The Money Multiplier and Asset Returns

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Abstract

In this paper, I study the relationship between aggregate money balances and subsequent stock and bond returns. I find that levels of broad money multipliers (the ratios of broad money to narrow money) forecast future returns with a negative sign, while changes in these multipliers forecast returns with a positive sign. These findings indicate that levels of multipliers are pro-cyclical: they tend to be high at times of low expected returns. The money multipliers' dynamics indicates changes in the volume of financial intermediation and the level of net leverage, consistent with credit-cycle theories of macroeconomic fluctuations.

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1 Introduction

In recent years, we have lived through times of unprecedented money and credit creation. This has prompted new interest in the role of money and credit in the economy and their impact on financial markets and economic fundamentals. Many theoretical models have tried to link money and credit creation to asset prices; however empirical work has not. At the same time, growing literature discusses the importance of leverage in the economy (Kiyotaki and Moore (1997), Geanakoplos (2010), Brunnermeier and Pedersen (2009), Adrian and Shin (2014) and many others), but very little work has documented the relationship between asset returns and aggregate measures of leverage and credit. This paper links the ideas of money creation and leverage and to fill the gap in empirical work.

In this work, I show that money multipliers, ratios of inside money to outside money, predict asset returns. I look at the past 59 years of U.S. stock market returns and show that what matters most for asset prices is the creation of inside money per dollar of outside money, rather than the quantity of money per se. In particular, I show that growth in money multipliers robustly predicts stock market excess returns over the period January 1959 - December 2015 (see Table 1 below). These multipliers remain statistically significant after controlling for outside money growth, while the t-statistics for outside money growth itself are very low. The $\bar{R}^2$ of around 5% for quarterly data increases to up to 17% for annual data.

Table 1: OLS estimates from a predictive regression of log U.S. stock market excess returns (CRSP value-weighted index): $r^e_{m,t+1} = \alpha + \beta X_t + \gamma \Delta lnMB_t + \varepsilon_{t+1}$. X_t is the money multiplier growth rate measured as the first difference of the log of the ratio of a broad money aggregate to the monetary base MB. $\Delta lnMB_t$ is the first difference of the log of the monetary base. I consider three monetary aggregates: M1, M2 and MZM (Money Zero Maturity). T-statistics in italics, quarterly data, 1959 Q1 - 2015 Q4.

X	β	γ	$\bar{R}^2$
$\Delta^{M1}/_{MB}$	0.74	0.23	4.69%
	2.32	*0.78*	
$\Delta^{M2}/_{MB}$	0.92	0.49	3.72%
	1.75	*0.95*	
$\Delta^{MZM}/_{MB}$	0.70	0.26	5.00%
	2.47	*0.88*	

While multiplier *growth* predicts market returns positively, its *level* predicts returns negatively. When more inside money is generated per dollar of the monetary base, the multiplier increases and so, subsequently, do stock prices. However, when the level of the multiplier is high, stock prices are high and expected returns are low. Thus the money multiplier is procyclical. These results are robust to controlling for inflation, stock market volatility, federal funds rate, total loan growth and some other key economic indicators, and also hold out of sample (Goyal and Welch (2008)). Furthermore, I show that changes in the multipliers are priced in the cross-section. Value stocks are more sensitive to the growth of inside money, and up to 10% of the variation of their quarterly returns is explained by variation in the money multiplier. I separately estimate the impact of inside and outside money in the cross-section and find that in all cases inside money matters more.

This paper argues that the money multiplier can be interpreted as a measure of net economy-wide leverage, since it captures the total amount of credit created in the economy per dollar of cash and reserves. Traditionally, it is common to distinguish between outside money, liabilities of the central bank created by central bank fiat, and inside money, liabilities of the rest of the private banking sector, with the latter responding endogenously to the demand for money of the wider economy. In this work I document the predictive properties of their relative dynamics. I also argue that the money multiplier is a better measure of leverage than those previously considered in the literature. It accounts for netting of interbank loans as well as for synthetic leverage, such as repos and money market funds.

When more net leverage is generated in the economy, the multiplier grows, and so do stock prices. One can speculate about the exact link between the two. One possibility is that rising optimism or risk tolerance induces people to lend money to each other more easily and invest in stocks more willingly. It is also possible that there is a financial friction that results in inside money fluctuation and consequently in the fluctuation of asset prices, as in financial accelerator models (Bernanke and Gertler (1995)) or models of funding liquidity (Brunnermeier and Pedersen (2009)). My empirical findings can be reconciled with models of the leverage cycle (e.g. Geanakoplos (2010)). Independently of the underlying mechanism, variation in inside money creation forecasts market excess returns.

In this work I make a theoretical link between stock prices and the money multiplier using the margin CAPM described in Ashcraft et al. (2011) and Frazzini and Pedersen (2014). In this model, money is created for the purpose of investing into a portfolio of stocks. Agents are born with some cash endowment, which they have to pledge against their loan together with the portfolio of stocks that they purchase. Agents differ by their leverage ratio, aggregated level of which equals the scaled ratio of total assets held by all agents over the total value of cash pledged. Since in this economy all money is invested in risky assets, the aggregate leverage ratio equals the scaled money multiplier.

This paper serves two purposes. First, it links the extensive literature on money and credit creation to models of leverage. Second, it introduces a new measure of leverage that spans not only financial intermediation sector, but the whole economy, thus providing a new metric for testing theories.

As such, my paper contributes to several fields of the existing financial literature. It relates to the literature on the predictability of stock returns by macro variables and to the ongoing discussion about the role of money and credit in driving the economy and financial markets. It fits into a growing literature following the 'credit view', that suggests that the structure and quantities of bank credit affect real economic decisions (Mishkin (1978), Bernanke (1983) and Gertler (1988)). Currently, most empirical papers in this field look at credit and money creation in relation to the financial crisis (Congdon (2005), Schularick and Taylor (2012), Jorda et al. (2015)), or at its impact on real activity (Adrian and Shin (2010)). I look at the relationship of money and stock prices, and document the money multiplier predictive power for aggregated stock market returns over different time horizons and show that it is priced in cross-section. To my knowledge these empirical findings are novel. Schularick and Taylor (2012) address the link between the ratio of bank loans/assets to money balances and broad stock market indices across a range of countries. However, they also focus on periods of financial crisis and show that lagged credit growth is a significant predictor of the crisis. The empirical results presented in current paper are the closest to Adrian et al. (2013), who look at predictability of stock and bond returns by different measures of broker-dealer leverage. While the multiplier can be interpreted as a leverage ratio, this paper emphasises the role of money creation for asset prices, and in particular, it pins down the greater importance of inside money creation relative to outside money. This newly documented empirical fact bridges the growing credit literature and classic Keynesian macroeconomics.

At the same time, the majority of the credit literature focuses on the effect of credit creation alone, while this paper looks at the relative growth of inside money with respect to outside money, thus capturing the dynamics of both. King and Plosser (1984) were the first to address the difference between outside and inside money, pointing out that the former react to demand-type shocks, while the latter react more to supply-type shocks. With the growth of direct corporate lending during the past 25 years, the difference between the dynamics of inside money and outside money has become more pronounced, since demand and supply shocks often happen in different times. Thus the combination of these two very different dynamics underlines the role of efficient financial intermediation and results in strong predictive power for the multiplier.

On the other hand, this paper adds to the growing literature that links leverage to asset prices within the CAPM framework. Adrian et al. (2014), Adrian et al. (2013) and others show that intermediary leverage explains a large portion of contemporaneous stock returns and is priced in cross-section. My paper differs from this work, because I focus on a predictive relationship and because of the new measure of leverage that I use. Most of empirical work in this literature considers margin constraints and leverage of financial intermediaries, while I look at a measure of leverage that spans the non-financial sector as well. The latter is important, since households (non sophisticated investors) hold a large share of the stock market.

The rest of this work is organised as follows. Section II discusses inside money creation and motivates the money multiplier as a proxy for economy-wide leverage, section III presents the model and derives theoretical predictions, section IV presents the empirical findings and section V concludes.

2 The money multiplier as a measure of leverage

This section provides a brief overview of the measures of money supply in the U.S. economy, an introduction to the money multiplier, and a discussion of how the multiplier is a better measure measure of the economy-wide leverage.

2.1 Measures of money supply, inside and outside money.

In the U.S., money supply is measured using monetary aggregates. The most narrow aggregate is the monetary base (MB). It consists of cash and reserves and measures the most liquid money in the economy. This aggregate is the only one that can be directly controlled by the central bank via either printing money, or setting the federal funds rate, and is often referred in literature as outside money (Hartley and Walsh (1986)). M1 and M2 monetary aggregates consider a broader definition of money and are progressively less liquid. M1 consists of currency in circulation and non-savings deposits; M2 additionally includes savings deposits and retail money market funds; money zero maturity (MZM) consists of cash, savings deposits and money market funds, both institutional and retail. The non-cash components of M1, M2 and MZM result from the lending activity of the private sector and therefore are endogenous to the economy. It is commonly referred to as inside money (Hartley and Walsh (1986), Lagos (2010)). The dynamics of U.S. monetary aggregates and their main components over the past 55 years is illustrated with Figure 1.[1] Table 2 presents descriptive statistics for all monetary aggregates and their the quarterly changes. Results presented in this paper use not seasonally adjusted monetary data since the asset returns analysed in this paper are not seasonally adjusted either. However, I do the robustness check and run the analysis using the seasonally adjusted monetary data and find that it makes no difference for the main results.

Figure 1: **Monetary aggregates and their components.** This graph shows the dynamics of the five U.S. monetary aggregates from the narrowest, the U.S. Monetary Base (MB), to the broadest, M2 and MZM, in Billions of U.S. Dollars over the period of 1959.01 - 2015.12. Data is available from FED H.6 Money Stock Measures release, 224 quarterly data points, not seasonally adjusted, not inflation adjusted.[2]

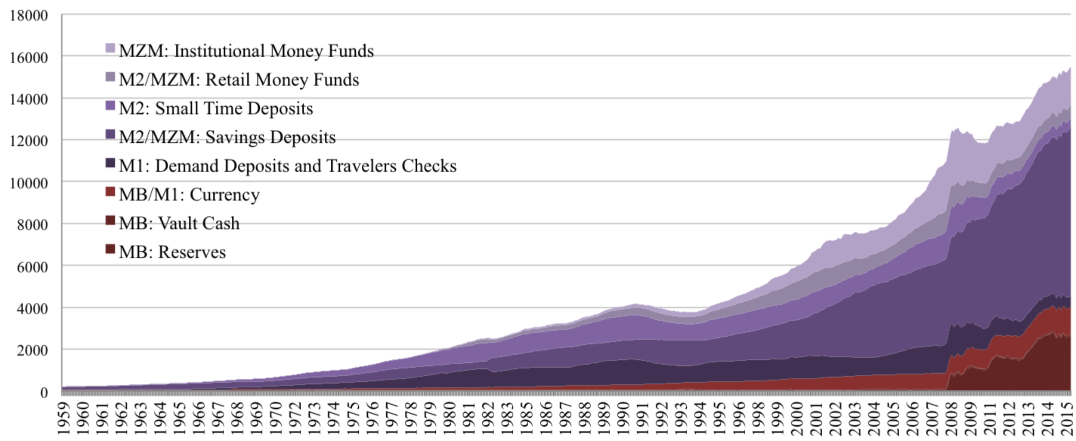


Table 2 shows that the MB grew almost 100 times from its minimum of 38.6 Billion Dollars at the beginning of 1959 to 4 Trillion at the end of 2015. M1 grew approximately 22 times, while broad monetary aggregates M2 and MZM grew about 43 and 50 times, respectively. From Figure 1 one can see that starting from the 1990s broad money started to grow rapidly. The share of demand deposits declines, but the share of savings deposits, financial instruments and money funds increases. At the end of 2015 MZM became larger than M2 due to a large increase in institutional money market funds.

[1]The detailed description of U.S. monetary aggregates is provided in Appendix.

Table 2: **Summary statistics.** Part (a) presents variables' descriptive statistics estimated from the full sample period, 1959.01 - 2014.12, quarterly data. Part (b) presents the contemporaneous correlations between variables. Δ for each variable is computed as a log change of the variable average quarterly value. σ_t and $\rho_{t,t-1}$ denote the standard deviation and the first order autocorrelation of the time series.

(a) Descriptive statistics

	Mean	*Median*	σ_t	*Min*	*Max*	$\rho_{t,t-1}$
MB	624.38	244.01	955.52	38.61	4076.1	0.998
M1	861.59	752.6	712.72	138.9	3093.8	1.000
M2	3558.12	2798.2	3210.96	290.2	12453.9	1.000
MZM	3424.71	2019.3	3685.46	278.2	13837.5	1.000
ΔMB	0.020	0.016	0.039	-0.071	0.425	0.330
$\Delta M1$	0.014	0.014	0.018	-0.030	0.078	0.252
$\Delta M2$	0.017	0.017	0.010	-0.008	0.046	0.317
ΔMZM	0.017	0.016	0.019	-0.036	0.145	0.370

(b) Correlation matrices

	MB	**M1**	**M2**	**MZM**
MB	1.000	0.931	0.912	0.928
M1		1.000	0.982	0.968
M2			1.000	0.993
MZM				1.000

	ΔMB	$\Delta M1$	$\Delta M2$	ΔMZM
ΔMB	1.000	0.359	0.189	0.175
$\Delta M1$		1.000	0.564	0.513
$\Delta M2$			1.000	0.679
ΔMZM				1.000

This can be explained by the growing sophistication of the financial intermediation sector and the rise of money markets. Tight financial regulation and the development of information technology led to financial innovation in the 1970s and 1980s and the increasing importance of financial markets.[3] Further advances in computer technology reduced transaction costs, thus making derivatives and other innovative financial instruments more attractive. The spread of the internet made it easier for individuals to access companies' information and reduced screening costs. This made bank loans less competitive than new types of direct financing and led to a shift of lending from traditional banks to financial markets. In the 1980s and 1990s the shadow banking sector started to grow rapidly.[1] Thus, commercial banks used to be a source of 40% of the loanable funds for companies in 1974, but their share declined to 25% in 2011 (Mishkin (2007)). This in turn resulted in the increased growth of the M2 and MZM components.

