Investor PSY-chology surrounding “Gangnam Style”

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Abstract

The global success of “Gangnam Style,” the 18th K-pop single by the South Korean rapper PSY in 2012, was an exogenous shock to international investor enthusiasm about DI Corp., because the company’s chairman and CEO is PSY’s father. The stock price of the semiconductor equipment company jumped by almost 800% in three months without material information. Using Korean microstructure data that identifies non-resident foreign individual (NRFInd, hereafter) investors and resident foreign individual (RFInd, hereafter) investors by nationality, we study international individual investor behavior. The count of flash mob videos and parody videos uploaded on YouTube from each country is our proxy for the enthusiasm of individual investors. We find that NRFInd (RFInd) investors in specific countries become net buyers (sellers) of DI Corp. when a flash mob or parody music video is uploaded in their country. This is because RFInd investors had already purchased the stock on the day PSY left Korea to meet Scooter Braun, the producer of Justin Bieber. Our results support a “resale option” explanation about the bubble in the asset price.

Key words: Gangnam Style, flash mob, Youtube, parody, bubble, investor awareness, individual investors, foreign investors, short sale, home bias, media, market efficiency

JEL classification: G02; G14; G12; G18

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1. Introduction and hypotheses development

The central tenet of the efficient market hypothesis (Fama, 1970) is that only information should move a stock price. However, researchers have found evidence that the price is sometimes significantly driven by non-informative attention and by the trading of enthusiastic individual investors under limits to arbitrage (Black, 1976; Barber and Odean, 2008; Engelberg, Sasseville, and Williams, 2012; Huberman and Regev, 2001; Kim and Meschke, 2012; Shleifer and Vishny, 1997; Tetlock, 2007, 2011). The recent case of DI Corp. (KRX:003160) provides intriguing evidence about the relationship between a bubble and trading behavior of international individual investors surrounding non-informative attention from global social media.

DI Corp. is a manufacturer of testing machines for semiconductors, founded in 1955 by the late grandfather of the world famous rapper, PSY, and has been listed on the Korean Stock Exchange (KSE) since 1996. Its chairman and co-CEO, Mr. Won Ho Park, is PSY’s father. Over the calendar year of 2012, the company had no material news about the fundamentals. As PSY’s “Gangnam Style” video achieved a world record of receiving more than 1.7 billion hits on YouTube from around the world since July 15th, 2012, and as his family relationship with the chairman of DI Corp. became public through news media in many languages, the stock price of DI Corp. jumped up by more than 790%. Consequently, the market cap increased from US$38 million to US$334 million. Although the price reversed after October 15th, by the end of 2012, it still maintained a level of 130% above what it had been before the release of “Gangnam Style.” Thus far, a typical analysis in financial media about the pricing pattern of DI Corp.’s stock has been a simple comparison with any bubble in asset prices driven by (domestic) individual investors, such as the Tulip Bubble in the 16th century (Economist, 2012). In this paper, we find that the pricing pattern was also driven by foreign individual investors placing orders for the stock from outside Korea.
Barber and Odean (2008) find that individual investors are the net buyers of attention-drawing stocks without material information about the fundamentals of the company. Engelberg, Sasseville, and Williams (2011), Kim and Meschke (2012) and Tetlock (2011) find that individual investors are the net buyers of stocks that draw media attention, such as non-informative stock recommendations on television, or CEO interviews on television, or stale information republished in news media. Leveraging the unique feature of Korean microstructure data surrounding DI Corp. and “Gangnam Style,” we test the following hypothesis:

(1) Individual investors are the net buyers of the DI Corp. stock when the attention to “Gangnam Style” is high.

The Korean microstructure data provides 250 unique country codes to identify the nationality of each trader that places an order. For offshore Koreans with permanent residency in foreign countries, the database provides a separate country code (CNTR_CD=997), which enables us to make sure that the trader is not really a domestic investor in disguise. Moreover, the data provides identification about whether the foreigner is a resident of Korea or non-resident (FORNINVST_TP_CD). In addition, it provides identification of whether the investor is an individual investor or institutional investor (INVST_TP_CD) for both foreign and domestic buyers. Choe, Koh, and Stulz (2005) are the first to utilize these features of the data to show that foreign investors face a disadvantage of a 37 basis point higher cost of round trip transactions of stocks compared to domestic investors.

To test our hypothesis, we proxy the level of attention to “Gangnam Style” in a foreign country by the cumulative count of the parody music videos and flash mob videos of “Gangnam Style” uploaded on YouTube from that specific country. A unique feature of the “Gangnam Style” music video is that PSY waived the copyright of the content of the video,
so that people who like it could create as many parody music videos as possible without worrying about the copyright issue (Chang, 2012).³

A recent development in pop culture, with the advancement of social media, such as Facebook, Twitter, and KakaoTalk, is to create and upload flash mob videos in tribute to the songs the people enjoy most. People’s enthusiasm and spontaneity are the keys to the creation of these flash mobs. Because people have to demonstrate and record their dance in a public place, participants must be excited enough about the song to practice the choreography by themselves before gathering. They then have to be willing to come together spontaneously at a certain predetermined place and time, because they have to “quickly blend back into the routine of their everyday lives” after the recording (Dow, 2011). In addition, they have to keep the schedule secret to make the event a surprise to the larger community (Dow, 2011).

While parody videos could be created by a handful of people, a flash mob typically involves a much larger number of people. For example, the flash mob of Gangnam Style in Milan, Italy on October 21, 2012 is reported to have involved more than 20,000 people (Lee, 2012). Which of the two phenomena –parody videos or flash mobs– is a better measure of the public’s attention given to the song is an empirical question. However, these two measures commonly indicate the enthusiasm of individual investors who could potentially be interested in DI Corp. due to the PSY effect.

We find that non-resident foreign individual (NRFInd, hereafter) investors trade more and become the net buyers of DI Corp. when one more flash mob videos or parody videos of “Gangnam Style” is uploaded from their own country. In contrast, resident foreign individual (RFInd, hereafter) investors of the same nationality who live in Korea are more likely to be

the net sellers on the same day. The reason is because RFInd had already purchased DI Corp.’s stock at the initial stage of Gangnam Style’s popularity in Korea, especially on the day (August 14, 2012) when PSY flew to the U.S. to meet Scooter Braun – Justin Bieber’s producer – for the first time to talk about producing an album in the U.S. (compare Panels A and B of Figure 2). Since RFInd live in Korea, they are exposed to the local media which reports attention-drawing news about PSY, giving more realistic and consistent information than is available to NRFInd. On August 14, 2012, Korea Joong Ang Daily (Korean newspaper) was the only English media that reported the news, according to Factiva. In addition, RFInd may have stronger local personal networks in Korea than NRFInd, and these contacts may transmit non-informative news about the family relationship between PSY and the chairman of DI Corp. Therefore, the result indicates that geographic proximity to the source of attention prompts an important difference in the trading behavior of individual investors.

We also investigate the trading behavior of foreign institutional investors. Consistent with the literature (Barber and Odean, 2008, and many others), we do not find any impact of investor enthusiasm on the trading volume or order imbalance of foreign institutional investors, regardless of if they are residents or non-residents. Although we document the effect of foreign individual investor trading, we do not deny that the major impact came from domestic individual investors due to the sheer size of trading volume. The unique feature of Gangnam Style enables us to better identify the attention level of foreign individual investors compared to that of domestic individual investors. For example, only a small number of domestically made flash mob videos like “Daegu Style” of “Hongdae Style” enable us to identify the geographic regions inside Korea.

When irrational individual investors drive the price away (up) from the fundamentals, rational arbitrageurs should trade on the opposite side and make the price more efficient
assuming minimal limits to arbitrage (Shleifer and Vishny, 1997). For example, Kim and Meschke (2012) find that when enthusiastic individual investors buy stocks after a CEO is interviewed on television financial media without material information, the institutional investors short sell the stock. Engelberg, Sasseville, and Williams (2012) also document significant short-selling volume after the Jim Cramer’s stock recommendation show. Although naked short selling is forbidden in Korea, investors can still sell stocks short by borrowing first. In addition, the Korean microstructure data provides information about which sell order is short-selling (ASK_TP_CD=2). Therefore, we hypothesize as follows:

(2) Institutional investors are the short sellers of DI Corp. after the release of the “Gangnam Style” music video, because the price starts to deviate from the fundamentals due to the buying pressure from irrational individual investors.

