UNIVERSIDAD ADOLFO IBÁÑEZ

Tesis Doctoral
Doctorado en Finanzas
Universidad Adolfo Ibáñez
2021

Heuristic Heaping in Firm Decision Making: Evidence in Dividend Distribution

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Agradecimientos

Esta tesis está dedicada a Maribel, mi querida esposa, y a mis hijos, Amelia y Germán, los que tenían 6 meses cuando ingresé al programa.

Quiero agradecer a Augusto Castillo (mi Advisor), a Jorge Niño y a Keith Jakob, por todo sus palabras, más allá de esta tesis. También, quisiera agradecer sinceramente a Viviana Fernandez, Herve Roche y Matias Braun, por la confianza, el apoyo y los consejos como directores del programa en estos años.

Y no podría dejar de mencionar a mis compañeros y amigos del doctorado de finanzas y del doctorado de management. Gracias!!!

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Introducción

Cuando existe demasiada información, o tenemos incertidumbre, tomamos atajos mentales en forma inconsciente para llegar a una rápida conclusión. Este proceso mental en psicología se denomina “Heurístico”. Si este proceso mental nos lleva a conclusiones equivocadas, se habla de la ocurrencia de un “sesgo cognitivo”.

Esta literatura ha sido tan importante que las finanzas le han otorgado un espacio en la denominada “finanzas del comportamiento” o “behavioral finance” que es la expresión en inglés más utilizada para referirse a ella. Una crítica que se le hace a las finanzas tradicionales es que se construye a partir de un supuesto importante: los inversionistas serían “racionales”, a pesar de la abundante evidencia empírica que refuta la validez de este supuesto. De esta forma, con las finanzas del comportamiento, podemos asumir que los inversionistas son parcialmente racionales.

Algunos ejemplos de sesgo cognitivo, relacionados a finanzas, son: el sesgo del presente (buscar la recompensa inmediata, en vez de una gratificación futura), la ilusión de control (tendencia a creer que podemos controlar o influir en ciertos acontecimientos), el sesgo de arrastre (solamente por que los demás lo hacen), etcétera. Todos estos sesgos están ampliamente documentados en experimentos.

Un sesgo cognitivo común es redondear números, a pesar de que se deseen resultados exactos o más precisos. Sobre esto, en finanzas, existe una literatura más o menos extensa que examina el redondeo en la distribución de los precios de las acciones. Pero, por el lado de la toma de decisiones corporativas, aún la literatura es pobre, y mayoritariamente centrada en el redondeo de utilidades o de utilidades por acción.

Tenemos por ejemplo a Herrmann y Thomas (2005). Ellos observaron que los analistas que realizan las proyecciones de utilidades por acción usan intervalos de 2,5 centavos en una mayor frecuencia que la observada en utilidades por acción reales. Ellos demuestran que esto sucede cuando los analistas están menos informados, hacen un menor esfuerzo de predicción, o tienen pocos recursos para hacer las proyecciones.

Sólo recientemente, se ha estudiado el tema del redondeo en las decisiones de distribución de dividendos. Nam, Niblock, Sinnewe y Jakob (2018) y Jakob y Nam (2020), examinan la distribución de dividendos en Australia y Estados Unidos, respectivamente. Ellos muestran que tanto la magnitud de los dividendos como la incertidumbre que enfrentan los ejecutivos sobre el desempeño futuro de la empresa afectan significativamente la probabilidad de que los gerentes elijan dividendos en intervalos redondeados.

En esta investigación, en el primer paper, verificamos que para Latinoamérica la relevancia tanto del tamaño del dividendo como de las variables de incertidumbre antes identificadas también se cumple, pero adicionalmente (en lo que definimos como el principal aporte de este paper) reportamos que la magnitud de la moneda (la moneda local respecto al dólar) también tiene un impacto significativo en la probabilidad de redondeo. Por ejemplo, el 57% y 49% de los dividendos de Colombia y Chile, respectivamente, están redondeados a un decimal. En el otro extremo, con monedas locales mucho más fuertes, el 2% de los dividendos de Brasil y el 11% de los de México, están redondeados.

Motivados por la relación significativa detectada en el paper 1 entre fortaleza de la moneda y probabilidad de redondeo del dividendo, en el paper 2 analizamos cómo un cambio en la moneda subyacente impacta en esta probabilidad tanto en el corto como en el largo plazo. Para ello seleccionamos una muestra de 4 países (Francia Alemania, Reino Unido y Suiza) y analizamos lo ocurrido en ellos durante el período 1981 a 2019. Mientras Francia y

Alemania cambiaron su moneda local por el Euro en 1999, el Reino Unido y Suiza no realizaron el cambio y son usados como países de control. Tanto en Francia como en Alemania identificamos claros efectos tanto de corto como de largo plazo. En ambos países la adopción del Euro produce una reducción drástica en el porcentaje de redondeo, por 2 ó 3 años. A largo plazo, después de la adopción del Euro, la probabilidad se recupera a sus niveles anteriores en los intervalos más pequeños, pero permanece baja en los intervalos más grandes.

En el paper 3, nos replanteamos el trabajo realizado en Estados Unidos, por Jakob y Nam (2020). En particular, el objetivo de este paper es ampliar y mejorar el estudio realizado originalmente por estos autores, incorporando nuevas variables de incertidumbre que no fueron consideradas por ellos y agregando un nuevo set de variables explicativas denominadas como "características financieras de la empresa". Para ello, tomamos como referencia el trabajo de Fama y French (2001) y Denis y Osobov (2008), quienes informaron que la propensión a pagar dividendos es mayor entre las firmas más grandes, más rentables y aquellas para las que las utilidades retenidas comprenden una gran fracción del patrimonio total. A partir de aquí nosotros pasamos a proponer y verificar que esas nuevas variables no sólo explicarían la propensión a pagar dividendos de las empresas sino que adicionalmente explicarían la probabilidad de que esos dividendos sean redondeados.

Además, profundizamos en el análisis, distinguiendo entre empresas que son pagadores habituales de dividendos, de aquellas que no lo son. Logramos verificar que los pagadores regulares de dividendos muestran una menor probabilidad de redondear que los pagadores no regulares, pero esa diferencia que es originalmente muy significativa, se reduce en el tiempo durante las últimas tres décadas. Finalmente, verificamos que existe una propensión cada vez mayor a redondear dividendos, en especial en el caso de los intervalos de 2 centavos, que no puede ser explicada únicamente por la evolución que muestran las variables explicativas de tamaño del dividendo, variables de incertidumbre o variables de características de la empresa.

En resumen, en este trabajo estudiamos la existencia del sesgo numérico en la distribución de dividendos, en diversas dimensiones, destacando estas conclusiones:

a) Se encuentra una relación positiva y significativa entre la magnitud de la moneda local frente al dólar norteamericano y el redondeo en los dividendos por acción;

b) Se determina que hay efectos de corto y largo plazo en la probabilidad de redondeo de los dividendos, ante un cambio obligatorio de moneda en el mercado;

c) El set de variables denominadas "características financieras de la firma" afectan la probabilidad de redondeo de los dividendos;

d) El comportamiento y la evolución durante el período de estudio (1990-2019) del porcentaje de redondeo de las firmas que pagan regularmente dividendos y de los que no lo hacen habitualmente no es el mismo; y

e) Por último, la evolución en la propensión a redondear ha cambiado, a pesar de haber controlado por las variables explicativas definidas (tamaño del dividendo, variables de incertidumbre y características financieras de la firma).

De esta forma, destacamos de este trabajo, en primer lugar, el tomar conciencia de la heurística y de los sesgos cognitivos, para comprender ciertos comportamientos, de inversionistas y administradores (en particular, el sesgo cognitivo presente en la distribución de resultados), ya que no somos completamente racionales. En segundo lugar, destacamos la influencia o los efectos de la magnitud de la moneda en la toma de decisiones, en términos generales. Es decir, la magnitud de la moneda deberá ser una variable de control en nuestros análisis. Por último, observamos que los resultados de esta investigación son sumamente dinámicos. Por ejemplo, al observar la evolución de los pagadores regulares de dividendos, de los que no lo son, y al estudiar la propensión a redondear los dividendos por acción. Entonces, ¿Cuál es el próximo paso?

Sabemos que la distribución de dividendos es importante para la compañía y para el inversionista, y que impacta en una serie de métricas en finanzas, como en la estructura de capital, el dividend yield, el precio de la acción, en los impuestos del inversionista, en la tasa de retención de resultados, en el crecimiento potencial… de esta forma, una pregunta muy válida es saber en cuánto afecta este sesgo cognitivo a la valorización de la compañía.

Currency Magnitude and Cognitive Biases:
Evidence of Dividend Rounding in Latin America

Abstract

In this article, we contribute to a branch of literature that examines cognitive biases that influence corporate decision making. We examine whether Latin American firms round their dividend distributions based on a managerial heaping heuristic. Heaping is a bias to round numbers even though precise results are desired. Our study focuses on dividends in four Latin American markets with starkly different currency magnitudes. We hypothesize and report that currency magnitude significantly influences the characteristics of rounding observed in the dividend data. From 1990 through 2018, we report that 57% of Colombian dividends are heaped to a one decimal place or less of the local currency. The proportions are 49% for Chilean dividends, but only 11% for Mexican Dividends and 2% for Brazilian dividends respectively. Consistent with the prior literature, we also report that the likelihood of heaping of dividends in each country is significantly related to both dividend size, and to the level of information uncertainty faced by firm management.

Keywords: Heaping, Dividends, Currency Order of Magnitude, Dividend Size

JEL Classifications: G35, G41

1. Introduction

Dividends are a form of cash flow to investors, and firms have been distributing dividends to their shareholders for over four centuries (Baskin 1988). When firm directors meet to review corporate financial results, they must decide whether to initiate a new dividend, continue with their current dividend policy, increase their dividend or reduce their dividend. The dividend distribution decision is important for both the firm and its investors, as it directly influences many relevant corporate metrics including the firm's capital structure, earnings retention, growth potential, dividend yield, investor taxation and stock price. There is a good deal of theoretical and empirical academic literature that examines the dividend distribution decision, however the complexities of dividend payout policy are still worthy of additional research.

In this article, we contribute to a branch of literature that examines cognitive biases that influence corporate decision making. Specifically, we examine whether Latin American firms round their dividend distributions based on a managerial cognitive heuristic. We find that Latin American dividend policy is heavily influenced by a decision heuristic known as Heaping. Turner (1958) suggests that persons will *Heap* or overuse those digits that are multiples of the divisors of the base of the number system, while underusing those digits that are not multiples of the divisor of the base number system. According to Turner, people will use more accurate numerical values when they can, but will estimate or round to a heaped measure when they are unsure of the correct value.

The majority of heaping research focuses on human behavioral biases in survey results related to age reporting or time budgeting (A'Hearn, Baten and Crayen 2009). However, there are several studies that examine the heaping heuristic within a corporate framework. Herrmann and Thomas (2005) report that analyst forecasts of earnings per share (EPS) occur in nickel intervals at a much greater frequency than do actual earnings per share. Bamber, Hui, and Yeung (2010) and Dechow and You (2012) further investigate both manager and analysts' motives for rounding annual EPS forecasts. Jakob and Nam (2019) examine dividend distributions in US data and report that 50.9% of their full sample of dividends are clustered or heaped at particular intervals. They report that the likelihood of heaping is significantly related to dividend size, and the level of information uncertainty faced by firm management. Finally, Nam et al. (2018) examine heaping in Australian dividends and they find the likelihood of heaping is tied to information uncertainty as well as other firm-level characteristics.

In this study, we extend the dividend rounding literature. We examine whether Latin American dividend policy is also affected by the heaping heuristic. To study heaping in Latin American dividends, we examine whether dividend observations are clustered. Dividend clustering is the phenomena where dividend distribution sizes are observed more often at specific increments. The Latin American case is particularly interesting for two reasons. The first one is that most Latin American countries have civil law oriented legal systems, while the US and Australia (the countries of the prior heaping studies) have common law legal systems. There is abundant literature on how these legal systems have an impact on both the degree of protection to investors (see for example La Porta, Lopez de Silanes, Schleifer and Vichny (1998)) and on corporate decisions such as dividends policies (see for example La Porta, Lopez de Silanes, Schleifer and Vichny (2000)). The other reason why Latin American markets are interesting is the large variation in currency magnitude across countries. Some countries have very small magnitude of currencies (relative to the US or Australian dollars), while other countries have stronger, larger magnitude, currencies. Our sample is composed of firms from Chile, Colombia, Brazil and Mexico[1]. For Chile and Colombia the magnitude of the unit of currency is extremely small relative to US or Australian Dollars. One US dollar is equivalent to approximately 641 Chilean Pesos and approximately 2,955 Colombian Pesos[2]. The heaping literature suggests that larger magnitude numbers are more likely to be heaped. With the very low currency unit of the Chilean and Colombian Pesos we therefore

[1] We selected these four countries because they have the most active stock markets of the region.
[2] Official exchange rate (Local Currency Unit per US $, 2018 average).

anticipate a high likelihood of heaping in the Chilean and Colombian samples at whole peso intervals. On the other hand, the magnitudes of the unit of currency for Brazil and Mexico are not that small. One US dollar is equivalent to approximately 3.65 Brazilian Real and approximately 19.24 Mexican Pesos. In these countries, we therefore anticipate finding much less rounding of dividend distributions to whole currency unit intervals.

For our Latin American dividend study, we find clear evidence of dividend clustering in all four countries' samples. We report that the most frequently observed dividends in each country are more often heaped at certain intervals. For example, in Chile the high observation frequency sample is heaped at the whole Peso level or first decimal level at 83% and 100% respectively. The low frequency observations, on the other hand, are rarely at heaped values (e.g. In Chile, 3% at Pesos and 8% at the first decimal place). The cross-country data clearly show that currency magnitude influences the rounding intervals used by firm management. For the two small currency magnitude countries of Chile and Colombia, dividends are often rounded to whole intervals or the first decimal of the currency unit. Whereas, in the two stronger currency countries of Brazil and Mexico the rounding is more often seen at the second, third or fourth decimal of the currency unit.

Cross-sectionally, for each of the four countries, we find a positive relation between dividend magnitude and the likelihood of heaping. We verify the phenomenon whether we sort across different dividend ranges, sort by dividend size quintiles or measure with regression analysis. This magnitude and heaping relation holds if we alternatively define heaping at 0.0005, 0.005, 0.05, 0.5, or 5 currency unit intervals. In time-trend or longitudinal analyses we report that the average dividend size in all four countries increases throughout our sample period. As the average dividend magnitude increases through time, heaping appears to shift to courser rounding intervals (e.g. shifting from one decimal of local currency rounding to whole local currency rounding). As an additional test we hold dividend magnitude fairly constant by looking at the quintiles of each countries' full sample split by dividend size. With this approach we find that heaping exists longitudinally in all four countries, but the level of heaping is not stable across time while dividend magnitude is held relatively steady. These time-trend results suggest that other factors beyond dividend magnitude influence the likelihood of managerial dividend heaping in the four Latin American country samples.

In our final set of regression analyses, we add information uncertainty measures and other control variables as additional explanatory variables for heaping. Consistent with the prior literature, we find that cross-sectionally some information uncertainty measures lead to significant changes in dividend heaping. These results verify that information uncertainty does influence manager choice and dividend policy. After including the additional explanatory variables, dividend size still remains positively and significantly related to the likelihood of heaping in the separate country samples.

2. Literature Review

There is a longstanding debate about whether or not dividends are an important aspect of firm management and investing. The dividend policy debate starts when Lintner (1956) surveys corporate managers about how they choose their dividend policy. Lintner's survey results indicate that firm managers believe that the dividend decision is an important factor in firm value. He suggests that managers target a long-term payout ratio for their dividend distributions, and corporate dividend decisions are made conservatively. His suggested dividend policy is based on the management view that most stockholders prefer a reasonably stable dividend rate and the market puts a premium on stability or gradual and steady growth in the rate. In contrast to the survey results, Miller and Modigliani (1961) create a theoretical framework for dividend policy with their classic dividend irrelevance paper. They show, under a set of strict assumptions, that dividend policy is irrelevant for firm value. Subsequently, there has been a continuous flow of academic papers that try to understand the factors that influence dividend payment policy despite the fact that Fama and French (2001) discuss how fewer and fewer firms are paying dividends.

Most of the subsequent dividend policy literature can be classified into categories of either rational or behavioral theories. In the rational theory camp, the dividend clientele hypothesis, also from Miller and Modigliani, suggests that tax rate heterogeneity leads to a "dividend clientele effect." According to this hypothesis, investors with low (high) marginal tax rates will be attracted to firms with high (low) dividend payout ratios. According to another rational based theory, the information signaling hypothesis, managers use dividends as a costly signal to mitigate asymmetric information between management and investors (e.g., Bhattacharya 1979). In these models, the firm uses dividends as a credible signal to investors about the future prospects of the company. In the agency theory hypothesis, the persistent distribution of cash is a form of discipline for managers that can reduce agency costs (e.g., Easterbrook 1984). More recently, Blau and Fuller (2008) develop a model of corporate dividend policy based on the idea that management values operating flexibility. By reducing dividends and conserving cash, management increases its flexibility. Also, Karpavičius (2014) argues that dividend policy is not irrelevant as postulated in Miller and Modigliani. He shows that in the shareholder wealth maximization framework, share price depends on the smoothness of dividends.

Many behavioral theories also try to explain observed dividend magnitude and overall dividend policy based on investor and managerial biases. Long (1978) finds evidence supporting the hypothesis that investors' demand for dividends varies over time. Baker and

Wurgler (2004) propose that the decision to pay dividends is driven by prevailing investor sentiment for dividend payers. They suggest that managers cater to investors by paying dividends when investors put a stock price premium on payers, and by not paying when investors prefer nonpayers. Several papers look at how investor based psychological biases influence dividend policy. The bird-in-hand argument (e.g., Gordon 1959; Lintner 1962) suggests that investors must realize wealth in order to consume and therefore prefer cash dividends over capital gains. However, this argument is theoretically contested by Miller and Modigliani (1961). Thaler and Shefrin (1981), Shefrin and Statman (1984), and Black (1990) suggest that dividends are an investor self- control mechanism. Without dividends, investors are tempted to sell stocks for the purpose of consumption. In this explanation, dividends are used to help investors pace consumption.

Firm management based behavioral studies link managerial over-optimism or overconfidence with both investment policy and dividend policy (e.g., Malmendier and Tate 2005; Deshmukh, Goel, and Howe 2013). These papers indicate that managerial overconfidence influences both the level of dividend distributions and the market reaction to announcements regarding these payouts. In our paper, we study another potential managerial behavioral bias called "Heaping". We propose that firm managers will be affected by this often observed behavioral heuristic and its use will directly influence their choice of dividend payouts.

A common human error or bias is to round numbers even though precise results are desired. This type of numerical rounding heuristic, known as heaping, is particularly evident in census returns where the age in years is sought (e.g., Myers 1940). Heaping has been reported in various surveys regarding human behavior. Heaping generally occurs when individuals are asked to provide a precise point estimate (e.g., number of headaches per month, cigarettes per day, age in years, weight in pounds, etc.). In their response, people tend to round to a nearby data point because of a lack of precision or uncertainty in the knowledge of the quantity being reported (e.g., Huttenlocher, Hedges, and Bradburn 1990; Houle et al. 2013).

It is a natural extension of the rounding literature to ask whether this type of heaping heuristic or other similar heuristics may systematically influence financial markets and corporate decision making. A long line of literature examines rounding or clustering in the distribution of stock prices on U.S. equity markets (e.g., Niederhoffer 1966; Harris 1991; Christie and Schultz 1994; Grossman, Miller, Cone, Fischel, and Ross 1997; Cooney, Van Ness, and Van Ness 2001). As an example, Grossman et al. suggest that uncertainty, the size of transactions, and volatility in the price of a security may lead to a greater amount of price clustering. As an extension to this literature there is a growing group of papers that examine rounding of stock prices on international stock markets (e.g., Aitken et al. 1996; Brown, Chua, and Mitchell 2002).

The literature related directly to heaping within corporate decision making is much smaller. A few papers examine heaping in corporate earnings forecasts including forecasts made by both analysts and corporate managers. Herrmann and Thomas (2005) show that analyst forecasts of earnings per share occur in nickel intervals ($0.05) at a much greater frequency than do actual earnings per share. They provide evidence that analysts who round their earnings per share forecasts to nickel intervals exhibit characteristics of analysts who are less informed, exert less effort, and have fewer resources. The rounded or heaped forecasts are less accurate and the negative relation between rounding and forecast accuracy increases as the rounding interval increases from nickel to dime, quarter, half-dollar, and dollar. Bamber et al. (2010) report that a similar heaping phenomenon occurs for managers'

EPS forecasts. They find managers' forecasts are more likely heaped when: there is more uncertainty about earnings; the firm has higher proprietary information costs; and managers have stronger incentives to upward-bias their forecasts and it is difficult for the market to assess the truthfulness of the forecast. Their results are of interest, since they indicate that heaping in management forecasts stems not only from a benign psychological heuristic response to uncertainty, but also from managers' strategic incentives.

Dechow and You (2012) expand on the findings in Hermann and Thomas and show that analysts engage in rounding more often for larger earnings amounts where the penny digit of the forecast is of less economic significance. By rounding, analysts reveal that their forecasts are not intended to be precise to the penny. They also show that analyst incentives impact the likelihood of rounding. Specifically, they find evidence that suggests that analysts exert less effort forecasting earnings for firms that generate less brokerage or investment banking business since such firms create less value for the analysts' employers. As a consequence of this reduced effort and attention, the analyst will be more uncertain about the penny digit of the forecast and so will round. While we agree that manager and analyst forecasting plays an important role in financial markets, these activities do not directly impact the flows of funds between the firm and shareholders.

In this paper, we choose to examine dividend policy because of its precise and direct impact on the funds available within a firm and the cash flows to investors. Jakob and Nam (2019) and Nam et al. (2018) examine dividend distributions in US data and Australian data respectively. Both studies report significant heaping. We extend these analyses with a Latin American sample. We specifically analyze data from Chile, Colombia, Brazil and Mexico. While Chile and Colombia have weak local currencies against the dollar, Brazil and Mexico have strong local currencies against the US dollar.

3. Data and Hypotheses

Our data for dividend size comes from Economatica, a dataset that covers publicly traded companies in Latin America and other companies that are required by law to disclose their financial statements. We extract the data following a procedure similar to that of Jakob and Ma (2007). We include all monthly cash dividends (i.e., ordinary and extraordinary dividends) with ex-dates between January 1990 and November 2018[3]. We then combine multiple dividends for a single stock having the same ex-date into a single observation. This gives us 8,920 observations for Chile; 4,155 for Colombia; 17,664 for Brazil and 2,702 for Mexico.

Dividend size is measured in local currencies and fractions of local currencies. We hypothesize that because firm management and directors face significant uncertainty when making dividend decisions, they will heap on particular dividend amounts. Turner (1958) says that people will use more accurate numerical values when they can, but will estimate or round to a heaped measure when they are unsure of the correct value.

We also hypothesize that whether managers ultimately heap dividends is jointly influenced by a magnitude effect (dividend size) as well as an information uncertainty effect.

H1. The likelihood of heaping increases with dividend size.

H2. The likelihood of heaping changes with information uncertainty.

H3. The likelihood of heaping increases with the weakness of currency.

