Long Live Hermes! Mercury Retrograde and Equity Prices

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Abstract

This paper examines the effect of Mercury Retrograde on stock market returns. Focusing on market indexes in 48 countries, we find that the average market returns in Mercury Retrograde periods are about 3.22% annually lower than those in other periods. Our additional tests offer supporting evidence that a belief channel explains the return prediction of Mercury Retrograde: investors who hold an astrological belief that Mercury Retrograde can destroy their decision-making will stay away from the market. This effect results in a higher risk premium required by remaining investors in sharing more risk. We further confirm that this belief channel is about a belief in ancient Greek culture, highlighting the importance of the ancient culture in the market returns. Collectively, our findings suggest that for some artificial cultures, investors may deem them important, and behave accordingly.

Keywords: Mercury Retrograde; culture; equity prices; international finance;
JEL classification:

1. Introduction

The motion of the planet has been associated with people's lives since ancient times. Such planetary motions' theory is rooted in ancient Greek mythology (e.g., Graf, 1993; Evans, 1999). The oldest known and salient planetary motions' theory is an ancient Greek relief sculpture that depicting the planet Mercury in the constellation of the Lion (Akurgal, 1978). Mercury is the closest planet to the Sun and the swiftest planet of all, which is why it named from Greek god Hermes, who is the winged-helmeted messenger of the gods and the son of Zeus and Maia.[1] In Greek myths, Hermes rules financial gain, commerce, communication, traffic, and boundaries; so does Mercury. Based on myths, astrological lore uses the analogy between the macrocosm and mythology to imply that the retrograde motion of Mercury is a cause of misfortune in Hermes' roles.

Mercury Retrograde is a visible astronomical phenomenon from the Earth. Retrograde refers to a perceived reversal in the standard west-to-east movement of planets in the solar system. Mercury Retrograde occurs when Mercury laps Earth. Because a year on Mercury is 88 Earth days and a year on Earth is 365 days, Mercury laps Earth (and hence retrogrades) three to four times annually, with three to four weeks per Retrograde. Mercury appears to move "backward" (east-to-west) across the sky is just an optical illusion caused by our position on Earth. When Mercury overtakes Earth and continues its orbit, its straight trajectory seems to change course. Hence, it just appears to be going backward relative to Earth's motion.

Because "backward" means negative, astrology believes that Mercury Retrograde is a cause of the disaster in Hermes' roles – communications and decision makings (McGuirk, 2016; Smoller, 2017; Crockford, 2018; Prado-Richardson, 2019; Boland, 2019). Accordingly, they suggest that individuals are more prone to make mistakes in decision makings during Mercury Retrograde, i.e., signing wrong contracts and creating incorrect business plans. Therefore, it is better to avoid making decisions during the Mercury Retrograde period.[2] Given that equity trading is decision-making, astrology believes that investors are better off staying away from the market to avoid decision-making (Edward, 1970; Gillen, 1979; Bost, 2012; Boland, 2019). This belief

[1] Mercury was derived from "medio currens" in Roman time, in reference to Hermes' role as a mediator and messenger who moves between worlds (Miller and Clay, 2019).

[2] The news from the New York Times provides an example of the astrological belief in Mercury Retrograde: "Do not sign contracts. Do not buy electronics, or anything with moving parts or gears. Do not be surprised if the mail is screwed up, or something goes awry when you're in transit. And be mindful: You're liable to forget something, like your glasses or phone." https://www.nytimes.com/2019/03/14/style/mercury-retrograde-facts.html.

could cause low investor recognition. Thus, markets need to offer a higher risk premium to compensate their holder for sharing more risk (Merton, 1987), which results in low current prices. Therefore, this paper hypothesizes that market returns are lower during the Mercury Retrograde period than during the remainder of the year. We call this view as the *Mercury effect hypothesis.*

To test the *Mercury effect hypothesis*, the null hypothesis in this paper is that Mercury Retrograde does not affect market returns. The null hypothesis comes from the possibility that the astrological belief is incorrect, or investors do not deem it important. In 1975, 186 leading scientists (including 18 Nobel Prize winners) claimed that astrological belief is incorrect and unscientific (Bok, Jerome, and Kurtz, 1975). Consistently, in modern societies, Mercury Retrograde has little tangible impact on social activities. If individuals also think such belief is incorrect, they are less likely to hold the astrological belief (Science and Engineering Indicators, 2011; Allum, 2011). Therefore, Mercury Retrograde might not produce substantial trading behavior swings in a large proportion of a country's population. These characteristics suggest that Mercury Retrograde could have an insignificant effect on market returns.

To investigate how the stock market reacts to Mercury Retrograde, we regress daily realized stock market index returns on an indicator variable for the Mercury Retrograde period using a sample of 48 countries between 1973 and 2019. The regressions control for both country and time fixed effects and cluster standard errors at the country and date level. We find that market returns are 3.22% annually lower during the Mercury Retrograde period than during the remainder of the year, which is consistent with our *Mercury effect hypothesis*. This result is significant at the 1% level and is robust to alternative time windows of Mercury Retrograde, various subsamples, and controlling for other market return puzzles.

To further understanding our *Mercury effect hypothesis*, we propose two nonexclusive channels: the *belief channel* and the *real effect channel*. The *belief channel* posits that investors believe that they will make more mistakes during Mercury Retrograde. Astrology suggests that it is better to avoid making decisions during the Mercury Retrograde period to prevent making mistakes (Crockford, 2018). Investors deem this astrological belief important and hence avoid making decisions accordingly. To avoid decision-making in the stock market, they are better off sitting out of the market (Gillen, 1979; Bost, 2012), which causes an unexpected negative shift in the number of investors during Mercury Retrograde periods. Because investors in the economy bear the risk in the economy, this negative shift causes the risk-bearing capacity in the economy

to decrease. The remaining investors are only willing to bear the risk if they receive a higher risk premium. The requirement for a higher risk premium will drive prices down during the period of Mercury Retrograde. Our intuition is consistent with studies which show that behavioral factors can result in limited stock market participation (Puri and Robinson, 2007; Dominitz and Manski, 2007; Guiso, Sapienza, and Zingales, 2008), which is responsible for the high equity premium (Mehra and Prescott, 1985; Merton, 1987; Basak and Cuoco, 1998; Heaton and Lucas, 1999; Vissing-Jørgensen, 1999; Dai, 2001; Bouman and Jacobsen, 2002; Guvenen, 2003; Gomes and Michaelides, 2008).

The *real effect* channel posits that the astrological belief of Mercury Retrograde is correct –Mercury Retrograde has a tangible effect on decision makings. Under this channel, we can observe lower market returns regardless of whether investors stay away from the market. The rationale is as follows. Astrologically, Mercury Retrograde should tangibly destroy Mercury governs activities (McGuirk, 2016; Crockford, 2018). As we discussed earlier, Mercury governs not only decision-making but also traffic and commerce. Thus, if Mercury Retrograde has a real effect on decision-making, it should also have a real effect on traffic and commerce, and vice-versa (Boland, 2019). Harming traffic-related activities could increase the number of aviation disasters (Crockford, 2018). Kaplanski and Levy (2010) show that aviation disasters can cause bad moods among investors, which results in lower market returns. Destroying commerce-related activities could cause firms to sign wrong contracts and experience low sales (Boland, 2019). These effects can generate a certain amount of fundamental loss for a firm, resulting in more negative cash flow news and hence lower market returns in Mercury Retrograde periods.

We start with the *real effect* channel. Testing the *real effect* channel is similar to test whether Mercury Retrograde has a tangible impact on traffic- and commerce-related activities. We use the traffic accident to proxy for the traffic-related activity and the amount of fundamental loss to proxy for the commerce-related activity. We first find that the effect of Mercury Retrograde in traffic accidents is negative and insignificant, which is inconsistent with the prediction of the *real effect* channel. We then find that cash flow news, as measured by the aggregate new sentiment and earnings surprise in each country-date, is not lower during Mercury Retrograde periods. Collectively, these results are inconsistent with the *real effect* channel.

We now test the *belief* channel. If investors' belief induces the Mercury effect, then we believe the most direct test is identifying investors likely to hold such shared belief in Mercury

Retrograde. First, we use a country's average daily return in the previous year's Mercury Retrograde periods to capture the shared belief in Mercury Retrograde in each country-year. The motivation comes from that 1) investors' astrological belief is persistent (Sales, 1973; Padgett and Jorgenson, 1982), and 2) investors' exposure to consistent astrology predictions (e.g., low returns in Mercury Retrograde) influence theirs toward belief in astrology (Lillqvist and Lindeman, 1998). We find that a country has performed poorly relative to other countries in the previous Mercury Retrograde periods also offers a low return relative to other countries in the current Mercury Retrograde periods. This result confirms the Mercury effect comes from the *belief* channel.

Second, we measure investors' beliefs through the Google Trend search volume intensity. The rationale arises from that investors' internet search behavior can capture their shared cognition in an event (e.g., Da, Engelberg, and Gao; 2011; Gao, Ren, and Zhang, 2018; Choi, Gao, and Jiang, 2020). Specifically, we identify country-date that is more likely to hold shared cognition in Mercury Retrograde as those have the higher Google Trend search volume intensity for the topic "Retrograde motion." As predicted, we find that this search volume can negatively predict future market returns. As further evidence that the *belief* drives our baseline result, we perform a cross-country difference test using the "interest by region" function in Google Trends to download the cross-sectional search interests in the above topic. The Mercury effect is stronger in counties with a high level of this search topic. Overall, our results are consistent with the *belief* channel.

Having identified the Mercury effect is associated with the *belief* channel, we now examine the factors that drive the *belief* channel. We propose that the belief in ancient Greek culture is the crucial driver for the *belief* channel. Our rationale comes from two ways. First, previous studies confirm that investors' cultural background is about their beliefs: the culture is the set of shared beliefs and practices that define a society's way of life (e.g., O' Bar and Conley, 1992; Guiso, Sapienza, and Zingales, 2006; McCleary and Barro 2006). Second, the shared belief of the motions of Mercury arises from the ancient Greek culture, which is one of the foundational to Western culture in general and an accepted part of popular culture in New Age (e.g., Highet, 1949; Alfven, 1984; Campion, 2009). Investors with a greater belief in ancient Greek culture could be more interested in the astrological belief of Mercury Retrograde, and hence most likely avoid market participating accordingly. Our view is consistent with Guiso, Sapienza, and Zingales (2008), who show that culture plays an important role in stock market participation rates.

A challenge in our analysis is to measure ancient Greek culture in a sufficiently narrow way, so that it becomes easier to identify a relationship between the culture and our *belief* channel. An obvious proxy for this purpose is people's interest in ancient Greece. Other proxies can come from our early discussion on the roles of Mercury – Hermes myth. Hence, we use cross-country Google search volume for the topic "Ancient Greece," "Mythology," and "Hermes" to proxy for an *ex post* belief in ancient Greek culture. We find that countries with a greater belief in *ex post* ancient Greek cultures, as measured by a higher cross-country Google search volume for these topics, experience a greater Mercury effect. This result confirms that the Mercury effect comes from a culture effect.

Next, we examine the relationship between culture and the Mercury effect using an *ex ante* proxy for ancient Greek culture. Resorting to the development in the historical literature, we define a country is an *ex ante* ancient Greek culture country if 1) it is related to ancient Greek colonies and 2) the primary religion is Christianity. Historically, colonialism denies history to the colonized, in the sense that it deprives the subject of their cultural rights and identity and build the new culture to the colonized (Ferro, 2005). One of the most important ways to build a new culture is using religions (Page and Sonnenburg, 2003), since religion plays a central role in people's culture toward others. Among religions, Christians hold values and wrote works that rested on ancient Greek culture, suggesting that Christianity is closely related to ancient Greek culture (e.g., Malkin, 1987; Graf, 1993; Smoller, 2017; Dowden and Livingstone, 2011; Gleaves, 2015). We first confirm that countries with an *ex ante* ancient Greek culture are positively related to the odds of observing an *ex post* ancient Greek culture. We then find these countries have a stronger Mercury effect, further confirming a culture effect mechanism.

To better understand the culture effect, we test why the above ancient culture can affect the *belief* channel persistently. Astrology turned out to be a permanent ingredient in ancient cultures because it is scientific in ancient times (e.g., Thorndike,1955; Alfven, 1984; Campion, 2015). However, after the Scientific Revolution around the 15th century, astrology becomes no scientific validity under the natural law of gravitation (e.g., Carlson, 1985; Zarka, 2011). It fundamentally shakes astrology and leads to a negative relation between the astrological belief and scientific development in modern societies.[3] Thus, in a poor scientific development country, people believe

[3] Specifically, after the impetus of the Scientific Revolution, the planetary motions have gradually developed into modern astronomy (e.g., the universal law of gravitation), parting ways from the planetary theory of mythology view.

that astrology is still scientific, and hence they persist in believing astrology (e.g., National Science Board, 2006; Allum, 2011). Consistent with this negative astrology-scientific development relation, we find that the Mercury effect is stronger in counties with a low level of scientific development. Importantly, this low scientific effect is more pronounced in countries with an *ex ante* ancient Greek culture, confirming the *belief* channel comes from a culture effect.

Finally, we test our channels using market variables other than returns. Our *belief* channel predicts a low trading volume in Mercury Retrograde periods since investors do not want to participate in the market these days. The *real effect* channel predicts a positive relation of Mercury Retrograde with market risk and pessimism, because bad mood can cause investor pessimism and negative cash flow news can result in higher market uncertainly (Campbell and Hentschel, 1992). We find that the trading volume is significantly reduced in Mercury Retrograde days, confirming a low investor recognition these days. But we find no evidence that Mercury Retrograde relates to the market risk and investor pessimism. These results help us to confirm the *belief* channel further and rule out the *real effect* channel.

Our findings contribute to different strands of the finance literature. First, we add to the studies in culture and finance who find several culture variables play a central role in equity prices, including the cultural framework from Hofstede and Schwartz, the religion, and the local festival (e.g., Chui, Titman, and Wei, 2010; Kumar, Page, and Spalt, 2011; Hillert, Jacobs, and Muller, 2014; Bergsma and Jiang, 2016; Cheon and Lee, 2018). In this paper, we identify a novel powerful cultural predictor of market returns, Mercury Retrograde – ancient Greek culture. Instead of studying the cross-country culture effect, a unique advantage of our financial setting is that we can study both the cross-country and cross-time culture effects. It allows us to reduce national and institutional influences that are correlated with the culture (e.g., Stulz and Williamson, 2003; Guiso, Sapienza, and Zingales, 2006; McCleary and Barro 2006; Aggarwal and Goodell, 2009). Overall, the repeat exogenous shocks of Mercury Retrograde on investors' trading behaviors help us to draw a causal inference and emphasize the importance of culture in stock market returns.

Second, our results have an important implication in social finance – any event and culture can influence the stock market (Hong, Kubik, and Stein, 2004, among others), as long as investors believe it and behave accordingly. By linking the belief to the market participation rate, our paper provides additional evidence that social events and cultures can affect equity premium through changing in market participation rates (e.g., Puri and Robinson, 2007; Dominitz and Manski, 2007;

Guiso, Sapienza, and Zingales, 2008; Hirshleifer, 2015; Han, Hirshleifer, Walden, 2018). For example, Bouman and Jacobsen (2002) show that the social belief about "Sell in May and go away" indeed results in low returns during the May-October period. They suggest that this effect is related to low market participation rates due to summer vacations.

Third, we add to the earlier works in celestial phenomena. The behavioral finances show that celestial phenomena have significant power in predicting stock market returns either by changing in risk aversion or misattribution (e.g., Dichev and Janes, 2003; Yuan, Zheng, and Zhu, 2006; Keef and Khaled, 2011; Novy-Marx, 2014). They view that celestial phenomena influence stock returns mostly by biological issues. These biological issues typically come from the real effect of celestial phenomena, for example, the mental issue (Law, 1986). We find that not only the real effect of celestial phenomena can affect the market returns but also investors' beliefs. By investigating the *belief* channel, we add an additional motivational feature of celestial phenomena: the impact of culture.

Finally, we provide new evidence that investors' trading behavior can come from a temporary event that is unrelated to any economic factors. Early works link market returns to a single event variable that impacts trading behavior (e.g., Thaler, 1987; Kamstra, Kramer, and Levi, 2000; Bouman, Jacobsen, 2002; Frieder and Subrahmanyam, 2004; Bergsma and Jiang, 2016). However, the number of observed events tends to be low, which reduces statistical power. Other studies use a continuous variable to identify a change in the trading behavior of investors (e.g., Saunders, 1993; Kamstra, Kramer, and Levi, 2003; Cao and Jason; 2005; Hirshleifer and Shumway, 2003; Kamstra, Kramer, and Levi, 2003; Yuan, Zheng, and Zhu, 2006; Novy-Marx, 2014). But this method could suffer a problem of incorrectly assuming a wrong cause for the observed seasonality in market returns (Jacobsen and Marquering, 2007). Our Mercury Retrograde event can reduce the above disadvantages. Mercury Retrograde occurs three-four times per year, which gives us greater statistical power in testing the effect of emotion in returns with a 47 years sample. By using a simple Mercury Retrograde dummy, the Mercury effect we observed does not have the danger of data mining.

The remainder of this paper is organized as follows. Section 2 describes the research design. Section 3 tests our baseline results and the channels for our baseline results. Section 4 discusses whether culture drives our results. The last section concludes.