We find supporting evidence for our hypothesis. More than 99% of short-selling volume came from non-resident foreign institutions after “Gangnam Style” became popular, while the remaining came from domestic individual investors. Interestingly, we do not find any short-selling volume coming from domestic institutional investors over the sample period until December 31, 2012. We consider several possible reasons in Section 4.2.

The dramatic spike and partial reversal of the stock price may allow for alternative explanations other than the individual investor psychology hypothesis. First, it is possible that the global smash hit of the song combined with the publicity of his relationship with DI Corp. increased investor awareness in the global capital market as in Merton (1987), Fang and Peress (2009), Petajisto (2009), and Bodnaruk and Ostberg (2011). Kang and Stulz (1997) argue that such investor awareness is an important reason for having home bias in the international capital market. We find some supporting evidence for the investor awareness hypothesis. For example, Dimensional Fund Adviser of Kenneth French (Austin, Texas) is
now the largest institutional investor of DI Corp. with ownership of 0.76%. In addition, the number of unique country codes where the orders originated from more than doubled after the release of “Gangnam Style,” and the number of unique small (individual) investors more than doubled. However, the effect of investor recognition seems to have been overwhelmed by the effect of individual investors’ enthusiasm, because (1) the attention level to the “Gangnam Style” stayed highest during the Christmas season due to the demand for party music; and (2) the price of DI Corp. surged again to the 800% level when PSY’s follow-up song, “Gentleman” was released globally on April 11, 2013!

The second explanation for the pricing pattern is the resale option theory as in Harrison and Kreps (1978), Morris (1996), Xiong and Yu (2009), and Scheinkman and Xiong (2003). Given the short sale constraint in the Korean stock market, and given that the aggregate ownership of DI Corp. by small (individual) investors is more than 50%, the price is more likely to be biased to the optimistic side than pessimistic side. As attention to the stock increases, investors disagree more, which increases the trading volume. Consequently, optimistic investors may believe that they can find even more optimistic investors subsequently, which triggers the former to value the resale option highly and buy the stock even though they know that they are riding on a bubble. Our initial result about the difference between RFInd and NRFInd already supports the theory, because the former could have accumulated the stock in anticipation that PSY would create a global phenomenon. Another piece of supporting evidence we find is that the price of DI Corp. increases significantly when trading volume is high.

We also consider other alternative explanations in Section 4.3, such as an agency problem (Allen and Gorton, 1993; Allen and Gale, 2000), rational bubble (Blanchard and Watson, 1983), gambling behavior (Barberis and Huang, 2008; Kumar, 2009), short squeeze (Xu and Liu, 2013), and price manipulation. However, we find that our result seems best
explained by the resale option theory: an asset price bubble could be triggered by enthusiastic individual investors from all around the world believing that they can resell the stock to more optimistic investors in the future.

The remainder of the paper is organized as follows. Section 2 describes Gangnam Style, PSY, and DI Corp. Section 3 describes the data. Section 4 presents the results with analysis. We check robustness of the results in Section 5 using related stocks that could potentially have attention spill-over effects. We conclude in Section 6.

2. “Gangnam Style,” PSY, and DI Corp.

“Gangnam Style” is the 18th K-pop single by the South Korean rapper musician PSY, who uploaded the song’s music video on YouTube on July 15, 2012. The music video drew tremendous attention on social media and then the mainstream media in many countries around the world, even though the lyrics are almost entirely in Korean. The song became number one on the pop music charts in more than 30 countries including Australia, Germany, Switzerland, the UK, and the U.S. (Billboard Rap songs; and #2 in the total Billboard chart). Chang (2012) summarizes the success factor of “Gangnam Style” as follows: (1) strategic waiving of copyrights to spawn as many parody videos; (2) crowd sourcing from the larger dance community to come up with the easy-to-follow “horse-riding-dance”; and (3) the “average Joe” appearance of the singer which strategically fits well with the sarcastic lyrics against materialism. Besides, the song had other success factors, such as viral hook and comic scenes (Madhawi, 2012).

PSY, the rapper, was not a rookie in the entertainment industry. His real name is Jae-Sang Park, and he has been a popular singer in Korea since 2001. For the semiconductor
equipment company, DI Corp., which is owned by PSY’s father, the global success of the music video was a purely exogenous shock that even the professionals in the Korea entertainment industry did not anticipate when PSY initially launched his music video. The company’s key business is in manufacturing Burn-in Board and it commands the largest market share of 38%. Most importantly, the firm has nothing to do with the entertainment business and the firm did not have any material news in 2012. PSY’s father (11%), uncle (17%) and grandmother (4%) have been the largest shareholders of the firm. The stock is not and has never been cross-listed in any other country.

As the song became more popular through the Internet, social media, and conventional media, the family relationship between PSY and the founder of DI Corp. was revealed in the news media in many languages and countries. Using Factiva, the largest database of news articles in various languages, we search for news articles about DI Corp. and its relationship with PSY in 2012. Noteworthy titles of news articles since June 2012 are shown in Figure 1, together with the cumulative abnormal return and relative trading volume of the stock. The cumulative abnormal return is measured using a market adjusted model, where the KOSPI index return is used as the market return. Relative trading volume is defined as the trading volume of the stock divided by the total trading volume in the Korean Stock Exchange.

[Figure 1 about here]

English newspapers in China and Korea first covered PSY’s family relationship with DI Corp. on September 27, 2012, to explain the surge of the stock price, but the articles provided no fundamentals news about the company. Then a Spanish media source in Chile and Portuguese media in Brazil followed the lead on September 30, 2012. Eventually, it was publicized in the Economist on October 2, 2012, which was followed by an English media
source in Zimbabwe on October 7, 2012; the Chinese media in mainland China on October 18, 2012; and the German media in Germany on October 19, 2012. All of this global media attention suggests that the PSY’s family relationship was covered in the media in major languages around the globe.

3. Data

We use the daily stock price data and accounting data of Korean firms from FN Guide. We obtain the microstructure data from Korea Exchange (KRX) that covers until December 31, 2012. If a trade is from a foreign (non-Korean) investor, it gives the country code of the foreigner and identifies whether the foreign investor is a resident of Korea or not. Some readers may wonder how non-resident foreign investors could trade stocks in the Korean market. However, some of the Korean brokerage houses have offshore branch offices where they have a contract with a brokerage house in the foreign country to buy and sell Korean stocks on behalf of the local clients in that country. Moreover, Korea offices of global investment banks also work as brokerage houses to conduct transactions on behalf of non-resident foreign investors.

We collect information about flash mob videos, such as the date and country of the uploads. We use “Gangnam style parody” and “Gangnam style flash mob” as our search key words in YouTube. Fortunately, many of the videos have titles that include the name of the region, such as “Singaporean Style” or “Hong Kong Style” or “Cornell University: Flash Mob -Gangnam Style” to celebrate their regional (community) identity, which makes it easier to identify the country of the upload. When we can not clearly identify the country by the title even though the name of the community/city/town is in the name or description of the video, we use Google maps to locate the country that has the named community/city/town in
the flash mob video title. As of the end of 2012, at least 193 unique parody music videos were uploaded on YouTube from 43 different countries outside Korea. In addition, at least 243 unique flash mob music videos were uploaded on YouTube from 80 different countries outside Korea. The video counts are made as of June 2013, so some videos that have been taken down from YouTube since then are not counted. We also restrict our data to videos for which we could identify the country of the upload by reading the text of titles and scripts, or by watching the content of videos (for example, identifying a unique landmark for a certain country). Therefore, we believe that our count is relatively conservative.4

4. Results

4.1. Bubble in the DI stock price and foreign individual investor trading

Barber and Odean (2008) document that individual investors buy stocks that draw more attention, such as stocks in the media or stocks experiencing a 52-week high. The fact that DI Corp.’s relationship with PSY was revealed in various news media outlets in a handful of major languages around the world indicates that the stock gained the attention of individual investors globally. In addition, we argue that the attention given to DI Corp. is correlated with the attention given to the viral music video, “Gangnam Style” during the sample period. Finally, we proxy the attention given to DI Corp. in a foreign country by the cumulative number of “Gangnam Style” flash mob videos or parody music videos uploaded from that country. Our empirical question is as follows:

4 Ideally, one could attempt to use the daily hit volume of the “Gangnam Style” music video on YouTube from different geographic regions or countries, but these data are not available from YouTube. Alternatively, one could use the Google search volume index of “Gangnam Style” from different countries (Da, Engelberg, and Gao, 2011). However, Google only provides data about the search volume by country on a monthly basis, which is coarsely matched with our daily (potentially millisecond) frequency data.
(1) Does the trading volume of individual investors in a foreign country increase the day after either a parody music video or flash mob video was uploaded from that country?

