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Asif M. Ruman

DIVIDENDS, FED'S TOTAL ASSETS, OUTSIDE MONEY AND STOCK MARKET PERFORMANCE

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Abstract

The literature shows that stock market performance can be predicted using financial ratios such as dividend yield and macroeconomic variables such as money supply and monetary policy tools. After the 2008 financial crisis, policymakers relied upon assets purchase programs because of near-zero interest rates, known as quantitative easing. The resemblance between a central bank's balance sheet size and outside money supply resurrects an age-old question: how does money supply affect stock market performance? This thesis comprises three essays and uses the asset-pricing framework to analyze stock market performance. The first essay highlights the role of high autocorrelation of dividend yield in predicting stock market return using dividend yield and payout yield. This essay shows that dividend yield does not predict price-series return that is the main component of market return.

Essays II and III analyze stock market performance using two different proxies for the financial demand for outside money supply. Specifically, essay II investigates the Fed's balance sheet size in the wake of unconventional monetary policy. Similarly, essay III discusses the similarities between the Fed's balance sheet size and the monetary base in addition to discussing the characteristics of different types of money supply. Collectively, essays II and III show that outside money supply (measured by the Fed's balance sheet size and the monetary base) compared to asset market wealth predicts stock market performance. These findings suggest that policymakers should strive to avoid a severe imbalance between outside money supply and asset market wealth.

Keywords: dividend yield, Fed's balance sheet size, inside vs. outside money, monetary base, payout yield, quantitative easing, return predictability, unconventional monetary policy

Ruman, Asif M., Yhdysvaltojen keskuspankin tase, rahan määrä ja osakemarkkinoiden performanssi.

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Tiivistelmä

Aikaisemmat tutkimustulokset osoittavat, että osakemarkkinoiden performanssia voidaan ennustaa tunnuslukujen, kuten osinkotuoton, ja makrotaloudellisten muuttujien, kuten rahan tarjonta ja rahapolitiikkan, avulla. Vuoden 2008 finanssikriisin jälkeen keskuspankit ovat rahapolitiikassan tukeutuneet erityisesti omaisuuserien osto-ohjelmiin (quantitative easing). Keskuspankin taseen ja rahan määrän välisestä suhteesta herää kysymys siitä, miten rahan tarjonta vaikuttaa osakemarkkinoiden performanssiin. Tämä väitöskirja muodostuu kolmesta tutkimusartikkelista, joissa tutkitaan osakemarkkinoiden performanssia omaisuuserien hinnoittelumallien teoriaa hyödyntäen. Ensimmäisessä tutkimusartikkelissa tutkitaan osinkotuoton korkean autokorrelaation merkitystä osakemarkkinoiden performanssin ennustamisessa käyttäen osinkotuottoa ja osinkosuhdetta muuttujina. Tuloksissa havaitaan, että osinkotuotto ei ennusta osakkeiden hinta-aikasarjan tuottoja.

Artikkeleissa 2 ja 3 analysoidaan osakemarkkinoiden performanssia käyttäen rahoituksen kysynnän ja tarjonnan näkökulmasta. Artikkelissa 2 tutkitaan erityisesti Yhdysvaltojen keskuspankin taseen kokoa epätavallisen rahapolitiikan ympäristössä. Artikkelissa 3 keskittyy vuorostaan tutkimaan keskuspankin taseen koon ja rahamäärän yhteneväisyyksiä raha tarjonnan lisäksi. Artikkeleiden 2 ja 3 tulokset näyttävät, että rahamäärä suhteutettuna arvopapereiden kokonaisarvon ennustaa osakemarkkinoiden performanssia. Näiden tulosten perusteella rahapolitiikassa tulisi välttää poikkeuksellisia eroavaisuuksia rahan tarjonnan ja arvopapereiden kokonaisarvon välillä.

Asiasanat: epätavallinen rahapolitiikka, osinkotuotto, rahan määrä, tuottojen ennustettavuus, Yhdysvaltojen keskuspankin tase

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December 2020 Asif M. Ruman

Abbreviations

CFS	Center for financial stability
CPI	Consumer price index
CRSP	Center for Research in Security Prices.
FA	Federal Reserve's total assets
FAMC	Fed's assets to market capitalization
Fed	Federal Reserve System
FRED	Federal Reserve Economic Data
GMM	Generalized Method of Moments
MB	Monetary base
MC	Stock market capitalization
MS	Money supply
OLS	Ordinary least square
TARP	Troubled Assets Relief Program

List of original essays

This thesis is based on the following manuscripts, which are referred throughout the text by their Roman numerals:

I Ruman, A. (2020). High autocorrelation of dividend yield and return predictability of dividend and payout yield (Manuscript).

II Ruman, A. (2020). Stock market implications of Federal Reserve's balance sheet size during 1926-2015 (Manuscript).