The majority of our uncertainty metrics are based on those from Zhang (2006). We also add an additional uncertainty metric based on concentration of shareholder ownership. Zhang investigates the role of information uncertainty in price continuation anomalies and

[3] This is true for Chile, Colombia and Mexico. For Brazil our sample starts in January 1995.

cross-sectional variations in stock returns. Zhang creates several measures for firm level information uncertainty. Our data for information uncertainty measures come from the Economatica database and from the Worldscope database. The sample period for the information uncertainty metrics is between 1989 and 2018.

The first and second measures of information uncertainty are based on stock returns. RET_{t+1} represents forward looking returns from month t+1. $RET_{t-11,t-1}$ represents accumulated returns from months t-11 to t-1. Both variables are measured in percent. Zhang states that if investors follow the direction of new information, a partition based on price momentum (i.e., accumulated returns) measures information uncertainty. Zhang states that greater uncertainty should result in greater price movements. We use four additional information uncertainty measures also based on Zhang: (1) 1/MV, inverted firm size, (2) 1/AGE, inverted firm age, (3) SIGMA, stock return volatility, and (4) CVOL, cash flow volatility.

The third measure, 1/MV, or inverted firm size, represents the inverse of market capitalization (in millions of local currency). Dechow and You (2012) argue that firm size has the potential to either increase or decrease heaping. Zhang states that large firms in general have more information available and are generally more diversified. Large firms may also have more shareholders, suppliers, and customers. However, based on this larger set of business endeavors, disclosure preparation costs for large firms would be higher. Since investors may have fixed costs of information acquisition, large firm's stocks may be more attractive. We follow Zhang in inverting firm size as a measure of information uncertainty.

The fourth measure, 1/AGE, or inverted firm age, represents the inverse of number of years since the firm was founded. We follow Zhang in using this approach. This variable is measured in years. Barry and Brown (1985) state that older firms have more information available to the market, which suggests less uncertainty, therefore we follow Zhang in using inverted firm age as a measure representing information uncertainty.

The fifth measure is SIGMA, stock return volatility, which is measured by the standard deviation of monthly market excess returns over the prior twelve months. This measure is in percent. This uncertainty measure captures the underlying volatility faced by the firm. The final measure based on Zhang (2006) is CVOL, cash flow volatility, which is measured by the standard deviation of quarterly cash flows from operations to total assets in the past 5 years (with a minimum of 3 years). This measure is in percent. This uncertainty measure also captures underlying volatility faced by the firm.

In this paper we use an additional measure of information uncertainty which is tied directly to ownership concentration. While large firms may have more shareholders, we believe that a measure of ownership concentration captures different aspects of firm uncertainty. In prior literature ownership concentration is linked to uncertainty. For example, Demsetz and Lehn (1985) argue that "the noisier a firm's environment, the greater the payoff to owners in maintaining tighter control. Hence, noisier environments should give rise to more concentrated ownership structures." Our new metric for Concentration of Ownership (Owner_1) represents the stock participation of the firm's largest shareholder[4]. We propose that more ownership concentration, all else equal, reflects less uncertainty to firm´s shareholders.

4. Empirical Results and Discussion

4.1. Heaped Dividends and Dividend Size

[4] As we show later, in Latin America the degree of concentration of property is much greater than in other world regions. In our sample the largest shareholder has an average ownership of 45.69%; 43.40%; 59.46% and 48.33% in Chile, Colombia, Brazil and Mexico respectively.

Table 1 examines dividend frequency and the likelihood of heaping in each country. This table is useful to determine whether dividends are clustered at specific amounts. It also helps verify whether or not the most common dividend amounts are typically at heaped intervals. In this table we evaluate two alternative heaping intervals for Chile and Colombia (whole local currency and one decimal or less) and five heaping intervals for Brazil and Mexico (whole local currency and one to four decimals or less). For example, the first row of panel A of the table shows that in Chile there are 18 unique dividend amounts that are observed 50 or more times in the full sample. 83% of these high-frequency cases are heaped to whole pesos and 100% are heaped at the first decimal. In the subsequent rows of Panel A, as the frequencies of the specific dividend amounts decline, we observe a monotonic decrease in the likelihood of heaping. In the least frequent dividend sizes, where only one observation at each dividend amount is recorded in the entire sample, only 3% of the cases are heaped to whole pesos and only 8% are heaped to the first decimal level. Panel B for Colombia shows the same positive relationship between dividend frequency and heaping likelihood for both whole local currency and one decimal or less. Panels C and D for Brazil and Mexico respectively show the same positive relationship between dividend frequency and heaping likelihood when heaping is measured with one or more decimals. The table is consistent with dividend clustering, coarser dividend rounding units in smaller currency magnitude countries, and a higher likelihood of heaping at more popular clustered dividend amounts in all the countries considered.

Tables 2, 3 and 4 examine whether dividend magnitude influences the likelihood of heaping. In Table 2 dividends are sorted by dividend amount and classified as heaped or not heaped based on the whole local currency and one decimal metrics (Chile and Colombia) and on the whole local currency and one to four decimal metrics (Brazil and Mexico). The first row of each panel in the table contains the smallest dividends and subsequent rows have larger dividend amounts. As dividend magnitude increases there is a clear increasing trend in the likelihood of heaping in each country, for all the alternative metrics considered. In the full sample, heaping occurs at one decimal of the local currency in 49% of the observations for Chile, in 57% of the observations for Colombia, but in only 2% of the observations for Brazil and 11% of the observations for Mexico. The cross-country results are consistent with more heaping in the small currency magnitude countries.

In Table 3, we examine alternative heaping intervals to further verify that the likelihood of heaping is related to both currency and dividend magnitude. In this table we divide the sample into quintiles based on dividend size. For each dividend size quintile, the first column shows the proportion of dividends heaped to the 0.0005 local currency intervals. The second column shows the proportion of dividends heaped to 0.005 local currency intervals, the third column shows the proportion of dividends heaped to 0.05 local currency intervals. The fourth column shows the proportion of dividends heaped to 0.5 local currency intervals, and the fifth column shows the proportion of dividends heaped to 5.0 local currency intervals. We report columns 3 to 5 for Chile and Colombia and all the columns for Brazil and Mexico. For each country, regardless of the chosen heaping interval, we again find a strong positive relationship between dividend magnitude and the likelihood of heaping. The cross-country results are again consistent with more heaping at coarser intervals in the small currency magnitude countries.

Table 4 presents Logit regressions to analyze the impact of dividend size on the likelihood of heaping in each country. In these regressions the dependent variable is an indicator variable taking a value of one if the dividend is heaped based on: (1) all whole local currency-intervals ($0, $1.0, $2.0, $3.0, etc.), and zero otherwise; (2) all 1 decimal-intervals

($0, $0.10, $0.20, $0.30, etc.), and zero otherwise; (3) all 2 decimal-intervals ($0, $0.01, $0.02, $0.03, etc.), and zero otherwise; (4) all 3 decimal-intervals ($0, $0.001, $0.002, $0.003, etc.), and zero otherwise; (5) all 4 decimal-intervals ($0, $0.0001, $0.0002, $0.0003, etc.), and zero otherwise; The explanatory variable in each regression is either dividend size or inverted dividend size. As reported in Table 4, in Chile all four regressions have the correct sign on the computed dividend magnitude coefficient and three of them are significant at the 1% level. In Colombia three of the four regressions are significant and have the correct sign on the computed coefficient. Two of the coefficients are significant at the 1% level and one at the 10% level. In Brazil all ten regressions have the correct sign on the computed coefficient with seven significant at the 1% level, two at the 5% level and one at the 10% level. In Mexico all ten regressions have the correct sign on the computed coefficient with six significant at the 1% level, two at the 5% level and one at the 10% level. These results again confirm that as dividend magnitude increases there is a higher likelihood of heaping in each country.

4.2. The time-trend in heaping

Figures 1.A to 1.D present for each country a graph of the percentage of dividends that are heaped in each month of the period considered. In Figures 1.A and 1.B we count dividends as heaped if they are rounded to either whole local currency or if they are rounded at one decimal of local currency or less (In Figures 1.C and 1.D we count dividends as heaped if they are rounded at either two decimals of local currency or less or if they are rounded at three decimals of local currency or less). Since heaped values at whole local currency are, by definition, also heaped at the one decimal level, it is important to understand that the whole local currency heaped sample is a subset of the one decimal heaped sample. In Chile and Brazil, the observed time trend in the likelihood of heaping is dependent on the heaping interval chosen. While for Chile (Brazil) overall heaping at the one decimal place (three decimal place) decreases through time, heaping at the full local currency level (two decimal place) increases. In Colombia and Mexico the trend in the likelihood of heaping is positive and independent of the heaping interval chosen. Figures 1.A to 1.D suggest that many firm managers use a heaping heuristic when determining the dividend amount for distribution, but they also suggest that heaping is more popular in Colombia and less popular in Brazil.

Figures 2.A and 2.B present the proportion of dividends heaped to whole local currency, relative to the sample of dividends heaped to one decimal of local currency over time. Figures 2.C and 2.D present the proportion of dividends heaped to two decimals of local currency, relative to the sample of dividends heaped to three decimals of local currency over time. These proportional measures increase in all of the countries of the sample. These results suggest that those managers that continue to heap dividends are more often rounding to larger, coarser intervals.

Figures 3.A to 3.D examine, for each country, the time-trend in dividend magnitude along with the likelihood of heaping, using on each case two different heaping intervals. Over the sample period there is a clear trend of increasing dividend magnitude in all countries. In Chile (and Brazil) the increasing dividend magnitude appears to be negatively related to one decimal heaping (three decimal heaping), but positively related to heaping at the whole local currency level (two decimal level). In Colombia (and Mexico) the increasing dividend magnitude appears to be positively related to both one decimal heaping (three decimal heaping) and heaping at the whole local currency level (two decimal level). The results in Figures 3.A and 3.C suggest that dividend magnitude positively impacts the coarseness of the heaping intervals used by managers. As dividend magnitude increases, managers round dividend distributions to larger intervals. However, the negative relation in Figures 3.A and

3.C indicates that there are perhaps other time-varying uncertainty factors that impact managers' overall choice to heap or round dividend distributions.

As an additional test, we hold dividend magnitude fairly constant by separately examining dividend size quintiles of each country's sample. Figures 4.A to 4.D show, for each country, the average dividend and the proportion of heaping through time for the third quintile, considering two different heaping intervals in each case. With this approach, we are able to hold dividend magnitude at a fairly stable level, and find heaping declines through time regardless of the heaping metric in Chile, Brazil and Mexico. With dividends magnitude held stable heaping increases through time in Colombia. These time-trend results again suggest that other factors beyond dividend magnitude influence the likelihood of managerial dividend heaping in the samples.

4.3. Heaped Dividends and Information Uncertainty

The next tests examine whether various firm level information uncertainty variables influence the likelihood of heaping. We examine information uncertainty variables based on those implemented in Zhang (2006). We also use an additional measure of information uncertainty tied directly to ownership concentration. This new metric, Concentration of Ownership (Owner_1), represents the stock participation of the firm's largest shareholder. Table 5 presents descriptive statistics for heaping, dividend magnitude and the information uncertainty variables for each country. One interesting result reported here is the high degree of ownership concentration of the companies in the sample. Note that the mean stock participation of the largest shareholder is 45.69% in Chile, 43.40% in Colombia, 59.46% in Brazil and 48.33% in Mexico. Table 6 presents a correlation coefficient matrix for all of these variables. This table shows that correlation coefficients between the different pairs of independent variables are relatively low. In Chile the highest reported correlation is between variables SIGMA and $RET_{t-11,t-1}$, with a reported value of 0.326. In Colombia the highest correlation is between variables SIGMA and $RET_{t-11,t-1}$, with a reported value of 0.406. In Brazil the highest correlation is also between variables SIGMA and $RET_{t-11,t-1}$, with a reported value of 0.161. In Mexico the highest correlation is between variables AGE and MV, with a reported value of -0.456.

Tables 7.A to 7.C present Logit regressions using dividend size and the various information uncertainty variables. Dividend Yield and Dividend Payout are added as control variables. For Chile and Colombia we consider two alternative dependent variables. One is an indicator variable taking the value of one if the dividend is heaped based on all whole local currency-intervals, and the other is an indicator variable taking the value of one if the dividend is heaped based on all one decimal of local currency-intervals, and zero otherwise. For Brazil and Mexico we consider five alternative dependent variables. One is an indicator variable taking the value of one if the dividend is heaped based on all whole local currency-intervals, and the other four are indicator variables taking the value of one if the dividend is heaped based on all one, two, three or four decimal of local currency-intervals, and zero otherwise. The information uncertainty independent variables are Forward looking return (RET_{t+1}), Accumulated return ($RET_{t-11,t-1}$), Stock volatility (SIGMA), Inverted firm size (MV_inv), Cash flow volatility (CVOL), Inverted firm age (AGE_inv) and Concentration of Ownership (Owner_1).

Consistent with the prior literature, we find that cross-sectionally some information uncertainty measures lead to significant changes in dividend heaping. These results suggest that information uncertainty does appear to significantly influence manager choice and dividend policy. It is interesting to note that the direction of influence of the various information uncertainty variables is not always the same from sample to sample. In the case of Chile the variable $RET_{t-11,t-1}$ is positively and significantly related to heaping, while the variables AGE_inv and Owner_1 are negatively and significantly related to heaping. In the case of Colombia the variables CVOL, MV_inv and Owner_1 are positively and significantly related to heaping. In the case of Brazil the variable MV_inv is positively and significantly related to heaping, while the variables CVOL, AGE_inv and Owner_1 are negatively and significantly related to heaping. Finally, in the case of Mexico the variables $RET_{t-11,t-1}$ and CVOL are positively and significantly related to heaping, while the variable MV_inv is negatively and significantly related to heaping. After including the additional explanatory and control variables, the dividend size variable appears to remain the most stable determinant of dividend rounding behavior. The coefficient on DPS remains positively and significantly related to the likelihood of heaping in each of the separate country samples. 13 of the 14 reported DPS coefficients are positive and 11 (0) of the DPS coefficients are positive (negative) and significant.

5. Conclusion

In this paper, we examine whether the behavioral heuristic or cognitive bias known as heaping is detected in dividend distribution data from Brazil, Chile, Colombia, and Mexico. The Latin American case is particularly interesting because the magnitude of the unit of currency varies dramatically from country to country. In Chile and Colombia the currency magnitude is extremely small relative to the US or Australian dollars studied in previous papers. One US dollar is equivalent to approximately 641 Chilean Pesos and approximately 2,955 Colombian Pesos. The magnitude of the unit of currency for Brazil and Mexico is relatively large with one US dollar equivalent to approximately 3.65 Brazilian Real and approximately 19.24 Mexican Pesos. The heaping literature suggests that larger magnitude numbers are more likely to be heaped. With the very low currency unit of the Chilean and

Colombian Pesos we expect relatively large dividend distributions (on a currency unit basis) and therefore anticipate a high likelihood of heaping in the Chilean and Colombian whole peso intervals.

Across all four countries we find strong evidence suggesting that managers use the heaping heuristic when choosing the amount of their firm's dividend distribution. Our results suggest that corporate dividend policy in Latin America, like that of the US and Australia, is plagued by a simple behavioral heuristic that affects management. In all four countries we find a strong positive relationship between the frequency of dividends and the likelihood of heaping (see Table 1). In Chile, for example, the most frequently observed dividends in the sample are heaped at the whole peso level or first decimal level at 83% and 100% respectively. The low frequency observations, on the other hand, are rarely at heaped values (3% at pesos and 8% at the first decimal place). The table is consistent with dividend clustering, and a higher likelihood of heaping at popular clustered dividend amounts. For the two small currency magnitude countries of Chile and Colombia, dividends are often rounded to whole intervals or the first decimal of the currency unit. Whereas, in the two stronger currency countries of Brazil and Mexico the rounding is more often seen at the second, third or fourth decimal of the currency unit.

Cross-sectionally, we find a strong positive relationship between dividend magnitude and the likelihood of heaping. This dividend magnitude and heaping relationship holds in all four countries regardless of the heaping interval chosen. We verify this result with different dividend size ranges and with regression analyses (see Table 2, Table 3 and Table 4). For example, In Chile we find that 49% of the dividends in the full Chilean sample are heaped to one decimal of peso or less. For small dividends (smaller than 1 Peso) frequency of heaping is only 18%. On the other hand, for very large dividends (greater than 1,000 Pesos) heaping frequency is 78%. The results in these tables also provide further evidence of coarser rounding intervals in small currency magnitude countries.

In time-trend or longitudinal analyses we report that average dividend size increases through our sample period in all four countries (see Figure 3). As the average dividend magnitude increases through time those managers that heap dividends are more often rounding to larger, coarser intervals (see Figure 2). As an additional test we hold dividend magnitude at a fairly constant level by looking at the quintiles of the full samples split by dividend size. With this steady dividend magnitude approach we find that heaping is not stable and declines through time in Chile, Brazil and Mexico, but increases through time in Colombia (see Figure 4).

The time-trend results suggest that other factors beyond dividend magnitude influence the likelihood of managerial dividend heaping in the Latin American samples. For this reason, in the subseque nt analyses, we add information uncertainty measures as well as additional control variables to our regression analyses. We use uncertainty measures proposed by Zhang (2006) and add an additional uncertainty measure for concentration of ownership. Consistent with the prior literature we find that cross-sectionally changing levels of several information uncertainty measures lead to a significant change in the likelihood of dividend heaping. In the case of Chile the variables RETt-11,t-1, AGE_inv and Owner_1 are significantly related to heaping. In the case of Colombia the variables CVOL, MV_inv and Owner_1 are significantly related to heaping. In the case of Brazil the variables MV_inv, CVOL, AGE_inv and Owner_1 are significantly related to heaping. Finally, in the case of Mexico the variables RETt-11,t-1, CVOL and MV_inv are significantly related to heaping. After including the additional explanatory variables, dividend size remains the most consistent predictor variable of the likelihood of heaping. Our DPS variable remains positively and significantly related to the likelihood of heaping in each separate country sample.

In the prior literature, heaping and rounding studies examine how the likelihood of heaping relates to the size of dividends and information uncertainty on a single market over time. In this study we examine four starkly different markets with respect to currency magnitude, and continue to find that dividend size and information uncertainty impact dividend heaping or rounding. As our primary contribution to the literature, we find that currency magnitude plays an important and significant role in whether certain cognitive biases impact financial data. We find that both the likelihood and the level of coarseness of the rounding interval are highly related to currency magnitude. Our findings indicate that future cognitive bias research, particularly in economics, accounting or finance, should consider currency magnitude as an important explanatory variable that influences managerial or corporate decision making.

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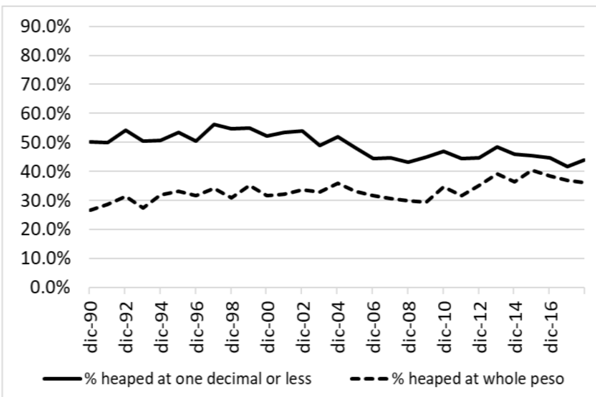
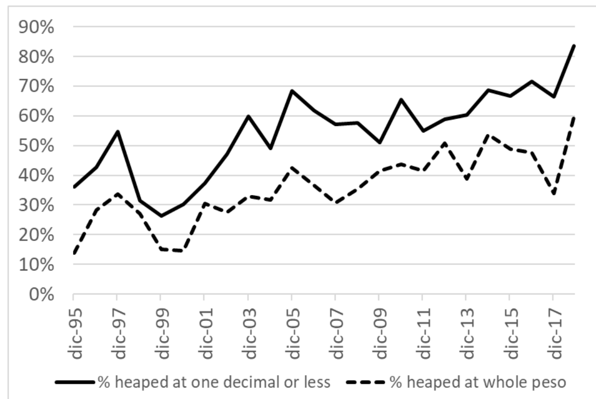
Figure 1. Percentage of dividends heaped by year using two different categories

This figure presents the full sample of dividends from 1990 through November 2018. For Chile and Colombia One decimal of local currency or less and whole local currency are indicator variables taking values of one if dividend is heaped based on the two different heaped categories: (1) one decimal of local currency or less ($0, $0.1, $0.2, $0.3, etc.), (2) whole local currency ($0, $1.0, $2.0, $3.0, etc.). For Brazil and Mexico Three decimal of local currency or less and two decimal of local currency are indicator variables taking values of one if dividend is heaped based on the two different heaped categories: (1) three decimal of local currency or less ($0, $0.001, $0.002, $0.003, $0.004, etc.), (2) two decimal of local currency ($0, $0.01, $0.02, $0.03, etc.). For each year, we calculate the percentage of dividends that are heaped.

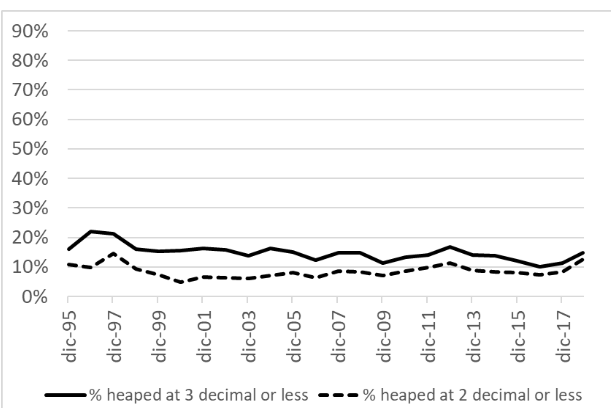
(1.A) Chile



(1.B) Colombia



(1.C) Brazil



(1.D) Mexico

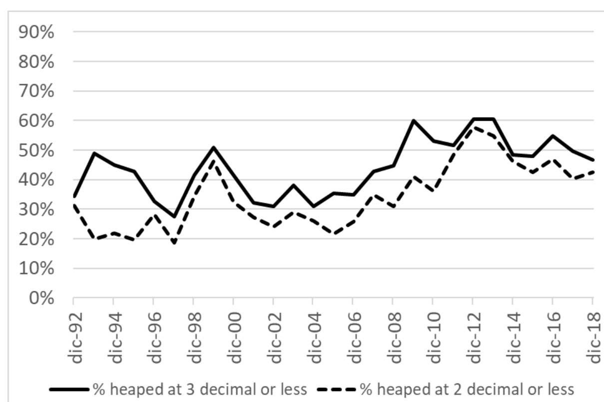
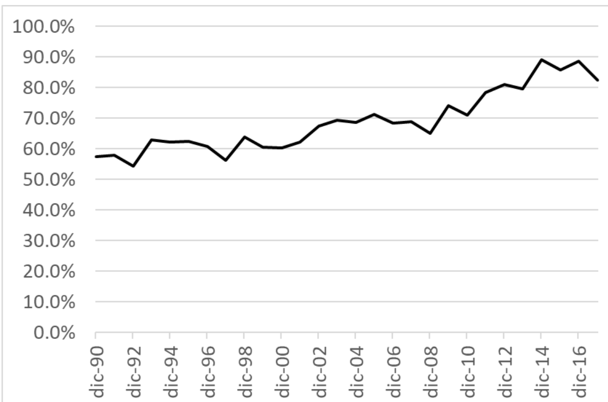


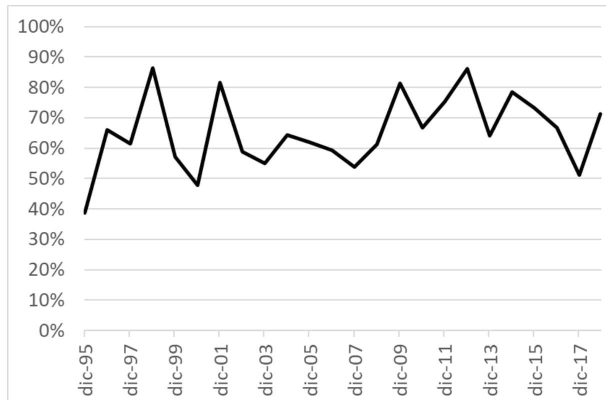
Figure 2. Percentage of dividends heaped to one category, relative to dividends heaped to the next category

This figure presents, for Chile and Colombia (Brazil and Mexico), the proportion of dividends heaped to whole local currency (two decimals) relative to dividends heaped to one decimal (three decimals) of local currency or less from 1990 through November 2018. For the full sample period, the average of this proportion is 68% for Chile, 65% for Colombia, 58% for Brazil and 78% for Mexico.