2. Research design

2.1. Mercury Retrograde and hypothesis development

The belief that motions of the planet affect people's lives (the theory of the planetary motions) has prehistoric origins and flourishes in the modern world.[4] The planetary motions' theory arises from ancient Greece (e.g., Guthrie, 1979; Evans, 1999). This theory in the ancient Greek times depended entirely upon the idea of a finite spherical and geocentric universe, viewed in with Aristotelian physics and cosmology. The idea came from the ancient Greek astronomical belief that the Earth was stationary and the center of the Solar System and their gods' cosmos, and everything in the heavens regularly moved about the central Earth in circular orbits (Guthrie, 1979).

To gain an understanding of the natural phenomena, ancient Greeks used myth to explain the beginnings of the universe. Hence, the name and the role of planets were rooted in ancient Greek myths (Graf, 1993). They then used the planetary motions together with the analogy between the macrocosm and mythology to imply that people's soul reflected the cosmic soul, provided the rationale for direct stellar influence upon society and the individual (Guthrie, 1979). The mythology-macrocosm analogy is therefore embedded within the astrological interpretation of the planetary motion and people's relation.

The oldest known Greek planetary motions' theory is a relief sculpture discovered in the Taurus range (Akurgal, 1978). It is spectacular evidence of ancient Greeks' interest in the motions of the planets by the first century B.C. This relief sculpture depicts the motion of Mercury in the constellation of the Lion. The planet Mercury was well known to many of the ancient Greeks as it is a comparatively bright object in the evening sky. Mercury is the swiftest planet of all and closest to the sun. The name and role of Mercury come from the Greek myths, the god Hermes.

The Greek god Hermes, whom the Romans called Mercury, was the general messenger of the gods of Olympus and the son of Zeus and Maia.[5] Hermes becomes Roman god Mercury because of Roman gods are syncretized with Greek gods during the time of the Roman Republic. Under Greek cultural influence, the two gods were linked early on, with the myths of Hermes being transferred to that of Mercury (Bird, 1992). Mercury was then derived from "medio currens"

[4] For example, Gallup polls reports that more than 25% of the U.S. population believes the position of the stars and planets could affect people's lives. The National Science Foundation (2002) finds that more than 15% of the survey respondents admitted reading newspaper astrology every day or "quite often."

[5] In other ancient cultures, Mercury also has its name in other languages, such as ancient China called Mercury "Chenxing." But the social meaning of Mercury only comes from ancient Greek myths.

in Roman time, in reference to Greek god Hermes' role as a mediator and messenger who moves between worlds (Miller and Clay, 2019). The astrological symbol of Mercury is a short vertical line crossing a circle above and a semicircle (Unicode: ☿). This symbol called the caduceus, which is the shape of the wand that Hermes took.

According to the myths, Hermes rules financial gain, commerce, communication, traffic, boundaries, and thieves (Graf, 1993).[6] Based on Hermes' roles, astrology believes that the motions of Mercury could affect the soul of people and thereby can predict the behaviors of people by observing the motions of Mercury. Among Mercury's motions, they believe that the retrograde motion of Mercury has a social meaning in the misfortune of Hermes' roles, for example, communications (Crockford, 2018).

Mercury Retrograde is a visible astronomical phenomenon from the Earth. Retrograde motion is when planets appear to temporarily change the direction of their orbit: a perceived reversal in the standard west-to-east movement of planets in the solar system. But they don't change direction; they look that way from Earth (an optical illusion). Figure 1 shows the idea of Mercury Retrograde. We see that both Mercury and Earth move in the same direction. Because Mercury is the planet closest to the sun, it moves faster than Earth. A year on Mercury is typically 88 Earth days, and a year on Earth is 365 days. It means that Mercury can lap Earth (next to Earth on the same side of the sun) three to four times annually. When Mercury laps Earth, Mercury looks like it's moving east to those of us on Earth (retrograding). The dash lines in Figure 1 show our view of Mercury against the fixed background stars. As Mercury passes us by, our line of sight shifts so that for about three to four weeks, Mercury will appear to loop back on itself when viewed from Earth. Hence, it's simply a function of two objects orbiting in the same direction at different speeds. If we stood on Mercury, we would see Earth make an apparent loop too.

[Figure 1 here]

However, because "backward" typically means negative in astrology, astrology believes that Mercury Retrograde can destroy communications and decision markings in a substantial and unambiguous way (e.g., McGuirk, 2016; Smoller, 2017; Crockford, 2018; Prado-Richardson, 2019). Astrologically, astrologers suggest that individuals are more prone to make mistakes during Mercury Retrograde periods, and hence it is better to avoid making decisions, i.e., avoid signing

[6] Consistently, Mercury is regarded as the ruler of the third house, which is called "The House of Communications."

contracts and making new business plans. This belief receives well attention in newspapers from the 1970s, for example, an April 1979 issue of The Baltimore Sun instructed its readers: "Don't start anything when Mercury is retrograde."[7] Given that investors' trading behavior is also a decision-making process, the importance of Mercury for equity markets has been known for some time (Edward, 1970; Gillen, 1979; Bost, 2012). For example, a famous astrology analyst Raymond Merriman often uses Mercury Retrograde to analyze the performance of financial markets.[8] Hence, it is reasonable to believe that the effect of Mercury Retrograde can be correlated across most investors within a country.

Collectively, astrology suggests that investors can make wrong decisions during Mercury Retrograde. They then believe that investors are better off staying away from the market to avoid decision-making (Edward, 1970; Gillen, 1979; Bost, 2012; Boland, 2019). This belief results in lower demand in the market. Because assets with lower investor recognition need to offer a higher risk premium to compensate their holder for sharing more risk (Merton, 1987), their prices should be low in Mercury Retrograde. Hence, this paper hypothesizes that market returns are lower during the Mercury Retrograde period than during the remainder of the year. We call this view as the *Mercury effect hypothesis.*

Our *Mercury effect hypothesis* can depend on two channels: the *belief* channel and the *real effect* channel. The *belief* channel posits that market returns are low in Mercury Retrograde because investors who hold an astrological belief of Mercury Retrograde do not participate in the market during Mercury Retrograde periods. To see this, we assume that there are two groups of investors bearing the risk in the economy. The first group investors hold the above astrological belief, and the remaining investors do not. The first group investors believe that it is better to avoid making decisions during Mercury Retrograde. To avoid decision-making in the stock market during Mercury Retrograde periods, they can sit out of the market and go away (Gillen, 1979; Bost, 2012).[9] This behavior causes an unexpected negative shift in the number of first group investors on those days, which results in the risk-bearing capacity in the economy decreases. Hence, the remaining investors in the market are only willing to bear the risk if they compensate for a higher risk premium (e.g., Merton, 1987; Bouman and Jacobsen, 2002; Gomes and Michaelides, 2008).

[7] Https://www.newspapers.com/newspage/373462725/.
[8] For example, see http://stariq.com/Main/Articles/P0005305.HTM.
[9] In other words, they can come back after Mercury Retrograde.

This effect will reduce prices during the period of Mercury Retrograde. Therefore, we can observe lower market returns during the Mercury Retrograde period than during the remainder of the year.

The *real effect* channel posits that Mercury Retrograde has a real effect on people's economic and social activities, regardless of whether investors hold an astrological belief or not. If Mercury Retrograde has a tangible impact on social activities, then it should affect the Mercury/Hermes governs activities negatively (Crockford, 2018; Prado-Richardson, 2019). For example, Mercury Retrograde might indeed, as suggested by astrologers, have a negative effect on traffic- and commerce-related activities. Then, the number of flight ancients could increase, and businesses could generate a certain amount of fundamental loss. The former case can cause bad moods among investors (Kaplanski and Levy, 2010), and the latter case can cause negative cash flow news. We know that both bad mood and negative cash flow news are associated with low returns. Hence, in both cases, we can observe low market returns in Mercury Retrograde periods. Collectively, the *real effect* channel tests whether there is some truth at the tangible effect of Mercury Retrograde. If there is, then we should see low market returns in Mercury Retrograde periods.

These two channels are not mutually exclusive. If Mercury Retrograde has no tangible impact on social activities, low returns could subject to investors' subjective beliefs. Once Mercury Retrograde has real effects on social activities, some low returns could subject to low investor recognition, and some could subject to other economic impacts of Mercury Retrograde.

Overall, we state our *Mercury effect hypothesis* in this paper as:

H1: Mercury Retrograde affects market returns negatively.

To test the *Mercury effect hypothesis*, the null hypothesis in this paper is that Mercury Retrograde does not affect market returns. The null hypothesis is based on the possibility that the astrological belief is incorrect, or investors do not deem it important. In 1975, 186 leading scientists (including 18 Nobel Prize winners) claimed that astrological belief is incorrect and unscientific (Bok, Jerome, and Kurtz, 1975). Consistently, in modern societies, Mercury Retrograde has little tangible impact on social activities. Studies suggest that if individuals do not think astrology is scientific, then they are less likely to hold astrological beliefs (e.g., Eysenck and Nias, 1982; Wyman and Vyse, 2008; Allum, 2011). Therefore, Mercury Retrograde might not produce

substantial trading behavior swings in a large proportion of a country's population. These characteristics suggest that Mercury Retrograde could have an insignificant effect on market returns.

2.2. Mercury Retrograde dates

Following Astrologer Richard Nolle, we collect the Mercury Retrograde dates from Matrix's BLUESTAR software, a software that can produce planet stations, with nominal precision to the nearest minute. Because this software is not for free, individuals can also observe the Mercury Retrograde dates from Astrologer Richard Nolle's website.[10] The Mercury Retrograde calendars are determined well in advance based on the orbit of the planet. Our sample period is from January 1973 to October 2019.

[Figure 2 here]

Figure 2 displays the distribution of the Mercury retrograde in each year and month. Figure 2.A shows that the number of Mercury Retrograde days are evenly spread across each year, with an average of 73 calendar days annually. As we discussed earlier, Mercury experiences retrograde motions three to four times annually, with around three to four weeks per time. Thus, an average of 73 calendar days annually is expected. It indicates that there are around 3.15 Mercury Retrograde events annually. For the 47 years sample, we have 148 observed Mercury Retrograde events.

Figure 2.B illustrates that the percentage of Mercury Retrograde days are steadily spread across each month, suggesting that Mercury Retrograde is not necessarily driven by calendar anomalies, mood seasonalities, or other time effects in the time series. But, to be conservative, we still control for the time fixed effect in our regression analysis in the sections below.

2.3. Other data

Our market return data come from DataStream. We download the country-level daily total return index (RI) in local currency.[11] The daily volatility is the absolute value of the return. When

[10] https://www.astropro.com/features/tables/geo/me-sta/.

[11] We use RI from each country indices with the DataStream classification that start with "TOTMK." We use the local currency as the main test to avoid the concern that Mercury Retrograde could affect the movement of the currency value and the macroeconomic value. Also, the level of astrological beliefs we have in mind most likely associated with local investors, for which local returns are relevant to the main analysis. In all regressions, we include the country

a price index is not available for a given trading day (i.e., holiday, the market is closed, or the data are not available), DataStream inserts the previous day's value. Hence, to eliminate such invalid observations, a total return index observation is not used if the price index exactly matches the previous reported day's price index (Pukthuanthong and Roll, 2014). Our sample consists of 48 countries from January 1973 to October 2019. Table 1 shows the country distribution of returns.

[Table 1 here]

For the other country-date variables, we collect data from several sources. We obtain the aviation disasters from the Aviation Safety Network of the Flight Safety Foundation database and the car accidents from the Fatality Analysis Reporting System from National Highway Traffic Safety Administration (January 1975 to December 2017 for the U.S.).[12] We also collect data for the cash flow information. Specifically, we collect the news sentiment score (ESS) from the RavenPack News Analytics, and the earnings surprise comes from I/B/E/S.[13]

We also collect some variables that might affect investors' trading behaviors globally. Following Novy-Marx (2014), we download sunspot data from Solar Influences Data Analysis Center,[14] and quasiperiodic Pacific Ocean temperature data from the National Oceanic and Atmospheric Administration (NOAA).[15] Novy-Marx (2014) shows that sunspot and global temperature can affect the stock returns globally. We download full moon data from the United States Naval Observatory (USNO) website to control for the moon effect of Yuan, Zheng, and Zhu (2006) in our robustness test.

We employ a broad set of country-level variables in our cross-country tests. We obtain information on a country's primary religion from Stulz and Williamson (2003) and the CIA Factbook 2003. To measure a country's scientific development, we use the time-series average value of the Estimated Civil Gross domestic expenditure on R&D as a percentage of GDP (EGERD) from UIS Stat.[16] We collect the colonization data from Heritage History Library and Page and

fixed effect, and hence the local returns are comparable country by country in our study. We also download the total return index in U.S. dollars to test the robustness of our results.

[12] The aviation disasters download from http://aviation-safety.net. The disasters contain descriptions of over airliner, military transport category aircraft, and corporate jet aircraft safety that occurred at any time during the day, all around the world. The car accident data download from ftp://ftp.nhtsa.dot.gov/fars/, which covers all traffic fatality in the U.S.

[13] We scale the ESS variable to vary between 1 and 1. Positive, negative, and zero values indicate positive, negative, and neutral sentiments of a particular news article, respectively.

[14] https://solarscience.msfc.nasa.gov/greenwch/spot_num.txt.

[15] https://www.cpc.ncep.noaa.gov/data/indices/.

[16] http://data.uis.unesco.org/index.aspx.

Sonnenburg (2003).[17] The number of countries in the tests using the above data is based on data availability.

3. Mercury Retrograde and equity prices

3.1. Baseline results

To test whether Mercury Retrograde has a negative effect on stock market returns, we use the usual regression analysis. We run the following panel regression:

$$Ret_{i,t} = \alpha + \beta_1 \times Mercury_t + Controls_{i,t} + FE + e_{i,t} \quad (1)$$

where, $Mercury_t$ a time dummy variable takes the value of one if day t falls on the event window of Mercury Retrograde, and zero otherwise. The event window of Mercury Retrograde in our main analysis is from the beginning of the Mercury Retrograde day to the beginning of the Mercury Prograde (direct motion) day $[Retrograde_t, Prograde_t]$. We also use other event windows to test the robustness of our results. As discussed by Jacobsen and Marquering (2007), using a simple dummy variable to address a market return effect does not have the danger of data mining. Another benefit of using a dummy variable is that it can capture a large signal-to-noise ratio in returns (Edmans, Garcia, and Norli, 2007).

In Table 2, we test whether the coefficient of $Mercury_t$ is significantly negative. In Column (1), we work with a simple regression as in equation (1) and control for the weekday, year-quarter, and country fixed effects (FE). These fixed effects mitigate the potential concern that our results are driven by other country factors and time effects that are correlated with stock market returns.[18] We find that the coefficient of $Mercury_t$ is -5.370 with a t-statistic of -3.00. The average returns in Mercury Retrograde periods are about 3.22% (5.370 bps×60 days÷100) per year lower than those in other periods (we call it as the "Mercury effect"), which corresponds to 22.56% of the in-sample unconditional mean in annually returns (i.e., 22.56% = 3.22×100÷(250×5.708)).

The benefit of our research design is that we do not need to control many economic factors, since Mercury Retrograde is not affected by any economic factors.[19] But one concern in Column (1) is that the daily returns have market microstructure phenomena, such as bid-ask bounce, sully

[17] https://www.heritage-history.com/ssl/cds/ancient_greece/html/guide_maps.html.
[18] Since the Mercury retrograde window can include more than 80% trading days within a calendar month, we cannot control the year-month fixed effect.
[19] Controlling for economic factors are likely resulted in a bad control problem because Mercury Retrograde could affect other economic outcomes.

the purity of the theoretical prediction. With these caveats in mind, in Column (2) of Table 1, we attempt to control for the influence of the lagged returns of indices and lagged return volatility acts as a proxy for the influence of several market frictions. The return and volatility predictability regressions control for all lags up to 5 trading days (1 week of calendar time). The tenor of the results is essentially the same as in Column (1); the coefficient of $Mercury_t$ is -5.178 with a t-statistic of -2.96. Overall, our baseline results are consistent with the *Mercury effect hypothesis.*

[Table 2 here]

To confirm the economic significance of our baseline result, we use the bid-ask spread (around 0.10% of the traded value) of emerging market exchange-traded funds (ETFs) as the transaction cost of implementing a Mercury effect trading strategy. For example, taking a short position in ETFs in Mercury Retrograde periods. Our trading strategy is easily implementable since Mercury Retrograde calendars are determined well in advance. Since Mercury Retrograde is about three-four times annually, our trading strategy involves about 0.3%-0.4% transaction cost. Hence, our Mercury effect net of transaction costs for the trading strategies range from 2.82% to 2.92% annually. This net return is comparable to that reported by other celestial phenomena (e.g., Yuan, Zheng, and Zhu, 2006; Novy-Marx, 2014).

3.3. Economic channels

The low returns in Mercury Retrograde periods can depend on two channels: the *belief* channel and the *real effect* channel. In this section, we perform a number of tests attempts to enrich our insights on the two channels.