III Ruman, A. (2020). Stock market implications of quantitative easing and outside money supply (Manuscript).

Contents

1 Introduction

1.1 Background

An increase in aggregate dividend implies good business performance and signals good future stock market performance (Rozeff, 1984). This intuition is the basis for a large part of asset-pricing literature in which researchers predict future market performance using variables such as dividend yield and earnings yield (Lewellen, 2004; Lettau and Ludvigson, 2005; Ang and Bekaert, 2007; Goyal and Welch, 2008; McMillan et al., 2015; Maio and Santa-Clara, 2015). Dividend yield predicts future stock market return (Ball, 1978; Campbell and Shiller, 1988b, 1998; Fama and French, 1988, 1989, 2001) and this predictive power has been diminishing (Sabbatucci, 2015). Boudoukh et al. (2007) argue that the decreasing relevance of dividend yield is related to the increasing importance of share repurchases. They also show that payout yield, a sum of dividend and share repurchase yield, provides stronger evidence of return predictability.

A body of finance literature focuses on the effect of a highly auto-correlated explanatory variable (such as dividend yield) in the evidence of stock return predictability (Lanne, 2002; Goyal and Welch, 2002; Campbell and Yogo, 2006). High autocorrelation of dividend yield is especially problematic because dividend yield is present on both sides of the predictive regression. The accounting identity of Cochrane (1998) shows that dividend yield should predict future market return or dividend growth. Conversely, Goyal and Welch (2002) use the same accounting identity and show that dividend yield should predict future market return, dividend growth or future dividend yield.

Return predictability by dividend yield (Fama and French, 1988, 2001) and high autocorrelation of dividend yield (Lanne, 2002; Goyal and Welch, 2002) are well documented in the literature. However, since market return, the sum of dividend yield and price-series return, intrinsically contains dividend yield, the evidence of return predictability by dividend yield must be influenced by the high autocorrelation of dividend yield. Therefore, it is important to investigate the extent to which dividend yield's presence in market return affects the evidence of return predictability by dividend and payout yields.

After the 2008 financial crisis, stock market implications of the actions of central banks gained tremendous importance. A central bank can influence the real interest rates, real output and nominal prices. The existing literature documents the

impact of economic growth, monetary policy and different instruments of monetary policy on future stock market performance (Patelis, 1997; Lettau and Ludvigson, 2001; Bekaert and Engstrom, 2010; Huther et al., 2017). As a result of the 2008 financial crisis and near zero interest rates, major central banks resorted to large asset-purchase programs to save the troubled financial system and boost inflation under deflationary forces that increased their respective balance sheets. This policy is known as Quantitative Easing, QE (Borio and Drehmann, 2009; Joyce et al., 2011; Chen et al., 2016; Reis, 2016). Subsequently, how the balance sheet size of a central bank relates to stock markets became an important research question (Curdia and Woodford, 2011; Billi and Vredin, 2014; Gambacorta et al., 2014).

Moreover, a central bank's balance sheet size and the monetary base are very similar in that they both comprise mainly the currency in circulation and reserves held at a central bank (Rule, 2015; FRED, 2019). Given near zero interest rates and that the balance sheet size of a central bank has been in focus after the 2008 financial crisis (Christensen et al., 2015; Greenwood et al., 2016), the resemblance between a central bank's balance sheet size and the monetary base leads to a classical question: how does the quantity of money affect stock market performance? This question has been addressed by researchers such as Friedman (1988), Choudhry (1996), Carpenter and Lange (2002) and McMillan (2017). Specifically, McMillan (2017) documents a negative relation between broad money supply (M1, M2 and M4) and stock returns using the S&P Composite returns. McMillan (2017) shows that higher broad money supply leads to improvement in economic conditions and lower required return. Moreover, the resemblance between the monetary base and the balance sheet size of a central bank suggests that it is important to distinguish between different types of money supply and separately investigate their impact on stock market performance.

The money supply varies in terms of (1) narrow vs. broad money (Fisher, 1922), (2) outside money vs. inside money (Lagos, 2010) and (3) simple-sum money vs. Divisia monetary aggregates (Chrystal et al., 1994; Barnett et al., 2013). For example, outside money supply, narrow money supply or high-powered base money are mainly different names of monetary base closely related to the balance sheet of a central bank. Moreover, inside money is privately produced money that comes from inside the private sector of an economy. Because broad money supply mostly contains inside money supply (Lagos, 2010), Divisia monetary aggregates are useful to measure pure inside money supply that can even contain credit-card transactions (Barnett and Su, 2017).

All in all, outside money supply has two unique characteristics compared to inside money supply: (1) it arrives in the economy from outside the economy or out of thin air, hence, it is a net asset to the economy, (2) it does not require private backing as it carries the guarantee of the money-issuing authority (Stracca, 2007).

