Excess elasticity in the financial system?

A study of how macroeconomic variables affect stock prices

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A thesis presented for the degree of

Bachelor in Economics

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2019-04-08

Abstract

Asset prices have had larger and more rapid increases since 1980 when compared to the post-war period, especially compared to the Bretton Woods period. In this thesis we test whether the excess elasticity view provides a plausible explanation for this change. The excess elasticity view, put forth by Borio and Disyatat (2011) and Borio and White (2003), argues that the financial system has become more elastic because regulations on the financial system have been relaxed and the creation of credit has become less constrained. We test the theory by analyzing whether the effect of macroeconomic variables on stock prices have increased after the financial system became more liberalized, which we identify to have occurred after the Bretton Woods system was abandoned 1971 and then post 1980 when the financial liberalization process accelerated. Three hypotheses connected to the excess elasticity view are tested in a series of regressions, using a quarterly panel containing 16 OECD countries and eight macroeconomic variables, during the time period 1960-2017. Our results show that there exist breakpoints in the effect of macroeconomic variables during the sample period, implicating that some fundamental aspects of the economy have changed. However, they do not indicate support for the excess elasticity view; rather the regulated financial environment of the Bretton Woods period seems to have amplified the effect of macroeconomic variables on stock prices.

Keywords: Stock prices, Macroeconomic variables, Excess elasticity, Bretton Woods, Financial liberalization

Contents

1. Introduction

There have been relatively large and rapid increases in asset prices since 1980 when compared to the post-war period, especially compared to the Bretton Woods period (1945-1971) (Bordo and Wheelock, 2007). For a set of developed countries[1], the trough to peak amplitude in percent has more than doubled for stock prices after 1985 compared to 1960-1984, while the lengths of the cycles have remained unchanged (Drehmann et al., 2012, p. 10). Two of the most prominent examples of these build-up phases are the second half of the 1990s and the considerable price increases in the stock and housing markets during the early 2000s.

There are several explanations for what made these large build-up phases possible. In this thesis we test the excess elasticity view, in which it is posited that the financial system has become more elastic (Borio and Disyatat, 2011; Borio and White, 2003). The elasticity of the financial system corresponds to "the degree to which the monetary and financial regimes constrain the credit creation process, and the availability of external funding more generally" (Borio and Disyatat, 2011, p. 24). An inelastic financial system is characterized primarily by heavy regulations on transferring financial means between countries and constrained domestic creation of credit. In such a system, it is more difficult for a prolonged boom cycle in asset prices to take place as there are strong endogenous anchors reining in and restricting the process (Borio, 2014; Borio and Disyatat, 2011; Borio and White, 2003). Fewer constraints entail a more elastic financial system, which can help create more credit which in turn inflates asset prices. This excess credit, or excess of financial means at large, is created endogenously in the financial system, often disregarding real economic underlying values. In other words, "the financial system does not just allocate, but also generates, purchasing power, and has very much a life of its own" (Borio, 2014, p. 183).

The excess elasticity view is not the only possible explanation. A prominent example of a competing explanation is the excess savings view (also known as the global savings glut hypothesis), concerning global current account imbalances (Bernanke et al., 2011; Council of Economic Advisers, 2009; Dunaway, 2009; Portes, 2009). In short, the excess savings view holds that global financial imbalances occurred when the ratio of savings over investments in emerging markets increased at the same time as it decreased in advanced economies during

[1] Australia, Germany, Japan, Norway, Sweden, the United Kingdom and the United States.

the late 1990s and early 2000s. Interest rates in advanced economies fell because of the influx of the excess savings from emerging markets, creating a credit boom and inflated asset prices (for a comprehensive overview, see Borio and Disyatat, 2011). However, several observed facts contradict the excess savings view. The link between long-term interest rates and the current account in the US seems weak, and despite the supposed appeal of US assets, the US dollar depreciated leading up to the financial crisis of 2007-2008 (Borio and Disyatat, 2011, pp. 4-5).

The financial liberalization that took place in mature economies in the 1980s reduced the amount of constraints in the financial system and the elasticity should therefore have increased. Examples of these reduced constraints are increased capital mobility (Reinhart and Rogoff, 2009) and a relaxation of borrowing constraints (Ranciere et al., 2006). The liberalization of the financial systems coincides with the increase in the length and intensity of what has been described as the financial cycle, which is defined as the combination of the amount of credit and house prices in the economy, but excludes stock prices (Borio, 2014; Drehmann et al., 2012). However, changes in stock prices should also be affected by the availability of financial means and credit in the economy (Borio and Disyatat, 2011; Bordo et al., 2001). In earlier research, stock prices have been found to react to changes in macroeconomic variables such as industrial production and inflation (Chen, Roll and Ross, 1986), as well as oil price (Cheung and Ng, 1998). If investors react to changes in macroeconomic variables, the effect of changes in these variables should be larger in a more elastic system, because there will be more available financial means which can facilitate price increases. Similarly, after the Bretton Woods system was abandoned in the early 1970s, capital mobility started to increase (Reinhart and Rogoff, 2009) and the financial liberalization process began (Bordo et al., 2001, p. 159; Borio and White, 2003, p. 7; DICE, 2010). The financial system should therefore have become more elastic and the effect of macroeconomic variables on stock prices should have increased.

In this thesis, three hypotheses, of which two connected directly to the excess elasticity view, are developed and tested using regression analysis. Five econometric models are used to test whether, and how, the effect of macroeconomic variables on stock prices has changed. A quarterly panel of 16 OECD countries and eight macroeconomic variables during the time period 1960-2017 is utilized. The macroeconomic variables included in the study are the Consumer Price Index, the exchange rate, Gross domestic product, industrial production, money supply, oil price, unemployment rate and the short-term interest rate. A control variable for periods of crisis was also included in the form of a dummy variable that checks for stock market crashes. Our results indicate the existence of breakpoints in how macroeconomic variables affect stock prices, with different effects during different time periods. However, no support could be found for the hypotheses stating that the effect should have increased after the Bretton Woods system was abandoned and after 1980. Other factors seem to affect when the effect of macroeconomic variables on stock prices change. Therefore, our results do not give support for the excess elasticity view.

The rest of the thesis is organized as follows. In section 2, three hypotheses are developed. Section 3 introduces the method used in the econometric analysis. Section 4 presents the countries and variables included in the regression model. Section 5 presents and discusses the results of the regression analysis. And lastly, concluding remarks are presented in section 6.

2. Hypotheses

While the bretton woods system was in effect, banking crises were almost nonexistent (Reinhart and Rogoff, 2009) and financial markets enjoyed a period of relative stability (Eichengreen, 1993). Since the abandonment of the Bretton Woods system, the number of banking crises has increased (Reinhart and Rogoff, 2009, p. 622), but for asset prices the incidence of crashes does not seem to have increased by a large amount (Reinhart et al., 2016). However, the duration of the build-up phases, trough to peak amplitude and the severity of the subsequent crashes have grown in magnitude for seven developed countries, which can be described as "larger medium-term fluctuations" (Borio and White, 2003, p. 5). This mostly applies to house prices, where both the duration and amplitude of the expansion phase has become larger after 1985; for stock prices however, only the trough to peak amplitude has increased, but by a considerable amount (Drehmann et al., 2012, p. 10). Consequently, the length of a cycle in stock prices is almost unchanged. The fundamental difference after 1985 lies in the increased quarterly growth rate in the build-up phase (Drehmann et al., 2012, p. 30) that generates higher peaks. According to the excess elasticity view this increase is expected in the more unregulated financial system after 1980, because of weak endogenous anchors that will have a higher probability in failing to restrain asset price booms.

There are numerous studies on the connection between changes in different macroeconomic variables and stock prices. Previous papers have studied different sets of countries and macroeconomic variables, during different time periods. Chen et al. (1986) find that inflation, industrial production, changes in the yield curve and the risk premium affect stock prices in the US. The oil price has been found to be significant in predicting stock returns in Canada, Germany, Italy, Japan, and the US (Cheung and Ng, 1998). In New Zealand, stock prices have been shown to be determined by the interest rate, money supply and Gross domestic product (Gan, Lee, Yong and Zhang, 2006). Pan (2018) observes a relationship between unemployment rate and stock prices in developed and developing countries. Jesús and Abderrahim (2017) and Boyd et al. (2005) also find similar results. Abbas et al. (2018) observe a relation between stock market volatility and macroeconomic fundamentals for G-7 countries and Erdem, Arslan and Erdem (2005) note a volatility spill over to stock prices from inflation, the interest rate, the exchange rate, money supply and industrial production.

