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Development of equity risk premium in 2021-2022

Ex-post analysis on U.S. stock markets

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ABSTRACT:

This study examines whether changes in the equity risk premium (ERP) in 2021 and 2022 were consistent with the previous financial literature and efficient market hypothesis. Study focuses on the role of inflation and inflation uncertainty shaping key ERP determinants such as risk-aversion, interest rate, monetary policy and liquidity.

The findings indicate ERP movements are not fully in line with the efficient market hypothesis, as markets did not efficiently process all available fundamental information. While ERP movements largely follow relationships suggested in prior literature, but liquidity and fund flows show contradictory results. It is shown that unexpected inflation and inaccurate forecasts have led to significant adjustments in monetary policy and increased uncertainty. These developments have resulted in higher required returns and notable shifts in asset pricing and valuation.

KEYWORDS: Equity risk premium, inflation, monetary policy, stock prices, central banks

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TIIVISTELMÄ:
Tässä tutkimuksessa tarkastellaan ovatko osakeriskipreemion (ERP) muutokset vuosina 2021 ja 2022 olleet linjassa aikaisemman kirjallisuuden ja tehokkaiden markkinoiden olettamuksen kanssa. Tutkimus keskittyy erityisesti inflaation ja siihen liittyvän epävarmuuden rooliin keskeisten ERP:tä selittävien tekijöiden kehityksessä. Näitä tekijöitä ovat mm. riskinottohalukkuus, korkotaso, rahapolitiikka ja likviditeetti.

Tulokset osoittavat, että ERP:n muutokset eivät olleet linjassa tehokkaiden markkinoiden olettamuksen kanssa, sillä markkinat eivät kyenneet käsittelemään olemassa olevaa tietoa oikein. Vaikka ERP:n kehitys noudattaa pääosin aiemmissa tutkimuksissa esitettyjä relaatioita, likviditeetin ja rahavirtojen liikkeiden osalta saatiin ristiriitaisia tuloksia. Lisäksi tutkimuksessa osoitetaan, että odottamaton inflaatio ja virheelliset ennusteet johtivat merkittäviin rahapolitiikan muutoksiin. Nämä tekijät ovat kasvattaneet ja aiheuttaneet merkittäviä muutoksia osakkeiden hinnoittelussa ja arvostamisessa.

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1 Introduction

The high inflation period between 2021 and 2022 has sparked loads of discussion in economics. The asset pricing and capital allocation are heavily impacted by the economic environment, and inflation is perhaps the most followed parameter since it is a key driver for Federal Reserve System (FED) when it comes to them dictating the level for interest rates.

After the beginning of 2007-2008 financial crises, U.S. inflation remained stable, and for most of the time, aligned with the target of 2%. Year 2020 started a period with uncertainties the globe had not seen for many years. The Covid-19 pandemic shut down the globe and inflation decreased drastically in the United States bottoming at 0,1982% (year-on-year) in May 2020 (Federal Reserve Bank of St. Louis, n.d.). Despite the "near-zero" inflation in May, the risk of deflation was not evident in the U.S. markets (Christensen, Gamble, & Zhu, 2020).

To boost the consumer confidence, the U.S. government implemented multiple stimulus measures, even direct payments to citizens. Checks were given to the citizens multiple times and on top of that FED started massive quantitative easing (QE) program, buying bonds with the amounts economic had never seen before (Alpert, 2024). FED's balance sheet surged form $4,2 trillion in March 2020 to $8,9 trillion by May 2022 (Federal Reserve Bank of St. Louis, n.d.).

Following the COVID-19 outbreak, the global supply chain disruptions, including production shutdowns and transportation bottlenecks, significantly escalated shipping costs putting major pressure to the inflation. Supply chain issues combined with the loose monetary policy drove inflation to a peak of 9,1% in June 2022 (Federal Reserve Bank of St. Louis, n.d.).

As the inflation surged, debates emerged about its causes and persistence. People were divided roughly in two groups. Others believed inflation to be high because of temporary

factors. They believed inflation to be transitory. On the other hand, there were people who believed the high inflation to be sticky and bigger problem. Their arguments were that if wages pick up with the inflation, the problem could need tighter monetary policy (Lansing, 2022). FED tended to lean towards the "team-transitory" until November 2021 when FED's chair Jeremy Powell admitted that the risk of persistent high inflation has risen (Lansing, 2022). Despite the statement, the first interest rate hikes were done on March 17th 2022. They raised the interest rate by 25 basis points to a range of 0,25-0,5%. Raises continued up to 4,75%-5,00% peaking on March 23rd 2023 (Board of Governors of the Federal Reserve System, n.d.).

For the investors years 2021 and 2022 were very different in multiple ways. Year 2021 was marked by low interest rates and strong corporate earnings. Despite high inflation, the investment environment was seen as favourable and the S&P 500 index rose 26,89% (macrotrends, n.d.). In contrast, 2022 was a period of rising interest rates and weaker market sentiment. Due to the increasing rates, stock markets faced alternatives and the capital flows began shifting away from stocks towards other equities. The S&P 500 index returns were -19,44% in 2022 (macrotrends, n.d.).

1.1 Purpose of the study

The purpose of this study is to investigate whether changes in the equity risk premium (ERP) were in line with the findings of previous research during the years of 2021 and 2022. With investing becoming increasingly popular among new generations who have not experienced a period with high inflation before, understanding market behaviour in such uncertainties provides valuable insights and prepares for the future in case of similar situations.

The question we are trying to answer in this thesis is: Does the historical research on the relationship between economic factors and ERP hold true during the most recent inflation peak in the year 2021 and 2022.

The first hypothesis that we form is relating to well known financial theory. According to efficient market hypothesis (EMH) there is no way of overperforming the market in a long run since every single piece of fundamental information is correctly always priced in. That said, the first null hypothesis of this paper is:

H0: ERP movement was in line with EMH since all available fundamental information was priced in correctly.

Our second hypothesis can be formed from understanding the development of stock market in years 2021-2022 and it is the alternative hypothesis for our first null hypothesis.

H1: ERP movements were not in line with EMH since markets did not price all fundamental information efficiently.