3.3.1. Mercury Retrograde and the real effect channel

We start with the *real effect* channel. Testing the real effect channel is like test whether Mercury Retrograde has a tangible impact on traffic- and commerce-related activities. First, we use the traffic accident to proxy for traffic-related activities and look at whether Mercury Retrograde has a real influence on traffic-related activities. To test the impact of the Mercury on the traffic accident, we run the following time-series regressions:

$$Accident_t = \alpha + \beta_1 \times Mercury_t + Five\ lags\ of\ Accident_t + FE + e_t \qquad (2)$$

where, $Accident_t$ is the logarithm of the daily number of aviation disasters or the daily number of car accidents, $Five\ lags\ of\ Accident_t$ is the five lags of the dependent variable ($Accident_{t-5}$ -

$Accident_{t-1}$) to control for the short-term pattern in $Accident_t$, and FE are the weekday and year-quarter fixed effects.[20]

[Table 3 here]

Table 3 presents OLS estimates of β_1, which represent Mercury Retrograde on traffic accidents, for all two measures of accidents. If the Mercury retrograde can adversely affect the traffic, we should expect β_1 to be significantly positive. However, the table indicates that β_1 is insignificantly negative in both Columns, which is inconsistent with the prediction that the Mercury Retrograde has a real influence on the organization and structure of our human activities.

We also construct two other proxies for the traffic based on Google search volumes. We obtain an index of daily search volumes from Google Trends for the topic "Flight cancellation and delay" and "Traffic collision" in the worldwide. It seems plausible that individuals might conduct online searches involving these phrases following flight delays and traffic collisions. In Column (3)-(4) of Table 3, we re-run the equation (2) using the daily google search volume for the above two topics as the dependent variable. We find that β_1 is insignificantly in both Columns, again suggesting that the Mercury effect is unlikely driven by the *real effect* channel.

Second, we use the aggregate fundamental loss to proxy for commence-related activities and test whether the Mercury Retrograde process engenders a certain amount of fundamental loss. We investigated this issue in the following way. We use the amount of negative aggregate cash flow information to capture the fundamental loss. Intuitively, if firms, on average, make losses during the Mercury Retrograde period, we then expect to see negative aggregate cash flow news in those days. The aggregate cash flow information can be reflected in news accounts. Specifically, we use the aggregate news sentiment ($News\ Sentiment_{i,t}$), aggregate corporate press release sentiment ($Corporate\ press\ Sentiment_{i,t}$), and aggregate earnings surprise ($SUE_{i,t}$) to capture the fundamental loss in each country-date. The aggregate value is then calculated as the equal-weighted average of all daily values of firms in each country-date.

We run the following regression:

$$Cash\ flow\ news_{i,t} = \alpha + \beta_1 \times Mercury_t + controls_{i,t} + FE + e_{i,t} \quad (3)$$

[20] The car accident only covers all traffic fatalities in the U.S from January 1975 to December 2017. Because the *real effect* channel implies that Mercury Retrograde should have equal influence in each country, data from the U.S. can also help us to test the *real effect.*

where, $Cash\ flow\ news_{i,t}$ is $News\ Sentiment_{i,t}$, $Corporate\ press\ Sentiment_{i,t}$, or $SUE_{i,t}$ in the country i in date t. The control variables include five lags of the dependent variable, five lags of return, and five lags of volatility. The fixed effects are weekday, year-quarter, and country fixed effects. If the Mercury Retrograde process engenders a certain amount of fundamental loss, we should expect to see that β_1 is significantly negative. We present our results in Table 4.

[Table 4 here]

In Column (1), we use $News\ Sentiment_{i,t}$ as the dependent variable and find that the coefficient of $Mercury_t$ is 0.001 with a t-statistic of 0.94. The similar insignificant effect is observed using $Corporate\ press\ Sentiment_{i,t}$ as the dependent variable in Column (2). Turning to Column (3), we find that the Mercury retrograde process has an insignificant effect on $SUE_{i,t}$. $Corporate\ press\ Sentiment_{i,t}$ and $SUE_{i,t}$ capture not only the market-level information but also the seasonal factor in the provision of news from the firm insider. Hence, Column (2) and (3) also indicate that our Mercury effect is unlikely driven by a seasonal factor in news.

Overall, the results from Table 4 suggest that the Mercury retrograde process does not engender a certain amount of fundamental loss, and hence our baseline results are less likely attributable to the *real effect* channel.

3.3.2. Mercury Retrograde and the belief channel

We now test the *belief* channel. If the Mercury effect is induced by investors' astrological beliefs, then we believe the most direct test is identifying investors likely to hold such shared cognition in Mercury Retrograde. Although we do not have a direct measure of shared cognition in Mercury Retrograde held by investors, we are able to examine other behaviors that may signal shared cognition in Mercury Retrograde in the population.

First, we use a country's average daily return in the previous year's Mercury Retrograde periods to capture the shared cognition in Mercury Retrograde held by investors. Our rationale is as follows. First, astrology studies suggest that people's astrological belief is persistent (Sales, 1973; Padgett and Jorgenson, 1982). Second, investors toward belief in astrology are positively related to their exposure to consistent astrology predictions (Lillqvist and Lindeman, 1998), i.e., the belief of Mercury Retrograde will be increased if market indeed performs poorly in Mercury Retrograde periods. Therefore, if a country has performed poorly relative to other countries in the previous-year Mercury Retrograde periods, we expect it also to offer a low return relative to other

countries in the current-year Mercury Retrograde periods. In contrast, the Mercury effect in the current-year periods should be unaffected by the market returns in the previous-year non-Mercury Retrograde periods, since the Mercury effect only comes from investors' shared belief in Mercury Retrograde.

To test the above prediction, we perform the following analyses. We construct a dummy variable $Low\ Ret_{i,t}^{last\ year\ MR}$ that is equal to one (zero) if a country's average daily return in the previous year's Mercury retrograde period is at the bottom (top) 1/3 of all the sample countries in that year. The regression model specified in our baseline results includes $Low\ Ret_{i,t}^{last\ year\ MR}$ as well as their interaction terms with $Mercury_t$ as additional explanatory variables.

Table 5 Panel A presents the results. In Column (1), we find that the coefficient on the interaction term between $Low\ Ret_{i,t}^{last\ year\ MR}$ and $Mercury_t$ is -3.366 with a t-statistic of -2.68, confirming that the Mercury effect is more pronounced in countries with a lower level of returns in the previous year Mercury Retrograde periods. In Column (2) - (3), we divide the sample into Mercury Retrograde days and other days. We find that the coefficient of $Low\ Ret_{i,t}^{last\ year\ MR}$ is only significantly negative in Mercury Retrograde days, confirming the Mercury effect only comes from investors' persistent shared cognition in Mercury Retrograde.

[Table 5 here]

In Table 5, Panel B, we also construct another dummy variable $Low\ Ret_{i,t}^{last\ year\ Non-MR}$ that is equal to one (zero) if a country's average daily return in the previous year's non-Mercury Retrograde period is at the bottom (top) 1/3 of all the sample countries in that year. The regression model specified in our baseline results includes $Low\ Ret_{i,t}^{last\ year\ Non-MR}$ as well as their interaction terms with $Mercury_t$ as additional explanatory variables. As predicted, we find that the coefficient on the interaction term between $Low\ Ret_{i,t}^{last\ year\ MR}$ and $Mercury_t$ is insignificantly different from zero. The coefficient of $Low\ Ret_{i,t}^{last\ year\ MR}$ is insignificantly in both Mercury retrograde days and other days. Overall, the results in Table 5 are consistent with the *belief* channel.

Second, we use the search volume intensity for the relevant topic from Google trend to capture investors' shared cognition in Mercury Retrograde. Suggested by Da, Engelberg, and Gao (2011), Google search volume intensity measures the popularity of a particular search term relative

to all other terms from the same location at the same time. In the international study, Gao, Ren, and Zhang (2018) show that the local Google search volume intensity is correlated with the local market returns. Hence, Google search volume clearly has the potential to capture investors' attitudes toward and reaction to Mercury Retrograde in each country-date.

We use search volume intensity for the topic "Retrograde motion." First, we use topics instead of search terms because of the former addresses misspellings and searches in deferent languages, as Google's algorithms can group deferent searches that have the same meaning under a single topic. Second, the definition of Mercury Retrograde is retrograde motion.[21] Hence, the topic "Retrograde motion" is a reasonable search topic for Mercury Retrograde.

We download the daily search volume intensity (*SVI*) for the topic "Retrograde motion" from 01/01/2004 to 31/10/2019 country by country. We standardize the time series by each country to make them comparable. We first verify whether *SVI* increased in the Mercury Retrograde period. We perform OLS regressions of the following form:

$$SVI_{i,t} = \alpha + \beta_1 \times Mercury_t + controls_{i,t} + FE + e_{i,t} \quad (4)$$

The control variables include five lags of the dependent variable, five lags of return, and five lags of volatility. The fixed effects are weekday, year-quarter, and country fixed effects.

Table 6 Panel A presents our results. In Column (1), we find that Mercury Retrograde leads to an increase in daily *SVI* for the topic "Retrograde motion." The evidence here suggests that people are more likely to search for information for Mercury Retrograde during Mercury Retrograde periods. In Column (2), we also test whether Mercury retrograde leads to a jump in daily *SVI* for the topic "Retrograde motion," since the dummy variable of Mercury Retrograde captures a sudden change in beliefs. As predicted, Column (2) shows that the extreme value of *SVI* more likely occurs in Mercury Retrograde periods. Overall, *SVI* of the topic "Retrograde motion" mostly captures the shared cognition in Mercury Retrograde held by investors.

We then replace the $Mercury_t$ by *SVI* for the topic "Retrograde motion" in our baseline regression (1). Specifically, we perform OLS regressions of the following form:

$$Ret_{i,t} = \alpha + \beta \times L(5)SVI_{i,t} + controls_{i,t} + FE + e_{i,t} \quad (5)$$

where $L(5)SVI_{i,t}$ is the five lags of $SVI_{i,t}$ ($SVI_{i,t-5}$ - $SVI_{i,t-1}$). Thus, the regression examines whether, on average, the lagged $SVI_{i,t}$ can predict future market returns.

[21] The google trend also shows that "Mercury" is the top one related topic to the topic "Retrograde motion."

[Table 6 here]

The results, shown in Panel B of Table 6, show a statistically significant negative relationship between $SVI_{i,t-2}$ - $SVI_{i,t-1}$ and the future market return. In terms of economic magnitude, the estimated coefficient suggests that a standard deviation increase in $SVI_{i,t-1}$ would result in a 0.51 bps decrease in the future market return. While the coefficients of $SVI_{i,t-5}$ - $SVI_{i,t-3}$ are insignificantly different from zero, the joint effect of $SVI_{i,t-5}$ - $SVI_{i,t-1}$ is significantly negative. In other words, $SVI_{i,t-5}$ - $SVI_{i,t-1}$ can predict future returns jointly. In Column (2), we control for both $Mercury_t$ and $L(5)SVI_{i,t}$, and find that the magnitudes and significance levels of $L(5)SVI_{i,t}$ are significantly reduced, confirming that the return predictably of $L(5)SVI_{i,t}$ is concentrated in the Mercury Retrograde period. These results suggest that the Mercury effect depends on the shared cognition in Mercury Retrograde held by investors, which is consistent with the *belief* channel.

[Table 7 here]

To further test the *belief* channel, we perform a cross-country difference test. We expect to see the Mercury effect displaying a significant cross-country variation along the dimension of investors' beliefs in Mercury Retrograde. To study the cross-country variation in Mercury Retrograde beliefs, we use the "interest by region" function in Google Trends to download the cross-sectional search interests in the topic "Retrograde motion" during 01/01/2004 to 31/10/2019. The country-level search volumes are calculated on a scale from 0 to 100. A higher value means a higher proportion of all search queries in that country, not a higher absolute query count. Therefore, these values are comparable across countries. We then construct a dummy variable $High\ SVI_i$ that is equal to one (zero) if a country's search volume intensity for the topic "Retrograde motion" is in the top (bottom) 1/3 of all the sample countries. The regression model specified in our baseline results includes $High\ SVI_i$'s interaction term with $Mercury_t$ as additional explanatory variables.

Table 7 reports the result. We find that the coefficient of $Mercury_t$ is still significantly negative. Importantly, we find that the coefficient on the interaction term between $High\ SVI_i$ and $Mercury_t$ is -2.996 with a t-statistic of -2.61, suggesting that the negative effect of Mercury Retrograde on market returns is more pronounced in countries with a greater belief in the topic "Retrograde motion." Economically, in countries with a stronger belief in Mercury Retrograde, the average returns in Mercury Retrograde periods are about 3.42% ((3.705+2.996) bps×60 days÷100) per year lower than those in other periods. Hence, the trading strategy of the Mercury

effect can be improved by investing in countries with a stronger belief in Mercury Retrograde. Overall, the results are consistent with our expectation that the lower market returns during the Mercury Retrograde period come from the *belief* channel. Investors who are more interested in the astrological belief of Mercury Retrograde are most likely to stay away from the market during Mercury Retrograde, resulting in a higher risk premium required by remaining investors.

3.4. Robustness checks

To ensure the robustness of our Mercury effect, we now conduct several additional tests and summarize the main findings in Appendix IA1 to IA3.

We start by augmenting the regression equation (1) with additional controls. Specifically, in Column (1) of Appendix IA1, we drop the January and control for the global temperature effect, sunspot effect, moon effect, other planet retrograde effects, major global financial crisis effect, and fixed effects for the day of the month and the last day of the month.[22] By controlling for these effects, we can address a potential alternative explanation for our finding, i.e., the Mercury Retrograde periods could be overlapping with low global temperature days, and as a result, the Mercury effect could come from the global temperature. We find that these control variables have little effect on the coefficient of $Mercury_t$ (-5.903 with a t-statistic of -2.91).

In Column (2), we use the daily market returns in U.S. dollars and find that the coefficient of $Mercury_t$ is -5.665 with a t-statistic of -2.57. In Column (3), we re-run the regression by using the market returns from the WRDS market indexes database. We find that our main results remain robust using returns from a different database and different countries (the coefficient is -6.488 with a t-statistic of -2.76), suggesting that data mining is unlikely a possible explanation of our findings. In Column (4) and (5), we perform the analysis using different event window for Mercury Retrograde. The Mercury effect remains significant in the new event window. The magnitudes in (4) and (5) are lower than those in the baseline results, suggesting that the Mercury effect is concentrated in the Mercury Retrograde period.

In Appendix IA2, we perform the same analysis by different periods and regions. Column (1) and (2) report the results for periods 1973-1997 and 1998-2019, and Column (3) and (4)

[22] Crisis periods: the 1987 U.S. stock market crash (October 19, 1987), the Gulf War (January 17, 1991 to February 17, 1991), the Mexican Peso crisis (December 20, 1994 to January 31, 1995), the Asian financial crisis (July 2, 1997 to December 3, 1997), the Russian crisis (August 11, 1998 to January 15, 1999), and GFC (September 2008 to September 2009).

summarizes the results for developed countries and emerging countries. The results show that all periods and regions present a negative relationship between Mercury Retrograde and market returns.

Finally, in Appendix IA3, we perform the placebo tests for the Mercury effect by using different event windows. First, we set the event window of Mercury Retrograde from the 30 days before the Mercury retrograde day to the one week before the Mercury Retrograde day $[Retrograde_{t-30}, Retrograde_{t-7}]$. Second, we set the event window of Mercury Retrograde from the seven days after the Mercury Prograde day to the 30 days after the Mercury Prograde day $[Prograde_{t+7}, Prograde_{t+30}]$. We find that the coefficients of $Mercury_t$ are insignificantly different from zero for both cases.

4. Origin of belief

4.1. Ancient Greek culture

To this point, we have proposed that the *belief* channel drives the lower market returns in Mercury Retrograde periods. This effect is stronger in countries with a greater belief in Mercury Retrograde. But why investors hold such beliefs? What is the origin of such beliefs? In this section, we propose that the belief in *ancient Greek culture* is the crucial driver for the *belief* channel of the Mercury effect.

The culture of ancient Greece has been influenced for thousands of years – from the Paleolithic era to the birth of the great civilizations of Minos, Mycenae and Cycladic in the classical period, which achieved great prosperity and led to unprecedented cultural prosperity. It is embodied in architecture, mythology, drama, science, and philosophy, and was nurtured in a democratic environment through a series of invasions and dominations: Macedonians, Romans, Byzantine Empire, and Ottoman Empire ruled for 400 years. The ancient Greek philosopher Plato Phaedo explained ancient Greece as "like frogs around a pond." That is, ancient Greece succeeded in spreading and maintaining a common culture around the Mediterranean Sea and Europe (Figure 3).[23]

[Figure 3 here]

None surprisingly, ancient Greek culture then came to be one of the foundational to Western culture in general (i.e., mythology, philosophy, mathematics, astronomy, medicine, art,

[23] The Figure comes from https://www.heritage-history.com/ssl/cds/ancient_greece/html/guide_maps.html.

literature, and theatre), especially after the Renaissance period in 14th century (Highet, 1949). It is also an accepted part of popular culture in the New Age (Alfven, 1984; Campion, 2009). Taking the mythology as an example, the flexible eve tools of allegory and exemplum take Greek myth well into the sixth century A.D. and set us up for the New Ages (Lear, 2012), i.e., the Olympics Games, the popular movie "Wonder Woman," and game "God Of War" are based on Greek myths. In terms of Hermes myth, many countries placed the god Hermes on a postage stamp from the 18th century.

Therefore, the ancient Greek cultures indeed affect our way of life. It is consistent with the definition of culture: the set of shared beliefs and practices that define a society's way of life (e.g., O' Bar and Conley, 1992; Guiso, Sapienza, and Zingales, 2006; McCleary and Barro 2006). Given that the social meaning of the motions of Mercury comes from ancient Greece, investors with a greater belief in ancient Greek culture could be more interested in the astrological belief of Mercury Retrograde. Therefore, these investors most likely not to participate in the market accordingly. Our rationale is consistent with Guiso, Sapienza, and Zingales (2008), who show that culture plays an important role in stock market participation.