Fayyad and Daly (2011) find different effects in UK compared to studies using US data for the oil price, suggesting the possibility of different relationships in the two continents. Furthermore, the size of the effects of the macroeconomic variables differed between most of the mentioned studies, which suggests that the effect of macroeconomic variables on stock prices is not homogeneous between countries.

Based on the literature, eight commonly used macroeconomic variables are included in the econometric analysis (see Section 3 and 4).

2.1 Changes in the effect of macroeconomic variables on stock prices

The effects of macroeconomic variables seem to differ between countries, as demonstrated above, and therefore it would also be expected for the effect to change over time. Indeed. several papers have found that the explanatory power of macroeconomic variables changes between different time periods (Campbell and Ammer, 1993; Chordia and Shivakumar, 2002; Tai, 2000; Flannery, Hameed and H. Harjes, 1997). Campbell and Ammer (1993) show an increase in explanatory power for interest rates in later sub-periods (1972-1987 vs 1952-1972) in the US. Tai (2000) finds time-variance in the estimation of the interest rate and the exchange rate while Flannery et al. (1997) find it in interest rate and market risk premia. Lee (2007) determined the existence of a breakpoint in the effect of inflation on stock prices for the UK sometime between 1969 and 1971. Before the breakpoint there is a significant negative relationship between stock prices and inflation; however, this effect becomes insignificant after the breakpoint. A similar study found that the negative effect of inflation on stock prices is larger during periods when the central bank tries to control the interest rate (1961-1979 in US, 1961-1983 for Canada, and 1957-1983 for the U.K. and Germany) (Kaul, 1990). The effect of industrial production on stock prices has also been shown to change between different time periods (see table II in Schwert, 1990).

Based on this research our first hypothesis is as follows:

H1. *The effect of macroeconomic variables on stock prices has changed during the period 1960-2017.*

Note that hypothesis one says nothing about the direction of the change or how it should have changed in different time periods, only that it has changed.

2.2 The Bretton Woods system

The Bretton Woods system was an international agreement among the US, Canada, the Western European countries, Australia and Japan that was in effect 1945-1971. After the experience with floating exchange rates and competitive devaluations during the 1930s, the participating countries sought to mandate their financial and commercial relations via rules and institutions. The most characterizing factor of the Bretton Woods system was the semi-fixed exchange rate regime which was monitored by the International Monetary Fund (IMF) and guaranteed by the convertibility of the US dollar into gold. The Bretton Woods system saw the most rapid growth of any modern exchange rate regime and the variability in output was also low compared to later regimes (Eichengreen, 1993). The same applied to other variables such as the interest rates and unemployment rates, indicating a very stable macroeconomic performance. Financial markets in developed countries during this period were highly regulated and capital mobility was relatively constrained. In fact, in many of the countries participating in the Bretton Woods system "international asset trade was encouraged only to the extent that it was needed to finance international goods trade" (Giovannini, 1993, p. 129). This implies an inelastic international economic system with strong anchors in place that could restrain financial instability and asset price booms. Indicative of this, there were almost no banking crises (Reinhart and Rogoff, 2009) and stock market boom phases were not as pronounced as during the time period after 1980.

The Bretton Woods system collapsed in 1971 when the US suspended the convertibility of US dollars into gold, after the pressure on the US gold reserves became too high. After this event (during the 1970s) capital mobility, which increased slightly towards the end of the Bretton Woods system, accelerated in its ascent (Reinhart and Rogoff, 2009) and the process of financial liberalization in developed countries began (Bordo et al., 2001, p. 159; Borio and White, 2003, p. 7; DICE, 2010). Also, when exchange rates started to become more flexible macroeconomic stability Thus, the economic system should have become more elastic and "more responsive to macroeconomic disturbances" (Bordo et al., 2001, p. 159), and the anchors in the economy should have weakened, facilitating larger trough to peak amplitudes of asset prices. Investors react to changes in macroeconomic variables, and the effect of changes in these variables should have increased if the financial system became more elastic.

The second hypothesis is therefore:

H2. *The effect of macro-variables on stock prices increased after the Bretton Woods system was abandoned in 1971.*

2.3 Financial liberalization

In the literature, the development of the financial system is often described as something mostly beneficial for the economy (Levine, 2005; Wachtel, 2003). It is asserted that a more developed and deregulated financial system in combination with more liberal capital mobility will lubricate the economy and harbor further effectiveness (Marston, 1993). Funds will be better distributed to the most promising firms and projects, because of the production of more reliable evaluation of creditworthiness by financial firms, and the risk of lending will be ameliorated (Levine, 2005). There are, however, tradeoffs, e.g. increased incidence of financial instability and crises (Ranciere et al., 2006) and the risk of inhibiting growth if the financial system attracts an excessive proportion of the skilled labor force, that would otherwise work in other, more productive, sectors of the economy (Philippon, 2010). The theory of excessive elasticity complements the view that developments in the financial sector come with tradeoffs.

Financial liberalization entails the removal of the state's control over the financial markets, i.e. deregulation. This removal of restrictions on the financial markets is most accurately described as a process where not all categories are liberalized at the same time, although there is a significant correlation between different categories (Abiad et al., 2010; DICE, 2010). The different reform dimensions can be divided into: credit controls and excessively high reserve requirements, interest rate controls, entry barriers, state ownership in the banking sector, capital account restrictions, securities market reforms, prudential regulations and supervision of the banking sector (DICE, 2010). All countries were not financially liberalized at the same time or at the same speed, but there is a clear increase in the trend of financial liberalization in advanced economies starting ca 1980 (Abiad et al., 2010, p. 27; Borio and White, 2003, p. 7). The index of capital mobility constructed by Reinhart and Rogoff (2009) also illustrates this tendency: capital mobility, which was comparably low under the Bretton Woods system, started to increase in the 1970s and began growing at an accelerated rate after 1980.

With financial liberalization came new financial innovations (e.g. securitization of assets, interest rate swaps, computerized high frequency trading) and a more extensive use of older innovations (e.g. different derivatives). This development lead to more liquidity in the markets and faster price reactions, but at the same time more risk taking. Especially the increase in use, and the development of new, derivatives introduced new forms of risk (Borio and White, 2003, p. 9). As Ranciere et al. (2006, p. 3332) puts it, financial "liberalization induces excessive risk-taking, increases macroeconomic volatility and leads to more frequent crises". At the same time, they argue that the benefit gained from the increase in GDP growth caused by financial liberalization far outweighs the increased incidence of financial crises.

Financial liberalization should thus have decreased the amount, and the strength, of the constraints in the economy. The endogenous anchors that serve to hold back the boom phase should have been weakened. This implies a more elastic system which, together with the increase in risk taking and the use of derivatives, can facilitate larger trough to peak amplitudes in stock prices.

Our third hypothesis is as follows:

H3. *The effect of macroeconomic variables on stock prices increased after the financial liberalization began in earnest, at the start of the 1980s.*

3. Methodology

The three hypotheses were tested using a quarterly unbalanced panel with 16 OECD countries (presented in section 4) during the period 1960-2017. Ordinary least squares (OLS) regression analysis was employed and the changes in effect of the macroeconomic variables were measured using interactive dummy variables for each variable and period. We estimated one model for the whole period without interactive dummy variables and then four models adapted to the three hypotheses.

The dependent variable in the regression models were stock prices (SP) and a set of eight macroeconomic variables were used as explanatory variables. Further, it is important to control for periods of crisis (Abbas et al., 2018) and therefore a dummy variable that checks for the effects of stock market crashes (SMC) was also included. Values for all variables are quarterly (compare Cheung and Ng, 1998; Nasseh and Strauss, 2000). The explanatory variables included were: the Consumer Price Index (CPI), the exchange rate (ER), Gross domestic product (GDP), industrial production (IP), money supply (MS), oil price (OP), unemployment rate (UN) and the short-term interest rate (IR). In the regression models, the first differences of IR and UN were used while the first difference of the natural logarithm of the values were used for all other variables, including SP (compare Abbas et al., 2018). IR and UN are in percentage form, which means that it is not optimal to log-transform these series. The first differences were calculated on a yearly basis (e.g $\Delta(IR) = IR_t - IR_{t-4}$, where t represents quarter) to ensure less noise in the regression results, compared to first differences on a quarterly basis. The reason for the first difference transformation is to make all time series stationary (Nasseh and Strauss, 2000), while taking the natural logarithm of a time series removes any exponential trend (Dougherty, 2011). Another benefit of using the diff-log transformation, $\Delta ln(Variable)$, is that the regression coefficients can be interpreted as the elasticity of that variable on SP (see below).