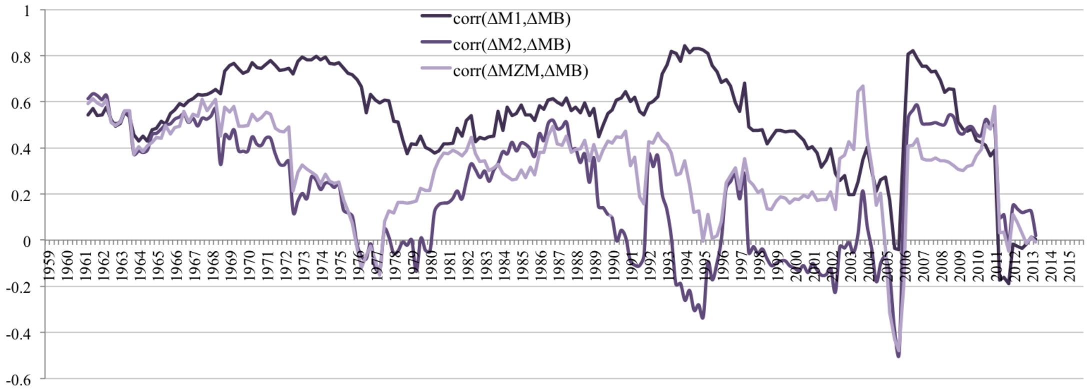
Table 2 part b shows less than perfect correlation between broad monetary aggregates and the MB. Given that the currency component remains the same in all aggregates, less than perfect correlation comes from the dynamics of reserves and inside money component of M2 and MZM. To understand this discrepancy better, Figure 2 presents rolling window correlations between the growth rates of broad monetary aggregates and the monetary base. M1 co-moves the most with the MB, with correlation level reaching above 0.8 during the mid 1990s and

[3]For example, until 1980, commercial banks were prohibited from paying interest rates on checkable deposits, and were subject to an interest rate ceiling on time deposits. This made bank deposits an unattractive investment during times of high inflation or volatile interest rates. In order to stop the outflow of funds by investors seeking higher and more sensitive interest yields, commercial banks had to develop new, more risky instruments, like sweep accounts, interest rate derivatives, commercial paper, etc.

[1]In this paper I call shadow banking all the non-bank type of lending, which in the context of monetary aggregates represented by money market funds components of M2 and MZM.

following the financial crisis. Average correlation between quarterly changes of M2 and MB is only 0.19, never goes above 0.6 and turns negative during the 1990s, a period of financial deregulation. It goes back up and reaches its maximum of 0.56 during the financial crisis, when financial markets got thinner and the Dodd-Frank Act made them more regulated.

Figure 2: This graph shows the 5 year rolling window correlation of the M2 and M3 multipliers over the period of 1959.01 - 2014.12, with corresponding 95% confidence bounds. Every 5 year window includes 20 quarterly observations and is measured at the middle point of the time window considered.



Presented statistics shows the divergence of inside and outside money dynamics depending on technological advances and regulatory climate: outside money is directly determined by the monetary authority, and inside money is fully endogenously determined by the economic activity. The fact that the two types of money do not move one to one with each other implies that the degree of financial intermediation and the speed of loan creation are time-varying.

2.2 The money multiplier

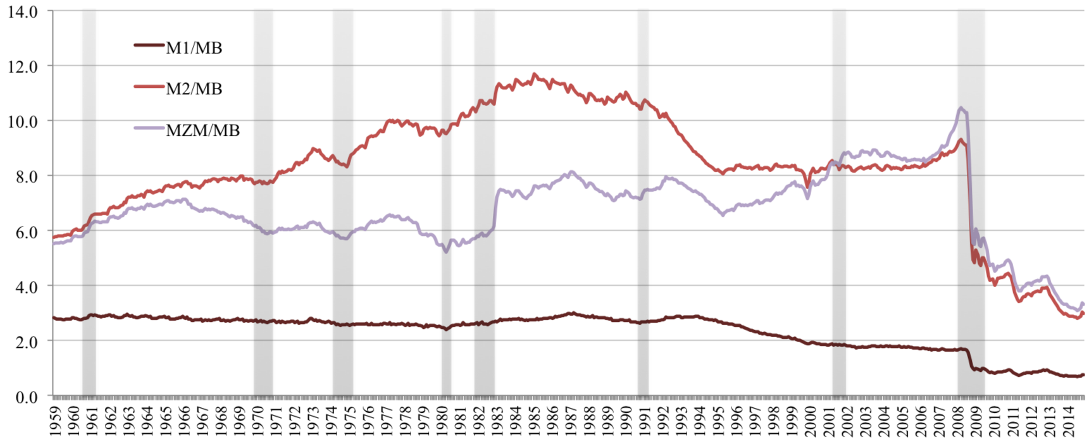
Now let's look at the ratio of inside money to outside money. In this paper I refer to the ratio of inside money to outside money as a broad money multiplier. It can be computed as a ratio of a broad monetary aggregate, M1, M2 or MZM, to the monetary base. Thus, the multiplier tells how much money supply is created out of a unit of cash or reserves and shows how far money spreads in the economy. When inside money grow faster than the total supply of currency and reserves, the multiplier increases. When loan creation slows down, the multiplier shrinks.

Figure 3 part a. presents the dynamics of three multipliers, ${}^{M1}/_{MB}$, ${}^{M2}/_{MB}$ and ${}^{MZM}/_{MB}$, during the period 1959 Q1 - 2015 Q4, and part b presents their summary statistics. The multipliers do not exhibit a clear trend on a graph, and their average quarterly change is around zero. ${}^{M2}/_{MB}$ and ${}^{MZM}/_{MB}$ vary more over time than ${}^{M1}/_{MB}$ with corresponding standard deviations of 2.4, 1.4 and 0.9. All three multipliers are highly persistent and have autocorrelation coefficients close to one. This is due to high persistence of aggregates' levels. Multipliers' quarterly changes are positively correlated as well, but with smaller autocorrelations, 0.29 for $\Delta^{M1}/_{MB}$, 0.35 for $\Delta^{M2}/_{MB}$ and 0.37 for $\Delta^{MZM}/_{MB}$. The augmented Dickey-Fuller test rejects the null hypothesis of a unit root for all three multipliers' growth rates.

The graph of broad multipliers' dynamics has two apparent waves: (1) during the mid 1980s and (2) right before the financial crisis. The first wave can be explained by overall

Figure 3: Graph in part a. shows the dynamics of the M1, M2, MZM money multipliers over the period of 1959.01 - 2014.12, and table in part b. presents their descriptive statistics. The multipliers are calculated by dividing the average monthly level of a monetary aggregate by the average level of the U.S. Monetary Base (MB) for the current quarter. Δ for each variable is computed as a log change of the variable average quarterly value. σ_t and $\rho_{t,t-1}$ denote the standard deviation and the first order autocorrelation of the time series. Shaded areas on the graph mark the U.S. recessions as defined by NBER. Time series consists of 224 quarterly data points and is adjusted for inflation.

(a) Money multipliers' dynamics.



(b) Descriptive statistics.

	Mean	*Median*	σ_t	*Min*	*Max*	$\rho_{t,t-1}$
$^{M1}/_{MB}$	2.521	2.897	0.872	0.707	3.635	0.998
$^{M2}/_{MB}$	8.826	9.072	2.418	2.830	12.125	0.995
$^{MZM}/_{MB}$	7.166	7.446	1.385	3.124	10.201	0.980
$\Delta^{M1}/_{MB}$	-0.007	-0.003	0.037	-0.348	0.098	0.285
$\Delta^{M2}/_{MB}$	-0.004	0.000	0.039	-0.381	0.096	0.348
$\Delta^{MZM}/_{MB}$	-0.003	0.000	0.040	-0.357	0.116	0.370

economic expansion and lending growth. At the same time, inflation was slowly rising. This contributed more to the expansion of broad money and did not affect the monetary base as much. The prompt growth and then decline of the multiplier during the 1980s corresponds to the U.S. savings and loan crisis. After the rise of financial innovation in the 1970s, the financial authorities removed the deposit rate ceiling from the commercial banks to make them more competitive with the growing financial markets. The financial deregulation took place in 1980 and 1982, which led to an expansion of banks' balance sheets and thus an increase of the broad money supply and therefore the multiplier. However, new activities involved greater risks and at the end of the 1980s a series of bankruptcies reduced the total supply of loans and significantly thinned the financial intermediation sector. This, together with ensuing regulation, led to a decrease in the multiplier. Subsequently, the multiplier grew particularly fast from 2005 and up to the beginning of the financial crisis in 2007. This is mainly attributed to the growth of money market funds and the use of repurchase agreements, which in turn was a result of the growing popularity of raising short term funds from the financial markets.

There is a structural break in the multipliers' dynamics during the financial crisis, when both broad multipliers drop during the second half of 2008. The drop is due to the rapid growth of the monetary base, which almost doubled in three months, rising from $890 billion in mid-September to $1,740 billion at the end of December. Such changes were driven by the FED's credit-oriented policies, which involved the purchase of non-Treasury securities, including commercial paper and asset-backed securities. Such purchases led to the expansion of both the asset and the liability side of the FED balance sheet and resulted in an increase in commercial banks' excess reserves held at the FED.

2.3 The money multiplier as a measure of economy-wide leverage

2.3.1 Why is it a proxy for leverage?

Firm's leverage is commonly defined as a ratio of total assets to equity or total debt to equity. If we talk about an individual taking a loan, then leverage is computed as a ratio of asset value individual gets relative to the amount of down payment Geanakoplos (2010). The leverage ratio of a bank is defined as the bank's total assets over its core capital, where the core capital is a sum of equity capital and declared reserves. Since the broad economy has a mixture of different types of agents, how would one measure economy-wide leverage?

Given that all money circulating in an economy are on the balance-sheet of a bank, or even balance-sheets of several banks concurrently, one can assume the economy-wide leverage ratio to be similar to the leverage ratio of a bank. In that case, the amount of aggregate credit can serve as a proxy of total assets, and total currency and reserves can be seen as core capital.

Going back to the definition of monetary aggregates, the MB consists of cash and reserves of all commercial banks that are typically on the asset side of banks' balance sheets. Broad money components of M2 and MZM, such as different types of deposits, are on the liability side of commercial banks' balance sheets. Thus, a broad money multiplier, a ratio of broad monetary aggregate to the MB, indicates the total value of deposits created in the economy per unit of cash and reserves, and can be seen as a measure of economy-wide leverage.

2.3.2 How does it compare to other existing proxies of leverage?

The two most common measures of leverage to be found in the literature are total loans and broker-dealer leverage. Broker dealer leverage is defined as the ratio of banks' total assets to its book equity, and is shown to predict market returns Adrian et al. (2013). Total loans are defined as the sum of the outstanding consumer, commercial and industrial loans issued by all commercial banks in the U.S. This definition is similar to Schularick and Taylor (2012), who showed that changes in total loans predict upturns and downturns in the economy. How does the multiplier differ from these two measures and why is it better?

Broker-dealer institutions include some commercial banks, but mainly are non-depositary financial institutions, like investment banks. Broad monetary aggregates, however, include only deposits of different types held 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). Thus, broker-dealer leverage refers mainly to the shadow banking sector, and the multiplier accounts for commercial banks and money market funds. Correlations between broker-dealer leverage log growth and multiplier log growth are presented in Table 3, part a. Broker-dealer leverage is constructed following Adrian, Etula and Moir (2013), using aggregate quarterly data on the levels of total financial assets and total financial liabilities of U.S. security broker-dealers as captured in Table L.130 of the Federal Reserve Flow of Funds. Contemporaneous correlations with growth rates of all three multipliers are very low, though significantly positive. Interestingly, the correlation of multiplier growth with broker-dealer leverage growth - one and two periods ahead - is significantly positive as well, while the reverse is not true.

Table 3: Correlations between different measures of leverage. $\Delta LevBD$ stands for quarterly log changes in broker-dealer leverage, computed as a ratio of total broker-dealer assets to their total liabilities. Data is available from the FED. ΔTL stand for quarterly log changes in total loans, computed as the sum of the outstanding consumer, commercial and industrial loans issued by all commercial banks in the U.S. 1959 Q2-2015 Q4, 227 quarterly observations. For this number of observations any correlation coefficient that is greater than 0.1. in magnitude is significantly different from 0 at 5% confidence level.

Part a. Correlations between broker-dealer leverage and multiplier growth.

	$\Delta^{M1}/_{MBt}$	$\Delta^{M2}/_{MBt}$	$\Delta^{MZM}/_{MBt}$	$\Delta LevBD_t$
$\Delta LevBD_{t-1}$	-0.080	-0.068	0.000	-0.096
$\Delta LevBD_t$	0.200	0.244	0.251	1.000
$\Delta LevBD_{t+1}$	0.233	0.222	0.204	-0.096
$\Delta LevBD_{t+2}$	0.202	0.240	0.215	0.150

Part b. Correlations between total loans and monetary aggregates growth.

	$\Delta M1_t$	$\Delta M2_t$	ΔMZM_t	ΔTL_t
ΔTL_{t-1}	0.009	0.181	0.015	0.513
ΔTL_t	-0.106	0.004	-0.165	1.000
ΔTL_{t+1}	-0.198	0.060	-0.192	0.513
ΔTL_{t+2}	-0.033	0.138	-0.084	0.353

Total loans, as mentioned above, include outstanding consumer, commercial and industrial loans issued by all commercial banks in the U.S. Monetary aggregates contain information about the amount of the deposits in commercial banks that can serve as a proxy for the amount of loans banks make. Additionally, broad aggregates M2 and MZM also contain information about money market accounts, which serve as an important source of direct market lending. This means that money multiplier growth captures some of the dynamics of the direct credit as well. Furthermore, the measure of total loans can include double counting of the same loans, while monetary aggregates are net measures of lending. To illustrate this point, table 3 part b. presents pairwise correlations of quarterly changes in total loans and changes in broad monetary aggregates. Contemporaneous and lagged correlations are very close to zero for all three monetary aggregates and are negative for M1 and MZM aggregates.

