

Chapter 2

Previous Research

2.1 Money and Stock Prices

2.1.1 *Historical Overview*

Sprinkel (1964) pioneered the investigation of the relationship between the amount of money and the stock market. He justifies his approach with the monetary portfolio model.¹ His findings are based on a graphical inspection of money growth and stock market turning points. His main conclusion is that stock prices lag behind changes in the growth rate of money supply. Applying this finding to the market, Sprinkel (1964, p. 149) formulates an investment rule, which states that “[a]ll funds were invested in stocks until monetary growth had declined 15 months, and then all funds were invested in bonds until monetary growth had risen two months.” This rule is based on the finding that for the period under investigation between 1918 and 1960 a bear market in stock prices was predicted 15 months after each peak in monetary growth, and that a bull market was predicted two months after each trough of monetary growth. One downside of Sprinkel’s analysis is the ex-post identification of peaks and troughs, because he uses data which is only available several quarters after the peaks and troughs. Hence, it is difficult to apply his rule in real time. The reason for this is that he identifies peaks and troughs not only numerically but also pays attention to business cycle peaks as identified by the National Bureau of Economic Research (NBER). The information from the NBER, however, is only available several quarters after the turning points (Rozeff 1974, p. 288).

In his follow-up book, Sprinkel (1971) finds that the relationship no longer holds true and, therefore, can no longer be used to gain excess returns. His explanation for this is that too many investors focus on money growth as a leading indicator and, as a result, price differences are immediately diminished. Modigliani (1971, p. 21) takes the same line when summarizing his discussion of the determination of the market value of corporate equity with the following statement: “[w]e still cannot

¹ See Sect. 3.2.1.1 for a description of the monetary portfolio model and the derivations for the relationship between money and asset prices.

see any direct mechanism through which the rate of change of money could affect market values – except possibly because operators take that variable as an indicator of things to come. But even this explanation is hardly credible except, perhaps, in the last couple of years, when watching every wiggle of the money supply has suddenly become so fashionable.”

This view is opposed by, for example, Hamburger and Kochin (1972, pp. 236–242), who find ample support for the hypothesis that money supply changes have an important impact on the stock market in the short run, independent of the influence money has on interest rates and expected corporate earnings.

In general, the relationship between money supply and stock prices was widely studied in the 1970s with mixed results. On the one hand, Homa and Jaffee (1971, quarterly data from 1954 to 1969, S&P 500, regression analysis), Keran (1971, quarterly data from 1956 to 1970, S&P 500, regression analysis) and [Hamburger and Kochin](#) (1972, quarterly data for three periods, 1956–1970, 1953–1960 and 1961–1970, S&P 500, regression analysis) find a positive significant relationship between money supply and stock prices. In their studies, money leads stock prices. The implication of their results is that investors can earn excess profits if they follow a trading strategy, which is based on the observed behavior of the money stock. Their findings show that the effect of money on stock prices is mostly indirect. As such, Keran (1971, p. 31) notes that “[a]ccording to this analysis, changes in nominal money stock have little direct impact on the stock price, but a major indirect influence on stock prices through their effect on inflation and corporate earnings expectations.”

On the other hand, Rozeff (1974, monthly data, several subperiods ranging from 1916 to 1970, S&P 500, regression analysis), Pesando (1974, quarterly data from 1956 to 1970, S&P 500, regression analysis), Cooper (1974, monthly, quarterly and annual data from 1947 to 1970, S&P 500, regression analysis) and [Rogalski and Vinso](#) (1977, monthly data from 1963 to 1974, four US stock market indices, Granger causality of mixed autoregressive-moving average processes) find evidence that past money changes do not contain predictive information for stock prices. They point out that their findings are consistent with the efficient market hypothesis as documented by Fama (1970). Current stock prices incorporate all information, which is contained in past money supply data and even seem to anticipate future money supply changes. Consequently, they deny the existence of lags and profitable trading rules. It is important to note, though, that these authors do not deny a relationship between money and stock prices. Instead, “monetary variables may have a consistent effect on stock returns in an efficient market without opportunities for excess profit arising” (Rozeff 1974, p. 247).

