NAVIGATING THROUGH ECONOMIC STORMS

A COMPARATIVE ANALYSIS OF STOCK MARKET RESPONSES TO RECENT EUROPEAN RECESSIONS

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Bachelor Thesis

Stockholm School of Economics

2023

Navigating through economic storms: A comparative analysis of stock market responses to recent European recessions

Abstract:

The study investigates the interplay between stock market behavior and recessions in the Northern and Western European area, focusing on data from three different recessions in five countries since 1986. First, unadjusted stock prices show some predictive power in anticipating financial crises, while time-aggregated stock prices do not. During the Covid-19 pandemic, the economic downturn could not be anticipated by the stock market, and investors were over-optimistic. Second, stock price changes exhibit an increase in volatility during recessions, contrasting with the relative stability of dividends. This implies heightened uncertainty and risk-aversion among investors in episodes of economic downturn. Third, standard asset pricing theories alone struggle to fully explain stock market behavior during recessions. The study suggests that short-term policy changes have a great impact on investor behavior during pandemics specifically.

Keywords:

Business cycles and the stock market; Predictability of the price-dividend ratio; Recession variance ratio; Swedish stock market

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1. Introduction

Based on data from three different recessions in five countries since 1986, we study the behaviour of the Northern/Western European stock market around the early 1990s and 2008 financial crises, and the Covid-19 pandemic, with a specific focus on the Swedish stock market. The main idea is to study movements in the price-dividend ratio to examine whether stock prices anticipate low future cash flows and economic growth during recessions. Moreover, the concept of the "recession variance ratio" is discussed related to stock price changes and dividend growth to explore how changes in the perceived risk among investors affect stock market behaviour during recessions. Consequently, a suggested investment strategy during recessions is presented. Then, implications for standard asset pricing theories are discussed to suggest whether existing theory aligns with, or contradicts, our findings, based on our aim of studying and providing future guidance on stock market behaviour around recessions in the Northern/Western parts of Europe. Thus, our research question boils down to: What drives stock market behaviour during recent Northern and Western European recessions, and how can the price-dividend ratio, recession variance ratio, and asset pricing theories aid in responding to future recessions?

While existing literature investigates stock market behavior around 43 recessions in 14 countries (Kroencke, 2022), our study fills a gap through comparing the implications of financial crises to those of the recent pandemic and war crises. Muir (2017) divides negative economic events into financial crises, "normal" recessions, and wars, and discusses the implications of each category of events on risk premia. Unlike Muir, who utilizes a panel data approach, we use an event study approach to show changes in the price-dividend ratio around recessions. While these two approaches typically provide similar results, event studies are suitable for analyzing the immediate impact of specific events, whereas panel data provides a more comprehensive understanding of long-term trends. We suggest that the latter is preferred due to its ability to analyse the specific recession variance ratio examined in our study.

Moreover, while Kroencke (2022) studies countries over four continents, we apply a narrower geographical scope, only including Northern and Western European countries in our main analysis. Through further analysis, we then compare the Swedish stock market to a sample of developed countries to deepen our study around the current economic downturn. As previous research covers general stock market behaviour around recessions, our specific focus on the Northern/Western European stock markets distinguishes our study from other authors and contributes to novel research on the stock market behaviour in these industrialized countries. Our study on the current crisis not only shows the implications of the Covid-19 pandemic, but also some indications of stock market behaviour around Russia's recent invasion in Ukraine. While existing literature covers stock market behaviour around recessions, we find a gap specifically in the Swedish stock market, and thus focus on Sweden and four other Northern or Western European countries nearby throughout this study.

The timing of the price-dividend ratio. We explore whether stock prices to some degree can anticipate the low future cash flows, or dividends, signifying a recession. The price-dividend ratio, defined as the ratio of the current price of an asset over its dividend

payments, may be used as an indicator of stock market valuation. A low price-dividend ratio suggests that the stock is traded at a low valuation compared to its dividends, which could imply an undervaluation. Conversely, a high ratio would imply an overvaluation. Hence, observing changes in the ratio around recessions generates insights into how the stock market reflects and potentially predicts economic downturns. If the price-dividend ratio starts to decline in advance of a recession, this suggests that investors may be anticipating an economic crisis. This decline may indicate that investors expect lower future dividends because of worsening economic conditions and lower expected profits. Respectively, the price-dividend ratio can provide insights into a potential increase or decrease in expected returns.

We find that the price-dividend ratio drops significantly during the early 1990s and the Great Recession. On the other hand, we observe an increase in the ratio during the Covid-19 pandemic. Consistently throughout all three crises, we find strong variations in the price-dividend ratio. This suggests that either expected returns or expected dividend growth fluctuate drastically during recessions (Campbell and Shiller, 1988). Campbell and Shiller argue that the price-dividend ratio does not necessarily predict how future dividends will change. Instead, changes in this ratio may indicate shifts in expected returns rather than changes in expected future dividend growth. Therefore, a higher price-dividend ratio might suggest lower expected returns since investors are willing to pay more for the same stream of future dividends.

Moreover, the Fama-French three-factor model (Fama and French, 1989), suggests that monthly or quarterly stock returns can be helpful in predicting future market conditions. Authors have supported the Fama-French theory by arguing that there is some degree of predictive power in stock returns (Ang, Bekaert, 2007). Earlier studies find evidence that during economic downturns, investors tend to demand higher expected returns, leading to lower price-dividend ratios for value stocks (Lustig and Verdelhan, 2012). This is consistent with the idea that the main cause behind a drop in the price-dividend ratio during recessions is increased uncertainty and risk aversion among investors. We explore our study's alignment with this existing literature through an analysis of the recession variance ratio, defined as the recession variance over the pre-recession variance for price changes and dividend growth.

The recession variance ratio. Based on the assumption that recessions are characterized by lower price-dividend ratios and higher expected returns, we study the potential factors behind the increase in expected returns. We divide the suggested drivers of the decreasing price-dividend ratio into two categories. One potential factor is the increase in uncertainty, which would lead to higher expected returns and lower price levels, thus affecting the variance of both cash flows and stock prices. Another possibility is that the increase in risk aversion leads to higher demands for the price of risk, thus only affecting stock prices (Jurado et al., 2015). We study the recession variance ratio for stock price changes and dividend growth to assess the volatility of uncertainty and risk aversion during recessions compared to pre-recessionary periods. A high ratio would suggest increased uncertainty, while a low ratio implies a more predictable or less uncertain response to changes in stock prices and dividends during recessions.

We find that the recession variance ratio for stock price changes is 1.07, which indicates a slight increase in variance during recessions compared to pre-recession periods. Our result for the ratio of dividend changes is 0.97, suggesting a slight decrease in the variance of dividends. Our findings align with the concept that stock return variance tends to increase during recessions. However, in contrast to existing literature, our results are not significant. As a result, we do not find robust evidence to support the conclusion that uncertainty and risk aversion significantly impact the relationship between stock prices and dividends during recessions. On the other hand, our analysis of the price-dividend ratio along with findings generated by other authors (Kroencke, 2022, Muir, 2017) strongly suggests that this is the case.

Valuable insights from our study. Studying stock market behaviour around recessions yields value for private and corporate investors, policymakers, and researchers, among others. An in-depth analysis of stock market behaviour and its potential factors during recessions sheds light on the connections between economic indicators and equity markets. This understanding helps with comprehending how macroeconomic variables influence market movements during periods of economic fraction. Consequently, our study enables the identification of patterns and responses to signals that precede or accompany economic downturns. The predictive aspect is valuable for investors and policymakers who seek to anticipate market movements in response to changing economic conditions. Moreover, understanding investor sentiments, risk aversion tendencies, and portfolio adjustments during market downturns is crucial for predicting market movements and developing effective investment strategies. While there are several established asset pricing theories, many of these contradict each other, hence the importance for further research in this area. Furthermore, since the stock market typically reflects the overall health of the economy, studying investor behaviour around recessions is relevant for evaluating how monetary and fiscal policies affect the economy. It helps policymakers refine and tailor effective strategies to enhance market stability and economic recovery.

The insights generated by our study contributes to previous research by shedding novel light on the current period of distress, caused partly by the Covid-19 pandemic. Various recent studies discuss the effects of the Covid-19 pandemic on GDP and unemployment rates (Ma et al., 2020). Ma et al. suggest that the impact of the Covid-19 pandemic on world GDP growth is close to four standard deviations worse than the mean of previous pandemics. We have recognized that existing literature has not yet studied the price-dividend ratio and recession variance ratio during the Covid-19 pandemic. Due to this gap in the literature, along with the increasing threat of pandemics with the rising world population, our study aims to provide guidance on how to effectively manage assets around future pandemics and other recessions.

Related literature. Our study is inspired by earlier work by Kroencke, who studies stock market behaviour around recessions based on 14 countries and 43 recessions since 1951. A key contribution to Kroencke's study is that while he uses data on real GDP, stock prices, and dividends until 2019, we add the corresponding data for our chosen countries from 2019 until the end of 2022 and have a specific focus on the current economic crisis. Moreover, Kroencke studies 14 countries across a wide geographical spread, covering 4 different continents. As we have a primary interest in the Nordic

stock market as Swedish citizens, the most relevant geographical area for our study would be the Nordic region. Consequently, our initial idea was to study only the Nordic countries, i.e. Denmark, Finland, Iceland, Norway, and Sweden. When gathering data from our available sources[1], we concluded that there were either too few years of available stock price and dividend data, or no reported real GDP data available for Denmark, Finland, Iceland, and Norway. As a result, we adjusted our initial idea and chose to study five countries located either in the Northern or Western region of Europe. We study Belgium, France, Germany, Sweden, and the United Kingdom, as these countries together form a relatively narrow geographical area for our study. Our choice of countries enables a comparison between our findings based on a sample of Northern/Western European countries and Kroencke's findings on a more global geographical basis.

Furthermore, we build on a study by Muir (2017), studying different types of economic events and their implications for risk premia. Muir suggests that risk premia spikes significantly during financial crises, i.e. banking crises, while only a slight increase is documented in other episodes such as wars. He shows that the dramatic spike in risk premia during financial crises led to average stock price declines in excess of fundamentals of nearly 30%. This implies that the magnitude of declines in asset prices is greater in financial crises than in "normal" recessions, despite similar changes in fundamentals. The significant differences in risk premia movements between the different categories of events is of interest to build on by analysing the implications of the ongoing economic crisis. Building on Muir's study, our hypothesis is therefore that the changes in the price-dividend ratio around our third recession (Covid-19) are less significant than the changes in the same ratio during recession one and two (financial crises 1990 and 2008). Muir further suggests that conventional asset pricing theories may encounter difficulties in explaining the significantly larger drops in asset prices during financial crises. As Muir's study does not cover the potential drivers of changes in asset prices during economic crises, Kroencke (2022) complements his study through evaluating different potential underlying mechanisms causing these dynamics. Our paper combines and builds on these two studies through an analysis of both potential drivers, and comparisons between different types of events, i.e. financial crises and pandemics/wars.