Of course, ancient Greek culture is not directly observable. Thus, the best we can do is measure ancient Greek culture in a sufficiently narrow way, so that it becomes easier to identify a relationship between the culture and our *belief* channel. An obvious proxy for this purpose is people's interest in ancient Greece. Other proxies can come from our early discussion on the roles of Mercury, which arise from mythology – the god Hermes. Individuals might conduct online searches involving these proxies if they are interested in ancient Greek cultures. Hence, to study the cross-country variation in investors' belief in ancient Greek culture, we use the "interest by region" function in Google Trends to download the cross-sectional search interests in the topic "Ancient Greece," "Mythology," and "Hermes" during 01/01/2004 to 31/10/2019.[24] These measures are more about *ex post* proxies for ancient Greek cultures.

[Figure 4 here]

Figure 4 plots the distribution of the above search topics. In all search topics, Greece is always in the top five. This result is consistent with the intuition that the Greeks should pay the most attention to ancient Greek cultures, suggesting that "Ancient Greece," "Mythology," and "Hermes" indeed capture individuals' belief in ancient Greek cultures. Figure 3 also shows that

[24] For "Hermes," we use the topic "Hermes – Deity" to avoid the search volume from company Hermes.

the top 16 countries are similar among topics "Retrograde motion," "Ancient Greece," "Mythology," and "Hermes," suggesting that these topics capture the similar characteristics.

In Appendix IA4, we report the top ten related Google Trend search topics to "Ancient Greece," "Mythology," and "Hermes." The top ten related topics are similar in each topic. For each topic, we find that more than five topics among the top ten appear the word "Greek," "Greece," or "Ancient." Moreover, "Mythology" is in the top ten related topics for "Ancient Greece" and "Hermes," and "Ancient Greece" is in the top ten related topics for "Mythology." Overall, we find that the above three topics indeed capture individuals' beliefs in ancient Greek cultures.

We construct a dummy variable for each search topic that is equal to one (zero) if a country's search volume intensity for this topic is in the top (bottom) 1/3 of all the sample countries. To reduce the variable-error in each google search topic, we also construct a combination culture index (*Combine*) by combining three topics above that signal the ancient Greek culture. Our objective in combining them is to produce a single measure that diversifies away some noise in each topic and thereby increases the precision of our culture test. We assign all countries into twenty groups based on each topic. We conduct the three sorting independently and create 60 groups. Group 20 (1) contains the stocks with the highest (lowest) *Ancient Greece*, highest (lowest) *Mythology*, or highest (lowest) *Hermes*. We then add up the group numbers of each country to a score between 3 and 60. Finally, we define *High Combine* as countries with top 1/3 scores and *Low Combine* as countries with bottom 1/3 scores. Countries in the high *Combine* index have a greater ancient Greek culture in the cross-section. The regression model specified in our baseline results includes each search topic's interaction terms with $Mercury_t$ as additional explanatory variables.

In Table 8, we find that the coefficient on the interaction term between each google search topic and $Mercury_t$ is significantly negative. For example, in Column (1), the interaction term between $High\ Ancient\ Greece_i$ and $Mercury_t$ is -2.341 with a t-statistic of -2.15. The similar significant effects are observed using $High\ Mythology_i \times Mercury_t$ and $High\ Hermers_i \times Mercury_t$ as the interaction terms in Column (2) and (3), respectively. These results confirm that the Mercury effect is more pronounced in countries with a greater belief in ancient Greek cultures.

[Table 8 here]

Column (4) of Table 8 reports the results for the *Combine* index. Since the *Combine* index reduces the variable-error, we find that the coefficient on the interaction term between

$High\ Combine_i$ and $Mercury_t$ is more significantly negative than the coefficients in Column (1)-(3) (–3.398 with t-statistic of -2.91). This result further confirms our expectation that the Mercury effect comes from the culture effect.

4.2. Spread of ancient Greek culture

4.2.1. Ancient Greek colonies

The Google search volume in the relevant ancient Greek culture topics is more likely an *ex post* proxy for ancient Greek culture. We now examine the relationship between culture and the Mercury effect using an *ex ante* proxy for ancient Greek culture.

Resorting to the development in the historical literature, we define a country is an *ex ante* ancient Greek culture country if it meets two criteria. First, this country is related to ancient Greek colonies. Second, the primary religion in this country is closely related to ancient Greece. Colonialism denies history to the colonized, in the sense that it deprives the subject of their cultural rights and identity and build the new culture to the colonized (Ferro, 2005). Cohen and Hill (2007) model that different religions have different effects on people's culture toward others, confirming that one of the most important ways to deprive the subject of cultural rights and build a new culture is using religions (Page and Sonnenburg, 2003).

We first discuss which religion is closely related to ancient Greece. Ancient Greek culture plays an important role in Christianity. Leiden (1968) finds that the vast corpus of inscriptions and sculptures associated with the cult of Mithras and Christianity provides the best known and most plentiful examples of religious uses of Greek myths ideas. Several studies suggest that Christians held values and wrote works that rested on ancient Greek culture (e.g., Graf, 1993; Dowden and Livingstone, 2011).[25] Recently, Allum (2011) shows that Christianity is more interested in ancient Greek astrology among 25 western countries. Overall, the historical literature suggests that Christianity is closely related to ancient Greece.

We then discuss which countries are related to ancient Greek colonies. We define a country is related to ancient Greek colonies if 1) it had ancient Greek colonies cities or 2) it was colonized by the country that had ancient Greek colonies cities. The ancient Greeks succeeded in spreading and maintaining colonies around the Mediterranean Sea, the Black Sea, and Europe by adopting

[25] Recent studies argue that the New Testament originally was written relied heavily upon the ancient Greek language and ideas (Gleaves, 2015).

immigration measures to solve the population growth problem. For example, in the 7th century B.C., a severe drought occurred on Tierra Island, and the residents of the island had to use a lottery to select some of them to colonize the island of Pratiera in Libya. In addition, the ancient Greeks were good at doing business. They often set up business stations overseas. These business stations gradually evolved into commercial bases and eventually became colonies (Malkin, 1987). Because ancient Greek culture is one of the earliest cultures in Europe, these colonies helped ancient Greek spread and maintain a common culture in Europe.[26]

In our sample, the Christian countries that had ancient Greek colonies cities are France, Greece, Italy, Russia, and Spain (Figure 3). However, it is well known that some European countries are called empires rather than countries around the rising time of ancient Greek culture (after the Renaissance period). Hence, we would expect to see countries in those European colonial empires also share a similar ancient Greek culture. We have two European colonial empires in our sample: Spanish and Russian empires. The Spanish empire includes the following countries: Spain, Argentina, Belgium, Chile, Colombia, Mexico, Netherlands, Peru, Philippines, and Venezuela. The Russian empire includes Russia, Finland, and Poland.

All countries above have Christianity as the primary religion. Hence, our *ex ante* ancient Greek culture countries include France, Greece, Italy, Russia, Spain, Argentina, Belgium, Chile, Colombia, Mexico, Netherlands, Peru, Philippines, Venezuela, Finland, and Poland (Panel A of Table 9). We use *ex ante* ancient Greek culture as an exogenous variable for the belief in ancient Greek culture, and then investigate how the Mercury effect varies across this *ex ante* variable.

Since the classification of *ex ante* ancient Greek culture countries is based on the historical and sociological literature, we need to verify whether those countries most likely have ancient Greek culture in our sample. To test this, we run the following logistic regression:

$$q_i = E[High\ Google_i \mid Colonization_i]$$
$$logit(q_i) = \gamma 1 \times Colonization_i + \varepsilon_i \quad (6)$$

where, $High\ Google_i$ the dummy for high google search volume for the topics defined in Table 8, and $Colonization_i$ is a dummy variable equal to one if a country is an *ex ante* ancient Greek culture country. The estimate of $\gamma 1$ that shows how *ex ante* ancient Greek culture is related to the

[26] There were about three ancient cultures around the Mediterranean Sea and Europe in the 5-7th century of B.C: ancient Greek culture, ancient Egyptian culture, and Phoenicia culture. Hence, ancient Greek culture was easy to spread and maintained by building colonies.

odds of observing *ex post* ancient Greek culture (i.e., the google search topics in Table 8). A positive estimate for $\gamma 1$ would confirm that a country with *ex ante* ancient Greek culture most likely has ancient Greek culture in our sample.

[Table 9 here]

We present the results in Panel B of Table 9. Column 1 - 4 reports the results using the topic "Ancient Greece," "Mythology," "Hermes," and their *Combine* index, respectively. As predicted, we find that Estimates of $\gamma 1$ are positive and statistically significant, suggesting that our *ex ante* ancient Greek culture countries are indeed more likely to have ancient Greek culture. Since we have a small number of observations in each regression, we also run a panel logistic regression to improve the efficiency of our test.[27] Column 5 reports the results for our panel logistic regression. Consistently, we find significantly positive $\gamma 1$. Overall, these results confirm that the *ex ante* ancient Greek culture countries we defined above most likely have an interest in ancient Greek culture, which is consistent with the conclusions in the historical and sociological literature.

In Figure 5, we plot the cumulative daily residual Google search volume for the topic "Retrograde motion." The residual value comes from regression (4). We plot this residual value for the group of countries if $Colonization_i$ equals to one and another group of countries if $Colonization_i$ equals to zero. We find that, before Mercury Retrograde occurs, these two groups have the same search volume. But, when Mercury Retrograde occurs, the search volume in countries with the *ex ante* ancient Greek culture is twice that in countries without the *ex ante* ancient Greek culture. This finding further confirms that the *ex ante* ancient Greek culture countries most likely have an interest in ancient Greek culture, for example, Mercury Retrograde.

[Figure 5 here]

We also plot each country's t-statistic in Figure 6 to visualize the distribution of our Mercury effect globally. We run the equation (1) for each country without controlling for country fixed effect. Figure 5 shows that the most significant Mercury effects come from countries located around the Mediterranean Sea and countries colonialized by Spain and Russia, which is consistent with the findings in historical and sociological literature.

[Figure 6 here]

[27] To let the rank in each topic comparable, we control for the search topic fixed effect in the regression.

We now test whether the Mercury effect is stronger in *ex ante* ancient Greek culture countries than in other countries. We construct a dummy variable $Colonization_i$ that is equal to one if a country is an *ex ante* ancient Greek culture country. The regression model specified in our baseline results includes an $Colonization_i$'s interaction term with $Mercury_t$ as an additional explanatory variable.

In Table 10 Column (1), we find that the coefficient on the interaction term between $Colonization_i$ and $Mercury_t$ is -1.765 with a t-statistic of -1.76, suggesting that the negative effect of Mercury retrograde on market returns is more pronounced in countries with *ex ante* ancient Greek culture. One concern here is that the results in Column (1) come from a religion effect since our *ex ante* ancient Greek culture conditioning on Christianity. To address this concern, in Column (2), we control for the interrelation term of $Christianity_i$ and $Mercury_t$, in which $Christianity_i$ is equal to one if a country's primary religion is Christianity. We find that the interaction term between $Colonization_i$ and $Mercury_t$ is -1.946 with a t-statistic of -1.97, but the interaction term between $Christianity_i$ and $Mercury_t$ is insignificant.

[Table 10 here]

The magnitude and statistical level in Table 10 both are lower than those using google search topics in Table 8. This difference is hardly surprising because countries have an *ex ante* ancient Greek culture are not always have an *ex post* ancient Greek culture (i.e., the odds from Table 10 are small than 100%). The weaker culture effect in Table 10 highlights the importance of a persistence belief in culture (e.g., Stulz, and Williamson, 2003; Guiso, Sapienza, and Zingales, 2006), i.e., a country has both *ex ante* and *ex post* ancient Greek culture. In the next section, we explain why the belief in ancient Greek culture is persistent.

4.2.2. Science and the influence of ancient Greek culture

To better understand the culture effect, we test why the above ancient culture can affect the *belief* channel persistently. We propose that it is because people cannot verify the scientific validity of astrology.

Science had important links to philosophy and religion and served as the technical foundation for ancient Greek astrology from the second century B.C., through which it acquired political significance. In ancient times, most ancient Greeks only know about the naked-eye astronomy, that the universe is Earth-centered and not Sun-centered. In that time, people believe

in astrology because it had scientific validity. Specifically, astrology can help ancient Greeks understanding the nature of the universe; thus, it turned out to be a permanent ingredient in ancient cultures (e.g., Thorndike, 1955; Alfven, 1984; Campion, 2015). After the Age of Enlightenment, with the impetus of the Scientific Revolution, the astrology becomes no scientific validity under the natural law of gravitation (e.g., Alfven, 1984; Carlson, 1985; Zarka, 2011). The planetary positions have then gradually developed into modern astronomy, parting ways from the planetary theory of naked-eye astronomy and ancient Greek astrology. Astronomy has become the mainstream science of that era. This fundamentally shakes astrology and leads to a negative relation between the astrological belief and scientific development in modern societies.

The above historical background narrative provides a motivation for the empirical studies to invariably include astrology as a touchstone for identifying pseudoscience in citizen scientific development. For example, according to the Science and Engineering Indicators (2011), most people consider astrology to be completely unscientific, and the megatrend of this proportion over the past 30 years has increased, from 50% in 1979 to 62% in 2010. The proportion of astrology that is completely unscientific increases with the level of scientific development. Allum (2011) finds that individuals in a poor scientific development country have greater beliefs in the validity of god and astrology, and hence have greater beliefs in the validity of celestial phenomena. Overall, evidence suggests that in a poor scientific development environment, people believe that astrology is still scientific, and hence they choose to believe in astrology persistently, just like what ancient Greeks did.

Hence, critical to our interpretations of the empirical evidence in Table 8 – 10, we test whether the lower scientific development could enhance the effect of ancient Greek culture on investors' reaction to Mercury Retrograde. We use the time-series average of EGERD (Sci) as the scientific development for each country. We construct a dummy variable $Low\ Sci_i$ that is equal to one (zero) if a country's Sci is in the bottom (top) 1/3 of all the sample countries.

[Table 11 here]

To test the above idea, we perform three tests. First, we verify whether a low level of scientific development is positively related to the odds of observing a persistent ancient Greek culture. That is, whether $\gamma 1$ in equation (6) is higher in countries with a low level of scientific development. In Column (1), Panel A of Table 11, we run a logistic regression using an *ex post* ancient Greek culture variable (all google search topics in Table 8) as a dependent variable and

$Low\ Sci_i$ as an independent variable. We find that countries with low scientific development have significantly positive odds of observing *ex post* ancient Greek cultures. We then include our main intertest variable, an interaction term between $Low\ Sci_i$ and $Colonzation_i$ in Column (2). We find that interaction term between $Low\ Sci_i$ and $Colonzation_i$ is significantly positive, confirming a low level of scientific development is positively related to the odds of observing a persistent belief in ancient Greek culture.

Second, we investigate whether the effect of Mercury Retrograde on returns displays any variations along the dimension of Sci. The regression model specified in our baseline results includes the scientific development's interaction terms with $Mercury_t$ as additional explanatory variables. We report the results in Panel B of Table 11. In Column (1), we find that the coefficient on the interaction term between $Low\ Sci_i$ and $Mercury_t$ is -3.053 with a t-statistic of -2.04, confirming that the negative effect of Mercury Retrograde on market returns is more pronounced in countries with a lower level of scientific development. These results are consistent with our expectation that the Mercury effect comes from the culture effect.

Finally, in Column (2) of Panel B, we include the three-way interaction among $Colonzation_i$, $Low\ Sci_i$, and $Mercury_t$, and with other two two-way interactions as controls. We find that the three-way interaction is significantly negative. As such, the market appears to earn a stronger Mercury effect on countries that have an *ex ante* ancient Greek culture. Hence, among countries with a belief in ancient Greek culture, low scientific development has an incremental effect on people's reaction to Mercury Retrograde. People in these countries think astrology is still scientific; thus, they will believe it as what ancient Greeks did. However, among countries without a belief in ancient Greek culture, low scientific development does not affect people's reactions to Mercury Retrograde. The reason is that scientific development effects on how people react to the scientific validity of astrology, but people in these countries do not hold the astrological belief in the first place. These results further confirm the robustness of our culture effect in Table 8-10.

5. Other tests

We have seen in the previous subsection that market prices, on average, decline during the Mercury Retrograde period. In this subsection we analyze other effects that may be related to Mercury Retrograde and rates of return.

5.1. Trading volume

This section investigates whether the Mercury retrograde affects trading volume. Our *belief* channel posits that investors who hold the astrological belief of Mercury Retrograde stay away from the market during the Mercury Retrograde period. This effect results in lower market returns since markets need to offer higher returns to compensate remaining investors for sharing more risk. Although we do not have a direct measure of investor recognition during the Mercury Retrograde period, we can examine other behaviors that may signal a low demand in the market. Intuitively, if investors do not want to participate in the stock market that day, the market, on average, becomes less active. Thus, we should expect to see low trading volumes during the Mercury Retrograde period. For example, Yu (2015) finds that a higher investor recognition in a market is associated with a greater trading volume in that market. To investigate this effect, we use data on the aggregate trading volume on the stocks in the national index.