2.3.3 Mechanism of loan and money creation

To better understand where the difference between the measure of total loans and monetary aggregates comes from, let us look in detail at the mechanism of money creation. Imagine an economy with three agents: one bank and two households, A and B. The bank has loans and reserves on the asset side of its balance sheet, and equity and deposits on the liability side. Households have loans that they provide and deposits as their assets, and have equity and loans that they take as their liability. The scheme is presented in Figure 4.

At the beginning of time, date $t = 0$, the bank has reserves of \$1 and equity of \$1, while the agents have nothing. Thus, in this economy the monetary base is \$1 and the money multiplier is one. Total loans are zero. Let's assume that the next day, on date $t = 1$, the bank gives a loan of \$1 to agent A by creating a deposit for her. The balance sheets of the bank and of the agent A change. Yet, the monetary base of this economy remains unchanged, \$1 of broad money is created, the multiplier equals 2, and the amount of total loans is \$1. Anther day passes, and on $t = 2$ agent A decides to lend her money to agent B, who in turn deposits this money into his bank account. However, since agent A emptied her deposit, the total number of deposits in the bank is still \$1. This means that both the monetary base and the multiplier stay unchanged, but number of total loans increased to \$2. On the last day of this economy, date $t = 3$, agent B decides to lend his money back to agent A, and agent A deposits it back into the bank. The deposit of agent B is again empty and that of agent A is again \$1, akin to date $t = 1$. The monetary base and the multiplier again stay the same as before, but total loans have increased up to \$3.

Thus, monetary aggregates capture how the issuance of loans contributes to money creation in a whole economy. It nets out the interbank loans, thus excluding the double counting present in the measure of total loans, and other loans that do not change the aggregate net purchasing power. At the same time, the multiplier considers a broader spectrum of loans than broker-dealer leverage does.

Studying the dynamics of the money multiplier in relation to asset returns helps us to better understand the effect of inside money creation on financial markets. Inside money growth contributes to an increase in economy-wide leverage, and might have the same effect on aggregate market returns as the one that firm leverage has on firm returns. At the same time money multiplier variations is an indicator of the degree of money creation in the economy, total demand for loans and overall economic activity. In that sense, the multiplier acts as a state variable and belongs to macroeconomic fundamentals.

Figure 4: Scheme of loan creation in an economy with three agents: one bank and two households, A and B. First part of the scheme presents balance sheet structure of the agents. Second part presents 4 time periods during which different types of loans are created. MB stands for the monetary base, MM for money multiplier and TL for total loans.

Bank

Assets	Liabilities
Loans	Equity
Reserves	Deposits

Households A,B

Assets	Liabilities
Loans out	Equity
Deposits	Loans in

t = 0 Bank has reserves of 1 and equity of 1: MB = 1, MM = 1, TL = 0.

	Bank		A		B	
	0	1	0	0	0	0
	1	0	0	0	0	0

t = 1 Bank makes a loan of 1 to A: MB = 1, MM = 2, TL = 1.

	Bank		A		B	
	1	1	0	0	0	0
	1	1	1	1	0	0

t = 2 Agent A makes a loan of 1 to agent B: MB = 1, MM = 2, TL = 2.

	Bank		A		B	
	1	1	1	0	0	0
	1	1	0	1	1	1

t = 3 Agent B makes a loan of 1 to agent A: MB = 1, MM = 2, TL = 3.

	Bank		A		B	
	1	1	1	0	1	0
	1	1	1	2	0	1

3 Theoretical predictions

To derive the theoretical link between the money multiplier and stock returns, I use margin CAPM described in Ashcraft et al. (2011) and Frazzini and Pedersen (2014). This is an OLG model with $i = (1, ..., I)$ agents born each period who live for two periods. Agents are born with wealth W_t^i, which they want to invest in a portfolio of s stocks $x = (x^1, ..., x^s)'$ during the first period, in order to maximise their wealth in the last period. Agents have quadratic utility, thus their maximasation problem looks as follows:

$$max_{x^i} \ E_t(W_{t+1}) - \frac{\gamma^i}{2} var(W_{t+1}),$$

Every agent can borrow money from a bank at a risk-free rate, r^f, however, agents are heterogeneous in their risk aversion and their ability to borrow money. Each agent has to pledge cash and assets purchased against the amount borrowed. Agents are endowed with different amounts of cash, W_t^i, but also differ by their leverage ratio, l_t^i, that they can get from the bank. l_t^i is exogenous.

The final period wealth of an agent consists of the amount of debt she has to repay and the total value of the assets she holds:

$$W^i_{t+1} = -(x^{i\prime}P_t - W^i_t)(1+r^f) + E_t(x^{i\prime}P_{t+1}),$$

where P_t and P_{t+1} are stock prices at time t and $t+1$. Thus at time t each agent i solves:

$$max_{x^i}\; x^{i\prime}(E_t(P_{t+1}) - (1+r^f)P_t) - \frac{\gamma^i}{2}x^{i\prime}\Omega_t x^i,$$

s.t.

$$\frac{1}{l^i_t}x^{i\prime}P_t \leq W^i_t.$$

where $\Omega_t = var(P_{t+1})$ is an invertible variance-covariance matrix of risky assets at time $t+1$. Funding constraint coefficient $\frac{1}{l^i_t}$ is equivalent to a margin requirement m^i_t from the original margin CAPM model. $\frac{1}{l^i_t} \leq 1$ implies that agent leverages her position in a risky assets portfolio, $\frac{1}{l^i_t} \geq 1$ implies that the agent does not invest all of her wealth, but has to keep some of it in cash.

Solving FOC with respect to x_i we get:

$$E_t(P_{t+1}) - (1+r^f)P_t - \gamma^i\Omega_t x^i - \frac{\lambda}{l^i}P_t = 0$$

where λ is a Lagrange multiplier that represents tightness of funding constraints depending on general economic conditions. Thus λ is the same for all investors, while their heterogeneity is captured by l^i. The optimal vector of weights for an investor i is:

$$x^i = \frac{1}{\gamma^i}\Omega_t^{-1}\Big(E_t(P_{t+1}) - (1+r^f+\frac{\lambda}{l^i})P_t\Big)$$

In equilibrium the total supply of assets meets the total demand: $x^* = \sum_i x^i$. Thus, the equilibrium market weights are

$$x^* = \frac{1}{\gamma}\Omega_t^{-1}\Big(E_t(P_{t+1}) - (1+r^f+\lambda\sum_i \frac{1}{\gamma_i}\frac{1}{l_i})\;P_t\Big),$$

where $\frac{1}{\gamma} = \sum_i \frac{1}{\gamma_i}$ is the aggregate risk-aversion and $\sum_i \frac{1}{\gamma_i}\frac{1}{l_i}$ represents the aggregate leverage ratio. Since in equilibrium funding constraint binds, the individual leverage ratio is equal to the total amount spent on risky assets over the cash pledged:

$$l^i_t = \frac{x^{i\prime}P_t}{W_t}$$

Thus the aggregate leverage ratio can be written as follows:

$$\sum_i \frac{1}{\gamma_i}\frac{1}{l_i} = \frac{1}{\gamma}\sum_i \frac{W^i_t}{\frac{\gamma_i}{\gamma}\,x^{i\prime}P_t} = \frac{1}{\gamma}\;\sum_i \frac{\widetilde{W_t}}{\frac{\gamma_i}{\gamma}\,\widetilde{x^{i\prime}P_t}}\,\frac{\sum W^i_t}{\sum x^{i\prime}P_t} = \frac{k}{\gamma}\,\frac{1}{mm_t}$$

where $\widetilde{W_t} = \frac{W_t^i}{\sum\limits_i W_t^i}$ is the fraction of all cash held by the agent i, $\widetilde{x^{i\prime}P_t} = \frac{x^{i\prime}P_t}{\sum\limits_i x^{i\prime}P_t}$ is the fraction of total asset value held by the agent i, $mm_t = \frac{\sum x^{i\prime}P_t}{\sum W_t^i}$ is the level of money multiplier at time t, the ratio of all money created in the economy via borrowing to the the total amount of cash pledged against it. $\sum\limits_i \frac{\widetilde{W_t}}{\frac{\gamma_i}{\gamma}\widetilde{x^{i\prime}P_t}}$ is a positive constant which I denote with k.

Prediction 1. *The money multiplier predicts future market returns. In particular, expected market return at* t+1 *is decreasing in the multiplier level at time t and is increasing in multiplier growth at time t:*

$$E_t(r_{t+1}^M - r^f) = \frac{k\lambda}{mm_t} + \gamma P_t' x^* \; var(r_{t+1}^M)$$

$$\frac{\partial E_t(r_{t+1}^M - r^f)}{\partial mm_t} > 0.$$

The times of low money multiplier levels are times when less money is lent for the purpose of stock investment. During this time, individual leverage ratios are smaller, fewer stock purchases are made and stock prices go down. An increase in money multiplier implies a positive shock to funding liquidity, more weight is allocated to risky assets, which drives up their next period price.

Prediction 2. *Loading on the money multiplier level and the growth rate varies across stocks. In particular, the slope in front of the multiplier is higher for stocks with lower market beta.*

$$E_t(r_{t+1}^s - r^f) = (1 - \beta_t^s)\frac{k\lambda}{mm_t} + \beta_t^s \; (E_t(r_{t+1}^M) - r^f)$$

$$\frac{\partial E_t(r_{t+1}^s - r^f)}{\partial mm_t} > 0, \qquad \frac{\partial E_t(r_{t+1}^i - r^f)}{\partial mm_t} \neq \frac{\partial E_t(r_{t+1}^j - r^f)}{\partial mm_t} \qquad for \;\; i \neq j.$$

Details of the derivations can be found in the Appendix.

In the model, money is created for the purpose of investing into a portfolio of stocks, which is a huge simplification of the reality with many more asset classes. However, model implications hold under the assumption that the proportion of wealth allocated to a particular asset class remains the same.

4 Empirical results

4.1 The money multiplier and stock returns

In this section, I analyse aggregate stock market and cross-sectional excess returns. I test two model predictions from the previous section and run some additional analysis. I compute market log excess returns as the difference between the log of CRSP value-weighted index returns and the log of the 1-month Treasury Bill rate. Data is obtained from CRSP. For cross-sectional analysis I use 25 stock portfolios sorted by size and book-to-market, decile portfolios sorted on momentum and decile portfolios sorted by past investment, using data obtained from professor Kenneth French's website.

First, I look at the forecasting power of money multiplier for the time-variation of market returns, i.e. test the predictions from Proposition 1. For the purpose of empirical testing, I approximate the multiplier containing variable as follows:

$$\frac{k\lambda}{mm_t} \approx a - b\ln(mm_t)$$

This approximation is in line with techniques suggested in Brunnermeier and Pedersen (2009) and Adrian et al. (2014). This way lower leverage corresponds to tighter funding constraints. Thus, I run the following one-period predictive regression:

$$r^{e,M}_{t+1} = \alpha + \rho^{Mx}/_{MBt} + \beta\Delta^{Mx}/_{MBt} + \varepsilon_{t+1}$$

where $^{Mx}/_{MBt}$ and $\Delta^{Mx}/_{MBt}$ are respectively level and quarterly growth rates computed for three money multipliers, M1/MB, M2/MB and MZM/MB. Results are presented in Table 4, part a.

Table 4: OLS estimates from a predictive regression of log U.S. stock market excess returns (returns on CRSP value-weighted index minus 1-month T-Bill rate). Part a. estimates a regression specification with M1, M2, MZM money multipliers' levels and log changes. Part b. estimates a specification with one of the broad money multipliers' log changes, M1, M2, MZM, and log changes in the MB. Regressions are estimated over the whole sample period, 1959 Q1 - 2015 Q4, as well as over the two sub-sample periods: 1959 Q1 - 1989 Q4 and 1990 Q1 - 2015 Q4. Quarterly data. T-statistics in italics.

(a) Multiplier level and the growth rate: $r^{e,M}_{t+1} = \alpha + \rho^{Mx}/_{MBt} + \beta\Delta^{Mx}/_{MBt} + \varepsilon_{t+1}$.

	1959 - 2015			1959 - 1989			1990 - 2015		
	ρ	β	$\bar{R}^2$	ρ	β	$\bar{R}^2$	ρ	β	$\bar{R}^2$
M1	-0.08	0.25	5.07%	-0.05	0.15	0.90%	-0.03	0.34	9.44%
	-1.23	*3.71*		*-0.55*	*1.71*		*-0.36*	*3.54*	
M2	-0.10	0.23	4.34%	0.04	0.10	-0.65%	-0.14	0.35	10.44%
	-1.53	*3.40*		*0.38*	*1.08*		*-1.47*	*3.60*	
MZM	-0.15	0.27	6.79%	0.02	0.19	1.99%	-0.24	0.37	13.04%
	-2.25	*4.06*		*0.24*	*2.06*		*-2.44*	*3.80*	

(b) Multiplier growth and MB growth: $r^{e,M}_{t+1} = \alpha + \kappa\Delta^{Mx}/_{MBt} + \beta\Delta MB_t + \varepsilon_{t+1}$.

