible new future research directions are also highlighted. In the empirical sections, namely Sections 5 and 6, regression analysis is used to cover part of the issues raised.

A key variable to be considered in the subsequent empirical model is, of course, the market excess return; we add additional variables to a standard model, namely labor income risk and the unemployment rate, respectively. Interestingly, labor income risk is negatively linked with the rate of return in stock markets while the unemployment rate has a positive relationship to the market excess return. As regards volatility, the findings are also interesting: Labor income is negatively, and unemployment positively, linked with the volatility of rates of return. Moreover, a key finding is that Granger causality runs from rate of return developments to labor market developments.

2. Descriptive and Theoretical Perspectives

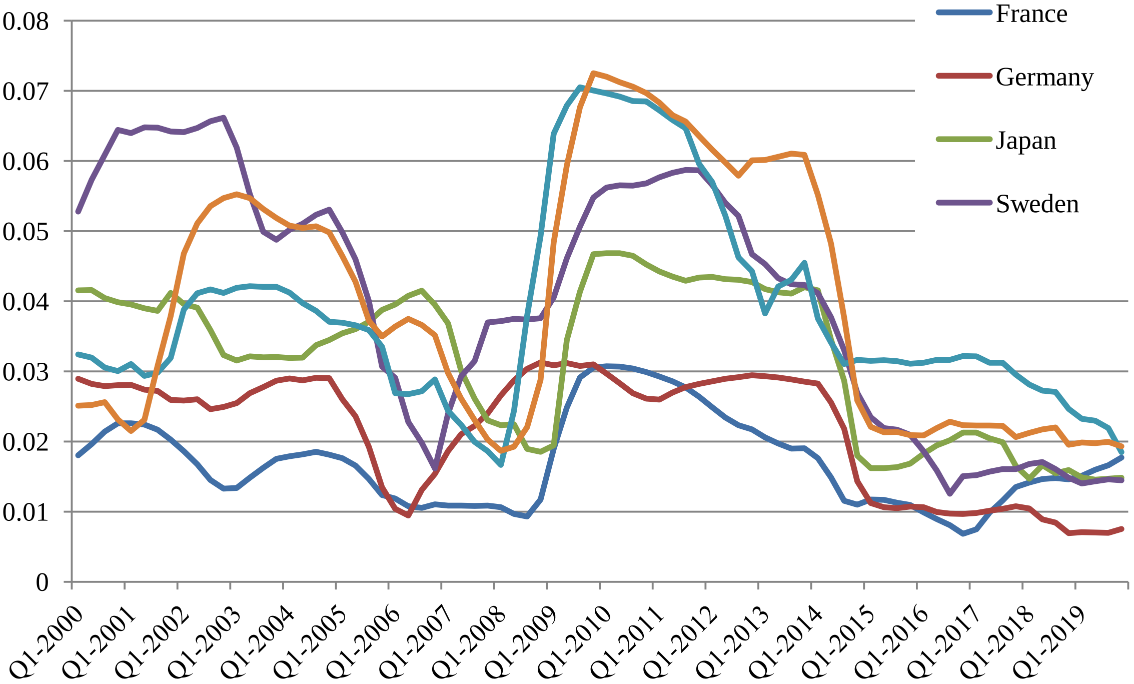
Generally, the ownership of stocks is not widespread amongst workers and employees in OECD countries. Sweden might be a special case in the European Union, namely to the extent that Swedish trade unions have, since the 1990s, pushed to expand the equity ownership of workers – via special investment funds – which could lead to somewhat different wage income volatility patterns in Sweden as compared to other EU countries. The highest wage volatility over the period from 1995Q1 to 2019Q4 was seen for the UK, followed by the US, Japan, Sweden, Germany and France.

Fig. 2.1: Rolling 1-year annual nominal wage income growth volatility in Germany, Sweden, France, Japan, UK and the US for the period 1995Q1-2019Q4.



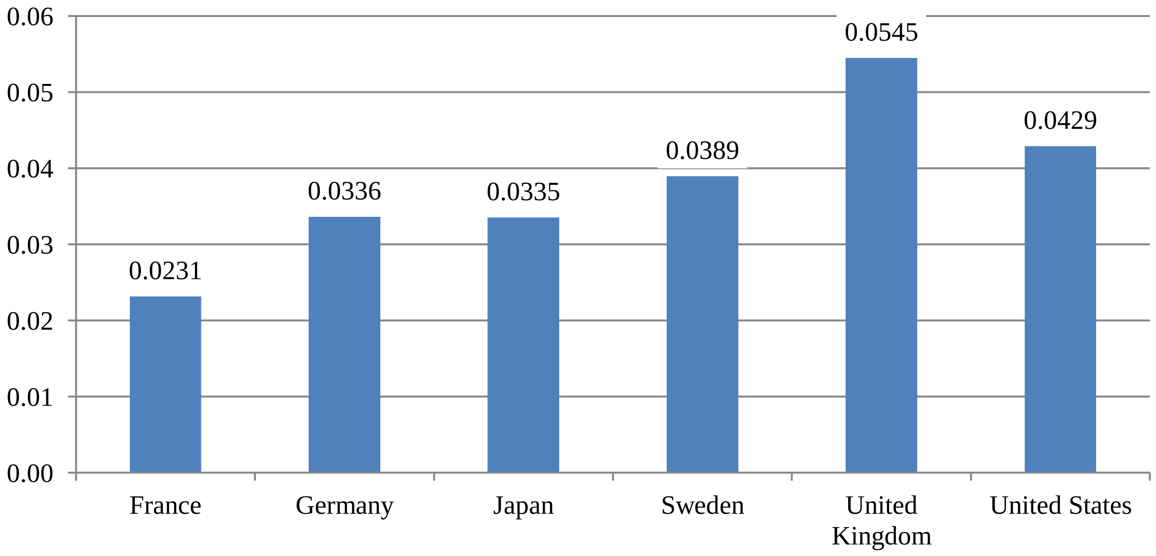
Note: The figures (standard deviations) are calculated using the latest 4 year-on-year quarterly growth rates of each period.
Source: OECD Quarterly National Accounts, own calculations

Fig. 2.2: Rolling 5-year annual nominal wage income growth volatility in Germany, Sweden, France, Japan, UK and the US for the period 1995Q1-2019Q4.



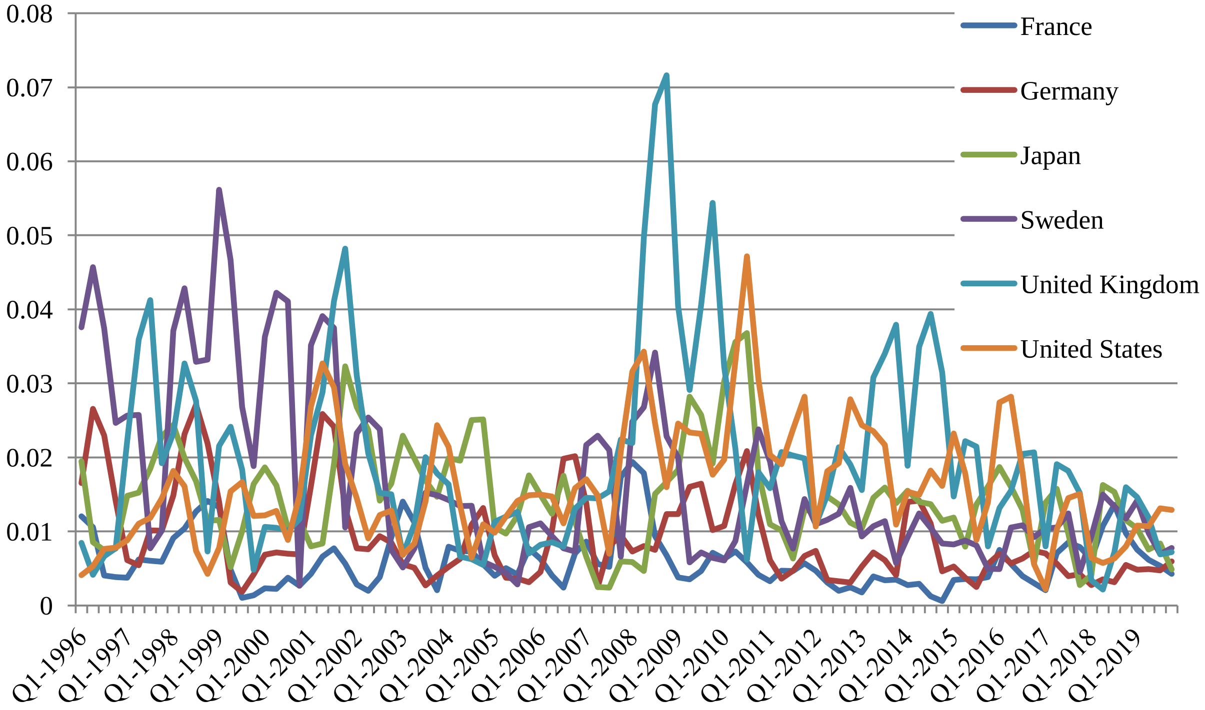
Note: The figures (standard deviations) are calculated using the latest 20 year-on-year quarterly growth rates of each period.
Source: OECD Quarterly National Accounts, own calculations

Fig. 2.3: Annual real wage income growth volatility in Germany, Sweden, France, Japan, UK and the US for the period 1995Q1-2019Q4.



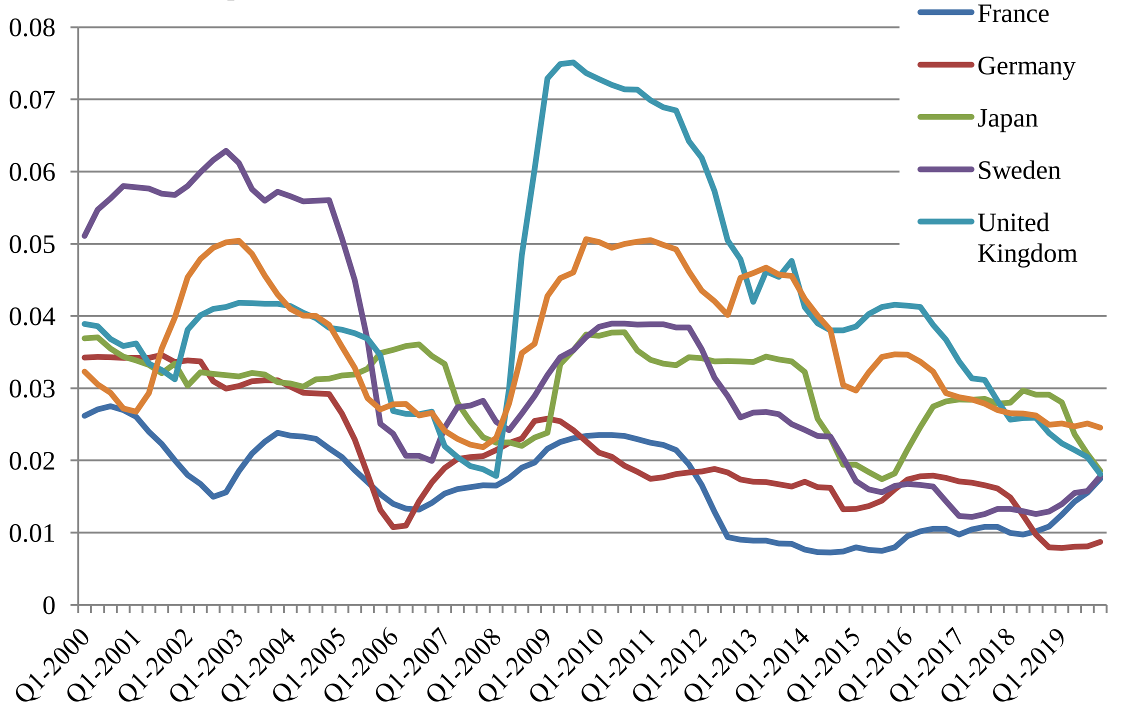
Note: The figures (standard deviations) are calculated using year-on-year quarterly growth rates of the real wage, which is the nominal wage divided by the consumer price index of each country.
Source: OECD Quarterly National Accounts, own calculations

Fig. 2.4: Rolling 1-year annual real wage income growth volatility in Germany, Sweden, France, Japan, UK and the US for the period 1995Q1-2019Q4.