[Table 12 here]

For most countries, DataStream volume data do not start until 1985, which reduces the number of observations that can be included in the sample. As a measure of volume, we look at the detrended log of daily volume (Volm). We focus on detrended log volume because the level of log volume is not stationary. We use a detrending methodology in the spirit of Campbell, Grossman, and Wang (1993). We calculate the short-term volume trend as a rolling average of the past 20 trading days (one month) of log volume.[28]

Table 12 reports results using the abnormal volume as the dependent variable. As predicted, we find that the point estimates of trading volume are all significantly negative in both columns, suggesting a reduction in volume on the Mercury Retrograde period. In Column (1), the coefficient on $Mercury_t$ is -0.011 with a t-statistic of -2.08. In Column (2), after controlling for lagged market variables (return, volatility, and trading volume), the coefficient on $Mercury_t$ is -0.007 with a t-statistic of -1.78. The average trading volumes in Mercury Retrograde periods are about 0.42 (0.007×60 days) per year lower than those in other periods, which corresponds to 24% of the in-sample unconditional mean in annually trading volumes (i.e., 24% = 0.42×÷(0.007×250)). This economic effect (24%) is similar to the effect of Mercury Retrograde on returns (22.56%) in our baseline results.

[28] The result is robust to using 40 trading days (two months) averages. The long-term trend in trading volume is detrended by including country fixed effect in the regression analysis.

We, therefore, conclude that the Mercury Retrograde has a negative effect on trading volumes, confirming that some investors stay away from the market during the Mercury Retrograde period. Overall, the low trading volumes in Mercury Retrograde periods further confirm the robustness of our *belief* channel.

5.3. Alternative explanations

Finally, we examine alternate explanations that could be driving our results. Specifically, we identify market risk and investor pessimism as two possible alternate causes of the Mercury effect. We go on to distinguish these alternate explanations for our empirical findings.

[Table 13 here]

A natural question to ask is whether our results are risk-related. If the market is riskier in Mercury retrograde periods, then we would observe a similar Mercury effect. The market could be risker in the following ways. First, it can coincide with some market crashes. Second, astrology believes that Mercury Retrograde is a cause of the disaster. They suggest that everything can be uncertain in this period (Boland, 2019). This uncertainty could be reflected in the stock markets. Third, the *real effect* channel says that Mercury Retrograde could destroy commerce-related activities, which would result in more negative cash flow news. We know that bad news is associated with greater market uncertainty (Campbell and Hentschel, 1992). Thus, the market could be risker in Mercury Retrograde periods. Although we already rejected these possibilities in our previous sections, our tests could contain some measurement errors. Therefore, it is still worth to test whether our results are risk-related by using the market risk directly.

To test this argument, we re-run the equation (1) using the daily return volatility (absolute return) as the dependent variable. The result in Column (1)-(2) of Table 13 shows that Mercury retrograde does not lead to an increase in realized market volatility. In addition to daily return volatility, we use the daily return covariance to proxy for the market covariance risk. The daily return covariance is the product of a daily country index return and a daily global index return divided by the absolute daily global index return. In Column (3)-(4), we find that the market covariance risk is unaffected by Mercury retrograde. Our results are consistent with Guiso, Sapienza, and Zingale (2006) and McCleary and Barro (2006), who suggest that the level risk is unaffected by culture. Collectively, the Mercury effect is unlikely driven by increases in market risk. These results also help us to future rule out the *real effect* channel.

Our results could also relate to investor pessimism. If Mercury Retrograde leads investors to have a pessimistic view of future market prices, we would observe a lower market returns in Mercury retrograde periods. This pessimistic view typically comes from a bad mood (e.g., Thaler, 1987; Lucey and Dowling, 2005; Bergsma and Jiang, 2016; Kamstra, Kramer, Levi, and Wermers, 2017; Birru, 2018; Hirshleifer, Jiang, and DiGiovanni, 2020). If individuals indeed are more prone to make mistakes during Mercury Retrograde (Mercury Retrograde has a real effect), they would have a bad feeling in this period. This bad feeling can cause low mood among investors, which leads to more pessimistic views on future returns (Hirshleifer, Jiang, and DiGiovanni, 2020).

Our previous findings in trading volumes suggest that our Mercury effect is unlikely driven by investor pessimism. In a behavioral story, there is ample psychological evidence that individuals typically take actions to fix their low mood. For example, Erber and Tesser (1992) find that a low mood is attenuated by performing challenging tasks. Edmans, Garcia, and Norli (2007) note that "trading is a plausible example of such a task: Not only is it a cognitively intense activity, but it also has the potential of generating profits to negate the negative mood." Therefore, investor pessimism should predict higher trading volumes in the Mercury Retrograde period, but our results in trading volumes reject this prediction.

To further test whether our results are related to investor pessimism, we use two variables to proxy for investor pessimism: the Google sentiment index of Gao, Ren, and Zhang (2018) and the Google search volume for the topic "Depression-Mood." The Google sentiment index is the weekly search volume of search terms related to economics and finance across various countries in different languages since 2004 (Gao, Ren, and Zhang, 2018). Because internet searches can reflect investors' expectations, so we interpret the Google sentiment index as an indicator of the representative agent's pessimistic expectations of future market returns. The Google search volume for the topic "Depression-Mood" is the country-date variable that reflects individuals feeling about depression. The depression mood is one of the most important feelings in a low mood (Carton, Jouvent, Bungener, and Widlocher, 1992). The higher search volume for the topic "Depression-Mood" indicates a greater depression in a country-date. We standardized this search volume in each country.

We use the above two variables as the dependent variable in our regression. For the Google sentiment index, if a week has at least 50% days are Mercury Retrograde days, then we set this week as the Mercury Retrograde week. In Table 14, we find that in Mercury Retrograde periods,

investors do not significantly alter their pessimistic views of market returns. The coefficients on $Mercury_t$ are insignificantly different from zero in both Columns. These results are inconsistent with the view of investor pessimism.

[Table 14 here]

Overall, these results help present a crucial distinction between our work on celestial phenomena and related studies of Yuan, Zheng, and Zhu (2006) and Novy-Marx (2014). Each of these studies relates to celestial phenomena and mood and finds a significant link between mood shock and equity prices. Using these two variables, we conclude that the low mood is unlikely the primary cause of our main results. Because low mood is most likely from the real effect of Mercury Retrograde, these results also further rule out the *real effect* channel.

6. Conclusion

Motivated by the astrological belief that investors better off staying away from the market during the Mercury Retrograde period, this paper hypothesizes that market returns are lower during the Mercury Retrograde period than during the remainder of the year. By regressing daily realized stock market index returns on an indicator variable for the Mercury Retrograde period using a sample of 48 countries between 1973 and 2019, we find that market returns are 3.22% annually lower during the Mercury Retrograde period than during the remainder of the year.

We do not find evidence that Mercury Retrograde has a real effect on people's economic and social activities. Therefore, the way that Mercury Retrograde effects on market returns come from the *belief* channel. Specifically, investors who hold the astrological belief will stay away from the market during the Mercury Retrograde period, and thus the market needs to offer a higher risk premium to compensate their remaining holder for sharing more risk. We find that the Mercury effect is indeed stronger among countries with a greater astrological belief in Mercury Retrograde.

We extend this *belief* channel and find that such astrological belief comes from a belief in ancient Greek culture. Given that ancient Greek culture is an important fundamental of western culture, it affects modern society's way of life. Since the shared belief of the motions of Mercury arises from the ancient Greek culture, investors with a greater belief in ancient Greek culture could be more interested in the astrological belief of Mercury Retrograde. Our results are consistent with this culture effect. Collectively, the repeat exogenous shocks of Mercury Retrograde on investors' trading behaviors help us to draw a causal effect of culture in stock market returns. Our findings

also suggest that for some artificial cultures, investors may deem them important, and behave accordingly.

It is important to remember that our results are based on market returns. Further research at the individual trading level will help us better understand the relation between Mercury Retrograde and the trading behavior of individual investors in countries with the ancient Greek culture. Future studies also can investigate the effect of ancient cultures on other economic outcomes.

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Figure 1

This Figure is the simultaneous positions of Earth and Mercury based on their orbits around the sun at successive times. The apparent position of Mercury, as seen from Earth, is the point where the line passing through the position of both appears to intersect the background of fixed stars. These points are represented at the right. The blue color is Earth, and the grey color is Mercury. Both planets move in the same direction (west to east) at different speeds.

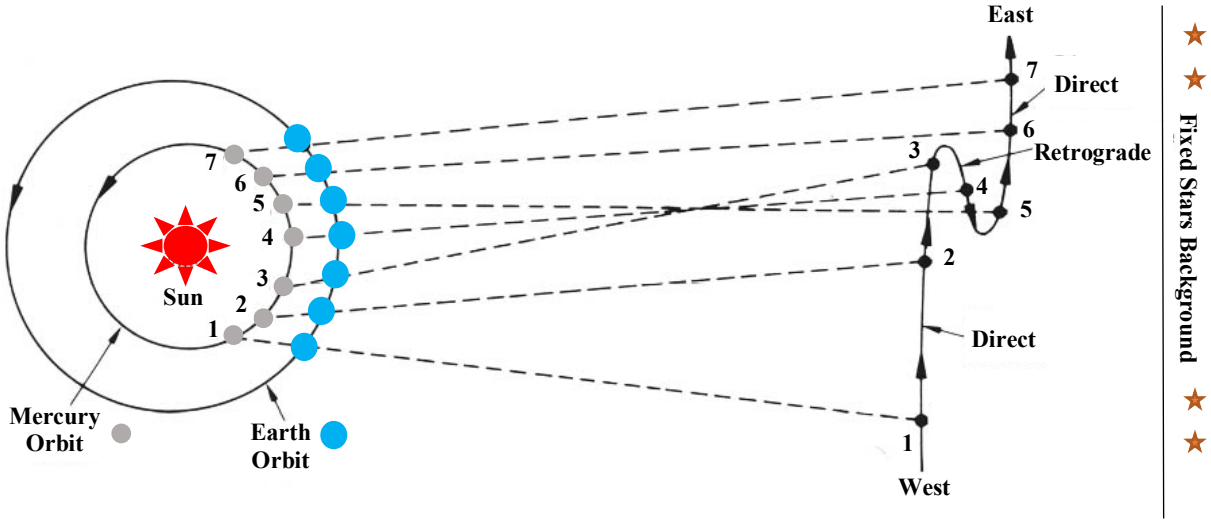

Figure 2

This Figure plots the distribution of Mercury Retrograde in each year (A) and month (B) from January 1973 to October 2019.

Figure 2.A

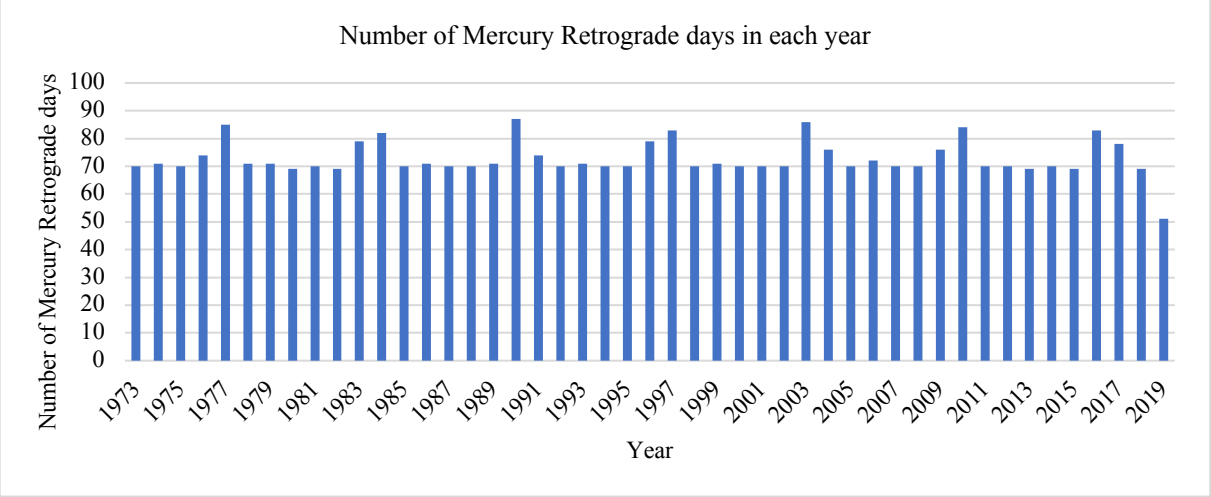

Figure 2.B

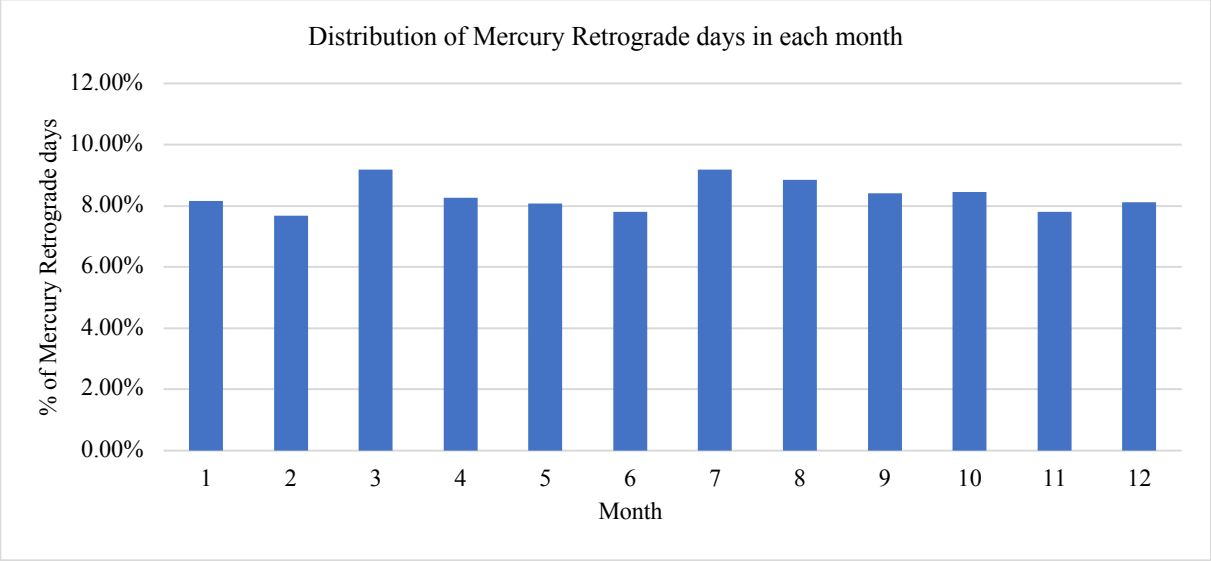

Figure 3

This Figure displays the map for ancient Greece in 550 B.C. The colorful areas are ancient Greece colonies.

Figure 4

This Figure plots the google search volume index for topics "Retrograde motion" (A), "Ancient Greece" (B), "Mythology" (C), and "Hermes" (D) for each country. We use the "interest by region" function in Google Trends to download the cross-sectional search interests in each topic from 01/01/2004 to 31/10/2019.