	1959 - 2015			1959 - 1989			1990 - 2015		
	κ	β	$\bar{R}^2$	κ	β	$\bar{R}^2$	κ	β	$\bar{R}^2$
M1	0.33	0.11	4.69%	0.16	0.07	1.14%	0.35	0.01	9.32%
	2.32	*0.78*		*1.78*	*0.76*		*1.20*	*0.02*	
M2	0.44	0.24	3.72%	0.27	0.24	1.90%	0.38	0.05	8.50%
	1.75	*0.95*		*2.04*	*1.81*		*0.73*	*0.10*	
MZM	0.35	0.12	5.00%	0.22	0.11	2.99%	0.13	-0.20	8.14%
	2.47	*0.88*		*2.35*	*1.14*		*0.37*	*-0.58*	

All three multipliers' levels appear in the regression with a negative coefficient. In the full sample, the M1 and M2 multipliers' levels have slope statistically indistinguishable from zero, and only the MZM multiplier level has a t-statistic greater than 2 in magnitude. At the same time, the multipliers' growth rates are strongly statistically significant, have t-statistics greater than 3.4, and predict market returns with a positive sign. Looking closely at the sub-samples, one sees that the predictive power of M1/MB and M2/MB in the full sample comes solely from the last 25 years, however MZM/MB is statistically significant in the early sample as well, with a t-statistic of 2.11. Adjusted R^2s are very high in the late sample for all three multipliers and vary between 9.5% and 12%. Sample sizes for early and late samples are sufficiently large to avoid small sample bias, 103 and 124 quarterly observations respectively. These findings can be interpreted as evidence in favour of the growing importance of leverage during the last 25 years, compared to the period between the 1960s and 1990s. To check these findings, I run individual predictive regressions of market excess returns by levels of the multipliers and separately by the multiplier growth rates and confirm my main results. Estimates for individual regressions are presented in Table 14 in the Appendix.[1]

The negative loadings on multiplier levels suggest that at times when leverage is high, expected market returns are low. However, the multiplier growth rate predicts next quarter excess returns positively. It is possible that at times when leverage is still growing, risk bearing capacity of financial system is still high and funding is easy to obtain. This leads to an increase in desired asset purchases, and drives asset prices up. In this case, times of leverage growth correspond to times of asset price growth, but only up to a point when leverage levels become unsustainably high.

The economic significance of the multipliers is relatively small. A change of three standard deviations in multiplier growth leads to only a one standard deviation change in next quarter market returns. The descriptive statistics in Figure 2 shows that during the sample period, quarterly multiplier growth volatility is around 0.04, while quarterly market returns are twice as volatile, $\sigma_M = 0.08$.

As already discussed in the introduction, it is the money multiplier, rather than the total money supply, which matters. I check whether stock return predictability is driven by changes in the monetary base. I run a predictive regression of market excess returns on multipliers' quarterly changes and control for quarterly changes in the MB. Results are presented in Table 4 part b. and show that the multiplier growth rate is significant, while the MB growth rate is not. Thus, inside money growth matters for expected market returns, and outside money growth does not.

A logical question, in this case, is whether dynamics of the inside money is driven by changes to outside money. To answer this question I run a predictive regression of multiplier changes on changes in the MB over different horizons. Results are presented in Table 5. I find that outside money predicts M1 and M2 multiplier growth over the following 1-3 months, and MZM multiplier growth only over 1 month, t-statistics are greater than 2. However, starting from the one quarter horizon the slope in front of the MB growth rate is statistically and economically indistinguishable from zero. Thus outside money have only a very short term effect on inside money.

[1] Results presented here are for nominal market returns, however I run the same analysis on real market excess return and results are very similar.

Table 5: OLS estimates from a predictive regression of the multipliers' growth rates by the MB growth rate: ${\Delta^{Mx}}/_{MBt+1} = \alpha + \beta \Delta MB_t + \varepsilon_{t+1}$. Quarterly data, 1959 Q1 - 2015 Q4. Standardised coefficients. T-statistics in italics.

	1 month		3 month		6 month		1 year	
	β	$\bar{R}^2$	β	$\bar{R}^2$	β	$\bar{R}^2$	β	$\bar{R}^2$
M1/MB	0.11	1.80%	0.10	4.43%	0.07	1.56%	0.04	-1.08%
	3.67		*3.38*		*1.66*		*0.65*	
M2/MB	0.03	0.48%	0.03	0.90%	-0.02	0.04%	-0.08	3.46%
	2.08		*1.74*		*-1.02*		*-1.03*	
MZM/MB	0.04	0.53%	0.04	0.22%	-0.03	-0.31%	-0.10	2.74%
	2.15		*1.22*		*-0.81*		*-1.59*	

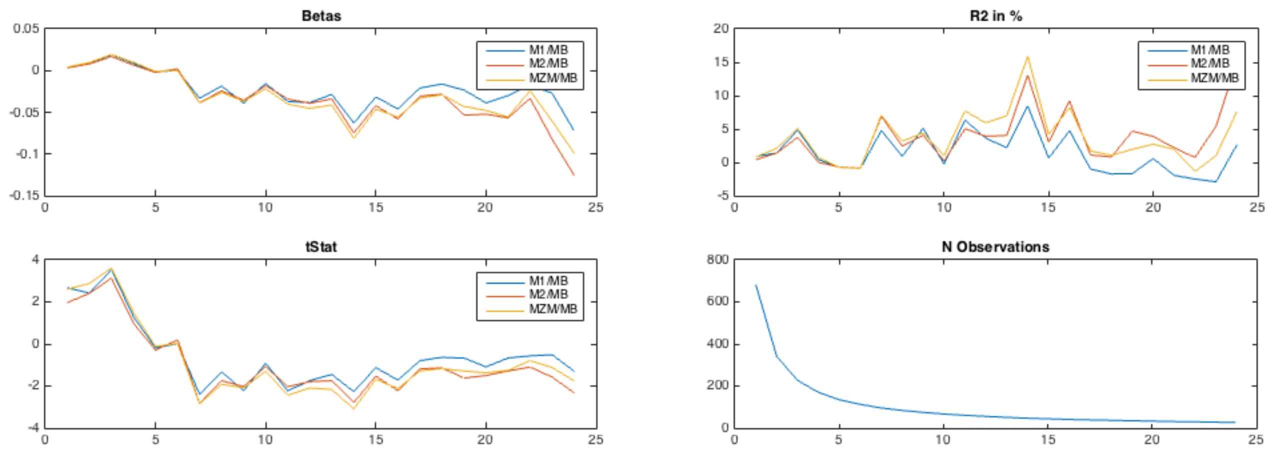
4.2 Different horizon predictability

Next, I try to understand how the predictive power of the multiplier depends on the chosen horizon. I estimate a simple one-period predictive regression for different horizons, from 1 to 25 month. :

$$r^e_{m,t+1} = \alpha + \beta {\Delta^{Mx}}/_{MBt} + \varepsilon_{t+1} \tag{1}$$

Beta estimates, corresponding t-statistics and $\bar{R}^2$s are plotted against the chosen time horizon and presented in Figure 5. Figures shows that β in the above predictive regression changes its sign. Growth of the multiplier predicts market returns positively for a horizon up to one quarter, and negatively for all horizons greater than two quarters.

Figure 5: OLS estimates from a predictive regression of log U.S. stock market excess returns (CRSP value-weighted index) on multiplier growth for different time horizons: $r^e_{m,t} = \alpha + \beta \Delta X_{t-1} + \varepsilon_t$, for M1, M2 and MZM multipliers. Beta coefficients, corresponding t-statistics and adjusted R^2 for each multiplier are plotted on Y axes against the time horizon on X axes. Sample period 1959:01 - 2015:12. Standardised coefficients.



These results are consistent with theories, where intermediaries have risk-based capital constraints, like Brunnermeier and Pedersen (2009) or Adrian and Shin (2014). In this models leverage is a key state variable that falls in downturns due to either increased collateral requirements or due to an increase in perceived market risk. Asset prices also decrease in downturns and expected future returns become large. Thus the negative relationship between leverage growth and expected stock returns is consistent with pro-cyclical leverage. The fact that during the first quarter returns respond positively to leverage growth can be explained by rapid stock price appreciation, or may be driven by times of large shocks to leverage when the marginal value of wealth is high.

The period of recent financial crisis is a good example of a large deleveraging in the economy, during which stock prices also fell. During this period the multiplier experienced a large drop related to the enormous growth of excess banks reserves at FED. The latter resulted from the FED asset purchase programs triggered by the Lehman collapse. The same event also led to a drop in stock market prices. However, further deleveraging of financial institutions exacerbated market downturn following the mechanism described by Brunnermeier and Pedersen (2009). The shock to the multiplier is, however, significantly large to be identified as a structural break. Thus, as a robustness check for all the results in this paper, I control for this structural break in the MB by introducing a dummy for the whole year of 2008. I find that the main results are not affected. Corresponding regression estimates can be found in Figure 7 and Figure 8 in the Appendix.

4.3 Other controls and out-of-sample forecasting

I control for some well-understood economic variables to see whether the multiplier growth rate remains an important predictor of expected market returns. In particular I control for: (1) the term yield (TY), which is computed as a difference between the 10-year Treasury note rate and the 3-month Treasury bill rate; (2) smoothened price earnings ratio (PE); (3) Federal funds rate (FF), to account for the monetary policy regime, which is traditionally associated with the level of money supply; (4) volatility index (VIX) as defined by CBOE, to control for market volatility[1]; (5) growth rate of the purchase power of money (ΔPP), computed as a log change in the M2 to GDP ratio; (6) credit spread (CS), computed as the difference between the Moody's Baa corporate bond yields and the 10-year U.S. constant maturity yields; (7) quarterly change in total loans (ΔTL), computed as the total amount of commercial, industrial and consumption loans outstanding issued by all commercial banks. Monthly data for corporate and treasury bonds, federal funds rate, GDP and total loans is available from FRED and is computed as an average of daily figures, but the quarterly value is taken at the end of the period. Data on VIX is available from CBOE webpage. Smoothened PE data is available from Bob Shiller's website.

I run a one-period predictive regression of market excess returns:

$$r^e_{m,t} = \alpha + \beta X_{t-1} + \varepsilon_t,$$

where X_{t-1} is a vector of state variables that consists of the broad multiplier growth rate and one of the controls. Table 6 presents OLS estimates of this regression, t-statistics and

[1]VIX represents the implied market expectation of future volatility, so to take quarterly averages would produce a significantly smoother measure. Thus I consider the end of period values of VIX, which is also consistent with how I compute quarterly values of the multiplier. This means that the Q1 (January, February and March) VIX represents investors expectations for the month of April

corresponding p-values for every newly added factor, as well as for the multiplier growth rate. In this analysis I consider only the late sample of the whole available data, 1990 Q1 - 2014 Q4. Partly because VIX data is only available for this period, and partly because the multiplier appears to be more important during the last two decades, when the expansion of the financial intermediation sector was most strongly reflected in broad money growth.

Table 6 shows that multiplier growth remains significant at the 5% confidence level after controlling for each one of the mentioned economic indicators, while none of the control variables individually has a t-statistic high enough for the variables to be considered relevant for predicting market returns. Economic significance of the multiplier in the late sample is also higher, than of any other control variable. A change of one standard deviation in $\Delta ln^{M2}/_{MB}$ predicts a change of 0.35 standard deviations in market returns, versus maximum of 0.13 standard deviations for other controls.[2]

I analyse the out-of-sample performance of each of the model specifications, using the root mean squared error ($GW\Delta RMSE$) computed according to the methodology of Goyal and Welch (2008). The chosen period of time, 1990 Q1 - 2014 Q4, contains 100 quarterly observations. I start with the in-sample period of 76 quarters and construct the out-of-sample forecast for the following 24 quarters using an expanding forecasting window. Tests show that none of the models beats the forecast by the mean in out-of-sample. However, these conclusions are not very robust and strongly depend on the choice of the in-sample and out-of-sample periods. For example, if one considers an out-of-sample period that starts just two quarters earlier, then numbers for models' $\Delta RMSE$ look completely different. Those are presented for comparison in the last column of Table 6 under $GW\Delta RMSE*$. Similar analysis is produced for another broad money multiplier, MZM/MB, with very similar results and can be found in Table 15 in the Appendix.

[2]A change of one standard deviation in PE predicts a 0.27 standard deviation change in future returns, which is close to the number obtained for money multiplier. However, PE is highly non-stationary, while $\Delta ln^{M2}/_{MB}$ is not.

Table 6: OLS estimates from a predictive regression of market excess returns: $r^e_{m,t} = \alpha + \beta X_{t-1} + \varepsilon_t$, where X_{t-1} is a vector of variables different for each model specification. Variables are presented in the first row. $\Delta^{M2}/_{MB}$ - growth of the broad money multiplier, TY is the term yield, PE - price earnings ratio, VIX - level of the CBOE volatility index, FF - federal funds rate, ΔPP - the growth rate of purchase power of money computed as the ratio of the level of the M3 to the GDP level, and CS - the credit spread, computed as the difference between Moody's BAA corporate bond yields and the 10 years US constant maturity yield. Estimates of the regression slopes are presented in the first line, t-statistics in the second and p-values in the third. Last three columns present $\bar{R}^2$ for each model specification for the analysed period of 1990 Q1 - 2014 Q4 and characteristics of models' out-of-sample performance. $GW\Delta RMSE$ compares out-of-sample forecast errors of each model with a forecast error of the sample mean, as in Goyal and Welch (2008). For $GW\Delta RMSE$ in-sample period is the first 76 quarters of the whole sample, for $GW\Delta RMSE*$ in-sample period is the first 76 quarters of the whole sample.