(2) Do the individual investors in a foreign country become the net buyers of DI Corp. stock the day after either a parody music video or flash mob video was uploaded from that country?

We test these hypotheses using the following regression model.

\[
\text{IndTV}_t = \beta_1 \text{Cum. Upload}_{t-1} + \text{Country FE} + \text{DayFE} + \epsilon \quad \ldots \ldots \ldots \ldots \ldots \ldots (1)
\]

\(\text{IndTV}_t\) is the trading volume on DI Corp.’s stocks of individual investors in the country on date \(t\). \(\text{Cum. Upload}_{t-1}\) is the cumulative number of uploaded parody music videos or flash mob videos from the country until the trading day \(t-1\). We construct a dataset, in which an observation is a country-trading day combination. For each trading day of DI Corp. during the sample period, we populate the sample by all 250 countries whose country codes are available in the KRX database. We exclude the trading of domestic investors, because our question focuses on foreign individual investors. Since we have repeated the sampling from one stock and from the same trading day, we use a two-dimension clustered standard error as in Petersen (2009) at the country level and trading date level. Since different countries have different economic, cultural, technological, or legal environments that make it easier or more difficult to create and upload videos on YouTube or invest in Korean stocks, we use firm fixed effects. Therefore, our analysis would be the change analysis of investors within a country. In addition, we use trading day fixed effects to control for any unobserved heterogeneity commonly shared in the same trading day around the world.

For the second empirical question, we replace the dependent variable with the order imbalance of the individual investors in a specific country. Order imbalance is computed as
the shares of buy orders minus shares of sell orders in the transaction data. In addition, we separately investigate the trading behavior of non-resident foreign investors and resident foreign investors to see if there is a significant difference between these two groups. For example, while foreign individual investors located in their home country may be belatedly excited about DI Corp. and buy the stock after an additional “Gangnam Style” flash mob video from their own country, their compatriots located in South Korea may already be informed about PSY’s family relationship and sell the stock before or immediately after the same uploading event in anticipation that more enthusiastic investors would buy it. Recent literature about individual investor trading finds evidence that some individual investors are better informed or better skilled than others (Kaniel, Liu, Saar, Titman, 2012) and move ahead of others to take advantage of the pricing pattern around media-attention-drawing non-informative events (Kim and Meschke, 2012). For example, Kim and Meschke (2012) document that some individual investors buy when a CEO interview on CNBC is announced two to three days before the actual airing of the show in anticipation of a price increase on the day of the aired interview. We also separately investigate the trading behavior of foreign institutional investors, predicting that they would not be responsive to the upcoming enthusiasm about the music video. We rationalize that sophisticated investors like institutions would purchase the stock only to the extent that they become aware of the stock and determine that it fits their investment criteria. The result is shown in Table 1.

[Table 1 about here]

Panel A of Table 1 shows summary statistics and Panel B shows the correlation table. Panel C shows the regression results of the model in equation (1). In the first regression, we use the trading volume of the stocks from resident foreign individual investors as the dependent variable. In the second regression, the dependent variable is the trading volume of the stocks from non-resident foreign individual investors. In the third regression, the
dependent variable is the trading volume of the resident foreign institutional investors. Lastly, in the fourth column, the dependent variable is the trading volume of non-resident foreign institutional investors. Consistent with our prediction, we find that foreign individual investors are more likely to trade DI Corp.’s stock when either a “Gangnam Style” flash mob video or parody music video is uploaded from their home country. The economic magnitude is larger (83.25) for resident foreign individual investors than for non-resident foreign individual investors (12.57). As predicted, we find that the trading volume of foreign institutional investors is not affected by the degree of enthusiasm of the general public about PSY, which has nothing to do with the fundamentals of DI Corp.

In Panel D of Table 1, we investigate the order imbalance of different types of investors. We keep a consistent order of the type of investors as in Panel C. We find that non-resident foreign investors are the net buyers the day after new “Gangnam Style” flash mob videos or parody videos are uploaded, which is consistent with the previous literature in that individual investors are the net buyers of attention-grabbing stocks (Barber and Odean, 2008). A very interesting contrast is the behavior of resident foreign individual investors. They become the net sellers of the stock on the same day a parody music video or flash mob video is uploaded in their home country. This suggests that a significant portion of resident foreign individual investors had already bought the stock beforehand in anticipation that an attention level could increase in the future that would trigger more buying by unsophisticated investors. When we look at the order imbalance of foreign institutional investors, we do not find a significant response of resident foreign investors. Instead, non-resident foreign investors in the country of an uploaded parody music video or flash mob video weakly become net sellers. The statistical significance is around the 15% level, yet the economic magnitude is large. The result weakly supports the notion that institutional investors take
advantage of the behavior of enthusiastic individual investors by providing liquidity when the latter buy a stock due to groundless excitement about the stock.

[Figure 2 about here]

In Figure 2, we graphically contrast the order imbalance of NRFInd investors and RFInd investors throughout the sample period. In Panel A, we find that net buying of RFInd investors spiked on August 14, 2012, which is the same day PSY flew to the US to meet Justin Bieber’s producer, Scooter Braun. Since the producer is one of the most influential figures in the global entertainment industry, the meeting signaled that the song would be distributed extremely well to the mass media in the US as well as other places. Although this meeting was a great signal for the singer, it was not an informative signal for the fundamentals of DI Corp. It was also well before the proliferation of offshore flash mobs and parodies of “Gangnam Style.” The result strongly suggests that RFInd investors were aware of the connection between PSY and DI Corp. through the local media or personal networks and they purchased the stock with the expectation that more optimistic investors than themselves would buy the stock in the future. In Panel B, we find that net buying by non-resident foreign individual investors became salient only after the common practice of uploading “Gangnam Style” parodies and flash mobs took off. The result suggests that geographic proximity to the source of attention makes a significant difference for individual investors trading surrounding a bubble. The result also seems to support the “resale option” theory of the asset pricing bubble by Harrison and Kreps (1978), which will be discussed further in the section 4.3.

[Table 2 about here]

In Panels A and B of Table 2, we split the explanatory variable of $Cum. Upload_{t-1}$ into $Cum. Flash Mobs_{t-1}$ and $Cum. Parody Videos_{t-1}$ to determine if either “Gangnam
Style” flash mob or parody videos have stronger predictive power of trading volume and order imbalance. The result is mixed. While the statistical significance is stronger for parody videos, the economic magnitude of the coefficients are similar between the correspondent specifications.

In Panel C, we replace the trading day fixed effects with a handful of dummy variables, weekday fixed effects, and month fixed effects. The dummy variables we use are the event dummies. The results show that the stock did not have any material events since the beginning of our sample period of June 1, 2012 until December 31, 2012. The only exception might be the two days after a quarterly earnings announcement, but the announcement showed no surprises according to analysts in the news media. There were several registrations reporting that the company made some sales contracts with its existing customers but there were no surprises. There were several announcements that the company extended its existing loan guarantee for its subsidiary, which was also no news. The company also registered to report some changes in ownership of major shareholders and insiders, but the amounts were negligible. Since the company experienced a significant price jump for an extended period of time and a plunge without material information, the regulators of the Korean financial market publicly sent inquiry letters to the management of the company, inquiring about the reason behind the abnormal price movement. In addition, for each of the inquiries, the company officially replied within a day, stating that there was no special reason that they were aware of. Thus, for this small number of events, we give dummy variables to control for the impact. Our result is robust. In a set of unreported regressions, we use the daily Google search volume index of “Gangnam Style” relative to that of the key word, “China,” as an alternative measure of the investor attention to DI Corp. We use the search volume of “China” as the denominator, because it is high and stable throughout the sample period. We also use monthly data of the Google search volume index number by country as
an alternative measure. However, these alternative measures lose explanatory power as we include our key explanatory variable in every regression.