An increase in money supply positively relates to major indicators of the macroeconomy (Bernanke and Blinder, 1988). An increase in money supply implies higher business activity, aggregate consumption, sales, corporate profits, employment levels and inflation. Most of these positive indications of macroeconomy translate into better performance in the stock market (Rudebusch and Wu, 2008; Wheelock and Wohar, 2009; Reis, 2016).

1.2 Aims and expected contribution

This dissertation contributes to the literature that bridges the gap between macroeconomics and asset-pricing. To achieve its aims, this dissertation provides the empirical evidence that contributes to macro-finance literature. This is achieved using three essays that are mainly related via databases (CRSP, FRASER, FRED and CFS) and methodology. Moreover, the 2nd and 3rd essays are also related in terms of variables and economic significance. Using the asset-pricing framework of market return predictability, this dissertation investigates how stock markets relate to explanatory variables such as dividend and payout yields, the Fed's balance sheet size and different types of money supply.

Essay 1 follows the literature on dividend and return predictability (e.g., Rozeff, 1984; Campbell and Shiller, 1988b, 1998; Fama and French, 1988, 1989; Goyal and Welch, 2002, 2008; Cochrane, 2008; Pástor and Stambaugh, 2009; Jagannathan and Liu, 2019) investigating the role of high auto-correlation of dividend yield in the evidence of return predictability offered by dividend yield (e.g., Campbell and Yogo, 2006) and payout yield (e.g., Boudoukh et al., 2007). Market return is price-series return plus dividend yield and the previous literature shows that current dividend yield successfully predicts future dividend yield. Thus, an intuitive question is: should one predict market return that includes highly persistent dividend yield with lagged dividend yield?

In essay 1, I argue that a considerable part of return predictability by dividend yield is due to high autocorrelation of dividend yield. If dividend yield effectively predicts market return and not just itself, it should also predict the main component of market return, i.e., price-series return. Given that payout yield has somewhat low autocorrelation compared to dividend yield, to what extent does the predictive

power of payout yield suffer due to the presence of dividend yield on both sides of the predictive regression?

By comparing the evidence of predictability by the dividend yield for market return with the evidence for price-series return, I aim to segregate and thus highlight the impact of autocorrelation of dividend yield in the existing empirical evidence. By doing so, I aim to contribute to the existing asset-pricing literature that highlights the persistence of the explanatory variable and its impact on the evidence of predictability (e.g., Goyal and Welch, 2002; Lanne, 2002; Campbell and Yogo, 2006). Furthermore, by adding the impact of share-repurchases to dividends, I follow, e.g., Boudoukh et al. (2007) to highlight the rising importance of payout yield in the evidence of return predictability offered by payout yield.

Essays 2 and 3 investigate how the balance sheet size of a central bank and aggregate money supply affect future market performance. Before the 2008 financial crisis, the general perception among policymakers and economists was that lowering interest rates should ease the demand for money. But as the interest rates approached the zero-lower-bound (see e.g., Ball, 2016), the focus shifted towards quantitative easing (Greenwood et al., 2016). This resulted in a huge increase in the balance sheet size of major central banks in the world (e.g., Brunnermeier, 2009; Reis, 2016). The monetary base is the sum of currency in circulation and reserves held at a central bank (e.g., FRED, 2019). This makes monetary base very similar to the liabilities side of the stylized balance sheet of a central bank (e.g., Rule, 2015). Taken together, it becomes apparent that the balance sheet of a central bank is closely related to the monetary base.

To broadly analyze stock market implications of monetary policy (Bjørnland & Leitemo, 2009), it is relevant to see how the financial demand for outside money (i.e., the monetary base) affects stock market performance. Moreover, the huge size of the US stock market, high volatility of stocks and the ability of financial markets to drag the entire economy into recession suggest that future stock market performance is, as it should be, an important indicator for policymakers.

Essay 2 aims to contribute to the macro-finance literature (e.g., Bordo and Jeanne, 2002; Gambacorta et al., 2014; Cieslak et al., 2015; Chen et al., 2016; Cieslak, 2018) by showing how the Fed's balance sheet size compared to asset market wealth affects future stock market performance. A similar question is also explored by Joyce et al. (2011) in the context of the United Kingdom. Moreover, essay 2 explores alternative explanations for the relation between the Fed's balance sheet size and stock market performance.

The empirical results of essay 2, albeit interesting and relevant to the recent macroeconomic situation, raise a few questions. For example, what is the theoretical justification of this potential relation and does it hold in the case of other major central banks? Given that the balance sheet of a central bank greatly resembles the monetary base, how does this empirical evidence change when the same procedure is applied using various proxies of money supply, i.e., outside monetary base, inside money supply and broad money supply? How do these results withstand the out-of-sample predictability exercise (Goyal and Welch, 2008; McMillan, 2017), impulse response analysis, regime switching model (Ang and Timmermann, 2012; Rapach and Zhou, 2013) and VAR analysis as in McMillan (2017). These unanswered questions represent the limitations of essay 2 and the direction for future research.