Figure 4.A

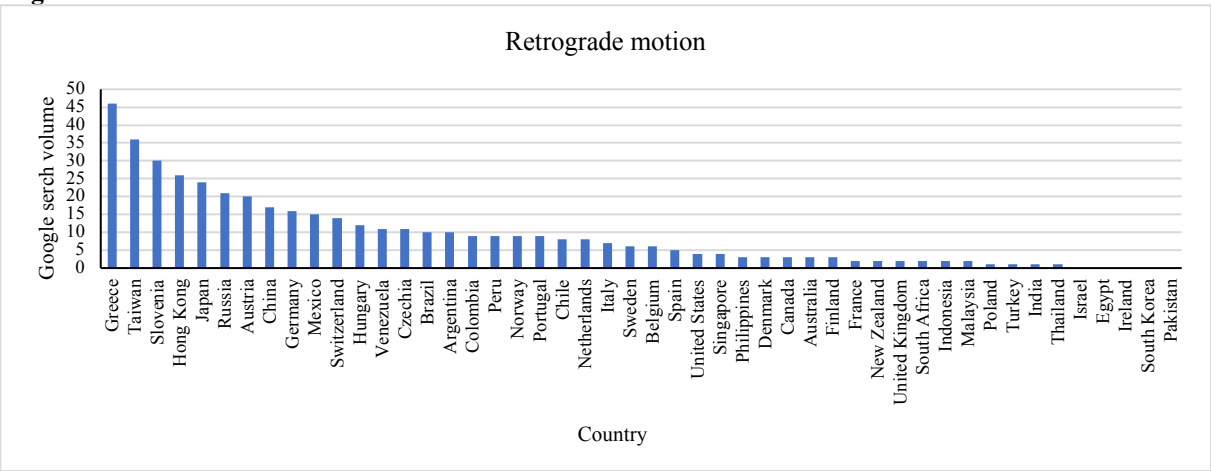

Figure 4.B

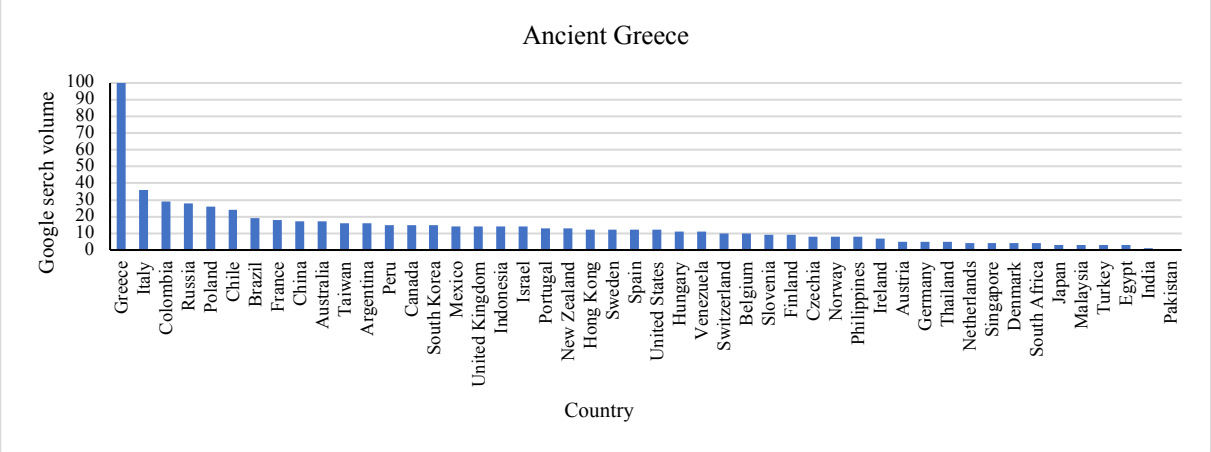

Figure 4.C

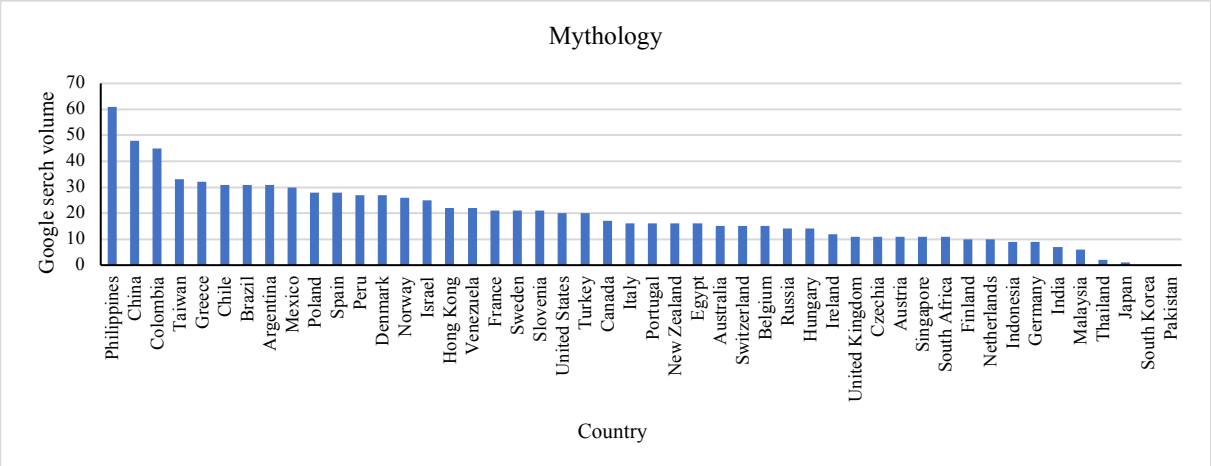

Figure 4.D

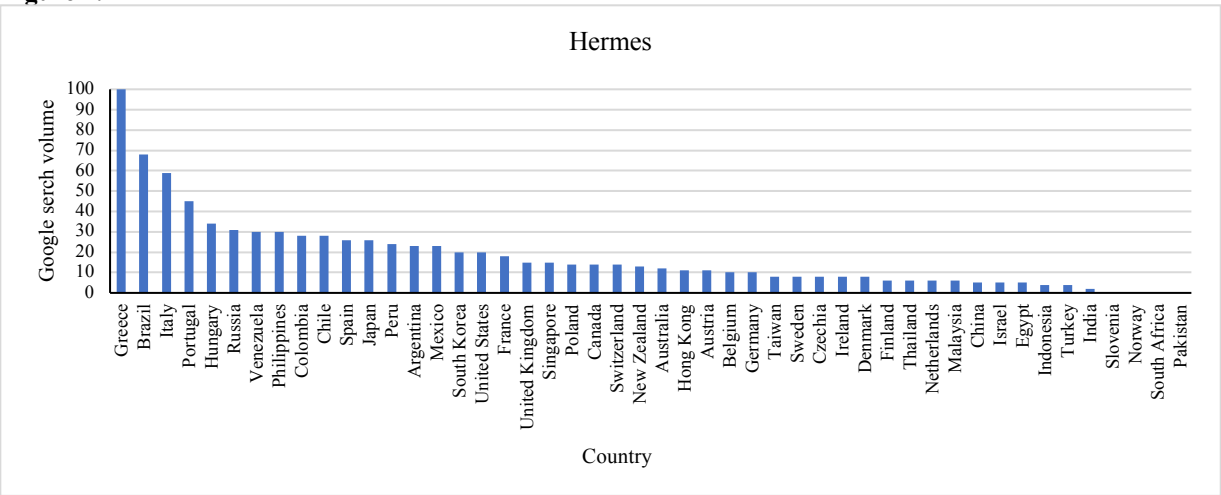
Hermes
Google serch volume
100
90
80
70
60
50
40
30
20
10
0
Greece
Brazil
Italy
Portugal
Hungary
Russia
Venezuela
Philippines
Colombia
Chile
Spain
Japan
Peru
Argentina
Mexico
South Korea
United States
France
United Kingdom
Singapore
Poland
Canada
Switzerland
New Zealand
Australia
Hong Kong
Austria
Belgium
Germany
Taiwan
Sweden
Czechia
Ireland
Denmark
Finland
Thailand
Netherlands
Malaysia
China
Israel
Egypt
Indonesia
Turkey
India
Slovenia
Norway
South Africa
Pakistan
Country

Figure 5

This Figure shows the cumulative residual Google Search Volume Index (SVI) for the topic "Retrograde motion." The y-axis represents the cumulative residual SVI. The daily residual SVI is the residual from the regression $SVI_{i,t} = \alpha + \beta_1 \times Mercury_t + controls_{i,t} + FE + e_{i,t}$. The blue line is the cumulative residual SVI for countries in non-*ex ante* ancient Greek culture group ($Colonization_i = 0$) and the gold dash line is the cumulative residual SVI for countries in ex ante ancient Greek culture group ($Colonization_i = 1$). $Colonization_i$ is a binary variable that is equal to one if a country has an *ex ante* ancient Greek culture. Day 0 is the beginning of Mercury Retrograde days.

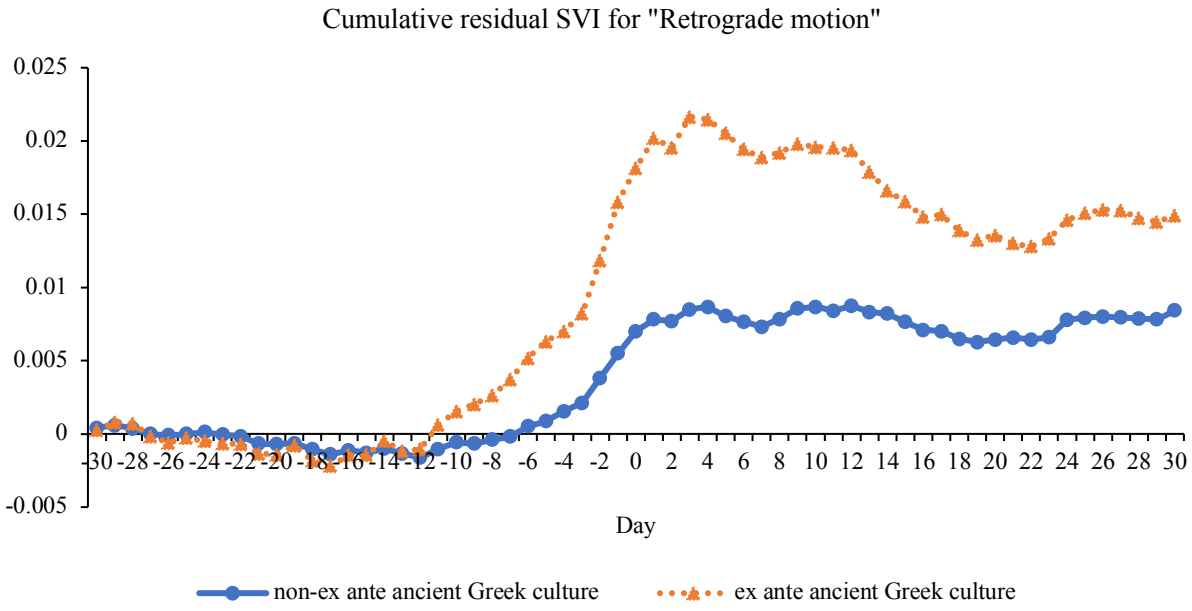

Figure 6

This Figure displays a global map for the Mercury effect using the t-statistic value in each country. Because only two countries have a positive reaction to Mercury Retrograde (Thailand with a t-statistic of 0.00 and Israel with a t-statistic of 0.07), we use the absolute value of the t-statistic (t-value). The gold color is for t- value between 2-4; the yellow color is for t-value between 1.65-2; the green color is for t-value between 1-1.65; the orange color is for t-value between 0-1; white color is for countries not covered in our sample.

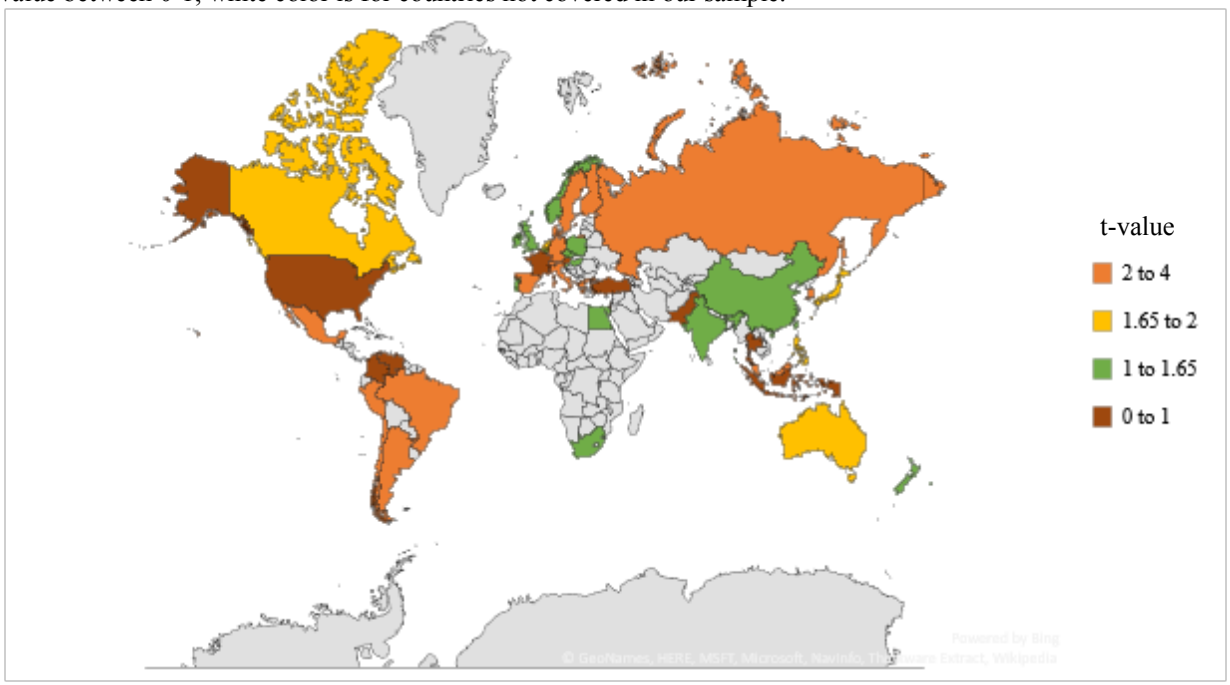

Table 1: Summary table

This table shows the summary statistics of our daily returns for 48 countries/regions over the sample period from January 1973 to Oct 2019. The summary statistics include the number of observations (Obs), the mean, standard deviation (Std), P25 (Q1), median (Median), and P75 (Q3) distributions of market returns (in bps). DEV means the developed markets (Panel A), and EM means the emerging markets (Panel B).

Panel A: Developed markets								
Country/Region	Market	Start date (m/y)	Obs	Mean	Std	Q1	Median	Q3
Australia	DEV	01/1973	11,850	4.77	105.09	-47.50	6.19	59.30
Austria	DEV	01/1973	10,896	3.58	99.95	-35.50	5.21	45.96
Belgium	DEV	01/1973	11,813	4.06	96.82	-38.66	5.23	49.50
Canada	DEV	01/1973	11,838	4.04	89.55	-36.65	6.53	48.98
Denmark	DEV	01/1973	11,078	5.47	111.48	-37.86	3.41	51.94
Finland	DEV	03/1988	7,940	5.06	165.81	-72.47	6.74	82.22
France	DEV	01/1973	11,845	5.04	117.43	-53.97	6.10	67.31
Germany	DEV	01/1973	11,801	3.62	106.22	-45.98	6.66	58.25
Hong Kong	DEV	01/1973	11,673	6.00	168.71	-65.90	6.60	83.02
Ireland	DEV	01/1973	11,770	4.97	118.39	-48.09	4.95	60.60
Israel	DEV	01/1993	6,581	3.60	120.88	-57.37	6.05	69.36
Italy	DEV	01/1973	11,838	4.64	135.63	-63.62	5.56	74.11
Japan	DEV	01/1973	11,642	2.63	114.25	-48.95	2.89	56.40
Netherlands	DEV	01/1973	11,917	4.38	108.58	-47.25	6.87	58.52
New Zealand	DEV	01/1988	7,985	4.15	88.09	-37.64	6.43	45.76
Norway	DEV	01/1980	10,036	5.39	141.76	-63.34	6.46	77.20
Portugal	DEV	01/1990	7,508	2.26	103.88	-43.72	3.84	51.69
Singapore	DEV	01/1973	11,796	3.24	127.30	-51.32	3.47	58.16
Spain	DEV	03/1987	8,265	3.99	123.75	-57.24	7.62	66.54
Sweden	DEV	01/1982	9,549	6.15	135.76	-61.49	7.52	76.00
Switzerland	DEV	01/1973	11,789	3.54	93.51	-36.37	5.71	47.72
United Kingdom	DEV	01/1973	11,962	4.77	106.23	-50.18	6.35	60.47
United States	DEV	01/1973	11,826	4.47	105.62	-44.38	5.86	55.57

Panel B: Emerging markets								
Country/Region	Market	Starting date (m/y)	Obs	Mean	Std	Q1	Median	Q3
Argentina	EM	08/1993	6,839	8.17	180.12	-69.53	2.98	89.10
Brazil	EM	07/1994	6,293	7.21	157.52	-72.24	8.52	87.60
Chile	EM	07/1989	7,615	6.28	89.05	-39.87	4.52	51.86
China	EM	07/1993	6,767	5.49	187.32	-83.13	2.34	91.49
Colombia	EM	03/1992	6,772	6.08	99.75	-36.00	4.22	49.01
Czech Rep	EM	11/1993	6,387	4.33	132.67	-55.78	5.59	64.94
Egypt	EM	10/1996	5,609	6.15	143.14	-57.20	7.94	74.12
Greece	EM	01/1990	7,432	2.98	188.80	-83.56	2.75	89.65
Hungary	EM	06/1991	7,059	6.29	154.31	-66.95	5.85	78.95
India	EM	01/1990	7,205	7.07	160.11	-64.22	7.92	79.92
Indonesia	EM	04/1990	7,205	5.50	195.29	-64.63	6.88	75.93
Korea, South	EM	09/1987	7,911	4.36	171.72	-75.78	2.85	81.87
Malaysia	EM	01/1986	8,366	4.75	126.69	-40.85	4.65	50.19
Mexico	EM	05/1989	7,858	7.91	122.23	-48.61	5.12	64.66
Pakistan	EM	07/1992	6,583	5.92	160.94	-59.90	6.71	77.71
Peru	EM	01/1994	6,550	5.14	100.86	-34.31	4.37	44.38
Philippines	EM	09/1987	7,988	5.62	130.83	-57.35	4.90	67.77
Poland	EM	03/1994	6,357	2.83	161.19	-73.94	4.23	78.74
Russia	EM	01/1998	5,557	11.16	240.42	-75.03	5.76	99.05
Slovenia	EM	01/1999	5,178	2.34	88.91	-38.61	2.62	45.40
South Africa	EM	01/1973	11,911	7.13	126.77	-56.26	6.90	74.55
Taiwan	EM	05/1988	7,716	3.78	172.29	-75.24	2.78	82.47
Thailand	EM	01/1987	8,089	5.87	166.98	-70.19	3.22	79.63
Turkey	EM	01/1988	8,227	15.81	235.08	-97.28	4.62	123.18
Venezuela	EM	01/1990	7,482	37.15	275.71	-45.30	5.36	82.96

Table 2: Mercury Retrograde and return

This table summarizes the estimation of equation (1) using different control variables. $Ret_{i,t}$ is the return (in basis points) of country i at day *t*. We include five lags of past returns and volatiles (absolute return), country fixed effect, year-quarter fixed effect, and weekday effect. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering. The sample period is from January 1973 to Oct 2019.