4.2. Short-selling volume analysis

Black (1986) states that it is possible for events that have no information content to affect price, because value is unobservable. Our case of DI Corp. shows that the price deviated from the fundamentals due to buying pressure of enthusiastic individual investors even from foreign countries. If the arbitrageurs are functioning well in the stock market, and if the cost of arbitraging is not formidable, they would short sell the stock to make the price closer to an efficient level. Therefore, in this subsection, we analyze the behavior of short sellers.

How easy is it to short sell in the Korean stock market? Naked short selling is banned in the South Korean stock market. In Korea, only covered short selling is allowed (either loan transactions or stock loans) and the up-tick rule is enforced. In loan transactions, an institution, such as an insurance company or a bank that possesses a certain stock over a long term, lends the stock to another institution that wishes to sell the stock short for a fee. Typically, foreign institutions use this loan transaction scheme to short sell stocks in Korea. Stock loan is a scheme where the investor deposits a certain amount of money (usually 70% of the market price, which is observable in the KRX website, but is still subject to the decision of brokerage house) into the brokerage firm to borrow a stock to sell it short. Stock loans have been allowed since 2008. Typically, domestic individual investors use this stock loan scheme, and they have to cover the short within 60 days and the maximum size of the account is 100 million KRW (=US$90,000) per person for a brokerage like Kiwoom. While the brokerage fee for online stock transactions (buy/sell) is 1~30 basis points depending on
the brokerage house, the brokerage fee for a stock loan is 10 basis points to 3% depending on the brokerage house.

We first study which types of traders shorted DI Corp.’s stock more before versus after the release of “Gangnam Style.” Table 3 shows the breakdown of short-selling volume by type of investor. Perhaps the most interesting result is that none of the short-selling volume during the sample period came from domestic institutional investors. Even though foreign institutional investors have been strong in short selling the stock, we find that none of the resident foreign institutional investors short sold the stock. Given that more institutional investors and foreign investors became aware of the stock through the “Gangnam Style” shock, it is less plausible to argue that the stock was completely ignored by domestic institutions or by resident foreign institutions. Rather, the absence of short selling might be attributable to implicit pressure from the regulators (or general public) against short-selling behavior (according to our interview with the practitioners). Occasionally, short sellers are portrayed in the media as evil greedy speculators who take advantage of unsophisticated individual investors by spreading groundless negative rumors about a company (Kim, 2013).

[Table 3 about here]

Therefore, to avoid any potential regulatory overreaction to their business inside Korean territory, domestic institutions and resident foreign institutions may have to avoid short selling as much as possible. Such implicit pressure against short sale may work as another kind of short sale constraint (Shleifer and Vishny, 1997; Miller, 1977; Jones, Lamont, 2002; Geczy, Musto, and Reed, 2002). However, it is worth questioning which situation is more effective in preventing a bubble and protecting individual investors: (1) leaving the short sellers alone to do their business or (2) de facto shackling of the short sellers inside the territory and letting individual investors ride on the bubble that eventually bursts. Of course,
the regulators officially announced warnings many times that DI Corp. is experiencing a price movement that is beyond a justifiable level according to the fundamentals. However, such an announcement seems to create unwanted consequences of attracting even more individual investors.

We plot the time series of total short-selling volume by all traders of DI Corp. in Panel A of Figure 3. Then in Panel B, we plot the time series of short selling volume from individual investors. The difference between what is shown in Panel A and Panel B is the short selling volume of non-resident foreign institutional investors. Ideally, one should look at the short interest which is the cumulative amount of shorted stocks net of covered shares. However, due to the limitation of our data, this is the best we can present about the short selling activity of the investors.

[Figure 3 about here]

One interesting pattern in Panel A of Figure 3 is that short volumes were high well before the rise of DI Corp.’s stock price and after the crash of the stock price, but not during the bubble and burst period. The near absence of short sellers surrounding the peak of the price could be attributable to the high volatility of the stock, which indicates a prohibitive cost of arbitrage (Shleifer and Vishny, 1997). In Panel B, we investigate the short-selling behavior of domestic individual investors. This behavior does not seem to suggest that domestic individual investors are sophisticated or informed (Boehmer, Jones, and Zhang, 2008; Engelberg, Reed, Ringgenberg, 2013), because their short selling is clustered intensively before and right after the release of the “Gangnam Style” music video. Another interesting fact is that absolutely none of the domestic individual investors dared to short sell the stock after the crash of the stock price, which suggests that they became more worried about the cost of arbitrage after watching the bubble form instead of learning from the
eventual burst. Part of the reason may be their anticipation that a subsequent release of PSY’s new music could bring about another bubble in the near future. However, it is difficult to fully reconcile this possibility with the story of the cost of arbitrage, because more sophisticated institutional investors were still short selling the stock during this period. The foreign countries hosting the short-selling institutions in this study are the UK, Germany, and Switzerland. We also find that most of the short selling come from institutions that are formally registered as brokerage houses and banks.

4.3. Alternative explanations about the pricing pattern of DI Corp.

4.3.1. Investor awareness hypothesis

The Korean stock market has been open to foreign investors (both individual and institutional) for more than two decades. Therefore, the diffusion of attention-drawing yet non-informative coverage in different language-based media in various countries makes it plausible to hypothesize that more individual and institutional investors outside Korea may have become aware of the company for the first time. In such a case, (a part of) the stock price increase would be permanent, according to Merton (1987). The investor awareness is an important driver of home bias in international portfolio management (Kang and Stulz, 1997).

We investigate if investor awareness of DI Corp. increased after the exogenous success of “Gangnam Style” outside Korea. One of the best ways to proxy for the awareness of potential investors is identifying investors who placed buy or sell orders of the stock. Although some trades could be cancelled for unknown reasons, the fact that an investor placed an order implies that the investor is at least aware of the existence of the stock. We do not have unique identification numbers for each trader in the microstructure data, but we
assume that finding a country code of the transaction orders by foreign investors, especially non-resident foreign investors, indicates that the firm is known to some investors in that foreign country. Thus, by splitting the sample period into before versus after the release of a “Gangnam Style” music video, i.e., January 1, 2011~July 14, 2012, versus July 15, 2012~December, 31, 2012, we examine whether the number of unique country codes in the transaction data of DI Corp. increased or not. Table 4 shows the results.

[Table 4 about here]

We find that the number of unique country codes of foreign traders buying and selling DI Corp. doubled after the release of “Gangnam Style” from 11 to 20, especially for non-resident foreigners [from 3 to 11 for institutional investors and 3 to 6 for individual investors]. The phenomenon is common for both individual investors (from 10 to 15) and institutional investors (from 4 to 12). One might argue that this increase is driven by Korean citizens or Korean institutions disguising foreign investors by trading from offshore locations. However, for all of the trades by Korean citizens or institutions placing orders from offshore locations, the data gives another unique country code, 997, which is excluded in our analysis. In an unreported analysis, we also find that the number of unique brokerage houses that execute the orders from domestic institutional investors more than doubled from 40 to 91. Assuming that a major portion of the executions of institutional orders in a brokerage house would be in-house orders, the result supports that awareness about DI Corp. increased significantly among domestic institutional investors.

The second best approach to gauge the change in investor awareness is to compare the count of unique shareholders (investors). Korean accounting reports force companies to report such information as is summarized in Panel B of Table 4. The number of unique shareholders (retail) more than doubled in one year from 7,676 as of June 2012 (before
Gangnam Style) to 15,215 as of June 2013 (after Gangnam Style). Moreover, according to the Thomson One database, Dimensional Fund Advisors, LP of Kenneth French is 0.76% owner of the stock after Gangnam Style, and its subsidiary, DFA Australia Ltd. owns 0.01% of the stock. In an unreported analysis, we find that foreign ownership jumped to 9% in mid-November 2012. If more investors become aware of a stock with an exogenous shock of visibility, the liquidity of the stock should improve (Grullon, Kanatas, and Weston, 2004). In an unreported analysis, we find that the liquidity of DI Corp. significantly improved after “Gangnam Style.”