Recently, an article was published in The Journal of Finance exploring the relationship between credit markets and macroeconomic shocks (Boons et al., 2023). These macro shocks, namely oil supply, investment-specific technology, and government spending, have a significant impact on the overall economy, showing a counter-cyclical pattern that mirrors macroeconomic activity. Boons et al. suggest that the response is driven mainly by credit risk premia, and find that equity risk premia exhibit similar responses, thus translating into return predictability. They decompose credit spreads into two components: default component due to credit losses (cash flows) and credit risk premia (discount rates). Then, they find that most of the countercyclical response of credit spreads to macro shocks can be attributed to the discount rate component. These findings indicate that expected returns share a common time-varying component across different asset classes, influenced by macroeconomic shocks. This further validates that time-variation in risk premia is common in stock and bond markets. As risk premia

[1] Data sources: S&P Capital IQ and Refinitiv Eikon.

increase, it implies that investors expect higher returns from investing in stocks compared to less risky assets such as bonds or treasury securities. Other authors suggest that investors are disappointment averse (Schreindorfer, 2020), implying that investors might react more strongly to negative news, contributing to market downturns or increased volatility. We build on these insights throughout our study. As many might be aware of, the stock market seemed to recover quickly from the Covid-19 pandemic. We study the causes and effects of this recovery and evaluate whether theory around risk premia or investors' reactions to negative news can explain our results.

Another paper we have gathered inspiration from studies stock markets and business cycles (Gómez-Cram, 2022). Gómez-Cram reveals a pattern in stock returns, where a delayed negative response is found for several months post the initiation of recessions. An important implication of his findings is that investors are slow to react to the onset of recessions. The study suggests that during periods of expected negative returns, analysts tend to be overly optimistic, leading to exceptionally high downward revisions in expectations. These findings compose a challenge to standard asset pricing theories that often assume stock prices efficiently and immediately incorporate all available information. Our study investigates this contradiction through a comparison between our findings for the price-dividend and recession variance ratio and standard asset pricing theories.

Outline. *Section 2* presents the data selected, the definition of, and background to, recession events, and the applied methodology. *Section 3* studies the timing of stock prices around recessions and the ability of the stock market to predict these recessions. *Section 4* provides results and discussions around the recession variance ratio. *Section 5* presents further empirical results. *Section 6* generates a discussion around the implications for asset pricing theories. Lastly, the conclusion is presented.

2. Data, recessions & methodology

Data

We collect quarterly data on real GDP, stock prices, and dividend yields[2] for Belgium, France, and the United Kingdom, from 1986 to 2022, and for Germany and Sweden from 1986 to 2022. We use the major indices for each country instead of firm-specific stock prices and dividend yields to represent each country's stock market, and start-of-period values for each quarter.[3] The prices and dividend yields for each country are collected based on the same indices, and thereafter real dividends are calculated.[4] As Belgium, France, and Germany use Euro as their currency, while Sweden has the Swedish Krona, and UK Pounds, we exchange the prices and dividends to the same currency to get comparable data across all five countries. The base-currency chosen was at first Euro. Later, it was realized that the exchange rates needed for converting SEK and Pounds to Euro did not range back further than to 1996. Hence, SEK is used as the

[2] Real GDP is gathered from S&P Capital IQ, and quarterly stock price indices and dividend yields are collected from Refinitiv Eikon.
[3] Indices used: Belgium: BEL 20, France: CAC 40, Germany: DAX Performance, Sweden: OMX Stockholm 30, UK: FTSE All Share Index.
[4] Real dividends are calculated by multiplying dividend yields by stock prices for each quarter.

base currency, and all values are exchanged to SEK.[5] Then, stock prices and dividend yields are deflated.[6]

Following our data collection, the data is formatted into pre-recession and recession periods ranging from 15 quarters before (t=-15), to 15 quarters after (t=+15), each business cycle peak before the beginning of each recession (t=0). Additionally, the price-dividend ratio, the trailing twelve month mean (TTM) of stock prices[7], and the time-aggregated price-dividend ratio[8] are calculated. Before conducting event studies to visualize the data, the real GDP, deflated stock prices, dividend, price-dividend ratio, time-aggregated price-dividend ratio, and TTM of stock prices are transformed into logarithmic data. The reasoning behind this is that logarithmic changes reflect relative changes, and logarithmic returns make gains and losses symmetric which is desirable when conducting event studies. After calculating the logarithmic changes, the cumulative logarithmic changes[9] and the variance of logarithmic changes are calculated[10] to enable our analysis of the price-dividend ratio over time, and the recession variance ratio.

Recessions

The National Bureau of Economic Research (NBER, 2023) defines a recession as "a significant decline in economic activity that is spread across the economy and that lasts more than a few months" (NBER, 2023).". While all economies show peaks and troughs, or lowest points, in their activity over a given time span, a recession is described as the period between a peak and its subsequent trough. Two different measures are typically used to determine business cycle peaks and troughs: Gross Domestic Product (GDP) and Gross Domestic Income (GDI). GDP and GDI together cover the expenditure- and income-side of real Gross Domestic Product. As the two measures are equal in equilibrium, our study utilizes movements in real GDP to determine peaks and troughs in economic activity.

We collect annual business cycle peaks from NBER (Jordà et al., 2011) and complement this information through our own analysis of each country's GDP growth, to analyse where the recessions occur. In previous literature, different approaches to defining recessions are utilized. Kroencke (2022) avoids confounding events by excluding financial crises due to Muir (2017) suggesting that recessions defined as financial crises differ from those categorized as "normal" recessions. We want to

[5] This is done by using the exchange rates for each quarter found at the European Central Bank and multiplying this rate with the price and the dividend separately.
[6] Deflation is conducted by using the Consumer Price Index for each country found at the World Bank and multiplying this by the stock prices and the real dividend.
[7] The TTM is calculated in excel by taking the average of the 3 previous and the current quarter for every quarter except the first, second and third one. Those are just the average of 1, 2 or 3 quarters and not 4 like the rest.
[8] Time-aggregated P/D is calculated by dividing the TTM mean of stock prices by their dividends.
[9] The cumulative logarithmic changes for the different parameters are calculated by adding up the logarithmic changes for all the previous quarters.
[10] The variance of logarithmic changes is calculated by using the VAR.S formula in excel, referencing to the logarithmic change data for that parameter, the current and previous quarter.

include different types of recessions, including financial crises, pandemics, and wars to compare stock market behaviour around these different events.

Although using changes in GDP is considered the most traditional method to define recessions, we acknowledge that various methodologies have been employed by scholars. Other methods include relying on formal declarations of the beginning and end of a recession from Business Cycle Dating Committees. While this approach could be functional, the lag in declarations may affect the timeliness of the recession start and end dates. Additionally, economic indicators such as unemployment rates and other labor market indicators could be used. Unemployment peaks tend to align with recessionary periods, thus providing a complement to the GDP approach. On the other hand, unemployment rates alone do not necessarily capture recessions' broader economic implications. A limitation of NBER's definition of recessions is the use of indefinite terms such as "a significant decline in economic activity", and "lasts more than a few months". Therefore, we use a combination of real GDP changes over time, and NBER's declarations of recessions to make our own judgment of when recessions occur based on our data. This study covers three recessions in each country since 1986, and these are referred to as Recession 1, Recession 2, and Recession 3.

Recession 1 refers to the early 1990s recession, where Europe experienced a significant economic downturn that was part of a global recession. This period was characterized by a financial crisis within the European Exchange Rate Mechanism, which deeply affected currency stability and led to broader economic distress. The difficulties were intensified by several other factors, including a challenging monetary policy environment where central banks were aggressively combating inflation, which in turn moderated business and consumer sentiment. Additionally, the decline in oil prices had a strong effect on the broader economy. Financial sectors were stressed, exemplified by the savings and loan crisis, and the real estate market faced a downturn after a period of expansion in the previous decade. These economic strains manifested in various ways: unemployment rates peaked, businesses went bankrupt, and the political landscape shifted as economic policies became a central issue. (Corsetti et al., 2023). Recession 1 did not begin at the exact same time in all countries being examined in this study (Jordà et al., 2011). Hence, the (t=0), indicating the peak right before the beginning of the recession, is placed at different years and quarters in the data for the five different countries. The business cycle peak is set at Q1 1990 in the data for Sweden, Q3 1992 in Germany, Q1 1990 in the UK, Q1 1994 in Belgium, and Q3 1992 in France.

Recession 2 represents the Great Recession that started in the US 2007 but affected Europe in the beginning of 2008. The Great Recession began with the collapse of the housing market in the United States, which then spread internationally, leading to a global impact. European countries were highly affected, with many experiencing significant contractions in economic activity. The crisis was exacerbated by a lack of confidence in the financial sector, which led to credit tightening and a decrease in investment. Additionally, some European economies were already vulnerable due to high public debt levels, making them less resilient to the shock (Christiano et al., 2014).

The implications of the recession were severe. There was a sharp increase in unemployment, a decline in consumer spending, and many European governments implemented spending cuts and tax increases to stabilize their economies. The crisis also exposed weaknesses in the economic governance of the Eurozone, particularly the lack of fiscal integration and policy coordination among member states. Consequences of the 2008 recession included long-term economic stagnation in several European countries and increased public debt. In the wake of the crisis, there was a concerted effort to strengthen the European banking system and to establish mechanisms such as the European Stability Mechanism to better handle similar crises in the future (Weinberg, 2013). In our data, (t=0) is placed at Q1 2008 for all countries.

Recession 3 is the Covid-19 crisis, which began in late 2019 when the coronavirus emerged in the city of Wuhan. The virus spread rapidly across the globe, leading the World Health Organization to declare it a pandemic in March 2020. The pandemic triggered a global economic crisis due to the necessary public health measures taken to mitigate the spread of the virus. Lockdowns, travel restrictions, and social distancing measures resulted in a sudden stop of economic activity. Many businesses faced closures, either temporarily or permanently. Unemployment rates increased as companies laid off workers in response to the reduced demand and operational constraints. The economic impact was severe and widespread, with the global economy contracting sharply in 2020. We label the Covid-19 crisis as a recession since we find that our sample experienced a significant decline in economic activity during more than two quarters. Hence, the crisis meets the criteria for a recession, as shown in our real GDP event study later in this section. We set (t=0) at Q1 2020 for all countries. The unique aspect of this recession is that it was not caused by economic imbalances or financial crises, but by a health crisis and the necessary response to contain it (Ma et al, 2023).

The data that this study is based on spans from the 1986 to the end of 2022. Although there are only three recessions considered in the study, it is still necessary to mention the potential recession that we are currently in, as we are in the aftermath of the Covid-19 pandemic and the Russia-Ukraine war. The Russian-Ukrainian conflict escalated significantly in February 2022, when Russia launched a full-scale military invasion of Ukraine. The war has caused disruptions in energy supplies, global food markets, and trade routes, contributing to inflationary pressures worldwide. Economically, the war has led to a sharp increase in energy prices, particularly in Europe, being heavily dependent on Russian gas. This increase in energy costs has driven up the cost of living and production, affecting industries and consumers alike. Additionally, Ukraine has seen its agricultural production and exports severely impacted, contributing to global food insecurity and rising prices (Jenkins, 2023). These factors have aggravated inflation, which was already on the rise due to post-pandemic recovery efforts and supply chain issues. Central banks, including the U.S. Federal Reserve and the European Central Bank, have responded by tightening monetary policies to curb inflation, which has the potential to slow economic growth (European Central Bank, 2022).