Dep. Variable=	$Ret_{i,t}$	
Variable	(1)	(2)
$\boldsymbol{Mercury_t}$	**-5.370**	**-5.178**
	(-3.00)	**(-2.96)**
$Ret_{i,t-1}$		0.081
		(5.19)
$Ret_{i,t-2}$		-0.002
		(-0.16)
$Ret_{i,t-3}$		0.001
		(0.08)
$Ret_{i,t-4}$		0.008
		(0.88)
$Ret_{i,t-5}$		-0.011
		(-1.25)
$VOL_{i,t-1}$		0.082
		(4.45)
$VOL_{i,t-2}$		0.016
		(1.17)
$VOL_{i,t-3}$		0.027
		(2.92)
$VOL_{i,t-4}$		0.000
		(0.00)
$VOL_{i,t-5}$		-0.006
		(-0.51)
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	426,154	425,914
$Adj\ R^2$	0.011	0.024

Table 3: Mercury Retrograde and traffic

In Column (1), we work with a simple regression using the logarithm of the daily number of aviation disasters as the dependent variables. In Column (2), we work with a simple regression using the logarithm of the daily number of car accidents as the dependent variables. In Column (3), we work with a simple regression using the daily google search volume in the topic "Flight cancellation and delay" as the dependent variables. In Column (4), we work with a simple regression using the daily google search volume in the topic "Traffic collision" as the dependent variables. The control variables are the past five lags of the dependent variable. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity.

Dep. Variable=	$Aviation_{i,t}$	$Car_{i,t}$	$Flight\ Delay_{i,t}$	$Trafic_{i,t}$
Variable	(1)	(2)	(3)	(4)
$\boldsymbol{Mercury_t}$	**-0.001**	**-0.003**	**0.164**	**0.056**
	(-0.16)	**(-1.15)**	**(0.41)**	**(0.25)**
Dep_{t-1}	-0.030	0.262	0.507	0.448
	(-3.83)	(28.70)	(22.14)	(12.81)
Dep_{t-2}	0.010	0.013	0.005	-0.019
	(1.27)	(1.49)	(0.26)	(-0.78)
Dep_{t-3}	0.007	-0.048	0.012	-0.002
	(0.91)	(-5.51)	(0.68)	(-0.18)
Dep_{t-4}	-0.003	-0.029	0.008	0.012
	(-0.34)	(-3.39)	(0.45)	(0.87)
Dep_{t-5}	-0.008	0.039	0.053	-0.002
	(-0.99)	(4.58)	(3.47)	(-0.19)
Weekday Fixed	Yes	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes	Yes
Obs	16,732	15,701	5,778	5,778
$Adj\ R^2$	0.017	0.745	0.492	0.898

Table 4: Mercury Retrograde and fundamental information

In this table, we examine the change in fundamental information in Mercury retrograde periods. In Column (1), the dependent variable is the daily news sentiment $(News\ Sentiment_{i,t})$ of all news from the RavanPack dataset. The daily news sentiment is the aggregate of firm-level news sentiment in each country-day. In Column (2), the dependent variable is the daily corporate press release sentiment $(Press\ Sentiment_{i,t})$, which is the aggregate of all firm-level corporate press release sentiment in each country-day. In Column 3, the dependent variable is the aggregate earnings surprise ($SUE_{i,t}$), where the aggregate earnings surprise is the aggregate of all firm-level earnings surprises in each country-day. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Dep. Variable=	$News\ Sentiment_{i,t}$	$Press\ Sentiment_{i,t}$	$SUE_{i,t}$
Variable	(1)	(2)	(3)
$\boldsymbol{Mercury_t}$	**0.001**	**0.001**	**-16.415**
	(0.94)	**(0.72)**	**(-0.94)**
Dep_{t-1}	0.072	0.026	
	(9.17)	(2.73)	
Dep_{t-2}	0.049	0.022	
	(10.51)	(2.73)	
Dep_{t-3}	0.041	-0.003	
	(8.41)	(-0.35)	
Dep_{t-4}	0.031	0.009	
	(5.04)	(1.41)	
Dep_{t-5}	0.041	0.007	
	(6.84)	(0.75)	
$Ret_{i,t-1}$	0.146	-0.011	0.018
	(2.48)	(-0.20)	(0.37)
$Ret_{i,t-2}$	-0.006	-0.081	0.185
	(-0.17)	(-1.82)	(1.02)
$Ret_{i,t-3}$	-0.008	-0.013	-0.050
	(-0.18)	(-0.24)	(-0.98)
$Ret_{i,t-4}$	0.019	0.056	0.089
	(0.60)	(0.97)	(1.11)
$Ret_{i,t-5}$	-0.002	-0.045	0.142
	(-0.04)	(-0.92)	(0.93)
$VOL_{i,t-1}$	-0.096	-0.093	-0.252
	(-1.47)	(-1.06)	(-0.90)
$VOL_{i,t-2}$	-0.050	-0.058	0.039
	(-0.89)	(-0.90)	(0.76)
$VOL_{i,t-3}$	0.053	0.167	-0.280
	(1.03)	(2.42)	(-0.98)
$VOL_{i,t-4}$	-0.126	-0.057	-0.053
	(-2.21)	(-0.68)	(-0.67)
$VOL_{i,t-5}$	-0.080	0.040	0.042
	(-1.03)	(0.52)	(0.71)
Weekday Fixed	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes
Clustering	Country & Date	Country & Date	Country & Date
Obs	116,002	63,381	55,943
$Adj\ R^2$	0.074	0.080	0.005

Table 5: Mercury effect and cross-country variation

This table summarizes the cross-country variations in the Mercury effect. In Panel A, $Low\ Ret_{i,t}^{last\ year\ MR}$ is a binary variable that is equal to 1 (0) if a country's average daily return in the previous year Mercury Retrograde period is in the bottom (top) 1/3 of all the sample countries. In Panel B, $Low\ Ret_{i,t}^{last\ year\ Non-MR}$ is a binary variable that is equal to 1 (0) if a country's average daily return in the previous year non-Mercury Retrograde period is in the bottom (top) 1/3 of all the sample countries. Sample with $Mercury_t = 1$ means that we only include days in the Mercury Retrograde period. Likewise, the sample with $Mercury_t = 0$ means that we only include days in the non-Mercury Retrograde period. In all columns, we include five lags of past returns and volatiles (absolute return), country fixed effect, year-quarter fixed effect, and weekday effect. The parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Panel A: Last year Mercury retrograde returns			
Dep. Variable =	$Ret_{i,t}$		
Sample =	Full	$Mercury_t$ =1	$Mercury_t$ =0
Variable	(1)	(2)	(3)
$\boldsymbol{Mercury_t \times Low\ Ret_{i,t}^{last\ year\ MR}}$	**-3.366**		
	(-2.68)		
$\boldsymbol{High\ Ret_{i,t}^{last\ year\ MR}}$	**-0.875**	**-4.141**	**-1.022**
	(-0.99)	**(-2.29)**	**(-1.16)**
$Mercury_t$	-3.124		
	(-1.65)		
$Ret_{i,t-1}$	0.089	0.051	0.093
	(5.08)	(1.75)	(5.07)
$Ret_{i,t-2}$	0.003	-0.007	-0.001
	(0.24)	(-0.25)	(-0.13)
$Ret_{i,t-3}$	-0.003	-0.018	-0.005
	(-0.28)	(-0.95)	(-0.32)
$Ret_{i,t-4}$	0.009	0.002	0.005
	(0.88)	(0.12)	(0.35)
$Ret_{i,t-5}$	-0.011	-0.034	-0.010
	(-1.20)	(-1.61)	(-0.84)
$VOL_{i,t-1}$	0.076	0.160	0.058
	(4.35)	(4.87)	(3.41)
$VOL_{i,t-2}$	0.028	0.015	0.036
	(3.08)	(0.54)	(3.23)
$VOL_{i,t-3}$	0.032	0.014	0.040
	(3.22)	(0.59)	(3.12)
$VOL_{i,t-4}$	0.001	0.017	-0.001
	(0.09)	(0.49)	(-0.08)
$VOL_{i,t-5}$	-0.003	-0.004	-0.001
	(-0.33)	(-0.14)	(-0.07)
Weekday Fixed	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes
Clustering	Country & Date	Country & Date	Country & Date
Obs	275,537	55,222	220,315
$Adj\ R^2$	0.026	0.057	0.027

Panel B: Last year Non-Mercury retrograde returns			
Dep. Variable=	$Ret_{i,t}$		
Sample =	Full	$Mercury_t$ =1	$Mercury_t$ =0
Variable	(1)	(2)	(3)
$\boldsymbol{Mercury_t \times Low\ Ret_{i,t}^{last\ year\ Non-MR}}$	**-1.611**		
	(-1.12)		
$\boldsymbol{High\ Ret_{i,t}^{last\ year\ Non-MR}}$	**0.221**	**-1.448**	**0.293**
	(0.28)	**(-1.03)**	**(0.38)**
$Mercury_t$	-4.373		
	(-2.22)		
$Ret_{i,t-1}$	0.091	0.046	0.096
	(5.64)	(1.37)	(5.68)
$Ret_{i,t-2}$	-0.000	-0.004	-0.006
	(-0.01)	(-0.12)	(-0.60)
$Ret_{i,t-3}$	-0.001	-0.012	-0.004
	(-0.07)	(-0.64)	(-0.42)
$Ret_{i,t-4}$	0.009	0.001	0.005
	(1.13)	(0.08)	(0.65)
$Ret_{i,t-5}$	-0.008	-0.031	-0.007
	(-0.94)	(-1.83)	(-0.73)
$VOL_{i,t-1}$	0.073	0.150	0.056
	(4.07)	(3.79)	(3.43)
$VOL_{i,t-2}$	0.028	0.024	0.034
	(3.21)	(0.72)	(3.20)
$VOL_{i,t-3}$	0.034	0.018	0.040
	(3.43)	(0.80)	(3.87)
$VOL_{i,t-4}$	0.003	0.012	0.003
	(0.42)	(0.33)	(0.38)
$VOL_{i,t-5}$	-0.005	-0.009	-0.002
	(-0.59)	(-0.34)	(-0.21)
Weekday Fixed	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes
Clustering	Country & Date	Country & Date	Country & Date
Obs	275,403	55,193	220,210
$Adj\ R^2$	0.026	0.055	0.027

Table 6: Mercury Retrograde and Google search interest

In Panel A, we regress search volume intensity for the topic "Retrograde motion" (SVI) on the Mercury retrograde period. SVI is the google search volume intensity after normalizing by each country. $Dummy_{i,t,svi>3}$ is a binary variable that is equal to one if a country's SVI is above three standard deviations. In Panel B, we regress market returns on the search volume intensity for the topic "Retrograde motion." In all columns, we include five lags of past returns and volatiles (absolute return), country fixed effect, year-quarter fixed effect, and weekday effect. The parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Panel A: Mercury and SVI		
Dep. Variable=	$SVI_{i,t}$	$Dummy_{i,t,svi>3}$
Variable	(1)	(2)
$\boldsymbol{Mercury_t}$	**0.096**	**0.009**
	(5.64)	**(5.16)**
$SVI_{i,t-1}$	0.063	0.003
	(7.27)	(4.60)
$SVI_{i,t-2}$	0.054	0.001
	(7.34)	(2.42)
$SVI_{i,t-3}$	0.053	0.001
	(7.09)	(2.15)
$SVI_{i,t-4}$	0.049	0.001
	(7.39)	(1.93)
$SVI_{i,t-5}$	0.050	0.002
	(7.79)	(2.80)
$Ret_{i,t-1}$	-0.250	-0.037
	(-1.80)	(-1.46)
$Ret_{i,t-2}$	-0.252	-0.023
	(-1.31)	(-0.91)
$Ret_{i,t-3}$	0.055	0.027
	(0.31)	(0.86)
$Ret_{i,t-4}$	-0.225	-0.002
	(-1.49)	(-0.08)
$Ret_{i,t-5}$	0.013	-0.024
	(0.07)	(-0.93)
$VOL_{i,t-1}$	0.051	-0.024
	(0.20)	(-0.60)
$VOL_{i,t-2}$	0.518	0.049
	(1.55)	(1.15)
$VOL_{i,t-3}$	-0.296	-0.013
	(-0.96)	(-0.34)
$VOL_{i,t-4}$	-0.441	-0.031
	(-1.51)	(-0.78)
$VOL_{i,t-5}$	0.120	0.007
	(0.43)	(0.20)
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	191,731	191,731
$Adj\ R^2$	0.092	0.012

Panel B: SVI and Return Predictability		
Dep. Variable=	$Ret_{i,t}$	
Variable	(1)	(2)
$\boldsymbol{Mercury_t}$		**-5.709**
		(-1.81)
$\boldsymbol{SVI_{i,t-1}}$	**-0.509**	**-0.410**
	(-1.88)	**(-1.54)**
$\boldsymbol{SVI_{i,t-2}}$	**-0.580**	**-0.481**
	(-2.00)	**(-1.62)**
$SVI_{i,t-3}$	-0.384	-0.290
	(-1.31)	(-0.96)
$SVI_{i,t-4}$	-0.327	-0.237
	(-1.41)	(-1.00)
$SVI_{i,t-5}$	-0.213	-0.123
	(-0.65)	(-0.37)
$Ret_{i,t-1}$	0.062	0.062
	(2.26)	(2.25)
$Ret_{i,t-2}$	0.002	0.002
	(0.09)	(0.08)
$Ret_{i,t-3}$	-0.003	-0.003
	(-0.18)	(-0.20)
$Ret_{i,t-4}$	0.005	0.005
	(0.26)	(0.26)
$Ret_{i,t-5}$	-0.010	-0.010
	(-0.62)	(-0.65)
$VOL_{i,t-1}$	0.080	0.081
	(2.24)	(2.25)
$VOL_{i,t-2}$	0.040	0.040
	(1.81)	(1.85)
$VOL_{i,t-3}$	0.059	0.060
	(3.32)	(3.32)
$VOL_{i,t-4}$	0.015	0.016
	(0.95)	(0.97)
$VOL_{i,t-5}$	0.001	0.002
	(0.08)	(0.10)
$\boldsymbol{Sum\ of\ SVI_{i,t-5,t-1}}$**[*Joint*]**	**-2.013**	**-1.541**
[*p-value*]	**[0.013]**	**[0.068]**
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	191,731	191,731
$Adj\ R^2$	0.025	0.025

Table 7: Cross-country SVI and Mercury effect

This table summarizes the cross-country variations in the Mercury effect. $High\ SVI_i$ is a binary variable that is equal to one (zero) if a country's search volume intensity for the topic "Retrograde motion" over the sample period (we use the "interest by region" function in Google Trends to download the cross-sectional search interests) is in the top (bottom) 1/3 of all the sample countries. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Dep. Variable=	$Ret_{i,t}$
Variable	(1)
$\boldsymbol{High\ SVI_i \times Mercury_t}$	**-2.996**
	(-2.61)
$Mercury_t$	-3.705
	(-2.16)
$Ret_{i,t-1}$	0.082
	(4.10)
$Ret_{i,t-2}$	0.004
	(0.36)
$Ret_{i,t-3}$	0.004
	(0.39)
$Ret_{i,t-4}$	0.008
	(0.97)
$Ret_{i,t-5}$	-0.007
	(-0.82)
$VOL_{i,t-1}$	0.091
	(4.19)
$VOL_{i,t-2}$	0.010
	(0.84)
$VOL_{i,t-3}$	0.032
	(3.21)
$VOL_{i,t-4}$	-0.001
	(-0.11)
$VOL_{i,t-5}$	-0.005
	(-0.69)
Weekday Fixed	Yes
Year-Quarter Fixed	Yes
Country Fixed	Yes
Clustering	Country & Date
Obs	259,820
$Adj\ R^2$	0.025

Table 8: Ancient Greece Culture and Mercury effect

This table summarizes the cross-country variations in the Mercury effect. In Column (1), $High\ Ancient_i$ is a binary variable that is equal to one (zero) if a country's search volume intensity for the topic "Ancient Greece" over the sample period is in the top (bottom) 1/3 of all the sample countries. In Column (2), $High\ Mythology_i$ is a binary variable that is equal to one (zero) if a country's search volume intensity for the topic "Mythology" over the sample period is in the top (bottom) 1/3 of all the sample countries. In Column (3), $High\ Hermes_i$ is a binary variable that is equal to one (zero) if a country's search volume intensity for the deity "Hermes" over the sample period is in the top (bottom) 1/3 of all the sample countries. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Dep. Variable=	$Ret_{i,t}$			
Variable	(1)	(2)	(3)	(4)
$\boldsymbol{High\ Ancient_i \times Mercury_t}$	**-2.341**			
	(-2.15)			
$\boldsymbol{High\ Mythology_i \times Mercury_t}$		**-2.402**		
		(-2.79)		
$\boldsymbol{High\ Hermes_i \times Mercury_t}$			**-2.680**	
			(-2.33)	
$\boldsymbol{High\ Combine_i \times Mercury_t}$				**-3.398**
				(-2.91)
$Mercury_t$	-4.411	-4.401	-4.316	-4.484
	(-2.64)	(-2.54)	(-2.27)	(-2.52)
$Ret_{i,t-1}$	0.080	0.070	0.087	0.084
	(7.87)	(5.04)	(3.86)	(4.26)
$Ret_{i,t-2}$	-0.009	-0.008	0.006	0.008
	(-1.21)	(-1.00)	(0.46)	(0.74)
$Ret_{i,t-3}$	-0.003	-0.006	-0.001	0.005
	(-0.44)	(-0.85)	(-0.12)	(0.62)
$Ret_{i,t-4}$	0.001	0.000	0.010	0.008
	(0.18)	(0.01)	(1.14)	(0.99)
$Ret_{i,t-5}$	-0.017	-0.019	-0.006	-0.009
	(-2.87)	(-3.00)	(-0.69)	(-1.01)
$VOL_{i,t-1}$	0.056	0.064	0.096	0.090
	(4.94)	(3.37)	(4.08)	(4.20)
$VOL_{i,t-2}$	0.011	0.013	0.008	0.010
	(0.81)	(1.51)	(0.61)	(0.85)
$VOL_{i,t-3}$	0.022	0.021	0.036	0.030
	(2.43)	(2.41)	(3.64)	(3.07)
$VOL_{i,t-4}$	-0.000	-0.008	-0.002	-0.002
	(-0.04)	(-1.04)	(-0.32)	(-0.33)
$VOL_{i,t-5}$	-0.011	-0.003	-0.001	-0.003
	(-1.35)	(-0.40)	(-0.17)	(-0.45)
Weekday Fixed	Yes	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes	Yes
Clustering	Country & Date	Country & Date	Country & Date	Country & Date
Obs	284,321	267,373	228,167	248,203
$Adj\ R^2$	0.020	0.019	0.027	0.026

Table 9: Ex ante ancient Greek culture

Panel A shows the colonized cities/countries by ancient Greece, Spain, and Russia. We manually collect data from Page and Sonnenburg (2003). In Panel B, we regress $High\ Google_i$ on $Colonization_i$ using a logistic regression. $High\ Google_i$ is a binary variable that is equal to one if a country's google search volume (topics in "Ancient Greece," "Mythology," and "Hermes") is in the top 1/3 of all the sample countries, else it is equal to zero. In the parentheses below coefficient estimates are robust t-statistics.

