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How money illusions and heterogeneous beliefs affect asset prices

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ABSTRACT

We develop a dynamic asset pricing model with two investors with money illusions and heterogeneous beliefs about some aspects of the economy. The model is tractable and delivers closed forms for all equilibrium quantities. The study shows that money illusion leads the nominal shock risk to generate spillover effects on the real side of the economy and affects all equilibrium quantities, even without inflation disagreement. We find that bond yields increase, but the stock price decreases, as money illusion increases. Bond yield and stock price volatilities increase with fundamental disagreement, while the latter decreases with inflation disagreement. We also discover that the stock risk premium is inverse-U shaped as inflation disagreement increases. Moreover, we find that the optimistic investor holds positions in real bonds and stocks, and shorts the nominal bond to hedge against the risk of market changes, which is in line with the pessimistic investor's beliefs.

1. Introduction

Fisher (2014) argues that money illusion influences almost everyone. Those suffering from money illusion can not distinguish nominal values from real values even when inflation makes them different. Consequently, money-illusioned investors always make biased decisions based on nominal rather than real values. Moreover, many economic state variables are generally unobservable for investors, who must then use available information to estimate them before making decisions. In reality, investors often have different abilities, knowledge, and experiences, which induce different interpretations about the common available information. This implies that heterogeneous beliefs generate persistent disagreements between investors, even if they receive identical information.

In this regard, we develop a general equilibrium model with money illusion and heterogeneous beliefs, and analyze how they affect equilibrium quantities including the risk free rate, asset prices, asset volatilities, and investors' optimal portfolio plans. To characterize the key feature of investors, we employ the same setting as Basak and Yan (2010) and Miao and Xie (2013), in which money-illusioned investors discount future real payoffs by a combination of the nominal and real values with the money illusion parameter controlling the bias. Additionally, we assume that investors cannot observe the expected inflation and the growth rate of the dividend stream, and investors have heterogeneous beliefs about them. As in the existing literature on the heterogeneous beliefs, such beliefs generate persistent disagreements between investors, and further influence all equilibrium quantities.

We first examine how money illusion and disagreements affect investors' individual-specific state price densities and their optimal consumption. We find that the former depend directly on the price level in presence of money illusion. The money-illusioned investors' consumption directly depends on the price level, which makes them undertake the nominal shock risk, which must be priced and impacts the state price densities. Furthermore, we find that an investor with a higher degree of money illusion and is risk intolerant consumes less goods. Though a higher degree of money illusion makes such investors feel wealthier and incites them to

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increase their nominal consumption, risk intolerant investors are inclined to anchor their current consumption when economic conditions change. Thus, they increase their nominal consumption so little relative to the price level, that their real consumption to decreases. The disagreements represent the wedge of opinions between investors, and generate different perceived risk prices. These differing perceived risk prices motivate investors toward speculative trading in securities markets and generate a wealth transfer between the investors. Consequently, investors with beliefs closer to reality can take advantage and occupy a large part of the wealth, and consumes more goods.

We second investigate how money illusion and the disagreements influence investors' perceived risk prices and the risk free rate. We show that money illusion only affects investors' perceived nominal shock risk prices, but has no effects on real shock risk prices. However, the influence of money illusion on nominal shock risk prices can be positive or negative, depending on the degree of risk aversion. As to the disagreements, we find that the fundamental disagreement affects investors' perceived real shock risk prices and the inflation disagreement influences nominal shock risk prices. The disagreements have opposite effects on the perceived risk prices: they reduce pessimistic investors' perceived risk prices and increase the risk price for optimistic investors'. Money illusion generates two effects on the risk free rate. The first is the income or substitution effect. If investors are risk intolerant, the income effect is dominant and the risk free rate increases with money illusion. Otherwise, the substitution effect dominates and the risk free rate decreases with money illusion. The second is the hedging effect. Money-illusioned investors must hold positions on securities that are sensitive to nominal shock risk, which further affects the risk free rate. Specially, this hedging effect will vanish if there is no uncertainty about the price level. The disagreements generate different investment sets for different investors, and motivate them toward speculative behaviors for the purpose of capturing consumption from other investors. This mechanism also impacts the risk free rate and expedites it toward to the beliefs of the investor who is relatively more successful.