In case markets were not efficient and all available fundamental information were not priced in, we are interested in knowing the factors that could have affected the ERP. Therefore, we form our third hypothesis as follows:

H2: High inflation and inflation-related uncertainty during 2021-2022 had a positive correlation with ERP, as increased macroeconomic instability led to higher required rate of return by investors.

The primary motivation for this thesis is to deepen understanding of market dynamics and the factors that shaped markets during the years 2021-2022. In the modern era of investing, where private investors and professional hedge funds try to outperform the market through intense competition, periods of uncertainty offer greater volatility and thus better opportunities for profits (or losses).

1.2 Structure of the study

In this thesis we will cover the topic in four different chapters. First chapter is purely about giving the reader a brief introduction to the topic and providing incentives and purposes of this study. Chapter two provides the theoretical background which is necessary to understand and achieve the best possible knowledge of this thesis. Chapter three reviews the existing literature about inflation estimations and ERP indicators and provides the development of drivers during years 2021-2022. Lastly, fourth chapter summarizes everything and provides critical thinking about the topic and covers ideas for future research topics.

Use of artificial intelligence was marginal. ChatGPT was used in the contects of grammarly purposes to enchance the structure and to give improvements for spelling. All findings and conclusions were developed independently by author and therefore represents author’s own human reasoning and critical thinking.

2 Theoretical background

This section presents the necessary theoretical knowledge and information that is needed to get a good understanding about EMH and ERP and factors affecting those.

2.1 Inflation

Inflation represents the rate at which prices increase over a specific time period, most commonly over a year. It can be calculated in many different contexts. You may calculate the inflation for any type of product but more commonly it is done for some type of housing expenses such as groceries and housing expenses in one country (Oner, 2010).

Personal consumption expenditures (PCE) is perhaps the most followed inflation metrics that we know. PCE inflation is one of the leading economic indicators that guide FED in their monetary policy decisions. PCE inflation is measured as a change of prices (year-on-year) in collective expenditures of durable and nondurable goods. Durable goods are the goods that lasts longer than three years. Nondurable goods have expected use of life under three years (Liberto, 2025). This inflation metrics is the one that FED reports in their monetary policy reports and therefore we are going to look at the development of PCE inflation in this thesis.

Inflation, as one of the most closely monitored economic indicators, plays a central role of developing other economic variables. Changes in inflation, or even just expectations of future inflation, can significantly affect risk aversion, consumption behaviour, wage dynamics or interest rates. As a result, inflation affects both individual decision-making and broader economic activity (Pannuti, 2022).

2.2 Capital asset pricing model

Capital asset pricing model (CAPM) is a financial risk model, presented by William F. Sharpe (1964) together with Lintner (1965) and Mossin (1966). They invented the model based on Harry Markowitz's portfolio theory which was invented in 1952. The model is used to calculate the expected return of an asset or a portfolio. The model uses three variables to estimate it: Risk free rate, expected return of the market and beta (measuring the risk) of an asset. The CAPM equation looks as follows:

$$E(r_i) = r_f + \beta_i * (r_m - r_f) \quad (1)$$

Where:

$E(r_i)$ = Expected return of asset or portfolio

r_f = Risk free rate, for example U.S. three- month T-bill

β_i = Asset's coefficient to the market portfolio

r_m = Expected return of the market portfolio

Equation 1. Capital asset pricing model

β is calculated for a single asset as follows:

$$\beta_i = \frac{Covariance\ (r_i, r_m)}{Variance\ (r_m)} \quad (2)$$

Equation 2. Coefficient to the market, Beta

From equation 2 we can see that the β for market portfolio must be 1 at all times. If we are looking the market as whole, we can rearrange the equation 1 and β variable will disappear

$$E(r_i) = r_f + (r_m - r_f) \quad (3)$$

Equation 3. Expected return for market

2.2.1 CAPM assumptions

CAPM theoretically is working under these six explicit assumptions (Kenton 2024).

1. CAP model assumes that all the investors act rationally and are risk-averse. Risk-averse investor chooses the asset with the higher risk only if it is expected to produce higher profits (Sharpe, 1964).

2. Investors have access to the financial market in a way that they can lend or borrow as much money as they want with the risk-free rate (Black, 1972).

3. The markets are efficient and there are no transaction costs, taxes and no special requirements for short selling. It also assumes that all the investors have same availability to the market information and hence investors cannot outperform the market in the long run (Fama, 1970).

4. The model expects that risk and return go hand in hand with each other. The relationship between those to variables are linear. So called “market opportunity line” start from y-axis at the risk-free rate and slopes upwards depending on the parameters of return and risk (Lintner, 1965).

5. All securities are marketable and highly divisible. This means that investors can buy any proportion of asset he/she wants. This is due to the assumptions that lending, borrowing and short selling doesn't have open to everyone (Merton, 19721, p. 1852).

6. Sixth assumption we have is that every investor shares the same view when it comes to risk and return. (Levy & Levy, 1996). This assumption can be understood by understanding the assumption 3 where all the investors share the same information about markets.

CAPM remains widely used to this day even though it is not perfect or accurate at all times. This is mainly due to its simple form and with the equation it is easy to compare different assets from one another (Kenton, 2024).

2.3 Equity risk premium

When you subtract the risk-free rate from market return (see Equation 3) we are left with the amount of profit investors require over the risk-free rate. This is called the equity risk premium (ERP) (Salomons, 2008, p.299).

$$ERP = r_m - r_f \tag{4}$$

Equation 4. Equity risk premium

Traditional view in the financial markets is the positive risk-return trade-off meaning that the more risk you take, the more you should earn in terms of profits. Following idea is presented in the Figure 1.