The evidence in this subsection seems to consistently support the economic explanation by Merton (1987), which predicts a permanent price increase after media attention. To make sure that the price increase in DI Corp. after the release of “Gangnam Style” is fully explained by Merton, we need two more tests. First, the stock price level should have been sustained even without a high attention level to “Gangnam Style” or to the singer PSY, because most of the increase in the investor base already took place. Second, the stock price should not be moving again when the attention level to PSY increases with the release of follow-up songs. Therefore, we first investigate the daily attention level to the music video “Gangnam Style” using Google Trends as in Da, Engelberg, and Gao (2012). To obtain the daily search volume index, we need to obtain it on a monthly basis. One limitation is that for each monthly download, Google sets the average search volume of the key word as 100 even though the absolute level of the search volume may have gone down compared to the previous month. Therefore, we need a benchmark search keyword whose search volume is high enough and stable enough over the sample period. The key word “China” is a great candidate in this respect, because the search volume has been consistently high and stable ever since Google data was available. Therefore, we divide the daily search volume index of
“Gangnam Style” by that of “China” and plot it in Figure 4. We need to check if the high price of DI Corp. was supported without a high search volume of the song in December 2012.

[Figure 4 about here]

Several interesting findings emerge. First, the search volume of “Gangnam Style” was larger than that of “China” from September 2012 to February 2013. Second, the search volume for the former had a very strong weekend effect and holiday effect. People were searching for “Gangnam Style” much more on weekends and holidays, possibly searching for party music. In addition, people searched for the music the most during the Christmas holiday season. Therefore, it seems difficult to argue that the high stock price level of DI Corp. at the end of 2012 was devoid of a bubble effect from enthusiastic individual investors.

We also check the pricing pattern of DI Corp. after December 2012 in Figure 5. We find another spike of similar magnitude in mid-April 2013, which coincides with the timing of releasing “Gentleman,” the follow-up music video by PSY. As of the point of writing this paper, the singer is scheduled to release another new music video in mid-September, which is driving the price up again. Therefore, even though we recognize that the investor recognition hypothesis by Merton (1987) is supported, its economic magnitude is simply swamped by the effect of the bubble attributable to the individual investor psychology for the case of “Gangnam Style.”

[Figure 5 about here]

4.3.2. Resale option hypothesis of a bubble

The bizarre pricing pattern of DI Corp. surrounding “Gangnam Style” is comparable to those of the Chinese Warrant bubble (Xiong and Yu, 2011), Volkswagen around Porsche’s
acquisition of stocks in 2008 (Xu and Liu, 2013), and the Chinese A-B share premia (Mei, Scheinkman, and Xiong, 2009). A handful of theories explain the bubble in asset prices, so we try to investigate which bubble theory best explains “Gangnam Style.” Under the presence of the Korean short sale constraint, optimistic investors would influence the price more than pessimistic investors, because the latter cannot short sell easily. According to Harrison and Kreps (1978) and Scheinkman and Xiong (2003), an asset has an option to resell to other traders with stronger optimistic beliefs when there is a short sale constraint. Thus, they would keep buying the stock, which results in a bubble. According to their argument, a bubble is “based on the recursive expectations of traders to take advantage of mistakes by others” (Scheinkman and Xiong, 2003). The theory by Scheinkman and Xiong (2003) predicts that the magnitude of a bubble is positively correlated with trading volume, because when investors disagree more due to larger differences in the degree of optimistic beliefs, trading volume would increase and at the same time, the value of the option to resell would be higher. We follow Xiong and Yu (2009) to check if the resale option hypothesis is supported in the case of DI Corp. Our baseline empirical model we test is as follows:

$$Price_t = \beta_0 + \beta_1 \text{TURNOVER}_t + \epsilon,$$ .................................(2)

where $Price_t$ is the stock price of DI Corp. on date $t$, and $\text{TURNOVER}_t$ is the share turnover (trading volume divided by number of shares outstanding) of DI Corp. on date $t$. Our key prediction is that $\beta_1 > 0$ when we use the subsample of the period after the release of “Gangnam Style,” i.e., July 15, 2012. Since our question is whether “Gangnam Style” significantly increased the bubble component of the stock price, our full empirical model should be as follows:

$$Price_t = \beta_0 + \beta_1 \text{TURNOVER}_t + \beta_2 \text{TURNOVER}_t \ast 1\{\text{After Gangam Style}\} + \beta_3 1\{\text{After Gangam Style}\} + \epsilon,$$ .................................(3)
1{After Gangnam Style} is a dummy variable that is one if the trading day is after July 15, 2012. Our key prediction is that $\beta_2 > 0$, which would confirm that Gangnam Style increased the bubble component of the stock price in DI Corp.

Another prediction by Scheinkman and Xiong (2003) is that the value of the option to resell the stock is positively correlated with the volatility of the stock. When the price is more volatile, the heterogeneity in beliefs among investors would increase, which would increase the chance of having more optimistic traders in the future. Thus, our empirical model is as follows:

$$
Price_t = \\
\beta_0 + \beta_1 VOL_t + \beta_2 VOL_t \times 1\{After Gangam Style\} + \beta_3 1\{After Gangam Style\} \ldots (4)
$$

$VOL_t$ is the intraday stock return volatility of the share of DI Corp. on date $t$. We measure the intraday return volatility by sampling the stock price at the end of every 5-minute interval for each trading day $t$, using the microstructure data. Our key prediction is that $\beta_2 > 0$, which would confirm that Gangnam Style increased the bubble. One caveat for this empirical model with $VOL_t$ is that there is a daily price limit of 15%. Once the stock price increases by 15% in a minute at the beginning of the day, the price would stay there for the whole day with minimal trading volume. Therefore, the volatility would be artificially lower especially for a day with a high bubble component in the price. The empirical result is in Table 5.

[Table 5 about here]

The result in the first regression suggests that there had been a significant bubble component in DI Corp.’s stock even before Gangnam Style. This makes sense because it was classified as one of the “Political Theme Stocks” associated with Mr. Un-Chan Chung, who
used to be the Prime Minister of Korea 2009~2010, and has shown substantial intention to run for president in the future. The father of PSY is a friend of Mr. Chung, a Princeton graduate economics professor at Seoul National University, where he served as the president. Moreover, he officiated at PSY’s wedding in 2006 indicating that they were indeed close friends. The regulators in KRX officially demanded the management of DI Corp. give an open explanation about the drastic price changes on April 3, 2012, which was a week before the general election in Korea. The company officially responded that they could not find any material reason for the price increase.

More importantly, the coefficient of the interaction between the after “Gangnam Style” dummy and the turnover is positive and significant at the 1% level, which suggests that the bubble component expanded significantly after the release of “Gangnam Style.” In the second regression, we replace the share turnover with intraday volatility. We do not find any significant coefficients. We believe that this is because of the 15% daily price limit in the Korean market. The interaction term is marginally significant at the 8.64% level under the one-tailed test. In an unreported regression, we include all the explanatory variables, but the coefficient of 5-minute volatility becomes significantly negative, while the interaction between the volatility and the after Gangnam Style dummy becomes insignificant due primarily to high multicollinearity (an average VIF score of 9.72). Therefore, in the third regression, we restrict our sample period to the after Gangnam Style period and use the two explanatory variables (share turnover and 5-minute volatility) with the caveat that the volatility is not a strong predictor in the Korean microstructure setting. The result supports that the resale option theory well explains the pricing pattern of DI Corp. surrounding “Gangnam Style.”

4.3.3. Other possible explanations related to the asset bubble
Another explanation for the pricing pattern could be an agency problem by institutional investors as in Allen and Gorton (1993) and Allen and Gale (2000). That is, the fund manager of institutional investors may churn DI Corp.’s stock to window dress their own performance. However, the aggregate institutional ownership was estimated to be only 11% before “Gangnam Style,” and it decreased to 10% after “Gangnam Style.” which makes it less likely to support the agency theory.

One could argue that the bubble was an example of a rational bubble as in Blanchard and Watson (1983), in which rational investors keep buying the stock as long as the bubble is expected to grow at the same rate as the discount rate. However, the low level of institutional ownership makes the pricing pattern hard to reconcile with a rational bubble story in this case.

Some readers might argue that DI Corp. stock may have become more like a lottery ticket which promises a large positive payoff but with a very small probability. Barberis and Huang (2008) point out that people tend to overweight the tail probability when evaluating risk. Kumar (2009) finds that individual investors prefer stocks that are more like the lottery. For this hypothesis to be confirmed, the skewness of the daily return of DI Corp. should have increased after “Gangnam Style.” However, the skewness has decreased from 0.34 to 0.15.