		$\Delta^{M2}/_{MB}$	TY	PE	CPI	VIX	FF	PP	CS	ΔTL	$\bar{R}^2$	$GW\Delta RMSE$	$GW\Delta RMSE*$
	beta	0.34	0	0	0	0	0	0	0	0	10.37%	-0.0082	0.0006
Model 1	*t-stat*	*3.51*	0	0	0	0	0	0	0	0			
	p-value	0.00	0	0	0	0	0	0	0	0			
	beta	0.36	0.09	0	0	0	0	0	0	0	10.20%	-0.0101	0.0004
Model 2	*t-stat*	*3.62*	*0.90*	0	0	0	0	0	0	0			
	p-value	0.00	0.37	0	0	0	0	0	0	0			
	beta	0.41	0	-0.27	0	0	0	0	0	0	16.31%	-0.0031	0.0066
Model 3	*t-stat*	*4.26*	0	*-2.81*	0	0	0	0	0	0			
	p-value	0.00	0	0.01	0	0	0	0	0	0			
	beta	0.34	0	0	0.04	0	0	0	0	0	9.57%	-0.0172	0.0009
Model 4	*t-stat*	*3.51*	0	0	*0.37*	0	0	0	0	0			
	p-value	0.00	0	0	0.71	0	0	0	0	0			
	beta	0.35	0	0	0	0.11	0	0	0	0	10.59%	-0.0076	-0.0018
Model 5	*t-stat*	*3.66*	0	0	0	*1.11*	0	0	0	0			
	p-value	0.00	0	0	0	0.27	0	0	0	0			
	beta	0.36	0	0	0	0	-0.13	0	0	0	11.00%	-0.0081	0.002
Model 6	*t-stat*	*3.73*	0	0	0	0	*-1.30*	0	0	0			
	p-value	0.00	0	0	0	0	0.20	0	0	0			
	beta	0.30	0	0	0	0	0	-0.09	0	0	10.07%	-0.0098	0.0023
Model 7	*t-stat*	*2.87*	0	0	0	0	0	*-0.82*	0	0			
	p-value	0.01	0	0	0	0	0	0.41	0	0			
	beta	0.37	0	0	0	0	0	0	0.10	0	10.27%	-0.0207	-0.0051
Model 8	*t-stat*	*3.60*	0	0	0	0	0	0	*0.94*	0			
	p-value	0.00	0	0	0	0	0	0	0.35	0			
	beta	0.34	0	0	0	0	0	0	0	-0.09	10.32%	-0.0096	-0.0001
Model 9	*t-stat*	*3.55*	0	0	0	0	0	0	0	*-0.97*			
	p-value	0.00	0	0	0	0	0	0	0	0.33			
	beta	0.28	-0.662	-0.426	-0.373	0.400	-0.950	-0.164	-0.443	-0.093	21.82%	-0.0226	-0.0115
Model 10	*t-stat*	*2.55*	*-2.889*	*-3.655*	*-1.589*	*2.779*	*-2.794*	*-1.292*	*-2.161*	*-0.897*			
	p-value	0.01	0.005	0.000	0.116	0.007	0.006	0.200	0.033	0.372			

4.4 The money multiplier and the cross-section of returns

The previous sections presented evidence that multiplier growth is a risk factor for aggregate market returns. In this section, I examine whether this risk factor is priced in the cross-section of stocks, i.e. test the predictions from Proposition 2 in the previous section.

Asset pricing equation from Proposition 2 can be tested with the following regression:

$$r_t^{e,p} = \alpha + \kappa^{Mx}/_{MBt-1} + \beta r_t^{e,M} + \varepsilon_t$$

OLS estimates of this regression are presented in Table 7. All portfolios' returns load with a negative sign on the past period level of the multiplier. The economic and statistical significance of the slope is increasing with firm's size and decreasing with the book-to-market ratio. Thus, levels of the multiplier are the most significant for big growth firms.

Table 7: OLS estimates from a predictive regression: $r_t^{e,p} = \alpha + \kappa^{Mx}/_{MBt-1} + \beta r_t^{e,M} + \varepsilon_t$, where $r_{p,t}^e$ are returns at time t on the 25 U.S. stock portfolios formed on size and book-to-market equity, $^{Mx}/_{MBt-1}$ is the level of the M2 money multiplier at time t-1 and $r_t^{e,M}$ is market return at time t. Quarterly data, 1959 Q1 - 2015 Q4, 228 observations. For each portfolio, top row presents standardised regression slope coefficients, the second row presents t-statistics, the last row presents adjusted R^2.

		Growth		**BM2**		**BM3**		**BM4**		**Value**	
		$^{M2}/_{MBt-1}$	$r_t^{e,M}$	$^{M2}/_{MBt-1}$	$r_t^{e,M}$	$^{M2}/_{MBt-1}$	$r_t^{e,M}$	$^{M2}/_{MBt-1}$	$r_t^{e,M}$	$^{M2}/_{MBt-1}$	$r_t^{e,M}$
Small	slope	-0.049	0.796	-0.051	0.822	-0.030	0.831	-0.025	0.816	-0.015	0.807
	t-stat	*-1.2*	*19.7*	*-1.3*	*21.6*	*-0.8*	*22.3*	*-0.6*	*21.1*	*-0.4*	*20.4*
	$\bar{R}^2$	63%		67%		69%		66%		65%	
ME2	slope	-0.083	0.859	-0.058	0.877	-0.040	0.886	-0.009	0.875	0.014	0.839
	t-stat	*-2.4*	*25.2*	*-1.8*	*27.3*	*-1.3*	*28.6*	*-0.3*	*27.0*	*0.4*	*23.0*
	$\bar{R}^2$	74%		77%		78%		76%		70%	
ME3	slope	-0.081	0.878	-0.065	0.914	-0.046	0.903	-0.033	0.895	-0.008	0.832
	t-stat	*-2.5*	*27.7*	*-2.4*	*33.8*	*-1.6*	*31.4*	*-1.1*	*30.1*	*-0.2*	*22.5*
	$\bar{R}^2$	77%		84%		81%		80%		69%	
ME4	slope	-0.093	0.900	-0.095	0.934	-0.071	0.931	-0.046	0.907	-0.017	0.871
	t-stat	*-3.2*	*31.3*	*-4.0*	*40.0*	*-2.9*	*38.6*	*-1.6*	*32.2*	*-0.5*	*26.5*
	$\bar{R}^2$	81%		88%		87%		82%		76%	
Big	slope	-0.114	0.922	-0.090	0.950	-0.097	0.911	-0.043	0.910	-0.028	0.846
	t-stat	*-4.5*	*37.1*	*-4.3*	*46.7*	*-3.5*	*33.7*	*-1.5*	*32.8*	*-0.8*	*23.9*
	$\bar{R}^2$	86%		91%		84%		83%		72%	

Table 8 presents estimates from a one-period predictive regression (1) of 25 portfolios sorted on size and book-to-market by the growth rate of the M2 multiplier. Figures 16 - 17 in the Appendix present estimates of the same two regressions, but for M1 and MZM multipliers. Observed cross-sectional patterns are the same as for M2/MB.

Table 8 shows that the slope of the estimated regression, its statistical significance and adjusted R^2 are increasing with book-to-market, however, there is no clear relationship with the firm size, as in the previous table with the multiplier level. These results do not imply that exposure to leverage risk drives value premium, but they serve as an evidence that the same

Table 8: OLS estimates from a predictive regression: $r^e_{p,t} = \alpha + \beta \Delta^{M2}/_{MB\,t-1} + \varepsilon_t$, where $r^e_{p,t}$ is a return on 25 U.S. stock portfolios formed on size and book-to-market equity on the M2 multiplier changes. Quarterly data aggregated from monthly data obtained from professor Kenneth French's website. 1959 Q1 - 2015 Q4, 228 observations. For each portfolio, the top row presents standardised regression slope coefficients, the second row presents t-statistics, the last row presents adjusted R^2.

		BM Low	BM2	BM3	BM4	BM Hi
ME Small	β	0.114	0.116	0.152	0.197	0.208
	t-stat	*1.7*	*1.7*	*2.3*	*3.0*	*3.1*
	$\bar{R}^2$	0.82%	0.87%	1.82%	3.34%	3.76%
ME2	β	0.110	0.138	0.171	0.240	0.268
	t-stat	*1.6*	*2.1*	*2.6*	*3.6*	*4.1*
	$\bar{R}^2$	0.73%	1.42%	2.39%	5.15%	6.54%
ME3	β	0.112	0.162	0.168	0.202	0.172
	t-stat	*1.7*	*2.4*	*2.5*	*3.0*	*2.6*
	$\bar{R}^2$	0.78%	2.12%	2.31%	3.53%	2.43%
ME4	β	0.100	0.156	0.211	0.236	0.248
	t-stat	*1.5*	*2.3*	*3.2*	*3.6*	*3.8*
	$\bar{R}^2$	0.54%	1.93%	3.89%	4.97%	5.54%
ME Big	β	0.099	0.171	0.194	0.287	0.220
	t-stat	*1.5*	*2.6*	*2.9*	*4.4*	*3.3*
	$\bar{R}^2$	0.50%	2.40%	3.22%	7.56%	4.29%

factors can be driving the two. Intuitively, it is possible that companies with higher book-to-market ratios are more sensitive to changes in funding liquidity and thus load more on the leverage growth factor. At the same time, if changes in economy-wide leverage reflect changes in the broad investment opportunity set, then companies with initially more limited investment opportunities would be more susceptible to it. The latter is true for high book-to-market companies, if one treats the book-to-market ratio as a proxy for an inverse of Tobin's Q, as in Xing (2008). Following this theory, high book-to-market companies have lower productivity levels and therefore can afford to undertake a limited number of new investment projects.

The analysis of predictability of market returns time-variation shows that the multiplier is pro-cyclical. When the multiplier is high, expected returns are low. This is true for all horizons above two quarters and allows to suggest a negative relationship between the multiplier and marginal utility of wealth. When the multiplier is high, stock prices are booming, total wealth is growing and its marginal utility is decreasing. In this case, investors will require higher compensation for holding assets that co-move more with the multiplier, and the corresponding price of risk in the cross-section of stock returns should be positive.

Table 9 presents estimates from Fama-MacBeth tests for 25 portfolios sorted on size and book-to-market. The table shows that all three multipliers are priced in the cross-section. The price of risk is small, but positive and statistically significant, as expected. At the same time, the intercepts are economically and statistically insignificant, which implies that all returns in excess of the risk-free rate are a compensation for systematic risk, which is well captured by multiplier growth. This result is also robust to controlling for MB growth.

Table 9: Estimates from Fama-MacBeth prices of risk and corresponding t-statistics for the cross-sectional predictive regression for 25 stock portfolios sorted by size and book-to-market ratio on the multiplier growth rate.

		$\Delta^{M1}/_{MB}$	$\Delta^{M2}/_{MB}$	$\Delta^{MZM}/_{MB}$
Lambda	**mean**	0.074	0.0677	0.0909
	t-stat	*2.90*	*2.37*	*2.68*
Intercept	**mean**	-0.0002	0.0041	-0.003
	t-stat	*-0.03*	*0.42*	*-0.26*

Next, I run cross-sectional analysis on momentum sorted portfolios and stock portfolios sorted by past investment. The latter is defined as a relative change in total assets of the firm. Data for both is from professor Kenneth French's data library. Cross-sectional regression estimates are summarised in Table 10 and corresponding Fama-MacBeth prices of risk in Table 11.

While there are no clear patterns for portfolios sorted on past returns, Table 10, part a., there is a clear pattern for portfolios sorted on past investments, Table 10, part b. Slope coefficients, statistical significance, and adjusted R^2 are increasing from high to low. Thus, multiplier growth better predicts future growth of excess returns for firms with low past investments. The channel here is similar to the one for the value anomaly. Companies with low past investment are likely to have some limitation in exploiting new investment opportunities, thus they would be affected more when the number of investment opportunities decreases, or when the amount of available funding shrinks.

Table 10: Estimates from a predictive regression of portfolio excess returns on the multiplier growth rate: $r^e_{p,t} = \alpha + \beta \Delta^{Mx}/_{MBt-1} + \varepsilon_t$. Part a. presents estimates of this regression for 10 stock portfolios sorted on past returns, and part b. for 10 stock portfolios sorted on past investments. Past investment is defined as a past year relative change in total assets of the firm. Quarterly data aggregated from monthly data obtained from professor Kenneth French's website. 1959 Q1 - 2015 Q4, 228 observations. For each portfolio, the top row presents standardised regression slope coefficients, the second row presents t-statistics, the last row presents adjusted R^2.

(a) Portfolios sorted on past returns.

		Lo PRIOR	**PRIOR 2**	**PRIOR 3**	**PRIOR 4**	**PRIOR 5**	**PRIOR 6**	**PRIOR 7**	**PRIOR 8**	**PRIOR 9**	**Hi PRIOR**
$\Delta^{M1}/_{MB}$	β	0.158	0.208	0.176	0.209	0.198	0.161	0.144	0.188	0.221	0.176
	t-stat	*2.4*	*3.2*	*2.7*	*3.2*	*3.0*	*2.4*	*2.2*	*2.9*	*3.4*	*2.7*
	$\bar{R}^2$	2.05%	3.89%	2.66%	3.95%	3.50%	2.14%	1.62%	3.09%	4.48%	2.68%
$\Delta^{M2}/_{MB}$	β	0.108	0.164	0.139	0.182	0.166	0.119	0.104	0.171	0.196	0.152
	t-stat	*1.6*	*2.5*	*2.1*	*2.8*	*2.5*	*1.8*	*1.6*	*2.6*	*3.0*	*2.3*
	$\bar{R}^2$	0.72%	2.26%	1.49%	2.88%	2.33%	0.98%	0.63%	2.48%	3.41%	1.88%
$\Delta^{MZM}/_{MB}$	β	0.122	0.185	0.154	0.204	0.197	0.150	0.142	0.217	0.220	0.197
	t-stat	*1.8*	*2.8*	*2.3*	*3.1*	*3.0*	*2.3*	*2.1*	*3.3*	*3.4*	*3.0*
	$\bar{R}^2$	1.06%	2.97%	1.93%	3.73%	3.44%	1.82%	1.57%	4.27%	4.40%	3.43%

(b) Portfolios sorted on past investments.