Note: The figures (standard deviations) are calculated using the latest 4 year-on-year quarterly growth rates of each period of the real wage income, which is the nominal wage divided by the consumer price index of each country.
Source: OECD Quarterly National Accounts, own calculations

Fig. 2.5: Rolling 5-year annual real wage income growth volatility in Germany, Sweden, France, Japan, UK and the US for the period 1995Q1-2019Q4.



Note: The figures (standard deviations) are calculated using the latest 20 year-on-year quarterly growth rates of each period of the real wage income, which is the nominal wage divided by the consumer price index of each country.
Source: OECD Quarterly National Accounts, own calculations

As regards a representative stock market index for the US capital market, one might consider both the Dow Jones Index as well as the much broader S&P500 Index. To the extent that the labor market $ß^L$ is different for the two stock market indices, this would suggest that aggregate labor market volatility is obviously less well anticipated or less relevant for one of the stock market indices. In the Dow Jones Index there are more high-tech firms as appear in the S&P500 Index and thus the share of skilled labor could play a bigger role for the narrower index than for the broader S&P500 Index – with the wage income of skilled workers expected to be generally less volatile than the overall wage income composed of both skilled and unskilled workers.

In a basic theoretical perspective, one has to consider the linkages between stock market dynamics and the labor market equilibrium. There could be several links between stock market price developments and employment as well as labor income risk. A rise of the labor supply – a dampening of real wage income growth - should increase profitability and stock market prices, respectively; hence a negative link between relative stock market developments (stock market price index P' relative to the output price level P) should be expected. However, one cannot rule out a reverse link, namely that through, for example, exogenous capital imports and FDI inflows, respectively (driving up the stock market price index), the demand for labor is rising – in particular skilled labor – so that the skilled wage increases and a rising relative stock market price index should tend to go along with a lower unemployment rate and a possibly lower labor income risk; the later defined through the variance of labor income growth. Clearly, the issue of causality is raised here, so that a Granger causality analysis is useful.

A particular link between stock market index developments and the unemployment rate could occur in the context of an augmented Phillips curve which includes the role of wealth for private households. An enhanced Neo-Keynesian Phillips curve model would argue that an increased, while still modest inflation rate – going along with a lower unemployment rate – brings about a fall of the real wage rate, assuming that the inflation increase is unanticipated; and therefore – assuming that the decline in the real wage rate is less than offset in the medium term by a rise in employment - real wage income could reduce. A rise of profits of firms (ultimately a rise of profits in the current period and in the medium term) can be expected so that the stock market index, relative to the GDP deflator, will increase. This suggests that a higher stock market index and a lower unemployment rate, going along with reduced real income growth in the medium term. The situation in the long run could be different.

Labor Supply Perspectives and the Role of Unearned Income

The role of unearned income for consumption and the labor supply can be assessed in various ways, where dividend income as well as future uncertain pension income may be considered as offering interesting insights for highlighting part of the linkages between stock market dynamics and labor income risk. As regards the US, FADLON/RAMNATH/TONG (2019) indicate a participation elasticity of labor supply of roughly −0.35 as a result of becoming eligible for the US survivor pension scheme at the age of 60 (as US survivor pension plans impose limits on the maximum annual earnings above which the pension is subject to additional taxation, the authors' estimated effect is a mix of a substitution effect and an income effect). Evidence from Swedish lotteries indicate an average lifetime marginal propensity on unearned income of -0.11, while labor-supply elasticities were in the lower range of previously reported estimates (CESARINI/LINDQVIST/NOTOWIDIGDO/ ÖSTLING, 2017). NEBIOGLU/GIRITLIGIL (2018) offer additional insights into the links between the wealth effect and the labor supply, namely based on experimental studies which, however, yield partly inconclusive results.

Stock market developments – and dividend payments – could affect labor supply to the extent that working households have invested directly or indirectly in stocks. Following the standard Q-approach of Tobin, stock market price developments will in turn affect aggregate investment and labor demand and a fortiori also the equilibrium real wage (amongst the OECD members, those countries where workers – directly or indirectly - hold a rather high share of overall stocks are Sweden, the US and also the UK; through a national stock and investment fund, respectively, stock market investments also plays a role for households in Norway as the Norwegian government has decided to accumulate an extra national savings fund from oil revenues.). To the extent that worker households partly obtain income from stock market investments, the behavior of trade unions could differ from that in other OECD countries and this would affect labor income development. As regards the share of "unearned income" in the overall income of households, there is empirical evidence from Austria that a higher level of "unearned income"/expected pension payment (BÖHEIM/TOPF, 2020) leads to a lower labor supply and thus should bring about a rise of the real wage in equilibrium; but it is not clear whether or not wage income would be thereby raised since high real wages and lower employment will be observed.

Looking at the analytical links between stock market dynamics – rates of return and volatility – and economic and labor market developments, respectively, requires to consider a broad range of influences and variables, respectively. To examine the linkages between equity returns and both labor income and unemployment, respectively, the FAMA-MACBETH (1973) cross-sectional 2-step regression is used – within an augmented analytical and regression framework. For the first step, where each portfolio's exposure to risk factors is determined, we use the FAMA-FRENCH (2015) 5-factor model (FF5M) which is extended here to accommodate additional variables, namely labor income risk and the unemployment rate.

3. Factor Analysis Model

Let $R_{i,t}$ and $R_{F,t}$ denote the gross return of a stock or a portfolio *i* and the risk-free return in period *t*, R_{mt} denotes the gross return of the market portfolio. Besides the market excess return ($r_m = R_m - R_F$), the containing risk factors in the 5-factor model (FAMA/FRENCH, 2015) are "Small-Minus-Big" (SMB), which denotes the size premium and accounts for the spread in returns between smaller capitalized stocks and larger capitalized stocks, "High-Minus-Low" (HML), which is the value premium and gives the return-spread of stocks with high and low book-to-market ratios, "Robust-Minus-Weak" (RMW), which is the profitability premium and is the difference in returns of robust and weak operating profitability stocks, "Conservative-Minus-Aggressive" (CMA), which is the investment premium and accounts for the difference in the returns of stock-companies exhibiting conservative and aggressive investment behaviors. As additional risk factors, we include the growth rate of labor income

(LI) and the unemployment rate (U), respectively. As a result, the model equation, with m=7 factors, is expressed as follows:[1]

$$R_{i,t} - R_{F,t} = c + \beta_{i,M} r_{m,t} + \beta_{i,L} LI_t + \beta_{i,U} U_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,RMW} RMW_t + \beta_{i,CMA} CMA_t + \varepsilon_{i,t} \quad (1)$$

where $\varepsilon_{i,t}$ is a zero-mean residual for portfolio i (with i=[1;n]). Hence, the factor exposure of each single asset or portfolio i can be measured using Equation 1.

To estimate risk premia of the factors and to assess the validity of the factor model, in the second step of the FAMA/MACBETH approach, the cross-section of returns is regressed using the estimated risk factor exposures (betas) from Equation 1 for each time period. The model is given as follows:

$$E[R_{i,t} - R_{F,t}] = \gamma_0 + \gamma_M \beta_{i,M} + \gamma_L \beta_{i,L} + \gamma_U \beta_{i,U} + \gamma_{SMB} \beta_{i,SMB} + \gamma_{HML} \beta_{i,HML} + \gamma_{RMW} \beta_{i,RMW} + \gamma_{CMA} \beta_{i,CMA}. \quad (2)$$

Following Model 2, the estimates of the betas from Equation 1 are used to compute T cross-sectional regressions:

$$\begin{aligned} R_{i,1} - R_{F,1} &= \gamma_{1,0} + \gamma_{1,M} \hat{\beta}_{i,M} + \gamma_{1,L} \hat{\beta}_{i,L} + \gamma_{1,U} \hat{\beta}_{i,U} + \gamma_{1,SMB} \hat{\beta}_{i,SMB} + \gamma_{1,HML} \hat{\beta}_{i,HML} \\ &\quad + \gamma_{1,RMW} \hat{\beta}_{i,RMW} + \gamma_{1,CMA} \hat{\beta}_{i,CMA} + \varepsilon_{i,1} \\ R_{i,2} - R_{F,2} &= \gamma_{2,0} + \gamma_{2,M} \hat{\beta}_{i,M} + \gamma_{2,L} \hat{\beta}_{i,L} + \gamma_{2,U} \hat{\beta}_{i,U} + \gamma_{2,SMB} \hat{\beta}_{i,SMB} + \gamma_{2,HML} \hat{\beta}_{i,HML} \\ &\quad + \gamma_{2,RMW} \hat{\beta}_{i,RMW} + \gamma_{2,CMA} \hat{\beta}_{i,CMA} + \varepsilon_{i,2} \\ &\vdots \\ R_{i,T} - R_{F,T} &= \gamma_{T,0} + \gamma_{T,M} \hat{\beta}_{i,M} + \gamma_{T,L} \hat{\beta}_{i,L} + \gamma_{T,U} \hat{\beta}_{i,U} + \gamma_{T,SMB} \hat{\beta}_{i,SMB} + \gamma_{T,HML} \hat{\beta}_{i,HML} \\ &\quad + \gamma_{T,RMW} \hat{\beta}_{i,RMW} + \gamma_{T,CMA} \hat{\beta}_{i,CMA} + \varepsilon_{i,T}, \end{aligned} \quad (3)$$

where each regression i runs from 1 to n, and γ are coefficients subsequently used to calculate the risk premiums for each factor. As a result, m+1 series for the coefficients γ (including the constant) are obtained. The risk premium γ_j (j=[1;m]) for each factor is the average over T. By calculating standard deviations of each γ_j series, the cross-sectional significance of the risk premiums can be tested by the t-statistics $\gamma_j/(\frac{\sigma_{\gamma_j}}{\sqrt{T}})$.

Using the average of the adjusted R^2 measures stemming from the T cross-sectional regressions of Model 2 ($\bar{R}^2_{cs} = \frac{\sum_{t=1}^{T} \bar{R}^2_t}{T}$), the Model's explanatory capacity of the cross sectional variability of returns in any given month can be assessed.[2]

[1] To account for possible autocorrelation, we use the heteroskedastic-autocorrelation consistent (HAC) variance-covariance estimator proposed by NEWEY/WEST (1987) with automatic lag selection.

4. Data

As regards the FF5M, monthly data on the five factors described in Section 3 and 25 equity portfolio returns formed on size and book-to-market ratios are extracted from Kenneth French's webpage for the period 1999M01 to 2019M12.[3] Factors and portfolios are calculated by using all NYSE, AMEX and NASDAQ firms. Table 4.1 gives a detailed overview of the factors, whereas Table 4.2 presents descriptive statistics for the 25 equity portfolios sorted according to size and book-to-market criteria (Panel A), labor income and unemployment rate (Panel B).