Panel A: Colonized cities/countries

Ancient Greece	**Time/War**	**Religion**
France	550 B.C	Catholic
Italy	550 B.C	Catholic
Greece	550 B.C	Orthodox
Russia	550 B.C	Orthodox
Spain	550 B.C	Catholic

Spain	**Time/War**	**Religion**
Argentina	The Age of Discovery	Catholic
Belgium	Spanish Netherlands	Catholic
Chile	The Age of Discovery	Catholic
Colombia	The Age of Discovery	Catholic
Mexico	The Age of Discovery	Catholic
Netherlands	Spanish Netherlands	Catholic
Peru	The Age of Discovery	Catholic
Philippines	The Spanish Habsburgs	Catholic
Venezuela	The Age of Discovery	Catholic

Russia	**Time/War**	**Religion**
Finland	Great Northern War	Protestant
Poland	Catherine the Great	Catholic

Panel B: Ex ante and ex post ancient Greek culture

Dep. Variable=	$High\ Ancient_i$	$High\ Mythology_i$	$High\ Hermes_i$	$High\ Combine_i$	*All Topics*
Variable	(1)	(2)	(3)	(4)	(5)
$\boldsymbol{Colonization_i}$	**2.420**	**2.351**	**2.803**	**2.565**	**2.524**
	(2.59)	**(2.51)**	**(2.87)**	**(2.69)**	**(4.63)**
Topic Fixed	No	No	No	No	Yes
Obs	32	31	29	30	92
$Pseudo\ R^2$	0.196	0.188	0.274	0.229	0.218

Table 10: Ex ante Ancient Greek Culture and Mercury effect

This table tests whether the Mercury effect is stronger among *ex ante* ancient Greek culture countries. $Colonization_i$ is a binary variable that is equal to one if a country has an *ex ante* ancient Greek culture. $Christianity_i$ is a binary variable that is equal to one if a country's primary religion is Christianity. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Dep. Variable =	$Ret_{i,t}$	
Variable	(1)	(2)
$\boldsymbol{Colonization_i \times Mercury_t}$	**-1.873**	**-1.946**
	(-1.74)	**(-1.97)**
$\boldsymbol{Christianity_i \times Mercury_t}$		-0.133
		(-0.15)
$Mercury_t$	-4.589	-4.508
	(-2.69)	(-2.70)
$Ret_{i,t-1}$	0.081	0.081
	(5.18)	(4.96)
$Ret_{i,t-2}$	-0.002	-0.002
	(-0.15)	(-0.15)
$Ret_{i,t-3}$	0.001	0.001
	(0.08)	(0.08)
$Ret_{i,t-4}$	0.008	0.008
	(0.87)	(0.91)
$Ret_{i,t-5}$	-0.011	-0.011
	(-1.26)	(-1.20)
$VOL_{i,t-1}$	0.082	0.082
	(4.59)	(4.23)
$VOL_{i,t-2}$	0.016	0.016
	(1.18)	(1.37)
$VOL_{i,t-3}$	0.027	0.027
	(2.91)	(2.92)
$VOL_{i,t-4}$	0.000	0.000
	(0.00)	(0.00)
$VOL_{i,t-5}$	-0.006	-0.006
	(-0.62)	(-0.59)
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	425,914	425,914
$Adj\ R^2$	0.024	0.024

Table 11: Science and Mercury effect

In Panel A, we run a logistic regression using Google search topics as dependent variables. Google search topics are "Ancient Greece," "Mythology," "Hermes," and combine index in Table 8. Panel B summarizes the cross-country variations in the Mercury effect across different levels of science. $Low\ Sci_i$ is a binary variable that is equal to one (zero) if a country's scientific indicator is in the bottom (top) 1/3 of all the sample countries. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering in Panel A and are robust t-statistics in Panel B.

Panel A: Science, ex ante, and ex post ancient Greek culture		
Dep. Variable=	*All google search topics*	
Variable	(1)	(2)
$\boldsymbol{Low\ Sci_i}$	**1.308**	-0.473
	(2.00)	(-0.51)
$\boldsymbol{Low\ Sci_i \times Colonization_i}$		**3.878**
		(2.35)
$Colonization_i$		-0.867
		(-0.64)
Topic Fixed	Yes	Yes
Obs	52	52
$Pseudo\ R^2$	0.118	0.288

Panel B: Science and Mercury effect		
Dep. Variable=	$Ret_{i,t}$	
Variable	(1)	(2)
$\boldsymbol{Low\ Sci_i \times Mercury_t}$	**-3.053**	0.655
	(-2.04)	(0.48)
$\boldsymbol{Low\ Sci_i \times Colonization_i \times Mercury_t}$		**-6.074**
		(-2.16)
$Mercury_t$	-4.433	-4.425
	(-2.26)	(-2.36)
$Ret_{i,t-1}$	0.065	0.065
	(6.33)	(6.27)
$Ret_{i,t-2}$	-0.018	-0.018
	(-2.01)	(-2.00)
$Ret_{i,t-3}$	-0.013	-0.013
	(-1.77)	(-1.78)
$Ret_{i,t-4}$	0.001	0.001
	(0.17)	(0.17)
$Ret_{i,t-5}$	-0.021	-0.021
	(-3.28)	(-3.24)
$VOL_{i,t-1}$	0.060	0.060
	(5.16)	(5.19)
$VOL_{i,t-2}$	0.012	0.012
	(0.74)	(0.75)
$VOL_{i,t-3}$	0.029	0.029
	(2.74)	(2.78)
$VOL_{i,t-4}$	0.005	0.005
	(0.59)	(0.58)
$VOL_{i,t-5}$	-0.014	-0.014
	(-1.41)	(-1.40)
$Colonization_i \times Mercury_t$		-0.040
		(-0.01)
$Colonization_i \times Low\ Sci_i$		1.467
		(2.04)
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	197,994	197,994
$Adj\ R^2$	0.019	0.019

Table 12: Mercury Retrograde and Trading volume

This table examines the change in the market turnover (trading volume) in the Mercury retrograde days. We use a detrending methodology based on Campbell, Grossman, and Wang (1993) that calculate the turnover trend as a rolling average of the past 20 trading days of log turnover. In all columns, we include country fixed effect, year-quarter fixed effect, and weekday effect. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Dep. Variable=	$Volm_{i,t}$	
Variable	(1)	(2)
$\boldsymbol{Mercury_t}$	**-0.011**	**-0.007**
	(-2.08)	**(-1.78)**
$Volm_{i,t-1}$		0.290
		(14.29)
$Volm_{i,t-2}$		0.101
		(11.82)
$Volm_{i,t-3}$		0.053
		(11.76)
$Volm_{i,t-4}$		0.029
		(5.75)
$Volm_{i,t-5}$		0.024
		(4.63)
$Ret_{i,t-1}$		1.231
		(5.92)
$Ret_{i,t-2}$		0.159
		(1.24)
$Ret_{i,t-3}$		0.228
		(2.41)
$Ret_{i,t-4}$		0.095
		(1.02)
$Ret_{i,t-5}$		0.068
		(0.70)
$VOL_{i,t-1}$		2.997
		(13.57)
$VOL_{i,t-2}$		-0.596
		(-5.35)
$VOL_{i,t-3}$		-0.900
		(-5.20)
$VOL_{i,t-4}$		-1.009
		(-7.18)
$VOL_{i,t-5}$		-0.791
		(-6.75)
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	354,584	352,760
$Adj\ R^2$	0.024	0.175

Table 13: Mercury Retrograde and Risk

In this table, we examine the change in market volatility in the Mercury Retrograde days. In Columns (1)-(2), we use the daily absolute return ($VOL_{i,t}$) as the dependent variable. In Columns (3)-(4), we use the return covariance ($COV_{i,t}$) as the dependent variable, where $COV_{i,t}$ is the product of the daily market index return and the daily global index return divided by the absolute daily global index return. In all columns, we include country fixed effect, year-quarter fixed effect, and weekday effect. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and date-level clustering.

Dep. Variable=	$VOL_{i,t}$	$VOL_{i,t}$	$COV_{i,t}$	$COV_{i,t}$
Variable	(1)	(2)	(3)	(4)
$\boldsymbol{Mercury_t}$	**1.595**	**0.280**	**1.462**	**0.648**
	(1.65)	**(0.33)**	**(1.26)**	**(0.58)**
$Ret_{i,t-1}$		-0.042		-0.014
		(-3.48)		(-0.98)
$Ret_{i,t-2}$		-0.034		-0.028
		(-4.84)		(-3.28)
$Ret_{i,t-3}$		-0.025		-0.021
		(-3.83)		(-2.34)
$Ret_{i,t-4}$		-0.019		-0.025
		(-4.02)		(-3.38)
$Ret_{i,t-5}$		-0.009		-0.013
		(-1.81)		(-2.15)
$Dep_{i,t-1}$		0.159		0.055
		(8.03)		(4.53)
$Dep_{i,t-2}$		0.120		0.053
		(15.92)		(7.03)
$Dep_{i,t-3}$		0.108		0.052
		(12.71)		(5.92)
$Dep_{i,t-4}$		0.077		0.038
		(13.03)		(7.15)
$Dep_{i,t-5}$		0.085		0.040
		(17.07)		(7.51)
Weekday Fixed	Yes	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes	Yes
Clustering	Country & Date	Country & Date	Country & Date	Country & Date
Obs	426,154	425,914	420,691	420,691
$Adj\ R^2$	0.117	0.222	0.045	0.061

Table 14: Mercury Retrograde and mood

In Column (1), we work with a regression using the weekly Google sentiment index as the dependent variables. In Column (2), we work with a regression using the daily Google search volume for the topic "Depression-Mood" as the dependent variables. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity.

Dep. Variable=	$Google\ sentiment\ index_{i,t}$	$Depression - Mood_{i,t}$
Variable	(1)	(2)
$\boldsymbol{Mercury_t}$	**0.006**	**-0.002**
	(0.69)	**(-0.46)**
Dep_{t-1}	-0.393	0.145
	(-26.92)	(10.71)
Dep_{t-2}	-0.211	0.110
	(-16.97)	(14.01)
Dep_{t-3}	-0.132	0.099
	(-9.51)	(16.99)
Dep_{t-4}	-0.071	0.094
	(-5.33)	(17.64)
Dep_{t-5}		0.104
		(14.46)
Weekly Fixed	Yes	No
Weekday Fixed	No	Yes
Year-Quarter Fixed	Yes	Yes
Country Fired	Yes	Yes
Obs	20,634	186,666
$Adj\ R^2$	0.141	0.353

Appendix IA1

In Column (1), we perform the analysis controlling other factors. Specifically, we drop the January and control for the global temperature effect, sunspot effect, moon effect, other planet retrograde effects, major global financial crisis effect, and fixed effects for the day of the month and the last day of the month (end of month). The crisis periods: the 1987 U.S. stock market crash (October 19, 1987), the Gulf War (January 17, 1991 to February 17, 1991), the Mexican Peso crisis (December 20, 1994 to January 31, 1995), the Asian financial crisis (July 2, 1997 to December 3, 1997), the Russian crisis (August 11, 1998 to January 15, 1999), and GFC (September 2008 to September 2009). In Column (2), we calculate market returns against the U.S. dollars. In Column (3), we use market indexes from WRDS indexes database (January 1986 to Mar 2019 with 39 countries). In Column (4), we use the one week before the Mercury Retrograde day to the beginning of the Mercury Prograde day $[Retrograde_{t-7}, Prograde_t]$ as the Mercury Retrograde event window. In Column (5), we use the beginning of the Mercury Retrograde day to one week after the Mercury Prograde day $[Retrograde_t, Prograde_{t+7}]$ as the Mercury retrograde event window. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and year-week-level clustering.

Dep. Variable=	$Ret_{i,t}$				
Variable	(1)	(2)	(3)	(4)	(5)
$\boldsymbol{Mercury_t}$	**-5.903**	**-5.665**	**-6.488**	**-3.874**	**-4.476**
	(-2.91)	**(-2.57)**	**(-2.76)**	**(-2.41)**	**(-2.80)**
$Crisis_t$	-24.126				
	(-1.44)				
$Moon_t$	-1.930				
	(-1.11)				
$El\ Niño_t$	3.756				
	(3.73)				
$Sunspot_t$	-0.049				
	(-0.79)				
$Jupiter_t$	-6.280				
	(-2.05)				
$Pluto_t$	-0.483				
	(-0.17)				
$Saturn_t$	-0.287				
	(-0.12)				
$Neptune_t$	-2.021				
	(-0.59)				
$Uranus_t$	0.967				
	(0.34)				
$Venus_t$	8.909				
	(2.27)				
$Mars_t$	-2.350				
	(-0.76)				
Controls	Yes	Yes	Yes	Yes	Yes
Weekday Fixed	Yes	Yes	Yes	Yes	Yes
Year-Quarter	Yes	Yes	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes	Yes	Yes
End of month	Yes	No	No	No	No
Day of month	Yes	No	No	No	No
Clustering	Country & Date	Country & Date	Country & Date	Country & Date	Country & Date
Obs	339,847	424,953	233,094	425,914	425,914
$Adj\ R^2$	0.023	0.015	0.017	0.024	0.024

Appendix IA2

In Column (1), we perform the analysis for the periods between 1973 and 1997. In Column (2), we perform the analysis for the periods between 1998 and 2019. In Column (3), we perform the analysis for the developed countries. In Column (4), we perform the analysis for the emerging countries. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and day-level clustering.

Dep. Variable=	$Ret_{i,t}$			
Variable	(1)	(2)	(3)	(4)
$\boldsymbol{Mercury_t}$	**-4.115**	**-5.750**	**-4.816**	**-5.757**
	(-2.04)	**(-2.23)**	**(-2.59)**	**(-2.96)**
Controls	Yes	Yes	Yes	Yes
Weekday Fixed	Yes	Yes	Yes	Yes
Year-Quarter Fixed	Yes	Yes	Yes	Yes
Country Fixed	Yes	Yes	Yes	Yes
Clustering	Country & Date	Country & Date	Country & Date	Country & Date
Obs	162,105	263,809	245,083	180,831
$Adj\ R^2$	0.030	0.022	0.020	0.027

Appendix IA3

This table examines the placebo tests for the Mercury effect. Return windows are as indicated in column headers. For example, $(t+7, t+30)$ is from the 7th day of Mercury Prograde to the 30th day of Mercury Prograde. In the parentheses below coefficient estimates are robust t-statistics based on standard errors adjusted for heteroskedasticity and country-level and week-level clustering.

Dep. Variable=	$R_{i,t-30,t-7}$	$R_{i,t+7,t+30}$
Variable	(1)	(2)
$\boldsymbol{Mercury_t}$	**1.873**	**-1.317**
	(1.20)	**(-0.76)**
Controls	Yes	Yes
Weekday Fixed	Yes	Yes
Year-Quarter Fixed	Yes	Yes
Country Fixed	Yes	Yes
Clustering	Country & Date	Country & Date
Obs	425,914	425,914
$Adj\ R^2$	0.023	0.023

Appendix IA4

This table reports the top ten related Google Trend search topics to the topic "Ancient Greece," "Mythology," and "Hermes." The topic in each column is in the order from the top one to the top ten.

Ancient Greece	Mythology	Hermes
(1)	(2)	(3)
Ancient history – Topic	Greek mythology – Literary genre	Deity – Topic
Greece – Country in the Balkans	Norse mythology – Topic	God – Supreme being
Greek language – Human language	Deity – Topic	Greek mythology – Literary genre
Greeks – Ethnic group	Myth – Literary genre	Hermès – Fashion company
Greek mythology – Literary genre	God – Supreme being	Hermes Group – Company
Ancient Greek – Human language	Greek language – Human language	Mythology – Topic
Mythology – Topic	Greeks – Ethnic group	Greeks – Ethnic group
History – Filed of study	Greece – Country in the Balkans	Greek language – Human language
Myth – Literary genre	Goddess – Topic	Apollo – Deity
Ancient Rome - Topic	Ancient Greece – Topic	Greece – Country in the Balkans