		Lo PRIOR	**PRIOR 2**	**PRIOR 3**	**PRIOR 4**	**PRIOR 5**	**PRIOR 6**	**PRIOR 7**	**PRIOR 8**	**PRIOR 9**	**Hi PRIOR**
$\Delta^{M1}/_{MB}$	β	0.264	0.334	0.262	0.328	0.276	0.267	0.256	0.257	0.178	0.196
	t-stat	*3.9*	*5.1*	*3.9*	*5.0*	*4.1*	*4.0*	*3.8*	*3.8*	*2.6*	*2.9*
	$\bar{R}^2$	6.50%	10.69%	6.40%	10.34%	7.18%	6.70%	6.09%	6.16%	2.70%	3.38%
$\Delta^{M2}/_{MB}$	β	0.209	0.286	0.239	0.285	0.252	0.249	0.248	0.240	0.146	0.158
	t-stat	*3.1*	*4.3*	*3.5*	*4.3*	*3.8*	*3.7*	*3.7*	*3.6*	*2.1*	*2.3*
	$\bar{R}^2$	3.91%	7.72%	5.27%	7.67%	5.91%	5.76%	5.69%	5.30%	1.67%	2.03%
$\Delta^{MZM}/_{MB}$	β	0.266	0.318	0.271	0.323	0.292	0.289	0.282	0.285	0.193	0.204
	t-stat	*4.0*	*4.8*	*4.1*	*4.9*	*4.4*	*4.3*	*4.2*	*4.3*	*2.8*	*3.0*
	$\bar{R}^2$	6.60%	9.70%	6.90%	10.00%	8.08%	7.93%	7.53%	7.67%	3.26%	3.71%

Table 11: Estimates of Fama-MacBeth prices of risk and corresponding t-statistics for the cross-sectional predictive regression for 10 stock portfolios sorted by past returns and 10 portfolios sorted by past investments on the multiplier growth rate.

		(a) Portfolios sorted on past returns			(b) Portfolios sorted on past investments		
		$\Delta^{M1}/_{MB}$	$\Delta^{M2}/_{MB}$	$\Delta^{MZM}/_{MB}$	$\Delta^{M1}/_{MB}$	$\Delta^{M2}/_{MB}$	$\Delta^{MZM}/_{MB}$
Lambda	**mean**	0.0999	0.1594	0.2211	0.058	0.0538	0.0616
	t-stat	*3.71*	*5.23*	*5.26*	*2.09*	*1.77*	*1.88*
Intercept	**mean**	-0.0081	-0.0136	-0.0292	0.027	0.0298	0.0254
	t-stat	*-0.89*	*-1.48*	*-2.48*	*0.87*	*0.96*	*0.80*

All cross-sectional tests presented in this section I also run controlling for the growth of the monetary base. In each case, I find that the latter is statistically insignificant in predicting future returns and is not priced in the cross-section, while the multiplier growth rate remains a priced factor.

4.5 The money multiplier and bond returns

In this subsection, I look at the predictability of treasury and corporate bond returns by money multiplier. Treasury returns are returns on 1,2,5,7,10,20 and 30 year constant maturity Treasury notes. Corporate bond returns are returns on Moody's seasoned Aaa and Baa corporate bond indices. Data is available from FRED.

Table 12 provides estimates from a predictive regression of the excess returns on two corporate bonds portfolios, of Aaa and of Baa rated bonds, with multipliers levels and growth rates. Aaa bond returns are better predicted by the multiplier than Baa returns across subsamples: multipliers' β has higher statistical and economic significance in the regression for Aaa bonds than in a regression for Baa bonds, and corresponding $\bar{R}^2$ is higher. For both corporate portfolios, multiplier growth predicts returns positively in the early sample and negatively in the late sample. In the late sample, an increase of one standard deviation in MZM multiplier results in a 0.26 standard deviations decrease in excess returns on Aaa portfolio and a 0.18 decrease in excess returns on Baa portfolio.

Table 13 presents estimates from the same predictive regression, but for Treasury notes with fixed maturities. In full sample M2 and MZM multiplier growth is statistically significant for predicting excess returns for treasuries of all maturities, have t-statistics of a magnitude greater than 2. M1 multiplier growth is statistically significant only for 3, 5 and 7 year Treasury returns. Looking at the regression estimates in sub-samples, one can notice that all the predictive power of the multiplier growth rate in full sample comes from the past 30 years, i.e. during the period of growing financial intermediation and sophistication of the banking sector. One big difference of predictability results for the bond market compared to the stock market is that predictability is high for monthly changes but vanishes for quarterly changes.

Table 12: Table presents OLS estimates of the predictive regression of corporate bond excess returns by levels of three different money multipliers and by their quarterly changes: $r^e_{cb,t} = \alpha + \beta X_{t-1} + \varepsilon_t$. Part a. presents estimates for Aaa bond portfolio, and part b. for Baa portfolio. Estimates are computed for the full sample period of 1959 Q1 - 2015 Q4, as well as for two subsample periods, 1959 Q1 - 1989 Q4 and 1990 Q1 - 2015 Q4. Standardised coefficients.

Part a. Aaa bonds.

	1959 Q1 - 2015 Q4			1959 Q1 - 1989 Q4			1990 Q1 - 2015 Q4		
X	β	$t-stat$	$\bar{R}^2$	β	$t-stat$	$\bar{R}^2$	β	$t-stat$	$\bar{R}^2$
$^{M1}/_{MB}$	-0.516	*-8.90*	25.81%	0.583	*7.85*	33.17%	-0.680	*-9.62*	47.54%
$^{M2}/_{MB}$	-0.707	*-14.63*	48.63%	-0.536	*-6.99*	28.17%	-0.679	*-9.50*	46.91%
$^{MZM}/_{MB}$	-0.240	*-3.64*	5.17%	0.535	*6.98*	28.15%	-0.490	*-5.73*	23.97%
$\Delta^{M1}/_{MB}$	-0.112	*-1.65*	0.76%	0.043	*0.47*	-0.64%	-0.084	*-0.85*	-0.27%
$\Delta^{M2}/_{MB}$	-0.179	*-2.68*	2.68%	0.195	*2.19*	3.00%	-0.228	*-2.36*	4.33%
$\Delta^{MZM}/_{MB}$	-0.116	*-1.73*	0.87%	0.198	*2.23*	3.16%	-0.262	*-2.75*	6.11%

Part b. Baa bonds.

	1959 Q1 - 2015 Q4			1959 Q1 - 1989 Q4			1990 Q1 - 2015 Q4		
X	β	$t-stat$	$\bar{R}^2$	β	$t-stat$	$\bar{R}^2$	β	$t-stat$	$\bar{R}^2$
$^{M1}/_{MB}$	-0.502	*-8.59*	24.44%	0.569	*7.58*	31.61%	-0.650	*-8.81*	43.12%
$^{M2}/_{MB}$	-0.691	*-14.00*	46.43%	-0.508	*-6.50*	25.25%	-0.666	*-9.13*	44.89%
$^{MZM}/_{MB}$	-0.238	*-3.62*	5.10%	0.560	*7.47*	30.97%	-0.498	*-5.83*	24.64%
$\Delta^{M1}/_{MB}$	-0.066	*-0.97*	-0.03%	0.062	*0.69*	-0.44%	0.003	*0.03*	-1.00%
$\Delta^{M2}/_{MB}$	-0.141	*-2.09*	1.48%	0.212	*2.39*	3.71%	-0.154	*-1.56*	1.41%
$\Delta^{MZM}/_{MB}$	-0.062	*-0.92*	-0.07%	0.266	*3.05*	6.38%	-0.182	*-1.88*	2.43%

Figure 6: OLS estimates from a predictive regression of log excess returns on Treasury 5 year fixed maturity CRSP index on the multiplier growth rate for different time horizons: $r^e_{TN5,t} = \alpha + \beta \Delta X_{t-1} + \varepsilon_t$, for M1, M2 and MZM multipliers. Beta coefficients, corresponding t-statistics and adjusted R^2 for each multiplier are plotted on Y axes against the time horizon on X axes. Sample period 1959:01 - 2015:12. Standardised coefficients.

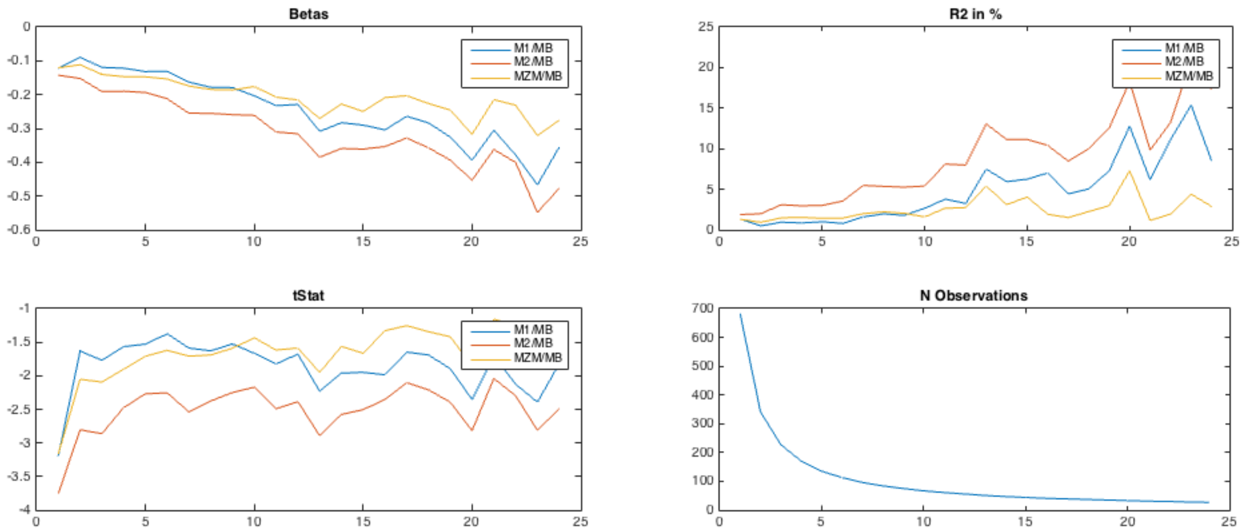


Figure 6 presents OLS estimates over various time horizons, from 1 to 25 months, from a predictive regression of 5-year Treasury on changes in the money multiplier. Slopes of the regression, corresponding t-statistics and adjusted R^2 are plotted against time horizons used in the regression. Over a one-month horizon, all three multipliers are statistically significant

Table 13: OLS estimates of the predictive regression of excess returns on Treasury constant maturity: $r^e_{TN,t} = \alpha + \beta X_{t-1} + \varepsilon_t$, $r^e_{TN,t}$ monthly excess return on CRSP fixed maturity indices, constructed from Treasury notes with 1,2,5,7,10,20 and 30 year maturities. Estimates are computed for the full sample period of 1959:01 - 2015:12, as well as for two subsample periods, 1959:01 - 1989:12 and 1990:01 - 2015:12. First row for each model specification presents standardised regression coefficients, second row presents t-statistics, third adjusted R^2.

Full sample

	1 year	3 years	5 years	7 years	10 years	20 years	30 years
	-0.069	-0.087	-0.105	-0.114	-0.072	-0.045	-0.063
$\Delta^{M1}/_{MB}$	*-1.79*	*-2.27*	*-2.77*	*-2.99*	*-1.87*	*-1.16*	*-1.65*
	0.3%	0.6%	1.0%	1.2%	0.4%	0.1%	0.3%
	-0.069	-0.081	-0.096	-0.116	-0.077	-0.079	-0.106
$\Delta^{M2}/_{MB}$	*-1.79*	*-2.12*	*-2.52*	*-3.04*	*-2.01*	*-2.06*	*-2.77*
	0.3%	0.5%	0.8%	1.2%	0.5%	0.5%	1.0%
	-0.067	-0.083	-0.092	-0.114	-0.080	-0.075	-0.098
$\Delta^{MZM}/_{MB}$	*-1.74*	*-2.16*	*-2.39*	*-2.98*	*-2.09*	*-1.95*	*-2.55*
	0.3%	0.5%	0.7%	1.1%	0.5%	0.4%	0.8%

Early sample

	1 year	3 years	5 years	7 years	10 years	20 years	30 years
	-0.030	-0.039	-0.035	-0.060	-0.029	0.041	0.021
$\Delta^{M1}/_{MB}$	*-0.58*	*-0.75*	*-0.66*	*-1.16*	*-0.55*	*0.78*	*0.40*
	-0.2%	-0.1%	-0.2%	0.1%	-0.2%	-0.1%	-0.2%
	-0.007	-0.021	-0.027	-0.066	-0.006	-0.012	-0.053
$\Delta^{M2}/_{MB}$	*-0.13*	*-0.39*	*-0.51*	*-1.27*	*-0.11*	*-0.22*	*-1.01*
	-0.3%	-0.2%	-0.2%	0.2%	-0.3%	-0.3%	0.0%
	-0.042	-0.054	-0.031	-0.071	-0.031	-0.010	-0.034
$\Delta^{MZM}/_{MB}$	*-0.81*	*-1.03*	*-0.59*	*-1.37*	*-0.60*	*-0.19*	*-0.64*
	-0.1%	0.0%	-0.2%	0.2%	-0.2%	-0.3%	-0.2%

Late sample

	1 year	3 years	5 years	7 years	10 years	20 years	30 years
	-0.170	-0.177	-0.180	-0.172	-0.109	-0.107	-0.128
$\Delta^{M1}/_{MB}$	*-3.03*	*-3.16*	*-3.22*	*-3.06*	*-1.92*	*-1.88*	*-2.26*
	2.6%	2.8%	2.9%	2.6%	0.9%	0.8%	1.3%
	-0.189	-0.174	-0.161	-0.170	-0.125	-0.131	-0.157
$\Delta^{M2}/_{MB}$	*-3.37*	*-3.09*	*-2.85*	*-3.03*	*-2.21*	*-2.31*	*-2.78*
	3.2%	2.7%	2.3%	2.6%	1.2%	1.4%	2.1%
	-0.152	-0.155	-0.155	-0.166	-0.124	-0.133	-0.159
$\Delta^{MZM}/_{MB}$	*-2.69*	*-2.75*	*-2.76*	*-2.95*	*-2.20*	*-2.35*	*-2.82*
	2.0%	2.1%	2.1%	2.4%	1.2%	1.4%	2.2%

in forecasting future treasuries' excess returns, but only the M2 multiplier remains significant for all horizons, t-statistic is always greater than 2 in magnitude. M2 multiplier growth of one standard deviation predicts a decline in treasury returns of 0.15 standard deviations over the next month, a decline of 0.25 standard deviations over the following two quarters and a decline of 0.4 standard deviations over the next year.