Just as the anecdote of Volkswagen in 2008, a short squeeze could be the reason behind the pricing pattern (Xu and Liu, 2013). After an arbitrageur sells a stock short, he/she has to cover the short position at a certain point in time. However, this short cover activity increases the demand for the stock and drives up the price. SEC defines the term, short squeeze, as follows:

“[1] the pressure on short sellers to cover their positions as a result of sharp price increase or [2] difficulty in borrowing the security the sellers short.”
Since the Korean stock market bans naked short selling, the second definition is not applicable. Thus, we focus more on the possibility that the price spike of DI Corp. is driven by the pressure to cover short-sellers’ positions. We should first check the capital constraint of short sellers and the short sale constraint on DI Corp. stock. One of the most binding short sale constraints is to have lower institutional ownership, because a smaller number of institutions can lend the stock for a short sale in the first place. Unfortunately, the aggregate institutional ownership data is not available, but only estimable based on the existing data (11% level). An additional short sale constraint is the float of a stock. As depicted in the dramatic anecdote of the short squeeze of Volkswagen in 2008, the float of the stock after the announcement of Porsche’s acquisition announcement was only 6% of the total outstanding shares (Xu and Liu, 2013). In the case of DI Corp., the insiders sold off the stocks during the price bubble, which increased the float of shares available for stock lending for the brokerages (47% to 65%), which weakens the explanatory power of the short squeeze story.

Finally, one could argue that price manipulation could have been a possibility. Since the company’s stock hit the daily price limit of 15% repeatedly over the sample period, the regulator of Korea Exchange (KRX) demanded that the management of DI Corp. to provide an open explanation about the drastic price changes three times during the last year [September 25, 2012, October 15, 2012, and April 3, 2013]. The management reported immediately each time, stating that they found no reason and no material information. Although the price reversal since October 15, 2012 was triggered by the sale of the stock by PSY’s grandmother, the sale amount (5,378 shares) was negligible compared to the number of shares she had been holding (1.2 million shares) throughout the period. They followed the due legal process to implement the sale. At least, we do not find evidence of manipulation by insiders.
5. Robustness check

If the stock price bubble caused by non-informative attention stemming from “Gangnam Style” occurred for DI Corp., there could have been a significant spill-over effect to other stocks simultaneously. We investigate several more cases here. Figure 8 shows the pricing pattern of these stocks.

[Figure 8 about here]

5.1. D.ID Corp. (KOSDAQ:074130)

D.ID Corp. is a manufacturer of liquid crystal display (LCD) semiconductor components, such as back light units. It is the only supplier to Samsung Display Ltd. for the tablet PC display. It was established in 1998 and has been listed on the KOSDAQ market since 2005. Its largest shareholder is KOWAC Ltd. of Japan (25%). Over the last year, the daily return of the company closely paralleled that of DI Corp. with a correlation coefficient of 52%. One might think that the similarity of the name spelling (or pronunciation) between the two companies would have caused the excited individual investors to trade by mistake as in the case of MCI and MCIC (Rashes, 2002) or as in Bae and Wang (2012). However, the company has two more valid reasons to excite the individual investors with the global smash hit of “Gangnam Style.” Mr. Won Ho Park, PSY’s father, is the company’s director. As of June 30, 2012, DI Corp. also owned 14.92% of D.ID Corp. The non-informative yet attention-drawing news about the personal network with PSY’s father triggered the investor excitement, and the price of D.ID Corp. increased by 140% until October 15, 2012. Moreover, the same Dimensional Fund Adviser is the largest institutional investor of the company with 0.35% ownership as of June 2013.

[Table 6 about here]
Ever since February 2012, D.ID Corp. has not announced any acquisitions. Although the company did not have material news in 2012, the company announced material news several times in 2013. On February 25, the company announced its set up of the Tablet PC business unit which resulted in significant increase in revenues and net income. On March 22, it announced that it was replacing the CEO, Mr. Nak Hwang Lee, with Mr. Sung Soo Park. On April 30, the company announced that the company’s stock moved from the Ventures Division of KOSDAQ to the MidCap Division of KOSDAQ. On May 8, the company also initiated a loan guarantee for its subsidiary, and the notional amount of the guarantee is equivalent to 15% of its book value of equity. Finally, on June 3, the company announced that its independent director resigned for family reasons. Interestingly, throughout the period, the two days when the company’s stock price reached its peak were not the days of release of material information, but the days when DI Corp. reached its peak due the attention to the rapper PSY.

5.2. DI Corp.’s industry competitors

Industry competitors could be the companies that experience an attention spill-over effect at least in terms of visibility, because investors may pay more attention to these companies because they show up on the list of competitors. We obtain the list of industry competitors from the DI Corp. page in the Thomson One database. The competitors are Avaco Co. Ltd. (083930), PSMC Co.Ltd. (024850) Meere Company Inc. (49950), DMS Company Ltd. (068790), and Techwing Inc. (089030). However, the five competitors of DI Corp. in Korea do not seem to have benefitted from any increase in investor awareness.

5.3. PSY’s manager company, YG Entertainment and its industry competitors

As PSY becomes more well known as a world class rapper, the investors may revise their beliefs about the cash flow and risk of the company that manages PSY, YG
Entertainment. At the same time, the investors may revise their beliefs about cash flow and risk of all the entertainment firms in South Korea as a whole. Accordingly, the stock price of YG Entertainment and its three key competitors would be driven higher with the success of “Gangnam Style.” The three competitors are S.M. Entertainment (041510), JYP Entertainment (035900), and KeyEast Co. Ltd. (054780). We use market adjusted model to compute the cumulative abnormal return. The pricing pattern is shown in Panels C and D of Figure 8. While the pricing pattern of DI is purely driven by the attention and bubble, the pricing patterns of Korean entertainment firms are driven by one more component: information. The comparison suggests that PSY’s success in global entertainment had a significant spill-over effect on Korean entertainment stocks, because the success is informative about the newly recognized competence of the Korean entertainment industry. However, it is difficult to argue that the movement was driven by attention.

6. Conclusion

There is only one PSY in the world, so some readers may argue that the case of “Gangnam Style” and DI Corp. is difficult to generalize. We do not deny the limitation. However, bubble repeats itself in different market in different form throughout human history. The case of “Gangnam Style” enables us to clearly identify the attention given to PSY’s father’s company, using flash mob video uploads on YouTube, and to test a theory about bubbles. The case also enables us to study the international individual investor trading behavior, which has never been shown before. The unique feature of Korean microstructure data accompanied by hand collected data related to the new pop culture such as parody music videos enables us to extract a rich set of implications for researchers of financial economics using the case of the “Gangnam Style” global popularity.
We also contribute to the literature about media attention and market efficiency using a new type of media data and international data (Tetlock, 2007; Tetlock, Saar-Tsechansky, Macscassy, 2008; Engelberg and Parsons, 2011; Fang and Peress, 2009; Da, Engelberg, and Gao, 2011; Gurun and Butler, 2011; Gurun, 2013; Kim and Meschke, 2012). Typically, the critical issue in the literature is the endogeneity of media attention (Gurun, 2013). In our paper, the mega-hit of a rap song on a global scale by the son of the founder and chairman of a Korean semiconductor equipment manufacturer provides a novel way of overcoming the endogeneity issue. Our finding that individual investors who are geographically closer to the source of company information behave in a less naïve fashion contributes to the strands of literature about the behavior of individual investors and foreign investors and home bias (Barber and Odean, 2008; Grinblatt and Keloharju, 2009; Grinblatt, Keloharju, Linnainmaa, 2011; Kaniel, Liu, Saar, Titman, 2012; Kim and Meschke, 2012; Engelberg, Sasseville, Williams, 2012; Choe, Kho, and Stulz, 1999, 2005; French and Poterba, 1991; Kang and Stulz, 1997; Doidge, Karolyi, Stulz, 2004; Lau, Ng, Zhang, 2010).
References


http://www.economist.com/blogs/banyan/2012/10/investing-gangnam-style

2723-2753.

Cumulative abnormal return (red line) and relative trading volume (blue bar) of DI Corp. since June 1, 2012. In calculating the CAR, we use a market model. For each trading day, we subtract the KOSPI index return (value weighted) from the stock price return of DI Corp. to compute excess return. Then we accumulate the excess return from June 1, 2012 until December 28, 2012. To calculate the relative trading volume of DI Corp., we divide DI Corp.’s daily trading volume by the aggregate trading volume of the Korean Stock Exchange and multiply it by 10,000 to represent the amount in basis point units.
Figure 2. Order imbalance of foreign individual investors and the cumulative number of “Gangnam Style” flash mobs and parodies

Panel A. Resident foreign individual investors

Panel B. Non-resident foreign individual investors
Figure 3. Short-selling volume of DI Corp. surrounding “Gangnam Style”

Panel A.