While it may be too early to conclusively label the current economic downturn as a recession, there are concerns that persistent inflation, combined with efforts to control

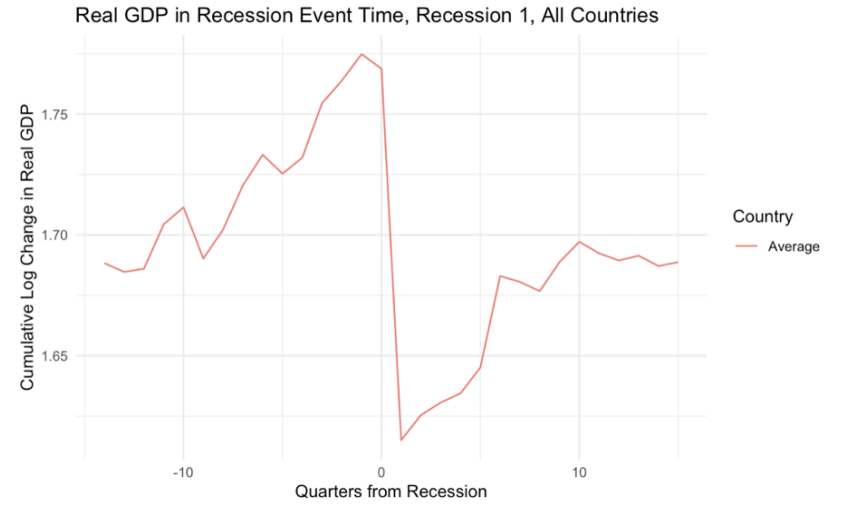
it, could lead to a period of stagflation or a recession. Economic indicators such as GDP growth, employment rates, and consumer spending in the coming quarters will be critical in determining whether the global economy will enter a recessionary phase.

Economic methodology and real GDP in recession event time

Following our real GDP data collection, we prepare our data by first calculating the mean of each country's real GDP growth over the entire period, and then de-meaning the country-specific real GDP growth for each quarter. This process is done to remove country-specific effects, such as long-term growth trends, which are not related to the cyclical business patterns being studied.

Since the aim of this paper is to study and compare stock market behaviour around the three different recessions, we study each of the three recessions separately as opposed to Kroencke's aggregate level approach. We first compute the average cumulative log change in real GDP for all countries around recession one, and then repeat the process for recession two, and lastly recession three.

Fig.1 shows the average cumulative log change in de-meaned real GDP for the All-countries sample in recession event time during recession 1, 2, and 3. We complement the NBER declarations (Jordà et al., 2010) with our own interpretation of business cycle peaks based on collected data[11]. All three recessions are shown separately to see whether our interpretation supports the NBER declarations. We find that all countries experienced a decrease in real GDP during the Covid-19 pandemic, hence we assume Q1 2020 as a business cycle peak for all countries. We shift real GDP according to the business cycle peaks, meaning that the 0-value on the x-axis aligns with the quarter of the maximum real GDP value of the event period (t=0). We include 15 quarters prior to, and 15 quarters after these peaks, i.e., an event window spanning from t=-15 to t=+15 quarters[12].



[11] Business cycle peaks are determined based on the highest value of real GDP before a subsequent significant decrease over several quarters.
[12] Due to data limitations, recession 3 spans from (t=-15) to (t=+12).

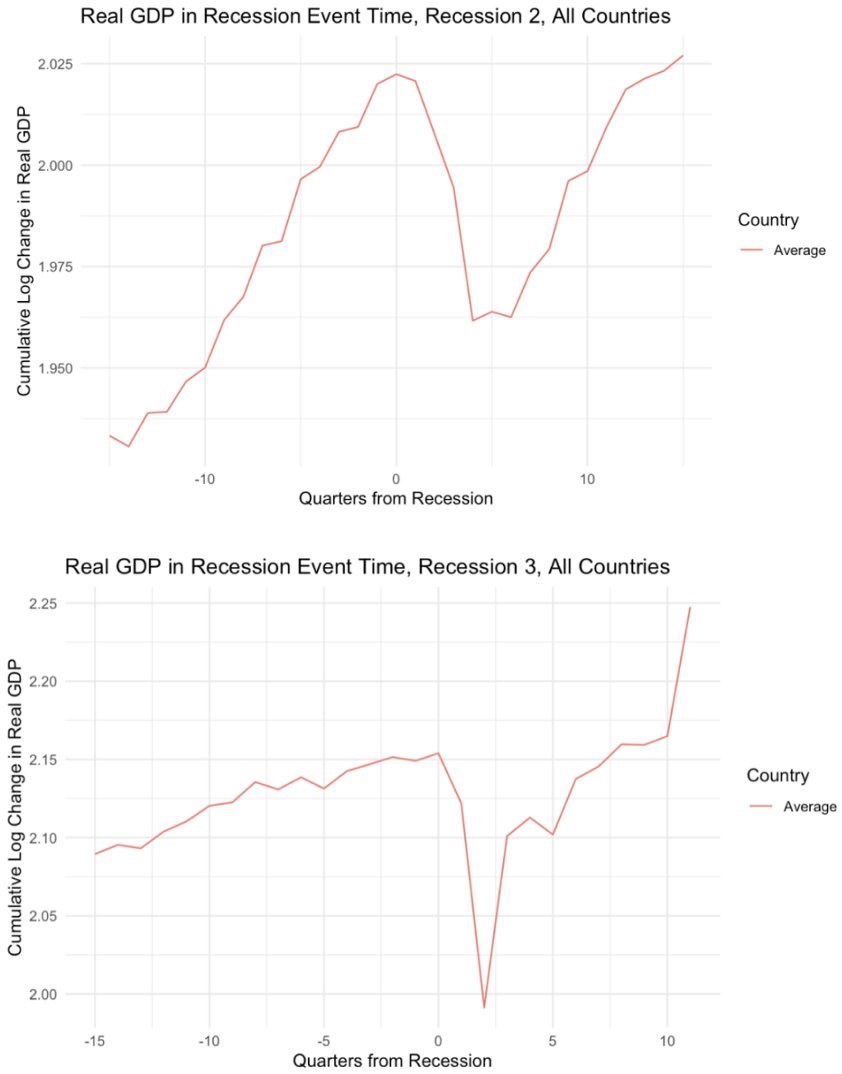


Fig. 1. Real GDP in recession event time (1986–2022, Recession 1, Recession 2, Recession 3).

The upper figure shows real GDP around recession 1, the middle figure shows recession 2, and the lower figure recession 3. It is evident that real GDP drops significantly around each business cycle peak and remains at a low point over the course of a few quarters. Recession 3 is less significant than the first two recessions, which is seen in the sharp increase in real GDP around two quarters after the beginning of the economic downturn (around t=+2). These findings do however support the choice of business cycle peaks which will be applied throughout this study, thus validating that the appropriate recessionary periods are being studied. For the following event studies, the same business cycle peaks are being applied and the values are consistently shifted so that the peak is at (t=0) to explore stock market behaviour around each recession.

3. The timing of the stock market around recessions

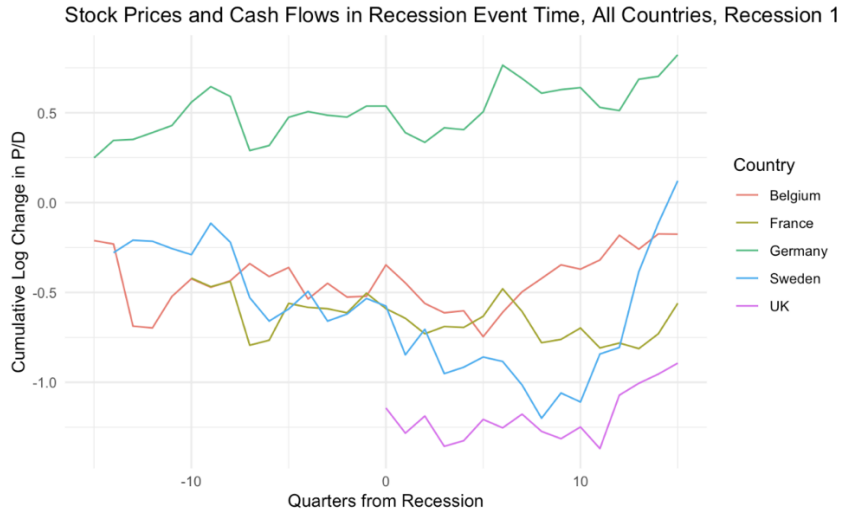
3.1 Accounting for the time-aggregation bias in dividends

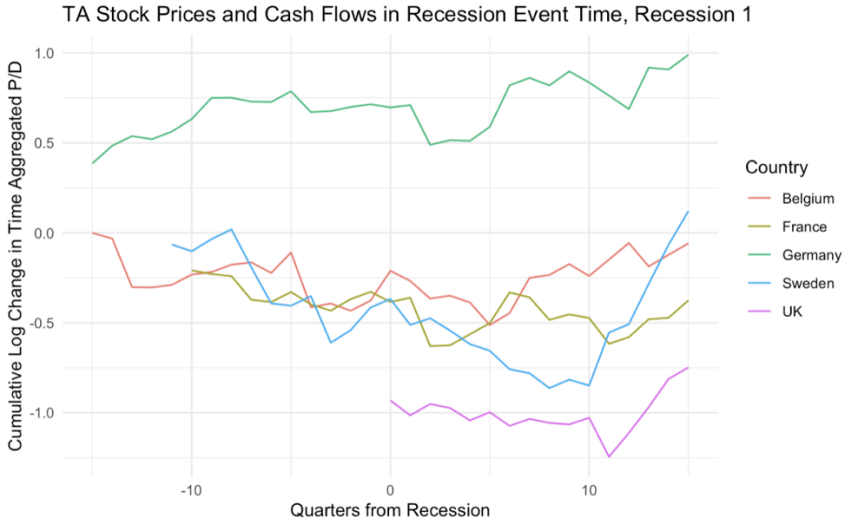
As dividends are typically measured on a trailing 12-month basis, while stock prices are commonly measured at the beginning or end of a period, this difference in frequency can lead to a misalignment in the timing of the data. This gives rise to a time-aggregation bias, which can potentially affect the analysis of their relationship due to a mechanical lag. Accounting for the time-aggregation bias is especially important during economic events due to the immediate and significant impacts occurring around these events. If the data is aggregated over longer periods, such as trailing 12-month dividends, the speed or severity of market reactions to these events may be diluted if not accounted for. This could lead to an underestimation of the true effects. To address this bias, we create a separate dataset of time-aggregated stock prices by calculating the trailing 12-month mean (TTM mean) of stock prices for each quarter. We then create a time-aggregated price-dividend ratio based on time-aggregated stock prices and our collected dividend yields. The event studies presented in the following section, first using the unadjusted price-dividend ratio and then the time-aggregated price-dividend ratio, show that the time-aggregation bias has a significant effect on the price-dividend ratio.

3.2 The timing of stock prices and cash flows

First, we show the cumulative log change in the price-dividend ratio for all countries separately. We then compute an average of the countries and include Sweden separately to be able to view any differences between our sample of Northern/Western European countries and Sweden. This approach is motivated by our interest in focusing specifically on the Swedish stock market. As Sweden's stock market is significantly smaller than the other countries in our analysis based on total market value, it could be misleading to argue around how investors in the Swedish stock market behave around recessions by relying solely on the all-countries sample. We also conduct a panel data study on the price-dividend ratio for statistical reference to our event studies which can be found in Appendix 1-6.