These results are also consistent with the theories of pro-cyclical leverage and the mechanism described earlier for stock markets. However, there is one difference. Multiplier growth predicts changes in expected stock returns positively for one quarter ahead, and negatively for all horizons above the two quarters. I associate it with the fact that growing leverage indicates good times for financial markets when funding can be easily obtained and used for asset purchases. Since bonds are less risky investments, they experience fewer demand fluctuations associated with good and bad times than stocks do. Thus the relationship between leverage and expected bond returns is always negative. When leverage is high, markets are saturated and bond prices are high, meaning that expected returns are low.

5 Conclusion

In this paper, I introduce a measure of economy-wide leverage, the money multiplier. The multiplier is a ratio of a broad monetary aggregate to the MB and corresponds to the ratio of inside to outside money. I show that the multiplier growth rate significantly and robustly predicts stock market excess returns on aggregate and in the cross-section, as well as it predicts bond returns for a range of bond maturities. This links inside money creation in the economy to stock and bond price dynamics across the business cycle.

As a proxy for the level of economy-wide leverage, the money multiplier may serve as an indicator of risk-bearing capacity of the financial system, tightness of margin constraints that are so difficult to observe, and generally, can be used as a state variable for dynamics induced by financial frictions. In this paper, I do not argue that the multiplier drives asset returns, but merely show its strong forecasting power. It is likely that the multiplier reacts to the same endogenous changes in the economy that affect asset prices. Since the multiplier is determined by the amount of money that has actually been borrowed in the economy, it can be seen as an indicator of funding liquidity, a state variable that otherwise is not so easily captured.

The multiplier has a very different dynamics compared to other common measures of leverage, like broker-dealer leverage or total loans. Compared to the former, the multiplier considers loans made by a different financial sector, commercial banks, and partly accounts for the direct market lending too, due to its money market funds component. Compared to total loans, the multiplier excludes double counting of the same loans and therefore represents net lending in the economy.

Empirical predictions obtained in this paper for stock and bond excess returns are consistent with theories of risk based funding constraints, that generate pro-cyclical leverage as a state variable (Geanakoplos (2010), Brunnermeier and Pedersen (2009), Adrian and Shin (2014)). When the multiplier is high, expected returns are low. Thus the general mechanism that relates changes in the multiplier is similar to the models of financial intermediaries leverage. Agents adjust risk exposure of their asset portfolios based on broad economic conditions. This affects demand for assets and their equilibrium price. However, when dealing with broker-dealer leverage one considers risk exposures of financial intermediaries, very specific economic agents, subject to constraints arising from agency problems. Looking at the broad money multiplier allows assessing changes in investors risk exposure more generally: it unites borrowing by financial and private sector in one measure. Thus the multiplier is a better indicator of changes in the marginal utility of wealth in different states of the economy. It serves as a macroeconomic state variable, that characterises the aggregate agents' response to changes in investment opportunity set.

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A Proofs

A.1 Proof of Proposition 1.

From the expression for equilibrium market weights we get equilibrium price vector:

$$x^* = \frac{1}{\gamma}\Omega_t^{-1}(E_t(P_{t+1}) - (1 + r^f + \frac{k\lambda}{mm_t})P_t)),$$

$$P_t = (-\gamma\Omega_t x^* + E_t(P_{t+1}))/(1 + r^f + \frac{k\lambda}{mm_t}),$$

Then equilibrium expected returns at $t+1$ on asset s and on the market are:

$$\frac{E_t(P_{t+1}^s)}{P_t^s} = (1 + r^f + \frac{k\lambda}{mm_t}) + \frac{\gamma e^{s\prime}\Omega_t x^*}{P_t^s}$$

where e^s is a chooser vector for asset s.

$$E_t(R_{t+1}^s) - (1 + r^f) = \frac{\gamma}{P_t^s}\, cov(P_{t+1}^s, P_{t+1}^{\prime} x^*) + \frac{k\lambda}{mm_t}$$

$$E_t(r_{t+1}^s - r^f) = \gamma P_t^{\prime} x^*\, cov(r_{t+1}^s, r_{t+1}^m) + \frac{k\lambda}{mm_t}$$

$$E_t(r_{t+1}^m - r^f) = \gamma P_t^{\prime} x^*\, var(r_{t+1}^m) + \frac{k\lambda}{mm_t}.$$

Taking the derivative of the market expected return with respect to the money multiplier we get:

$$\frac{\partial E_t(r_{t+1}^M - r^f)}{\partial mm_t} = -\frac{k\lambda}{mm_t^2} + \gamma\, var(r_{t+1}^m) P_t^{\prime} \frac{\partial x^*}{\partial mm_t}.$$

Here, changes in money multiplier that result from changes in individual leverage ratios, do not affect current prices, but affect investors weights in risky assets. An increase in the money multiplier results in a greater amount of investment:

$$\frac{\partial x^*}{\partial mm_t} = \frac{1}{\gamma}\Omega_t^{-1} P_t \frac{k\lambda}{mm_t^2}$$

Plugging this back into the derivative of market expected return we get:

$$\frac{\partial E_t(r_{t+1}^M - r^f)}{\partial mm_t} = \frac{k\lambda}{mm_t^2}(\Omega_t^{-1}\, var(r_{t+1}^m) P_t^{\prime} P_t - 1) > 0,$$

since $k = \sum_i \frac{\widetilde{W_t}}{\frac{\gamma_i}{\gamma}\, \widetilde{x^{i\prime} P_t}} > 0$, $\widetilde{W_t} = \frac{W_t^i}{\sum_i W_t^i}$ is the fraction of all cash held by the investor i, $\widetilde{x^{i\prime} P_t} = \frac{x^{i\prime} P_t}{\sum_i x^{i\prime} P_t}$ is the fraction of total asset value held by the investor i and $\lambda > 0$.

A.2 Proof of Proposition 2.

From the expression for market return we get:

$$\gamma P_t' x^* = \frac{E_t(r^m_{t+1} - r^f) - \frac{k\lambda}{mm_t}}{var(r^m_{t+1})}.$$

Plugging this back into the expression for stock s return, we get:

$$E_t(r^s_{t+1} - r^f) = \frac{k\lambda}{mm_t} - \frac{cov(r^s_{t+1}, r^m_{t+1})}{var(r^m_{t+1})} \left(E_t(r^m_{t+1} - r^f) - \frac{k\lambda}{mm_t}\right),$$

$$E_t(r^s_{t+1} - r^f) = (1 - \beta^s)\frac{k\lambda}{mm_t} - \beta^s \left(E_t(r^m_{t+1} - r^f\right),$$

where $\beta^s = \frac{cov(r^s_{t+1}, r^m_{t+1})}{var(r^m_{t+1})}$ is the usual CAPM beta.

Similarly to the derivative of the market return with respect to the multiplier we find the derivative of stock s return:

$$\frac{\partial E_t(r^s_{t+1} - r^f)}{\partial mm_t} = \frac{k\lambda}{mm_t^2}(\Omega_t^{-1}\, cov(r^s_{t+1}, r^m_{t+1}) P_t' P_t - 1) > 0,$$

which is a function of asset s covariance with the market and therefore is different for every asset.

B U.S. Monetary Aggregates and their components

The definition and the composition of different monetary aggregates varies across countries. Since this paper focuses on the U.S. economy, I use the definition of monetary aggregates provided by the Federal Reserve Bank. MB, M1, M2, MZM and M3 are progressively more inclusive measures of money with the narrowest component being the adjusted monetary base (MB). The monetary base is defined as those liabilities of the monetary authorities that households and firms use as media of exchange and that depository institutions use to satisfy statutory reserve requirements and to settle interbank debts. In the United States, this includes currency (including coin) held outside the Treasury and the Federal Reserve Banks (referred to as currency in circulation) plus deposits held by depository institutions at the Federal Reserve Banks. The demand of public onto these liquid assets allows the monetary authority to control the prevailing money market interest rate.[1]

M1 includes funds that are readily accessible for spending, i.e. the most liquid forms of money. It consists of (1) currency outside the U.S. Treasury, the Federal Reserve Banks, and the vaults of depository institutions, (2) travellers checks of nonbank issuers, (3) demand deposits, and

[1]Details about the measurement of the Monetary Base can be found in the Appendix. The MB data is adjusted for the effects of changes in statutory reserve requirements on the quantity of base money held by depositories.

(4) other checkable deposits, which consist primarily of negotiable order of withdrawal accounts at depository institutions and credit union share draft accounts.

M2 includes a broader set of financial assets held primarily by households. M2 consists of M1 plus (1) savings deposits (which include money market deposit accounts), (2) small-denomination time deposits (time deposits in amounts of less than $100,000) issued by financial institutions, and (3) balances in retail money market mutual funds (funds with initial investments under $50,000), net of retirement accounts.

M3 consists of M2 and (1) all other certificates of deposits (large time deposits, institutional money market mutual fund balances), (2) deposits of eurodollars and (3) repurchase agreements. Monitoring of M3 was discontinued in March 2006, because M3 “does not appear to convey any additional information about economic activity that is not already embodied in M2 and has not played a role in the monetary policy process for many years”.[1], [2]

MZM stands for money zero maturity and is calculated by the Federal Reserve Bank of St. Louis. It equals M2 minus small-denomination time deposits, plus institutional money market mutual funds (that is, those included in M3 but excluded from M2). The aggregate itself was proposed by Motley (1988).

C The multiplier levels and growth rates and market excess returns

Table 14: Table presents OLS estimates of the predictive regression of market premium by levels of three different money multipliers and separately by their quarterly changes. Estimates are computed for the full sample period of 1959 Q1 - 2015 Q4, as well as for two subsample periods, 1959 Q1 - 1989 Q4 and 1990 Q1 - 2015 Q4.

	Full sample: 1959 Q1 - 2015 Q4			Early sample: 1959 Q1 - 1989 Q4			Late sample. 1990 Q1 - 2015 Q4		
	b	**tStat**	$\bar{R}^2$	**b**	**tStat**	$\bar{R}^2$	**b**	**tStat**	$\bar{R}^2$
$^{M1}/_{MB}$	-0.036	*-0.53*	-0.32%	-0.040	*-0.44*	-0.66%	0.003	*0.03*	-1.00%
$^{M2}/_{MB}$	-0.052	*-0.77*	-0.18%	0.021	*0.23*	-0.78%	-0.084	*-0.84*	-0.30%
$^{MZM}/_{MB}$	-0.088	*-1.31*	0.32%	0.044	*0.49*	-0.63%	-0.154	*-1.53*	1.32%
$\Delta^{M1}/_{MB}$	0.234	*3.53*	4.86%	0.151	*1.68*	1.48%	0.341	*3.54*	10.23%
$\Delta^{M2}/_{MB}$	0.208	*3.13*	3.76%	0.094	*1.04*	0.06%	0.327	*3.39*	9.41%
$\Delta^{MZM}/_{MB}$	0.238	*3.62*	5.09%	0.188	*2.11*	2.76%	0.316	*3.27*	8.75%

[1]http://www.federalreserve.gov/releases/h6/discm3.htm

[2]In my analysis I use the time series provided by OECD: "Main Economic Indicators - complete database"

D Predictability over different horizons with crisis dummy

Figure 7: OLS estimates from a predictive regression of log U.S. stock market excess returns (CRSP value-weighted index) that includes a crisis dummy for the whole year of 2008. Quarterly data, 1959 Q1 - 2015 Q4. Standardised coefficients.

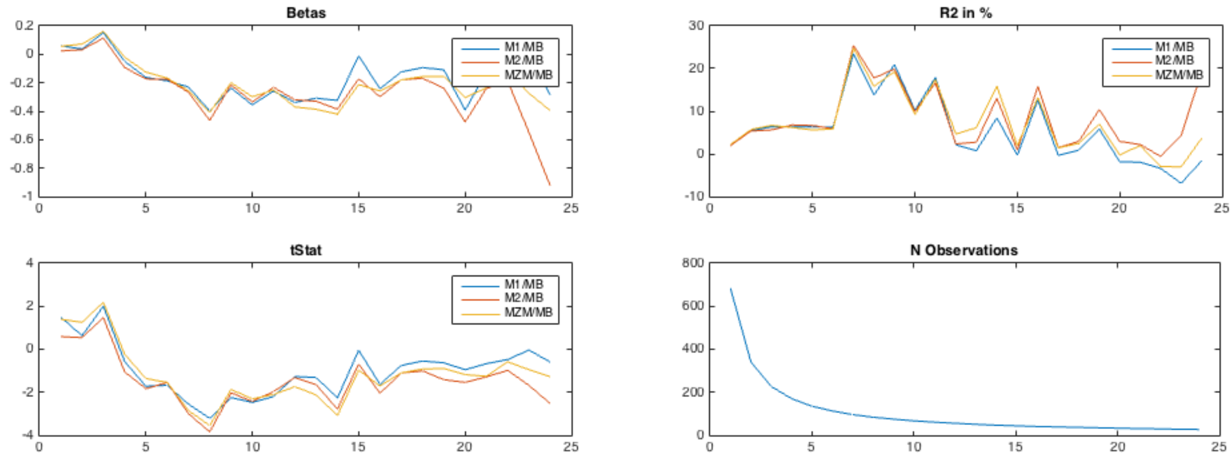
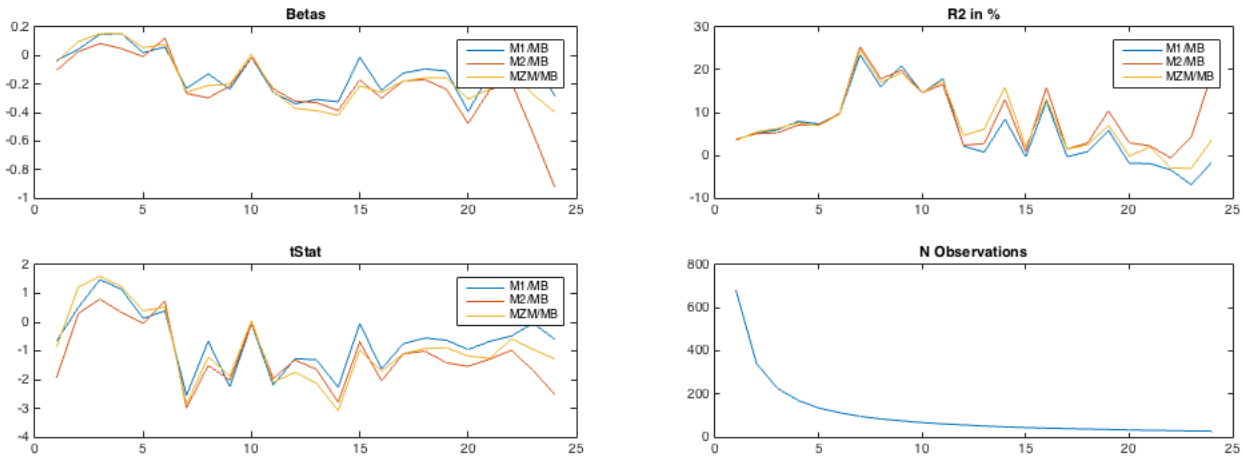


Figure 8: OLS estimates from a predictive regression of log U.S. stock market excess returns (CRSP value-weighted index) that includes a crisis dummy for the whole year of 2008 and an interaction term. Quarterly data, 1959 Q1 - 2015 Q4. Standardised coefficients.