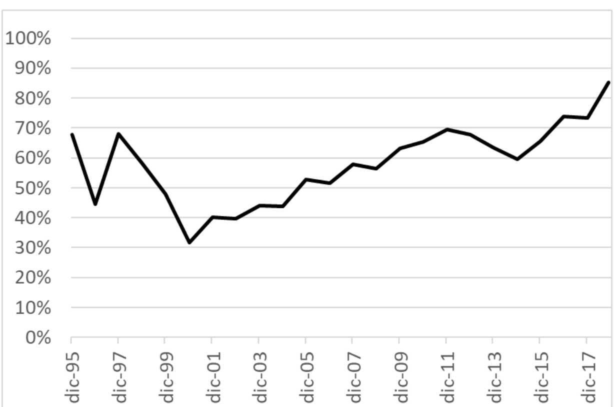
(2.A) Chile



(2.B) Colombia



(2.C) Brazil



(2.D) Mexico

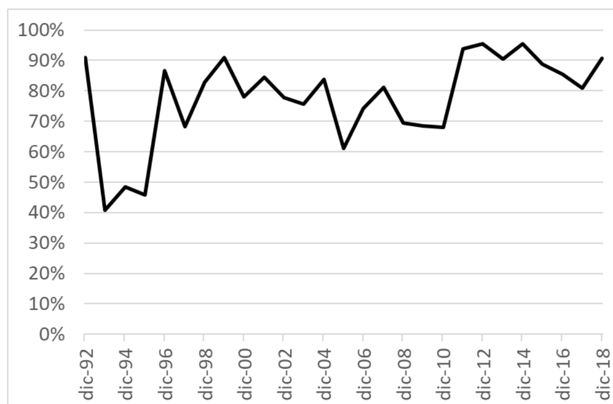
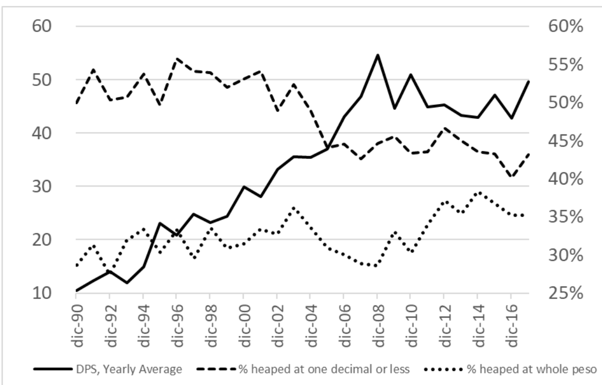


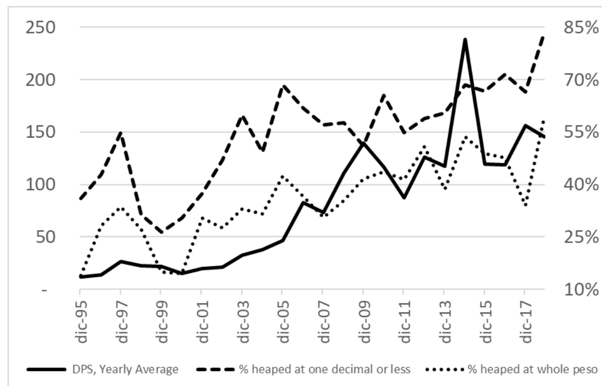
Figure 3. Percentage of dividends heaped and dividend size by year

This figure presents, for each country, the dividend size and the percentage of dividends heaped using two different categories, from 1990 through November 2018. For Chile and Colombia, for each year, we calculate the percentage of dividends that are heaped to a one decimal of local currency or less ($0, $0.1, $0.2, $0.3, etc.), and the percentage of dividends that are heaped to whole local currency ($0, $1.0, $2.0, $3.0, $4.0, etc.). For Brazil and Mexico, for each year, we calculate the percentage of dividends that are heaped to a three decimal of local currency or less ($0, $0.001, $0.002, $0.003, etc.), and the percentage of dividends that are heaped to two decimals of local currency or less ($0, $0.01, $0.02, $0.03, etc.).

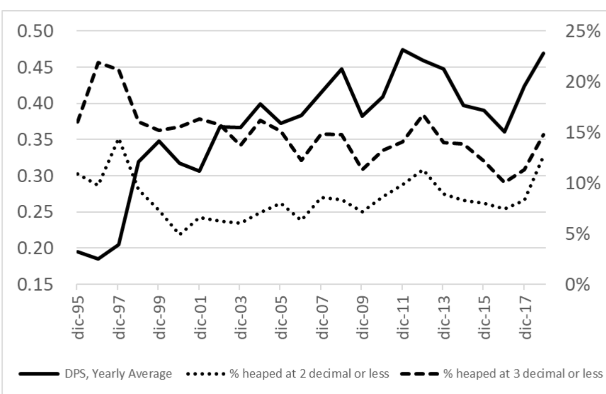
(3.A) Chile



(3.B) Colombia



(3.C) Brazil



(3.D) Mexico

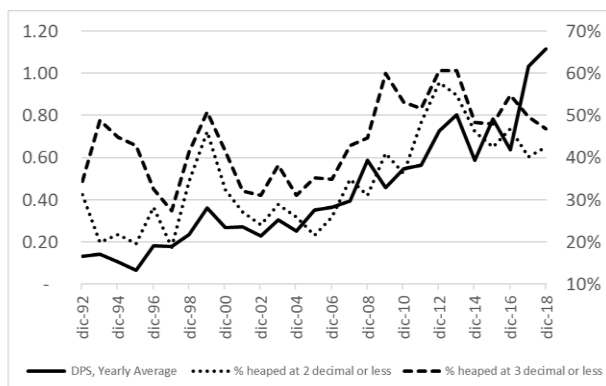
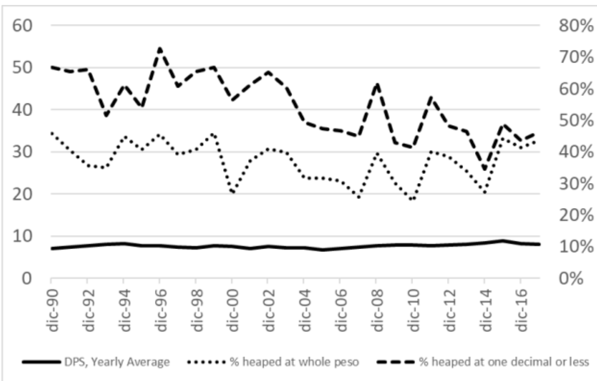


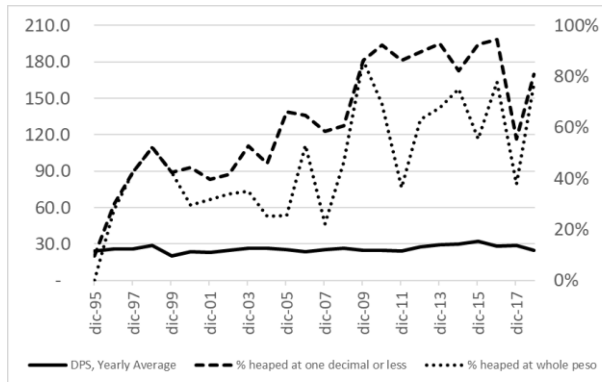
Figure 4. Percentage of dividends heaped to one decimal of pesos or less and narrow dividend size by year

This figure present the third quintile of the full sample of dividends and dividend size from 1990 through November 2018. The narrow size band represent the average dividend size for the quintile over time. For Chile and Colombia (Brazil and Mexico) we calculate for each year the percentage of dividends that are heaped to both whole local currency (two decimals) and one decimal of local currency or less (three decimals).

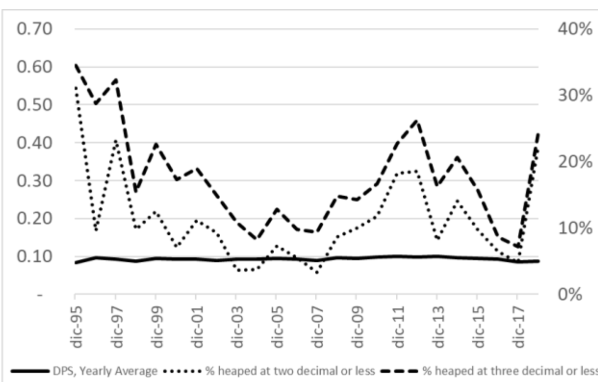
(4.A) Chile



(4.B) Colombia



(4.C) Brazil



(4.D) Mexico

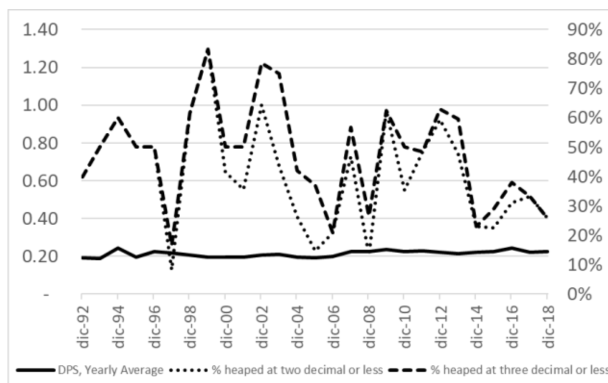


Table 1. Frequency of dividends and heaping

This table presents heaping using the number of times that one specific dividend is repeated. For countries with weaker local currency against the dollar (Chile and Colombia), see the proportion of dividends heaped to whole peso and the proportion heaped to one decimal or less. For countries with stronger local currency against the dollar (Brazil and Mexico), see the proportion of dividends heaped to whole peso or real and the proportion heaped to one, two, three and four decimal or less. For instance, for Brazil, the first row shows 4 specific dividends are repeated 50 or more times. None of these cases are heaped to whole real, 50% are heaped to the 1st decimal, and 75% are heaped to the 2nd, 3rd, and 4th decimal. Instead, 8707 dividends aren't repeated, they are unique. None of these cases are heaped to whole-real or to the first decimal.

Frequency	Number of unique	% Heaped at whole local currency	% Heaped at all 1 decimal intervals	% Heaped at all 2 decimal intervals	% Heaped at all 3 decimal intervals	% Heaped at all 4 decimal intervals
Panel A: Chile						
50 or more	18	83%	100%			
30 to 49	17	71%	94%			
10 to 29	81	38%	85%			
2 to 9	635	20%	34%			
1	3510	3%	8%			
Panel B: Colombia						
50 or more	2	100%	100%			
30 to 49	12	75%	92%			
10 to 29	108	38%	63%			
2 to 9	374	21%	39%			
1	263	15%	25%			
Panel C: Brazil						
50 or more	4	0%	50%	75%	75%	75%
30 to 49	19	0%	5%	68%	74%	74%
10 to 29	86	1%	5%	22%	37%	41%
2 to 9	2623	0%	1%	5%	12%	24%
1	8707	0%	0%	1%	4%	11%
Panel D: Mexico						
50 or more	0	-	-	-	-	-
30 to 49	5	0%	40%	100%	100%	100%
10 to 29	37	5%	22%	81%	92%	95%
2 to 9	271	1%	5%	26%	39%	52%
1	970	0%	2%	8%	14%	21%

Table 2. Dividends and heaping by size

This table presents heaping by dividend size using different ranges, depending on the strength of the local currency. Each row presents a different size range. For countries with weaker local currency against the dollar (Chile and Colombia), see the proportion of dividends heaped to whole peso and the proportion heaped to one decimal or less. For countries with stronger local currency against the dollar (Brazil and Mexico), see the proportion of dividends heaped to whole peso or real and the proportion heaped to one, two, three and four decimal or less. For instance, for Chile, the first row shows dividends smaller than $1, and here the proportion of dividends heaped to one decimal is 18%. The second row shows dividends from $1 and smaller than $10. Here the proportion of dividends heaped to whole pesos is 25% and the proportion heaped to one decimal or less is 47%.

Magnitude Range	# of dividends within this range	Mean DPS	% Heaped at whole local currency	% Heaped at all 1 decimal intervals	% Heaped at all 2 decimal intervals	% Heaped at all 3 decimal intervals	% Heaped at all 4 decimal intervals
Panel A: Chile							
0 to < $1	1325	0.422	-	18%			
$1 to < $10	3630	4.034	25%	47%			
$10 to < $100	3055	32.809	51%	61%			
$100 to < $1000	749	231.600	53%	58%			
>= $1000	161	39895.593	77%	78%			
All	8920	752.477	33%	49%			
Panel B: Colombia							
0 to <1	122	0.580	-	22%			
1 to <10	1194	4.328	24%	55%			
10 to <100	2112	39.863	39%	55%			
>= 100	727	382.042	61%	70%			
All	4155	88.369	38%	57%			
Panel C: Brazil							
0 to <0.01	2526	0.003	-	-	-	1%	4%
0.01 to <0.1	5664	0.045	-	-	6%	13%	22%
0.1 to <1	7360	0.337	-	3%	12%	19%	29%
1 to <10	1823	2.535	2%	5%	15%	22%	32%
>= 10	291	142.541	5%	10%	33%	38%	49%
All	17664	2.765	0%	2%	9%	15%	24%
Panel D: Mexico							
0 to <0.01	122	0.005	-	-	-	2%	7%
0.01 to <0.1	602	0.049	-	-	15%	29%	33%
0 to <1	1666	0.333	-	11%	41%	50%	59%
1 to <10	307	2.532	16%	34%	70%	72%	76%
>=10	5	16.034	40%	60%	80%	80%	80%
All	2702	0.534	2%	11%	37%	46%	53%

Table 3. Heaping and dividend size by quintiles

This table presents heaping by quintiles using different criteria to define heaping ($0.0005, $0.005, $0.05...), depending on the strength of the local currency. Quintiles are constructed considering dividend size. For countries with weaker local currency against the dollar (Chile and Colombia), cases $0.05, $0.5 and $5 apply. For countries with stronger local currency against the dollar (Brazil and Mexico), those from $0.0005 to $5 apply. For instance, for Brazil, the first column shows proportion of dividends heaped to R$0.0005 by quintile. The second column shows proportion of dividends heaped to R$0.005 by quintile. The third column shows proportion of dividends heaped to R$0.05 by quintile, etc.

Quintile	# of dividends within this range	Mean DPS	% heaped at				
			$0.0005 intervals	$0.005 intervals	$0.05 intervals	$0.50 intervals	$5.00 intervals
Panel A: Chile							
1st	1784	0.61			33%	11%	-
2nd	1784	2.78			48%	28%	-
3rd	1784	7.52			57%	42%	15%
4th	1784	22.26			62%	53%	20%
5th	1784	3,729.21			61%	55%	34%
All	8920	752.48			52%	38%	14%
Panel B: Colombia							
1st	831	2.18			61%	28%	-
2nd	831	9.53			73%	50%	10%
3rd	831	25.86			66%	57%	12%
4th	831	58.53			52%	44%	8%
5th	831	345.73			69%	61%	29%
All	4155	88.37			64%	48%	12%
Panel C: Brazil							
1st	3532	0.01	6%	3%	-	-	-
2nd	3532	0.04	16%	8%	1%	-	-
3rd	3532	0.12	19%	13%	3%	-	-
4th	3532	0.32	21%	14%	5%	1%	-
5th	3536	13.33	24%	17%	6%	2%	1%
All	17664	2.77	17%	11%	3%	0%	0%
Panel D: Mexico							
1st	540	0.03	25%	16%	6%	-	-
2nd	540	0.11	46%	37%	14%	-	-
3rd	540	0.22	48%	41%	10%	-	-
4th	540	0.41	59%	54%	26%	7%	-
5th	542	1.89	64%	61%	37%	14%	1%
All	2702	0.53	48%	42%	19%	4%	0%

Table 4. Heaping and dividend size

This table presents Logit regressions for the data sample between 1990 and November 2018 for Chile, Colombia, and Mexico. For Brazil the data starts in 1995. The dependent variable is an indicator variable taking value of one if dividend is heaped based on: (1) all $1 peso or real-intervals ($0, $1.0, $2.0, $3.0, etc.), (2) all 10 cent-intervals ($0, $0.10, $0.20, $0.30, etc.), (3) all 1 cent-intervals ($0, $0.01, $0.02, $0.03, etc.), (4) all 0.1 cent-intervals ($0, $0.001, $0.002, $0.003, etc.), (5) all 0.01 cent-intervals ($0, $0.0001, $0.0002, $0.0003, etc.), and zero otherwise. The explanatory variable is dividend size (DPS) or inverted dividend size (DPS_inv). Standard errors are clustered at the firm and date level. For the ease of interpretation, the explanatory variables have been standardized. The t-statistics are presented in parenthesis. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively.

	Heaped at whole local currency		Heaped at all 1 decimal intervals		Heaped at all 2 decimal intervals		Heaped at all 3 decimal intervals		Heaped at all 4 decimal intervals	
Panel A: Chile										
DPS	1.10		0.48***							
	1.6		3.3							
DPS_inv		-586.73***		-110.39***						
		-19.3		-10.7						
_cons	-0.65***	-46.11***	-0.02	-8.45***						
	-12.5	-19.5	-0.9	-10.6						
N	8920	8920	8920	8920						
Panel B: Colombia										
DPS	0.10*		0.00							
	1.9		-0.1							
DPS_inv		-2.12***		-0.29***						
		-9.6		-3.1						
_cons	-0.51***	-0.67***	0.27***	0.27***						
	-15.9	-16.5	8.7	8.5						
N	4155	4155	4155	4155						
Panel C: Brazil										
DPS	0.29***		0.20***		0.38**		0.29**		0.19*	
	5.3		3.3		2.1		2.0		1.7	
DPS_inv		-58914.99***		-3223.83***		-365.31***		-155.92***		-16.71***
		-7.5		-11.5		-11.0		-6.5		-3.1
_cons	-5.75***	-2682.69***	-3.89***	-149.50***	-2.30***	-18.55***	-1.71***	-8.56***	-1.18***	-1.86***
	-43.0	-7.5	-72.1	-11.7	-87.6	-12.4	-81.6	-7.9	-66.2	-8.1
N	17664	17664	17664	17664	17664	17664	17664	17664	17664	17664
Panel D: Mexico										
DPS	0.41***		0.31***		0.29***		0.19**		0.12*	
	3.4		4.2		3.2		2.5		1.9	
DPS_inv		-5.40***		-0.35***		-0.22***		-0.09**		-0.03
		-12.2		-3.9		-5.1		-2.4		-0.7
_cons	-4.07***	-8.50***	-1.80***	-1.82***	-0.36***	-0.37***	-0.06	-0.07*	0.18***	0.18***
	-28.2	-16.9	-32.7	-30.6	-9.2	-9.4	-1.6	-1.7	4.8	4.7
N	2702	2702	2702	2702	2702	2702	2702	2702	2702	2702

Table 5. Descriptive statistics

This table presents descriptive statistics for data sample between 1990 and November 2018 for Chile, Colombia, and Mexico. For Brazil the data starts in 1995. Dividend Size (DPS) represents dividend size in local currency in month t. RET_{t+1} indicates forward looking returns in month t+1. $RET_{t-11,t-1}$ represents accumulated returns from months t-11 to t-1. Stock volatility (SIGMA) indicates the standard deviation of monthly stock returns in the previous 12 months. Firm size (MV) indicates the market capitalization (in millions of local currency). Cash flow volatility (CVOL) represents the annual standard deviation of cash flows from operations to total assets in the past 5 years (with a minimum of 3 years). Firm age (AGE) represents the number of years since the firm was founded. Concentration of Ownership (Owner_1) represents the stock market participation of the largest shareholder.

Variable	N	Mean	Std. Dev.	Min	Max
Panel A: Chile					
RET_{t+1}	6,268.00	1.54	10.95	-71.32	200.00
$RET_{t-11,t-1}$	6,100.00	25.89	61.98	-83.87	987.67
SIGMA	4,795.00	8.84	6.06	0.00	155.98
MV	6,640.00	672,539.10	1,368,877.00	75.97	14,400,000.00
CVOL	4,593.00	0.04	0.07	0.00	1.43
AGE	7,207.00	45.70	31.77	1.00	149.00
Owner_1	6,753.00	45.69	24.60	2.69	100.00
DPS	8,920.00	752.48	9,937.21	0.00	340,000.00
Panel B: Colombia					
RET_{t+1}	2,971.00	1.51	9.51	-77.79	124.56
$RET_{t-11,t-1}$	2,825.00	22.03	44.77	-74.20	605.13
SIGMA	2,413.00	7.82	4.59	0.97	33.83
MV	3,023.00	7,153,498.00	12,500,000.00	3,124.00	234,000,000.00
CVOL	3,068.00	0.03	0.03	0.00	0.14
AGE	3,705.00	57.33	32.92	1.00	148.00
Owner_1	2,947.00	43.40	22.80	6.45	98.55
DPS	4,155.00	88.37	533.43	0.02	26,464.00
Panel C: Brazil					
RET_{t+1}	14,663.00	5.38	24.70	-77.78	1,512.07
$RET_{t-11,t-1}$	13,970.00	298.23	1,067.56	-94.58	21,918.35
SIGMA	12,005.00	13.42	16.72	0.40	1,259.99
MV	16,395.00	13,718.95	38,749.58	1.00	412,882.00
CVOL	5,757.00	0.05	0.14	0.00	6.09
AGE	11,623.00	55.81	34.10	1.00	210.00
Owner_1	14,006.00	59.46	27.31	0.14	100.00
DPS	19,671.00	4.03	185.72	0.00	15,000.00
Panel D: Mexico					
RET_{t+1}	2,320.00	1.22	9.52	-58.92	117.78
$RET_{t-11,t-1}$	2,170.00	20.35	50.25	-70.19	1,269.86
SIGMA	1,876.00	7.85	5.64	0.13	142.55
MV	2,473.00	91,813.18	181,404.90	41.00	1,421,886.00
CVOL	1,679.00	0.04	0.03	0.00	0.40
AGE	1,974.00	46.56	31.26	1.00	260.00
Owner_1	556.00	48.33	21.09	5.41	99.99
DPS	2,702.00	0.66	1.18	0.10	26.22

Table 6. Matrix of correlation coefficients

This table reports, for each country, the matrix of correlations between each of the dependent and independent variables considered in our final model. The correlations where computed using only the data set considered in the regressions reported in table 8. Dividend Size (DPS) represents dividend size in local currency in month t. RET_{t+1} indicates forward looking returns in month t+1. $RET_{t-11,t-1}$ represents accumulated returns from months t-11 to t-1. Stock volatility (SIGMA) indicates the standard deviation of monthly stock returns in the previous 12 months. Firm size (MV) indicates the market capitalization (in millions of local currency). Cash flow volatility (CVOL) represents the annual standard deviation of cash flows from operations to total assets in the past 5 years (with a minimum of 3 years). Firm age (AGE) represents the number of years since the firm was founded. Concentration of Ownership (Owner_1) represents the stock market participation of the largest shareholder.