Total short-selling volume and CAR of DI Corp.

Panel B.

Domestic individual investors' short selling and CAR of DI Corp.
Figure 4. Time series of daily Google search volume of "Gangnam Style" relative to "China"

Figure 5. Extended time series of DI Corp.’s share performance and trading volume
Figure 8. Share performance and volume of the companies that could have a spill-over effect of attention associated with “Gangnam Style”

Panel A. D.ID Corp.

![CAR (left axis) and share turnover (right axis) of D.ID Corp. until July 2013](image)

We use market adjusted model to compute cumulative abnormal return.

Panel B. DI Corp.’s 5 competitors

![CAR of DI Corp.'s 5 competitors](image)

We obtain the list of industry competitors from the DI Corp. page in the Thomson One database. The competitors are Avaco Co. Ltd. (083930), PSMC Co.Ltd. (024850) Meere Company Inc. (49950), DMS Company Ltd. (068790), and Techwing Inc. (089030). We use a market adjusted model to compute the cumulative abnormal return.
Panel C. YG Entertainment

We use market adjusted model to compute cumulative abnormal return.

Panel D. YG Entertainment’s 3 competitors

The three competitors are S.M. Entertainment (041510), JYP Entertainment (035900), and KeyEast Co. Ltd. (054780). We use a market adjusted model to compute the cumulative abnormal return.
Table 1. Trading DI Corp. by different kinds of foreign investors and “Gangnam Style” flash mobs and parodies of in their home countries

Note: RFInd stands for resident foreign individual investors. NRFInd stands for non-resident foreign individual investors. RFInst stands for resident foreign institutional investors. NRFInst stands for non-resident foreign institutional investors. For each group of foreign investors from 250 unique countries, we have 142 trading days (June 1, 2012–December 28, 2012), which makes the total number of observations 35,500. For each country-trading day combination, we use the trading volume (number of shares ordered) or order imbalance (number of shares in buy orders minus the number of shares in sell orders) as the dependent variable. In the last column, we use the short-selling volume as the dependent variable, but 100% of the short-selling volume comes from the non-resident foreign institutional investor sample. Cum. Upload\textsubscript{t-1} is the cumulative number of uploaded parody music videos or flash mob videos until the trading day t-1. 1\{Sales contract\} is a dummy variable that is one if the trading day is the day of DI Corp.’s announcement about sales contract. 1\{Earnings announcement\} is a dummy variable that is one if the trading day is the day of DI Corp.’s quarterly earnings announcement. 1\{Loan guarantee extension\} is a dummy variable that is one if the trading day is the day of DI Corp.’s announcement to extend its loan guarantee for its subsidiary. 1\{Regulators’ inquiry\} is a dummy variable that is one if the trading day is the day when the Financial Supervisory Service (government regulator of the stock market) announced its inquiry into the company, questioning the reason for the drastic stock price movement. 1\{Firm response to inquiry\} is a dummy variable that is one if the trading day is the date when the company officially responded to the government regulator. 1\{Ownership report\} is a dummy variable that is one if the trading day is the date of DI Corp.’s announcement about the change in share ownership by the management and founder’s family members. Since our observations are based on the trading of a single stock (DI Corp.) over the 143 trading days, the standard errors are clustered at the country level and trading date level (Petersen, 2009).
Panel A. Summary statistics

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<th>Std.</th>
<th>Min</th>
<th>Max</th>
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Panel B. Correlation table

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<th>E.</th>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. daily_g-lsvi</td>
<td>0.1505*</td>
<td>0.2104*</td>
<td>0.0972*</td>
<td>0.3006*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. salescontr-t</td>
<td>0.0147*</td>
<td>0.0207*</td>
<td>0.0098</td>
<td>0.0160*</td>
<td>0.0236*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. earn_ann</td>
<td>0.0036</td>
<td>0.0053</td>
<td>0.0022</td>
<td>0.0133</td>
<td>-0.012</td>
<td>-0.0228*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. guarantee~d</td>
<td>-0.0121</td>
<td>-0.0174*</td>
<td>-0.0081</td>
<td>-0.0231*</td>
<td>-0.0574*</td>
<td>-0.0161*</td>
<td>-0.0101</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. reg_inquiry</td>
<td>0.0017</td>
<td>0.0009</td>
<td>0.0016</td>
<td>0.011</td>
<td>0.1163*</td>
<td>-0.0228*</td>
<td>-0.0143*</td>
<td>-0.0101</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>J. co_respond</td>
<td>0.003</td>
<td>0.0034</td>
<td>0.0021</td>
<td>0.011</td>
<td>0.1180*</td>
<td>-0.0228*</td>
<td>-0.0143*</td>
<td>-0.0101</td>
<td>-0.0143*</td>
<td>1</td>
</tr>
<tr>
<td>K. ownership</td>
<td>0.0342*</td>
<td>0.0500*</td>
<td>0.0210*</td>
<td>0.0734*</td>
<td>0.2050*</td>
<td>0.1498*</td>
<td>-0.0251*</td>
<td>-0.0177*</td>
<td>-0.0251*</td>
<td>-0.0251*</td>
</tr>
</tbody>
</table>
### Panel C. Trading volume regressions by type of foreign investor

<table>
<thead>
<tr>
<th>Subsample</th>
<th>RFInd</th>
<th>NRFInd</th>
<th>RFInst</th>
<th>NRFInst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cum. Upload_{t-1}</td>
<td>83.254 ***</td>
<td>12.57 ***</td>
<td>0.016</td>
<td>565.013</td>
</tr>
<tr>
<td>constant</td>
<td>-227.703 ***</td>
<td>-26.035 ***</td>
<td>-0.066</td>
<td>-612.398</td>
</tr>
<tr>
<td>constant</td>
<td>(4.07)</td>
<td>(4.52)</td>
<td>(0.75)</td>
<td>(1.26)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Trading day FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>35500</td>
<td>35500</td>
<td>35500</td>
<td>35500</td>
</tr>
<tr>
<td>Adj. R2</td>
<td>0.131</td>
<td>0.098</td>
<td>0.033</td>
<td>0.311</td>
</tr>
</tbody>
</table>

### Panel D. Order imbalance regressions by type of foreign investor

<table>
<thead>
<tr>
<th>Subsample</th>
<th>RFInd</th>
<th>NRFInd</th>
<th>RFInst</th>
<th>NRFInst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cum. Upload_{t-1}</td>
<td>-48.543 ***</td>
<td>2.999 ***</td>
<td>0</td>
<td>-437.402</td>
</tr>
<tr>
<td>constant</td>
<td>63.294 **</td>
<td>-5.011 ***</td>
<td>0.001</td>
<td>2038.589 *</td>
</tr>
<tr>
<td>constant</td>
<td>(-6.44)</td>
<td>(5.27)</td>
<td>(-0.00)</td>
<td>(-1.45)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Trading day FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>35500</td>
<td>35500</td>
<td>35500</td>
<td>35500</td>
</tr>
<tr>
<td>Adj. R2</td>
<td>0.007</td>
<td>0.014</td>
<td>-0.007</td>
<td>-0.003</td>
</tr>
</tbody>
</table>

*Cum. Upload_{t-1}* is the cumulative number of uploaded parody music videos or flash mob videos until the trading day t-1.
Table 2. Robustness checks

Panel A. Impact of flash mob music videos

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Subsample:</th>
<th>Shares traded&lt;sub&gt;t&lt;/sub&gt;</th>
<th>Order imbalance&lt;sub&gt;t&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RFInd</td>
<td>NRFInd</td>
<td>RFInd</td>
</tr>
<tr>
<td>Cum.Upload Flash Mobs&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>151.529 *  (1.87)</td>
<td>22.889 *  (1.79)</td>
<td>0.028  (0.86)</td>
</tr>
<tr>
<td>constant</td>
<td>-198.284 ** (-2.34)</td>
<td>-21.601 *  (-1.77)</td>
<td>-0.059  (-1.48)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>35500</td>
<td>35500</td>
<td>35500</td>
</tr>
<tr>
<td>Adj.R2</td>
<td>0.127</td>
<td>0.089</td>
<td>0.033</td>
</tr>
</tbody>
</table>