For the volatility analysis, we additionally extracted daily return data for the same 25 equity portfolios as above. Using these daily data, monthly volatilities (standard deviations) $\sigma_{i,t}$ are calculated for the portfolios. The econometric approach described in Section 2 for the excess return of portfolio i ($R_{i,t} - R_{F,t}$) can be easily carried out for the volatility of portfolio i ($\sigma_{i,t}$).

Using seasonally adjusted monthly data from the US Bureau of Economic Analysis (BEA) and the US Bureau of Labor Statistics (BLS), the additional factors of labor income (referred to as "wages and salaries" by the BEA) and the unemployment rate (BLS) are calculated using the monthly growth rates for the same period as above.

Tab. 4.1: Overview of the used factors for the US equity market.

Factor	Calculation	Proxy
Market excess return ($r_m = R_m - R_F$)	The value-weight return of NYSE, AMEX and NASDAQ listed firms minus the one-month Treasury bill rate	Market premium
Small-Minus-Big (SMB)	Using the 6 value-weight portfolios based on size, the spread in returns between smaller capitalized stocks and larger capitalized stocks is calculated	Size premium
High-Minus-Low (HML)	Using the 6 value-weight portfolios based on size and book-to-market ratio, the return-spread of stocks with high and low book-to-market ratios is calculated	Value premium
Robust-Minus-Weak (RMW)	Using the 6 value-weight portfolios based on size and operating profitability, the difference in returns between robust and weak operating profitability stocks is calculated	Profitability premium
Conservative-Minus-Aggressive (CMA)	Using the 6 value-weight portfolios based on size and investment, the difference between the returns of stock-companies with conservative and aggressive investment behavior is calculated	Investment premium

Note: Factors are calculated by using all NYSE, AMEX and NASDAQ firms with available data. For further details about factor construction and description see:
https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_5_factors_2x3.html

[2] Note that $\bar{R}^2_{cs}$ coincides with "r^2_{II}" in JAGANNATHAN/WANG (1993, p.13), which consider the average (not adjusted) R^2 of the cross-sectional regressions.
[3] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Tab. 4.2: Descriptive statistics for the monthly returns of the 25 (5x5) US stock portfolios formed on size and book-to-market (Panel A), US labor income and US unemployment rate (Panel B).

Panel A			(Low) 1	2	Book-to-Market 3	4	(High) 5
Market Equity	(Small) 1	Mean	0.5432	1.0971	0.9372	1.1875	1.1293
		Median	0.8789	0.9204	1.0510	1.2376	1.1890
		Maximum	38.3214	42.4214	21.0566	26.3689	16.2581
		Minimum	-23.6139	-19.7197	-19.7991	-15.1745	-21.4401
		Std. Dev.	8.3516	7.4912	5.8669	5.7799	5.8799
		Skewness	0.3971	0.6067	-0.0843	0.1244	-0.4563
		Kurtosis	5.2146	7.1147	3.7725	4.4297	3.7581
		Jarque-Bera (p-value)	0.0000	0.0000	0.0376	0.0000	0.0006
	2	Mean	0.8727	1.0833	1.0526	0.9375	0.8991
		Median	1.4754	1.4946	1.1611	1.4277	1.1966
		Maximum	28.1148	18.7850	16.0623	16.1926	19.2040
		Minimum	-22.7658	-23.1164	-18.4271	-18.2549	-23.1765
		Std. Dev.	7.0330	5.8321	5.2898	5.4797	6.3419
		Skewness	-0.1939	-0.3362	-0.3486	-0.4981	-0.5845
		Kurtosis	3.9351	4.2320	3.7149	3.9104	4.3131
		Jarque-Bera (p-value)	0.0046	0.0000	0.0053	0.0001	0.0000
	3	Mean	0.8009	1.0242	0.9611	1.0096	1.0489
		Median	1.6902	1.3131	1.3711	1.3854	1.1345
		Maximum	23.1302	18.9691	16.7573	16.9364	17.5026
		Minimum	-22.6891	-19.5121	-16.8988	-19.7922	-21.0702
		Std. Dev.	6.4479	5.3078	4.9982	5.2064	5.9558
		Skewness	-0.3928	-0.1730	-0.2588	-0.2828	-0.4285
		Kurtosis	4.0875	4.1263	3.7486	4.1102	4.3578
		Jarque-Bera (p-value)	0.0001	0.0007	0.0129	0.0003	0.0000
	4	Mean	1.0254	1.0161	0.8743	0.9610	0.8405
		Median	1.3974	1.2133	1.0582	1.4055	1.4974
		Maximum	26.0441	15.8985	15.5146	15.0181	18.3356
		Minimum	-20.8403	-20.1651	-25.3272	-21.5963	-19.4062
		Std. Dev.	5.9936	4.8782	5.0413	5.0149	5.9575
		Skewness	-0.0964	-0.5134	-0.6794	-0.5277	-0.5299
		Kurtosis	5.1907	4.5784	6.0443	4.7626	4.3980
		Jarque-Bera (p-value)	0.0000	0.0000	0.0000	0.0000	0.0000
	5 (Big)	Mean	0.6874	0.7398	0.8066	0.4071	0.6064
		Median	0.9052	1.2176	1.4581	0.8245	1.2725
		Maximum	10.4195	11.2394	12.5703	15.8776	21.4935
		Minimum	-14.7760	-14.6040	-14.4490	-27.1643	-22.1472
		Std. Dev.	4.2647	4.0743	4.2195	5.1932	6.4642
		Skewness	-0.4943	-0.4466	-0.4032	-1.1281	-0.3060
		Kurtosis	3.6029	3.9754	4.0340	7.5533	3.9968
		Jarque-Bera (p-value)	0.0009	0.0001	0.0001	0.0000	0.0008

Panel B	Labor income (month-on-month growth rate)	Unemployment rate (month-on-month growth rate)
Mean	0.3117	-0.0535
Median	0.3468	0.0000
Maximum	1.8471	8.0000
Minimum	-2.2878	-7.4627
Std. Dev.	0.4895	2.7424
Skewness	-0.9776	0.4218
Kurtosis	8.2044	3.2153
Jarque-Bera (p-value)	0.0000	0.0187

Note: Portfolios are compiled at the end of the month of June each year and are calculated by using all NYSE, AMEX and NASDAQ firms with available data. Except for labor income, the dataset ranges from January 1999 to December 2019 (252 observations for each variable). The original time series for labor income, called "wage and salaries" by the Bureau of Economic Analysis, starts in January 1999. Hence, the calculated month-on-month growth rate series is available from February 1999.

5. Results for the Factor Analysis

5.1 5-Factor Model for 25 Portfolios Formed on Size and Book-to-Market

As can be seen from Table 5.1, where labor income is included as an additional risk factor, about the half of the labor betas have a significant impact on the 25 portfolios based on size and book-to-market rations according to both t-test and likelihood-ratio tests (LR-test). Labor betas vary from a low of -0.9707% to 0.9129%. An interesting point to note, is that with the exception of the first row, which contains all portfolios with the companies with the smallest market capitalizations and where all labor betas are significant at least the 10% level according to the LR-test, significant labor betas are all negative. Moreover, the last row, which displays portfolios constructed using the highest market capitalization stock companies, shows that none of them is significantly impacted by labor income. Apparently, smaller capitalized stocks tend to have a positive labor beta, medium capitalized stocks a negative labor beta, and high capitalized stocks hardly any effect at all.

Looking at Table 5.2, where the unemployment rate is regarded as a further risk factor, only 4 or 5 betas show a significant impact according to either the t-test or the LR-test, respectively. These significant unemployment betas tend to be located at the highest book-to-market or highest market capitalization levels. Nevertheless, no precise indication of the direction of the link or any other pattern can be given in the case of unemployment rate.

Tab. 5.1: The exposure of the returns of the 25 stock portfolios based on size and book-to-market ratio to labor income.

			low		Book-to-Market		high
			1	2	3	4	5
Small	1	$\hat{\beta}_L$	0.9129	0.4867	0.3192	0.6217	0.4977
		t-statistic	2.1820	1.7094	1.3014	2.6996	2.2837
		p-value	**0.0301**	0.0887	0.1943	**0.0074**	**0.0232**
		LR-test (p-value)	**0.0052**	0.0815	0.0810	**0.0014**	**0.0152**
Market Equity	2	$\hat{\beta}_L$	-0.0274	-0.1323	-0.3987	-0.1423	-0.0987
		t-statistic	-0.1621	-0.7743	-2.2839	-0.8593	-0.5174
		p-value	0.8714	0.4395	**0.0232**	0.3910	0.6053
		LR-test (p-value)	0.8959	0.4734	**0.0384**	0.3950	0.5863
	3	$\hat{\beta}_L$	-0.4202	-0.2643	-0.4183	-0.6000	-0.9707
		t-statistic	-1.7122	-1.2141	-2.2179	-2.7057	-3.4353
		p-value	0.0881	0.2259	**0.0275**	**0.0073**	**0.0007**
		LR-test (p-value)	**0.0264**	0.2194	**0.0447**	**0.0047**	**0.0005**
	4	$\hat{\beta}_L$	-0.1930	-0.4958	-0.6097	-0.4315	-0.1287
		t-statistic	-0.9887	-1.6641	-2.0901	-1.8749	-0.5060
		p-value	0.3238	0.0974	**0.0376**	0.0620	0.6133
		LR-test (p-value)	0.3505	**0.0182**	**0.0114**	0.0757	0.6625
	5	$\hat{\beta}_L$	-0.0036	0.2150	-0.1159	0.2743	-0.1937
		t-statistic	-0.0301	1.1859	-0.5135	0.9035	-0.3940
Big		p-value	0.9761	0.2368	0.6081	0.3671	0.6939
		LR-test (p-value)	0.9709	0.2100	0.5975	0.2589	0.6147

Note: This table gives the estimated coefficients for the labor income factor exposure, the corresponding t-statistics (calculated using HAC standard errors) and their p-values as well as the p-values of the likelihood-ratio test (LR-test). Returns of each portfolio of the 25 (5x5) portfolios based on size and book-to-market ratio is used as regressand $R_{i,t}$ in the equation $R_{i,t} - R_{F,t} = c + \beta_{i,M} r_{m,t} + \beta_{i,L} LI_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,RMW} RMW_t + \beta_{i,CMA} CMA_t + \varepsilon_{i,t}$.

Tab. 5.2: The exposure of the returns of the 25 stock portfolios based on size and book-to-market ratio to unemployment.

			low		Book-to-Market		high
			1	2	3	4	5
Small	1	$\hat{\beta}_U$	0.0200	-0.0075	-0.0340	-0.0443	-0.0016
		t-statistic	0.4145	-0.1858	-0.8968	-1.4372	-0.0396
		p-value	0.6789	0.8528	0.3707	0.1519	0.9685
		LR-test (p-value)	0.7339	0.8804	0.3035	0.2124	0.9654
	2	$\hat{\beta}_U$	0.0109	-0.0056	0.0059	-0.0528	0.0921
		t-statistic	0.3044	-0.1829	0.1521	-1.2490	2.7568
		p-value	0.7611	0.8550	0.8792	0.2129	**0.0063**
		LR-test (p-value)	0.7717	0.8669	0.8657	0.0812	**0.0043**
Market Equity	3	$\hat{\beta}_U$	0.0074	-0.0013	0.0319	-0.0113	0.1438
		t-statistic	0.2472	-0.0412	0.8938	-0.3104	2.3213
		p-value	0.8049	0.9672	0.3723	0.7565	**0.0211**
		LR-test (p-value)	0.8288	0.9731	0.3984	0.7672	**0.0044**
	4	$\hat{\beta}_U$	0.0461	0.0610	-0.0036	0.0205	0.0650
		t-statistic	1.2501	1.5350	-0.0746	0.4521	1.2153
		p-value	0.2125	0.1261	0.9406	0.6516	0.2254
		LR-test (p-value)	0.2227	0.1112	0.9346	0.6416	0.2190
	5	$\hat{\beta}_U$	-0.0095	0.0629	0.0593	-0.1140	0.0979
		t-statistic	-0.5867	2.2238	1.0470	-1.8592	1.2882
Big		p-value	0.5580	**0.0271**	0.2961	0.0642	0.1989
		LR-test (p-value)	0.5882	**0.0398**	0.1305	**0.0085**	0.1556

Note: This table gives the estimated coefficients for the unemployment factor exposure, the corresponding t-statistics (calculated using HAC standard errors) and their p-values as well as the p-values of the likelihood-ratio test (LR-test). Returns of each portfolio of the 25 (5x5) portfolios based on size and book-to-market ratio is used as regressand $R_{i,t}$ in the equation $R_{i,t} - R_{F,t} = c + \beta_{i,M} r_{m,t} + \beta_{i,U} U_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,RMW} RMW_t + \beta_{i,CMA} CMA_t + \varepsilon_{i,t}$.