	H_0dec	H_1dec	H_2dec	H_3dec	H_4dec	RET_t1	RET_t1~1	SIGMA	MV	CVOL	AGE	Owner_1	DPS
Panel A: Chile													
RET_t1	-0.016	-0.006				1.000							
RET_t11_t1	0.028	-0.007				0.051	1.000						
SIGMA	-0.087	-0.084				0.043	0.326	1.000					
MV	0.062	-0.003				-0.026	-0.030	-0.183	1.000				
CVOL	-0.013	0.030				-0.032	0.086	0.094	-0.136	1.000			
AGE	0.300	0.308				0.019	-0.091	-0.159	0.190	-0.126	1.000		
Owner_1	-0.152	-0.301				-0.011	0.025	0.041	-0.008	-0.071	0.017	1.000	
DPS	0.131	0.070				-0.006	0.003	-0.091	0.089	-0.029	0.136	0.030	1.000
Panel B: Colombia													
RET_t1	0.015	-0.023				1.000							
RET_t11_t1	-0.012	-0.012				0.048	1.000						
SIGMA	-0.090	-0.114				0.066	0.406	1.000					
MV	0.113	0.215				-0.105	-0.161	-0.311	1.000				
CVOL	-0.013	0.023				0.005	0.016	0.145	-0.101	1.000			
AGE	0.311	0.145				0.036	-0.030	-0.065	0.078	-0.255	1.000		
Owner_1	0.288	0.134				-0.031	-0.092	-0.242	0.198	-0.309	0.395	1.000	
DPS	0.280	0.113				-0.040	-0.104	-0.209	0.319	-0.035	0.319	0.254	1.000
Panel C: Brazil													
RET_t1	-0.002	-0.001	-0.042	-0.029	-0.024	1.000							
RET_t11_t1	0.008	-0.037	-0.039	-0.012	0.014	0.049	1.000						
SIGMA	-0.012	-0.011	-0.017	-0.013	-0.004	0.122	0.161	1.000					
MV	-0.016	0.134	0.137	0.100	0.084	0.010	0.009	-0.097	1.000				
CVOL	0.013	-0.023	-0.068	-0.079	-0.079	-0.003	0.029	0.001	-0.104	1.000			
AGE	-0.045	0.002	0.088	0.108	0.101	0.031	0.033	0.113	-0.044	-0.100	1.000		
Owner_1	-0.047	-0.090	-0.031	-0.024	-0.043	0.020	-0.007	0.031	0.004	0.014	0.104	1.000	
DPS	0.058	0.088	0.082	0.073	0.076	-0.005	-0.014	0.030	-0.049	0.008	-0.046	-0.026	1.000
Panel D: Mexico													
RET_t1	-0.035	0.007	-0.020	-0.095	-0.112	1.000							
RET_t11_t1	0.099	0.026	-0.014	-0.057	-0.003	0.057	1.000						
SIGMA	-0.086	0.060	0.027	-0.066	-0.033	0.014	0.185	1.000					
MV	-0.122	-0.142	-0.041	-0.114	-0.186	-0.009	-0.036	-0.101	1.000				
CVOL	0.308	0.281	0.106	0.049	0.106	-0.048	0.029	0.098	-0.165	1.000			
AGE	-0.116	-0.043	-0.030	0.108	0.172	-0.007	0.024	0.101	-0.456	0.014	1.000		
Owner_1	-0.090	0.022	-0.075	-0.007	0.030	0.049	-0.042	-0.131	0.189	-0.116	-0.102	1.000	
DPS	0.161	0.122	0.087	0.047	0.011	0.160	0.111	0.145	-0.147	0.087	0.086	-0.132	1.000

Table 7.A Heaped dividends, dividend size, information uncertainty and concentrated ownership variables: Chile and Colombia

This table presents Logit regressions for the dividend data between 1990 and November 2018. Standard errors are clustered at the firm and date level. For the ease of interpretation, the explanatory variables have been standardized. Variables control: Dividend Yield and Dividend Payout. The t-statistics are presented in parenthesis. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively.

	Chile		Colombia	
Variable	Heaped at whole local currency	Heaped at all 1 decimal intervals	Heaped at whole local currency	Heaped at all 1 decimal intervals
RET_{t+1}	-0.0830	-0.0472	0.0792	0.0370
	-1.31	-0.86	1.12	0.56
$RET_{t-11,t-1}$	0.2406***	0.0795	0.0993	0.0960
	3.38	1.22	1.46	1.55
SIGMA	-0.2165***	-0.1748***	0.0170	-0.0931
	-2.90	-2.66	0.21	-1.05
MV_inv	-0.7338	0.0967	-0.5271	-1.8478
	-0.83	0.09	-0.37	-1.45
CVOL	-0.0202	0.0694	0.1909***	0.1677***
	-0.33	0.83	3.02	2.79
AGE_inv	-1.9306***	-1.4714***	-0.2980	0.4146***
	-4.43	-4.55	-1.43	3.13
Owner_1	-0.4932***	-0.9239***	0.6725***	0.4314***
	-7.39	-12.94	8.63	5.48
DPS	20.3104**	10.0537	3.1088***	0.9860**
	2.09	1.46	5.34	2.16
_cons	-130.6208	-89.5166	-15.2722	-0.5937
	-1.11	-1.42	-1.36	-0.11
N	2370	2370	1554	1554

Table 7.B Heaped dividends, dividend size, information uncertainty and concentrated ownership variables: Brazil

This table presents Logit regressions, for the dividend data between 1995 and November 2018. Standard errors are clustered at the firm and date level. For the ease of interpretation, the explanatory variables have been standardized. Variables control: Dividend Yield and Dividend Payout. The t-statistics are presented in parenthesis. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively.

Variable	Heaped at whole local currency	Heaped at all 1 decimal intervals	Heaped at all 2 decimal intervals	Heaped at all 3 decimal intervals	Heaped at all 4 decimal intervals
RET_{t+1}	-0.0250	0.0034	-0.1697**	-0.0850*	-0.0586
	-0.09	0.03	-2.47	-1.65	-1.39
$RET_{t-11,t-1}$	1.4925***	-0.9647**	-0.2565*	0.0301	0.2004*
	3.30	-2.34	-1.65	0.23	1.80
SIGMA	-2.5363	-0.4870	-0.2473	-0.2597	-0.1724
	-1.43	-1.19	-1.30	-1.61	-1.27
MV_inv	8.6058***	2.7542***	2.4277***	3.1181***	2.5903***
	8.49	3.26	3.94	5.34	4.82
CVOL	0.8261***	-1.1738**	-1.9735***	-2.0060***	-1.5392***
	3.07	-2.10	-6.77	-8.08	-7.82
AGE_inv	2.3704***	0.1288	-0.2212*	-0.3332***	-0.2871***
	3.18	0.59	-1.82	-2.84	-3.06
Owner_1	-5.1941***	-0.8481***	-0.0661	-0.0394	-0.0839*
	-2.81	-6.11	-1.15	-0.76	-1.90
DPS	-6.1046	4.6085***	6.5135**	5.9348**	7.7769***
	-0.28	3.04	2.30	2.13	2.76
_cons	-14.8406***	-4.0322***	-1.8947***	-1.3314***	-0.9376***
	-3.10	-18.80	-14.73	-11.14	-8.52
N	4197	4197	4197	4197	4197

Table 7.C Heaped dividends, dividend size, information uncertainty and concentrated ownership variables: Mexico

This table presents Logit regressions, for the dividend data between 1990 and November 2018. Standard errors are clustered at the firm and date level. For the ease of interpretation, the explanatory variables have been standardized. Variables control: Dividend Yield and Dividend Payout. The t-statistics are presented in parenthesis. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively.

Variable	Heaped at whole local currency	Heaped at all 1 decimal intervals	Heaped at all 2 decimal intervals	Heaped at all 3 decimal intervals	Heaped at all 4 decimal intervals
RET_{t+1}	-0.8965*	0.0357	0.0327	-0.2661	-0.3607
	-1.70	0.16	0.16	-1.19	-1.30
$RET_{t-11,t-1}$	1.1617***	0.1331	-0.0037	-0.2093	-0.0012
	2.90	0.60	-0.01	-0.80	0.00
SIGMA	-4.7639**	-0.0661	-0.2255	-0.5081*	-0.1917
	-2.45	-0.16	-0.77	-1.72	-0.52
MV_inv	-4.0645	-2.9028	-9.5794**	-8.6571**	-10.2126**
	-0.56	-0.90	-2.47	-2.27	-2.36
CVOL	2.2935***	1.1939***	0.4209*	0.1648	0.6810**
	3.75	4.51	1.74	0.67	2.17
AGE_inv	-1.2209	-0.3435	-0.1532	-1.3592**	-2.9030***
	-0.43	-0.93	-0.80	-2.38	-3.33
Owner_1	-0.8923	0.2196	-0.0971	0.0871	0.3856**
	-1.25	1.17	-0.76	0.66	2.30
DPS	0.1224	0.4271**	0.9269***	0.7710***	0.8987***
	0.24	2.21	4.15	3.80	3.25
_cons	-6.6749**	-1.9915***	-2.1876**	-1.8902**	-1.7954*
	-2.24	-2.81	-2.43	-2.10	-1.70
N	315	315	315	315	315

Changing Currencies and Cognitive Biases:
Evidence of the Impact of Introducing the Euro on Dividend Heaping in Europe

Abstract

Heaping is defined as a cognitive bias to round numbers even if precise results are desired. This article targets on dividends in four key European markets (Germany, France, the UK, and Switzerland) over the 1981-2019 period. We hypothesize and report that the change of currency in Germany and France (they both adopted the Euro in January 1999) significantly influenced the characteristics of heaping observed in the dividends both in the short and in the long run. We also report that consistent with the prior literature, the probability of rounding of dividends in each country is significantly related to both information uncertainty and dividend size. In the UK and Switzerland heaping increases over time for the full 1981-2019 period for all designated rounding intervals. For Germany and France heaping increases for all rounding intervals during the 1981-1998 period, but the adoption of the Euro leads to a drastic reduction of heaping that lasts several years in both markets. In the long run, after the adoption of the Euro, the likelihood of heaping recovers for small rounding intervals, but remains well below the previous levels for larger rounding intervals.

Keywords: Heaping, Dividends, Dividend Size, Change of Currency.

JEL Classifications: G35, G41

1. Introduction

Stock investors have two primary ways of receiving cash from their equity investments. Stockholders can either sell their shares, or the company can distribute cash dividends to shareholders. Companies have been allotting dividends to stockholders for at least four centuries (Baskin 1988). Each fiscal quarter, managers and firm directors meet to review corporate financial results, and they must decide whether the firm should initiate a new dividend distribution, continue with its current level of dividends, reduce its dividend payment or increase its dividend distribution. The decisions revolving around distributing dividends are important for both the corporation and its investors. The chosen magnitude of the dividend distribution influences several relevant corporate metrics such as the firm's capital structure, the earnings reinvestment rate or plowback, the firm's future growth potential, the dividend yield, and the overall taxation of investors. Most stock valuation techniques also rely heavily on dividends as a key input into the analyses. There is a large body of empirical and theoretical academic literature that investigates the approach and intentions of corporate dividend payments; however, the intricacies of the firm's dividend issuance decision still warrant additional investigation.

In this study, we extend the academic literature that examines how cognitive biases can influence corporate decisions regarding dividend allotment. In particular, we examine whether European companies in France, Germany, the UK, and Switzerland round their dividends in ways that are consistent with a managerial cognitive heuristic. We jointly examine whether the transition to a new currency, the Euro, significantly impacts the likelihood of dividend distribution rounding. The Euro conversion allows us to create an event study to determine how a simple mechanical currency conversion and changes in currency magnitude and exchange rate risk can influence cognitive biases such as rounding.

While heaping is not a determinant of dividend policy per se, our results indicate that it clearly impacts the precise choice of the specific magnitude of dividend distributions. We find, consistent with the previously available literature, that the dividend distributions in all four countries are strongly influenced by the cognitive decision heuristic called Heaping. We also report that the introduction of the Euro significantly reduces observed dividend heaping in France and Germany. The changes around the Euro conversion are consistent with mechanical conversion, changes in currency magnitude and reductions in exchange rate risk. The long-term changes in heaping appear stronger in France (the country where the magnitude of the currency changed more) than in Germany.

Turner (1958) proposes that people will underuse those digits that are not multiples of the divisor of the base of the number system while overusing or heaping at those digits that are multiples of the divisors of the base of the number system. According to Turner, people will estimate or round to a heaped measure when they are unsure of the correct value, but they will use more accurate numerical values when they can. The main divisors of the base ten numbering system are ten, five and two.

Most of the prior heaping research focuses on human behavioral or cognitive biases that occur in demographic surveys where data is collected from a pre-defined set of respondents to gather information and insights on various topics of interest such as the respondents ages, use of cigarettes or other tobacco products, etc. Age data, for example, frequently display excess frequencies of observations at attractive numbers, such as multiples of five. (A'Hearn, Baten and Crayen 2009). There is a recent and growing line of academic research that examines the heaping heuristic inside a corporate accounting and finance framework. Herrmann and Thomas (2005) observe that the forecasts of earnings per share (EPS) performed by analysts occur in nickel intervals at a significantly higher frequency than do actual earnings per share. Dechow and You (2012) subsequently find that analyst incentives impact the likelihood of rounding, and analysts will exert less effort forecasting earnings for firms that generate less brokerage or investment banking business, since such firms create less value for the analysts' employers. Bamber, Hui and Yeung (2010) examine firm manager EPS forecasts rather than analyst forecasts, and observe a similar heaping phenomenon in the managers' EPS forecasts. Jakob and Nam (2019) study the distribution of cash dividends in the US and report that 51% of their full sample of dividends are rounded or clustered at specific intervals consistent with heaping in a base ten numbering system. They report that the probability of rounding is significantly and positively related to the size of the dividend distribution. They also report that heaping is significantly related to several different measures of the level of information uncertainty faced by the management of the company. Nam, Niblock, Sinnewe, and Jakob (2018) examine rounding of dividends in Australia and concur that the probability of heaping is related to information uncertainty as well as to other corporate-level characteristics. Finally, Castillo, Rubio, and Jakob (2020) examine dividend payout policy in four Latin American countries with significantly different currency magnitudes. They hypothesize and find results that confirm that the magnitude or strength of the country-specific currency significantly influences the likelihood and characteristics of heaping observed in the dividends for each country.

In this article, we expand the corporate decision making and dividend distribution heaping literature. We examine whether dividend distributions for firms in four European countries are also affected by a rounding cognitive heuristic. First, we study if dividend observations are clustered. The clustering of dividends is the phenomenon where the distribution of dividend sizes is observed more frequently at some particular increments. The European case is particularly intriguing because several countries switched currencies with the introduction of the Euro in January 1999. Our full sample contains data for two countries that switched to the Euro (Germany and France) and two countries that did not switch to the new currency (the UK and Switzerland). This allows us to directly examine whether the currency conversion event has a significant impact on the cognitive biases associated with the use of rounding in managerial decision making.

For our European heaping on dividends study, we find compelling evidence of dividend clustering in all four countries. We also report a positive and significant relationship between the frequency of observed dividends and the likelihood of heaping at certain intervals. For example, in Germany in the pre-Euro conversion period for the highest observation frequency classification, where there are 50 or more observations of the same unique dividend amount, we report 100% of the cases are heaped at the whole German Mark level. The observations with low frequencies, on the other hand, are rarely at heaped values (e.g. In Germany for the lowest frequency observations only 1% are heaped at whole German Marks). For each of the four countries' samples, we also find a positive and significant relationship between dividend size and the likelihood of rounding. We verify these results by sorting using different dividend ranges, sorting by dividend size quintiles, and by using logit regression analysis.

Consistent with our hypotheses we find that the switch to the new Euro currency leads to a profound decrease in the use of heaping by firm management. In both short and long-term time-trend analyses we report starkly different findings for France and Germany that switch to the Euro in comparison to the UK and Switzerland that keep their original currencies of the British Pound and Swiss Franc. In Germany and France for the shorter one-year pre-conversion and one-year post-conversion event window we see a very significant decline in the likelihood of heaping when the currency is changed to the Euro. For example, in France, 65% of dividends in the pre-conversion year are heaped at the 0.01 French Franc interval, but only 1% are heaped at the same Euro interval in the post-conversion year. For the UK and Switzerland, the countries that did not change their currency, we see that the likelihood of heaping stays nearly unchanged over the same two-year event window. When the longitudinal study is expanded to the full 1981-2019 period, the graphical images of dividend rounding clearly show that the Euro conversion permanently impacts heaping at larger intervals, however the sharp reduction in heaping triggered by the conversion gradually fades with time for the smaller intervals and only certain trends in heaping previous to the conversion appear to slowly resume. The long-term reduction in heaping produced by the exchange conversion is greater in France than in Germany. This is reasonable considering that France endured a larger change of currency.

Even though dividend size and dividend size from a currency magnitude perspective are our primary explanatory variables of interest, in our final set of regression analyses, and to be consistent with the previous literature, we include additional explanatory variables, such as information uncertainty variables and other control measures. Consistent with the previous literature, we find that cross-sectionally some information uncertainty variables lead to significant changes in dividend heaping, even though the direction of the relationship is not always the one that could be expected from a theoretical point of view. These results corroborate that information uncertainty has a significant influence on manager decisions regarding dividends. After including the additional explanatory variables, dividend size, remains both positively and significantly connected to the likelihood of heaping in each of the countries.

2. Literature Review

Among investment practitioners and academics there is a long-lasting debate about whether or not dividend policy is a relevant aspect of firm management. In one of the earliest research papers on this topic Lintner (1956) surveys managers about how they select their dividend policy. Lintner’s results show that company managers think that the dividend distribution decision has an important impact on the value of the corporation. He suggests that those managers target a long-term payout ratio for their dividend payments and that decisions regarding dividends are made conservatively. He recommends a dividend policy based on the management view that shareholders generally prefer a stable, slowly increasing dividend rate. He indicates that the investment market pays a premium for stability accompanied by gradual and steady increases in the magnitude of the dividend distribution.

In opposition to Lintner's results, Miller and Modigliani (1961) develop a theoretical framework for dividend policy with their well-known dividend irrelevance paper. They argue that dividend policy can be irrelevant for a company's value under a set of very strict assumptions. Within the framework of these two contrasting views of dividend policy relevance, there has been a continuous flow of academic articles that explore the many different factors that influence dividend payment policy. Within this research stream there are studies that continue to question whether dividend distributions are necessary. For example, Fama and French (2001) discuss how fewer and fewer firms are paying dividends, and in many cases, they are replacing those dividends payments with share repurchases or buybacks.

The majority of the ensuing dividend policy literature can be classified into categories of either rational or behavioral theories. In the area of rational theories, the dividend clientele hypothesis, also developed by Miller and Modigliani, suggests that tax rate heterogeneity among shareholders leads to a "dividend clientele effect". Following this theory, stockholders that face high (low) marginal tax rates will be attracted to corporations that offer low (high) dividend payout ratios. According to the information signaling hypothesis, another rational based theory, managers use dividends as a costly signal to reduce asymmetric information between investors and firm management (e.g., Bhattacharya 1979). In these signaling hypothesis models, the firm managers use dividend distributions as a credible signal to investors about the future prospects of the corporation. In the rational-based agency theory hypothesis, the persistent distribution of cash works as a form of discipline for firm managers that reduces agency costs (e.g., Easterbrook 1984). Blau and Fuller (2008) develop a corporate dividend policy model based on the idea that management highly values operating flexibility. Management can easily increase its operating flexibility by reducing dividend payments and thus conserving additional cash. Finally, Karpavičius (2014) argues that dividend policy is not irrelevant as postulated in Miller and Modigliani. He shows that in a shareholder wealth maximization framework, the stock price is related to the smoothness or consistency of dividend payments.

Several behavioral theories attempt to explain observed corporate dividend policy based on managerial and investor biases. Long (1978) provides evidence that investors' interest in or demand for dividends varies across time. Baker and Wurgler (2004) postulate that the dividend payment decision is driven by such prevailing investor sentiment regarding dividend payers. They proclaim that managers attract investors by paying dividends when investors prefer payers, and by not paying dividends when investors put a stock price premium on nonpayers.

Several additional articles look at how psychological biases by investors can influence dividend payout policy. The bird-in-hand argument (e.g., Gordon 1959; Lintner 1962) proposes that since investors must realize wealth to be able to consume, they, therefore, prefer cash dividends over capital gains. However, this bird-in-hand argument is theoretically contested by Miller and Modigliani (1961). Thaler and Shefrin (1981), Black (1990), and Shefrin and Statman (1984) suggest that dividends are primarily an investor self-control mechanism. In the absence of dividends, shareholders are forced to liquidate shares for the purpose of consumption. In this explanation, dividends are used as a tool to help investors regulate and control their level of consumption.

In another line of research, corporate management behavioral studies associate managerial over-optimism or overconfidence with both dividend policy and investment policy (e.g., Malmendier and Tate 2005; Deshmukh, Goel, and Howe 2013). This research indicates that overconfidence by managers impacts the overall level of dividend distributions and the market response to announcements regarding dividend payments. In our paper, we study another managerial behavioral bias called heaping. We argue that firm managers will be affected by this often-observed behavioral heuristic and its use directly influences their choice of dividend payouts.

A well-documented bias or human error is to round numbers even though precise results are preferred. This numerical rounding heuristic, known as heaping, is particularly noticeable in census or demographic surveys where the age in years is sought (e.g., Myers 1940). Heaping has been reported in a wide variety of surveys regarding human behavior. Heaping occurs when individuals are requested to provide an exact point estimate (e.g., cigarettes per day, number of headaches per month, weight in pounds, age in years, etc.). In their response, people often round because of a lack of precision or uncertainty in the knowledge of the quantity being asked to report (e.g., Huttenlocher, Hedges, and Bradburn 1990; Houle et al. 2013). The literature finds observations heaped or clustered at intervals of ten, five, and two which are the principal divisors of the base ten numbering system.

As an extension to the survey data rounding literature, several researchers ask whether this particular kind of cognitive bias or other similar heuristics systematically influence the actors within the financial markets as well as firm management and their corporate decision making. An extensive line of literature examines rounding or clustering in the distribution of share prices on U.S. equity markets (e.g., Niederhoffer 1966; Harris 1991; Christie and Schultz 1994; Grossman, Miller, Cone, Fischel, and Ross 1997; Cooney, Van Ness, and Van Ness 2001). As an example, Grossman et al. suggest that the size of transactions, uncertainty, and volatility in the price of stocks leads to a greater amount of share price clustering. Within this stream of research, there is an increasingly large group of papers that examine rounding of stock prices on international stock markets (e.g., Aitken et al. 1996; Brown, Chua, and Mitchell 2002).