One important advantage of using panel data is the possibility to control for individual-specific and time-specific effects using an error component model, instead of pooled OLS (compare Andersson, 2018). Fixed time-specific effects were included to control for global effects during individual quarters, e.g. the global business cycle, that can affect several variables in all countries simultaneously. Fixed country-specific effects were also included to check for constant factors in individual countries, e.g. a certain culture when it comes to investing, institutional frameworks etc.[1] The effect of the macroeconomic variables were tested by lagging them one quarter (compare Cheung and Ng, 1998).

Consequently, the employed regression model for the whole period, without interactive dummy variables, is defined as:

$$SP_{i,t} = \alpha + \beta MV_{i,t-1} + \theta SMC_{i,t-1} + C_i + T_t + \varepsilon_{i,t} \tag{3.1}$$

where $SP_{i,t}$ is the first difference of logged stock prices for country i at quarter t and α is a constant. β is an 8 length vector containing the regression coefficients for all macroeconomic variables. $MV_{i,t-1}$ is a 8x1 column matrix with all explanatory macroeconomic variables (first difference or first difference of logged values) for country i at quarter $t-1$. $SMC_{i,t-1}$ is a dummy variable equal to one if the country at quarter $t-1$ is experiencing a stock market crash, otherwise it is zero. θ is the effect of a stock market crash on stock prices. C_i is the country-specific effect, T_t is the quarter-specific effect and $\varepsilon_{i,t}$ is the error term.

For the macroeconomic variables that were transformed by taking the first difference of the logged values, each individual β is the average elasticity of that variable. They answer the question: for a one percent increase in the explanatory variable, keeping all other variables constant, approximately how many percent will SP increase/decrease?[2] For IR and UN, the individual $\beta \cdot 100$ is interpreted differently: they tell us, keeping all other variables constant, approximately how many percent SP will increase/decrease when that variable increases by one percentage point.

In our other models interactive dummy-variables were used to measure deviations in the effect of the macroeconomic variables from the base group (the Bretton Woods period 1960-1971 for H1 and H2 or 1960-1979/1971-1979 for H3) (compare Kaul, 1990). To test if the effect had changed at all during the sample period (H1) interactive decade dummy variables for all decades (D_d) were used. For H2 and H3 an interactive dummy variable for the post Bretton Woods period and post 1980 were used respectively.[3][4]

[1] Also, the Hausman test was first performed to decide whether fixed or random effects would be used in the model.

[2] This definition of elasticity is not to be confused with the elasticity of the financial and monetary system as described by Borio and Disyatat (2011) and Borio and White (2003).

[3] When the Bretton Woods period is the base group, the base group extends until Q3 1971 to include all quarters in the sample under the Bretton Woods system. Therefore, the 1970s decade dummy covers the quarters Q4 1971 - Q4 1979. The last decade dummy, for the 2010s, covers observations between Q1 2010 and Q4 2017. Similarly, the post Bretton Woods dummy begins in Q4 1971.

[4] The decade dummy variables are equal to 1 if the quarter corresponds to that decade, otherwise they are equal

Thus, the model with interactive decade dummy variables is defined as follows:

$$SP_{i,t} = \alpha + \beta_0 MV_{i,t-1} + \sum_{d=1}^{5} \beta_d D_d MV_{i,t-1} + \theta SMC_{i,t-1} + C_i + T_t + \varepsilon_{i,t} \tag{3.2}$$

where all recurring variables from equation 3.1 are defined in the same way. β_0 is an 8 length vector containing the regression coefficients for all macroeconomic variables, during the base period (the Bretton Woods period). $MV_{i,t-1}$ is defined the same way as in equation 3.1 as an 8x1 column matrix. β_d is an 8 length vector containing the β coefficients for all macroeconomic variables during a specific decade, i.e. a specific value of d. They represent the extra effect of each macroeconomic variable in decade d. D_d is an 8x8 diagonal matrix containing the decade dummy variables for a specific time period, indicated by the subscript d, in the diagonal. From the sum term, the end result is the matrix multiplication $\beta_d D_d MV_{i,t-1}$ summed over all decades d.

The model with the post Bretton Woods dummy variable is defined as:

$$SP_{i,t} = \alpha + \beta_0 MV_{i,t-1} + \beta_d D_{PBW} MV_{i,t-1} + \theta SMC_{i,t-1} + C_i + T_t + \varepsilon_{i,t} \tag{3.3}$$

and the model with the post 1980 dummy variable is defined as:

$$SP_{i,t} = \alpha + \beta_0 MV_{i,t-1} + \beta_d D_{P80} MV_{i,t-1} + \theta SMC_{i,t-1} + C_i + T_t + \varepsilon_{i,t} \tag{3.4}$$

with the only difference being that equation 3.3 has D_{PBW} and equation 3.4 has D_{P80}. D_{PBW} and D_{P80} are 8x8 diagonal matrices with the post Bretton Woods dummy variable and the post 1980 dummy variable, respectively, in the diagonal.

For equations 3.2, 3.3 and 3.4 the macroeconomic variables that were transformed by taking the first difference of the logged values, each individual β_0 is the average elasticity of that variable in the base period. For IR and UN, the individual $\beta_0 \cdot 100$ is interpreted the same way as in the model for the whole period, except that it is now in the base period.

For all other periods/decades, the effect of an individual macroeconomic variable during that period/decade is obtained by taking the partial derivative of $SP_{i,t}$ with respect to $MV_{i,t-1}$.

to zero. The post Bretton Woods dummy variable is equal to 1 during all quarters after the Bretton Woods period and the post 1980 dummy variable is equal to 1 during all quarters after 1980, otherwise they are equal to zero.

This is exemplified by equation 3.2, the model with decade dummy variables:

$$\frac{\delta SP_{i,t}}{\delta MV_{i,t-1}} = \beta_0 + \beta_d D_d$$

The marginal effect of an individual macroeconomic variable in decade d is thus the combination of the effect in the base period (β_0) and the extra effect of that decade (β_d). In the other models, the marginal effect is given by $\beta_0 + \beta_d D_{PBW}$ and $\beta_0 + \beta_d D_{P80}$ and the base period is different for equation 3.4. Note that D_d for that decade, as well as D_{PBW} and D_{P80} in their respective models, will be equal to one.

Hypothesis 1 is rejected if the extra effect of of the macroeconomic variables (β_d) do not differ from zero, or from each other, in a statistically significant way. If hypothesis 1 is not rejected, hypothesis 2 and 3 are considered. Hypothesis 2 is rejected if the effect of the macroeconomic variables does not increase after the abandonment of the Bretton Woods system. Hypothesis 3 is rejected if the effect does not increase after 1980.

To remedy potential deviations from the assumptions in OLS-regressions using panel data, relevant tests were performed and consequently, possible measures were taken where needed. To check for non-stationarity in the data, tests for unit root were performed on stock prices and all macroeconomic variables. All tested variables (logged values of all variables except IR and UN) were found to be stationary after taking the first difference. By using the lagged values for all explanatory variables, possible endogeneity between them and the dependent variable (also known as simultaneity) is countered (Steinberg and Malhotra, 2014; Baccini and Urpelainen, 2014). The inclusion of fixed time-specific and fixed country-specific effects counteracts the endogeneity between the explanatory variables and the error term, related to specific countries and time periods (Wachtel, 2003, p. 345). Tests for autocorrelation and heteroscedasticity were performed, and they showed that all regressions suffer from both problems. Fixed period and cross-section specific effects ameliorate the heteroscedasticity problems as the estimated dummy variables erases parts of the trends in the error term. Regarding cross-sectional dependence, the fixed time-specific effects partly corrects this problem. However, we were unable to use White's cross-sectional standard errors because our sample included insufficient amounts of cross-sections in relation to the number of time periods. The models might also be too over specified to be able to use White's cross-sectional standard errors. Concerning White's diagonal standard errors, we were not able to fully justify using them as the fulfillment of the assumptions required to use them are particularly specific (Eviews, 2017). Therefore a conservative approach was applied with the aim of not overstating what the model shows: the regression results with White's diagonal standard errors were compared to the results with ordinary standard errors, and the model with the least amount of significance was used. In all cases ordinary standard errors gave the least amount of significance, although the differences were modest, and was therefore used in all regressions.