5.2 Fama–MacBeth cross-sectional 2-step regression

Tables 5.3, 5.4 and 5.5 show the results for the 25 portfolios based on size and book-to-market ratios using the FAMA/MACBETH (1973) cross-sectional 2-step regression. As shown in the second and third specifications in Table 5.5, both labor income and the unemployment rate have a similar positive effect on the adjusted R^2, increasing it from 16.96% (CAPM) to just under 25%. Each of the remaining classical factors also increases the adjusted R^2 into a comparable range, namely between about 25% and 30%. Looking at specifications 7 and 9 of Table 5.3, one can see that the coefficient of the labor beta is in both cases negative and significantly different from zero at least at the 5% level. Table 5.4 indicates that the coefficient of the unemployment rate is in both cases positive and significantly different from zero at the 1% level. In contrast to that, the classical factors do not show any significant direction. Comparing the results in Tables 5.3 and 5.4 and looking to specifications 8 and 9 in each Table, the labor beta increases the adjusted R^2 slightly more than the unemployment beta. It is remarkable, that the coefficients and the significance of both labor and unemployment betas remain stable when regressed on both simultaneously, as is shown in specification 7 in Table 5.5.

Tab. 5.3: Performance of the different beta pricing models in the 25 portfolio returns based on size and book-to-market ratios using the labor income beta.

Specification		Coefficient							$\bar{R}^2_{cs}$
		γ_0	γ_M	γ_L	γ_{SMB}	γ_{HML}	γ_{RMW}	γ_{CMA}	
1	Estimate	0.88	0.02						0.1696
	t-stat.	1.27	0.03						
	p-value	0.2039	0.9769						
2	Estimate	0.87	0.03	0.00					0.2433
	t-stat.	1.57	0.06	-0.02					
	p-value	0.1174	0.9540	0.9841					
3	Estimate	1.65	-0.84		0.19				0.3013
	t-stat.	3.01	-1.52		0.85				
	p-value	0.0029	0.1294		0.3944				
4	Estimate	0.91	0.00			-0.01			0.2973
	t-stat.	1.93	0.00			-0.05			
	p-value	0.0547	0.9979			0.9580			
5	Estimate	1.32	-0.40				-0.01		0.2578
	t-stat.	3.44	-0.83				-0.03		
	p-value	0.0007	0.4059				0.9730		
6	Estimate	0.64	0.21					0.07	0.3040
	t-stat.	1.16	0.32					0.34	
	p-value	0.2457	0.7479					0.7379	
7	Estimate	1.47	-0.72	-0.20	0.27	0.01			0.5208
	t-stat.	4.02	-1.56	-2.02	1.36	0.05			
	p-value	0.0001	0.1194	0.0441	0.1757	0.9574			
8	Estimate	1.08	-0.32		0.28	0.00	0.37	0.05	0.5451
	t-stat.	2.65	-0.65		1.39	0.01	1.42	0.18	
	p-value	0.0085	0.5165		0.1668	0.9936	0.1564	0.8576	
9	Estimate	1.90	-1.15	-0.35	0.24	0.04	-0.05	0.31	0.5602
	t-stat.	4.20	-2.16	-2.87	1.22	0.21	-0.18	1.16	
	p-value	0.0000	0.0313	0.0045	0.2226	0.8363	0.8555	0.2476	

Note: This table gives the estimated values of the second stage of the FAMA/MACBETH cross-sectional regression model with $E[R_{i,t} - R_{F,t}] = \gamma_0 + \gamma_M\beta_{i,M} + \gamma_L\beta_{i,L} + \gamma_{SMB}\beta_{i,SMB} + \gamma_{HML}\beta_{i,HML} + \gamma_{RMW}\beta_{i,RMW} + \gamma_{CMA}\beta_{i,CMA}$, where γ_L denotes the coefficient for the labor income risk premium, γ_0 denotes the constant, γ_M denotes the coefficient for the market risk premium, γ_{SMB} denotes the coefficient for the size premium, γ_{HML} denotes the coefficient for the value premium, γ_{RMW} denotes the coefficient for the profitability premium, and γ_{CMA} denotes the coefficient for the investment premium. Besides the estimated coefficients, this table reports the t-statistics (t-stat.) and their p-values as well as the adjusted R^2 for various specifications.

Tab. 5.4: Performance of the different factor models in the 25 portfolio returns based on size and book-to-market ratios using the unemployment beta.

Specification		Coefficient							$\bar{R}^2_{cs}$
		γ_0	γ_M	γ_U	γ_{SMB}	γ_{HML}	γ_{RMW}	γ_{CMA}	
1	Estimate	0.88	0.02						0.1696
	t-stat.	1.27	0.03						
	p-value	0.2039	0.9769						
2	Estimate	1.77	-0.85	1.29					0.2419
	t-stat.	4.34	-1.73	1.65					
	p-value	0.0000	0.0844	0.0999					
3	Estimate	1.65	-0.84		0.19				0.3013
	t-stat.	3.01	-1.52		0.85				
	p-value	0.0029	0.1294		0.3944				
4	Estimate	0.91	0.00			-0.01			0.2973
	t-stat.	1.93	0.00			-0.05			
	p-value	0.0547	0.9979			0.9580			
5	Estimate	1.32	-0.40				-0.01		0.2578
	t-stat.	3.44	-0.83				-0.03		
	p-value	0.0007	0.4059				0.9730		
6	Estimate	0.64	0.21					0.07	0.3040
	t-stat.	1.16	0.32					0.34	
	p-value	0.2457	0.7479					0.7379	
7	Estimate	1.80	-1.05	1.75	0.23	0.03			0.4585
	t-stat.	4.53	-2.17	3.27	1.15	0.13			
	p-value	0.0000	0.0310	0.0012	0.2512	0.8984			
8	Estimate	1.08	-0.32		0.28	0.00	0.37	0.05	0.5451
	t-stat.	2.65	-0.65		1.39	0.01	1.42	0.18	
	p-value	0.0085	0.5165		0.1668	0.9936	0.1564	0.8576	
9	Estimate	1.43	-0.68	1.37	0.28	-0.01	0.39	0.10	0.5485
	t-stat.	3.41	-1.33	2.89	1.38	-0.07	1.47	0.40	
	p-value	0.0008	0.1833	0.0043	0.1675	0.9466	0.1419	0.6924	

Note: This table gives the estimated values of the second stage of the FAMA/MACBETH cross-sectional regression model with $E[R_{i,t} - R_{F,t}] = \gamma_0 + \gamma_M\beta_{i,M} + \gamma_U\beta_{i,U} + \gamma_{SMB}\beta_{i,SMB} + \gamma_{HML}\beta_{i,HML} + \gamma_{RMW}\beta_{i,RMW} + \gamma_{CMA}\beta_{i,CMA}$, where γ_U denotes the coefficient for the unemployment risk premium, γ_0 denotes the constant, γ_M denotes the coefficient for the market risk premium, γ_{SMB} denotes the coefficient for the size premium, γ_{HML} denotes the coefficient for the value premium, γ_{RMW} denotes the coefficient for the profitability premium, and γ_{CMA} denotes the coefficient for the investment premium. Besides the estimated coefficients, this table reports the t-statistics (t-stat.) and their p-values as well as the adjusted R^2 for various specifications.

Tab. 5.5: Performance of the different factor models in the 25 portfolio returns formed on size and book-to-market ratios using the labor income and unemployment risk, respectively.

Specification		γ_0	γ_M	γ_L	γ_U	γ_{SMB}	γ_{HML}	γ_{RMW}	γ_{CMA}	$\bar{R}^2_{cs}$
1	Estimate	0.88	0.02							0.1696
	t-stat.	1.27	0.03							
	p-value	0.2039	0.9769							
2	Estimate	1.77	-0.85	0.00						0.2419
	t-stat.	4.34	-1.73	-0.02						
	p-value	0.0000	0.0844	0.9841						
3	Estimate	0.87	0.03		1.29					0.2433
	t-stat.	1.57	0.06		1.65					
	p-value	0.1174	0.9540		0.0999					
4	Estimate	1.67	-0.75	-0.07	1.25					0.3233
	t-stat.	4.58	-1.66	-0.76	1.70					
	p-value	0.0000	0.0984	0.4466	0.0908					
5	Estimate	1.08	-0.32			0.28	0.00	0.37	0.05	0.5451
	t-stat.	2.65	-0.65			1.39	0.01	1.42	0.18	
	p-value	0.0085	0.5165			0.1668	0.9936	0.1564	0.8576	
6	Estimate	1.62	-0.87	-0.19	1.21	0.27	-0.01			0.5226
	t-stat.	4.50	-1.91	-1.93	2.59	1.36	-0.03			
	p-value	0.0000	0.0567	0.0550	0.0102	0.1745	0.9782			
7	Estimate	1.96	-1.22	-0.31	1.26	0.25	0.02	0.04	0.29	0.5639
	t-stat.	4.32	-2.28	-2.54	2.66	1.25	0.11	0.15	1.08	
	p-value	0.0000	0.0236	0.0119	0.0083	0.2121	0.9162	0.8802	0.2814	

Note: This table gives the estimated values of the second stage of the FAMA/MACBETH cross-sectional regression model with $E[R_{i,t} - R_{F,t}] = \gamma_0 + \gamma_M\beta_{i,M} + \gamma_L\beta_{i,L} + \gamma_U\beta_{i,U} + \gamma_{SMB}\beta_{i,SMB} + \gamma_{HML}\beta_{i,HML} + \gamma_{RMW}\beta_{i,RMW} + \gamma_{CMA}\beta_{i,CMA}$, where γ_L and γ_U denote the coefficient for the labor income and unemployment risk premium, respectively, γ_0 denotes the constant, γ_M denotes the coefficient for the market risk premium, γ_{SMB} denotes the coefficient for the size premium, γ_{HML} denotes the coefficient for the value premium, γ_{RMW} denotes the coefficient for the profitability premium, and γ_{CMA} denotes the coefficient for the investment premium. Besides the estimated coefficients, this table reports the t-statistics (t-stat.) and their p-values as well as the adjusted R^2 for various specifications.

5.3 5-Factor model & Fama–MacBeth cross-sectional 2-step regression for volatilities

As mentioned in Section 4, we investigate the relationship of labor income and the unemployment rate with portfolio volatilities by using monthly standard deviations calculated from daily portfolio returns $\sigma_{i,t}$ in lieu of portfolio excess returns. Tables 5.6 and 5.7 show the results for the labor beta and unemployment beta, respectively, with respect to the 25 portfolios based on size and book-to-market value. It is remarkable that the coefficients for the labor income are significantly different from zero in every case at least at the 5% level and indicate a negative relationship towards volatilities. This means that rising labor incomes are associated with falling stock market volatilities, which could result from business-cycle developments. For the unemployment rate, the results indicate a positive relationship with stock market volatilities. The t-test and the LR-test show coefficients for the unemployment rate significantly different from zero in most cases, but not in all cases as shown for labor income.