A smaller and newer line of literature examines heaping directly within a corporate decision-making framework. Several papers examine heaping in corporate earnings forecasts, including forecasts made by both corporate managers and security analysts. Herrmann and Thomas (2005) report that security analyst forecasts of EPS occur in nickel intervals ($0.05) at a much greater frequency than do actual EPS. They show that analysts who round their EPS forecasts to these $0.05 intervals are less informed, exert less effort, and have fewer resources. They also prove that heaped forecasts are less accurate and that the negative relation between forecast accuracy and rounding increases as the rounding interval increases in size from a nickel to dime, quarter, half-dollar, and dollar.

Dechow and You (2012) expand on the findings in Hermann and Thomas and discover that analysts engage in rounding more frequently for larger earnings amounts where the penny digit of the forecast is of less economic significance. They propose that by rounding, analysts reveal that their forecasts are not intended to be precise to the penny. They also show that analyst incentives affect the probability of rounding. Expressly, they conclude that analysts exert less effort forecasting earnings for companies that generate less brokerage or investment banking business since such corporations create less value for the analysts' employers. As a consequence of this diminished effort and attention, the analyst will be less certain about the penny digit of the forecast and will round.

Bamber, Hui, and Yeung (2010) report an analogous heaping phenomenon seen for analysts also occurs when corporate managers make their own EPS forecasts. They find persistent heaping in manager EPS forecasts and they also verify that forecasts are more often heaped when: there is more uncertainty about earnings; managers have stronger incentives to upward-bias their forecasts and it is difficult for the market to assess the truthfulness of the forecast and the firm has higher proprietary information costs. Their results are interesting since they suggest that the decision to round or heap in management forecasts stems not only from a benign psychological heuristic response to uncertainty but also from strategic incentives faced by managers. We agree that manager and analyst forecasting play an important role in financial markets and investor decisions, however, these activities do not directly affect the flows of funds between the firm and stockholders.

In this paper, we examine managerial heaping in dividend distribution decisions because of the precise and direct impact on both the capital remaining available within a firm and the cash flow stream received by investors. Nam, Niblock, Sinnewe, and Jakob (2018), Jakob and Nam (2019), and Castillo, Rubio, and Jakob (2020) examine dividend distributions in Australian, USA, and Latin American data respectively. These studies all report significant heaping. Nam, Niblock, Sinnewe, and Jakob (2018), and Jakob and Nam (2019) show that dividend magnitude and information uncertainty impact the likelihood that managers choose dividends in rounded intervals. Castillo, Rubio, and Jakob (2020) identify that currency magnitude measured as the strength of each currency relative to the US dollar also significantly impacts the likelihood of heaping. We extend and expand on these analyses with a European sample. We specifically analyze data from Germany, France, the UK, and

Switzerland. The goal of our paper is to further substantiate the results from other regions and to analyze whether or not a mandated change in the underlying currency further impacts the decision to heap dividends.

3. Data and Hypotheses

Our data comes from the Worldscope and Datastream platform which offers fundamental data on the world's leading public companies, including information such as fully adjusted pricing, dividends, price/earnings ratios, yields, earnings per share, market value, traded volume, and shares outstanding. Adjustments for corporate actions are also included and comprehensive annual history dates back to 1981. We extract the dividend data following a procedure analogous to that of Jakob and Ma (2007). We include all cash dividends (i.e., ordinary and extraordinary dividends where the distribution amount is greater than zero) with recorded dates from 1981 to 2019. This gives us 10,058 observations for Germany; 13,584 for France; 44,925 for UK and 5,915 for Switzerland.

Dividend size is measured in local currencies and fractions of local currencies. We refer to the local currency as Units of Monetary Currency (UMC). Both Germany and France changed their UMC from German Marks and French Francs to Euros in January 1999, while both the UK and Switzerland kept their own local currencies (British Pounds and Swiss Francs) for the entire sample period. Based on the Euro conversion dates in the Datastream database we break our overall sample into two subsets from 1981-1998 and 1999-2019. Consistent with the prior literature, we hypothesize that firm management and directors face significant uncertainty when making dividend decisions and will, therefore, heap or round dividends to particular discrete dividend amounts or intervals. Our hypotheses are based on the heaping concept originally presented in Turner (1958) who says that people will use more accurate values when they can but will round to a heaped measure when they are unsure of the exact value. We believe that the changes in the UMC to the Euro for Germany and France will lead to significant changes in the likelihood of heaping around the currency conversion date. We expect a decline in heaping with the introduction of the Euro for the following reasons.

1. The Euro Currency is a strong currency relative to the French Franc and German Mark. (€1 = FF 6.55957 and €1 =DM 1.95583). A reduction in heaping around the currency conversion would be consistent with a currency magnitude effect first documented in Castillo, Rubio and Jakob (2020).
2. The prescribed Euro conversion rates are not whole integer multiples. (€1 = FF 6.55957 and €1 =DM 1.95583). Therefore, a heaped pre-conversion dividend that is mechanically converted to Euros would become non-heaped in the new currency. For example, a heaped 1.00 German Mark pre-conversion dividend would be approximately € 0.511 on a direct mechanical conversion basis.
3. Kenen (2003) argues and shows evidence that the primary benefit of the Euro conversion is a significant decrease in exchange rate risk or trade uncertainty for corporate managers. This sharp decrease in uncertainty should decrease manager use of the heaping cognitive bias. Later, Bartram and Carolyi (2006) show that the decrease in exchange rate risk, while relevant, is not as significant as previously estimated. Finally, Aabo and Pantzalis (2011), show how the reduction in exchange rate risk and trade uncertainty can be linked to managerial decisions such as the likelihood of exercising some real options linked to investments.

Consistent with the prior literature, we also hypothesize that whether managers ultimately heap dividends is jointly influenced by a magnitude effect (dividend size) as well as an information uncertainty effect.

H1. The likelihood of heaping increases with dividend size.

H2. The likelihood of heaping decreases in the short run with the change of currency due to: currency magnitude, non-integer conversion and a reduction of exchange rate risk.

H3. The likelihood of heaping will fluctuate in the long run with the change of currency.

For the longer sample the short-term effects of non-integer conversion should fade as dividends are subsequently adjusted, but impacts of currency magnitude and exchange rate risk will generally remain. With the increase in currency magnitude in France and Germany we anticipate a long-term change in the heaping intervals chosen by managers. The switch to the Euro leads to significantly smaller UMC dividends, which should shift and reduce large increment rounding, while potentially increasing small increment rounding. We expect the currency magnitude effect to be greater in France than Germany. However, currency strength of the Euro will vary through time and firms in non-Euro countries will also begin to benefit from the Euro in terms of exchange rate risk. For example, English firms don't use the Euro, but now have primarily one currency exchange rate to manage in Europe (Pound/Euro) with the adoption of the Euro.

H4. The likelihood of heaping changes with the magnitude of information uncertainty.

The majority of our uncertainty metrics are based on those from Zhang (2006), and Castillo, Rubio, and Jakob (2020). Zhang creates several measures for firm-level information uncertainty. Our data for information uncertainty measures come from the Worldscope database and the Datastream database. The sample period considered for the information uncertainty measures is from 1981 to 2019.

RET_year represents the return of the stock from the year the dividend is paid. RET_year-1 represents returns from the year before the dividend is paid. Both variables are measured in percent. Zhang states that greater uncertainty should result in higher price increments. AGE_inv, inverted firm age, represents the inverse of the number of years since the firm was listed in the stock exchange. Barry and Brown (1985) state that older companies have more information available to the market, which suggests less uncertainty. We use the following additional information uncertainty measures also inspired on Zhang: (1) MV_inv, inverted firm size, which represents the inverse of market capitalization in millions of local currency, (2) SIGMA, which represents the standard deviation of monthly stock returns the year before the dividend is paid, and (3) CVOL, cash flow volatility, which is measured by the standard deviation of annual cash flows from operations to total assets in the past 5 years (with a minimum of 3 years).

It is important to note that the prior literature is not clear in the specific direction of the impact of each information uncertainty variable. Prior research argues that uncertainty variables can potentially impact heaping in either direction. To be consistent, we add uncertainty metrics to verify if they play a role in managerial heaping of dividends, but the sign of the relations must be interpreted with caution. As an example, Dechow and You (2012) argue that company size has the potential to either decrease or increase heaping. Zhang states that larger corporations, in general, have more information available and are generally more diversified. Large firms may also have more customers, suppliers, and shareholders. However, based on this larger set of business connections and stakeholders, disclosure preparation costs for large companies would be higher. Since investors may have some fixed costs of acquiring information, large firm's stocks may be more attractive.

4. Empirical Results and Discussion

4.1. Frequency of Dividends, Size of Dividends, and Heaping

Table 1 explores the potential link between dividend frequency and the likelihood of heaping in each country, for the two sub-periods considered. This table helps to verify whether or not the most common dividend amounts are typically at heaped or rounded intervals. In this table, we evaluate four alternative heaping intervals (multiples of 10 UMC; multiples of 1 UMC, multiples of the first decimal of UMC and multiples of the second decimal of UMC). For example, the first part of Table 1 shows that during the 1981-1998 period in Germany there are 5 unique dividend amounts observed 50 or more times in the full sample. 20% of these high-frequency cases are heaped to multiples of 10 UMC and 100% are heaped to multiples of 1, to the first decimal, and the second decimal. In the subsequent rows, as the frequencies of the dividends decline, we observe in most cases a clear decrease in the probability of heaping. In the least frequent dividend sizes, where only one observation at each dividend amount is recorded in the entire sample, only 0.3% of the cases are rounded to multiples of 10 UMC, 1% are heaped to multiples of 1 UMC, 2% are heaped to the multiples of the first decimal and 5% are heaped to multiples of the second decimal. With very few exceptions, the same positive relationship between dividend frequency and the likelihood of heaping is observed across all the countries considered and for the two separate periods we examine. Table 1 is therefore consistent with both dividend clustering and a higher likelihood of heaping for the more popular dividend sizes in all countries considered. Finally, Table 1 shows bigger changes in rounding behavior in Germany and France before and after the conversion compared to Switzerland and the UK.

Tables 2 and 3 examine whether dividend magnitude influences the probability of heaping. In Table 2 dividends are sorted by dividend amount and classified as either heaped or not heaped based on the same four interval sizes already described. The first row of each panel in the table holds the smallest dividends and the following rows have larger dividend sizes. Here we see that, with few exceptions, as the magnitude of the dividends increases there is a clear increasing trend in the likelihood of rounding in each country, for all alternative metrics considered. In the complete first period sample, during the 1981-1998 period, heaping occurs at one decimal of the UMC in 28% of the observations for Germany, in 44% of the observations for France, in 33% of the observations for the UK and in 27% of the observations for Switzerland. During the 1999-2019 period, heaping occurs at one decimal of the UMC in 23% of the observations for Germany, in 30% of the observations for France, in 45% of the observations for the UK and in 49% of the observations for Switzerland. All these results are consistent with our hypothesis 1.

Table 3 presents Logit regressions to evaluate the effect of dividend size on the likelihood of heaping in each country and on each of the two periods of time considered. In these regressions the dependent variable is an indicator variable taking a value of one when the dividend is heaped based on: (1) all multiples of 10 UMC-intervals (10.0, 20.0, 30.0, etc.), and zero otherwise; (2) all multiples of 1 UMC-intervals (1.0, 2.0, 3.0, etc.), and zero otherwise; (3) all 1 decimal of UMC-intervals (0.1, 0.2, 0.3, etc.), and zero otherwise; (4) all 2 decimal of UMC-intervals (0.01, 0.02, 0.03, etc.), and zero otherwise. The explanatory variable in each regression is inverted dividend size (DPS_inv). As reported in Table 3, all the 32 regressions have the correct sign on the computed dividend size coefficient, and all of them are significant at the 1% level. These results again verify that as dividend size increases the likelihood of heaping also increases in each of the countries and each of the periods considered. All these results give strong support to our hypothesis 1.

4.2. The time-trend in heaping and the change in currency effect

4.2.1. The short term trend in heaping and the change in currency effect

In Table 4, we examine the short-term impact on heaping with the change of currency in Germany and France in 1999. To that end, we only consider dividends paid in the last year before the change of currency (1998) and dividends paid in the first year after the change of currency (1999). We consider four alternative heaping intervals and divide the sample into quintiles based on dividend magnitude. For each dividend quintile, the first column shows the portion of dividends rounded to 10 UMC intervals, the second column shows the proportion of dividends heaped to 1 UMC intervals, the third column shows the portion of dividends rounded to 0.1 UMC intervals and the fourth column shows the proportion of dividends heaped to 0.01 UMC intervals. For Germany and France, regardless of the chosen heaping interval, we see a very significant decline in the likelihood of heaping when the currency is changed. These findings are consistent with our Hypothesis 2.

One possible partial explanation of the steep decline in heaping from 1998 to 1999 in both countries would be that firms maintained the precise size of the dividends they were paying, while simply mechanically converting them from the prior currency to the Euro. Consistent with this hypothesis, in non-tabulated results, we find that 36% of the 469 dividends paid in France in 1998 were mechanically converted to Euros in 1999. For Germany, out of the 273 dividends paid in 1998, 32% were mechanically converted to euros in 1999. It is interesting to note that the mechanical conversion is much more likely for dividends that are heaped in the original currency. For example, in Germany, the proportion of dividends mechanically converted from 1998 to 1999 is 44% for dividends heaped to one

UMC, and only 25% for dividends not heaped to one UMC. These findings strongly support the non-integer currency conversion explanation for Hypothesis 2. For the UK and Switzerland, the countries that did not change their currency, we see that, regardless of the chosen heaping interval, the likelihood of heaping stays almost unchanged from 1998 to 1999. These results also give strong support to our Hypothesis 2.

4.2.2. The long term trend in heaping and the change in currency effect

Figures 1.A to 1.D present, for each country, a graph of the percentage of dividends that are heaped in each year of the 1981-2019 period. We consider 4 different heaping intervals. In Germany and France, the observed time trend in the likelihood of heaping is dependent on both the heaping interval chosen and the period selected. For both countries, over the 1981-1998 period, the trend in the likelihood of heaping is positive and independent of the heaping interval chosen. When these two countries switch their currencies to Euros in January 1999 the likelihood of heaping decreases to almost zero for all rounding intervals. Over the post-conversion 1999-2019 period in France and Germany, we find a relatively swift increase in the likelihood of heaping for the two smaller UMC increments, but the larger UMC increments remain at low levels for the remainder of the sample period. In the UK and Switzerland, the countries that did not change their currency, the trend in the likelihood of heaping is positive over the whole 1981-2019 period and independent of the heaping interval chosen. We also observe, from Table 2, how the long-term impact of the change of currency is greater in France than in Germany, which is consistent with the fact that the currency magnitude increased more in France than in Germany. The change in heaping from the previous period is in general greater when negative and smaller when positive in France than in any of the other countries. These results persist even if we partition the sample (un-tabulated) into dividends of similar magnitude across periods and countries. The divergent findings for France and Germany relative to the UK and Switzerland are consistent with the currency magnitude portion of Hypothesis 2 as well as Hypothesis 3.

Figures 2.A to 2.D present both the portion of dividends rounded to one UMC relative to the proportion of dividends heaped to two decimals of UMC over time and the portion of dividends rounded to one decimal of UMC relative to the proportion of dividends heaped to two decimals of UMC over time, for each country. These proportional measures decrease significantly from 1981-1998 to 1999-2019, in both Germany and France, due to the adoption of the Euro in January 1999. These results suggest that after the currency change, managers in these countries rounded dividends to smaller intervals. The same proportional measures show small changes over the whole 1981-2019 period for both the UK and Switzerland. While the proportion of dividends heaped to 1 decimal of UMC over the proportion of dividends heaped to 2 decimals of UMC stay around 70% for the UK and around 90% for Switzerland over most of the 1981-2019 period, the proportion of dividends heaped to 1 UMC over the proportion of dividends heaped to 2 decimals of UMC stay around 26% for the UK for the whole period, but it stays around 80% for Switzerland over the 1981-1998 period showing also a clear negative trend over the 1999-2019 period going from 80% to 40% over this period.

As an additional test, we attempt to hold dividend magnitude fairly constant by separately examining dividend size quintiles of each country's sample. Figures 3.A to 3.D show, for each country, the average dividend and the proportion of heaping through time for the third quintile, considering two different heaping intervals in each case. With this approach, we can capably hold dividend magnitude at a fairly stable level, at least for the UK and Switzerland, and find that in these two countries heaping increases through time regardless of the heaping metric. In Germany (France), during the 1981-1998 period, we have an increasing slope in dividends (decreasing in France) accompanied in both cases by a positive trend in heaping. During the 1999-2019 period, while dividends stay fairly constant over time, heaping increases through time in France and show in Germany first an increasing trend and later a decreasing trend in all intervals considered. These time-trend results again suggest that other factors beyond dividend magnitude influence the likelihood of managerial dividend rounding in all the samples considered. These results can be seen as support to both hypothesis 3 and hypothesis 4.

4.3. Heaped Dividends and Information Uncertainty

We include information uncertainty variables based on those considered in Zhang (2006) and Castillo, Rubio, and Jakob (2020). Table 5 presents descriptive statistics of these uncertainty variables. We observe that company size, return of the year before the dividend and dividends per share are the variables that consistently show large variations across periods. Regarding consistency of the movements across countries, company size increases in all 4 countries, return of the year before the dividend increases in 3 of the 4 countries and average age of companies decreases in 3 of the 4 countries. Table 6 reports the correlation coefficients among all these variables. The correlation factors are in general fairly small among all variables. Table 7 presents Logit regressions for the 1981-2019 period, for each of the countries considered. The dependent variable is a variable taking value of 1 if dividend is heaped based on: (1) all 10 UMC multiples-intervals (10.0, 20.0, 30.0, etc.), (2) all 1 UMC multiples-intervals (1.0, 2.0, 3.0, etc.), (3) all 1 decimal of UMC-intervals (0.1, 0.2, 0.3, etc.), (4) all 2 decimal of UMC-intervals (0.01, 0.02, 0.03, etc.), and taking value of 0 otherwise. The explanatory variables are inverted dividend size (DPS_inv), Return in the year the dividend is paid ($Ret_{\_year}$), Return of the year before the dividend ($Ret_{\_year-1}$), Stock Volatility of the year before the dividend is paid (SIGMA), Inverted company size (MV_inv), Volatility of cash flows (CVOL), and Inverted firm age (AGE_inv).

Consistent with the previous literature, we verify that several information uncertainty measures help to explain significant changes in the likelihood of rounding dividends. These results affirm that information uncertainty significantly influences both manager choices in general and the precise choice of the specific magnitude of the dividend distribution in particular. Consistent with the prior literature, the direction of influence of the different information uncertainty variables considered is often, but not always, the same across countries or rounding intervals. These results give support to our hypothesis 4. In the case of Germany, the variables SIGMA, MV_inv, CVOL, and AGE_inv, are all mostly positively related to heaping. In the case of France, the variables SIGMA, MV_inv and CVOL are all mostly positively related to heaping. In the case of the UK the variables SIGMA, MV_inv, CVOL, and Ret_year are all mostly positively related to heaping. Finally, in the case of Switzerland the variables SIGMA and CVOL are mostly positively related to heaping. The results observed here give support to the theory that the likelihood of heaping and uncertainty, at least uncertainty measured by volatility of returns (SIGMA), volatility of cash flows (CVOL) and the inverse of market value (MV_inv) are positively correlated.

After including the additional explanatory and control variables previously described, dividend magnitude remains a stable determinant of dividend heaping behavior. The coefficient on DPS_inv remains negatively and significantly related to the probability of heaping in most of the separate country samples. These results are particularly robust for the larger UMC 10 and UMC 1 intervals. As can be appreciated in Table 7, a count of 11 of 16 of the computed DPS_inv coefficients are negative and all of them are significant.

5. Conclusion

In this article, we contribute to a branch of the accounting and finance literature that examines cognitive biases that influence corporate decision making with regards to earnings forecasts and dividend distributions. Specifically, we examine whether European firms in France, Germany, the UK, and Switzerland round their dividend distributions based on a managerial cognitive heuristic. We jointly examine whether the transition to a new currency, the Euro, impacts the likelihood of dividend distribution rounding. We find, consistent with the previous studies, that the dividend distributions for all four countries are heavily influenced by the decision heuristic known as heaping. Across all four countries considered we find strong evidence suggesting that managers use the heaping heuristic when choosing the magnitude of their dividends.

We report that the most frequently observed dividends in each country are more often heaped at certain intervals (see Table 1). For example, in Germany in the pre-Euro conversion sample for the highest observation frequency classification, where there are 50 or more observations of the same unique dividend amount, we report 100% of the cases are heaped at the whole German Mark level. The low-frequency observations, on the other hand, are rarely at heaped values (e.g. In Germany for the lowest frequency observations only 1% are heaped at whole German Marks).

For each of the four countries' samples, we obtain a similar strong and positive relationship between dividend size and the probability of heaping. We verify the phenomenon whether we sort across different dividend ranges, or measure through logit regressions (see Table 2 and Table 3).

The switch to the new Euro currency had a profound and permanent effect on the dividend distribution rounding heuristic used by firm management. In both short and long time-trend analyses we report starkly different findings for France and Germany that switch to the Euro in comparison to the UK and Switzerland that keep their original currencies. In Germany and France for the shorter one-year pre-conversion and one-year post-conversion event window we see a very significant decline in the likelihood of heaping when the currency is changed to the Euro (see Table 4). For example, in France, 65% of dividends in the pre-conversion year are heaped at the 0.01 French Franc interval, but only 1% are heaped at the same Euro interval in the post-conversion year. For the UK and Switzerland, the countries that did not change their currency, we see that the likelihood of heaping stays nearly unchanged over the same two-year event window. The significant declines in heaping for the Euro conversion countries are consistent with our hypotheses.

When the longitudinal study is expanded to the full 1981-2019 period, the graphical images of dividend rounding clearly show that the sharp reduction in heaping triggered by the Euro conversion only partially fades with time. There is a strong resurgence of heaping at the smaller UMC intervals, but heaping at the larger intervals remains low for the remaining period. One possible explanation for this unusual finding is that dividend distributions directly after the Euro currency conversion may have been heavily anchored to the prior dividends directly before the currency conversion. If stable heaped dividends prior to the currency conversion were merely translated by managers to the new Euro, this may have led to an immediate sharp reduction in observed heaping in the sample. Managerial cognitive biased dividend changes post-conversion would lead to the slow return of the high levels of heaping seen before the Euro. We verify that in both Germany and France a significant proportion of the dividends paid in 1998 in those countries (32% in Germany and 36% in France) are mechanically converted to dividends in Euros in 1999. In each case we also verify that the proportions of dividends mechanically converted are much higher for dividends that are heaped prior to the currency conversion. For example, in Germany, the proportion of dividends mechanically converted from 1998 to 1999 is 44% for dividends heaped to one UMC, and only 25% for dividends not heaped to one UMC. In the post conversion sample, we do see a return to heaping, but only at smaller UMC values which is consistent with the stronger Euro currency.

We also observe that the impact of the change of currency is greater in France than in Germany, which is consistent with the fact that the currency magnitude increased more in France than in Germany. These results hold even if we compare the impact in heaping of the change of currency for dividends of similar sizes when measuring them in the same currency across periods and countries.

In our final set of regressions, presented in Table 7, we include information uncertainty measures and other traditional control variables as additional explanatory variables for rounding. Consistent with the previous literature, we find that many of the information uncertainty measures lead to significant changes in the likelihood of dividend heaping. These results verify that information uncertainty does influence both manager choices in general and dividend magnitude distributions in particular. Even after including these additional explanatory variables, dividend magnitude remains both positively and significantly related to the likelihood of heaping in each of the country samples. In conclusion, our findings suggest that dividend magnitude and information uncertainty play a significant role in the likelihood of heaping, and a currency change has both a significant immediate impact as well as a strong permanent effect on managerial cognitive decision making.