Next, we explore how money illusion and disagreements affect the real and nominal bond yields and their volatilities. Money illusion affects bond yields via the classical income and substitution effect. When investors are risk intolerant, the income effect dominates the substitution effect, and the bond yields increase with money illusion. Different from bond yields, risk intolerant investors tend to keep positions in the bonds for the purpose of smoothing consumption in their life time, which decreases the volatilities of bond yields. Meanwhile, we reveal that the inflation disagreement has negative effects on bond yields, but have positive effects on their volatilities. Our results are consistent with that of Bomberger and Frazer (1981), who empirically show that a higher dispersion of expected inflation has negative impacts on the risk free rate. Simultaneously, the positive relationship between the inflation disagreement and bond yield volatility could help explain the excessive volatilities of bond yields, as Shiller (1979) points out. More importantly, our model also reveals that both the bond yields and their volatilities are more sensitive to the inflation disagreement relative to the fundamental disagreement. Croitoru and Lu (2014) empirically test the influences of heterogeneous beliefs about the growth rate of the endowment on the bond yields, and find that they are less significant than that of heterogeneous beliefs about the growth rate of money. Our finding also reflects the same result.

Meanwhile, we examine the effects of money illusion and disagreements on stock prices. A higher degree of money illusion makes the current consumption more valuable relative to future consumption (Basak & Yan, 2010). Because stocks are claims on future consumption, the stock price decreases with money illusion. Our conclusion is in line with that of Ritter and Warr (2002) and Campbell and Vuolteenaho (2004). The stock price decreases with the fundamental disagreement but increases with the inflation disagreement. This is because increasing the fundamental disagreement makes the stock more uncertain, which moves investors to short the stock and lower its price. Diether and Malloy (2002) provide supporting evidence for this finding by showing that when optimistic perspectives dominate the stock market, stock prices decrease with investors' dispersions. Conversely, increasing the inflation disagreement makes the nominal bond more risky and makes the stock more attractive. This encourages investors to put more weight on the stock and increases its price.

We also examine the effects of money illusion and disagreements on stock volatility and its risk premium. Raising the degree of money illusion not only lowers the stock's attractiveness, but also leads investors to become more sensitive to the price level. Thus, investors alter their consumptions frequently as the price level changes, which further increases stock volatility and its risk premium. This positive relationship between the stock risk premium and money illusion is consistent with Modigliani and Cohn's (1979) inflation illusion hypothesis and Fama's (1981, 1983) proxy hypothesis, which state that inflation illusion generate this positive relationship. Because the fundamental disagreement represents an additional risk in the stock and increases its uncertainty, both the volatility and risk premium increase with the fundamental disagreement. This result is similar to that of David (2008) and Banerjee and Kremer (2010), who find that the stock return is positive with investors' dispersions about the expected growth rate of the endowment stream. Furthermore, this result is also consistent with Buraschi and Jiltsov (2006), Dumas, Kurshev, and Uppal (2009), Bhamra and Uppal (2013), and Cujean and Hasler (2017), who show that heterogeneous beliefs about fundamentals increase the stock's uncertainty. On contrary, boosting the level of inflation disagreement makes the stock relatively safe and incites investors to keep their stock positions, which reduces its volatility. More importantly, the stock risk premium has an inverted-U shape as the inflation disagreement increases. When the inflation disagreement is not high enough, investors view the nominal bond as relatively safe and are inclined to keep their positions in it. This implies that investors need a higher risk premium to hold the stock. However, when the inflation disagreement is high enough, the nominal bond's risk is higher than that of the stock. Thus, investors put more weight on the stock and only need a lower risk premium to hold it.

Finally, we examine how money illusion and the disagreements affect investors' optimal portfolio plans. Increasing the degree of money illusion makes money-illusioned investors care more about current consumption relative to future consumption. Since the stock is a claim on future consumption, and both the real and nominal bonds are short-term claims, investors reduce positions in the stock and increase positions in the nominal and real bonds as the degree of money illusion increases. Both the fundamental and inflation disagreements have positive effects on the optimistic investor's stock and real bond positions. Raising the fundamental