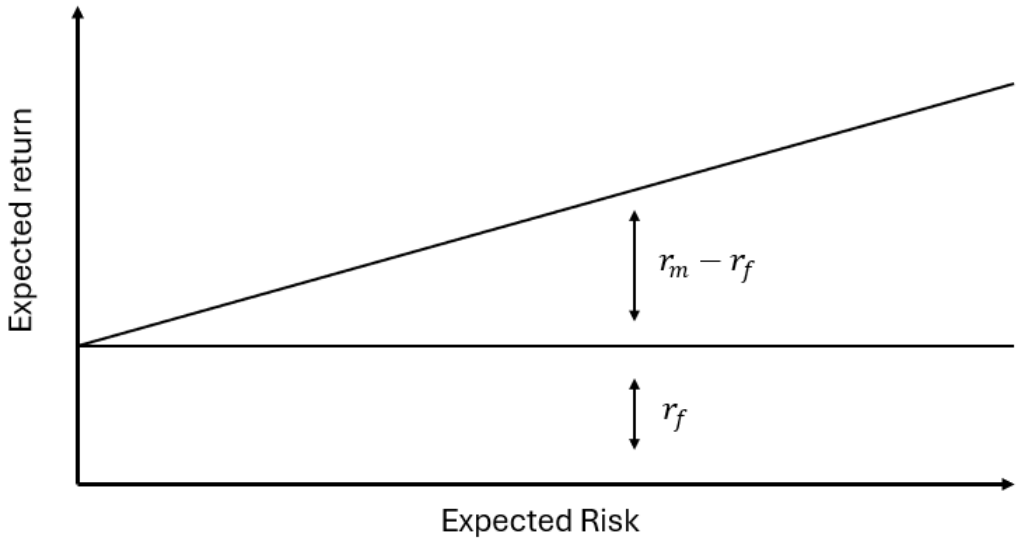

Figure 1. Risk-return tradeoff

This relationship between risk and return is considered to hold in the long periods but in the short-term, relationship may show contradictory results (Lundblad, 2007).

ERP can be approached in two different perspectives. Ex ante ERP is an estimation of ERP in the future. It is measured as an estimated risk premium subtracted by government bonds. Ex post ERP is taking a historically perspective. It calculates historical returns subtracted by bonds at the time (Salomons, 2008, p.299). In other words, ex-post ERP is answering the question what the risk premium was looking backwards. Ex-ante ERP has major implications to the stock markets. Ex-ante ERP represents the required return investors require from the stock market. Changes in required rate of return moves the stock prices through valuation (Ewijk. C. et al., 2012, p.821). If ex-ante ERP increases (decreases), lower (higher) valuations are justified.

Historically the ex-post risk premium has been larger than the expected risk premium (ex-ante), in the financial literature this relation in called ERP puzzle (Mehra, 2003, p.54).

ERP captures investors' overall assesment of risk regarding the equity markets and the compensation bearing the risk itself. It directly contributes to returns we achieve on the assets and the valuation we assing to them (Damodaran, 2023, p.6).

Although the consept of ex-ante and ex-post ERP provide the framework for measuring it, it does not provide any drivers behind the movements of ERP. Aswath Damodaran (Damodaran, 2023) has given several determinants of ERP. Determinants can affect to the risk-free rate or overall stock market changing the risk premium in some way. In this thesis we are going to focus four ERP determinants that were raised by Damodaran. These four determinants are interest rates, monetary policy, risk-aversion and liquidity and money flow (Damodaran, 2023), all of which are heavily influenced by inflation.

2.4 Efficient market hypothesis

Efficient market hypothesis (EMH) is a traditional financial theory, developed by Eugene Fama (1970), argues that markets are efficient in a way that asset prices are correctly priced, reflecting all publicly available fundamental information. Theory is split into three stages of efficiency: weak-, semi-strong- and strong-form. Weak form suggests that prices reflect all available fundamental information from the past. Semi-strong form argues that prices reflect all publicly available fundamental information at the time (annual earnings, news, estimates etc.). Strong form includes all insider fundamental information on top of the semi-strong stage. The main outcome from this theory is that it should be impossible to outperform the market portfolio in a long run since asymmetric information can not be used in our advantage.

This theory causes a lot of debate whether it can be true because it overrides the aspect of human psychology completely. Stock market has seen bubbles in the past and those are evidence of mispricing and market irrationalities.

3 Literature review

In this section the development of an ex-post ERP is examined in the contects of the EMH and previous research about the subject. The analysis begins by reviewing inflation estimates and expectation after which we will look at ERP determinants. The analysis relies on ex post ERP data obtained from Aswath Damoraran's publicly available dataset since he has documented the ERP movements from the year 1928 to this day.

From the Damodaran's data we can observe that the year 2021 had ex-post ERP of 28,43% (S&P500 subtracted by 3-month t-bill), a change of 10,77%- points from the previous year 2020. Year 2022 had ex-post ERP of -20,13% which is total of -48,56%-point change from the year 2021. According to EMH (Fama, 1970), investors behave rationally and the asset prices reflect all available fundamental information and therefore the risks should be priced in.

Even though we are working with a very short time-period such a drastic change in risk premium is very unusual. Previously we have seen such a drop in risk premium in the year 1937.

3.1 Inflation during 2021-2022

The FED's monetary policy reports and Federal Open Market Committee's (FOMC) minutes are closely monitored at the time when released. Rosa (2013) investigates whether market volatility and trading volumes are affected by FOMC statements and minutes. He finds that both trading volumes and the volatility of U.S. financial assets are significantly impacted by these releases (Rosa, 2013, p.79). Evidence shows that trading volumes of S&P 500 are, on average, approximately four times higher than normal following the release of FOMC statements (Rosa, 2013, p.78). Statements are given immediately after the FOMC meetings. In addition, the trading volumes are rougly twice as high following the release of FOMC minutes, which are released three week later (Rosa,

2013, p.77). These findings highlight the significant role of FED's communications in shaping market activity, particularly in terms of trading intensity.

3.1.1 Impact of the FED's statements and estimates

In year 2021 and 2022 FOMC had eight meetings each year and FED published two monetary policy reports in a year, one in February and other during the summer. These reports give a good indication of FED's forecast of future inflation and their view whether the inflation is considered to be sticky or transitory. As discussed in the introduction, debate about stickiness of inflation divided investors and FED's opinion was considered.