4. Data

The panel used for the regression analysis was created by collecting quarterly data on stock prices, the 8 macroeconomic variables and the stock market crash dummy variable for 16 OECD countries during 1960-2017. Some data sets were monthly, and only yearly data was available for stock market crashes; they were therefore converted to quarterly data.[1] Data availability was the deciding factor for the choice of which OECD countries to include in the sample. All countries included, except Japan and Australia, are European or North American countries, as can be seen in table 4.1. However, the length of the data series differed for countries as well as variables (see table 4.1). For example, data on GDP was available from ca 1960 for all countries, whereas the lengths of the data series on the unemployment rate were more heterogeneous between countries. Data for Japan and Canada were available from 1950 to 1960 on most variables while it was more difficult to find data for Spain and Greece. Therefore, an unbalanced panel was used.

Using an unbalanced panel could potentially lead to problems when estimating our models because the missing values are not random. Skewed or biased parameter estimates are possible consequences (Wooldridge, 2008, p. 491). However, as has been done in other similar studies (see for example Ludwig and Slok, 2004) the decision was made to use an unbalanced panel, rather than dropping a large amount of the countries, so that all available data could be used. The models were also estimated with a balanced panel (containing only the countries that have data for the whole sample period) to check if the estimates were robust (compare Warzynski, 2003). The same patterns were found in the balanced panel estimates as in the unbalanced

[1] For the stock market crash dummy variable, if a country was coded "1" during a year, all quarters that year was coded "1". There were only data until 2015 so 2016 and 2017 were coded as "0", because no stock market crash took place in the countries in the sample during these two years. The monthly time series were converted by taking the mean of the months included in that quarter.

Table 4.1: Countries and variables, as well as the periods in which countries have data for each variable.

	SP	CPI	ER	GDP	IP	MS	OP	UN	IR	SMC
Australia	60-17	60-17	60-17	60-17	74-17	60-17	60-17	66-17	76-17	60-17
Canada	60-17	60-17	60-17	61-17	61-17	60-17	60-17	60-17	60-17	60-17
Denmark	70-17	67-17	60-17	60-17	74-17	70-17	60-17	70-17	60-17	60-17
Finland	60-17	60-17	60-17	60-17	60-17	80-17	60-17	60-17	60-17	60-17
France	60-17	60-17	60-17	60-17	60-17	60-17	60-17	75-17	60-17	60-17
Germany	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17
Greece	85-17	60-17	60-17	60-17	61-17	60-17	60-17	98-17	80-17	60-17
Ireland	60-17	60-17	60-17	60-17	75-17	75-17	60-17	60-17	84-17	60-17
Italy	60-17	60-17	60-17	60-17	60-17	62-17	60-17	79-17	78-17	60-17
Japan	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17
Netherlands	60-17	60-17	60-17	60-17	60-17	60-17	60-17	70-17	75-17	60-17
Spain	70-17	60-17	60-17	60-17	65-17	62-17	60-17	86-17	73-17	60-17
Sweden	60-17	60-17	60-17	60-17	60-17	98-17	60-17	70-17	60-17	60-17
Switzerland	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17
United Kingdom	60-17	60-17	60-17	60-17	60-17	71-17	60-17	71-17	60-17	60-17
United States	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17	60-17

panel, although the size of the coefficient estimates in some cases differed significantly (see section 5.1).

Data on all macroeconomic variables as well as data on stock prices came primarily from the OECD statistics database and the online Thomson Reuters DataStream, while missing data series (e.g. IR for Finland and France) were from The Federal Reserve Bank of St. Louis' (FRED) website. Moreover, most of the data from FRED and Datastream were old OECD data series not available on the OECD statistics database anymore. Stock market crash data was taken from a data-set developed by Reinhart et al. (2016) that is available on the Harvard business school's website.[2]

Stock prices are expressed in the form of price indices covering a broad amount of stocks in each country. Industrial production and money supply (represented by narrow money: M1) are also in index form, while inflation is represented by the change in the Consumer Price Index and the interest rate is the call-money rate or 24 hour central bank percentage rate. For all indices, 2015 is the base year and is equal to 100. GDP is expressed in millions of US dollars, where the reference year is 2010. The exchange rate is the amount of domestic currency for one US dollar, except for the US where it is the amount of dollars per euro. The exchange rate for all the current euro countries is the amount of euros per dollar. The exchange rate, together with the West Texas Intermediate oil price expressed in US dollars, was then used to calculate the oil price in domestic currency for all countries except the US (compare Abbas et al., 2018).

[2]See the Appendix for more specific references to the origin of the data.

Lastly, unemployment rate is represented by the OECD harmonized unemployment rate in percentage and the stock market crash variable is a dummy variable equal to one if the country is experiencing a stock market crash, otherwise it is equal to zero.

Figure 4.1 and 4.2 show the average level and average natural logarithm, respectively, of all countries stock prices.[3] The level values indicate very little change until ca 1980, after which more pronounced peaks and troughs appear, especially around 2000 and 2007. In contrast, the natural logarithm of stock prices show the existence of peaks and troughs even before 1980. However, even after removing the exponential trend in the time series, there seem to be an increase in the magnitude of the trough to peak cycle after 1970 (with a more distinct increase after 1980), and the peaks of 2000 and 2007 once again stick out. This tendency supports the excess elasticity view because the economic system in most OECD countries started to become more liberalized after 1980.

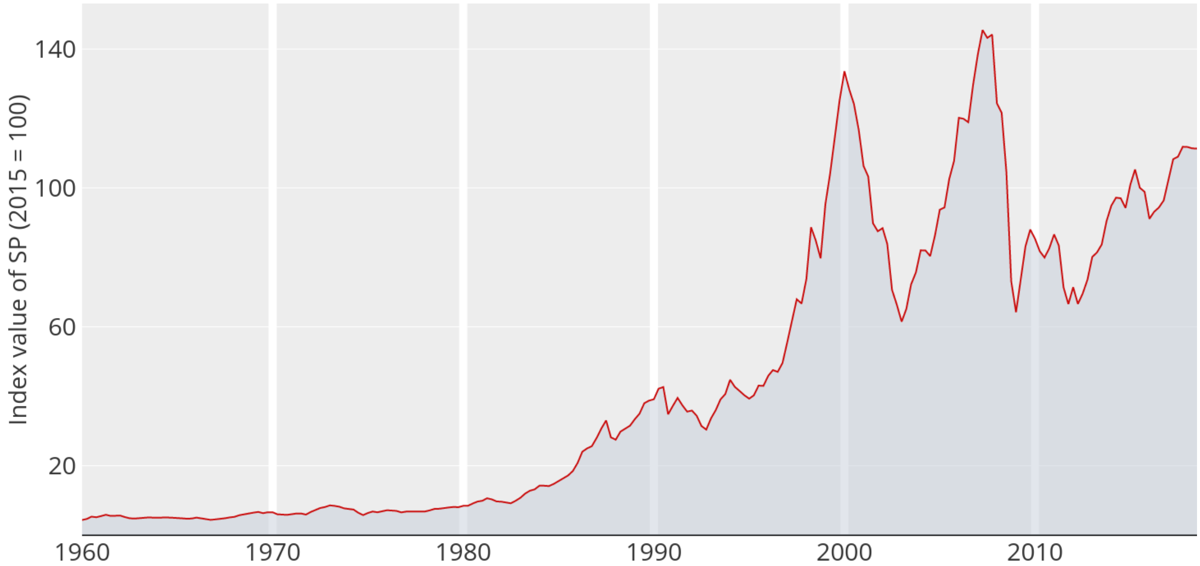


Figure 4.1: Stock prices for all countries in the study during the time period 1960-2018.