Lastly, essay 3 represents the continuation of essay 2. Given the resemblance between a central bank's balance sheet and the monetary base, this essay aims to show how the empirical evidence of essay 2 changes once outside money supply replaces the Fed's balance sheet size. Additionally, it explores various types and characteristics of money supply, e.g., narrow vs. broad money, inside vs. outside money, simple sum vs. Divisia monetary aggregates (See e.g., Barnett, 2000; Lagos, 2010). By doing so, essay 3 aims to contribute to the literature, such as Friedman (1988), Choudhry (1996), Carpenter and Lange (2002) and McMillan (2017), by examining the predictive power offered by broad money supply (such as McMillan, 2017) as well as the predictive power offered by narrow money, inside money and outside money supply.

1.3 Structure of the dissertation

The structure of this dissertation is as follows: Chapter 1 provides background, aims, expected contribution and the structure of the dissertation. Chapter 2 presents the background literature, asset-pricing and motivational framework. This chapter presents the theoretical framework, originating from Campbell and Shiller (1988b), that this dissertation uses following the asset-pricing literature. Moreover, this chapter discusses money supply and how the financial demand for money varies due to different characteristics of money supply (Barnett, et. al. 1984; Stracca, 2007; Lagos, 2010). This chapter shows that the high-powered monetary base (Brunner, 1989) is closely related to the Fed's balance sheet size (Rule, 2015). Lastly, this chapter discusses why outside money supply is important for future stock market performance.

Chapter 3 provides a summary of contributions of each essay and finally chapter 4 provides the main implications of these findings, a few limitations of the study and the future direction.

2 Theoretical and motivational framework

2.1 Review of asset-pricing literature

Origins of the asset-pricing literature can be traced in Dow (1920) and Cowles (1933). Cowles (1933), in his paper titled, "Can Stock Market Forecasters Forecast?", suggests that stock return forecasters cannot forecast. Analyzing broad market indices, Alexander (1964) suggests that portfolios formed based on certain filter rules outperform buy-and-hold index return. Focusing on individual stocks, researchers such as Cootner (1962), Fama and Blume (1966), and Jensen and Benington (1970) suggest that portfolios formed based on filter rules and technical indicators generally fail to outperform buy-and-hold portfolios, after transaction costs. These findings laid the foundation for the efficient market hypothesis (Fama & Malkiel, 1970) and the random walk model (Malkiel, 1973).

The asset-pricing literature advanced significantly during the 1980s and afterwards. Extensive literature compiles the evidence that a variety of economic variables predict aggregate stock returns on monthly, quarterly and annual frequencies using the predictive regression framework (Rapach and Zhou, 2013). For example, dividend yield is one of the oldest and most researched indicators in asset-pricing literature (Rozeff, 1984; Campbell and Shiller, 1988b, 1998; Fama and French, 1988, 1989, 2001; Cochrane, 2008; Lettau and Van Nieuwerburgh, 2008; Pástor and Stambaugh, 2009; Sabbatucci, 2015; Jagannathan and Liu, 2019). Other predictive variables include[1]:

Earnings yield (Campbell and Shiller, 1988a, 1998),

Book-to-market (Kothari and Shanken, 1997; Pontiff and Schall, 1998),

Nominal interest rates (Fama and Schwert, 1977; Breen et al., 1989; Ang and Bekaert, 2007),

Interest rate spreads (Campbell, 1987; Fama and French, 1989),

Monetary policy (Patelis, 1997),

Inflation (Nelson, 1976; Campbell and Vuolteenaho, 2004),

Dividend-payout ratio (Lamont, 1998),

[1] These variables and respective references are only a small selection of the possible choices.

Corporate issuing activity (Baker and Wurgler, 2000; Boudoukh et al., 2007),

Consumption-to-wealth ratio (Lettau and Ludvigson, 2001),

Stock market volatility (Guo & Savickas, 2006),

Labor income (Santos & Veronesi, 2005),

Aggregate output (Rangvid, 2006),

Output gap (Cooper and Priestly, 2008),

Expected business conditions (Campbell and Diebold, 2009),

Oil prices (Driesprong et al., 2008),

Lagged industry portfolio returns (Hong et al., 2007), and

Accruals (Hirshleifer et al., 2009).