Recession 1. Figure 2 shows the cumulative log change in the price-dividend ratio around the early 1990s recession for Belgium, France, Germany, Sweden, and the UK. The upper figure shows the price-dividend ratio before accounting for the time-aggregation bias for all countries around recession 1. The second figure shows the cumulative log change in the time-aggregated price-dividend ratio around the same recession. The third figure shows the price-dividend ratio for all five countries, as well as the Sweden's price-dividend ratio for comparison. The lower figure shows the time-aggregated average price-dividend ratio, and Sweden's time-aggregated ratio. The variables are rearranged so that each recession is centred around their local business cycle peak (y=0) to visualize the changes before, during, and after each recession.


Stock Prices and Cash Flows in Recession Event Time, All Countries, Recession 1
Cumulative Log Change in P/D
0.5
0.0
-0.5
-1.0
-10
0
10
Quarters from Recession
Country
Belgium
France
Germany
Sweden
UK


TA Stock Prices and Cash Flows in Recession Event Time, Recession 1
Cumulative Log Change in Time Aggregated P/D
1.0
0.5
0.0
-0.5
-1.0
-10
0
10
Quarters from Recession
Country
Belgium
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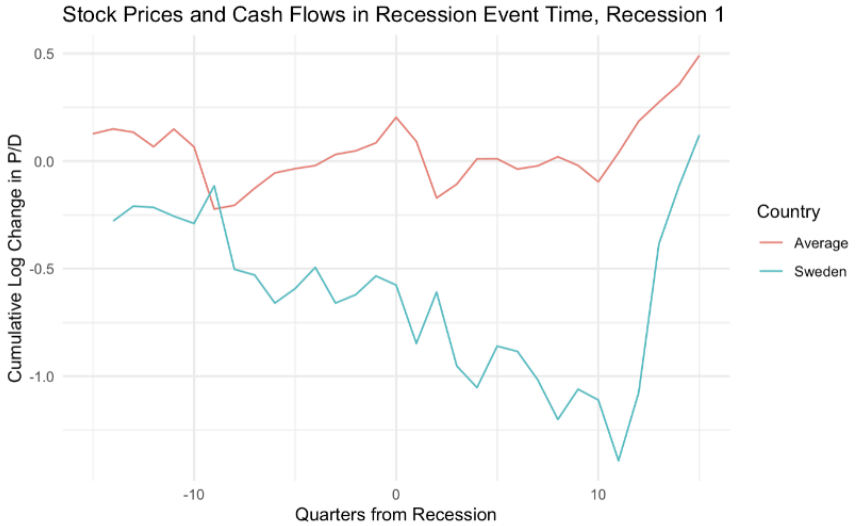

Stock Prices and Cash Flows in Recession Event Time, Recession 1
Cumulative Log Change in P/D
0.5
0.0
-0.5
-1.0
-10
0
10
Quarters from Recession
Country
Average
Sweden

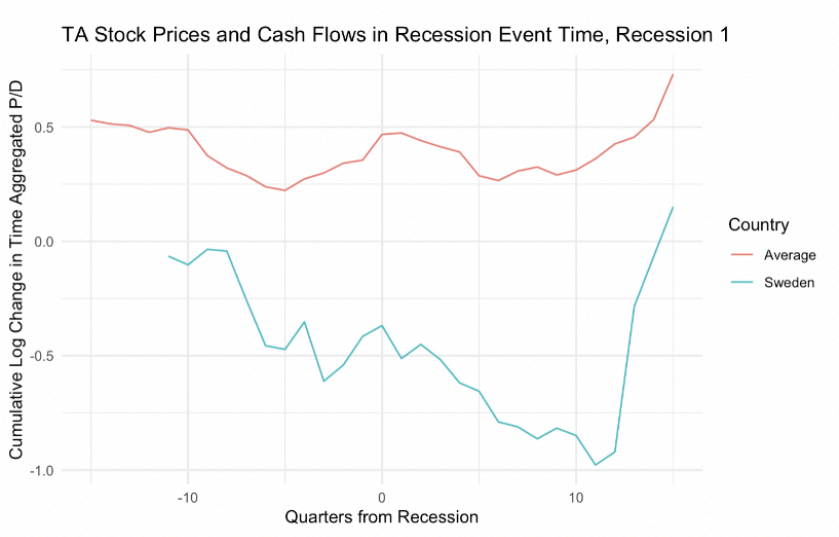
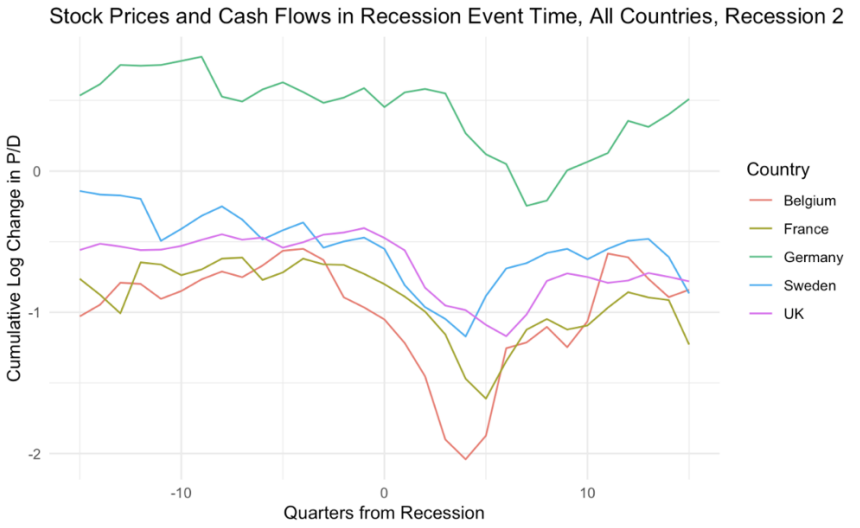


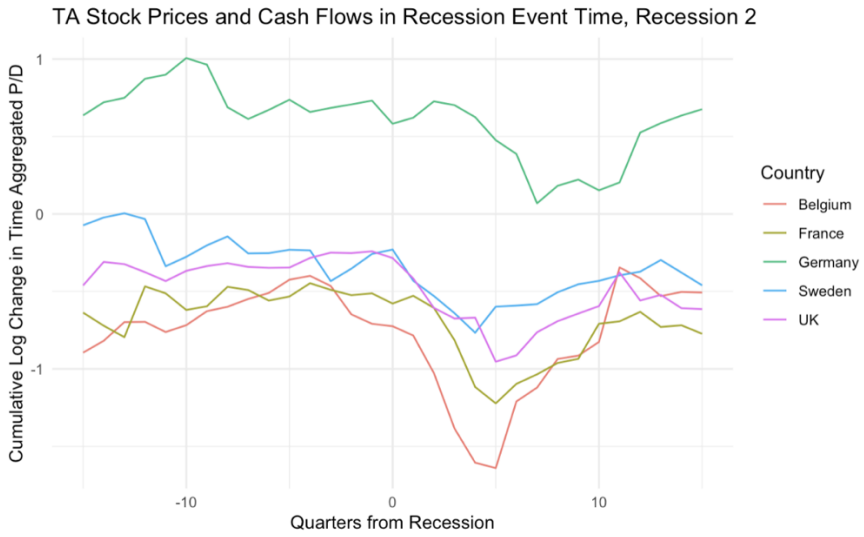
Fig. 2. The stock market in recession event time (All countries, 1986-1994, Recession 1).

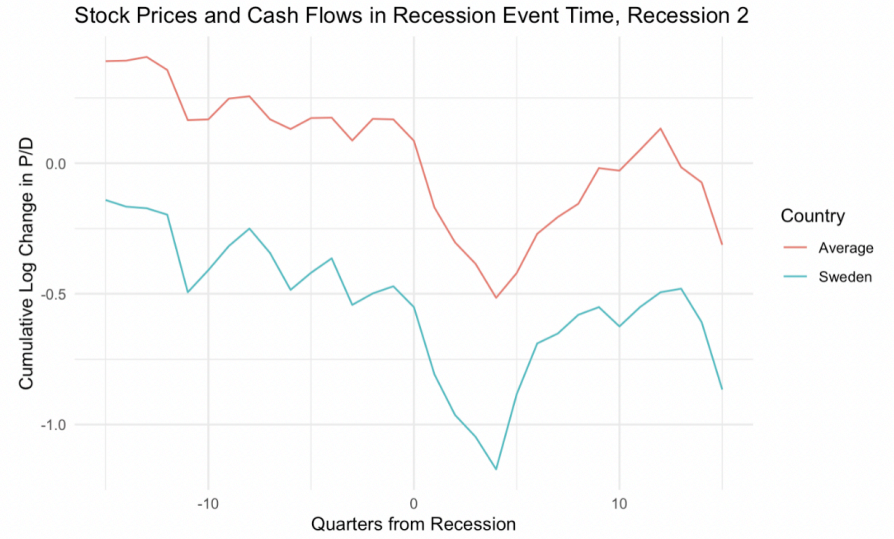
Around recession 1 we find that, for the All-countries sample, the unadjusted price-dividend ratio starts dropping significantly immediately after the local business cycle peak at (t=0). However, when looking at the time-aggregated price-dividend ratio, the drop begins approximately one quarter after the peak, i.e. at (t=1), and is not as significant. This suggests that the unadjusted price-dividend ratio for the Northern/Western European sample can to some degree "predict" recession 1, although not significantly due to the drop in the quarter right after the peak. On the contrary, the time-aggregated price-dividend ratio does not seem to anticipate recession 1 since the decline begins approximately one quarter past the local peak, or the offset of a recession.

In Sweden, the unadjusted price-dividend ratio starts declining approximately one quarter before the business cycle peak, at (t=-1), whereas the time-aggregated ratio starts dropping at (t=0). Hence, Sweden's unadjusted price-dividend ratio can be argued to predict recession 1 even better than the average Northern/Western European country. Before the business cycle peak is reached, either stock prices increase, or dividends decrease, implying that the Swedish stock market may anticipate a recession. Even though Sweden's time-aggregated price-dividend ratio seems to increase consistently in the quarters prior to the business cycle peak, we see a clear negative trend from around (t=-9) to (t=+11) in both the unadjusted and the time-aggregated ratio. A similar pattern is not observed in the All-countries sample. Thus, our findings for recession 1 indicate that the Swedish stock market has a significantly higher predictive power in anticipating the early 1990s recession than the average Northern/Western European country.

Recession 2. We repeat the methodology, but now around recession 2 to visualize the effects of the Great Depression on the stock market. Figure 3 shows the cumulative log change in the price-dividend ratio around recession 2 for Belgium, France, Germany, Sweden, and the UK.