[3] Graphs of the first difference or first difference of the natural logarithm (depending on which variable) for SP and all macroeconomic variables can be found in the Appendix.

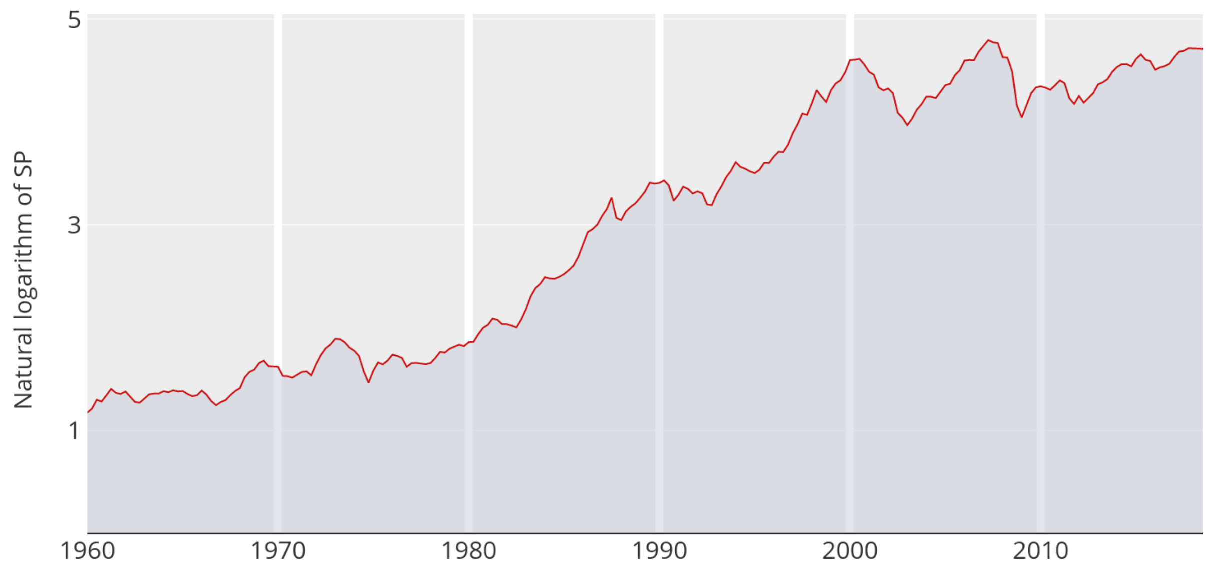


Figure 4.2: Average of the natural logarithm of stock prices for all countries in the study during the time period 1960-2018.

5. Empirical results

Table 5.1 reports the regression results for model 1 (whole period) and model 2 (interactive decade dummy variables with the Bretton Woods period as base period). The results for model 1 show that, when estimating the effect of macroeconomic variables on stock prices for the whole period of 1960-2017, several of the included explanatory variables seem to have a statistically significant effect. Changes in the interest rate, consumer price index and GDP have the largest effect, with coefficients of 0.041, 0.907 and 0.967 respectively, all three significant on the 1 percent level. The exchange rate also has a significant positive effect while unemployment rate has a relatively minor positive effect. All macroeconomic variables, except IR and UN, are in diff-log form so the parameter coefficients should be interpreted as the elasticity of that variable on stock prices. For example, if GDP increases 1 percent while holding all other variables constant, stock prices in the following quarter are expected to increase by approximately 0.967 percent. IR and UN are in percentage form, as such, if for example IR were to increase with 1 percentage point, keeping all other variables constant, stock prices are expected to decrease by $0.041 \cdot 100 = 4$ percent in the following quarter. The coefficient for the dummy variable controlling for the effect of stock market crashes (SMC) is also statistically significant at the 1 percent level. The coefficient affects the intercept and, unsurprisingly, implies larger negative returns during a stock market crash. This effect is almost exactly the same in all models and is therefore robust. The explanatory power of the model is relatively high ($R^2 = 0.683$), amplified from the inclusion of the fixed time and country specific effects. Interestingly, R^2 increases in the models using interactive dummy variables with the highest values reported in model 3 and 5 as can be seen in table 5.3.

Table 5.1: Regression results for model 1 (whole period) and model 2 (interactive decade dummy variables).

The first difference of the natural logarithm of stock prices is the dependent variable for both models.

	Model 1	Model 2					
	Whole period	BW-period	1970s	1980s	1990s	2000s	2010s
CPI	**0.907*** **	**-3.397*** **	**4.383*** **	**4.195*** **	**4.290*** **	**3.934*** **	**4.102*** **
	(0.149)	(0.821)	(0.859)	(0.858)	(0.941)	(0.960)	(1.008)
ER	**0.221** **	2.634	-3.073*	-2.583	-2.112	-2.197	-2.348
	(0.088)	(1.624)	(1.654)	(1.628)	(1.638)	(1.636)	(1.641)
GDP	**0.967*** **	**1.761** **	-1.558*	-0.803	-1.284	-0.218	-0.763
	(0.175)	(0.772)	(0.911)	(0.895)	(0.878)	(0.852)	(0.858)
IP	-0.004	**-1.486** **	**1.955*** **	**1.642*** **	**2.089*** **	**1.114** **	**1.433*** **
	(0.087)	(0.448)	(0.535)	(0.494)	(0.488)	(0.474)	(0.488)
MS	-0.033	**1.105*** **	-0.523	**-1.020*** **	**-1.111*** **	**-1.208*** **	**-0.946** **
	(0.035)	(0.346)	(0.392)	(0.363)	(0.362)	(0.349)	(0.377)
OP	-0.162	-2.559	2.965*	2.587	2.105	2.194	2.340
	(0.101)	(1.711)	(1.741)	(1.717)	(1.727)	(1.726)	(1.733)
UN	**0.006*** **	-0.030	0.039	**0.084*** **	0.045*	0.031	0.019
	(0.003)	(0.024)	(0.027)	(0.026)	(0.025)	(0.025)	(0.025)
IR	**-0.041*** **	-0.049	0.012	0.046	0.005	0.007	-0.026
	(0.007)	(0.037)	(0.041)	(0.039)	(0.040)	(0.046)	(0.068)
SMC	**-0.214*** **	**-0.210*** **					
	(0.011)	0.011					
Constant	**0.042*** **	**0.038*** **					
	(0.008)	0.012					
Adjusted R^2	0.683	0.697					
F-statistic	23.649	21.912					
Observations	2644	2644					

Note: All explanatory variables are lagged one period. Both models include fixed time specific and fixed country specific effects. In model 2, the "BW-period" column reports the estimated coefficients for the base period (β_0) and the other columns report the estimated extra effect, compared to the base period, in that decade (β_d). The standard errors for the coefficients are reported in parenthesis and *, **, *** denote significance at the 10%, 5% and 1% levels. All coefficients with p-values below 0.05 are highlighted in bold.

In model 2 the effect of each variable is divided into decades, where the Bretton Woods period (1960-1971) acts as the base period. The effect of a macroeconomic variable in the other decades is given by the Bretton Woods coefficient plus the coefficient of that decade ($\beta_0 + \beta_d$). The most noteworthy deviations comparing model 2 to model 1 is the difference in which macroeconomic variables are statistically significant. Furthermore, the fact that the coefficients during the Bretton Woods period differ from the coefficients for the whole period, implies the existence of breakpoints in the effect. When comparing the base period in model 2 to the whole period in model 1, the exchange rate, unemployment rate and interest rate no longer have an effect while industrial production and money supply do. The reason could be the existence of breakpoints in the effect of several of the macroeconomic variables. In the case of unemployment rate, the effect during the base period does not significantly differ from zero, but the interactive decade dummy variable for the 1980s does, which means that the effect during the 1980s ($\beta_0 + \beta_{1980s} = -0.030 + 0.084 = 0.054$) is different from the effect during the Bretton Woods period. The same principle applies for the other variables; e.g. for the consumer price index, the coefficient is significant during the Bretton Woods period and all coefficients for the decade dummy variables are significant, so that the effect during the 1990s is 0.893 compared to -3.397 during the Bretton Woods period. Also, note the difference between the coefficients for the other macroeconomic variables for the whole period in model 1 and the base period in model 2.