The results for the Fama–MacBeth cross-sectional regression, which are displayed in Tables 5.8 and 5.9, confirm the aforementioned directions and significances of relationship. The labor income factor and the unemployment factor increase the adjusted R^2 from 15.29% (CAPM) to 30.06% and 27.26%, respectively. Thus, the two additional factors are again in a comparable range to the classic factors in terms of their effect on the adjusted R^2 and help to enhance the explanatory power as regards stock volatilities.

Tab. 5.6: The exposure of the return volatilities of the 25 stock portfolios based on size and book-to-market ratio to labor income.

			low		Book-to-Market		high
			1	2	3	4	5
Small	1	$\hat{\beta}_L$	-0.3475	-0.3388	-0.3609	-0.3645	-0.3721
		t-statistic	-2.5670	-2.5310	-2.2313	-2.1540	-2.1247
		p-value	**0.0109**	**0.0120**	**0.0266**	**0.0322**	**0.0346**
		LR-test (p-value)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Market Equity	2	$\hat{\beta}_L$	-0.3127	-0.3086	-0.3510	-0.4015	-0.5066
		t-statistic	-2.5955	-2.5865	-2.5567	-2.7184	-2.5444
		p-value	**0.0100**	**0.0103**	**0.0112**	**0.0070**	**0.0116**
		LR-test (p-value)	**0.0001**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	3	$\hat{\beta}_L$	-0.2837	-0.3125	-0.3531	-0.3914	-0.5068
		t-statistic	-2.2374	-2.7872	-2.8728	-2.9384	-2.6686
		p-value	**0.0262**	**0.0057**	**0.0044**	**0.0036**	**0.0081**
		LR-test (p-value)	**0.0008**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	4	$\hat{\beta}_L$	-0.2779	-0.3289	-0.3703	-0.3960	-0.5699
		t-statistic	-2.1395	-3.0970	-2.8244	-2.6224	-2.8251
		p-value	**0.0334**	**0.0022**	**0.0051**	**0.0093**	**0.0051**
		LR-test (p-value)	**0.0020**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	5	$\hat{\beta}_L$	-0.2499	-0.2641	-0.3342	-0.5869	-0.6789
		t-statistic	-2.8741	-2.6617	-2.4308	-2.8952	-2.6867
Big		p-value	**0.0044**	**0.0083**	**0.0158**	**0.0041**	**0.0077**
		LR-test (p-value)	**0.0002**	**0.0001**	**0.0000**	**0.0000**	**0.0000**

Note: This table gives the estimated coefficients for the exposure of the return volatilities of the 25 stock portfolios to labor income, the corresponding t-statistics (calculated using HAC standard errors) and their p-values as well as the p-values of the likelihood-ratio test (LR-test). Instead of returns, monthly volatilities $\sigma_{i,t}$ (standard deviation) calculated using daily return data for each portfolio of the 25 portfolios based on size and book-to-market ratios is used as regressand in the equation $\sigma_{i,t} = c + \beta_{i,M} r_{m,t} + \beta_{i,L} LI_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,RMW} RMW_t + \beta_{i,CMA} CMA_t + \varepsilon_{i,t}$.

Tab. 5.7: The exposure of the return volatilities of the 25 stock portfolios based on size and book-to-market ratio to unemployment.

			low		Book-to-Market		high
			1	2	3	4	5
Small	1	$\hat{\beta}_L$	0.0536	0.0506	0.0495	0.0482	0.0564
		t-statistic	1.4976	1.3700	1.2595	1.1088	1.2523
		p-value	0.1355	0.1719	0.2091	0.2686	0.2117
		LR-test (p-value)	**0.0004**	**0.0006**	**0.0003**	**0.0009**	**0.0001**
Market Equity	2	$\hat{\beta}_L$	0.0617	0.0620	0.0637	0.0688	0.0894
		t-statistic	2.4591	2.1194	1.7776	1.7397	1.7261
		p-value	**0.0146**	**0.0351**	0.0767	0.0832	0.0856
		LR-test (p-value)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	3	$\hat{\beta}_L$	0.0691	0.0614	0.0609	0.0599	0.0881
		t-statistic	2.5458	2.1007	1.9249	1.6848	1.8154
		p-value	**0.0115**	**0.0367**	0.0554	0.0933	0.0707
		LR-test (p-value)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	4	$\hat{\beta}_L$	0.0679	0.0565	0.0613	0.0721	0.1004
		t-statistic	2.5426	1.8912	1.6733	1.8024	1.8764
		p-value	**0.0116**	0.0598	0.0955	0.0727	0.0618
		LR-test (p-value)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	5	$\hat{\beta}_L$	0.0585	0.0543	0.0686	0.1094	0.1045
		t-statistic	2.7152	2.0714	1.9437	1.9345	1.7058
Big		p-value	**0.0071**	**0.0394**	0.0531	0.0542	0.0893
		LR-test (p-value)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Note: This table gives the estimated coefficients for the exposure of the return volatilities of the 25 stock portfolios to unemployment, the corresponding t-statistics (calculated using HAC standard errors) and their p-values as well as the p-values of the likelihood-ratio test (LR-test). Instead of returns, monthly volatilities $\sigma_{i,t}$ (standard deviation) calculated by daily return data for each portfolio of the 25 portfolios based on size and book-to-market ratios is used as regressand in the equation $\sigma_{i,t} = c + \beta_{i,M} r_{m,t} + \beta_{i,U} U_t + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + \beta_{i,RMW} RMW_t + \beta_{i,CMA} CMA_t + \varepsilon_{i,t}$.

Tab. 5.8: Performance of the different beta pricing models in the 25 portfolio return volatilities based on size and book-to-market ratios using the labor income beta.

Specification		Coefficient							$\bar{R}^2_{cs}$
		γ_0	γ_M	γ_L	γ_{SMB}	γ_{HML}	γ_{RMW}	γ_{CMA}	
1	Estimate	1.03	-2.89						0.1529
	t-stat.	20.04	-3.20						
	p-value	0.0000	0.0016						
2	Estimate	0.92	-1.80	-0.44					0.3006
	t-stat	20.50	-1.91	-4.46					
	p-value	0.0000	0.0571	0.0000					
3	Estimate	0.88	-4.60		-4.82				0.2177
	t-stat.	12.30	-4.61		-3.70				
	p-value	0.0000	0.0000		0.0003				
4	Estimate	1.26	-0.85			8.28			0.3493
	t-stat.	23.28	-0.92			10.97			
	p-value	0.0000	0.3571			0.0000			
5	Estimate	0.96	-3.57				8.96		0.3794
	t-stat.	18.84	-3.96				14.21		
	p-value	0.0000	0.0001				0.0000		
6	Estimate	1.37	2.99					5.36	0.2798
	t-stat.	23.62	2.69					8.45	
	p-value	0.0000	0.0076					0.0000	
7	Estimate	1.09	1.27	-0.68	-1.70	9.78			0.5465
	t-stat.	26.85	1.43	-7.31	-2.39	16.11			
	p-value	0.0000	0.1542	0.0000	0.0175	0.0000			
8	Estimate	1.04	-5.01		2.76	3.85	10.37	-1.74	0.5294
	t-stat.	26.79	-5.45		2.94	4.11	16.07	-1.96	
	p-value	0.0000	0.0000		0.0036	0.0001	0.0000	0.0511	
9	Estimate	1.00	-3.84	-0.37	0.83	6.07	8.71	-0.23	0.6095
	t-stat.	26.42	-4.48	-3.70	1.07	8.35	14.13	-0.46	
	p-value	0.0000	0.0000	0.0003	0.2866	0.0000	0.0000	0.6439	

Note: This table gives the estimated values of the second stage of the FAMA/MACBETH cross-sectional regression, where monthly volatilities $\sigma_{i,t}$ calculated by daily return data for each portfolio of the 25 portfolios based on size and book-to-market ratios is used in model $\sigma_{i,t} = \gamma_0 + \gamma_M \beta_{i,M} + \gamma_L \beta_{i,L} + \gamma_{SMB} \beta_{i,SMB} + \gamma_{HML} \beta_{i,HML} + \gamma_{RMW} \beta_{i,RMW} + \gamma_{CMA} \beta_{i,CMA}$, where γ_L denotes the coefficient for the labor income risk premium, γ_0 denotes the constant, γ_M denotes the coefficient for the market risk premium, γ_{SMB} denotes the coefficient for the size premium, γ_{HML} denotes the coefficient for the value premium, γ_{RMW} denotes the coefficient for the profitability premium, and γ_{CMA}denotes the coefficient for the investment premium. Besides the estimated coefficients, this table reports the t-statistics (t-stat.) and their p-values as well as the adjusted R^2 for various specifications.

Tab. 5.9: Performance of the different beta pricing models in the 25 portfolio return volatilities based on size and book-to-market ratios using the unemployment beta.

Specification		Coefficient							$\bar{R}^2_{cs}$
		γ_0	γ_M	γ_U	γ_{SMB}	γ_{HML}	γ_{RMW}	γ_{CMA}	
1	Estimate	1.03	-2.89						0.1529
	t-stat.	20.04	-3.20						
	p-value	0.0000	0.0016						
2	Estimate	1.01	-1.33	1.62					0.2726
	t-stat.	20.86	-1.11	2.53					
	p-value	0.0000	0.2666	0.0122					
3	Estimate	0.88	-4.60		-4.82				0.2177
	t-stat.	12.30	-4.61		-3.70				
	p-value	0.0000	0.0000		0.0003				
4	Estimate	1.26	-0.85			8.28			0.3493
	t-stat.	23.28	-0.92			10.97			
	p-value	0.0000	0.3571			0.0000			
5	Estimate	0.96	-3.57				8.96		0.3794
	t-stat.	18.84	-3.96				14.21		
	p-value	0.0000	0.0001				0.0000		
6	Estimate	1.37	2.99					5.36	0.2798
	t-stat.	23.62	2.69					8.45	
	p-value	0.0000	0.0076					0.0000	
7	Estimate	1.03	3.75	3.62	-4.42	9.54			0.5406
	t-stat.	26.32	3.42	5.41	-5.66	15.33			
	p-value	0.0000	0.0007	0.0000	0.0000	0.0000			
8	Estimate	1.04	-5.01		2.76	3.85	10.37	-1.74	0.5294
	t-stat.	26.79	-5.45		2.94	4.11	16.07	-1.96	
	p-value	0.0000	0.0000		0.0036	0.0001	0.0000	0.0511	
9	Estimate	1.01	0.89	2.92	-1.96	6.33	7.57	1.42	0.5673
	t-stat.	26.08	0.84	4.33	-2.24	8.38	14.01	2.61	
	p-value	0.0000	0.3997	0.0000	0.0263	0.0000	0.0000	0.0096	

Note: This table gives the estimated values of the second stage of the FAMA/MACBETH cross-sectional regression, where monthly volatilities $\sigma_{i,t}$ calculated by daily return data for each portfolio of the 25 portfolios based on size and book-to-market ratios is used in model $\sigma_{i,t} = \gamma_0 + \gamma_M\beta_{i,M} + \gamma_U\beta_{i,U} + \gamma_{SMB}\beta_{i,SMB} + \gamma_{HML}\beta_{i,HML} + \gamma_{RMW}\beta_{i,RMW} + \gamma_{CMA}\beta_{i,CMA}$, where γ_U denotes the coefficient for the unemployment risk premium, γ_0 denotes the constant, γ_M denotes the coefficient for the market risk premium, γ_{SMB} denotes the coefficient for the size premium, γ_{HML} denotes the coefficient for the value premium, γ_{RMW} denotes the coefficient for the profitability premium, and γ_{CMA} denotes the coefficient for the investment premium. Besides the estimated coefficients, this table reports the t-statistics (t-stat.) and their p-values as well as the adjusted R² for various specifications.