In the 1980s, the focus shifted a bit to the relationship between macroeconomic factors and stock returns. The main reason for this was the development of the Arbitrage Pricing Theory by Ross (1976) in the second half of the 1970s. This framework is used to address the question of whether risk, which is associated with certain macroeconomic variables, is reflected in expected asset returns. It is the main finding of Chen et al. (1986) that macro variables have a systematic effect on stock returns. In their view, economic forces affect the discount rate, the ability of firms

to generate cash flows and future dividend payments.² This approach was applied in many studies.³

In addition, the 1980s also introduced studies that focused on the relationship between anticipated and unanticipated changes of money supply and stock prices. For example, Pearce and Roley (1983, weekly data from September 1977 to January 1982, Dow Jones Industrial Average, regression analysis) investigate the response of stock prices to weekly money announcements. They apply survey data on market participants' forecasts to distinguish expected from actual changes in money. Their results are in line with the efficient market hypothesis because only unanticipated changes have a significant effect on stock prices. The distinguished relationship is negative, which they justify with the increase in expected inflation associated with an unanticipated rise in money supply.⁴

In contrast, Hashemzadeh and Taylor (1988, p. 1608, weekly data from January 1980 to July 1986, S&P 500, regression analysis) find bidirectional causality between money supply and stock prices in the US. They find that both variables react to each other. Consequently, they characterize the relationship between money supply and stock prices as a feedback system, which reminds one of a cointegration relation. Moreover, Friedman (1988, quarterly data from 1961 to 1986, S&P 500, regression analysis) finds that real stock prices are positively correlated with the velocity of money three quarters ahead. Darrat (1987, quarterly data from 1960 to 1982, UK and West Germany, regression analysis) focuses his regression analyses on West Germany and the UK. Lagged anticipated as well as unanticipated money growth is statistically significant for stock returns in both countries.

The preferred research methodology to analyze the relationship between money and stock prices in the 1990s was the vector autoregressive (VAR) model. Lee (1992, monthly data from 1947 to 1987, New York Stock Exchange (NYSE), VAR analysis), Marshall (1992, quarterly data from 1959 to 1990, NYSE, VAR analysis), Dhakal et al. (1993, monthly data from 1973 to 1991, S&P 400 industrials, VAR analysis) and Abdullah and Hayworth (1993, monthly data from 1980 to 1988, S&P 500, VAR analysis) apply a VAR model to analyze the relationship between share prices and the macro economy. Since the multivariate VAR model allows for the inclusion of several endogenous variables, these investigations did not focus solely on the relationship between stocks and money but included a broad set of macro indicators and are, therefore, closer to the analysis in this contribution. Marshall (1992, p. 1335), Dhakal et al. (1993, p. 71) and Abdullah and Hayworth (1993, p. 58) find a significant causal impact of money supply changes on share price changes. In addition, Lastrapes (1998) analyzes the reaction of real equity returns to money supply shocks across the Group of Seven (G7) countries and the Netherlands for

² See Sect. 3.2.2.2 for theoretical considerations of the discount factor for stock prices as well as Sect. 3.2.3.1 for theoretical aspects of the relationship between dividends and stock prices.

³ For non-US analyses, see, for example, Cheng (1995) for the UK and Cheng (1996) for international analyses.

⁴ See Sect. 3.2.1.2 for theoretical considerations of the relationship between inflation and stock prices.

post-war data. His results, based on a VAR in first differences, show that, with the exception of France and the UK, “real equity prices respond positively, persistently and significantly” to nominal money supply shocks (Lastrapes 1998, p. 394).

The research presented above is characterized by a strong focus on US markets. While more recent research still has a bias in favor of US markets, newer studies also incorporate international and global perspectives. Two of the first important studies to do so are Conover et al. (1999) and Baks and Kramer (1999). While Conover et al. focus on developments across 16 countries,⁵ Baks and Kramer are the first to introduce the concept of global liquidity and its potential impact on aggregated global stock markets.

2.1.2 *Recent Research*

Baks and Kramer (1999) pioneered the analysis of the impact of global liquidity on asset prices in a scientific context. Preceding their research, the notion that global excess liquidity exists and that it influences global capital markets, e.g., by compressing risk premia before the 1998 Russian debt crisis and the collapse of Long Term Capital Management (LTCM), was mainly advocated in research conducted by investment banks or newspapers.⁶

Baks and Kramer (1999) assess the empirical influence of global excess liquidity on asset prices utilizing three different aggregation methods for money growth, namely, a weighted growth rate series (by GDP in US Dollars (USD)), a simple sum USD aggregate and a Divisia index. All three aggregation methods are applied to narrow and broad money. Their global measures are based on the G7 countries. Excess liquidity is derived by subtracting weighted average nominal GDP growth rates from money growth rates.⁷

Based on quarterly data between 1971 and 1998, Baks and Kramer (1999) derive three main conclusions from their empirical research. First, higher liquidity growth rates are consistent with higher real stock returns. Second, an increase in liquidity growth rates leads to a reduction in real interest rates. And third, liquidity spillovers exist. This means that increased liquidity growth in one country is consistent with the first two results in other countries.⁸

⁵ The analysis of Conover et al. (1999, monthly data from 1956 to 1995, national stock markets, regression analysis) focuses more on the monetary policy stance and stock prices instead of money supply developments.