These results give strong support for H1, which stated that there are breakpoints in the effect of the macroeconomic variables on stock prices. Some aspect changed, politically or economically, that caused signals in some macroeconomic variables to be interpreted differently, e.g. unemployment data became more important for investors during the 1980s. These results are in line with other studies in the sense that they have found breakpoints in the effect of different macroeconomic variables. Lee (2007) for example found a similar change in the effect of the CPI as indicated by our results.

When considering H2 (increased effect of macroeconomic variables after the Bretton Woods system ended) and H3 (increased effect of macroeconomic variables after 1980) the results from model 2 do not seem to support any of them. The consumer price index had a substantial negative effect during the Bretton Woods period, but all coefficients for the decade dummy variables are positive, indicating that the effect did not become more negative, but rather positive. Such an interpretation is strengthened when comparing to the coefficient over the whole period in model 1, which estimates the average effect over the sample period. The same pattern is present for both industrial production and money supply; the effect in later decades seems to return to zero or switch signs, not increase in the same sign as the coefficient during the Bretton Woods period. The other macroeconomic variables seem to either have a constant effect during the whole period (GDP), only to have a significant effect during one decade (UN) or not to have any effect during the whole sample period (ER, OP and IR). For UN the effect increased during the 1980s, however it seems have returned to zero again during the 1990s or 2000s. Therefore, the increase during the 1980s, and possibly 1990s, can not be attributed to an increase in the elasticity of the financial system but, rather, to other factors.

As an indication of the stability of the effect of the macroeconomic variables after the Bretton Woods period, Wald-tests were performed. The null hypothesis states that, for a given macroeconomic variable, all coefficients for the interactive decade dummy variables are the same, and the alternative hypothesis implies a heterogeneous effect after 1971. The results, reported in table 5.2, indicate that ER, IP, MS and UN do not have the same effect during the whole period after the Bretton Woods system ended. The P-values for the CPI and GDP however are above 0.05 which, combined with the results from model 2, indicates that the CPI has one effect during the Bretton Woods period and another effect thereafter while GDP only had a single effect during the whole sample period. In model 1, the effect of the CPI is averaged over the whole period which gives an inaccurate representation of the true effect: it changes from a negative to a positive effect after the Bretton Woods system ended. The results from the Wald-tests are relevant in interpreting the relevance of the results from models 3, 4 and 5 reported below.

Table 5.2: Statistics for Wald-tests examining whether all coefficients for the decade dummy variables in model 2 are equal to the 70s decade dummy variable, for all macroeconomic variables.

	CPI	ER	GDP	IP	MS	OP	UN	IR
P-value	0.938	**0.048**	0.182	**0.001**	**0.004**	0.144	**0.000**	0.143
F-statistic	0.201	2.400	1.5600	4.634	3.927	1.716	8.234	1.720

Note: The p-values in the table are from Wald-tests testing, for all macroeconomic variables, the null-hypothesis: $\beta_{MV,80} = \beta_{MV,90} = \beta_{MV,00} = \beta_{MV,10} = \beta_{MV,70}$. A statistically significant result here implies that there are some decades that differ in a significant way from the others. All p-values below 0.05 are highlighted in bold.

The initial results regarding H2 and H3 from model 2 are mostly further supported by the regression results for model 3, 4 and 5 reported in table 5.3. Model 3, designed to test H2, uses the Bretton Woods period as the base period but, in contrast to model 2, uses only one interactive dummy variable for the whole period after 1971 (PBW). Model 4 and 5 are used to test H3 and uses an interactive dummy variable for the post 1980 period (P80). The only difference between the two models is that model 4 uses the 1960-1979 as the base period and model 5 uses 1971-1979.

Regarding H2, Model 3 confirms the initial indicative results from model 2. The post Bretton Woods dummy variables that are statistically significant indicate a decreased effect, hence, no support for H2. For the CPI and IP, the coefficient during the Bretton Woods period was negative (-3.44 and -1.479) but the coefficient for the post Bretton Woods interactive dummy variable was positive, indicating that the total effect either turned positive or became zero. MS changed from a positive to a negative, or zero, effect and the positive effect of GDP did not change during the sample period as the value for PBW was not statistically significant (the PBW coefficient was even negative). No other PBW coefficient was significantly different from zero, suggesting that the other macroeconomic variables did not have breakpoints when the Bretton Woods system ended.

When divided into pre and post 1980 periods in model 4 and 5 three macroeconomic variables have a statistically significant effect in the base period: CPI, MS and IR. One major difference from model 3 is that CPI in the base period now has a positive coefficient. However this can be explained from the results in model 2 where the effect is negative during the Bretton Woods period and the decade dummy variable for the 1970s has a larger positive value, resulting in a positive value when taking the average. When combined with the Wald-tests in table 5.2 the most correct way to describe the effect of the CPI seem to be model 3.

Similar to the results from model 3 for H2, model 4 and 5 indicate the same conclusions regarding H3, except for the exchange rate in model 5. In both model 4 and 5 the same general patterns as in model 3 can be observed; the P80 coefficients for most variables either have the wrong sign or are not significantly different from zero. Nevertheless, in model 4, the P80 coefficient has the correct sign according to H3 for CPI, but the null hypothesis was not rejected in either two sided or one sided hypothesis tests [1] which means that P80 for CPI is not larger than zero. In model 5 the P80 for IR has the correct sign for H3, but similar to CPI in model 4 the null hypothesis could not be rejected for either one sided or two sided hypothesis tests, indicating that the coefficient was not smaller than zero. In contrast, the P80 coefficient for IP and OP are both statistically smaller than zero in one sided hypothesis tests, however the combined effect indicates that the relationship in the whole post 1980 period is zero for both variables. Such an interpretation is supported by the results in model 1 which indicate a zero

[1] For the one sided hypothesis test the null hypothesis states that for a negative (positive) coefficient in the base period, the coefficient for the interactive dummy variable is equal to or higher (lower) than zero and the alternative hypothesis is that the coefficient is lower (higher) than zero.

Table 5.3: Regression results for model 3 (interactive post Bretton Woods dummy variable), model 4 (interactive post 1980 dummy variable) and model 5 (interactive post 1980 dummy variable with base period 1971-1979).

The first difference of the natural logarithm of stock prices is the dependent variable for all three models.

	Model 3		Model 4		Model 5	
	BW-period	PBW	1960-1979	P80	1971-1979	P80
CPI	**-3.440***** (0.833)	**4.548***** (0.848)	**0.613***** (0.258)	0.306 (0.314)	**1.044***** (0.270)	-0.013 (0.321)
ER	2.601 (1.649)	-2.391 (1.651)	-0.227 (0.306)	0.499 (0.320)	-0.428 (0.311)	**0.696**** (0.324)
GDP	**1.726**** (0.784)	-0.719 (0.802)	0.361 (0.416)	0.713 (0.458)	0.241 (0.501)	0.848 (0.536)
IP	**-1.479***** (0.455)	**1.519***** (0.463)	-0.055 (0.236)	0.046 (0.254)	0.500* (0.297)	-0.523* (0.312)
MS	**1.081***** (0.351)	**-1.107***** (0.352)	**0.427***** (0.170)	**-0.477***** (0.173)	**0.560***** (0.198)	**-0.606***** (0.201)
OP	-2.536 (1.737)	2.381 (1.740)	0.223 (0.326)	-0.423 (0.344)	0.384* (0.332)	-0.579* (0.348)
UN	-0.030 (0.024)	0.038 (0.025)	-0.005 (0.011)	0.013 (0.012)	0.009 (0.013)	-0.002 (0.014)
IR	-0.047 (0.038)	0.006 (0.039)	**-0.042***** (0.016)	0.008 (0.018)	**-0.034**** (0.017)	-0.001 (0.019)
SMC	**-0.217***** (0.011)		**-0.213***** 0.011		**-0.226***** 0.011	
Constant	**0.046***** (0.009)		**0.035***** 0.010		**0.029***** 0.010	
Adjusted R^2	0.718		0.684		0.700	
F-statistic	23.458		23.059		27.254	
Observations	2644		2644		2438	

Note: All explanatory variables are lagged one period. All models include fixed time specific and fixed country specific effects. In model 3, the "BW-period" column reports the estimated coefficients for the base period (β_0) and the "PBW" column reports the estimated extra effect in the post Bretton Woods period (β_{PBW}). For model 4 the base period is 1960-1979 and for model 5 the base period is 1971-1979. In both models "P80s" is the extra effect in the post 1980 period. The standard errors for the coefficients are reported in parenthesis and *, **, *** denote significance at the 10%, 5% and 1% levels. All coefficients with p-values below 0.05 are highlighted in bold.

relationship during the whole period.