However, a major portion of evidence is in-sample predictability. In-sample return predictability using predictive regressions suffers from Stambaugh's (1999) bias, especially when the predictor variable is highly persistent. To address this issue, researchers such as Amihud and Hurvich (2004), Lewellen (2004), Torous et al. (2005), Campbell and Yogo (2006), Pástor and Stambaugh (2009), and Amihud et al. (2010) develop procedures for improving inference in predictive regressions with persistent predictors. One issue in long-horizon return predictability is that return observations are usually overlapping, resulting in serial correlation in the error-term. To address the statistical repercussions of regression results with overlapping returns, many researchers have developed econometric procedures for making more reliable inferences (See for example, Hodrick (1992), Goetzmann and Jorion (1993), Nelson and Kim (1993), Valkanov (2003), Boudoukh et al. (2006), and Hjalmarsson (2010)).

Moreover, researchers such as Bossaerts and Hillion (1999), Goyal and Welch (2002, 2008), Brennan and Xia (2005), and Butler et al. (2005) argue that the in-sample evidence of return predictability is not enough. The evidence of return predictability should be robust to out-of-sample validation. The most popular metric for evaluating forecast accuracy is 'mean squared forecast error', i.e., MSFE (Campbell and Thompson, 2007; Goyal and Welch, 2008; Rapach and Zhou, 2013; McMillan D. G., 2017). If R^2_{OS} represents out-of-sample R-squared, $MSFE_i$ represents mean squared forecast error for the predictive regression forecast over

the forecast evaluation period and $MSFE_0$ represents MSFE for the historical average benchmark forecast, then R^2_{OS} is given by;

$$R^2_{OS} = 1 - (MSFE_i / MSFE_0)$$

R^2_{OS} greater than zero suggests that the predictive regression forecast is more accurate than the historical average in terms of mean squared forecast error. Similarly, R^2_{OS} less than zero suggests that the predictive regression forecast is less accurate than the historical average in terms of MSFE (Campbell and Thompson, 2007).

Using economic variables from the literature, Goyal and Welch (2008) show that out-of-sample equity premium forecasts based on the bivariate predictive regression mostly fail to outperform the simple historical average benchmark forecast in terms of MSFE. With extensive empirical analysis, Goyal and Welch (2008) suggest that evidence based on predictive regressions fails to outperform the historical average and is unreliable.

Surveying the literature, Rapach and Zhou (2013) suggest certain approaches that have been recently used to improve the odds of predicting stock returns. These approaches include (1) economically motivated model restrictions, (2) use forecast combinations, (3) diffusion indices and (4) regime shifts. For example, Campbell and Thompson (2007) recommend imposing sign restrictions on coefficients and returns. Similarly, Ferreira and Santa-Clara (2011) consider other types of restrictions on stock return forecasts involving valuation ratios, e.g., sum-of-the-parts method, in which stock returns are converted into two components, capital gains and dividend yield.

2.2 Asset-pricing framework

Cochrane, (1998) uses the dividend-price ratio (DP) to derive the accounting identity below.

$$1 = R_{t+1}^{-1} R_{t+1} = R_{t+1}^{-1} \left(\frac{P_{t+1}+D_{t+1}}{P_t}\right).$$

$$\frac{P_t}{D_t} = R_{t+1}^{-1} \left(\frac{P_{t+1}+D_{t+1}}{D_t}\right) = R_{t+1}^{-1} \left(\frac{P_{t+1}}{D_{t+1}} + 1\right) \frac{D_{t+1}}{D_t}.$$

$$\frac{P_t}{D_t} = \sum_{[j=0]}^{\infty} \prod_{k=1}^{j} R_{t+k}^{-1} \frac{D_{t+k}}{D_{t+k-1}} + \lim_{j\to\infty} \left(\prod_{k=1}^{j} R_{t+k}^{-1}\right) \frac{P_{t+j}}{D_{t+j}}.$$

Following Campbell and Shiller (1988), Taylor expansion is performed to the above equation:

$$DP_t = Rm_{t+1} - \triangle D_{t+1} + \kappa DP_{t+1} - K. \quad (1)$$

$$DP_t = \sum_{[i=0]}^{\infty} \kappa^i [Rm_{t+1+i} - \triangle D_{t+1+i}] + constant. \quad (2)$$

Goyal and Welch (2002) define Rm_t as market return, $\triangle D_t$ as dividend growth, DP_t as dividend to price, $\kappa = {}^{1}/_{(1+e^{DP_t})}$ and $K = -log\kappa - (1-\kappa)log({}^{1}/_{\kappa-1})$. The widely used interpretation of Cochrane's accounting identity corresponds to Eq. (2), i.e., dividend price (DP_t) must predict either the long-run future returns or the long-run dividend growth rate (Cochrane, 1998)**.** According to Goyal and Welch (2002), Eq. (1) seems more informative for finite-period ahead prediction. It states that dividend-price must predict either next period market return, dividend growth or dividend-price ratio. Dividend-price ratio is also referred to as dividend yield by some authors such as Fama and French (1988). Although dividend-price depicts similar statistical characteristics such as mean, standard deviation and auto-correlation as dividend yield, this dissertation focuses on dividend yield defined as ${}^{D_t}/_{Pt-1}$, since dividend yield defined as ${}^{D_t}/_{Pt-1}$ is also present in the definition of market return (e.g., Goyal and Welch, 2002, 2008).