Stock Prices and Cash Flows in Recession Event Time, All Countries, Recession 2
Cumulative Log Change in P/D
0
-1
-2
-10
0
10
Quarters from Recession
Country
Belgium
France
Germany
Sweden
UK


TA Stock Prices and Cash Flows in Recession Event Time, Recession 2
Cumulative Log Change in Time Aggregated P/D
1
0
-1
-10
0
10
Quarters from Recession
Country
Belgium
France
Germany
Sweden
UK


Stock Prices and Cash Flows in Recession Event Time, Recession 2
Cumulative Log Change in P/D
0.0
-0.5
-1.0
-10
0
10
Quarters from Recession
Country
Average
Sweden

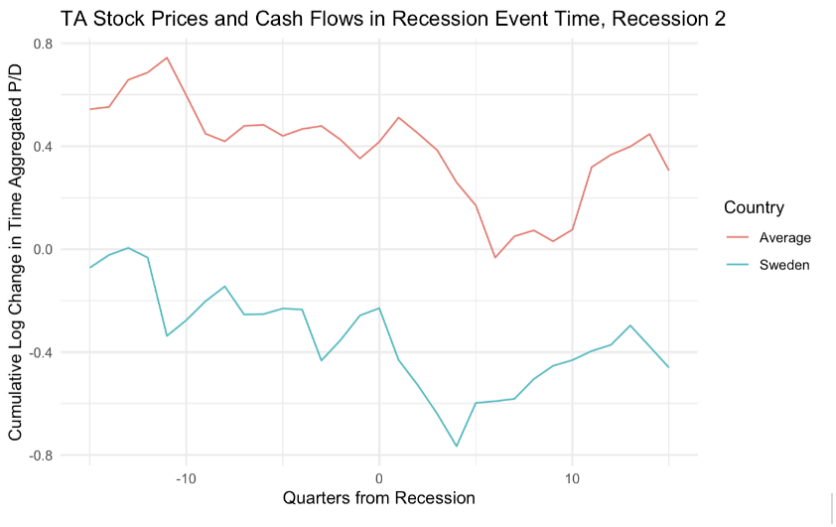
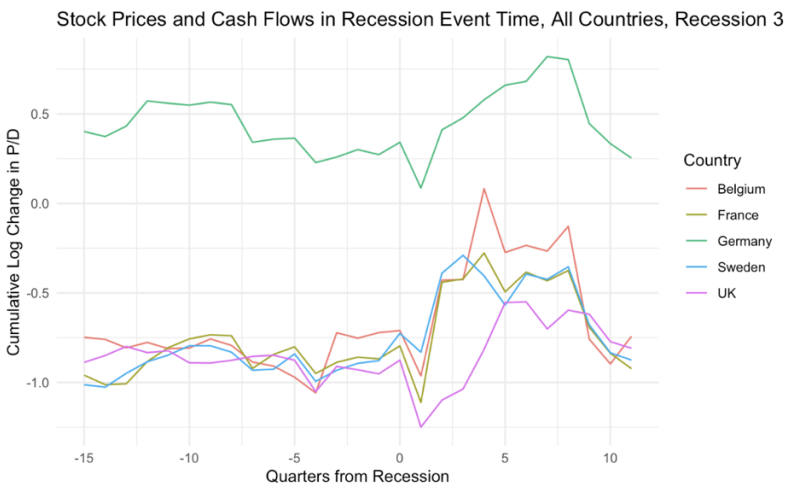


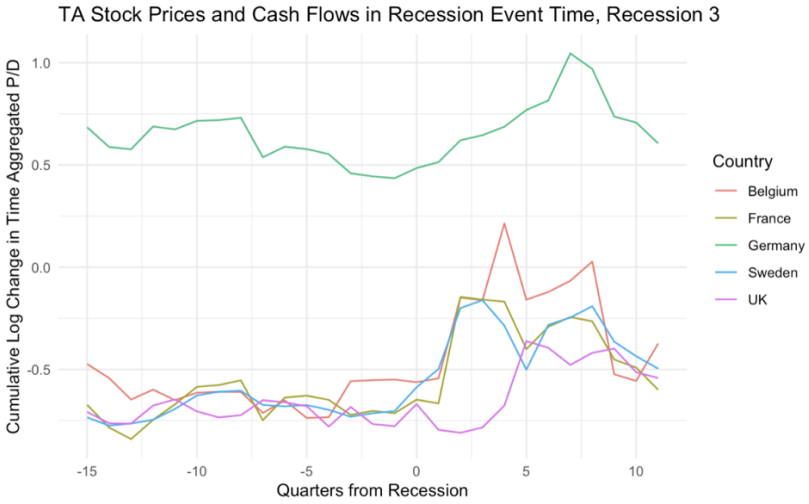
Fig. 3. The stock market in recession event time (All countries, 2004-2011, Recession 2)

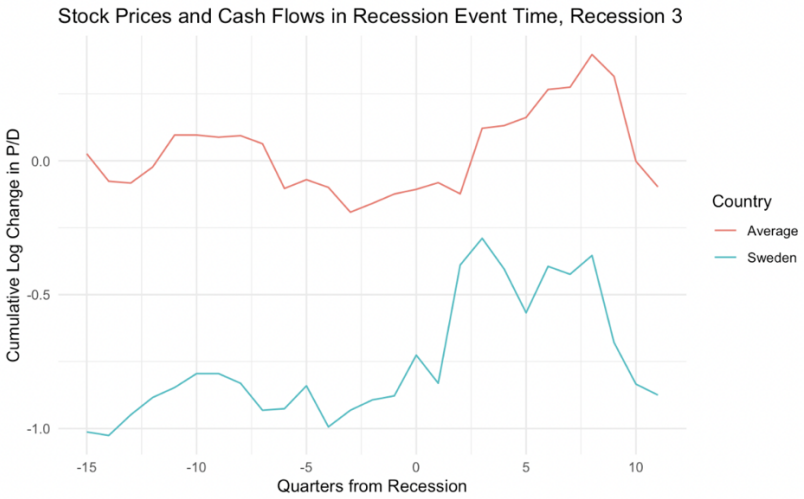
Around recession 2, we find that the All-countries unadjusted price-dividend ratio starts dropping approximately one quarter before the business cycle peak (t=-1), while the time-aggregated ratio shows a delay and begins decreasing significantly around (t=1). This suggests that the unadjusted ratio of the All-countries sample can predict recession 2, although not significantly, while the time-aggregated ratio cannot anticipate it.

In Sweden, the unadjusted price-dividend ratio seems to start declining approximately one quarter before the business cycle peak, at (t=-1), while the time-aggregated ratio starts declining immediately after the peak. Consistent with our findings for recession 1, we also observe a slight negative trend in the ratio for Sweden well in advance of the recession. These findings suggest that the Swedish unadjusted price-dividend ratio can predict recession 2, while the time-aggregated price-dividend ratio is unable to fully anticipate it due to the sharp decrease immediately after the peak. Comparing Sweden to the European sample, we again argue that Sweden seems to predict this recession more accurately than the average Northern/Western European country.

Recession 3. Next, we study the price-dividend ratio around recession 3. Figure 4 shows the cumulative log change in the price-dividend ratio around recession 3 for Belgium, France, Germany, Sweden, and the UK.


Stock Prices and Cash Flows in Recession Event Time, All Countries, Recession 3
Cumulative Log Change in P/D
0.5
0.0
-0.5
-1.0
-15
-10
-5
0
5
10
Quarters from Recession
Country
Belgium
France
Germany
Sweden
UK


TA Stock Prices and Cash Flows in Recession Event Time, Recession 3
Cumulative Log Change in Time Aggregated P/D
1.0
0.5
0.0
-0.5
-15
-10
-5
0
5
10
Quarters from Recession
Country
Belgium
France
Germany
Sweden
UK


Stock Prices and Cash Flows in Recession Event Time, Recession 3
Cumulative Log Change in P/D
0.0
-0.5
-1.0
-15
-10
-5
0
5
10
Quarters from Recession
Country
Average
Sweden

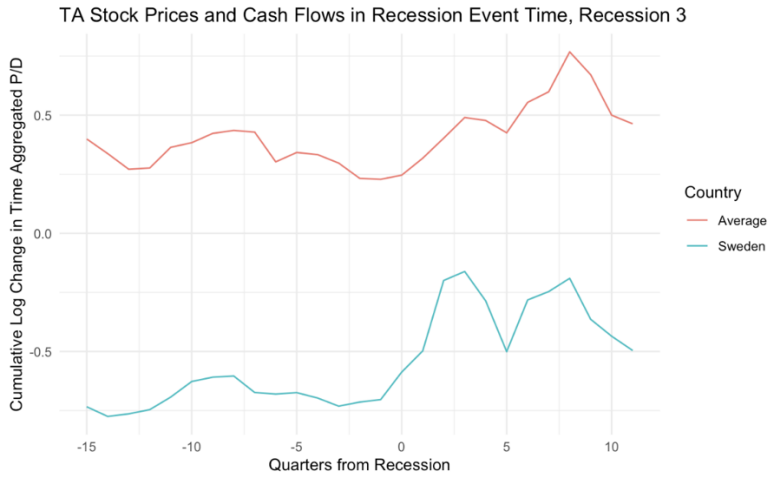


Fig. 4. The stock market in recession event time (All countries, 2016-2022, Recession 3)

Figure 4 does not show the significant drop in the price-dividend ratio at around (t=0), like what was shown in figure 2 and 3. Rather, it shows that there might have been a business cycle peak around six quarters after our assumed peak, at approximately (t=+6), reflecting Q3 2021. We find a small and insignificant decrease in the unadjusted price-dividend ratio immediately after the peak in Sweden, and a delayed slight drop in the All-countries unadjusted ratio. However, these drops were quickly recovered from, and the time-aggregated price-dividend ratios do not show any decrease during the Covid-19 crisis. Thus, we are unable to find that any of the countries could anticipate the crisis. More interestingly, the increase rather than decrease in the price-dividend ratio around the pandemic distinguishes this from other types of recessions. Our findings become even more interesting when looking at the sharp decline around (t=+6). We find that the price-dividend ratio drops sharply in all countries and remains at a low level at least until Q4 2022 where the time frame for our data ends. We also find that the price-dividend ratio seems to decline in the same quarter for all countries. This suggests that none of the observed stock markets could predict the Russia-Ukraine crisis in 2022 either.

Our main analysis of the price-dividend ratio in Northern/Western European countries around recession 1, 2, and 3 suggests that changes in the price-dividend ratio are different across different types of economic events. We find that during the 1990 and 2008 financial crises, investors were more risk-averse, leading to a potential decline in stock prices. During the Covid-19 pandemic, we find a reversed relationship between prices and dividends, implying that stock prices increase and that assets are potentially overvalued. The price-dividend ratio shows a decrease during the Russia-Ukraine war in 2022, consistent with financial crises. On the other hand, we find a difference in the predictive aspects of the stock market around the Russia-Ukraine crisis compared to the financial crises. We suggest that the 1990 and 2008 crises could be anticipated by the Northern/European stock markets, while the 2022 economic downturn could not be predicted. However, it is important to note that a decrease in the price-dividend ratio

does not necessarily imply that declining stock prices is the accurate conclusion. The observed decline in the relationship between prices and dividends could also be affected by increasing dividends increasing, or a combination of both decreasing stock prices and increasing dividends. As existing literature suggests, a decrease in the price-dividend ratio would most likely be the consequence of declines in stock prices. This is explored further through the recession variance ratio.

4. Recession variance ratios

4.1 Motivation

Stock returns consist of a price component and dividend, also referred to as a cash flow component. These two components respond differently to economic factors such as risk aversion, as suggested by Jurado et al. (2015). Jurado concludes that the variance in stock price changes can be influenced by risk aversion and similar factors, while the variance in dividend growth is not as affected. He also discovers, among other scholars (Nyberg 2012, Ludvigson 2015), that stock return variance increases during recessions.