These estimations and statements about inflation are tight together with nominal interest rates and real interest rates through Fisher's equation (Benninga, 1983, p.858). Equation 5 shows the relationship between these three things.

$$1 + i_1 = (1 + r_1) * \frac{E(p)}{p_0} \tag{5}$$

where:

i_1=nominal interest rate

r_1=real interest rate

$\frac{E(p)}{p_0}$=Expected inflation

Equation 5. Fisher's equation

Rearrenging the equation 5 we can see that the real interest rate (which really affects the economy) is an outcome of nominal interest rate divided with inflation expectation. Statements of FED's are trying directly to influence the inflation expectation part.

2021 July Monetary Policy Report mentioned that the PCE inflation had risen from 1,2% in December 2020 to 3,9% in May 2021. This was the first time the PCE inflation is well above the FOMC's target of 2% (Federal Reserve, 2021, p. 11). According to FED, PCE was increased due to rebound from pandemic and supply and demand imbalances caused by supply chain bottlenecks. Despite High inflation FED states that they see the environment as "extraordinary circumstances" and expect inflation widely to decrease towards FOMC's target of 2% (Federal Reserve, 2021, p.14). FED expected PCE inflation to decrease to a level of 2,1% in 2022 (Federal Reserve, 2021, table 1). In addition, FED kept the interest rates near zero and continued the quantative easing program with asset purchases (Federal Reserve, 2021 p.2).

2022 FED published its first monetary policy report of the year in February. Between this and the previous reports the inflation had continued to increase. The PCE inflation increased to 5,8% once again being far more than FOMC 2% target (Federal Reserve, 2022, p.13). FED stated that the price increase was driven by bottlenecks and constraints in supply chain. Although this time they also mentioned supply-demand imbalances, labor shortages and rising wages as reason for the development (Federal Reserve, 2022, p.15). The increasing inflation did not cause FED to raise their expectations for 2022 much. They forecasted PCE inflation to be at the level of 2,6%. On the other hand, their view of Federal Fund Rate changed since they increased the forecast for 2022 to 0,9% from 0,1% (Federal Reserve, 2022, Table 1). Still the currect target range for Federal Fund Rate remained untouched (Federal Reserve, 2021 p.2).

The third Monetary Policy Report during the research period was published in June 2022. The PCE inflation continued its rise to 6,3%, highest level of PCE inflation since 1980s. According to FED the development of PCE inflation was caused by higher commodity and energy prices due to Russia's invasion of Ukraine. Another reason for the change was supply chain bottle necks and high wage growths (Federal Reserve, 2022. p.2). The Federal Fund Rate was increased to a range of 1,5% – 1,75% and in first of June, FED started to reduce the amount of assets after heavily buying the bonds for years to increase the

recovery of economic pandemic (Federal Reserve, 2022, p. 3). They estimated Federal Fund Rate is to be in level of 3,4% and PCE inflation in level of 5,2% by the end of the year 2022 (Federal Reserve, 2022, Table 1). By the end of 2022, the Federal Fund Rate was raised to 4,25%-4,5% (Federal Reserve, 2022, p.10).

3.1.2 Accuracy of inflation estimates and consequences

Now that we know what the estimations and views of FED's, we can start to unravel the accuracy of these estimates and the possible consequences of FED misleading the economic outlooks.

First problem or inaccuracy of estimates comes out from FED being biased with their estimates. Capistrán (2008) examined the biasedness of FED in the contects of inflation reporting and found evidence of underprediction of inflation. According to Capistrán, this is due to FED thinking that the above-target-inflation is more expensive than under-target-inflation. This also causes that when the inflation is above the FED's targets, they are likely to forecast towards their targets too soon (Capistrán, 2008, p.1416).

Koch and Noureldin (2024) examined post-2020 research on inflation forecast errors during the period between Q1 2021 and Q3 2022 from data they have from International Monetary Fund (IMF). IMF's inflation forecasts are based on CPI, whereas FED uses PCE inflation as its policy. Although these organizations use different measures of inflation, those highly correlate with each other and responds similarly to macroeconomic shocks (Haubrich & Millington, 2014). This is why we can proxy the unexpected inflation development with this data.

They found out that worldwide the average headline inflation forecast error was 1,7% in 2021 and 3,2% in 2022. These numbers are significantly higher than what the average has been in the past. Compared to the average in 2010-2019, year 2021 and 2022 forecast errors are 2,5 and 5 times higher worldwide. In terms of U.S. the 2021 forecast error

was 2,5% and 1,8% in 2022 (Koch & Noureldin, 2024, p.854). Koch and Noureldin (2024) conducted ex post and ex ante analysis of inflation movements. Ex post-wise, they took four economic drivers and studied whether it had any correlation between core inflation error. In the U.S. all these drivers were roughly on the regression line but “Fiscal Stimulus (percent of GPD)” was slighty above the line. (Koch & Noureldin, 2024, Figures 11-14). Their ex-ante analysis tried to answer the question: Could this sudden increase in inflation have been anticipated. The most important finding from the ex-ante analysis found evidence that there was a possibility to see the impact of fiscal stimulus checks on inflation (Koch & Noureldin, 2024 p. 867). On top of that, they don’t rule out the possibility of fiscal stimulus causing other problems to economics such as labour market and supply contraints (Koch & Noureldin, p. 867-868).

Another study conducted by Ko (2025) studies the effects of American Rescue Plan (ARP) in inflation. ARP was an emergency fiscal policy tool where 1,9 trillion dollars were push to economic system including fiscal stimulus package 400 billion dollars straight to citizens (Geier, 2021). Ko (2025) constructs a “synthetic representation of the United States” which he then compares what did happen in real U.S. (Ko, 2025, p.7) “Synthetic U.S.” represent comparable version to the real U.S. The main idea of this study is that synthetic U.S. does not receive the ARP. The gap between the actual U.S. and synthetic U.S. after the horizontal dashed line, which represent the deployment of ARP, increases massively. (Ko, 2025, Figure 4d). This finding suggests that the ARP packace had great impact on inflation development after it was published. These findings support also the findings of Koch and Noureldin (2025).

From FED’s monetary reports, the global supply chain issues are the most used explanation for the development of inflation in 2021. The tone shifts from supply chain issues to commodity price increases after Russia’s invasion to Ukraine. Diaz et al. (2024) investigated the drivers of inflation in Germany, Japan, U.K. and U.S. between 1988 and 2022. They found out that contribution of supply chain disruptions has, indeed, increased after COVID-19 pandemic and is the main contributor, but still explaining only 20% of inflation

innovations. Other factor they measure is “demand shock” and that factor could explain only 15% of unexpected movements in inflation in 2022 (Diaz et al., 2024).