Eq. (1) and Eq. (2) from the accounting identity provide the theoretical base for the predictive regression analysis. Consider a first-order VAR representation of log returns, log dividend-price ratios and log dividend growth (Cochrane 2011).

$$r_{t+1} = \alpha_r + b_r dp_t + \epsilon_{t+1}{}^r \quad (3)$$

$$d_{t+1} = \alpha_d + b_d dp_t + \epsilon_{t+1}{}^d \quad (4)$$

$$dp_{t+1} = \alpha_r + \varphi dp_t + \epsilon_{t+1}{}^{dp} \quad (5)$$

The present value identity (Eq. 1 and Eq. 2) implies that the regression coefficients in Eq. (3), Eq. (4) and Eq. (5) are related by:

$$b_r - b_d + \gamma\varphi \approx 1 \quad (6)$$

where γ is defined as $\gamma = \frac{exp(-\overline{dp})}{1+exp(-dp)}$ and $\overline{dp}$ is the mean log dividend-price ratio. This theoretical framework forms the basis for a major portion of the asset-pricing literature. Researchers have modified this framework according to their research objectives and economic intuition (Sabbatucci, 2015). For example, Lettau and Ludvigson (2001) investigate the interaction between aggregate consumption,

aggregate total wealth (most of which is aggregate asset market wealth measured by stock market capitalization) and expected stock market return (see Fig. 1).

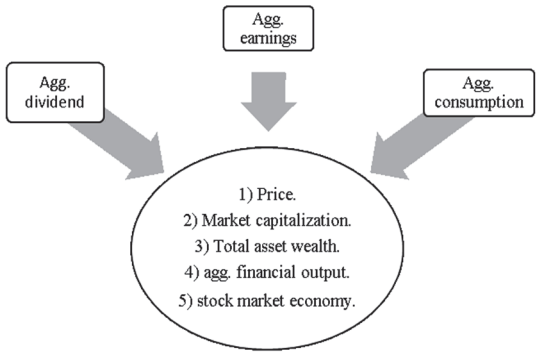

Fig. 1. Aggregate dividend, earnings or consumption compared to asset market wealth and stock market performance.

Moreover, Eq. 3 is closely related to the univariate predictive regression Eq. 7 by Fama and French (1988) that is used in this dissertation following the asset-pricing literature, where x is an explanatory variable of interest. In the first essay, the variables of interest are dividend and payout yields. In the second essay, the variables of interest are the Fed's balance sheet size and the Fed's balance sheet size deflated by asset market wealth. Lastly, in the third essay, the variables of interest are various types of aggregate money supply deflated by asset market wealth.

$$r_{t+1} = \alpha_r + b_r . x_t + \epsilon_{t+1}{}^r \tag{7}$$

2.3 Money supply and financial demand for money

Money serves as a medium of exchange. Money supply comprises safe assets that households and businesses use to make payments or investments (Lagos, 2010). The aggregate money supply definition varies from narrow vs. broad money, outside vs. inside money and simple-sum vs. Divisia monetary aggregates. The monetary base is conventionally characterized as narrow money supply and M1, M2, M3, etc., are called broad proxies of money supply. The US central bank defines the monetary base as the sum of currency in circulation and reserve balances, i.e., deposits held by banks and other depository institutions in their

accounts at the central bank (FRED, 2019). M1 is the sum of currency held by the public and transaction deposits at depository institutions (which are financial institutions that obtain their funds mainly through deposits from the public, such as commercial banks, savings and loan associations, savings banks, and credit unions).

Lagos (2010) provides the distinction between outside and inside money. Outside money can be defined as the fiat money that is not backed by anything or is backed by some asset that is not in zero net supply within the private sector of the economy. Therefore, outside money is a net asset for the private sector. The qualifier 'outside' is short for coming from outside the private sector. Conversely, inside money is an asset representing any form of private credit that circulates as a medium of exchange. Since it is one private agent's liability and at the same time some other agent's asset, inside money is in zero net supply within the private sector.

How to keep record of aggregate money supply in an economy? The widely used method is simple: just take the arithmetic sum of various types of assets that are money or type of money. This is referred to as simple sum monetary aggregate. According to simple sum, all the heads in M1, M2 and M3, etc., are perfect substitutes. The Divisia monetary aggregates measure demand-side monetary services, using the economic aggregation and index number theory developed by Barnett et al. (1984). The Divisia monetary aggregates give different weights to different monetary assets.

The monetary base is the sum of currency in circulation and reserves held at a central bank (FRED, 2019). Moreover, the stylized balance sheet of a central bank is given in Table 1 (Rule, 2015). Notice that total liabilities of a central bank mainly comprise of banknotes and reserves. Given the zero lower bound and quantitative easing, the resemblance between a central bank's balance sheet and the monetary base raises the question: how does the monetary base relate to future market performance?