To investigate the variance in stock price changes further and to apply these former findings and methodology on the data sample of Northern/Western Europe, the formula for variance in stock prices have been decomposed as seen in Equation 1.

$$\sigma^2_{p,t} = \sigma^2_{pd,t} + \sigma^2_{d,t} + 2\sigma_{d,pd}.$$

Eq. 1. The formula for computing variance in stock prices.

In simple terms, the variance of changes in asset prices can be expressed as the sum of the variance of dividend growth, the variance of changes in the price-dividend ratio, and twice the covariance term. Equation 1 illustrates that if uncertainty regarding dividend growth increases, it will impact both the variance in dividend growth and the overall variance of asset prices, assuming all other factors remain constant. Conversely, an increase in the volatility of changes in the price-dividend ratio will only affect the variance of stock price changes and not the variance of dividend growth. From a conceptual standpoint, the volatility of changes in the price-dividend ratio is associated with innovations in expected returns or long-term cash flow news. This relationship is fundamental in any asset pricing model, as it is grounded in an accounting identity.

Motivated by our interest in studying the changes in variance during recessions, we define the recession variance according to Equation 2.

$$recession\ variance\ ratio\,(x) = \frac{Var(x|recession)}{Var(x|pre{-}recession)}$$

Eq. 2. The definition of the recession variance ratio.

4.2 Empirical results

Table 1 shows the pre-recession variance, the recession variance, and the recession variance ratio of log changes in stock prices and dividends. The upper table shows the All-countries sample including all three recessions, and the lower table shows the three recessions for the Swedish sample.[13] 95% confidence intervals are based on a bootstrap resampling of the data in event time.

Variance Analysis Results for All Countries

Metric	F_Value	P_Value	CI_Lower	CI_Upper	Ratio_of_Variances	Pre_Recession_Variance	Recession_Variance	Variance_Ratio
Stock Price Changes	1.25040	0.3576	0.77550	2.00935	1.25037	0.02092	0.02248	1.07481
Dividend Changes	0.96863	0.8932	0.60076	1.55658	0.96863	0.02683	0.02613	0.97392

Variance Analysis Results for Sweden

Metric	F_Value	P_Value	CI_Lower	CI_Upper	Ratio_of_Variances	Pre_Recession_Variance	Recession_Variance	Variance_Ratio
Stock Price Changes	0.87357	0.4887	0.57283	1.28671	0.87357	0.01156	0.01485	1.28452
Dividend Changes	1.02320	0.9340	0.67097	1.50715	1.02323	0.01677	0.01678	1.00054

Table 1. Variances in stock price changes and dividend growth (All countries and Sweden, 1986-2022, All recessions)

For stock price changes in the All-countries sample, we receive an F-value of 1.25, and for dividend changes, we get 0.97. For Sweden, the F-value for stock price changes is 0.87 and for dividend changes we receive a value of 1.02. The F-value measures the ratio of the variance between the two periods (pre-recession and recession) to the variance within the periods. An F-value greater than 1 suggests a systematic variance, while an F-value below 1 suggests an unsystematic variance.

In the upper table, we find that the F-value of stock price changes might indicate some degree of systematic variance during recessions, although not a significant one. However, the F-value for dividend changes, which is below 1, suggests that the different recession phases, pre- and during recession, do not have a significantly different impact on the variance of dividend changes. The results indicate that the variance within each phase is greater than any variance that could be attributed to changing from a pre-recession to a recession phase. This variance is due to random, uncontrolled factors and cannot be explained by the factors being studied. However, the results are not statistically significant, which is apparent when testing for the P-value. In the sample containing All-countries, the P-value is 0.36 for stock price changes and

[13] The variance in stock prices changes and dividend growth are first calculated in Excel using the VAR.S formula and the log change in stock prices for the present and previous year before conducting the panel data study.

0.89 for dividend changes. Both these values are highly above the significance level of 0.05, indicating that the increase in variance for stock price changes during recessions is not statistically significant at the 95% confidence level.

In the lower table, the Sweden sample, the F-value for stock price changes is less than 1 which indicates that the variance within the pre-recession and recession periods is greater than the variance between these two periods. For dividend changes, the F-value is slightly above 1, instead suggesting there might be slightly more variance between the two periods than within them, indicating systematic variance. The Sweden sample does not show significant results either with a P-value of 0.49 for stock price changes and 0.93 for dividend changes.

The conclusion of the tests for P-values is that we cannot confidently say that the observed differences in variance are due to the economic phase rather than random chance for any of the two samples. The reason for the high P-values is difficult to determine but it could be due to the nature of the data, sample size, or the periods examined. This test is conducted on the three recessions as a whole and not on each one individually to see how the components behave during recessions generally. This means that the third recession, the Covid-19 crisis, that behaves differently than the previous two recessions, is affecting the results. This could be the reason for the insignificant results, thus a test considering only recession 1 and 2 could give more accurate results. Although the changes are not statistically significant, they may still offer insights into market behaviour during recessions.

When looking exclusively at the All-countries sample, it is visible that pre-recession, the variances were 0.02092 (2.092%) for stock price changes and 0.02683 (2.683%) for dividend changes. During the recession, these variances changed to 0.02248 (2.2248%) and 0.02613 (2.613%), respectively.

As shown in Fig. 6, we find that the recession variance ratio for stock price changes in the All-countries sample is 1.07, which indicates a slight increase in variance during the recession compared to the pre-recessionary period. The recession variance ratio for dividend changes in the All-countries sample is 0.97, suggesting an insignificant decrease in variance during the recession. For the Swedish sample, we receive a recession variance ratio of 1.28 for stock price changes, suggesting a moderate increase in variance during recessions compared to pre-recessionary periods. For dividend changes, the ratio is 1.00, which implies that dividends exhibit no change in variance around recessions. Our findings align with the concept that stock return variance tends to increase during recessions, albeit in this case, not significantly. However, our results are consistent with earlier literature in the sense that the variance of stock prices tends to increase more than the variance of dividends during recessionary periods.

Furthermore, our findings suggest a more nuanced picture. The slight increase in the recession variance ratio for stock prices suggests that recessions primarily affect short-term expectations, causing an increase in risk aversion among investors during recessions. As suggested by Jurado et al. (2015), there is a possibility that the increase in risk aversion leads to higher demands for the price of risk, thus leading to an increased volatility in stock prices. However, as mentioned before, the lack of statistical

significance means that we cannot confidently say the variance increased due to the recession. The relatively unchanged recession variance ratio for dividends implies that the dividends are less affected by recessions, supporting the notion that dividends are a more stable component of stock returns.

Given that our results show no significant change in the variance for both price and dividends, while previous research (Kroencke, 2022) finds that there is a significant change, this may be an area for further investigation. Due to our uncertain panel data results from studying the recession variance ratio around the three recessions, we also conduct visual results through an event study approach, where the three event windows are separated to show the changes in variance around each recession. Due to the previous assumption of the Covid-19 pandemic and recession 3 affecting the results in a misleading way, we have focused on recession 1 in order to analyse a proper financial crisis. The graphs for recession 2 and 3 can be found in the appendix.

Figure 5 shows the variance of dividend changes, unadjusted stock price changes, and time-aggregated stock price changes, i.e. changes in the TTM mean, around recession 1. We shift the x-variable so that (t=0) represents the business cycle peak presented earlier.

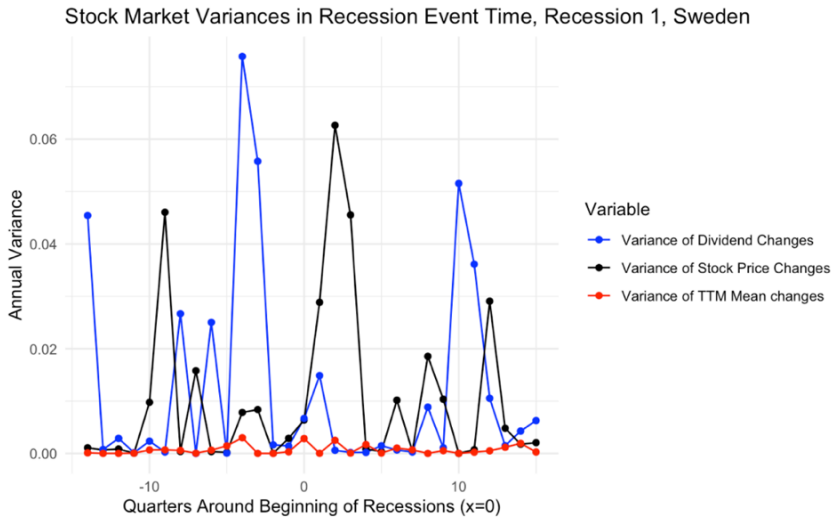


Fig. 5. Stock market variance in recession event time (Sweden, 1986-1994, Recession 1)

We find sharp peaks in the variance of stock price changes around the business cycle peak at (t=0). These peaks suggest high volatility in Swedish stock prices around the recession. The variance of dividend changes shows less pronounced peaks compared to stock price changes, which implies that dividends are generally more stable during the recession, although they show some volatility. The variance of time-aggregated stock price changes remains relatively low and stable throughout the period, suggesting that the mechanical lag in measurement timing between stock prices and dividends has a strong impact on the volatility around recessions.

The heightened sensitivity of stock prices during recession 1 could be attributed to investor reactions to immediate economic indicators, changes in uncertainty, or changes in perceived risk. These factors would more directly affect stock prices than dividends or time-aggregated stock prices. The relative stability in the variance of dividends implies that dividends are less sensitive to short-term market fluctuations. Moreover, relatively consistent time-aggregated stock price changes may suggest that underlying company fundamentals, as averaged over the previous year, do not shift as rapidly in response to economic downturns.

A similar study around recession 1 is shown in Figure 6, but now based on the All-countries sample, to explore how well the Swedish findings aligns with the sample.

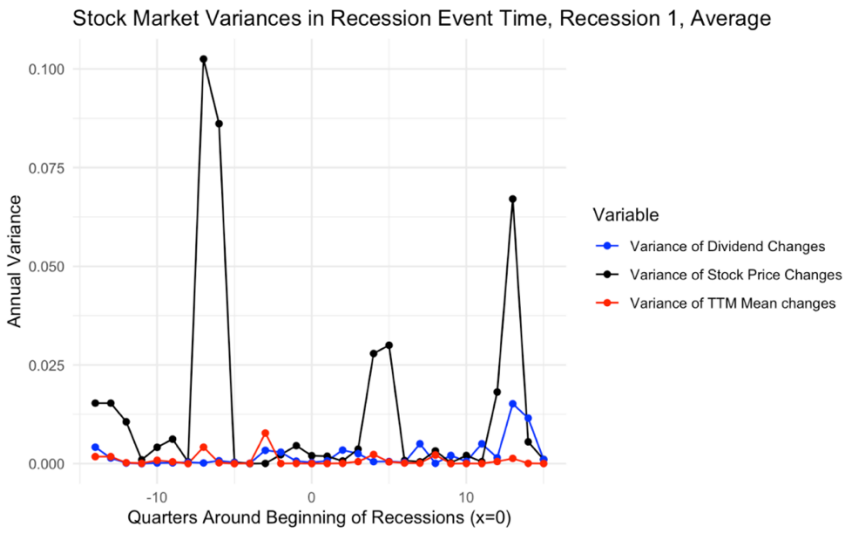


Fig. 6. Stock market variance in recession event time (All countries, 1986-1994, Recession 1)

We find that the variance of dividend changes remains low and relatively stable, suggesting that dividends are not as affected by the recession as stock prices. The variance of time-aggregated stock price changes is also low and shows minimal fluctuation. In contrast, unadjusted stock prices experienced substantial volatility, pointing to their instability in the face of economic downturns. Our findings suggest that during the early 1990s recession, Sweden experienced a heightened risk aversion, leading to higher demands for the price of risk. The findings for recession 1 support existing literature suggesting that risk aversion among investors during recessions contribute to higher volatility in stock prices than dividends.