After examining the movements of PCE inflation expectations and research covering ex-post and ex-ante analysis of the situation, we can review our null hypothesis and the first hypothesis. Since Koch & Noureldin (2024) found evidence of policy makers not understanding direct, or indirect, effects of fiscal stimulus to inflation given the material they had, we can comfortably reject the null hypothesis and accept the first hypothesis. This is also backed up with evidence of significant effect of ARP on inflation. This is important point in this study since we can say that markets were not efficient at the time. This causes stock prices and interest rates to be misleading at the time and causing also ERP movements to be inefficient.

3.2 Factors affecting equity risk premium

This part of thesis covers four different ERP determinants mentioned by Damodaran (2023) We study how these determinants are developing in 2021 and 2022. Also, we will see the consequences it had to market movements. The ERP affects how much we allocate across all available asset classes and it also determinates how much and what specific asset we choose within each different asset classes (Damodaran, 2023, p.6). The determinants we cover in this chapter are risk aversion, inflation and interest rates, monetary policy and liquidity and fund flows.

3.2.1 Risk aversion

According to Damodaran risk aversion is the most crucial factor for the markets. While investors may have different level of risk aversion, the collective risk aversion is the one that defines ERP. As investor’s risk aversion increases (decrease), ex-ante risk premium will increase (decrease) as well (Damodaran, 2023, p. 10).

Prior research has established a clear relationship between inflation and risk aversion. Reasearch done by Brandt & Wang (2003) found positive correlation between level of inflation and risk aversion. They also found out that the news about the inflation is a statistically significant factor when it comes risk aversion. Study comes down to a conclusions that high and unexpectedly rising inflation is in relation with high risk aversion and that when the risk aversion is high, holding risky securities need to be rewarded with bigger returns (Brandt & Wang, 2003, p. 1480).

At the same time, during COVID-19 period U.S. was impacted by ARP. In total appoximately 50% of U.S. citizens received 3200 dollars in three waves of stimulus money given by U.S. government between summer 2020 and March 2021 (Geier, 2021). Greenwood et al. (2023) found out that stimulus checks increased both trading volumes and stock prices. Based on survey, 72% of existing users of online broker platform received stimulus money and over 50% said they invested the money some part of it into the stock market. As money was given for free, investors could seek profits in more speculative assets representing lowel risk aversion. Their rought estimate is that 170 billion dollars flowed to the stock market after the third stimulus package (Greenwood, et al., 2023, p. 4095).

Combining the inflation evidence from FED's monetary reports (see section 3.1.1) and studies regarding the unexpected inflation and the additional money given by ARP we can state that in 2021 risk aversion was at the low-level in causing ERP increase ex-post wise. FED did not see inflation to be harmful and expected inflation to decrease to normal level by 2022. However, economic environment really changed after FED increased their 2022 PCE inflation expectations from 2,6% to 5,2%. This event caused a lot of uncertainties in the markets, hence raising the risk aversion and ERP. In this situation stock prices must fall to reflect the new level of return required to hold risky assets bringing down ERP ex-post-wise.

3.2.2 Inflation and interest rates

Second determinant mentioned by Damodaran is inflation and interest rates. According to FED, their interest rate policy relies on two things, 2% PCE inflation target and labor market (Federal reserve, 2021). High unexpected inflation force FED to turn tables in early 2022 and start raising Federal Fund Rate and increase their estimates for 2022 (see section 3.1.1.) During 2022 FED raised Federal Fund Rate from 0%-0,25% to 4,25-4,5%.

After FED started to increase the Federal Fund Rate, U.S. treasury bills (Risk-free rate that Damodaran applies when calculating ERP) started to increase rapidly. In January 2022 3-Month T. Bill was at the level of 0,15% and during the year it rose to 4,25% indicating 4,1%-point increase (Federal Reserve Bank Of St. Louis, n.d.).

Ewijk, C. et al. (2012) conducted an empirical analysis of economic variables and ERP. The relationship between U.S. treasury bills and ERP is visible in regression results. Coefficient on U.S. treasury bills are statistically significant and in level of approximately 1,0 (average of 4 tests) (Ewijk. C. et al., 2012, table 3). It means that every percentage point increase in U.S. treasury bills, ERP increases roughly by 1 percentage points.

Based on Ewijk, C. et al (2012) research the ERP should have increased around 4 percentage points. From Damodaran's publicly available database we can seen that the ex-ante ERP rose from 4,24% to 6,21% during 2022. A complex as economy is, we cannot fully state that ERP should have increase more but still it is much below that Ewijk, C et al. (2012) anticipated.

In the contects of the ex-post ERP, the rise of ex-ante ERP is a major driver for adjusting the stock prices in a new level of risk premium causing stock prices to go down. On top of that risk-free rate is substantially higher. These two things contributing at the same time makes a big difference in ex-post ERP since both components of the ERP equation are making ERP lower.

3.2.3 Monetary policy

Another monetary policy tool which FED uses has to do with the FED's balance sheet. They either buy U.S. treasuries or sell them. The first is called quantative easing (QE) and the latter quantative tightening (QT). QE is done when boosting the economy and trying to increase inflation and QT is done when they try to tackle the inflation by increasing the supply in bond markets and that way increasing the rates. The transition period between QE and QT is called tapering and it is crucial part of monetary policy since tapering is always done before starting the QT itself (Ganti, 2026).

Smith & Valcarcel (2023) have researched the effects of unwinding the FED's balance sheet on financial markets. Their time period was between 2008 and 2020 in which FED carried out QT program from 2013 to 2019. Tapering was done in 2013 and the unwindening between 2014 and 2017 (Smith & Valcarcel, 2023, table 3). In October 2017 FED started officially reducing their balance sheet. The period of quantative tightening lasted 23-months to August 2019 and during that time FED's balance sheet reduced roughly by 700 billion dollars.