Table 1. Stylized balance sheet of a central bank.

Assets	Liabilities
Foreign Assets (net)	Banknotes
Government balances (net)	Commercial bank reserves
Central bank operations (net)	
Other items (net)	Capital and Reserves

2.4 Outside money supply and stock market performance

Compared to inside money supply, outside money supply has two unique characteristics. First, it arrives in the economy from outside the economy or out of thin air; therefore, it is a net asset to the economy. Second, it does not require private backing as it carries the guarantee of a money-issuing authority (Stracca, 2007). Low interest rate regimes during the last two decades enabled economic agents' cheaper access to inside money. Agents with good enough credit worthiness can access as much inside money as required (Kiyotaki and Moore, 2000), however, credit worthiness itself is a time-varying concept.

For example, ability to access inside money can reach a point of saturation. Similarly, financial condition, job or life situation of some agents can change, subsequently affecting the credit worthiness of some agents. Additionally, some economic agents may have poor credit worthiness and therefore cannot access inside money at all. Due to several reasons, if a considerable portion of society cannot access inside money, it will adversely affect aggregate consumption, sales and corporate profitability. Moreover, this negatively affects economic outlook and stock markets are quick to react to a worsening economic outlook. Hence, the segment of society that cannot access inside money adds to the demand for outside money supply.

Therefore, policymakers should notice any possible imbalance between outside money and asset market wealth because a severe imbalance between outside money supply and aggregate financial output should signal increased financial demand for outside money (Friedman, 1988).

3 Summary of Original Essays

3.1 Essay I: High autocorrelation of dividend yield and return predictability by dividend and payout yields.

Asset-pricing literature shows that dividend yield predicts future market return (Fama and French, 1988) and that the predictive power diminishes over time (Sabbatucci, 2015). Boudoukh et al. (2007) argue that the decreasing relevance of dividend yield is related to the increasing importance of share repurchases. They also show that payout yield provides stronger return predictability. The literature shows that current dividend yield successfully predicts future dividend yield (Lanne, 2002). Given the definition of market return, i.e., price-series return plus dividend yield, an unanswered question is: should one predict market return that includes highly auto-correlated dividend yield with lagged dividend yield as an independent variable? Essay I highlights the impact of high autocorrelation of dividend yield in return predictability offered by dividend yield and payout yield. Essay I uses the CRSP database during 1926-2015 and follows the asset-pricing literature (Ang, 2007, 2012; Sabbatucci, 2015) to compare the predictive power by dividend yield and payout yield for market return and price-series return.

Essay I shows that current dividend yield does not predict future market return, instead, it predicts future dividend yield present in market return. These findings weaken the theoretical argument of accounting identity, since dividend yield does not predict price-series return anymore, nor does it predict future dividend growth[2]; it only predicts future dividend yield, implying that high autocorrelation of dividend yield derives the empirical evidence of market return predictability by dividend yield.

The second contribution shows that the predictive power of payout yield is not primarily driven by high autocorrelation of dividend yield that is present on both sides of predictive regression. Rather, the superior predictive power of payout yield can be attributed to share repurchases that have gained importance due to the rise of tech startups in recent decades. These results also strengthen an already established argument that payout yield, as opposed to dividend yield, offers a

[2] To say that the dividend yield does not predict future dividend growth (e.g., Cochrane, 1998, 2008; Lettau and Ludvigson, 2005; Lettau and Van Nieuwerburgh, 2008) is not the complete story. Chen (2009) shows that it depends on how dividends are defined. If dividends are assumed to be reinvested in the market, the recent literature (e.g., Chen, 2009; Van Binsbergen and Koijen, 2010; Sabbatucci, 2015; Jagannathan and Liu, 2019) shows that the dividend yield predicts future dividend growth.

complete picture of corporate payouts to the shareholders (e.g., Boudoukh et al., 2007).

3.2 Essay II: Stock market implications of a central bank's balance sheet size during 1926-2015.

The impact that macroeconomy, monetary policy or individual tools of monetary policy have on future stock market return are well documented in the literature (Patelis, 1997; Borio and Drehmann, 2009; Huther et al., 2017; Cieslak, 2018). However, the impact of a central bank's balance sheet size on stock markets gained researchers' attention after the 2008 financial crisis (Curdia and Woodford, 2011; Carpenter et al., 2013; Rule, 2015; Greenwood et al., 2016). Essay II investigates how the Fed's balance sheet size affects US stock market performance. The importance of this topic arises from quantitative easing and near zero interest rates (e.g., Ball, 2016).