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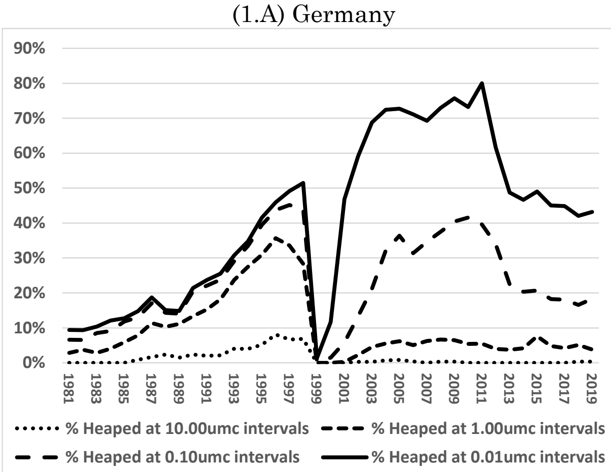
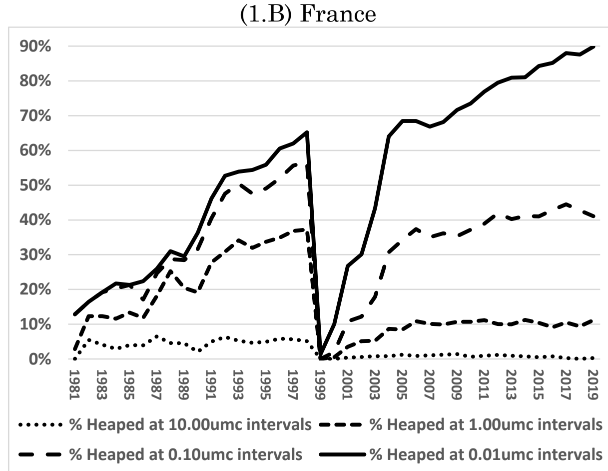
Figure 1. The proportion of dividends heaped across time using four different categories

This figure presents the full sample of dividends from 1981 through 2019. For each country we have four different heaping interval categories: (1) multiples of 10 UMC (10.0, 20.0, 30.0, etc.), (2) multiples of 1 UMC (1.0, 2.0, 3.0, etc.), (3) multiples of one decimal of UMC (0.1, 0.2, 0.3, etc.), (4) multiples of two decimals of UMC (0.01, 0.02, 0.03, etc.). For each year, we calculate the percentage of dividends that are heaped at each category.

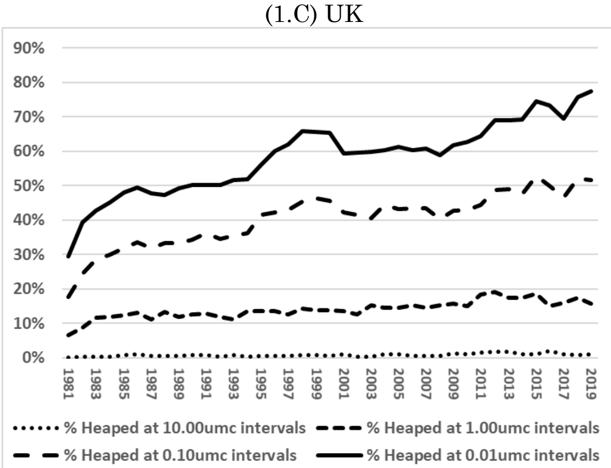
(1.A) Germany



(1.B) France



(1.C) UK



(1.D) Switzerland

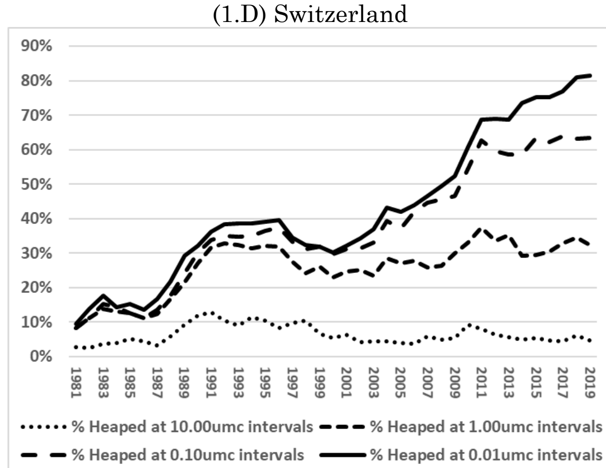
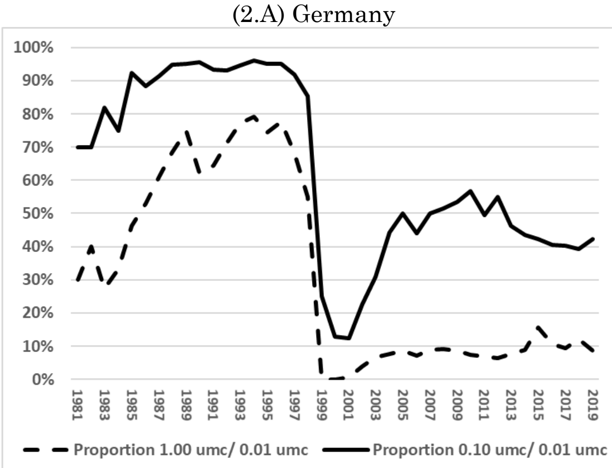


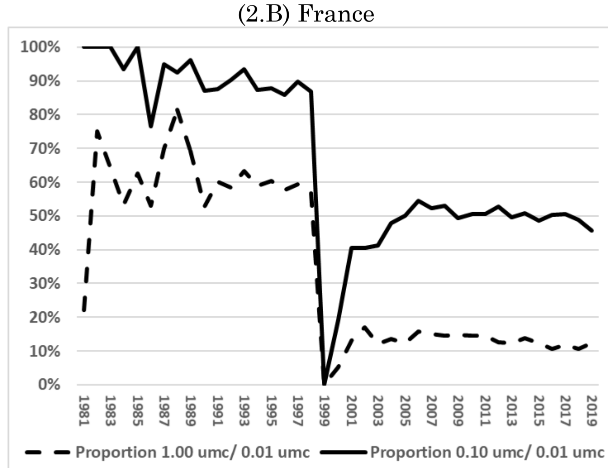
Figure 2. The proportion of dividends rounded to one category, relative to the proportion of dividends rounded to another (smaller) category

This figure presents, for each country, the proportion of dividends heaped to 1 unit of UMC relative to dividends heaped to two decimals of UMC from 1981 through 2019. It also presents the proportion of dividends heaped to 1 decimal of UMC relative to dividends heaped to two decimals of UMC from 1981 through 2019. For the full sample period, the average of these proportions is 31% and 63% for Germany, 34% and 67% for France, 24% and 69% for the UK and 68% and 89% for Switzerland.

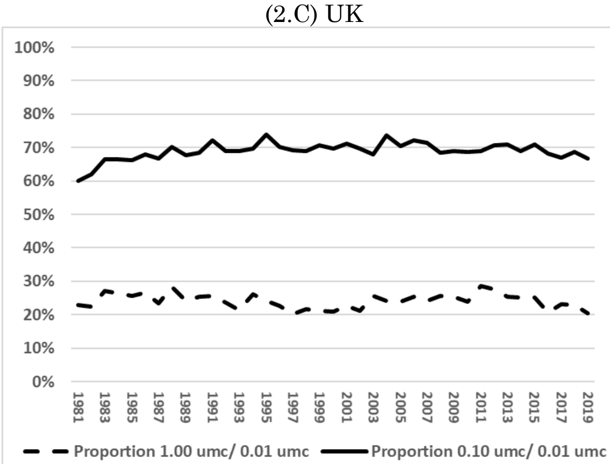
(2.A) Germany



(2.B) France



(2.C) UK



(2.D) Switzerland

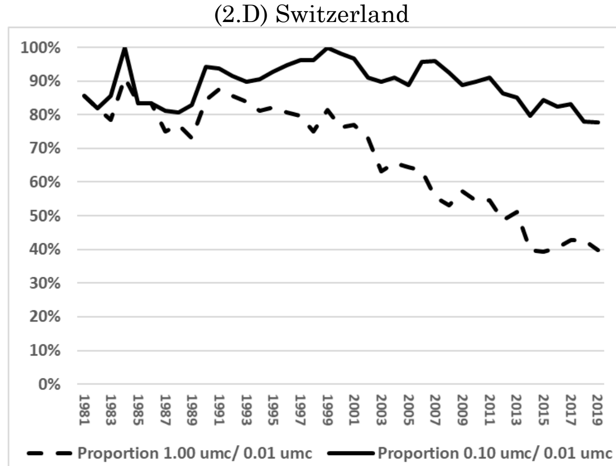
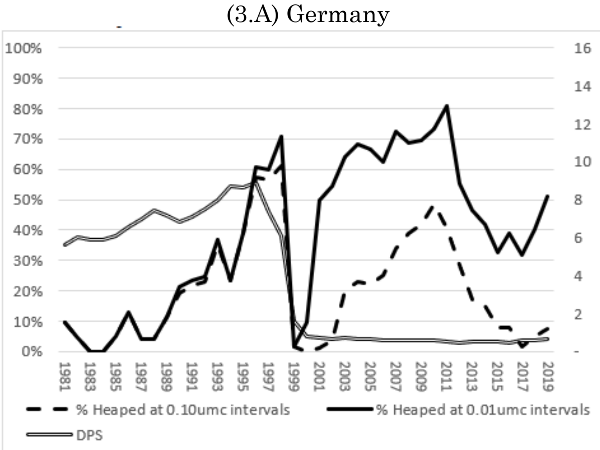


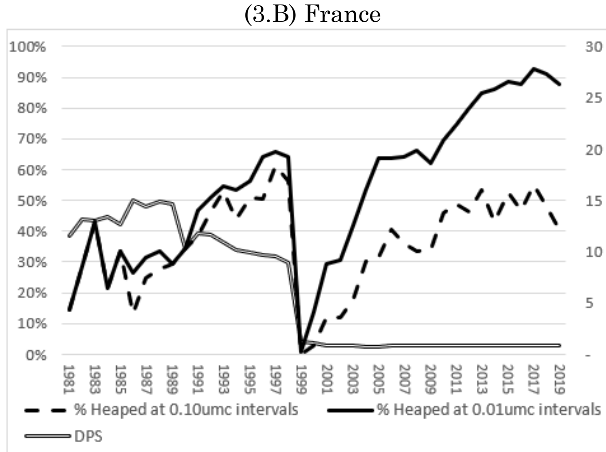
Figure 3. The proportion of dividends heaped to two intervals and narrow dividend size by year

This figure presents the third quintile of the full sample of dividends and dividend size from 1981 through 2019. The narrow size band represents the average dividend size, in units of UMC, for the third quintile over time. For each country, we calculate for each year the percentage of dividends that are heaped to both one and two decimals of UMC.

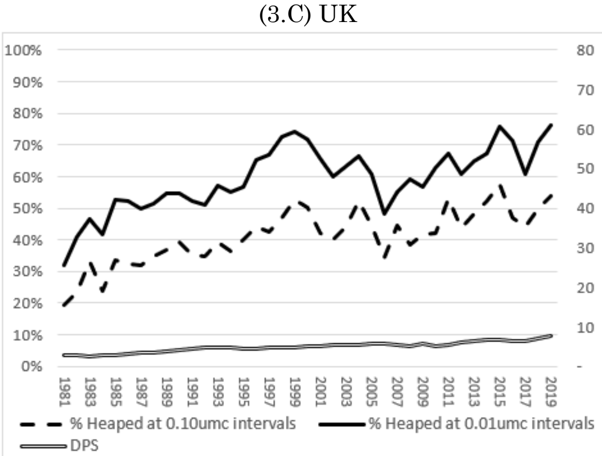
(3.A) Germany



(3.B) France



(3.C) UK



(3.D) Switzerland

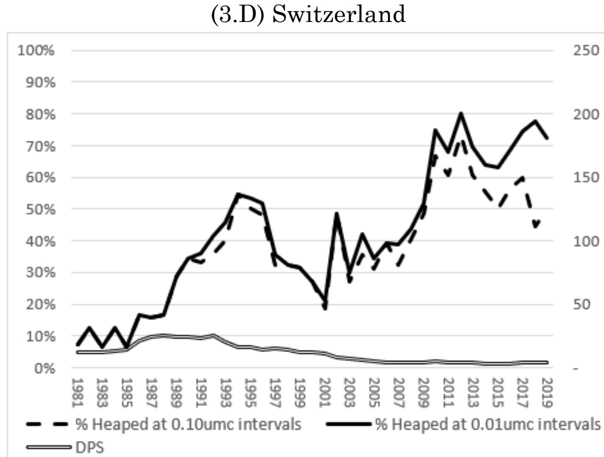


Table 1. Frequency of dividends and the likelihood of heaping

This table reports rounding using the number of times that one particular dividend is repeated. We consider two periods of time, 1981-1998 and 1999-2019. We look at 4 different intervals: multiples of 10 UMC; multiples of 1 UMC; multiples of 0.1 UMC; and multiples of 0.01 UMC. For instance, for Germany, during the 1981-1998 period, the first row shows 5 specific dividends are repeated 50 or more times. 20% of them are heaped to multiples of 10 UMC and 100% are heaped to 1 UMC, to the 1st decimal, and the 2nd decimal. Instead, for the same period, 1114 dividends are unique. None of these cases are heaped to multiples of 10 UMC, 1% are heaped to multiples of 1 UMC, 2% are heaped to the first decimal and 5% are heaped to the second decimal. In the first period (1981-1998) each country has its own currency. In the second period (1999-2019) Germany and France both have Euros as currency.

From 1981 to 1998					
Frequency	Number of unique	% Heaped at multiples of 10 umc	% Heaped at whole umc	% Heaped at multiples of one decimal of umc	% Heaped at multiples of two decimal of umc
Panel A: Germany (DM)					
50 or more	5	20%	100%	100%	100%
30 to 49	3	0%	100%	100%	100%
10 to 29	17	6%	53%	100%	100%
2 to 9	562	1%	2%	7%	10%
1	1114	0%	1%	2%	5%
Panel B: France (FF)					
50 or more	7	14%	100%	100%	100%
30 to 49	10	20%	90%	100%	100%
10 to 29	27	4%	56%	96%	96%
2 to 9	428	2%	7%	27%	37%
1	1414	1%	2%	6%	13%
Panel C: United Kingdom (£)					
50 or more	65	2%	23%	80%	100%
30 to 49	45	0%	4%	67%	98%
10 to 29	144	1%	8%	35%	81%
2 to 9	2010	0%	1%	4%	22%
1	9655	0%	0%	1%	4%
Panel D: Switzerland (SF)					
50 or more	0	n.a.	n.a.	n.a.	n.a.
30 to 49	2	50%	100%	100%	100%
10 to 29	21	29%	95%	95%	95%
2 to 9	388	4%	10%	14%	17%
1	826	0%	3%	4%	8%

From 1999 to 2019					
Frequency	Number of unique	% Heaped at multiples of 10 umc	% Heaped at whole umc	% Heaped at multiples of one decimal of umc	% Heaped at multiples of two decimal of umc
Panel A: Germany (Euro)					
50 or more	18	0%	6%	44%	72%
30 to 49	16	0%	6%	50%	94%
10 to 29	86	0%	3%	10%	69%
2 to 9	518	1%	2%	7%	28%
1	1207	0%	1%	3%	10%
Panel B: France (Euro)					
50 or more	23	0%	13%	70%	100%
30 to 49	36	0%	6%	28%	89%
10 to 29	97	3%	7%	25%	82%
2 to 9	824	0%	3%	8%	30%
1	2000	0%	2%	3%	11%
Panel C: United Kingdom (£)					
50 or more	40	0%	30%	90%	98%
30 to 49	58	5%	21%	79%	97%
10 to 29	165	0%	9%	50%	84%
2 to 9	1129	1%	4%	19%	56%
1	4940	0%	1%	4%	14%
Panel D: Switzerland (SF)					
50 or more	7	14%	86%	100%	100%
30 to 49	9	11%	67%	100%	100%
10 to 29	39	8%	38%	90%	100%
2 to 9	406	3%	8%	19%	30%
1	973	1%	4%	6%	11%

Table 2. Dividend size and the likelihood of heaping

This table reports heaping by dividend magnitude. We consider two periods of time, 1981-1998 and 1999-2019. We look at 4 different intervals: multiples of 10 UMC; multiples of 1 UMC; multiples of 0.1 UMC and multiples of 0.01 UMC. For instance, for Germany, during the 1981-1998 period, the first row reports dividends smaller than 1 UMC, and here the portion of dividends heaped to one decimal is 16%. The second row reports dividends from 1 UMC and smaller than 10 UMC. Here the portion of dividends heaped to one decimal is 27%. The third row reports dividends from 10 UMC and smaller than 100 UMC. Here the portion of dividends rounded to one decimal is 34%. For dividends greater than 100 UMC the portion of dividends rounded to one decimal is 41%. In the first period (1981-1998) each country has its own currency. In the second period (1999-2019) Germany and France have both Euros as currency.

From 1981 to 1998					
Magnitude Range	# of dividends within this range	% Heaped at multiples of 10 umc	% Heaped at whole umc	% Heaped at multiples of one decimal of umc	% Heaped at multiples of two decimal of umc
Panel A: Germany (DM)					
0 to <1	391	n.a.	n.a.	16%	21%
1 to <10	2143	n.a.	20%	27%	28%
10 to <100	973	12%	29%	34%	37%
>= 100	29	24%	31%	41%	45%
All	3536	4%	20%	28%	30%
Panel B: France (FF)					
0 to <1	83	n.a.	n.a.	5%	13%
1 to <10	1714	n.a.	23%	44%	52%
10 to <100	2033	8%	35%	46%	49%
>= 100	61	48%	74%	77%	77%
All	3891	5%	30%	44%	50%
Panel C: United Kingdom (£)					
0 to <1	3972	n.a.	n.a.	20%	34%
1 to <10	20076	n.a.	13%	35%	51%
10 to <100	3511	4%	21%	42%	52%
>= 100	110	7%	14%	21%	28%
All	27669	1%	12%	33%	49%
Panel D: Switzerland (SF)					
0 to <1	110	n.a.	n.a.	1%	1%
1 to <10	575	n.a.	12%	17%	18%
10 to <100	1450	10%	29%	32%	34%
>= 100	165	27%	41%	41%	56%
All	2300	9%	24%	27%	30%

From 1999 to 2019					
Magnitude Range	# of dividends within this range	% Heaped at multiples of 10 umc	% Heaped at whole umc	% Heaped at multiples of one decimal of umc	% Heaped at multiples of two decimal of umc
Panel A: Germany (Euro)					
0 to <1	4340	n.a.	n.a.	19%	53%
1 to <10	2002	n.a.	12%	31%	56%
10 to <100	178	6%	17%	33%	69%
>= 100	2	0%	50%	50%	50%
All	6522	0%	4%	23%	54%
Change from previous period		-3%	-16%	-4%	24%
Panel B: France (Euro)					
0 to <1	5215	n.a.	n.a.	20%	59%
1 to <10	4056	n.a.	15%	41%	64%
10 to <100	362	13%	41%	56%	75%
>= 100	60	32%	58%	62%	80%
All	9693	1%	8%	30%	62%
Change from previous period		-4%	-22%	-14%	12%
Panel C: United Kingdom (£)					
0 to <1	2189	n.a.	n.a.	28%	58%
1 to <10	9771	n.a.	15%	46%	66%
10 to <100	5159	3%	21%	51%	66%
>= 100	137	19%	47%	64%	77%
All	17256	1%	15%	45%	65%
Change from previous period		0%	3%	12%	16%
Panel D: Switzerland (SF)					
0 to <1	451	n.a.	n.a.	30%	53%
1 to <10	2002	n.a.	21%	47%	55%
10 to <100	1078	14%	53%	57%	58%
>= 100	84	56%	80%	80%	80%
All	3615	5%	29%	49%	56%
Change from previous period		-3%	5%	21%	26%

Table 3. Logit Regressions of dividend size and the likelihood of heaping

This table reports the results of Logit regressions for the two periods considered, for each of the countries considered. The dependent variable is a variable taking value of 1 if dividend is heaped based on: (1) all 10 UMC multiples-intervals (10.0, 20.0, 30.0, etc.), (2) all 1 UMC multiples-intervals (1.0, 2.0, 3.0, etc.), (3) all 1 decimal of UMC-intervals (0.1, 0.2, 0.3, etc.), (4) all 2 decimal of UMC-intervals (0.01, 0.02, 0.03, etc.), and taking value of 0 otherwise. The explanatory variable is inverted dividend size (DPS_inv). Standard errors are clustered at the firm and year level. All the explanatory variables have been standardized. The t-statistics are presented in parenthesis. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively.

1981 to 1998				
Variable	Heaped at multiples of 10 umc	Heaped at whole umc	Heaped at multiples of one decimal of umc	Heaped at multiples of two decimal of umc
Panel A: Germany (DM)				
DPS_inv	-13484.86***	-939.05***	-120.09***	-81.82***
	-13.02	-9.27	-4.52	-4.44
constant	-633.81***	-45.05***	-6.51***	-4.62***
	-13.07	-9.54	-5.29	-5.41
N	3536	3536	3536	3536
Panel B: France (FF)				
DPS_inv	-933.68***	-83.70***	-29.28***	-18.46***
	-9.5	-6.62	-5.03	-4.94
constant	-69.12***	-6.66***	-2.23***	-1.26***
	-9.85	-7.54	-5.55	-4.89
N	3891	3891	3891	3891
Panel C: United Kingdom (£)				
DPS_inv	-5103.55***	-216.07***	-21.01***	-5.57***
	-20.32	-19.44	-10.28	-4.44
constant	-84.48***	-5.09***	-0.96***	-0.10***
	-21.28	-30.83	-31.56	-5.21
N	27669	27669	27669	27669
Panel D: Switzerland (SF)				
DPS_inv	-5112.63***	-1426.73***	-794.99***	-926.05***
	-8.07	-9.54	-4.33	-4.54
constant	-143.77***	-40.38***	-22.79***	-26.27***
	-8.18	-9.78	-4.5	-4.67
N	2300	2300	2300	2300

1999 to 2019				
Variable	Heaped at multiples of 10 umc	Heaped at whole umc	Heaped at multiples of one decimal of umc	Heaped at multiples of two decimal of umc
Panel A: Germany (Euro)				
DPS_inv	-13988.98***	-706.07***	-51.25***	-13.63***
	-5.26	-19.54	-10.51	-4.56
constant	-658.31***	-34.83***	-3.35***	-0.38***
	-5.29	-21.1	-15.92	-2.98
N	6522	6522	6522	6522
Panel B: France (Euro)				
DPS_inv	-1120.27***	-82.93***	-8.60***	-0.60***
	-10.32	-22.06	-14.57	-5.27
constant	-82.18***	-6.92***	-1.08***	0.47***
	-10.57	-29.2	-33.25	22.45
N	9693	9693	9693	9693
Panel C: United Kingdom (£)				
DPS_inv	-5814.03***	-168.03***	-40.97***	-11.21***
	-11.49	-16.93	-14.61	-6.58
constant	-96.12***	-4.14***	-.73***	0.49***
	-11.92	-27.6	-17.38	18.2
N	17256	17256	17256	17256
Panel D: Switzerland (SF)				
DPS_inv	-4371.21***	-703.78***	-47.01***	-0.18***
	-12.94	-11.83	-5.37	-5.64
constant	-122.77***	-19.68***	-1.25***	0.24***
	-13.14	-12.19	-5.45	7.16
N	3615	3615	3615	3615

Table 4. Heaping before and after the change of currency

This table presents heaping on quintiles constructed based on dividend size. We consider two periods of time, 1998 (the last year before Germany and France adopted the Euro) and 1999 (the first year after Germany and France adopted the Euro). We look at 4 different intervals: multiples of 10 UMC; multiples of 1 UMC; multiples of 0.1 UMC and multiples of 0.01 UMC. For instance, for Germany, during 1998, for the whole sample, the proportion of dividends heaped to multiples of 10 UMC, heaped to multiples of 1 UMC, heaped to multiples of one decimal of UMC and heaped to multiples of two decimals of UMC were 6%, 26%, 42%, and 50% respectively. During 1999 these proportions went down to 0%, 0%, 0% and 1% respectively.