6. Dynamic Granger Causality analysis

6.1 Model Specifications

In this section, we investigate dynamic Granger causality between labor income, the unemployment rate and excess returns on the market $r_{m,t}$ by using a 5-year rolling AR(1)-GARCH(1,1) regression with up to 6 months lagged regressors. Using the Akaike Information Criterion (AIC), we specify the number of lags and use the Wald-test to evaluate the joint impact of the lagged regressors. To counter for different Granger causality directions and also to consider the impact on volatility, four alternative AR(1)-GARCH(1,1)-model specifications are applied.

In the first model specification, we test for Granger causality from labor income and the unemployment rate, respectively, to excess returns on the market:

Mean equation:

$$r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \beta_2 LI_{t-1} + \beta_3 LI_{t-2} + \cdots + \beta_7 LI_{\mathrm{t}-6} + \varepsilon_t \tag{4}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \tag{5}$$

and

Mean equation:

$$r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \beta_2 U_{t-1} + \beta_3 U_{t-2} + \cdots + \beta_7 U_{\mathrm{t}-6} + \varepsilon_t \tag{6}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \tag{7}$$

By conducting the Wald-test $\beta_2 + \beta_3 + \cdots + \beta_k = 0$ for k=[2, …, 7], we can check for the significance of the Granger causal impact of labor income and the unemployment rate on market returns.

In the second model specification, we test for Granger causality from the excess returns on the market to labor income and the unemployment rate, respectively:

Mean equation:

$$LI_t = \beta_0 + \beta_1 LI_{t-1} + \beta_2 r_{m,t-1} + \beta_3 r_{m,t-2} + \cdots + \beta_7 r_{m,t-6} + \varepsilon_t \tag{8}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \tag{9}$$

and

Mean equation:

$$U_t = \beta_0 + \beta_1 U_{t-1} + \beta_2 r_{m,t-1} + \beta_3 r_{m,t-2} + \cdots + \beta_7 r_{m,t-6} + \varepsilon_t \tag{10}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \tag{11}$$

Again, we can use the Wald-test $\beta_2 + \beta_3 + \cdots + \beta_k = 0$ for k=[2, …, 7] to test the significance of the Granger causal impact of the market return on labor income and the unemployment rate.

In the third model specification, we test for Granger causality from labor income and the unemployment rate, respectively, to the conditional variance of excess returns on the market:

Mean equation:

$$r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \varepsilon_t \tag{12}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 LI_{t-1} + \alpha_4 LI_{t-2} + \cdots + \alpha_8 LI_{\mathrm{t-6}} \tag{13}$$

and

Mean equation:

$$r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \varepsilon_t \tag{14}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 U_{t-1} + \alpha_4 U_{t-2} + \cdots + \alpha_8 U_{\mathrm{t-6}} \tag{15}$$

Using the Wald-test $\alpha_3 + \alpha_4 + \cdots + \alpha_k = 0$ for k=[3, …, 8] we can test the significance of the Granger causal impact of labor income and the unemployment rate, respectively, on conditional variance of market returns.

In the fourth model specification, we test for Granger causality from excess returns on the market to the conditional variance of labor income and the unemployment rate, respectively:

Mean equation:

$$LI_t = \beta_0 + \beta_1 LI_{t-1} + \varepsilon_t \tag{16}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 LI_{t-1} + \alpha_4 LI_{t-2} + \cdots + \alpha_8 LI_{t-6} \tag{17}$$

and

Mean equation:

$$U_t = \beta_0 + \beta_1 U_{t-1} + \varepsilon_t \tag{18}$$

Variance-equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 r_{m,t-1} + \alpha_4 r_{m,t-2} + \cdots + \alpha_8 r_{m,t-6} \tag{19}$$

Using again the Wald-test $\alpha_3 + \alpha_4 + \cdots + \alpha_k = 0$ for k=[3, …, 8] we can test the significance of the Granger causal impact of market returns on the conditional variance of labor income and the unemployment rate, respectively.

6.2 Results for the Granger Causal Analysis

The dynamic 5-year rolling Granger causal approach allows us not only to get some indication of the causal direction of the impact, but also to reveal the significance of the impact across the whole sample. Showing the sum of the coefficients calculated for the Wald test along with the corresponding significance levels, Figures 6.1 and 6.2 present the dynamic results for the first model specification (Granger causality: labor income and the unemployment to market returns), whereas Figures 6.3 and 6.4 present the dynamic results for the second model specification (Granger causality: market returns to labor income and unemployment).

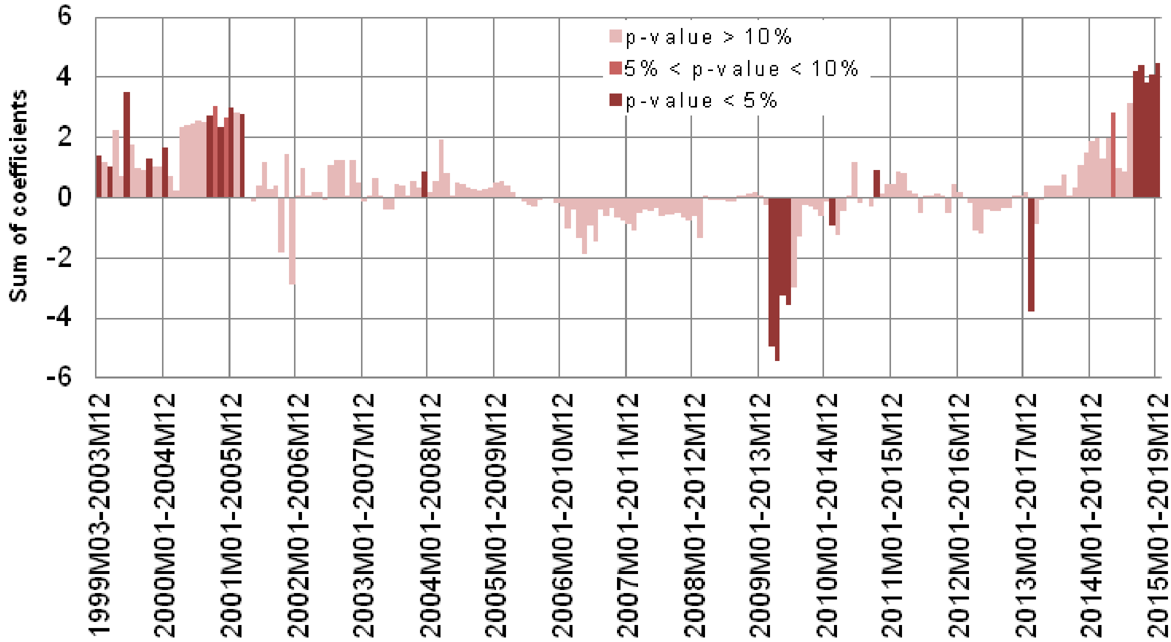
As regards labor income, Figure 6.1 shows that there are only a few phases where the sum of the coefficients becomes significant (25 phases with significant impact at least at the 10% level). Figure 6.3, on the other hand, shows that the number of significant phases is significantly higher than in the first model specification (119 phases with significant impact at least at the 10% level). Thus, one can argue that the results are more indicative of Granger causality from market returns to labor income. It is worth noting that this effect was always positive, indicating that higher stock market returns lead to higher labor income, but since around the 2014-2018 period, this effect has become negative.

Figure 6.2 shows that the Granger causal impact of the unemployment rate on stock market returns is negative until around the 2007-2010 period. Especially during the financial market crisis, the summed coefficients show a clear significance. After that crisis, however, the direction of the effect turns and remains positive until the end of 2019, with the number of significant phases decreasing. Figure 6.4, illustrating the Granger causal impact of stock market returns on the unemployment rate, shows a similar pattern to the results for the first model specification, with a significant and decreasing impact up to around the 2009-2013 period and some positive impact in the periods thereafter. The results for the first model specification and the second model specification show 88 and 109 phases, respectively, with significant impact at least at the 10% level. The higher number of significant phases provides more evidence for the Granger causal relationship from stock market returns to the unemployment rate, but both values are relatively high and too close to infer only one direction. As regards the relationship between stock market returns and the unemployment rate, there seems to be more of an interdependence and dynamic dependence in this relationship.

As regards the Granger causal impact on the conditional variance, Figures 6.5, 6.6, 6.7 and 6.8 illustrate the results for the third and fourth model specifications. Figure 6.5 shows that the direction of the Granger causal impact from labor income to the conditional variance of stock market returns is not stable, but includes 84 phases with significant impact at least at the 10% level. In particular, during the period of the financial crisis the impact is rather negative, suggesting that higher labor income decreases stock market volatility and vice versa. For the other periods, the direction of the impact is less clear but rather positive, indicating that higher labor income increases stock market volatility. Figure 6.7, however, shows that the Granger causal impact of stock market returns on the conditional variance of labor income is, in almost all phases, negative, indicating that higher stock market returns lead to lower labor income volatilities. Nevertheless, the amount of significant phases is somewhat lower than in the third model specification (namely 51). Although these results provide slightly more evidence of the presence of a Granger causal relationship from labor income to stock market volatility, a clear Granger causal direction cannot be identified. Also for this relationship there seems to be more of an interdependence and dynamic dependence.

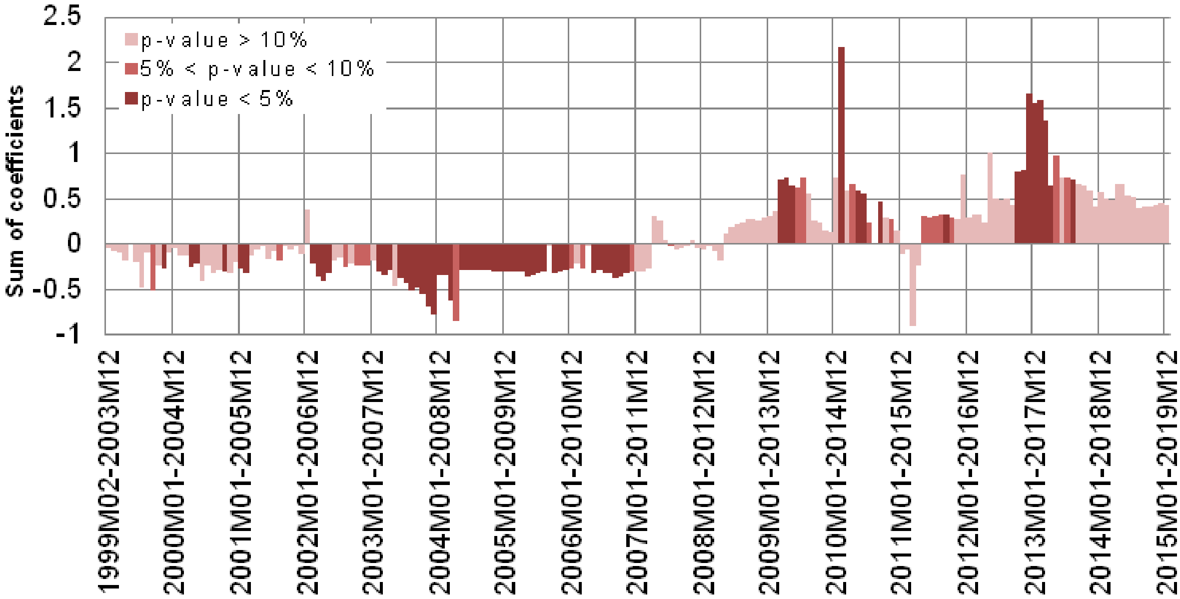
Figure 6.6 shows that the Granger causal impact of the unemployment rate on the conditional variance of stock market returns is positive in almost every period. Particularly during periods spanning the financial market crisis, the sum of coefficients are higher and show a higher significance level compared to the remaining periods (91 phases with significant impact at least at the 10% level). Thus, increasing unemployment rates lead to higher stock market volatilities, especially during the financial crisis. Figure 6.8, illustrating the Granger causal impact of the stock market returns on the conditional variance of the unemployment rate, shows in most periods a negative relationship. Especially in the periods spanning the financial crisis and at the end of the sample, the summed coefficients show higher significance levels than in other phases, indicating that higher stock market returns lead to lower unemployment rate volatilities. Regarding the smaller number of periods with significant impacts (52 phases with a significant impact at least at the 10% level), the results show more evidence for the Granger causal impact of the unemployment rate on the conditional variance of stock market returns.