Comparing our Swedish results to the All-countries sample, we find that the Swedish stock market exhibits even greater volatility in stock price changes and dividend changes during recessions than other Northern/Western European countries. Our findings imply that the optimal investment strategy during recessions would be to invest

in dividend shares, or high dividend-yield shares. Since stock prices are generally more volatile than dividends during recessions, risk-averse investors can mitigate the risk by opting for the stable cash flows generated by high dividend-paying stocks. This strategy is especially beneficial for the other countries in the sample but also holds for investors in the Swedish stock market.

5. Further empirical results

1. **Cumulative Log Change in Price-Dividend Ratio:**
    - Showed for all countries separately.
    - Average computed for countries, with Sweden presented separately due to its smaller stock market.
    - Panel data study conducted on the price-dividend ratio for statistical reference to event studies (in Appendix 1-6).
2. **Recession 1 (Early 1990s):**
    - All-countries unadjusted price-dividend ratio drops significantly immediately after the local business cycle peak.
    - Time-aggregated ratio shows a less significant drop starting approximately one quarter after the peak.
    - In Sweden, unadjusted ratio starts declining approximately one quarter before the business cycle peak, indicating better predictive power compared to the average Northern/Western European country.
3. **Recession 2 (Great Depression, 2004-2011):**
    - All-countries unadjusted ratio starts dropping approximately one quarter before the business cycle peak.
    - Time-aggregated ratio shows a delay, beginning to decrease significantly around one quarter after the peak.
    - In Sweden, unadjusted ratio starts declining one quarter before the peak, suggesting better predictive power than the average Northern/Western European country.
4. **Recession 3 (Covid-19, 2016-2022):**
    - No significant drop in the price-dividend ratio at (t=0).
    - Business cycle peak around six quarters after the assumed peak, reflecting Q3 2021.
    - Small and insignificant decrease in unadjusted ratio immediately after the peak in Sweden.
    - All-countries unadjusted ratio shows a delayed slight drop.
    - Time-aggregated ratios do not show any decrease during the Covid-19 crisis.
    - Increase in the price-dividend ratio around the pandemic, distinguishing it from other recessions.

- Sharp decline in the ratio observed around (t=+6) for all countries, suggesting none could predict the Russia-Ukraine crisis in 2022.

5. **Main Analysis Findings:**
   - Changes in the price-dividend ratio differ across different economic events.
   - During financial crises in 1990 and 2008, investors were more risk-averse, potentially leading to a decline in stock prices.
   - During the Covid-19 pandemic, a reversed relationship between prices and dividends is found, suggesting potential overvaluation.
   - Price-dividend ratio shows a decrease during the Russia-Ukraine war in 2022, consistent with financial crises.
   - Difference in predictive aspects of stock market around the Russia-Ukraine crisis compared to the financial crises.
   - Decline in the price-dividend ratio may imply declining stock prices, explored further through the recession variance ratio.

6. Implications for asset pricing theories

As discussed, we find that typical investor behaviour during financial crises differs from the behaviour observed during the Covid-19 crisis. Our study reveals that the pandemic did not depress the price-dividend ratio, implying that stocks may have been overvalued during the pandemic, only to drop sharply later. This contradicts typical stock market behaviour during recessions, where financial crises are shown to cause a decrease in the price-dividend ratio, and greater volatility in stock prices. Based on these findings, we discuss the implications for standard asset pricing theories (EMH, habits, rare disasters, long-run risk, herd behaviour). We suggest that conventional asset pricing theories struggle to explain our results. None of our suggested theories are alone able to capture the full implications of our results. However, we suggest that a combination of the rare disasters, long-run risk, and herd behaviour theories can support our findings to a large extent.

6.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) suggests that all available information is reflected in asset prices, and any new information is quickly and accurately incorporated. If the price-dividend ratio reacts more negatively to financial crises compared to pandemics, it may suggest that markets are not fully efficient in incorporating information during different types of economic shocks. Based on our real GDP analysis, we find that fundamentals seem to move similarly during financial crises and pandemics. Even though the Covid-19 crisis was a short-term economic downturn in relation to the 1990 and 2008 financial crises, the drop in real GDP was significant. Despite negative economic growth and low consumer spending patterns during the pandemic, investors were shown to be optimistic. As a result, the price-dividend ratio

increased until approximately one year after the beginning of the Covid-19 crisis, only to drop sharply later. This investor behaviour may not be considered rational and thus contradicts the EMH. In addition, we find that the time-aggregated price-dividend ratio tends to react to recessions with a delay compared to the unadjusted ratio. This suggests that there may be a mechanical lag between stock prices and dividends, implying that markets are not perfectly efficient during recessions. Our study's implications for the EMH would thus be that the theory does not hold during all different types of events.

6.2 Habits

The habit model (Campbell and Cochrane, 1999) suggests that investors have certain habits and derive utility from relative consumption levels. Campbell and Cochrane argue that asset prices are influenced by the desire to maintain a certain degree of consumption relative to a habit, suggesting that consumption is unpredictable. Normal recessions should not be dramatically different to financial crises in terms of variations in stock prices and dividends according to the habit model. Instead, the increase in uncertainty and risk aversion during different types of recessions should then cause investors to behave relative to their developed habit, which would most likely imply decreasing price-dividend ratios and increasing recession variance ratios across all types of negative economic events. However, the timing and magnitude of changes in the price-dividend ratio and increasing price volatility we observe during the pandemic appear to be different than in financial crises. As a result, we argue that the habit model cannot explain our findings either.

6.3 Rare disasters

Rare disaster models incorporate the possibility of rare and extreme events, such as financial crises or extreme economic events, and their impact on asset prices. Consistent with the habit model, (Wachter, 2013) argues that consumption has an unpredictable component that captures the impact of rare disasters. This implies that asset prices decline when investors perceive a higher probability of a rare disaster occurring due to increased risk-aversion, which can explain the variation in stock price changes around recessions. Thus, to some degree, the rare disasters theory supports our findings, at least regarding financial crises. However, the Covid-19 crisis may be a special case since the decrease in the price-dividend ratio became evident approximately 6 quarters after the beginning of the crisis. Consequently, investors may not have been as risk-averse during the pandemic although it could be classified as a rare disaster. Therefore, we suggest that the rare disasters theory does not to hold across all types of events.

6.4 Long-run risk

The long-run risk model (Bansal and Yaron, 2004) assumes that there is a process for consumption, which is divided into three components: Short-run risk, long-run risk, and time-varying volatility. Short-run risk represents temporary unpredictable fluctuations in consumption. Long-run risk includes persistent and slow-moving changes in consumption growth and has a lasting impact on consumption. The time-varying volatility component allows the model to capture the changes in uncertainty in the economy. Bansal and Yaron further suggest that dividend growth shares the long-run risk, i.e. the persistent component of consumption risk, making it somewhat predictable.

Consequently, the long-run risk theory supports our suggestion to invest in dividend shares during recessions. A combination of this theory and the rare disasters theory can explain why the price-dividend ratio tends to move drastically around recessions. However, we still lack support for our findings around the Covid-19 crisis.

6.5 Herd behaviour

Investors may engage in market timing based on their perceptions of economic cycles. Behavioural factors, such as herd behaviour or overreaction to recent events, could contribute to the rapid adjustment in the price-dividend ratio following a business cycle peak. For example, investors may anticipate and react positively to government and central bank interventions. The expectation that authorities will implement policies to support the economy and stock market can contribute to increased confidence and thus lead to higher asset prices. The herd behaviour theory implies that investors may imitate the actions of others, leading to trends and price movements that may not be completely rational, hence contradicting the EMH. During the pandemic, there were strong legislative responses to the economic uncertainty, enabling the economy to recover quickly despite spiking unemployment rates and low consumer spending (Barnes et al., 2021). If investors could anticipate the governmental supply, this may have contributed to overoptimistic investor behaviour during the pandemic, aligned with the herd behaviour theory. Thus, this asset pricing theory could possibly explain our findings. Drawing upon this theory, the overoptimistic behaviour during Covid-19 may have formed a market bubble, resulting in a subsequent crash because of Russia's invasion in Ukraine. The effects of the Russia-Ukraine situation on the stock market are yet to be explored due to the limitations in our data up to this point. Although it is out of the scope for this study, there is clearly room for further research around the cumulative consequences of the Covid-19 pandemic and the Russia-Ukraine war on the stock market.

7. Conclusion

We have studied stock market behaviour of five countries located in the Northern or Western European area around three recent recessions, including the Covid-19 and Russia-Ukraine crises, to fill a gap in literature. Our estimates reveal that the price-dividend ratio drops more significantly during financial crises than other crises, implying that investors might have unrealistic expectations of future dividend growth around financial crises. When comparing the early 1990s and the 2008 financial crises to the Covid-19 pandemic in Sweden, a key difference is the predictability. While the first two recessions were somewhat foreseeable, the third was not. Financial crises and other types of recessions, such as those caused by wars or pandemics, differ primarily in their origins and impacts. Financial crises often stem from internal market dynamics, whereas wars and pandemics are external shocks. Despite the sharp drop in real GDP during Covid-19, we find an increase in the price-dividend ratio around the onset. This suggests investor optimism despite the economic crisis, possibly explained by short-term policies and the herd behaviour theory. Through an analysis of the recession variance ratio, we find that the variance of stock price changes and dividend growth are not significant unlike previous research reveals. However, we find that the variance of stock price changes increases more than the variance of dividend growth during

recessions, strengthening our idea of investors' uncertainty of future dividend growth and risk aversion. These results indicate that stock prices are more volatile and reactive to immediate economic shocks while dividends seem to be more stable in troubled times. As a result, we suggest that the risk-averse investor should opt for high-dividend yield shares during recessions.