Contrary to the other results regarding H3, the effect of ER in model 5 seems to increase from an effect not significantly different from zero during the 1970s, to a significant positive effect after 1980 comparable to the one estimated during the whole period in model 1.[2] If we take the results from the other models into account, the effect of ER might have been positive or zero during the Bretton Woods period, zero during the 1970s and then become positive after 1980. This gives modest support for H3 as the effect of one macroeconomic variable increased after 1980. An explanation could be that the amount of countries adopting a floating or semi-

[2]We could reject the null hypothesis of a Wald-test testing whether the total effect of ER during the post 1980 period was significantly different from zero.

floating exchange rate increased after the Bretton Woods system was abandoned and during the 1980s and 1990s. According to the excess elasticity view, this in itself should increase the elasticity of the financial system and, coupled with the increase in the other categories of financial liberalization, could explain the increase in the effect of the exchange rate on stock prices.

However, the fact that no results support H2 and only one out of eight variables supports H3 casts doubts on the credibility of the excess elasticity view. The changes in the effect of the macroeconomic variables on stock prices, overall, does not seem to follow the patterns implied by the excess elasticity view. When our results indicate the existence of a breakpoint in the effect of a macroeconomic variable, the effect seems to have been stronger during the Bretton Woods period and the 1970s, except for the unemployment rate that only had a significant effect during the 1980s, and ER whose effect increased after 1980 compared to the 1970s. Most of the changes in the effects of macroeconomic variables are therefore implied to be caused by other factors.

5.1 Stability test with the balanced panel

To test the stability of our results the models were reestimated with a balanced panel containing only the countries that had data for all variables during the whole sample period.[3] The results from the unbalanced panel seem to be relatively robust, as can be seen in table 5.4 where the unbalanced results are exemplified with model 2. Although the magnitude of the coefficients differ significantly in some cases, most notably for ER and OP, the patterns observed in the unbalanced panel recur in the regression results for the balanced panel. The effect of the macroeconomic variables does change over time, although in the wrong direction compared to the Bretton Woods period and the 1970s. The conclusions drawn from the unbalanced panel results are therefore strengthened.

[3]USA, Germany, Japan, and Switzerland

Table 5.4: Regression results for model 2 (interactive decade dummy variables) with the balanced panel.

The first difference of the natural logarithm of stock prices is the dependent variable.

	Model 2					
	BW-period	1970s	1980s	1990s	2000s	2010s
CPI	**-4.208*****	**4.629*****	**4.973*****	**4.977*****	**3.630*****	**5.241*****
	(0.821)	(0.859)	(0.858)	(0.941)	(0.960)	(1.008)
ER	**4.121*****	**-4.310*****	**-4.004*****	**-3.676*****	**-3.515****	**-3.581****
	(1.624)	(1.654)	(1.628)	(1.638)	(1.636)	(1.641)
GDP	**2.220*****	**-1.843****	**-2.300****	**-2.976*****	-1.320	-1.362
	(0.772)	(0.911)	(0.895)	(0.878)	(0.852)	(0.858)
IP	**-1.910*****	**2.249*****	**2.991*****	**4.153*****	**1.980*****	**1.571*****
	(0.448)	(0.535)	(0.494)	(0.488)	(0.474)	(0.488)
MS	**1.413*****	-0.649*	**-1.392*****	**-1.628*****	**-1.347*****	**-1.029****
	(0.346)	(0.392)	(0.363)	(0.362)	(0.349)	(0.377)
OP	**-5.091*****	**5.148*****	**4.876*****	**4.507*****	**4.451*****	**4.990*****
	(1.711)	(1.741)	(1.717)	(1.727)	(1.726)	(1.733)
UN	0.000	0.033	0.049	**0.058****	-0.004	-0.016
	(0.024)	(0.027)	(0.026)	(0.025)	(0.025)	(0.025)
IR	-0.012	0.009	-0.039	-0.029	-0.059	-0.010
	(0.037)	(0.041)	(0.039)	(0.040)	(0.046)	(0.068)
SMC	**-0.197*****					
	(0.018)					
Constant	**0.065*****					
	(0.017)					
Adjusted R^2	0.727					
F-Statistic	9.690					
Observations	911					

Note: All explanatory variables are lagged one period. The model includes fixed time specific and fixed country specific effects. The "BW-period" column reports the estimated coefficients for the base period (β_0) and the other columns report the estimated extra effect, compared to the base period, in that decade (β_d). The standard errors for the coefficients are reported in parenthesis and *, **, *** denote significance at the 10%, 5% and 1% levels. All coefficients with p-values below 0.05 are highlighted in bold.

5.2 Discussion

The results of our empirical analysis give support for H1 (that there exist breakpoints in the effect of the macroeconomic variables during the sample period), which was a prerequisite for considering H2 and H3, which are more relevant to testing the excess elasticity view. There seem to exist breakpoints in the effect for most of the macroeconomic variables, which could be observed in model 2-5. The implication is that some fundamental aspects of the economy changed during the sample period, causing the effect of the macroeconomic variables to change, indicating that the way in which investors reacted to signals in the macroeconomic variables changed. The excess elasticity view assumes that this fundamental change was that the economic system itself changed and became more elastic. If the economic system became more elastic, larger reactions in stock prices to changes in macroeconomic variables should be expected, as an elastic system can respond more to a given change in e.g. the interest rate and affect stock prices more.

However, with the exception of ER in model 5 our results do not support the hypotheses based on the excess elasticity view. If anything, the effect of the macroeconomic variables seem to have been larger during the Bretton Woods period, when the economic system should have been very inelastic and the endogenous anchors should have been able to stabilize the economy. Altogether, changes to the economy and to the financial system, brought about after the Bretton Woods system ended through financial liberalization, does not seem to have caused the economic system to become elastic in the way implied by Borio and Disyatat (2011). Other factors must have affected how the macroeconomic variables affect stock prices.

A striking result is that UN only seems to have had a significant positive effect on stock prices during the 1980s. One possible explanation is that during the 1980s stock prices seem to have had an almost continuous boom cycle during the whole decade, which was not the case during the other decades in our sample. A continuous boom in stock prices suggests an expanding economy, during which it has been shown that a rise in unemployment rate has a significant positive effect on stock prices (Boyd et al., 2005). Other factors, such as the oil crises during the 1970s or the era of inflation targeting central banks starting during the 1980s and 1990s, could have had similar effects on how investors react to changes in different macroeconomic variables during different time periods. One could also possibly draw the conclusion that the stock market has "very much a life of its own" (Borio, 2014, p. 183).

Regarding the more pronounced effect during the Bretton Woods period, the results for the CPI are perhaps the best indicator of this trend, and they can be connected to other similar studies. Analyzing UK data, Lee (2007) found that the CPI had a strong negative effect on stock prices during the Bretton Woods period, which turned insignificant after the breakpoint sometime between 1969 and 1971. Our results for 16 OECD countries support the significant negative relationship before 1971, the existence of the breakpoint and the reduced effect of CPI on stock prices thereafter, although our results indicate that the effect turned slightly positive after 1971. Lee (2007) does not explicitly try to explain what caused the shift other than noting that such breakpoints occur "due to political and economic reforms and institutional changes" (Lee, 2007, p. 125). Marston (1993) stresses the profound effect the restrictions on the financial system and capital mobility had on the efficiency of financial markets. As a sign of these inefficiencies, he points to the relatively large interest rate differentials between countries, compared to the covered interest rate parity, that occurred during the Bretton Woods period. These interest rate differentials, and other inefficiencies during the Bretton Woods period, could have caused distortions when it comes to investment and borrowing decisions that can explain the more pronounced effect of certain macroeconomic variables on stock prices. After 1971 and during the 1980s and 1990s, when restrictions were lessened on the financial markets and capital mobility increased, market powers could reduce these inefficiencies, causing the risk premium of certain macroeconomic variables to decrease.