⁶ See, for example, Williams (1999), Montgomery (1999) and The Economist (1997, pp. 77–78).

⁷ However, this measure of excess liquidity has a crucial underlying assumption. It assumes that the velocity of money remains constant over time, which is far from certain (Becker 2007, p. 6).

⁸ A study that closely follows the systematic of Baks and Kramer (1999) is the one from Borja and Goyeau (2005). They apply quarterly data between 1995 and 2005 to determine whether or not international liquidity affects asset prices in the US, the euro area and the ASEAN⁹ region. The findings of their regression analyses can be summarized by the fact that liquidity spillover effects

Rapach (2001) uses a structural VAR model to analyze the effects of macro factors on a broad index of US stock prices in real terms. His findings, which are based on quarterly data between 1959 and 1999, indicate that money supply shocks have a positive short-run effect on real stock prices.

Gouteron and Szpiro (2005) analyze a set of excess liquidity measures and their effect on stock, bond and housing prices in the US and the euro area for the time period 1980–2004.¹⁰ They do not find causality (Granger causality) from any of the excess liquidity measures to asset prices. Instead, causality runs from assets to money, which they rationalize with the ‘flight to quality’ effects after the market turmoil at the beginning of the millennium.

Congdon (2005) limits his analysis of money and asset prices to major boom-bust phases in the UK, the US and Japan. He also investigates sectoral money holdings during boom-bust cycles in the UK. His main conclusions are that it is broad money instead of narrow money, which is important for asset prices. In his view, causality runs from money to asset prices and inflation.

Pepper and Oliver (2006) analyze the interplay of monetary developments and the stock market for different boom-bust periods in the UK and in the US. Based on a fact-based approach, they find ample evidence of the positive influence of monetary forces on investors and the stock market. They admit, though, that their findings can not be replicated econometrically. Their main point is that ‘liquidity’ is not the sole factor explaining stock market behavior; but, it is important for deviations from market fundamentals.

Adalid and Detken (2007) focus on the relationship between developments in money and credit aggregates and asset price developments. They, too, limit their analysis to phases of asset price booms, which are followed by a bust. They identify 42 boom-bust episodes across 18 OECD (Organisation for Economic Co-operation and Development) countries since the beginning of the 1970s. Their findings are that money growth shocks during the boom and pre-boom phases and real residential property prices during the boom and in the post-boom period partly explain the depth of the recessions following the boom. While two liquidity measures are applied, namely a broad monetary aggregate and private credit growth, the results are mainly based on the former. The latter does not include much informational content. In addition, Adalid and Detken (2007) show that the positive relationship between liquidity conditions and asset price developments are stronger during boom-bust periods. If the whole sample (boom and non-boom periods) is used for the analysis their results show a much weaker relationship.

While Adalid and Detken (2007) analyze the interplay of money and asset prices during phases of asset price booms, Bruggeman (2007) focuses on periods of sustained excess liquidity and investigates how often these periods are followed by an asset price boom. In doing so, the author allows for non-linearities in the relationship

exist, which play a role for US and European asset returns, but not for asset returns in the ASEAN region.

¹⁰ Since their paper is only available in French, this overview is based on the description in Clerc (2007, pp. 19–22).

between liquidity and asset prices. The first main finding is that only about a third (14 out of 40) of sustained excess liquidity periods are followed by a boom (Bruggeman 2007, p. 21). Hence, Bruggeman warns against a naive type of monetary analysis with respect to asset prices. The other main finding is that the inclusion of other variables, such as inflation and real GDP growth helps to forecast asset price booms. In particular, periods of strong real money growth in combination with low interest rates, high economic growth and low inflation increase the risk of being followed by an asset price boom (Bruggeman 2007, p. 21).

Giese and Tuxen (2007, 2008) analyze the impact of global liquidity on asset prices in a CVAR framework. Their findings show that money supply has exceeded money demand since the beginning of this millennium. Excess liquidity is defined as deviations from the long-run money demand relation. The identified excess liquidity contributed, among other factors, to rising asset prices. Their analyses focuses on aggregated quarterly data between 1982 and 2006 for France, Germany, Italy, Japan, the UK and the US.