E Controls and out-of-sample predictability for MZM/MB

Table 15: OLS estimates from a predictive regression of market excess returns: $r^e_{m,t} = \alpha + \beta X_{t-1} + \varepsilon_t$, where X_{t-1} is a vector of variables different for each model specification. Variables are presented in the first row. $\Delta^{MZM}/_{MB}$ - growth of the broad money multiplier, TY is the term yield, PE - price earnings ratio, VIX - level of the CBOE volatility index, FF - federal funds rate, ΔPP - the growth rate of purchase power of money computed as the ratio of the level of the M3 to the GDP level, and CS - the credit spread, computed as the difference between Moody's BAA corporate bond yields and the 10 years US constant maturity yield. Estimates of the regression slopes are presented in the first line, t-statistics in the second and p-values in the third. Last three columns present $\bar{R}^2$ for each model specification for the analysed period of 1990 Q1 - 2014 Q4 and characteristics of models' out-of-sample performance. $GW\Delta RMSE$ compares out-of-sample forecast errors of each model with a forecast error of the sample mean, as in Goyal and Welch (2008). For $GW\Delta RMSE$ in-sample period is the first 76 quarters of the whole sample, for $GW\Delta RMSE*$ in-sample period is the first 76 quarters of the whole sample.

		$\Delta^{MZM}/_{MB}$	TY	PE	CPI	VIX	FF	PP	CS	ΔTL	$\bar{R}^2$	$GW\Delta RMSE$	$GW\Delta RMSE*$
	beta	0.32	0	0	0	0	0	0	0	0	9.29%	-0.0015	-0.0014
Model 1	*t-stat*	*3.35*	*0*	*0*	*0*	0	0	0	0	0	0		
	p-value	0.00	0	0	0	0	0	0	0	0	0		
	beta	0.35	0.11	0	0	0	0	0	0	0	9.52%	-0.0008	-0.0008
Model 2	*t-stat*	*3.54*	*1.12*	*0*	*0*	0	0	0	0	0	0		
	p-value	0.00	0.26	0	0	0	0	0	0	0	0		
	beta	0.39	0	-0.25	0	0	0	0	0	0	14.29%	0.0052	0.0045
Model 3	*t-stat*	*4.04*	*0*	*-2.60*	0	*0*	0	0	0	0	0		
	p-value	0.00	0	0.01	0	0	0	0	0	0	0		
	beta	0.34	0	0	0.08	0	0	0	0	0	8.96%	-0.0003	-0.0002
Model 4	*t-stat*	*3.44*	*0*	*0*	*0.80*	0	0	0	0	0	0		
	p-value	0.00	0	0	0.43	0	0	0	0	0	0		
	beta	0.33	0	0	0	0.10	0	0	0	0	9.32%	-0.0079	-0.0075
Model 7	*t-stat*	*3.47*	*0*	*0*	0	*1.02*	0	0	0	0	0		
	p-value	0.00	0	0	0	0.31	0	0	0	0	0		
	beta	0.37	0	0	0	0	-0.17	0	0	0	11.08%	0.0005	0.0004
Model 8	*t-stat*	*3.74*	*0*	*0*	0	0	*-1.73*	0	0	0	0		
	p-value	0.00	0	0	0	0	0.09	0	0	0	0		
	beta	0.28	0	0	0	0	0	-0.11	0	0	9.43%	0.0019	0.0022
Model 9	*t-stat*	*2.74*	*0*	*0*	0	0	0	*-1.08*	*0*	*0*	0		
	p-value	0.01	0	0	0	0	0	0.28	0	0	0		
	beta	0.35	0	0	0	0	0	0	0.09	0	9.10%	-0.005	-0.0044
Model 10	*t-stat*	*3.44*	*0*	*0*	0	0	0	*0*	*0.89*	*0*	0		
	p-value	0.00	0	0	0	0	0	0	0.38	0	0		
	beta	0.32	0	0	0	0	0	0	0	-0.09	9.19%	-0.0024	-0.0025
Model 9	*t-stat*	*3.38*	*0*	*0*	0	0	0	*0*	*0*	*-0.94*	0		
	p-value	0.00	0	0	0	0	0	0	0	0.35	0		
	beta	0.28	-0.674	-0.419	-0.351	0.433	-1.051	-0.187	-0.495	-0.093	22.69%	-0.0047	-0.0045
Model 10	*t-stat*	*2.70*	*-2.950*	*-3.698*	-1.473	3.107	-3.022	*-1.536*	*-2.494*	*-0.908*	0		
	p-value	0.01	0.004	0.000	0.144	0.003	0.003	0.128	0.015	0.366	0		

E.1 Cross-sectional results for M1/MB and MZM/MB

Table 16: OLS estimates from a predictive regression: $r_t^{e,p} = \alpha + \kappa^{Mx}/_{MBt-1} + \beta r_t^{e,M} + \varepsilon_t$, where $r_{p,t}^e$ are returns at time t on the 25 U.S. stock portfolios formed on size and book-to-market equity, $^{Mx}/_{MBt-1}$ is the level of the M1 money multiplier at time t-1 in Part (a) and the level of the MZM money multiplier at time t-1 in Part (b) of the Table, $r_t^{e,M}$ is market return at time t. Quarterly data, 1959 Q1 - 2015 Q4, 228 observations. For each portfolio, top row presents standardised regression slope coefficients, second row presents t-statistics, last row presents adjusted R^2.

Part (a)

		Growth		BM2		BM3		BM4		Value	
		$^{M1}/_{MBt-1}$	$r_t^{e,M}$	$^{M1}/_{MBt-1}$	$r_t^{e,M}$	$^{M1}/_{MBt-1}$	$r_t^{e,M}$	$^{M1}/_{MBt-1}$	$r_t^{e,M}$	$^{M1}/_{MBt-1}$	$r_t^{e,M}$
Small	slope	-0.031	0.796	-0.051	0.822	-0.040	0.831	-0.023	0.817	-0.013	0.807
	t-stat	*-0.8*	*19.6*	*-1.3*	*21.6*	*-1.1*	*22.3*	*-0.6*	*21.1*	*-0.3*	*20.4*
	$\bar{R}^2$	63%		67%		69%		66%		65%	
ME2	slope	-0.077	0.859	-0.064	0.877	-0.048	0.887	-0.009	0.875	0.018	0.839
	t-stat	*-2.2*	*25.2*	*-2.0*	*27.4*	*-1.5*	*28.6*	*-0.3*	*27.0*	*0.5*	*23.0*
	$\bar{R}^2$	74%		77%		78%		76%		70%	
ME3	slope	-0.075	0.879	-0.064	0.914	-0.061	0.904	-0.032	0.895	-0.036	0.833
	t-stat	*-2.3*	*27.6*	*-2.3*	*33.8*	*-2.1*	*31.6*	*-1.1*	*30.1*	*-1.0*	*22.5*
	$\bar{R}^2$	77%		84%		82%		80%		69%	
ME4	slope	-0.092	0.901	-0.091	0.935	-0.052	0.931	-0.032	0.907	-0.019	0.871
	t-stat	*-3.2*	*31.3*	*-3.8*	*39.9*	*-2.1*	*38.3*	*-1.1*	*32.1*	*-0.6*	*26.5*
	$\bar{R}^2$	81%		88%		87%		82%		76%	
Big	slope	-0.091	0.923	-0.090	0.951	-0.058	0.911	-0.029	0.910	-0.016	0.846
	t-stat	*-3.6*	*36.5*	*-4.4*	*46.8*	*-2.1*	*33.1*	*-1.0*	*32.7*	*-0.4*	*23.8*
	$\bar{R}^2$	86%		91%		83%		83%		72%	

Part (b)

		Growth		BM2		BM3		BM4		Value	
		$^{MZM}/_{MBt-1}$	$r_t^{e,M}$	$^{MZM}/_{MBt-1}$	$r_t^{e,M}$	$^{MZM}/_{MBt-1}$	$r_t^{e,M}$	$^{MZM}/_{MBt-1}$	$r_t^{e,M}$	$^{MZM}/_{MBt-1}$	$r_t^{e,M}$
Small	slope	-0.009	0.795	-0.013	0.820	0.009	0.831	0.017	0.817	0.030	0.808
	t-stat	*-0.2*	*19.6*	*-0.3*	*21.4*	*0.2*	*22.2*	*0.4*	*21.1*	*0.8*	*20.4*
	$\bar{R}^2$	63%		67%		69%		66%		65%	
ME2	slope	-0.046	0.856	-0.022	0.875	0.011	0.886	0.021	0.876	0.051	0.841
	t-stat	*-1.3*	*24.9*	*-0.7*	*27.1*	*0.4*	*28.4*	*0.6*	*27.0*	*1.4*	*23.1*
	$\bar{R}^2$	74%		77%		78%		76%		70%	
ME3	slope	-0.048	0.875	-0.028	0.912	0.006	0.903	0.009	0.895	0.034	0.833
	t-stat	*-1.5*	*27.3*	*-1.0*	*33.3*	*0.2*	*31.2*	*0.3*	*30.0*	*0.9*	*22.5*
	$\bar{R}^2$	77%		83%		81%		80%		69%	
ME4	slope	-0.051	0.897	-0.040	0.931	-0.048	0.928	0.006	0.906	0.000	0.871
	t-stat	*-1.7*	*30.7*	*-1.6*	*38.7*	*-1.9*	*38.1*	*0.2*	*32.0*	*0.0*	*26.4*
	$\bar{R}^2$	81%		87%		87%		82%		76%	
Big	slope	-0.081	0.917	-0.061	0.946	-0.065	0.907	-0.038	0.908	-0.012	0.845
	t-stat	*-3.1*	*36.1*	*-2.9*	*45.4*	*-2.3*	*33.0*	*-1.3*	*32.6*	*-0.3*	*23.8*
	$\bar{R}^2$	85%		90%		83%		83%		72%	

Table 17: Estimates of the predictive regression: $r^e_{p,t} = \alpha + \beta \Delta^{M1}/_{MBt-1} + \varepsilon_t$ for 25 U.S. stock portfolios formed on size and book-to-market equity. Part (a) presents estimates for the M2 multiplier growth and Part (b) for MZM multiplier growth. Quarterly data aggregated from monthly data obtained from Kenneth French website. 1959 Q1 - 2015 Q4, 228 observations. For each portfolio, top row presents standardised regression slope coefficients, the second row presents t-statistics, the last row presents adjusted R^2.

Part (a).

		Low	**BM2**	**BM3**	**BM4**	**High**
Small	β	0.157	0.170	0.207	0.255	0.284
	t-stat	*2.3*	*2.5*	*3.1*	*3.9*	*4.4*
	$\bar{R}^2$	1.94%	2.37%	3.72%	5.88%	7.39%
ME2	β	0.145	0.186	0.218	0.284	0.327
	t-stat	*2.2*	*2.8*	*3.3*	*4.3*	*5.1*
	$\bar{R}^2$	1.60%	2.92%	4.15%	7.38%	9.94%
ME3	β	0.150	0.206	0.211	0.253	0.239
	t-stat	*2.2*	*3.1*	*3.2*	*3.8*	*3.6*
	$\bar{R}^2$	1.74%	3.68%	3.86%	5.76%	5.09%
ME4	β	0.133	0.190	0.252	0.275	0.292
	t-stat	*2.0*	*2.8*	*3.8*	*4.2*	*4.5*
	$\bar{R}^2$	1.26%	3.05%	5.74%	6.89%	7.83%
Big	β	0.110	0.189	0.227	0.306	0.270
	t-stat	*1.6*	*2.8*	*3.4*	*4.7*	*4.1*
	$\bar{R}^2$	0.72%	3.02%	4.53%	8.66%	6.68%

Part (b).

		Low	**BM2**	**BM3**	**BM4**	**BM High**
Small	β	0.152	0.162	0.203	0.241	0.248
	t-stat	*2.3*	*2.4*	*3.1*	*3.7*	*3.8*
	$\bar{R}^2$	1.82%	2.14%	3.59%	5.24%	5.58%
ME2	β	0.146	0.178	0.208	0.269	0.285
	t-stat	*2.2*	*2.7*	*3.2*	*4.1*	*4.4*
	$\bar{R}^2$	1.63%	2.66%	3.81%	6.63%	7.55%
ME3	β	0.149	0.199	0.210	0.224	0.204
	t-stat	*2.2*	*3.0*	*3.2*	*3.4*	*3.1*
	$\bar{R}^2$	1.74%	3.46%	3.87%	4.50%	3.65%
ME4	β	0.139	0.198	0.236	0.253	0.251
	t-stat	*2.1*	*3.0*	*3.6*	*3.9*	*3.8*
	$\bar{R}^2$	1.44%	3.42%	5.01%	5.82%	5.74%
Big	β	0.140	0.203	0.224	0.294	0.237
	t-stat	*2.1*	*3.1*	*3.4*	*4.5*	*3.6*
	$\bar{R}^2$	1.48%	3.61%	4.47%	8.00%	5.11%