Another possible explanation for why our results did not corroborate the excess elasticity view might be because of misspecifications in our econometric model, or the use of a suboptimal estimation method. Different forms of dynamic econometric models (used by e.g. Tai, 2000; Lee, 2007) or VAR-models (compare e.g. Campbell and Ammer, 1993), outside the scope of this thesis, might have better been able to capture the relationship between the macroeconomic variables and stock prices. Future research might want to further investigate our hypotheses and the excess elasticity view using other econometric models. Another suggestion for future research, based on our findings, is to further investigate what the effect of the more constrained financial system during the Bretton Woods period had on how stock prices reacted to changes in macroeconomic variables.

In summary, the excess elasticity view does not seem to be an adequate way of explaining the changing patterns of how the stock market works, or the reason for the more pronounced and rapid increases in stock prices since 1980. It is therefore thought that other factors may better explain the changes in how macroeconomic variables affect stock prices.

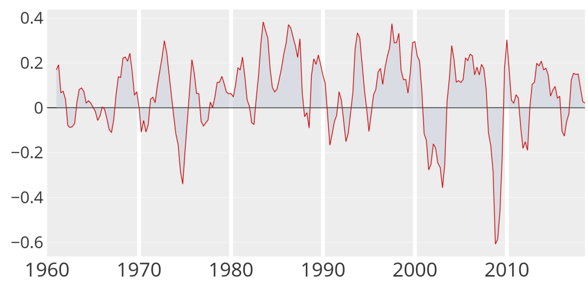
6. Conclusion

This thesis has investigated the more rapid increases in stock prices after 1980 when compared to the post-war period. We tested the excess elasticity view, put forth by Borio and Disyatat (2011) and Borio and White (2003), in explaining this change by analyzing the effect eight macroeconomic variables has had on stock prices in 16 OECD countries during the time period 1960-2017. The excess elasticity view argues that the financial system has become more elastic because regulations on the financial system have been relaxed and the creation of credit has become less constrained. In a more elastic system the effect of macroeconomic variables on stock prices should have increased. Overall, our results do not lend credence to the excess elasticity view as the effect of macroeconomic variables did not increase after the Bretton Woods system was abandoned in 1971 or after 1980. We do, however, find support for the existence of breakpoints in the effect of several of the macroeconomic variables. Most notably, the effect of certain macroeconomic variables seem to have been stronger during the Bretton Woods period. A possible explanation for these results are the inefficiencies on the financial markets that occurred during the Bretton Woods period because of restrictions on the financial system and capital controls. Our way of testing the excess elasticity view might also not have been optimal. We therefore urge future research on the excess elasticity view to focus on other econometric approaches, e.g. the use of VAR-models or dynamic models. We also encourage future research to focus on the change that occurred in the effect of several macroeconomic variables after the Bretton Woods system was abandoned.

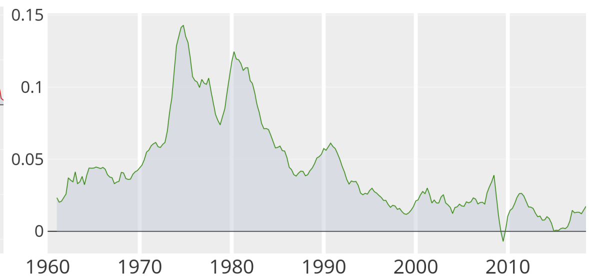
A. Appendix

Table A.1: Sources of the data

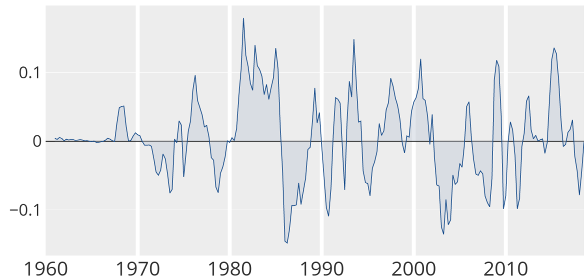
Variable	Data source
Stock prices	OECD statistics Thomson Reuters DataStream
Consumer Price Index	OECD statistics Thomson Reuters DataStream https://fred.stlouisfed.org/
Exchange rate	OECD statistics https://fred.stlouisfed.org/
Gross domestic product	OECD statistics
Industrial Production	OECD statistics Thomson Reuters DataStream https://fred.stlouisfed.org/
Money supply	OECD statistics Thomson Reuters DataStream https://fred.stlouisfed.org/
Oil price	https://fred.stlouisfed.org/
Unemployment	OECD statistics Thomson Reuters DataStream https://fred.stlouisfed.org/
Interest rate	OECD statistics https://fred.stlouisfed.org/ Thomson Reuters DataStream
Stock market crash	Reinhart et al. (2016)



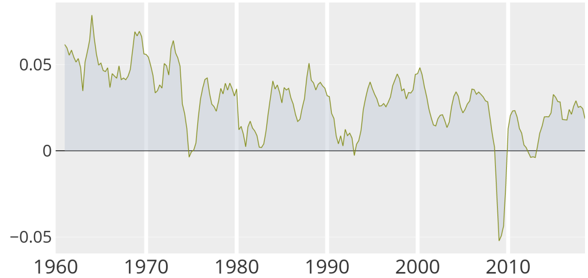
(a) SP



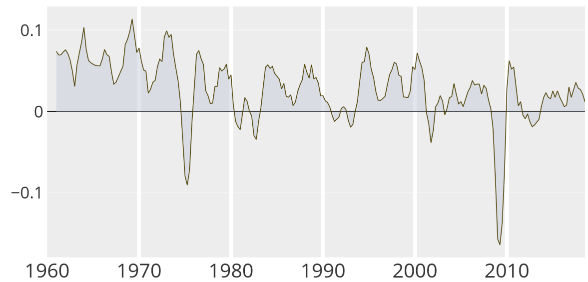
(b) CPI



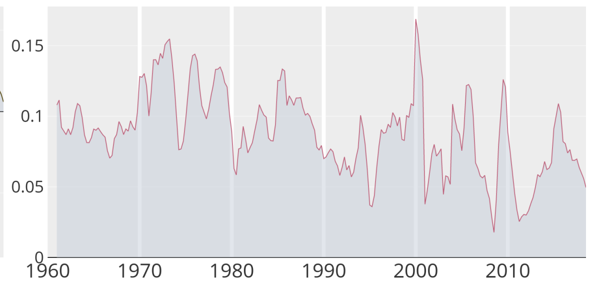
(c) ER



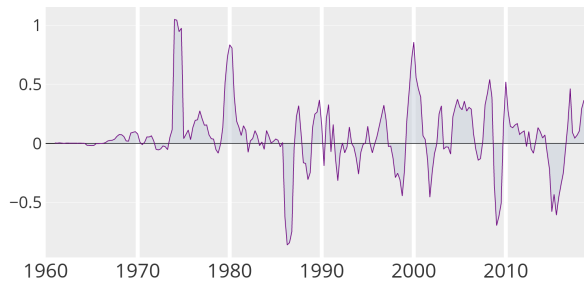
(d) GDP



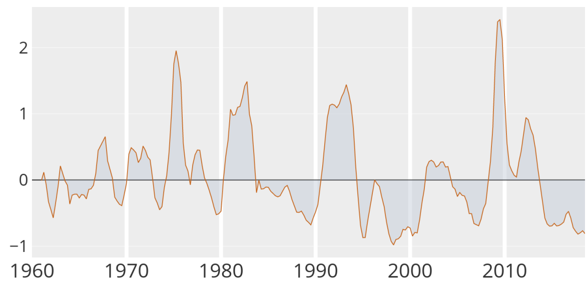
(e) IP



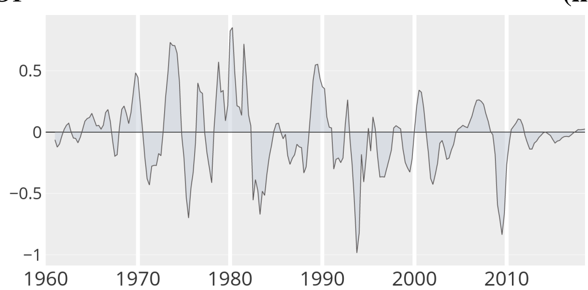
(f) MS



(g) OP



(h) UN



(i) IR

Figure A.1: The first difference for IR and UN and first difference of the natural logarithm for all other macroeconomic variables and SP. The first difference is yearly.

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