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Appendix

Recession 1, All Countries

	Period <chr>	ΔTA P/D <dbl>	ΔP/D <dbl>
Pre-Recession	-12	0.5294110	0.12724971
	-8	0.4964833	0.14887820
	-4	0.2969108	-0.12612242
	-2	0.2226569	-0.03511353
After Beginning of Recession	0	0.2988707	0.03104553
	1	0.3414629	0.04788165
	2	0.3551577	0.08487923
	4	0.4704338	0.09148739
	8	0.2909603	0.01077107
	12	0.4360722	0.06866543

Appendix 1: Cumulative log changes of the price-dividend ratio around beginning of recession (All countries, 1990-1994, Recession 1)

Recession 2, All Countries

	Period <chr>	ΔTA P/D <dbl>	ΔP/D <dbl>
Pre-Recession	-12	0.59775662	0.35670220
	-8	0.48299859	0.25587710
	-4	0.42472025	0.17413857
	-2	0.41708344	0.16953992
	0	0.45000580	0.08550257
After Beginning of Recession	1	0.38413729	-0.16970632
	2	0.25918694	-0.30300485
	4	-0.03295551	-0.51509234
	8	0.07571540	-0.15520894
	12	0.44704704	0.13246920

Appendix 2: Cumulative log changes of the price-dividend ratio around beginning of recession (All countries, 2004-2011, Recession 2)

Recession 3, All Countries

	Period <chr>	ΔTA P/D <dbl>	ΔP/D <dbl>
Pre-Recession	-12	0.4354314	0.09380853
	-8	0.3329268	-0.09951502
	-4	0.2460449	-0.10670574
	-2	0.4026422	-0.12356059
	0	0.4774480	0.13144123
After Beginning of Recession	1	0.4253560	0.16181875
	2	0.5542035	0.26624437
	4	0.7678128	0.39673840
	7	0.4633459	-0.09769721

Appendix 3: Cumulative log changes of the price-dividend ratio around beginning of recession (All countries, 2016-2022, Recession 3)

Recession 1, Sweden

	Period <chr>	ΔTA P/D <dbl>	ΔP/D <dbl>
Pre-Recession	-12	*NA*	-0.2150812
	-8	0.01923973	-0.2203016
	-4	-0.35225232	-0.4937946
	-2	-0.54113145	-0.6205463
	0	-0.36824388	-0.5759141
After Beginning of Recession	1	-0.51197304	-0.8468594
	2	-0.47490449	-0.7051322
	4	-0.61859268	-0.9161827
	8	-0.86312906	-1.2003648
	12	-0.50774419	-0.8067054

Appendix 4: Cumulative log changes of the price-dividend ratio around beginning of recession (Sweden, 1990-1994, Recession 1)

Recession 2, Sweden

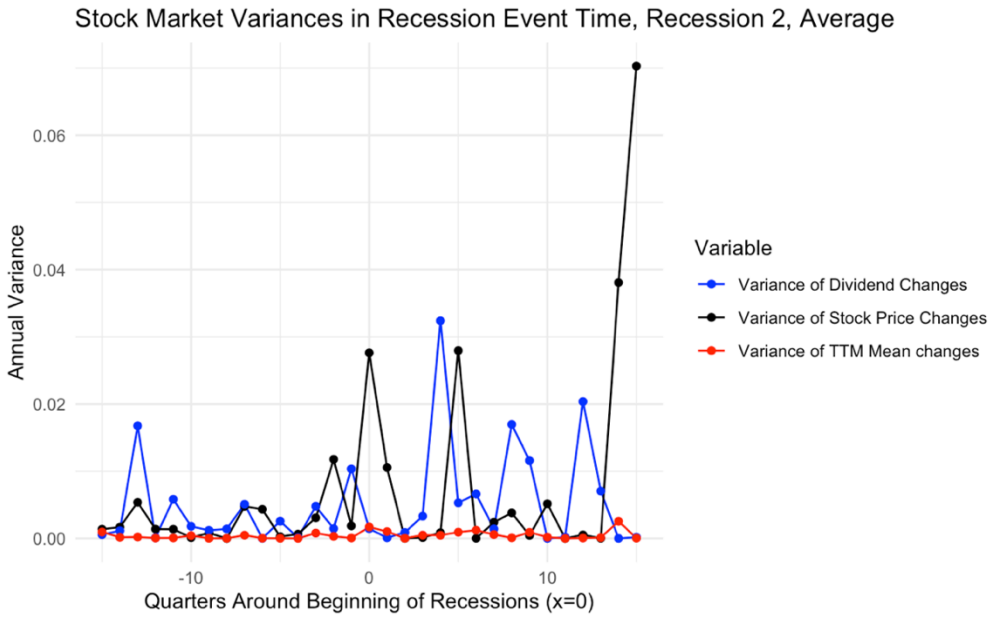
	Period <chr>	ΔTA P/D <dbl>	ΔP/D <dbl>
Pre-Recession	-12	-0.03288763	-0.1970627
	-8	-0.14492253	-0.2501725
	-4	-0.23478392	-0.3641168
	-2	-0.35284161	-0.4982890
	0	-0.22953741	-0.5507027
After Beginning of Recession	1	-0.43092310	-0.8081449
	2	-0.52932016	-0.9632350
	4	-0.76607204	-1.1710504
	8	-0.50506748	-0.5800549
	12	-0.37206166	-0.4937946

Appendix 5: Cumulative log changes of the price-dividend ratio around beginning of recession (Sweden, 2004-2011, Recession 2)

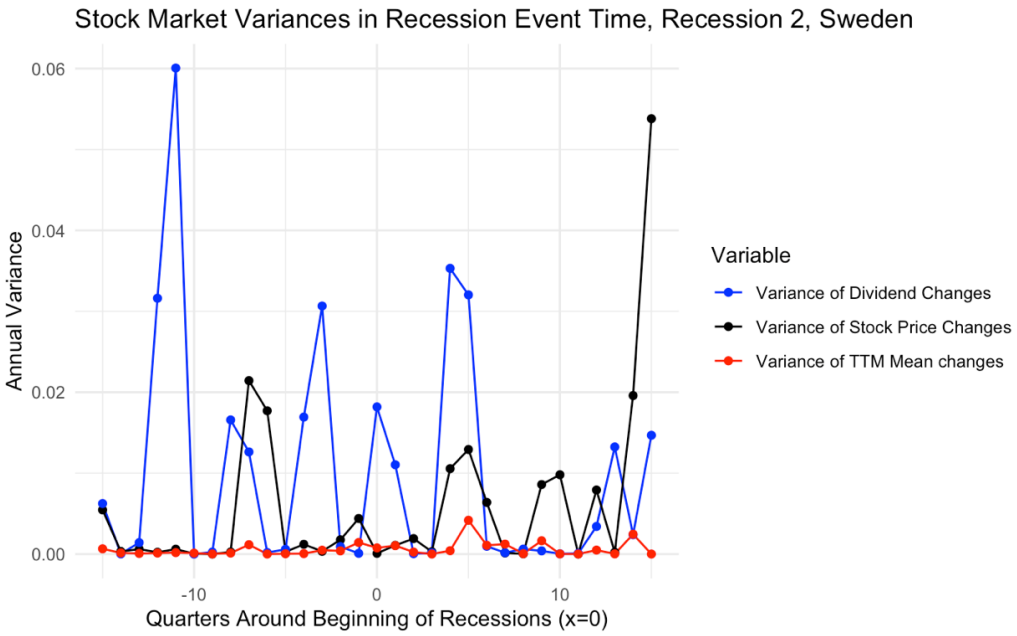
Recession 3, Sweden

	Period <chr>	ΔTA P/D <dbl>	ΔP/D <dbl>
Pre-Recession	-12	-0.6088381	-0.7948997
	-8	-0.6741877	-0.8405102
	-4	-0.7035162	-0.8780146
	-2	-0.4977060	-0.8309101
	0	-0.1614287	-0.2896142
After Beginning of Recession	1	-0.2859453	-0.4043232
	2	-0.5009306	-0.5675807
	4	-0.2465786	-0.4238360
	8	-0.4958769	-0.8749424

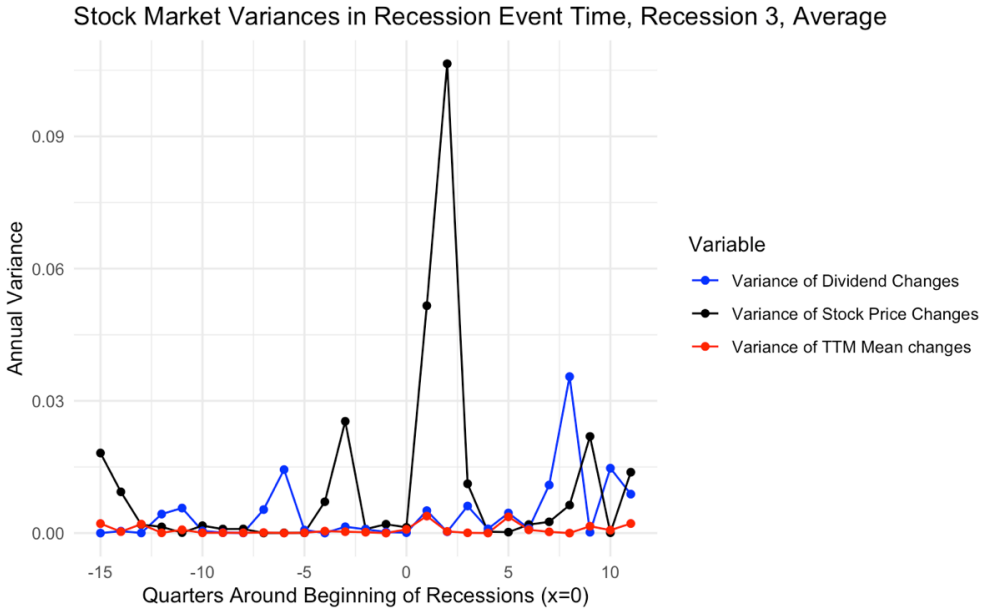
Appendix 6: Cumulative log changes of the price-dividend ratio around beginning of recession (Sweden, 2016-2022, Recession 3)



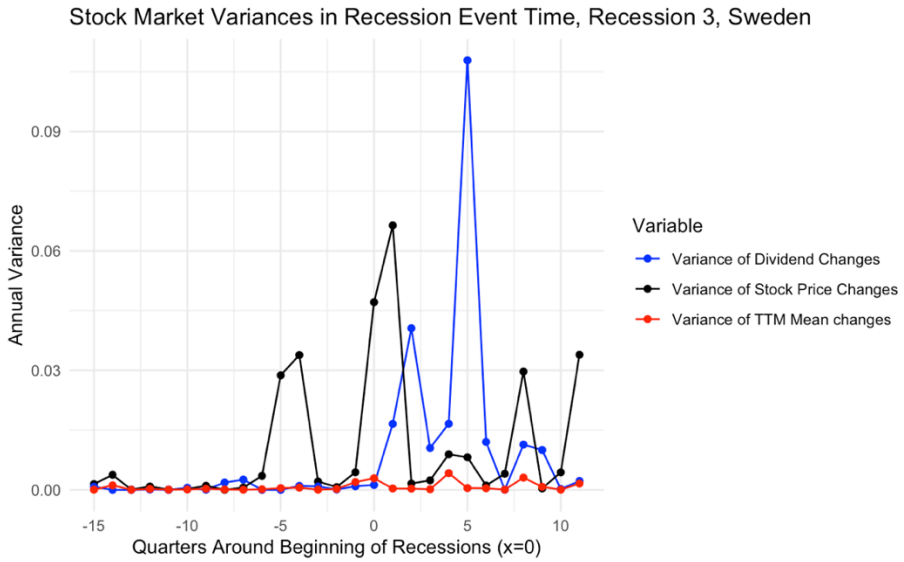
Appendix 7. Stock market variance in recession event time, (All countries, 2004-2011, Recession 2)



Appendix 8. Stock market variance in recession event time, (Sweden, 2004-2011, Recession 2)



Appendix 9. Stock market variance in recession event time, (All countries, 2016-2022, Recession 3)



Appendix 10. Stock market variance in recession event time (Sweden, 2016-2022, Recession 3).