The empirical results of essay II show that the Fed's balance sheet size compared to asset market wealth – FAMC – predicts future stock market performance. The evidence is robust against various sample-periods, horizons and control variables, potential outliers and major financial crashes. An increase in FAMC ratio due to an increase in the Fed's balance sheet size (e.g., accommodating monetary policy) decreases the overall systematic risk and required rate of return. This decreased required rate of return implies higher realized stock return. Conversely, an increase in FAMC due to decreased asset market wealth implies higher future stock return due to the mean-reverting nature of stock returns.

Overall, an expansionary monetary policy increases the wealth of the agents that increases aggregate consumption (e.g., Ludvigson and Steindel, 1998). This implies better future stock market performance through the wealth channel of monetary policy. These empirical findings imply that central banks, policy supervisors and macroprudential authorities should strive to avoid a severe imbalance between a central bank's balance sheet size and asset market wealth.

3.3 Essay III: Stock market implications of financial demand for outside money supply.

Essay III analyzes the main characteristics of different types of money supply such as inside vs. outside money, narrow vs. broad money and simple-sum money vs. Divisia monetary aggregates. Moreover, it highlights the similarity between the

Fed's balance sheet size and the monetary base that is mainly outside money supply. Given that interest rates cannot drop too much below zero and large-scale asset-purchase programs by major central banks (Reis 2016), it is important to see how the evidence presented in essay II changes once the Fed's balance sheet size is replaced by outside money supply. Specifically, how the financial demand for money predicts future stock market performance. The findings in this essay contribute to the literature that focuses on quantitative easing, money supply and stock market performance, e.g., Choudhry, (1996); Carpenter and Lange, (2002), McMillan, (2017) and essay II in this dissertation.

The empirical evidence in essay III shows that the financial demand for outside money supply, e.g., the monetary base, predicts future stock market performance during 1926-2017 and various subsamples, robust against standard control variables. Conversely, the financial demand for broad money or inside money supply does not predict future market performance. This differing predictive power based on the demand for different types of money can be explained by noticing the differences in the characteristics of each type of money supply. For example, the demand for outside money arises from the segment of population that cannot access inside money. Due to lack of access to money, these economic agents exert downward pressure on main macroeconomic indicators of growth. Specifically, if some agents cannot access money to satisfy their needs, it should negatively affect aggregate consumption, sales and corporate profits and that worsens the economic outlook and expected stock market performance.

Consistent with essay II, these findings imply that policymakers should avoid a severe imbalance between outside money supply and asset market wealth.

4 Implications and future research directions

Collectively, the findings in essays II and III have monetary policy and macroprudential implications such that policymakers should notice whether outside money supply is in harmony with asset market wealth. Although the financial demand for inside money is also important, policymakers have already been focusing on lowering interest rates for quite some time and during last decade interest rates have been near zero. Moreover, the access to inside money supply relates to credit worthiness. Conversely, an increase in outside money is a net asset to the overall economy and does not require private backing since it contains the backing of a money-issuing authority.

These findings show that around the Dot-Com bubble, the financial demand for outside money was high. Policymakers lowered interest rates as much as possible and that somewhat facilitated the (cheaper) access to inside money (Stracca, 2007; Lagos, 2010). Cheaper and easier access to inside money helped the economy to some extent by enabling easier access to NINJA (no income, no job or assets) loans. However, since inside money is not a perfect substitute for outside money supply, in 2007 the financial demand for outside money peaked again. This time lowering interest rates to zero or below zero did not prove to be enough. Subsequently, the 2008 financial crisis led to massive asset-purchases by major central banks, i.e., an increased outside money supply.

This empirical evidence has some limitations. For example, these findings require more theoretical understanding that calls for more research. Moreover, how these results withstand the out-of-sample predictability exercise (Goyal and Welch, 2008; McMillan, 2017), impulse response analysis, regime switching model (Ang and Timmermann, 2012; Rapach and Zhou, 2013) and VAR analysis as in McMillan (2017). After 2008, policymakers have increasingly relied upon dynamic stochastic general equilibrium (DSGE) modelling; therefore, it is important to incorporate the literature on DSGE models (e.g., Christiano et al., 2018). Similarly, it is relevant to conduct a cross-sectional analysis that involves major central banks and stock markets, as in Gambacorta et al. (2014).

Finally, findings in essay I suggest that in the age of technology, dividend yield has lost the signaling advantage that it once offered because of high information asymmetry among stock market participants before the internet. For example, if Amazon does not pay a dividend, it does not imply that Amazon's share price should perform poorly in the next period. Additionally, firms are increasingly relying upon share buybacks. Thus, payouts have already gained huge importance.

Future research should construct other proxies of dividend yield as a robustness check and investigate how these findings hold for dividend-price and earnings-price ratio. Another interesting future direction can be to see how these findings hold in the case of industry and size portfolios. Moreover, future research should focus on rising share repurchases and rising corporate debt.

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