Pre Euro (1998)						
Quintile	# of dividends within this range	Mean DPS	% heaped at			
			10.00 umc intervals	1.00 umc intervals	0.10 umc intervals	0.01 umc intervals
Panel A: Germany (DM)						
1st	55	0.68	0%	5%	35%	47%
2nd	55	1.94	0%	0%	25%	33%
3rd	55	6.28	0%	42%	55%	65%
4th	54	10.76	19%	43%	50%	54%
5th	54	38.51	13%	39%	48%	52%
All	273	11.54	6%	26%	42%	50%
Panel B: France (FF)						
1st	94	2.17	0%	16%	55%	68%
2nd	94	4.77	0%	31%	50%	63%
3rd	94	9.17	10%	37%	59%	67%
4th	94	16.00	4%	48%	56%	64%
5th	93	94.24	12%	51%	60%	62%
All	469	25.12	5%	36%	56%	65%
Panel C: United Kingdom (£)						
1st	245	0.94	0%	9%	36%	59%
2nd	245	2.84	0%	16%	48%	72%
3rd	245	4.86	0%	17%	46%	71%
4th	245	7.80	1%	11%	42%	56%
5th	244	18.56	2%	19%	47%	61%
All	1224	6.99	1%	14%	44%	64%
Panel D: Switzerland (SF)						
1st	30	3.73	0%	3%	10%	10%
2nd	30	7.89	13%	23%	30%	30%
3rd	30	13.93	0%	20%	30%	30%
4th	30	23.63	17%	40%	43%	43%
5th	31	871.00	23%	32%	39%	42%
All	151	188.59	11%	24%	30%	31%

Euro (1999)						
Quintile	# of dividends within this range	Mean DPS	% heaped at			
			10.00 umc intervals	1.00 umc intervals	0.10 umc intervals	0.01 umc intervals
Panel A: Germany (Euro)						
1st	55	0.53	0%	0%	0%	2%
2nd	55	0.96	0%	0%	2%	2%
3rd	55	2.72	0%	0%	0%	2%
4th	54	4.95	0%	0%	0%	0%
5th	54	9.93	0%	0%	0%	2%
All	273	3.79	0%	0%	0%	1%
Panel B: France (Euro)						
1st	94	0.38	0%	0%	0%	2%
2nd	94	0.86	0%	0%	0%	0%
3rd	94	1.43	0%	0%	0%	1%
4th	94	2.39	0%	0%	0%	0%
5th	93	11.01	0%	0%	0%	2%
All	469	3.20	0%	0%	0%	1%
Panel C: United Kingdom (£)			$10	$1.00	$0.10	$0.01
1st	245	1.67	0%	10%	40%	60%
2nd	245	3.39	0%	12%	47%	75%
3rd	245	5.18	0%	17%	51%	71%
4th	245	8.40	1%	12%	43%	60%
5th	244	19.45	3%	21%	52%	61%
All	1224	7.61	1%	14%	46%	65%
Panel D: Switzerland (SF)						
1st	30	4.41	0%	3%	10%	10%
2nd	30	8.17	7%	23%	30%	30%
3rd	30	14.14	0%	27%	30%	30%
4th	30	22.92	13%	43%	43%	43%
5th	31	866.84	16%	32%	39%	39%
All	151	187.82	7%	26%	30%	30%

Table 5. Descriptive statistics

This table presents descriptive statistics of the DPS and of all the uncertainty variables, for the two periods and for each of the countries considered. The explanatory variables are dividend size (DPS) in units of monetary currency, Return in the year of the dividend (Ret_{year}) computed as the stock return of the year the dividend is paid, Return of the previous year (Ret_{year-1}) represents the return of the stock on the year before the dividend is paid, Stock Volatility (SIGMA) computed as the monthly stock returns standard deviation on the year before the dividend is paid, company size (MV) computed as the market capitalization in the year of the dividend, Volatility of cash flows (CVOL) represents the standard deviation of cash flows over assets in the last 5 years, and company age (AGE) represents the number of years since the firm was listed.

	1981 - 1998						1999 - 2019					
Variable	Obs	Mean	Std. Dev.	p.25	Med.	p.75	Obs	Mean	Std. Dev.	p.25	Med.	p.75
Panel A: Germany (DM/Euro)												
DPS	3,079	6.38	3.68	3.50	6.50	9.19	6,025	1.39	2.12	0.30	0.64	1.30
RET_year	3,274	5.68	24.70	-11.36	2.00	20.28	5,738	5.63	25.22	-11.03	2.57	20.66
RET_year -1	3,163	5.25	24.74	-11.87	1.20	19.50	5,676	7.92	25.97	-9.59	4.82	23.74
SIGMA	3,049	3.83	4.83	0.76	1.69	4.66	5,974	3.42	3.87	0.97	2.02	4.20
MV	3,293	1455.37	2921.59	157.74	427.64	1247.51	5,707	1092.42	1990.52	74.63	249.94	1093.08
CVOL	2,091	0.0245	0.0197	0.0106	0.0184	0.0321	5,740	0.0296	0.0212	0.0140	0.0237	0.0391
AGE	2,644	86.75	42.56	53.00	94.00	121.00	4,507	62.24	48.23	18.00	46.00	105.00
Panel B: France (FF/Euro)												
DPS	3,411	10.97	7.75	4.76	9.50	15.50	8,816	1.87	3.15	0.42	0.94	2.00
RET_year	2,983	7.81	28.13	-12.70	2.85	24.53	8,303	9.92	27.07	-9.04	6.49	26.58
RET_year -1	3,337	6.49	27.23	-13.13	2.43	22.94	8,585	8.43	27.04	-10.32	5.58	25.58
SIGMA	3,420	4.28	4.81	1.09	2.54	5.46	8,758	4.41	4.71	1.26	2.74	5.72
MV	3,680	4077.49	8937.92	271.24	870.72	3231.47	8,498	880.62	1805.66	43.80	149.96	643.46
CVOL	2,702	0.0211	0.0151	0.0099	0.0166	0.0281	8,111	0.0204	0.0151	0.0091	0.0162	0.0272
AGE	2,887	42.93	26.28	25.00	36.00	59.00	7,924	36.98	21.18	20.00	32.00	50.00
Panel C: United Kingdom (£)												
DPS	25,751	4.94	4.28	1.91	3.70	6.60	14,685	6.83	5.71	2.30	5.10	10.00
RET_year	24,753	8.90	28.59	-8.98	3.02	26.63	15,316	6.55	29.38	-14.18	3.41	25.45
RET_year -1	23,720	9.10	29.28	-10.76	3.99	27.37	15,094	8.35	30.12	-13.86	5.89	28.00
SIGMA	24,399	17.57	18.47	5.50	11.54	22.59	15,685	29.16	26.26	9.53	20.76	40.51
MV	24,687	144.33	359.80	8.28	24.15	91.98	15,313	370.60	602.13	27.52	104.03	407.41
CVOL	10,403	0.0329	0.0221	0.0163	0.0272	0.0433	14,795	0.0314	0.0230	0.0140	0.0242	0.0421
AGE	15,844	43.61	28.40	17.00	39.00	67.00	14,085	33.79	26.62	13.00	23.00	50.00
Panel D: Switzerland (SF)												
DPS	2,016	23.29	20.08	8.00	16.22	32.82	3,309	11.02	14.86	2.33	5.00	13.00
RET_year	2,078	5.06	22.06	-10.25	2.39	18.66	3,233	6.25	21.32	-7.52	3.59	19.14
RET_year -1	2,041	4.58	21.55	-10.48	1.95	17.10	3,193	8.00	21.47	-6.45	5.19	21.03
SIGMA	1,909	28.48	35.79	3.50	12.87	39.19	3,367	21.46	28.80	3.76	9.38	26.12
MV	2,064	738.88	1617.65	89.65	217.81	603.25	3,245	1718.56	2687.43	240.50	679.20	1857.24
CVOL	1,087	0.0153	0.0121	0.0059	0.0118	0.0211	2,883	0.0183	0.0129	0.0083	0.1518	0.0252
AGE	1,301	63.21	36.43	28.00	66.00	95.00	2,552	64.16	40.35	28.00	53.50	101.00

Table 6. Matrix of correlation coefficients

This table reports, for each country, the matrix of correlations between each of the dependent and independent variables considered in our final model. The correlations where computed using only the data set considered in the regressions reported in Table 7. The explanatory variables are dividend size (DPS) in units of monetary currency, Return in the year of the dividend ($Ret_{\_year}$) computed as the stock return of the year the dividend is paid, Return of the previous year ($Ret_{\_year-1}$) represents the return of the stock on the year before the dividend is paid, Stock Volatility (SIGMA) computed as the monthly stock returns standard deviation on the year before the dividend is paid, company size (MV) computed as the market capitalization in the year of the dividend, Volatility of cash flows (CVOL) represents the standard deviation of cash flows over assets in the last 5 years, and company age (AGE) represents the number of years since the firm was listed.

	DPS	RET_year	RET_year -1	SIGMA	MV	CVOL	AGE
Panel A: Germany							
DPS	1						
RET_year	-0.0324*	1					
RET_year -1	-0.0523*	0.0477*	1				
SIGMA	0.2135*	-0.0310*	0.0262*	1			
MV	-0.0144	0.0330*	0.0868*	0.0778*	1		
CVOL	-0.1282*	-0.0528*	-0.0433*	-0.0271*	-0.1440*	1	
AGE	0.2540*	-0.0211	-0.0218	0.0993*	-0.0511*	-0.1353*	1
Panel B: France							
DPS	1						
RET_year	0.0016	1					
RET_year -1	-0.0246*	0.0406*	1				
SIGMA	0.1458*	0.0553*	0.0298*	1			
MV	-0.0435*	0.0620*	0.0594*	0.0544*	1		
CVOL	-0.0337*	-0.0536*	-0.0669*	0.0026	-0.1638*	1	
AGE	0.1256*	-0.0073	-0.0045	0.1744*	0.0111	-0.0914*	1
Panel C: United Kingdom							
DPS	1						
RET_year	0.006	1					
RET_year -1	0.0214*	0.0515*	1				
SIGMA	0.4045*	-0.0665*	0.0654*	1			
MV	0.3462*	0.0027	0.0594*	0.2802*	1		
CVOL	-0.2035*	-0.0473*	-0.0715*	-0.0388*	-0.1785*	1	
AGE	0.0953*	0.0067	-0.0014	-0.0653*	0.0029	-0.1498*	1
Panel D: Switzerland							
DPS	1						
RET_year	-0.0527*	1					
RET_year -1	-0.0638*	0.0455*	1				
SIGMA	0.3097*	-0.0472*	0.0123	1			
MV	-0.1435*	0.0462*	0.1132*	-0.0642*	1		
CVOL	-0.1210*	0.0203	-0.0002	0.0531*	-0.0623*	1	
AGE	0.0517*	0.0079	-0.0042	0.1515*	-0.1088*	-0.0917*	1

Table 7. Heaping, dividend size, and information uncertainty variables.

This table reports the results of Logit regressions for the 1981-2019 period, for each of the countries considered. The dependent variable is a variable taking value of 1 if dividend is heaped based on: (1) all 10 UMC multiples-intervals (10.0, 20.0, 30.0, etc.), (2) all 1 UMC multiples-intervals (1.0, 2.0, 3.0, etc.), (3) all 1 decimal of UMC-intervals (0.1, 0.2, 0.3, etc.), (4) all 2 decimal of UMC-intervals (0.01, 0.02, 0.03, etc.), and taking value of 0 otherwise. The explanatory variables are inverted dividend size (DPS_inv), Return in the year of the dividend (Ret_{year}) computed as the stock return of the year the dividend is paid, Return of the previous year (Ret_{year-1}) represents the return of the stock on the year before the dividend is paid, Stock Volatility (SIGMA) computed as the monthly stock standard deviation on the year before the dividend is paid, Inverted company size (MV_inv) computed as the inverse of the market capitalization in the year of the dividend, Volatility of cash flows (CVOL) represents the standard deviation of cash flows over assets in the last 5 years, and Inverse of company age (AGE_inv) represents the inverse of the number of years since the firm was listed. Standard errors are clustered at the firm and date level. Control variables are Dividend Yield and Dividend Payout. All the explanatory variables have been standardized. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively. All variables have been winsorized at 5% and 95% to reduce the influence of outliers.

Variable	Heaped at multiples of 10 umc	Heaped at whole umc	Heaped at multiples of one decimal of umc	Heaped at multiples of two decimal of umc
Panel A: Germany				
RET_year	-0.4352*	-0.1946***	0.0082	0.0293
RET_year -1	-0.3944*	-0.2125***	-0.0591	0.0004
SIGMA	-0.2917	0.0288	0.2138***	0.2234***
MV_inv	-0.1678	0.0741	0.1018**	0.0419
CVOL	0.0793	0.2073***	0.1659***	0.1640***
AGE_inv	-0.0280	0.0857	0.1514***	0.1101***
DPS_inv	-62.8706***	-3.6648***	-0.1038**	0.2952***
constant	-49.6952***	-3.9215***	-0.9974***	0.1141***
N	3048	3048	3048	3048
Panel B: France				
RET_year	0.0334	-0.0544	-0.0106	-0.0587**
RET_year -1	-0.1500	-0.1183**	-0.0317	-0.0697**
SIGMA	0.2843***	0.1571***	0.1720***	0.2186***
MV_inv	0.2278	0.2116***	0.2106***	0.0157
CVOL	0.0388	0.1892***	0.1726***	0.1158***
AGE_inv	0.1504	0.0359	-0.0212	-0.0186
DPS_inv	-32.9495***	-2.8615***	-0.6253***	0.2145***
constant	-27.1133***	-3.0256***	-0.5708***	0.5587***
N	5316	5316	5316	5316
Panel C: United Kingdom				
RET_year	0.1121	0.0188	0.0030	-0.0360**
RET_year -1	0.0412	0.0064	-0.0465**	-0.0963***
SIGMA	0.1808*	0.1608***	0.1587***	0.1243***
MV_inv	0.5112***	0.3049***	0.3480***	0.4013***
CVOL	0.2446**	0.1630***	0.0995***	0.0597***
AGE_inv	-0.0630	-0.0218	0.0245	0.0107
DPS_inv	-10.7301***	-0.3554***	-0.0929***	0.0935***
constant	-13.0748	-1.5167**	-0.3998	0.5477
N	14194	14194	14194	14194
Panel D: Switzerland				
RET_year	0.1443	0.0446	-0.0492	-0.0151
RET_year -1	0.1434	-0.0069	-0.0363	-0.0421
SIGMA	0.4909***	0.5056***	0.4627***	0.4495***
MV_inv	0.1265	-0.0713	-0.2771***	-0.3449***
CVOL	-0.1398	0.0929	0.0178	0.0026
AGE_inv	-0.1748	-0.2340***	-0.1607***	-0.1548***
DPS_inv	-4.3791***	-0.5953***	0.2444***	0.4063***
constant	-4.9940***	-0.9914***	-0.0994*	0.0725
N	1703	1703	1703	1703

When do Firms Heap Dividends?

New Evidence on the Key Role of Firm Characteristics.

Abstract

In this paper we explore how a cognitive bias known as heaping influences the dividend policy of companies. Recent articles have shown that the size of the dividends and the level of some information uncertainty variables are useful to explain changes in the likelihood of rounding dividends. Using data from the US that covers the 1990-2019 period, we verify that the previous literature overlooked the key role played by a group of variables denominated as firm characteristics. We also show how other characteristics such as being regular payers of dividends also impact the likelihood of rounding dividends. Finally, we verify that the propensity to heap dividends has been changing over time, even after controlling by changes in the dividend size, in the level of the information uncertainty variables and in the status of the firm characteristic variables.

Keywords: Dividends, Heaping, Cognitive Bias, Firm Characteristics.

JEL Classifications: G03, G35

1. Introduction

Companies have been paying dividends to stockholders for at least four centuries (Baskin 1988). The decisions revolving around distributing dividends are important for both the corporation and its investors. The chosen magnitude of the dividend distribution influences several relevant corporate metrics such as the firm's capital structure, the earnings reinvestment rate or plowback, the firm's future growth potential, the dividend yield, and the overall taxation of investors. Most stock valuation techniques also rely heavily on dividends as a key input into the analyses. There is a large body of empirical and theoretical academic literature that investigates the approach and intentions of corporate dividend payments; however, the intricacies of the firm's dividend issuance decision still deserve additional consideration.

Turner (1958) proposes that people will underuse those digits that are not multiples of the divisor of the base of the number system while overusing or heaping at those digits that are multiples of the divisors of the base of the number system. According to Turner, people will estimate or round to a heaped measure when they are unsure of the correct value, but they will use more accurate numerical values when they can. The main divisors of the base ten numbering system are ten, five and two.

There is a recent and growing line of academic research that examines the heaping heuristic inside a corporate accounting and finance framework (Herrmann and Thomas, 2005; Dechow and You, 2012; Bamber, Hui and Yeung, 2010). Jakob and Nam (2020) study the distribution of cash dividends in the US and report that 51% of their full sample of dividends are rounded or clustered at specific intervals consistent with heaping in a base ten numbering system. They report that the probability of rounding is significantly and positively related to the size of the dividend distributed. They also report that heaping is significantly related to several different measures of the level of information uncertainty faced by the management of the company. In the same way, Nam, Niblock, Sinnewe, and Jakob (2018) examine rounding of dividends in Australia and concur that the probability of heaping is related to information uncertainty. Castillo, Rubio, and Jakob (2020) examine dividend payout policy in four Latin American countries with significantly different currency magnitudes. They verify that the magnitude or strength of the country-specific currency significantly influences the likelihood and characteristics of heaping observed in the dividends for each country. Finally, Jakob, Castillo, and Rubio (2021) study four key European markets (Germany, France, the UK, and Switzerland). They report that the change of currency in Germany and France (they both adopted the Euro in January 1999) significantly influenced the likelihood of heaping observed in dividends paid both in the short and in the long run.

In this study, we extend the academic literature that examines how cognitive biases can influence corporate decisions regarding dividend allotment. In particular, the objective of the paper is to expand and improve the methodology used on previous studies to analyze the reasons why managers heap dividends. We do it by incorporating new information uncertainty variables to the model and by adding some financial characteristics of the firm as additional explanatory variables.

Also, we deepen the analysis by distinguishing between companies that are regular payers of dividends, and those who are not regular payers. We verify that regular payers of dividends present a lower likelihood of rounding dividends, but we also verify that the difference in likelihood of heaping between regular payers and non-regular payers has been decreasing over the last three decades. Finally, we verify that the propensity to heap dividends has been increasing over time, even after controlling by changes in the dividend size, in the level of the information uncertainty variables and in the status of the firm characteristic variables.

2. Literature Review

The majority of the ensuing dividend policy literature can be classified into categories of either rational or behavioral theories. In the area of rational theories, there are recognized studies such as: Miller and Modigliani (1961), Bhattacharya (1979) Easterbrook (1984), Karpavičius (2014), etc.

Several behavioral theories attempt to explain observed corporate dividend policy based on managerial and investor biases. Long (1978) provides evidence that investors' interest in or demand for dividends varies across time. Baker and Wurgler (2004) postulate that the dividend payment decision is driven by such prevailing investor sentiment regarding dividend payers. They proclaim that managers attract investors by paying dividends when investors prefer payers, and by not paying dividends when investors put a stock price premium on nonpayers.

Several additional articles look at how psychological biases by investors can influence dividend payout policy. The bird-in-hand argument (e.g., Gordon 1959; Lintner 1962) proposes that since investors must realize wealth to be able to consume, they, therefore, prefer cash dividends over capital gains. However, this bird-in-hand argument is theoretically contested by Miller and Modigliani (1961). Black (1990), and Shefrin and Statman (1984) suggest that dividends are primarily an investor self-control mechanism. In the absence of dividends, shareholders are forced to liquidate shares for the purpose of consumption. In this explanation, dividends are used as a tool to help investors regulate and control their level of consumption.

In another line of research, corporate management behavioral studies associate managerial over-optimism or overconfidence with both dividend policy and investment policy (e.g., Malmendier and Tate 2005; Deshmukh, Goel, and Howe 2013). This research indicates that overconfidence by managers impacts the overall level of dividend distributions and the market response to announcements regarding dividend payments. In our paper, we study another managerial behavioral bias called heaping. We argue that firm managers will be affected by this often-observed behavioral heuristic and its use directly influences their choice of dividend payouts.

A well-documented bias or human error is to round numbers even though precise results are preferred. This numerical rounding heuristic, known as heaping, is particularly noticeable in census or demographic surveys where the age in years is sought (e.g., Myers 1940). The literature finds observations heaped or clustered at intervals of ten, five, four, and two which are the principal divisors of the base ten numbering system.

As an extension to the survey data rounding literature, several researchers ask whether this particular kind of cognitive bias or other similar heuristics systematically influence the actors within the financial markets as well as firm management and their corporate decision making. An extensive line of literature examines rounding or clustering in the distribution of share prices on U.S. equity markets (e.g., Niederhoffer 1966; Harris 1991; Christie and Schultz 1994; Grossman, Miller, Cone, Fischel, and Ross 1997; Cooney, Van Ness, and Van Ness 2001). As an example, Grossman et al. suggest that the size of transactions, uncertainty, and volatility in the price of stocks leads to a greater amount of share price clustering. Within this stream of research, there is an increasingly large group of papers that examine rounding of stock prices on international stock markets (e.g., Aitken et al. 1996; Brown, Chua, and Mitchell 2002).

A smaller and newer line of literature examines heaping directly within a corporate decision-making framework. Several papers examine heaping in corporate earnings forecasts, including forecasts made by both corporate managers and security analysts. Herrmann and Thomas (2005) report that security analyst forecasts of EPS occur in nickel intervals ($0.05) at a much greater frequency than do actual EPS. They show that analysts who round their EPS forecasts to these $0.05 intervals are less informed, exert less effort, and have fewer resources. They also prove that heaped forecasts are less accurate and that the negative relation between forecast accuracy and rounding increases as the rounding interval increases in size from a nickel to dime, quarter, half-dollar, and dollar.

Dechow and You (2012) expand on the findings in Hermann and Thomas and discover that analysts engage in rounding more frequently for larger earnings amounts where the penny digit of the forecast is of less economic significance. They propose that by rounding, analysts reveal that their forecasts are not intended to be precise to the penny. They also show that analyst incentives affect the probability of rounding. Expressly, they conclude that analysts exert less effort forecasting earnings for companies that generate less brokerage or investment banking business since such corporations create less value for the analysts' employers. As a consequence of this diminished effort and attention, the analyst will be less certain about the penny digit of the forecast and will round.