Panel B. Impact of parody music videos

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Subsample:</th>
<th>Shares traded&lt;sub&gt;t&lt;/sub&gt;</th>
<th>Order imbalance&lt;sub&gt;t&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RFInd</td>
<td>NRFInd</td>
<td>RFInd</td>
</tr>
<tr>
<td>Cum.Upload Parody Videos&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>137.884 *** (6.05)</td>
<td>20.866 *** (8.73)</td>
<td>0.027  (0.71)</td>
</tr>
<tr>
<td>constant</td>
<td>-221.271 *** (-5.70)</td>
<td>-25.105 *** (-4.21)</td>
<td>-0.065  (-1.28)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>35500</td>
<td>35500</td>
<td>35500</td>
</tr>
<tr>
<td>Adj.R2</td>
<td>0.132</td>
<td>0.102</td>
<td>0.033</td>
</tr>
</tbody>
</table>
### Panel C. Controlling for event dummies

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Shares traded, t</th>
<th>Order imbalance, t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RFInd</td>
<td>NRFInd</td>
</tr>
<tr>
<td>Cum. Upload, t-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>83.675***</td>
<td>12.583***</td>
</tr>
<tr>
<td></td>
<td>(4.17)</td>
<td>(4.56)</td>
</tr>
<tr>
<td>1{Sales Contract}</td>
<td>5.897</td>
<td>4.507</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(. )</td>
</tr>
<tr>
<td>1{Earnings Announcement}</td>
<td>716.099</td>
<td>-7.104</td>
</tr>
<tr>
<td></td>
<td>(1.63)</td>
<td>(-0.67)</td>
</tr>
<tr>
<td>1{Loan guarantee extension}</td>
<td>-99.793**</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>(-2.43)</td>
<td>(. )</td>
</tr>
<tr>
<td>1{Regulators' inquiry}</td>
<td>174.153</td>
<td>7.894</td>
</tr>
<tr>
<td></td>
<td>(1.27)</td>
<td>(0.68)</td>
</tr>
<tr>
<td>1{Firm response to inquiry}</td>
<td>163.785</td>
<td>-9.215</td>
</tr>
<tr>
<td></td>
<td>(0.72)</td>
<td>(-1.14)</td>
</tr>
<tr>
<td>1{Ownership report}</td>
<td>180.376</td>
<td>8.684*</td>
</tr>
<tr>
<td></td>
<td>(1.50)</td>
<td>(1.66)</td>
</tr>
<tr>
<td>constant</td>
<td>-119.096**</td>
<td>-1.377</td>
</tr>
<tr>
<td></td>
<td>(-2.07)</td>
<td>(-0.44)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Weekday FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Month FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>35500</td>
<td>35500</td>
</tr>
<tr>
<td>Adj.R2</td>
<td>0.13</td>
<td>0.099</td>
</tr>
</tbody>
</table>
Table 3. Breakdown of the count of sell orders by type of investor

<table>
<thead>
<tr>
<th>count of sell orders</th>
<th>Before Gangnam Style</th>
<th>After Gangnam Style</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short-sell</td>
<td>Sell</td>
</tr>
<tr>
<td>Domestic Individual</td>
<td>609</td>
<td>522030</td>
</tr>
<tr>
<td>Foreign Individual</td>
<td>0</td>
<td>687</td>
</tr>
<tr>
<td>Domestic Institutional</td>
<td>0</td>
<td>432</td>
</tr>
<tr>
<td>Foreign Institutional</td>
<td>234</td>
<td>21314</td>
</tr>
<tr>
<td>Total</td>
<td>843</td>
<td>544463</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% out of total sell order counts</th>
<th>Before Gangnam Style</th>
<th>After Gangnam Style</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short-sell</td>
<td>Sell</td>
</tr>
<tr>
<td>Domestic Individual</td>
<td>0.11%</td>
<td>95.73%</td>
</tr>
<tr>
<td>Foreign Individual</td>
<td>0.00%</td>
<td>0.13%</td>
</tr>
<tr>
<td>Domestic Institutional</td>
<td>0.00%</td>
<td>0.08%</td>
</tr>
<tr>
<td>Foreign Institutional</td>
<td>0.04%</td>
<td>3.91%</td>
</tr>
<tr>
<td>Total</td>
<td>0.15%</td>
<td>99.85%</td>
</tr>
</tbody>
</table>
Table 4. Did “Gangnam Style” increase the investor base of DI Corp.?

Panel A. The number of unique country codes of foreign investors trading DI Corp. before vs. after the release of the “Gangnam Style” music video

<table>
<thead>
<tr>
<th>Type of foreign investors</th>
<th>Before Gangnam Style</th>
<th>After Gangnam Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident [1]</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Non-Resident [2]</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>All</td>
<td>11</td>
<td>20</td>
</tr>
</tbody>
</table>

January 1, 2011~July 14, 2012 is the period before the “Gangnam Style” release and July 15, 2012~December 31, 2012 is the period afterwards.

Panel B. Retail investor count of DI Corp.

<table>
<thead>
<tr>
<th></th>
<th>Jun-12</th>
<th>Jun-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders</td>
<td>38%</td>
<td>27%</td>
</tr>
<tr>
<td>Small investors (retail)</td>
<td>51%</td>
<td>63%</td>
</tr>
<tr>
<td>Large investors*</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Number of unique small investors</td>
<td>7,676</td>
<td>15,215</td>
</tr>
</tbody>
</table>

*Large investors include Dimensional Fund Adviser 0.76% as of June 2013 based on the Thomson One database. The data in the table are from the website of financial supervisory services of Korea (dart.fss.or.kr).
Table 5. Testing the resale option theory to explain the bubble

<table>
<thead>
<tr>
<th>Dependent variable: Price</th>
<th>Period: 1/1/2011~12/31/2012</th>
<th>After Gangnam Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share Turnover</td>
<td>1080 ***</td>
<td>7638 ***</td>
</tr>
<tr>
<td></td>
<td>(7.27)</td>
<td>(2.75)</td>
</tr>
<tr>
<td>Share Turnover*1{After Gangnam Style}</td>
<td>3301 ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.94)</td>
<td></td>
</tr>
<tr>
<td>5min Volatility</td>
<td>1494</td>
<td>-231000</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td>(-1.28)</td>
</tr>
<tr>
<td>5min Volatility*1{After Gangnam Style}</td>
<td>128000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.38)</td>
<td></td>
</tr>
<tr>
<td>1{After Gangnam Style}</td>
<td>1698 ***</td>
<td>1631 **</td>
</tr>
<tr>
<td></td>
<td>(4.62)</td>
<td>(2.08)</td>
</tr>
<tr>
<td>constant</td>
<td>1536 ***</td>
<td>1558 ***</td>
</tr>
<tr>
<td></td>
<td>(100.63)</td>
<td>(41.27)</td>
</tr>
<tr>
<td>N</td>
<td>491</td>
<td>491</td>
</tr>
<tr>
<td>Adj.R2</td>
<td>0.466</td>
<td>0.418</td>
</tr>
</tbody>
</table>

The dependent variable is the price of DI Corp.’s stock at the end of each trading day. Share Turnover is the trading volume divided by the total number of shares outstanding. 1{After Gangnam Style} is a dummy variable that is one if the trading day is after the release of the “Gangnam Style” music video on July 15, 2012. 5-min Volatility is the intraday stock return volatility that is based on the stock price at the end of every 5-minute interval during the trading day based on the microstructure data. We run OLS regressions. t-statistics on every second row which is based on the heteroskedasticity robust standard errors.
Table 6. D.ID Corp.’s ownership breakdown

<table>
<thead>
<tr>
<th></th>
<th>06/30/2012</th>
<th>06/30/2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders</td>
<td>53%</td>
<td>35%</td>
</tr>
<tr>
<td>Small investors</td>
<td>33%</td>
<td>50%</td>
</tr>
<tr>
<td>Large investors*</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Number of unique small investors</td>
<td>1,308</td>
<td>4,807</td>
</tr>
</tbody>
</table>

*Large investors include Dimensional Fund Adviser 0.35% as of June 2013 based on the Thomson One database. The data in the table are from the website of financial supervisory services of Korea (dart.fss.or.kr).