Belke et al. (2008) pursue a related analysis estimating a variety of VAR models on a global level. They utilize aggregated data for a wide range of countries, which together account for 72.2% of global GDP (in 2006). The impulse responses, which are based on quarterly observations between 1984 and 2006, show that a positive shock leads to increases in global house prices but not to higher stock prices. These results are confirmed by Belke and Rees (2009, p. 18), who analyze how global shocks affect global aggregates as well as national variables to determine central banks' action span with respect to international spillovers. Their findings show that global liquidity shocks do not have a positive effect on global stock prices.¹¹

2.1.3 Research of Money and Stock Prices in Cointegrated VAR Models on a National Level

The following scientific contributions come closest to the analysis in this contribution. First, because they focus on national stock markets and domestic macro variables. Second, because they apply the same econometric methodology as in this contribution, the CVAR model.

Mukherjee and Naka (1995) focus their cointegration analysis on the Japanese stock market. They base their findings on monthly observations between 1971 and

¹¹ Other recent studies investigate the consequences of global excess liquidity. Since their focus is more on output and inflation than on the stock market, they are not described in detail. For example, Rüffer and Stracca (2006) analyze the consequences of global excess liquidity and liquidity spillovers on domestic variables in the US, the euro area and Japan in a VAR analysis for quarterly data between 1981 and 2004. Sousa and Zaghini (2004) estimate a structural VAR model to analyze the effects of global liquidity on euro area money stock, prices and output. In addition to academic contributions, the analysis of global liquidity and its consequences is on the radar of many investment banks and economic think tanks. See, for example, Heise et al. (2005), Financial Markets Center (2005, 2006), Sachs (2006) and BCA Research (2007).

1990 for the stock market and six macro variables. They find that money supply, among other variables, enters a relation with the stock market. However, since they do not interpret or show the adjustment coefficients towards this long-run relation, it is unclear whether or not the stock market reacts to the variables or only affects them.

Cheung and Ng (1998) apply cointegration analysis to country-specific economic real variables and the stock market. They analyze quarterly data for Canada, Germany, Italy, Japan and the US. The time periods differ but roughly cover the time between 1960 and 1990. They identify a negative relationship between the stock market and oil in four of the five countries and a positive relationship between consumption and the stock market in all countries. Results for real money and economic activity are ambiguous. Since they do not restrict the cointegration vectors, no t -values are reported. Consequently, the above results have to be interpreted with caution because it is unclear which of the variables form a statistically significant relationship.

Kwon and Shin (1999) analyze the relationship between macroeconomic variables and stock returns in Korea. They apply monthly data of the value-weighted Korea Composite Stock Price Index and the Small-Size Stock Price Index from 1980 to 1992. The macro variables included are industrial production and narrow money supply (M1) as well as the trade balance and the exchange rate; they account for the openness of the Korean economy and the importance of international trade. Their empirical analysis of cointegration and short-run adjustment shows that cointegration exists between the stock market and the macro variables. In addition, the macro variables cause the stock market, but not the other way round. Unfortunately, the cointegration analysis does not test for restrictions of the identified long-run structure and includes insignificant coefficients. Since the cointegration relation is normalized on the stock market variable, the significance of the stock market is unclear. Consequently, their results have to be interpreted with caution.¹²

Chaudhuri and Smiles (2004) analyze the relationship between the stock market and macroeconomic variables for Australia. They identify one cointegration relationship using quarterly data between 1960 and 1998. However, they do not provide information on the cointegration vector. Instead, their impulse response analysis shows that shocks to real GDP, real money and the real oil price have a negative effect on stock prices.

Ratanapakorn and Sharma (2007) focus their analysis on the US stock market (S&P 500) and investigate the relationship between stock prices and six macro variables. Their main finding is that all variables affect the stock market in the long run

¹² Maysami and Koh (2000) apply cointegration analysis to the Singapore stock market. They focus on a relatively short period of monthly data between 1988 and 1995. They identify a cointegration relationship between the stock market and the macro variables. However, no restrictions are tested. In addition, analysis of the adjustment coefficients shows that the stock market does not react to the long-run disequilibrium. Consequently, the derived results seem questionable and are not reported here. The same applies for analyses conducted by Wong et al. (2006) who perform cointegration analyses on the Singapore and US stock market.

but not in the short run. However, they admit that stock prices are relatively exogenous because 87% of stock market variance can be explained by shocks to the stock market, even after 24 months. They base their findings on monthly data between 1975 and 1999. They detect a clear positive relationship between the money supply and stock prices. However, they do not test restrictions of the long-run structure. Instead, they test whether variables can be excluded from the cointegration space (see test in Sect. 6.2.2.2). This test, however, only shows whether or not the variables react to or influence the system. The test does not provide information on the question of whether or not the stock market reacts to the variables included in the cointegration vector. In addition, the significance of the coefficients in the ‘untested’ long-run relation remains unclear. Hence, their results have to be viewed with caution as well.