Fig. 6.1: Time-varying Granger causal impact of labor income on stock market returns.



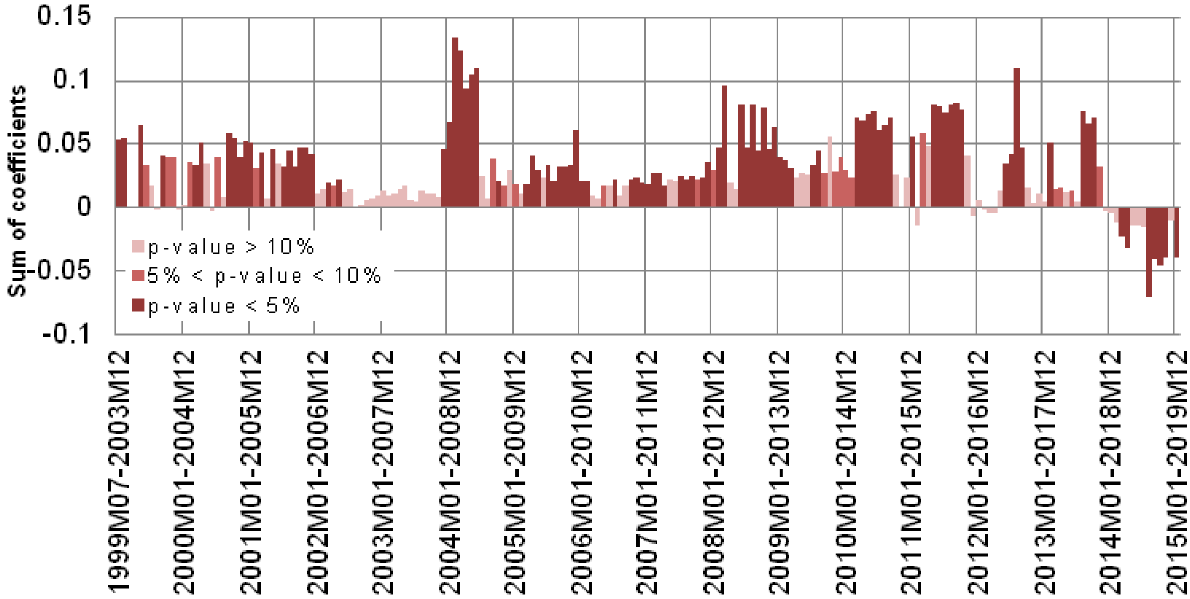
Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the excess return on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) is used as regressand, while up to 6 months lagged labor income month-on-month growth rates are taken as regressors in an AR(1)-GARCH(1,1) model with the mean equation $r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \beta_2 LI_{t-1} + \beta_3 LI_{t-2} + \cdots + \beta_{k+1} LI_{t-k} + \varepsilon_t$ (k=[1, …, 6]). The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\beta_2 + \beta_3 + \cdots + \beta_{k+1})$ is tested by the Wald test.

Fig. 6.2: Time-varying Granger causal impact of the unemployment rate on stock market returns.



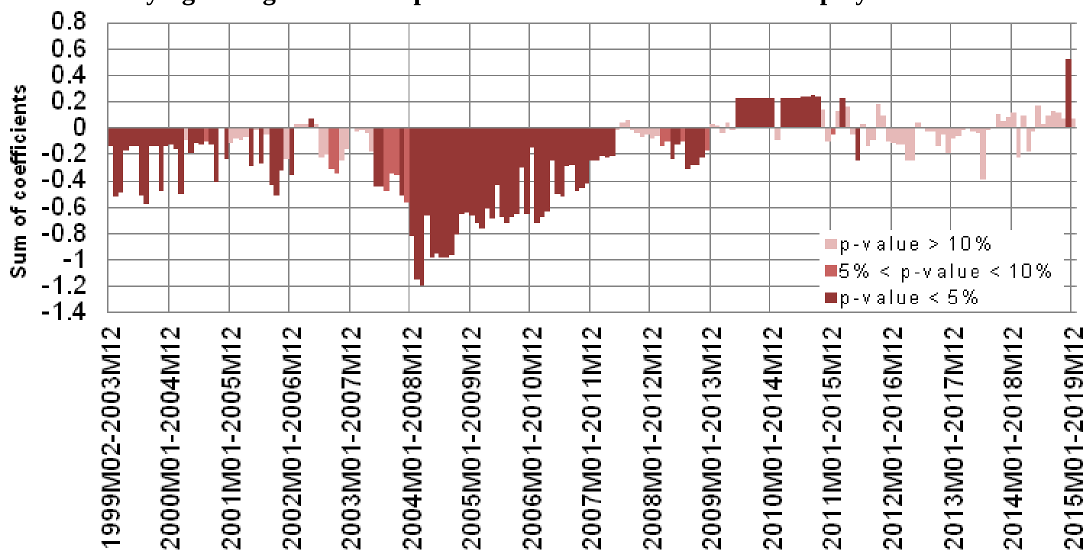
Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the excess return on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) is used as regressand, while up to 6 months lagged unemployment month-on-month growth rates are taken as regressors in an AR(1)-GARCH(1,1) model with the mean equation $r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \beta_2 U_{t-1} + \beta_3 U_{t-2} + \cdots + \beta_{k+1} U_{t-k} + \varepsilon_t$ ($k = [1, \ldots, 6]$.The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\beta_2 + \beta_3 + \cdots + \beta_{k+1})$ is tested by the Wald test.

Fig. 6.3: Time-varying Granger causal impact of market returns on labor income.



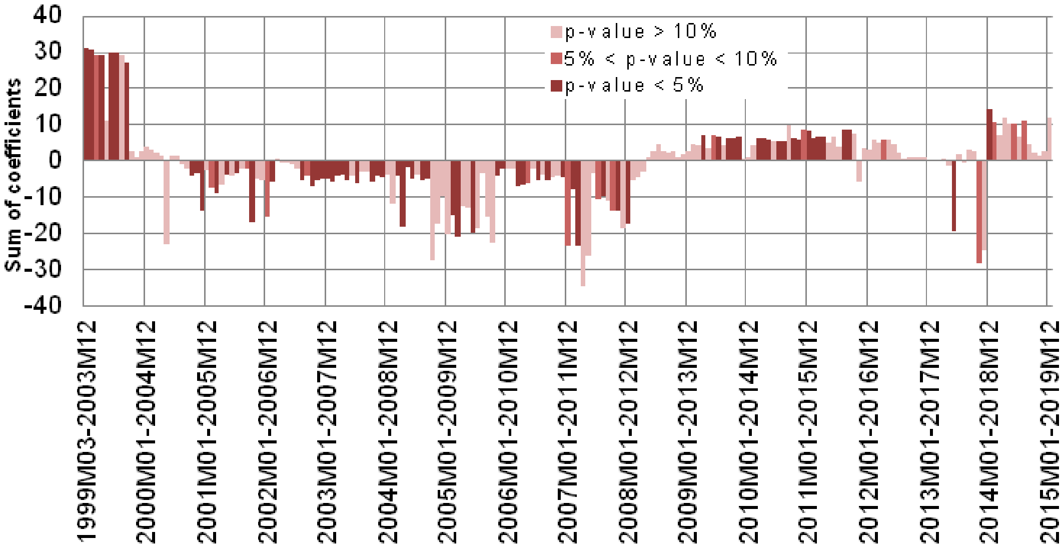
Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the labor income month-on-month growth rate is used as regressand, while up to 6 months lagged excess returns on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) are taken as regressors in an AR(1)-GARCH(1,1) model with the mean equation $LI_t = \beta_0 + \beta_1 LI_{t-1} + \beta_2 r_{m,t-1} + \beta_3 r_{m,t-2} + \cdots + \beta_{k+1} r_{m,t-k} + \varepsilon_t$ (k=[1, …, 6]). The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\beta_2 + \beta_3 + \cdots + \beta_{k+1})$ is tested by the Wald test.

Fig. 6.4: Time-varying Granger causal impact of market returns on the unemployment rate.



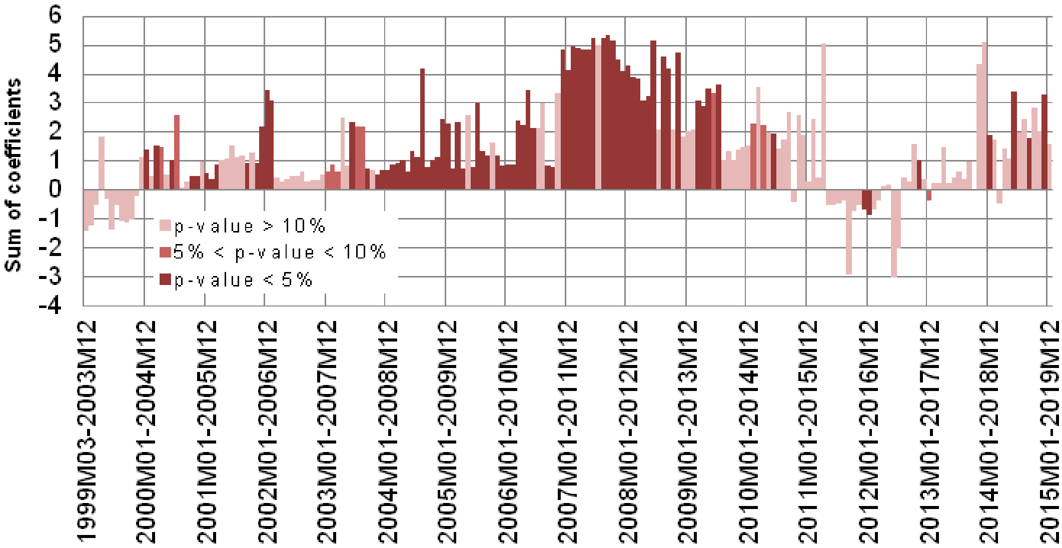
Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the unemployment month-on-month growth rate is used as regressand, while up to 6 months lagged excess returns on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) are taken as regressors in an AR(1)-GARCH(1,1) model with the mean equation $U_t = \beta_0 + \beta_1 U_{t-1} + \beta_2 r_{m,t-1} + \beta_3 r_{m,t-2} + \cdots + \beta_{k+1} r_{m,t-k} + \varepsilon_t$ (k=[1, …, 6]). The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\beta_2 + \beta_3 + \cdots + \beta_{k+1})$ is tested by the Wald test.