They found that tapering announcements had significant impact on longer-term U.S. treasury yields (3-30 years treasuries) but the unwindening did not have any significant effects on the markets (Smith & Valcarcel, 2023, table 4). The same results are visible when they observed the effects to other asset prices. Tapering announcements had significant impact to all the variables included in the regression and unwindening effects had no significances (Smith & Valcarcel, 2023, table 4). This highlights the finding of Rose (2013) that the FED's announcements are the dominant factor of moving the markets. Study also found that QT led to an increase in interest rates. According to Smith and Valcarcel (2023, p. 18), both short-term, and long-term interest rates increased but 10-yeas U.S. treasury bill outpaced the shorter terms.

Looking back to FED's statemants, the reduction of the net asset purchaces started in November 2021 (tapering period) and came to an end in March 2022. The tightening of the balance sheet began the first of June (Federal Reserve, 2022, p. 3). As we discussed in the previos chapter the U.S. 3-month treasury bills started to increase rapidly in January 2022 which supports the evidence of Smith and Valcarcel (2023).

We can conclude the tapering and tightening of FED's balance sheet had their impact on short-term interest rates which directly causes the Ex-post ERP to decrease since risk-free rate is at the higher level. We can also state that tapering and tightening have also indirect effects on ex-post ERP, because the discount rates for future cash flows has increased, bringing down stock prices.

3.2.4 Liquidity and fund flows

FED's QE and QT programs are affecting on amounts of money that is circulating the economy and therefore controls the liquidity of markets (Ganti, 2026). Gibson and Mougeot (2004) compared the average ERP and systematic liquidity risk and found out that liquidity risk is a major component of ERP and that it is time-varying (Gibson & Mougeot, 2004, p.176). They state that, the more volume a stock has, the less ERP there should be for that specific stock. Since we are looking at the whole U.S. stock market, we are intrested in trading volumes.

Despite the economic environment being vastly different, trading volumes of U.S. stock markets increased both 2021 and 2022. Trading volumes increased 3,5% in 2021 and another 3,7% in 2022 (Finra, n.d.). Based on Gibson and Mougeot (2004), an increase in trading volumes should lead to a decrease in the ex-ante ERP. All else equal, a lower ex-ante ERP implies higher stock prices. Evidence from the S&P 500 partially support this relationship. In 2021 the market increased by 26,89%, concistent with the declining ERP. However, in 2022 markets fell by 19,44%, which fights againts the expected outcome.

This suggests that findings of Gibson and Mougeot (2004) may have affacted the marktes in 2021 but in 2022 other factors dominated the market dynamics.

Another factor for ERP is the funds flowing in or out actively/passively managed equity funds. According to Damodaran (2023, p.17) ERP should decrease in case of funds flowing into the equity markets and increase if funds are escaping to another asset class or geography. French & Li (2022, p.3) found that economic policy uncertainty reduced the equity fund flows. On top of that they found that U.S. treasuries responded positively to unexpected shocks in 3-Month. U.S. treasury bills. Equity fund flows and treasury fund flows can also been seen as substitutes since there is a negative relationship between those (French & Li, 2022, p.3).

Sabban and Jackson has collected U.S. Fund flows data from 2021 and 2022. Fund flows of 2021 was at the record high level. In total 1,2 trillion dollars flowed to markets. U.S. equity markets saw contradictory results; money flowed out from actively managed funds by 195 billion, but passively managed funds increased by 346 billion totaling to 151 billion capital flow in U.S. equity. However, the biggest increase was in taxable bonds with flows in both active and passive funds increased. The organic in that category was 10,4% well above U.S. equity growth of 1,4% U.S. (Sabban & Jackson, 2022).

In 2022 tables turned, U.S. equity saw net inflows of 46 billion whereas taxable bonds saw enourmous outflow of of 216 billion dollars (Sabban & Jackson, 2023). This argues againts the findings of French and Li (2022). Based on their evidence, capital flows should move more towards bonds rather than U.S. equity funds when the unexpected inflation and interest rate hikes occurred in 2022.

Findings of Gibson & Mougeot (2004) and French & Li (2022) can be tied with the mixed conclusions. In 2021, improved liquidity and net inflows to U.S. equity market could've compressed the ex-ante ERP and fueling the high realized returns. In contrast, despite increased volumes and funds inflows in 2022, equity prices fell drastically. Furthermore,

the massive 216-billion-dollar outflow from taxable bonds in 2022 against the “flight-to-safety” behaviour predicted by French and Li (2022), indicates systematic repricing of risk. In this case equity valuations are decreasing bringing the realized returns down.

4 Conclusion

This thesis examined whether the changes in the ERP during the high inflation period of 2021-2022 were consistent with previous financial literature. The thesis focused particulary on the role of inflation and inflation related uncertainties, as well as key determinants of ERP which were closely related to inflation movements.

The findings suggest that the movements of ERP were not fully in line with the EMH. The bottom line for this is the findings of Capistrán (2008) which states that FED can have bias in their statements or forecasts. Markets cannot be efficient in case of FED is rounding the estimates in the way they want to affect the markets. Also, the inefficiencies were due to the much higher inflation than FED was anticipating and the findings of Koch & Noureldin (2024) that inflation surge was possible to forecast based on the fiscal stimulus packages announced. Also, Ko (2025) found evidence of immediate inflation surge after American Rescue Plan (ARP) was announced. With these arguments we can reject the null hypothesis (H0) which assumed ERP movements to be consistent with EMH. Instead results support the first hypothesis (H1) indicating that markets did not price correctly all available fundamental information.

Furthermore, the analysis shows that inflation and inflation-related uncertainties had significant impact on ERP during 2021-2022. Unexpected inflation led to changes in risk aversion, rapid increase in interest rates, major shifts in monetary policy, causing investors to demand higher compensation for holding risky assets. We studied the effects of ERP determinants over the long run and compared their development with the real market movements. We found out that movements of the determinants affected the ERP in line with the previous literature when it comes to 2021 but in 2022 liquidity and fund flows did not have the consequences Gibson and Mougeot (2004) anticipated (see Appendix 1), at least in our short time period. All in all, the findings support the second hypothesis (H2) suggesting that inflation and its uncertainty were key driver for direct or indirect movements of Ex-post ERP during 2021-2022, therefore H2 is accepted.