Humpe and Macmillan (2009) compare the behavior of potential relationships between the stock market and a set of macro variables between the US and Japan. They apply monthly data from 1965 to 2005. For the US, they find that the S&P 500 forms a long-run relationship with real industrial production, consumer price inflation and the real 10-year bond yield. Industrial production influences the stock market positively, inflation and the long rate negatively. Real money (M1) does not play a role in the US stock market. The findings for Japan are different. While industrial production also plays a positive role for the Nikkei 225, the money supply and the stock market form a negative relationship. Unfortunately, Humpe and Macmillan do not provide any tests on parameter constancy. It seems questionable that the parameters of the cointegration relations and the adjustment coefficients are constant over the analyzed 40-year time span, which includes oil price shocks and high inflation in the seventies, the stock market and real estate boom-bust in the 1980s in Japan and different monetary regimes, at least in the US.

2.2 Academic Void

The foregoing discussion of the literature, which is related to the subject of this thesis, shows the existence of a wide array of angles in approaching the topic of money and stock prices. It also shows that over the last 50 years many authors have tried to prove that there is a relationship between money and stock prices. At the same time, many others have tried to show that this relationship does not exist or that it can not be exploited to gain excess returns. Some focus on anticipated effects, others on surprise effects. Obviously, this is not an exhaustive overview, simply because the amount of literature is too vast. Instead, the focus is on empirical investigations, which are close to the study at hand and have received considerable attention in the scientific community. Nevertheless many more exist.¹³

¹³ As an example, Flannery and Protopapadakis (2002) estimate a generalized autoregressive conditional heteroskedasticity (GARCH) model based on daily equity returns between 1980 and 1996. They include announcements of 17 macroeconomic series and find that nominal money supply

This summary of the main literature shows that most studies focus solely on the US market. While empirical methods have changed over the course of the years, the main result has remained the same: it is mixed. Some authors find a significant and causal relationship between money and stock prices, others show that the relationship does not exist at all and a third group shows that causality runs from stocks to money.

More recent research increased the focus from US analyses to global developments. Here, too, results differ. However, most observers agree that global liquidity is related to the most recent housing boom, which took place in many countries across the world. While some of the global studies focus on spillover effects onto national stock markets, none of them includes international capital flows.¹⁴ Capital flows, however, can directly measure how much 'additional' money flows in and out of a specific currency area.

For the most part, recent publications that focus on national stock markets and domestic macro variables apply cointegration analysis. Unfortunately, the interpretation of the results remains questionable since important information on the behavior of the variables in the system is ignored or not provided. For example, many analyses do not restrict the cointegration space, which enables empirical testing of the cointegration relations and provides information on the significance of the coefficients. In addition, the analysis of the short-run adjustment structure is widely ignored. This, however, is essential to determine whether or not the stock market reacts to the variables in the system.

The main conclusion that can be drawn from this discussion is that economists still argue over whether or not a relationship exists, and if it does exist, how important it is and in which direction causality runs. In addition, the discussion suggests that many important issues concerning stock price fluctuations are still open to empirical investigation.

Room for improvement exists via a full and correct analysis of liquidity conditions and stock market behavior in a CVAR framework, which includes long-run equilibria as well as short-run dynamics and the long-run impact of shocks to the variables. In addition, the application of the same approach to several countries enables the comparison of results and the determination of country-specific characteristics that might influence the interplay between money and stocks. Moreover, the inclusion of international capital flows in the analysis enables one to analyze domestic developments without ignoring the global factor. This is especially important for

affects the level and volatility of equity returns positively. Even though their study is related to the subject at hand, it differs in its objective and approach.

¹⁴ The studies that investigate capital flows mostly focus on the determinants of international capital flows (see, for example, van Wincoop and Tille (2007), Reinhart and Rogoff (2004), and Taylor and Sarno (1997)). Sometimes they include implications on economic growth but rarely in relationship to the stock market. An exception is the literature on the Asian financial crisis, where capital flow reversals ('hot money') are often scapegoated for triggering the crisis (see, for example, Mishkin (1999) and Sarno and Taylor (1999)). This, however, is only a point analysis without a focus on the overall role of capital flows.

monetary policy since central banks need to understand how macroeconomic variables interact in their respective currency areas. As a result, the analysis in this contribution adds new insights to the following fields of research:

- The relationship between stock market developments and monetary conditions.
- The impact of international capital flows on stock markets.
- Comparisons of stock market behavior across a broad range of countries.
- The analysis of central banks' ability to influence the stock market.
- The interaction of domestic macro variables with each other in an endogenous system.



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