Fig. 6.5: Time-varying Granger causal impact of labor income on the conditional variance of stock market returns.



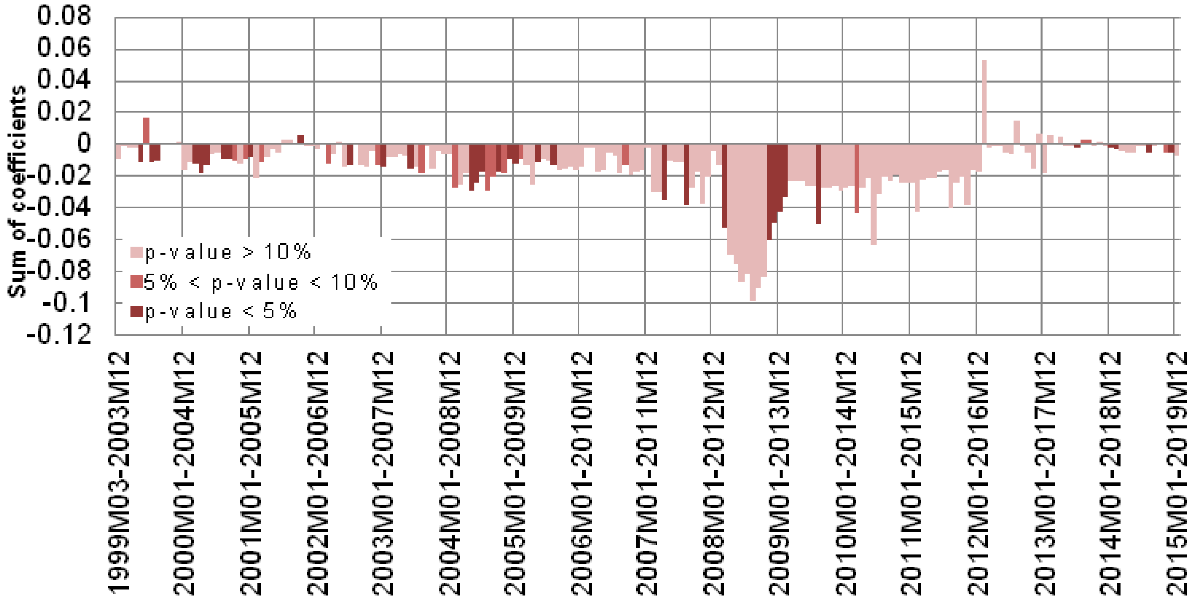
Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the excess return on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) is used as regressand, while up to 6 months lagged labor income month-on-month growth rates are taken as regressors in the variance equation of the AR(1)-GARCH(1,1) model with the mean equation $r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \varepsilon_t$ and the variance equation $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 LI_{t-1} + \alpha_4 LI_{t-2} + \cdots + \alpha_{k+2} L_{t-k}$. The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\alpha_3 + \alpha_4 + \cdots + \alpha_{k+2})$ is tested by the Wald test.

Fig. 6.6: Time-varying Granger causal impact of the unemployment rate on the conditional variance of stock market returns.



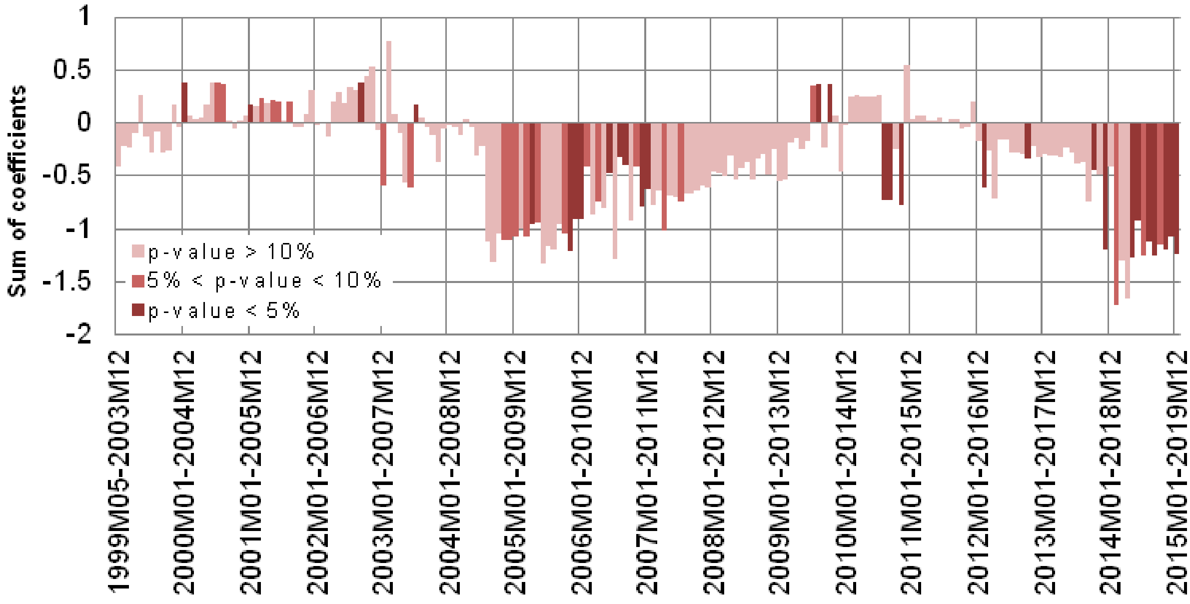
Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the excess return on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) is used as regressand, while up to 6 months lagged unemployment month-on-month growth rates are taken as regressors in the variance equation of the AR(1)-GARCH(1,1) model with the mean equation $r_{m,t} = \beta_0 + \beta_1 r_{m,t-1} + \varepsilon_t$ and the variance equation $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 U_{t-1} + \alpha_4 U_{t-2} + \cdots + \alpha_{k+2} U_{t-k}$. The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\alpha_3 + \alpha_4 + \cdots + \alpha_{k+2})$ is tested by the Wald test.

Fig. 6.7: Time-varying Granger causal impact of stock market returns on the conditional variance of labor income.



Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the labor income month-on-month growth rate is used as regressand, while up to 6 months lagged excess returns on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) are taken as regressors in the variance equation of the AR(1)-GARCH(1,1) model with the mean equation $LI_t = \beta_0 + \beta_1 LI_{t-1} + \varepsilon_t$ and the variance equation $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 r_{m,t-1} + \alpha_4 r_{m,t-2} + \cdots + \alpha_{k+2} r_{m,t-k}$ $(k = [1, \dots, 6])$. The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\alpha_3 + \alpha_4 + \cdots + \alpha_{k+2})$ is tested by the Wald test.

Fig. 6.8: Time-varying Granger causal impact of stock market returns on the conditional variance of the unemployment rate.



Note: This table shows the sum and the significance levels of the lagged coefficients estimated using 5-year rolling regressions. Here, the unemployment month-on-month growth rate is used as regressand, while up to 6 months lagged excess returns on the stock market $r_{m,t}$ (includes all NYSE, AMEX, and NASDAQ firms) are taken as regressors in the variance equation of the AR(1)-GARCH(1,1) model with the mean equation $U_t = \beta_0 + \beta_1 U_{t-1} + \varepsilon_t$ and the variance equation $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 + \alpha_3 r_{m,t-1} + \alpha_4 r_{m,t-2} + \cdots + \alpha_{k+2} r_{m,t-k}$ $(k = [1, \dots, 6])$. The lag-length k is specified by using the AIC, whereas the significance of the sum of the coefficients $(\alpha_3 + \alpha_4 + \cdots + \alpha_{k+2})$ is tested by the Wald test.

7. Economic Policy Conclusions and Further Research

The topic of linkages between labor income risk and the unemployment rate and the yield in stock markets has been covered here for the first time in a broad empirical framework. Labor income risk and the unemployment rate affect the rate of return in stock markets with a significant negative and a positive sign, respectively. This could imply that policy measures to reduce labor income risk will have a positive effect on the rate of return of stocks so that a broader social policy on the part of the US Administration could stimulate stock market dynamics in the United States. The Biden Administration might want to consider some new approaches to wealth redistribution; for example, by creating a special investment pension fund which could benefit from extra tax revenue raised through a higher income tax rate or some basic form of wealth taxation: The revenue could be used, on the basis of the few new competing portfolio funds, to invest in US stocks and also a more diversified international portfolio. Part of the extra tax revenue could be used to encourage more human capital formation and provide a college education for talented students from lower income strata. Thereby, a higher long run labor income and lower US inequality could be achieved within a new policy approach. The enormous income inequality in the US could partly be reduced by a new approach concerning international cooperation in taxing income and wealth – new research by TØRSLØV/WIER/ZUCMAN (2020) reveals that tax shifting is a major problem of fair taxation in the OECD countries. If the US had higher corporate and income tax revenues, it could spend more on social security and income redistribution: US expenditures on income redistribution and social expenditures are so much lower than in, for example, Switzerland, that one may expect that even some minimal reforms could be useful here.

One should note, however, that the highest contribution of income growth of the top 1% of income earners in the US is from the owners of private firms, not from publicly quoted stock companies. This raises new difficult questions concerning corporate taxation. As a rather paradoxical policy option, government might try to provide more incentives for medium-sized firms to seek a listing on the US stock market. It might be that publicly quoted companies have a lower minimum required ratio of equity than private owners of medium-sized firms.

As Granger causality runs from the rate of return in stock markets to labor income risk and unemployment, respectively, it does not seem that the United States benefits from an economic system in which a rather flexible labor market – and hence a rather high volatility of labor income – raises stock market developments. Government might therefore try to adopt a new regime with less ‘hire & fire’ elements in the US labor market system.

Labor income risk is negatively linked to the volatility of equity yields. This suggests that raising labor income risk could help to bring about reduced volatility of stock markets and hence lower risk prices in the US. This might suggest that there is a strong conflict of interest between those who rely mostly on stock market income and those who rely mostly or indeed entirely on labor market income. Reconciling theses different interests might be possible for the higher middle income strata where people have not only labor income but also stock market income – i.e., dividends – as well. However, it seems that certain economic dynamics, possibly related to globalization and increasing digitalization, are reinforcing economic inequality in the US so that the share of households not owning any stocks is likely to increase over time. More attention should be paid to this issue, as equities seem to offer a good hedge against decreasing labor income.

In the United States, the unemployment rate raises the volatility of equity yields. The US Administration could thus consider new options for supporting the training/retraining of workers where the US government expenditures for encouraging retraining – relative to GDP – have been close to zero over many decades; by contrast, in Denmark, the government spends about 0.6% of GDP on promoting training/retraining, in Switzerland meanwhile the share is 0.2% and in Germany 0.25% (WELFENS, 2019). Higher government expenditures on promotion of training/retraining should help to reduce the unemployment rate since the skill-specific unemployment rates are lower for skilled workers than for unskilled workers.

Here, again, a US income tax reform could be useful, namely a reform which gives incentives to households to seek more stable employment and a more stable source and level of labor income. Thus, one may propose a new income tax regime in which there is a tax bonus for households with a rather stable labor income (measured, for example, by the variance of labor income based on monthly labor income). This would provide an incentive for workers and employees to seek new contracts which would help to generate a steadier stream of labor income.

In terms of further research, it could be interesting to get additional insights into the income risk preferences of private households from the new World Value Survey. Moreover, there are also surveys on risk attitudes of households in many countries – such as those organized by IZA, Bonn. More comparative research, comparing the US, Sweden and the UK, for example, could also be rather useful as a future avenue for getting a better understanding of the linkages between stock market dynamics and labor income risk plus unemployment rates.

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