From broader perspective, the results emphasize the importance of expectations and policy creditablitity in financial markets. When expectations are misjudged, the resulting policy adjustments can have substantial effects on asset pricing and risk premium. This has important implications for both investors and policymakers, as it highlights the sensitivity of stock prices to macroeconomic uncertainty and communications. Based on the learnings of this thesis, I wouldn't trust too much on FED's inflation statements, and I would gather the inflation information from multiple different sources.

This study has certain limitations. Time period is short and therefore it may limit the generalizability of the findings. Additionally, it relies on existing literature and publicly available data meaning that we cannot have full certainty of causal relationships. The complexity of financial markets makes it difficult to isolate the exact contribution of single determinant.

Future research could extend this analysis with the longer timer period or comparing different inflationary periods to better understand the consistency and credibility of these findings. Empirical studies could also be done with different markets. Additionally, behavioural factors could be examined such as herding and prospect theory.

References

Alpert, G. (2024). *U.S. COVID-19 Stimulus and relief.* Retrieved 2025-7-21 from https://www.investopedia.com/government-stimulus-efforts-to-fight-the-covid-19-crisis-4799723

Benninga, S., & Protopapadakis, A. (1983). Real and Nominal Interest Rates under Uncertainty: The Fisher Theorem and the Term Structure. *Journal of Political Economy*, *91*(5), 856–867. https://doi.org/10.1086/261185

Black, F. (1972). Capital market equilibrium with restricted borrowing. *The Journal of Business, 45(3),* 444–455. https://doi.org/10.1086/295472

Brandt, M. W., &Wang, K. Q. (2003). Time-varying risk aversion and unexpected inflation. *Journal of Monetary Economics, 50(7),* 1457-1498. https://doi-org.proxy.uwasa.fi/10.1016/j.jmoneco.2003.08.001

Board of Governors of the Federal Reserve System. (n.d). *open market operations.* Retrieved 2025-7-27 from https://www.federalreserve.gov/monetarypolicy/open-market.htm

Capistrán, C. (2008). Bias in Federal Reserve inflation forecasts: Is the Federal Reserve irrational or just cautious? *Journal of Monetary Economics, 55(8),* 1415-1427 https://doi-org.proxy.uwasa.fi/10.1016/j.jmoneco.2008.09.011

Christensen, J. H. E., Gamble, J. M. IV, & Zhu, S. (2020). Coronavirus and the risk of deflation *FRBSF Economic Letter 2020(11).* Federal Reserve Bank of San Francisco. https://www.frbsf.org/research-and-insights/publications/economic-letter/2020/05/coronavirus-and-risk-of-deflation/

Diaz, E. M., Cunado, J. & Gracia, F. P. (2024). Global drivers of inflation: The role of supply chain disruptions and commodity price shocks. *Economic Modelling, 140.* https://doi.org/10.1016/j.econmod.2024.106860

Ewijk, C., Groot, H. L. F., & Santing, A.J. (2012). A meta-analysis of the equity premium. *Journal of Empirical Finance 19(5),* 819-830. https://doi-org.proxy.uwasa.fi/10.1016/j.jempfin.2012.07.002

Fama, E. F. (1970) Efficient Capital Markets: A review of Theory and Empirical Work. *Journal of Finance, 25(3),* 383–417. https://doi.org/10.2307/2325486

Federal Reserve Bank of St. Louis. (n.d). *Assets: Total Assets (Less Eliminations from Consolidation): Wednesday level.* [Dataset]. FRED. Federal Reserve Economic Data. Retrieved 2025-7-25 from https://fred.stlouisfed.org/series/WALCL

Federal Reserve Bank of St. Louis. (n.d). *3-Month Treasury Bill Secondary Market Rate.* [Dataset]. FRED. Federal Reserve Economic Data. Retrieved 2026-4-15 from https://fred.stlouisfed.org/series/TB3MS

Federal Reserve Board. (2021). *Monetary Policy Report– July 2021*. Retrieved 2026-4-10 from https://www.federalreserve.gov/monetarypolicy/files/20210709_mprfullreport.pdf

Federal Reserve Board. (2022). *Monetary Policy Report – February 2022*. Retrieved 2026-4-10 from https://www.federalreserve.gov/monetarypolicy/files/20220225_mprfullreport.pdf

Federal Reserve Board. (2022). *Monetary Policy Report – June 2022*. Retrieved 2026-4-10 from https://www.federalreserve.gov/monetarypolicy/files/20220617_mprfullreport.pdf

Federal Reserve Board. (2023). *Minutes of Federal Open Market Committee-December 13-14, 2022.* Retrieved-2026-4-16 from https://www.federalreserve.gov/monetarypolicy/files/fomcminutes20221214.pdf

Finra. (n.d.). *Shares of National Market Systems (NMS) Stock Trading Summary 2019-2023).* Retrieved 2026-4-17 from https://www.finra.org/media-center/reports-studies/2024-industry-snapshot/market-data#:~:text=Table_title:%20Table%203.1.%201.1%20Shares%20of%20National,Shares%20Volume:%202%2C760%2C416%2C311%2C642%20%7C%20OTC:%2044.0%25%20%7C

French, J. J. & Li, W. H. (2022). Economic policy uncertainty and fund flows to the United States. *Finance Research Letters, 45.* https://doi-org.proxy.uwasa.fi/10.1016/j.frl.2021.102126

Ganti, A. (2026). *Understanding Quantitative Tightening: How the Fed Reduces Market Liquidity.* Retrieved 2026-4-16 from https://www.investopedia.com/quantitative-tightening-6361478

Geier, B. (2021). *American Rescue Plan: Inside Biden's $1.9 Trillion Stimulus.* Retrieved 2026-4-11 from https://smartasset.com/financial-advisor/american-rescue-plan-biden-third-stimulus

Gibson, R. & Mougeot, N. (2004). The pricing of systematic liquidity risk: Empirical evidence from the US stock market. *Journal of Banking & Finance, 28(1),* 157-178. https://doi-org.proxy.uwasa.fi/10.1016/S0378-4266(02)00402-8

Greenwood, R., Laarits, T., & Wurgler, J. (2023). Stock Market Stimulus. *The Review of Financial studies, 36(10),* 4082-4112. https://doi-org.proxy.uwasa.fi/10.1093/rfs/hhad025

Haubrich, G. & Millington, S. (2014). PCE and CPI Inflation: What's the differene? Federar Reserve Bank of Cleveland. Retrieved 2026-4-14 from https://www.clevelandfed.org/publications/economic-trends/2014/et-20140417-pce-and-cpi-inflation-difference

Kenton, W. (2024). *Capital asset pricing model (CAPM): Definition, Formula and Assumption*. Retrieved 2025-3-11 from https://www.investopedia.com/terms/c/capm.asp

Ko, D. G. (2025). Did the American Rescue Plan cause inflation? A synthetic control approach. *Economic Modelling, 143.* https://doi.org/10.1016/j.econmod.2024.106935

Koch, C. & Noureldin, D. (2024). How we missed the inflation surge: An anatomy of post 2020 inflation forecast errors. *Journal of Forecasting, 43(4),* 852-870. https://doi.org/10.1002/for.3088

Lansing, K. (2022). Untangling Persistent versus Transitory Shocks to Inflation. *FRBSF Economic Letter 2022(13).* Federal Reserve Bank of San Francisco. https://www.frbsf.org/research-and-insights/publications/economic-letter/2022/05/untangling-persistent-versus-transitory-shocks-to-inflation/

Levy, M. & Levy, H. (1996). The Danger of Assuming Homogeneous Expectations. *Financial Analysts Journal, 52(3),* 65-70. https://doi.org/10.2469/faj.v52.n3.1997

Liberto, D. (2025) *Personal Consumption Expenditures (PCE): What it is and measurement.* Retrieved 2026-4-5 from https://www.investopedia.com/terms/p/pce.asp

Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The review of economics and statistics, 47(1),* 13–37. https://doi.org/10.2307/1924119

Lundblad, C. (2007). The risk return tradeoff in a long run: 1836-2003. *Journal of Financial Economics 85(1),* 123-150. https://doi-org.proxy.uwasa.fi/10.1016/j.jfineco.2006.06.003

Macrotrends. (n.d.). *S&P 500 historical annual returns.* Retrieved 2025-7-27 from https://www.macrotrends.net/2526/sp-500-historical-annual-returns

Mehra, R. (2003). The Equity Premium: Why is it a puzzle? *Financial Analyst Journal, 59(1), 54–69.* https://doi.org/10.2469/faj.v59.n1.2503

Merton, R. C. (1972). An Analytic Derivation of the Efficient Portfolio Frontier. *Journal of Finance and Quantative Analysis, 7(4),* 1851–1872. https://doi.org/10.2307/2329621

Mossin, J. (1966). Equilibrium in a Capital Asset Market. *Econometrica, 34(4),* 768–783. https://doi.org/10.2307/1910098

Oner, C. (2010). *Back to basics: What is inflation.* Retrieved 2025-3-10 from https://www.elibrary.imf.org/view/journals/022/0047/001/article-A017-en.xml

Pannuti, C. (2022). *Inflation and the cost of living: Are consumers spending less?* J.P. Morgan. Retrieved 2026-4-7 from https://www.jpmorgan.com/insights/global-research/economy/inflation-cost-of-living

Rosa, C. (2013). The Financial Market Effect of FOMC Minutes. *Economic Policy Review 19(2),* 67–79. https://ssrn.com/abstract=2378398

Saddan, A. & Jackson, R. (2022). *U.S. Fund flows Smashed Records in 2021.* Morningstar. Retrieved 2026-4-17 from https://www.morningstar.com/funds/us-fund-flows-smashed-records-2021

Saddan, A. & Jackson, R. (2023). *U.S. Fund Flows: Investors Bail in 2022.* Morningstar. trieved 2026-4-17 from https://www.morningstar.com/funds/us-fund-flows-investors-bail-2022

Salomons, R. (2008). A Theoretical and Practical perspective on the equity risk premium. *Journal of economic surveys, 22(2),* 299–329. https://doi.org/10.1111/j.1467-6419.2007.00536.x

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of finance 19(3),* 425–442. https://doi-org.proxy.uwasa.fi/10.1111/j.1540-6261.1964.tb02865.x

Smith, A. L., & Valcarcel, V. J. (2023). The financial market effects of unwinding the Federal Reserve's balance sheet. *Journal of Economic Dynamics and Control, 146.* https://doi.org/10.1016/j.jedc.2022.104582

Appendices

Appendix 1. Summary tables of the findings

Table 1: Impact of ERP determinants over the long time-period

Determinant	Author	Year	Sample period	Method	Result to ERP
Risk aversion	Brand & Wang	2003	1959-1998	SLS & GMM	ERP Increases when Risk aversion increases
Interest rate	Ewijk. C. et al	2012	1830-2000	Regression analysis	ERP Increases when interest rate increases
Monetary policy	Smith & Valcarcel	2023	2008-2018	Event study	Tapering announcement increases ERP
Liquidity/fund flows	Gibson & Mougeot	2004	1973-1997	Garch (1,1)	ERP decreases when liquidity/fund flows increase

Table 2: 2021 determinant development and assumed concequences to the market

Determinant	Developments	Ex-ante ERP	Stock price reaction	Ex-post ERP $(r_m - r_f)$
Risk aversion	↓	↓	↑	↑
Interest rate	→	→	→	→
Monetary policy	QE	↓	↑	↑
Liquidity/fund flows	↑	↓	↑	↑

Realized ex-post ERP for 2021 was 28,43%

Table 3: 2022 determinant development and assumed concequences to the market

Determinant	Develop-ments	Ex-ante ERP	Stock price reaction	Ex-post ERP $(r_m - r_f)$
Risk aversion	↑	↑	↓	↓
Interest rate	↑	↑	↓	↓
Monetary policy	QT	↑	↓	↓
Liquidity/fund flows*	↑	↓	↑	↑

*Development of this determinant did now have the predicted consequences to the market

Realized ex-post ERP for 2022 was -20,13%