Bamber, Hui, and Yeung (2010) report an analogous heaping phenomenon seen for analysts also occurs when corporate managers make their own EPS forecasts. They find persistent heaping in manager EPS forecasts and they also verify that forecasts are more often heaped when: there is more uncertainty about earnings; managers have stronger incentives to upward-bias their forecasts and it is difficult for the market to assess the truthfulness of the forecast and the firm has higher proprietary information costs. Their results are interesting since they suggest that the decision to round or heap in management forecasts stems not only from a benign psychological heuristic response to uncertainty but also from strategic incentives faced by managers.

Recently, managerial heaping in dividend distribution decisions has been studied because of the precise and direct impact on both the capital remaining available within a firm and the cash flow stream received by investors. Nam, Niblock, Sinnewe, and Jakob (2018), Jakob and Nam (2020), Castillo, Rubio, and Jakob (2020) and Jakob, Castillo, and Rubio (2021) examine dividend distributions in Australia, the USA, four Latin American countries, and four European countries respectively. These studies all report significant heaping. Nam, Niblock, Sinnewe, and Jakob (2018), and Jakob and Nam (2020) show that both the dividend magnitude and the level of information uncertainty impact the likelihood that managers choose to pay dividends in rounded intervals. Castillo, Rubio, and Jakob (2020) identify that the currency magnitude, measured as the strength of each currency relative to the US dollar, also significantly impacts the likelihood of heaping. Finally, Jakob, Castillo, and Rubio (2021) extend and expand on these analyses with a European sample of four countries. The goal of their paper is to analyze whether a mandated change in the underlying currency further impacts the decision of heaping dividends.

In this paper, we extend the academic literature that examines how cognitive biases can influence corporate decisions regarding dividend allotment. In particular, the objective of the paper is to expand and improve the paper made for the USA market by Jakob and Nam (2020), incorporating new uncertainty variables to the model and adding a new set of variables that are identified as characteristics of the firm, as explanatory variables. To do this, we take as a reference the paper made by Fama and French (2001) and Denis and Osobov (2008). Denis and Osobov reported that the likelihood of paying dividends is higher among larger, more profitable firms, and also among those companies for which retained earnings comprise a larger fraction of total equity.

Also, we want to deepen the analysis, distinguishing between companies that are regular payers of dividends, and those who are not regular payers. We hypothesize and verify that regular payers of dividends present a lower likelihood of rounding dividends. But the difference in likelihood of heaping between regular payers and non-regular payers has been decreasing over the last three decades. Finally, and following the methodology proposed by Fama and French (2001) and Denis and Osobov (2008), we verify that the propensity to heap dividends has been increasing over time, even after controlling by changes in the dividend size, in the level of the information uncertainty variables and in the status of the firm characteristic variables.

3. Data, Preliminary Results and Hypotheses

Our data is constructed using Worldscope, Datastream, and I/B/E/S. The data is collected via Refinitiv Eikon Datastream and considers the period between 1990 and 2019. The initial sample includes all firms of NYSE and NASDAQ, for which Worldscope provides information on dividends, total assets, common equity, and market capitalization. Information on stock prices is obtained from Datastream. Finally, the analyst forecast revisions are from I/B/E/S.

Following Fama and French (2001), we exclude firms with negative book equity. We also exclude non-USA firms, and firms that present their financial information in currencies other than US dollars (for example, ADRs), because we are studying in particular the dividends calculated and paid in US dollars. Finally, we exclude DPS greater than $5 (307 observations), and share price below $5, to make sure that the results are not driven by very small prices or by very high dividends. This gives us 50,972 observations.

Dividends obtained are "adjusted" for stock splits, therefore, they are "unadjusted" by the factor that Worldscope delivers. In this way, we recover the dividend delivered by the company, approaching to the third decimal place.

According to the previous literature, the larger the dividend, the greater the heaping. In Table 1 Panel A, dividends are sorted by dividend amount. The first row in the panel contains the smallest dividends and subsequent rows have larger dividends. As dividend magnitude increases there is a clear increasing trend in the likelihood of heaping in each interval considered. Also, we perform logit regressions to verify the impact of dividend size on the likelihood of heaping. The results, not reported here, show a very positive and significant relationship between dividend size and likelihood of heaping.

The previous literature also reports a strong relationship between several information uncertainty measures and the likelihood of rounding dividends. In Table 2 Panel A, we present descriptive statistics of these variables. We are including here two information uncertainty variables not considered in the previous studies regarding heaping of dividends. In Table 2 Panel B, we report the results of logit regressions that give support to the previous literature, considering at the same time dividend size and the information uncertainty variables described below.

We include information uncertainty variables based on those considered in Zhang (2006) and Castillo, Rubio, and Jakob (2020). RET_{t0} computed as the stock return in the year of the dividend. RET_{t1} computed as the stock return of the next year. Inverted company size (1/MV) computed as the inverse of the market capitalization of the Equity in the year of the dividend. Stock volatility (SIGMA) computed as the monthly stock standard deviation on the year of the dividend. Inverse of company age (1/AGE) represents the inverse of the number of years since the firm was listed. Volatility of cash flows (CVOL) represents the standard deviation of operational cash flows over assets in the last 5 years (with a minimum of 3 years). Two variables of information uncertainty mentioned by Zhang (2006), but not included in the previous papers related to heaping in dividends are Analyst Coverage and Forecast Dispersion. Analyst Coverage (COV) is the number of analysts following the firm in the year of the dividend. Forecast Dispersion (DISP) is computed as the coefficient of variation of all the Forecasts of EPS. We verify that information uncertainty significantly influences both dividend policy in general and rounding of dividends in particular.

In this paper we hypothesize that the same firm characteristics that influence the likelihood of paying dividends by a company, as shown by Fama and French (2001) and Denis and Osobov (2008), should also influence the likelihood of rounding those dividends that the firm distributes.

> **H1.** The likelihood of heaping depends on financial characteristics of firms.
>
> **H2.** The likelihood of heaping is better explained by considering at the same time size, information uncertainty and firm characteristics than excluding some of these variables.

The previous literature regarding dividend payments has explored if there are clear differences between firms that pay and those that do not pay dividends. Fama and French (2001) report that non payers of dividends tend to be smaller and younger companies with more growth opportunities. Here we propose that firms that are regular payers of dividends could have a different likelihood of rounding dividends when compared to those companies that do not pay dividends regularly.

> **H3.** Firms that regularly distribute dividends show a different likelihood of heaping than those that do not regularly pay dividends.

In this paper we also want to verify if the evolution over time in the propensity to pay dividends can be fully explained by the evolution shown by the evolution over time of the main explanatory variables we have identified.

H4. The likelihood of heaping changes over time for reasons that are not fully captured by the evolution of dividend size, uncertainty variables or firm characteristics.

4. Empirical Results and Discussion

4.1. The time-trend in heaping

Figure 1 present a graph of the proportion of dividends that are heaped in each year of the 1990-2019 period, from NYSE and NASDAQ. 2 cent-intervals, 5 cent-intervals, and 10 cent-intervals are indicator variables taking values of one if dividend is heaped based on the three different heaping categories: (1) multiples of 2 cents ($0.02, $0.04, $0.06, etc.), (2) multiples of 5 cents ($0.05, $0.10, $0.15, etc.), (3) multiples of 10 cents ($0.10, $0.20, $0.30, etc.), and zero otherwise. Since heaped values at 10 cent-intervals are, by definition, also heaped at the 2 cent-intervals, and 5 cent-intervals, it is important to understand that the 10 cent-intervals heaped sample is a subset of the 2 cent-intervals, and 5 cent-intervals heaped samples.

We find a strong and positive trend over time for 2 cent-intervals. For 5 cent-intervals, and 10 cent-intervals the trends are only slightly positive. These positive trends are also evident from Table 1, panel B. The heaping percentage of 2 cent-intervals increases over time from 55% to 66%, from period 1 to period 3. The heaping percentage of 5 cent-intervals, and 10 cent-intervals is the same in period 1 and period 2 (27%, and 21%, respectively), and increases in period 3 (to 30%, and to 23%, respectively).

Figure 1 also shows the time trend of the average dividend. We observe that the average dividend size falls at the beginning in the first decade considered, then it remains relatively stable during the second decade, and increases strongly in the last decade.

To verify if the likelihood of heaping changes over time for reasons different than the change in dividend size, we hold the dividend magnitude fairly constant by separately examining dividend size quintiles. Figure 2 shows the evolution over time of both the average dividend and the proportion of heaping for the third quintile, considering the three different heaping intervals. With this approach, we are able to hold dividend magnitude at a fairly stable level and here we find that heaping increases through time in the 2 cent-interval. However, the other two categories go from a marginally positive trend in the likelihood of heaping to a marginally negative one. These time-trend results suggest that other factors beyond dividend magnitude influence the likelihood of managerial dividend heaping in the samples, at least for the 2 cent-interval.

4.2. Heaped Dividends and the Characteristics of the Firms

Following Fama and French (2001) and Denis and Osobov (2008), we consider several measures of firm characteristics that provide financial information of the companies. We include two measures of profitability defined as ROA and ROE. We measure ROA as the ratio of earnings before interests but after taxes over the average book value of average total assets, and we compute ROE as the ratio of after-tax earnings over the average book value of equity, where book value of equity is defined as the book value of common equity plus the book value of non-equity reserves, if available. We also include two measures of growth opportunities. The first one, named P/B is measured as the ratio of the market price (year-end) of the firm to book value per share of total equity. The second measure, named Growth Assets, is computed as the percentage annual change in total assets. Firm size is measured as the book value of total assets (Total Assets) and reported in millions of US dollars. Finally, the measure named RE/BE is computed as the ratio of retained earnings over the book value of total equity.

Table 3 Panel A presents descriptive statistics of the firm characteristics variables considered. 58.46% of these observations correspond to firms that are listed on the NYSE, which are larger (by Total Assets) and marginally more profitable (by ROE and ROA) and with more growth opportunities (P / B) than firms that are listed on the NASDAQ. In Table 3 Panel B, which report logit regressions with heaping as the dependent variable and both dividend size and firm characteristics as the independent variables, we verify that the variables P/B, Growth Assets, ROE, and RE/BE are all strongly significant and negatively related to heaping, while only the variable Ln(Asset) is positively and significantly related to heaping. Thus, we report that profitability, growth opportunities and retention of earnings have a negative and significant relationship with rounding. This evidence gives strong support to our Hypothesis 1. Also, and consistent with all the evidence in previous works, the coefficient on 1/DPS remains negatively and significantly related to the probability of heaping in each of the intervals considered.

4.3. Heaped Dividends, Size of Dividends, Information Uncertainty, and the Characteristics of the Firms

In this section we combine the three set of independent variables that explain rounding in the distribution of dividends: dividend size, information uncertainty variables faced by management and the characteristics of the firms. Table 4 presents logit regressions for the 1990-2019 period. The coefficient on 1/DPS remains strongly negative and significant related to the probability of heaping in each of the intervals.

We observe that, in the 2 cent-interval, profitability (ROA), growth opportunities (P/B, and Asset Growth), Size of the company (Ln(Assets)) and retention of earnings (RE/EB) have a negative and significant relationship with heaping. In contrast, in the 5 cent-intervals and 10 cent-intervals, the coefficient Ln(Asset) is positive and significant, and only P/B and

RE/EB are negative and significant. We believe that this difference in significance between the variables of the intervals is related to the trends observed in Figure 1.

Regarding the uncertainty variables, RET_{t0} and RET_{t1} are strongly significant and negatively related to heaping, but only at 2 cent-intervals. SIGMA, 1/AGE, CVOL, COV, and DISP are all significant and positively related to heaping. We observe that 1/MV is not significant in any of the three intervals. This can be justified because there is another variable of size, Ln(Asset), which could be absorbing all the effect. The same could be happening with the ROE variable, because the ROA profitability variable could be absorbing all the effect. When testing both variables in the complete model, we cannot reject that they do not contribute to the results. By excluding them, the main results do not change.

In Table 5, we present the Wald chi-square statistic of the regressions performed in Table 4. We tested separately for each of the three sets of independent variables considered (dividend size, information uncertainty and firm characteristic variables). In all cases we can reject the hypothesis that each set of variables are not useful to explain the likelihood of heaping dividends by the companies of the sample. The results reported in Table 4 and Table 5 give support to Hypothesis 2.

4.4. Heaping of Dividends among regular and non-regular payers

The previous literature regarding dividend payments has explored if there are clear differences between firms that pay and those that do not pay dividends. Fama and French (2001) report that non payers of dividends tend to be smaller and younger companies with more growth opportunities.

Here we explore if firms that are regular payers of dividends (defined as those that pay dividends in more than 15 years of the whole period) do have a different likelihood of rounding dividends when compared to those companies that do not pay dividends regularly (defined as those who pay dividends in at least one and in no more than 15 years of the period considered). Panel A of Table 6 shows that the regular payers of dividends present a lower likelihood of heaping dividends in all of the three intervals considered. In all cases the differences are statistically significant. As a robustness test we split the sample in three groups and report the results in Panel B of Table 6. The first group, composed by firms that pay dividends in one to ten years, shows again higher likelihood of paying dividends across all of the intervals considered. At the same time, third group, composed by firms that pay dividends in twenty one to thirty years, shows the lower likelihood of paying dividends across all of the intervals considered. Again all the differences in likelihood of rounding dividends are significant for all of the intervals.

Panel C of Table 6 shows the likelihood of heaping dividends for regular and non-regular payers but splitting the sample in three decades. Here we can appreciate how the differences in likelihood of heaping between the two groups of firms has been decreasing across time, to became less significant in the last period for all of the intervals considered. In all the cases the difference decreases mainly due to an increase over time of the likelihood of heaping dividends among the regular payers of dividends. The results reported in Panel C are consistent with what report in Figure 3. The results reported in Table 6 give support to our Hypothesis 3.

4.5. Evolution of the Propensity to Heap over Time

In this section we explore if the evolution of the propensity to heap dividends over time is fully explained by the evolution of the explanatory variables we have identified. Inspired by both Fama and French (2001) and also Denis and Osobov (2008), we perform a logit regression over a period of reference and use the estimated parameters of that regression to obtain the "expected likelihood of heaping" using out of sample data for the set of dependent variables already described before. Then we compare the "actual likelihood of heaping" observed for those periods against the "expected likelihood of heaping" to verify if the evolution of the likelihood of heaping is fully explained by how the dependent variables evolve from one period to the other or not.

Table 7 reports the results of defining the period 1990-1999 as the base period and the periods 2000-2009 and 2010-2019 as the out of sample periods. What we observe here for the 2 cents intervals is that the expected likelihood of heaping is much smaller than the actual likelihood of heaping observed in the two out of sample periods. The observed difference here is very significant. In the 5 cents interval the expected likelihood of heaping in the two out of sample periods is just a little bit higher than the actual likelihood of heaping observed. The difference here is smaller and less significant than in the other periods. In the 10 cent interval the expected likelihood of heaping in the two out of sample periods is higher than the actual likelihood of heaping observed and the difference here is also significant. The evidence provided by Table 7, in particular in the case of the 2 cents and 10 cents intervals suggests that the evolution of the propensity to heap dividends over time is not fully explained by the evolution of the explanatory variables we have. These results give support to our Hypothesis 4.

Table 8 reports the results of defining our out of sample period as each year from 1995 to 2019 and defining in each case the base period as the five-year period before each of those years. We compute for each out of sample year the expected likelihood of heaping dividends and compare it against the actual likelihood of heaping those dividends observed. Here we observe that for the 2 cents interval the expected likelihood of heaping dividends is smaller than the actual likelihood of heaping dividends in 19 out of the 25 years considered, suggesting that there is an increase in the propensity to heap dividends not fully explained by the evolution of the explanatory variables considered. On the other hand, for the 10 cents interval the expected likelihood of heaping dividends is higher than the actual likelihood of heaping dividends in 17 out of the 25 years considered, suggesting that there is a decrease in the propensity to heap dividends not fully explained by the evolution of the explanatory variables considered. These results, in particular those for the 2 cents and 10 cents intervals give support to our Hypothesis 4.

5. Conclusions

In this article, we contribute to a branch of the finance literature that examines cognitive biases that influence dividend distributions. Specifically, we study a cognitive bias known as heaping dividends and provide new evidence on variables that allow to explain the likelihood of heaping dividends by a firm.

We start by verifying that, as shown by previous studies, there is a strong relationship between the likelihood of heaping and variables such as the size of the dividend and several information uncertainty measures. One contribution of this paper is that we include to the set of information variables two variables originally mentioned by Zhang (2006) but not included in previous studies exploring heaping of dividends. These additional variables prove to be relevant, as shown by Table 2.

Following Fama and French (2001) and Denis and Osobov (2008), we consider several measures of firm characteristics that provide financial information of the companies. As shown by Table 3 Panel B, we verify that the variables P/B, Growth Assets, ROE, and RE/BE are all strongly significant and negatively related to heaping, while only the variable Ln(Asset) is positively and significantly related to heaping. This evidence gives strong support to our Hypothesis 1.

In Section 4.3 we combine the three set of independent variables that explain rounding in the distribution of dividends: dividend size, information uncertainty variables faced by management and the characteristics of the firms. The results reported in Table 4 and Table 5 allow us to reject the hypothesis that each set of variables are not useful to explain the likelihood of heaping dividends by the companies of the sample. The results give support to Hypothesis 2.

In Section 4.4 we explore if firms that are regular payers of dividends (defined as those that pay dividends in more than 15 years of the whole period) do have a different likelihood of rounding dividends when compared to those companies that do not pay dividends regularly (defined as those who pay dividends from one to 15 years of the period considered). We verify that the regular payers of dividends present a lower likelihood of heaping dividends in all of the three intervals considered, and in all of the cases the differences are statistically significant. We also verify that the differences in likelihood of heaping between the two groups of firms has been decreasing across time, to became non-significant in the last period for all of the intervals considered. In all the cases the difference decreases mainly due to an increase over time of the likelihood of heaping dividends among the regular payers of dividends. The results, reported in both Table 6 and also Figure 3, give support to our Hypothesis 3.

Finally, in Section 4.5 we explore if the evolution of the propensity to heap dividends over time is fully explained by the evolution of the explanatory variables we have identified. In Table 7 we define a base period compose by years 1990 to 1999 and two out of sample periods which are 2000-2009 and 2010-2019. We observe here for the 2 cents intervals that the expected likelihood of heaping is much smaller than the actual likelihood of heaping observed in the two out of sample periods. The observed differences here are very significant.

In the 10 cent interval the expected likelihood of heaping in the two out of sample periods is higher than the actual likelihood of heaping observed and the difference here is also very significant. These results give support to our Hypothesis 4. Table 8 reports the results of defining our out of sample period as each year from 1995 to 2019 and defining in each case the base period as the five years period before each of those years. Here we observe that for the 2 cents interval the expected likelihood of heaping dividends is smaller than the actual likelihood of heaping dividends in 19 out of the 25 years considered, suggesting that there is an increase in the propensity to heap dividends not fully explained by the evolution of the explanatory variables considered. On the other hand, for the 10 cents interval the expected likelihood of heaping dividends is higher than the actual likelihood of heaping dividends in 17 out of the 25 years considered, suggesting that there is a decrease in the propensity to heap dividends not fully explained by the evolution of the explanatory variables considered. These results give support to our Hypothesis 4.

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Figure 1. Percentage of dividends heaped and dividend size, by year

This figure presents the full sample of dividends per share from 1990 through 2019, for a sample of US companies. 2 cent-intervals, 5 cent-intervals, and 10 cent-intervals are indicator variables taking values of one if the dividend is heaped based on the three different heaping categories: (1) multiples of 2 cents ($0.02, $0.04, $0.06, etc.), (2) multiples of 5 cents ($0.05, $0.10, $0.15, etc.), (3) multiples of 10 cents ($0.10, $0.20, $0.30, etc.), and zero otherwise. We also report here the evolution of the average DPS per year, in US dollars. Stocks with a price smaller than $5, and DPS higher than $5, are excluded from the sample.

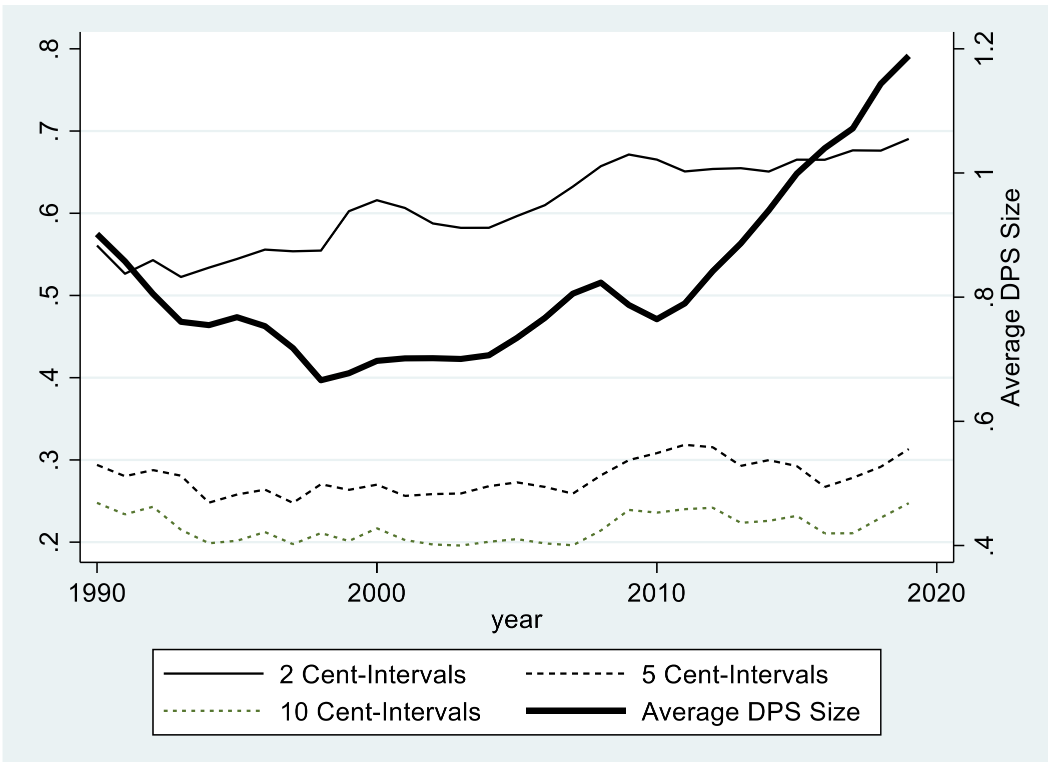

Figure 2. Percentage of dividends heaped and narrow DPS size, by year

This figure presents the third quintile of the full sample of dividends per share heaped to three different categories, and the dividend per share size from 1990 through 2019. 2 cent-intervals, 5 cent-intervals, and 10 cent-intervals are indicator variables taking values of one if the dividend is heaped based on the three different heaping categories: (1) multiples of 2 cents ($0.02, $0.04, $0.06, etc.), (2) multiples of 5 cents ($0.05, $0.10, $0.15, etc.), (3) multiples of 10 cents ($0.10, $0.20, $0.30, etc.), and zero otherwise. The narrow size band represents the average DPS size, for the third quintile over time, in US dollars.

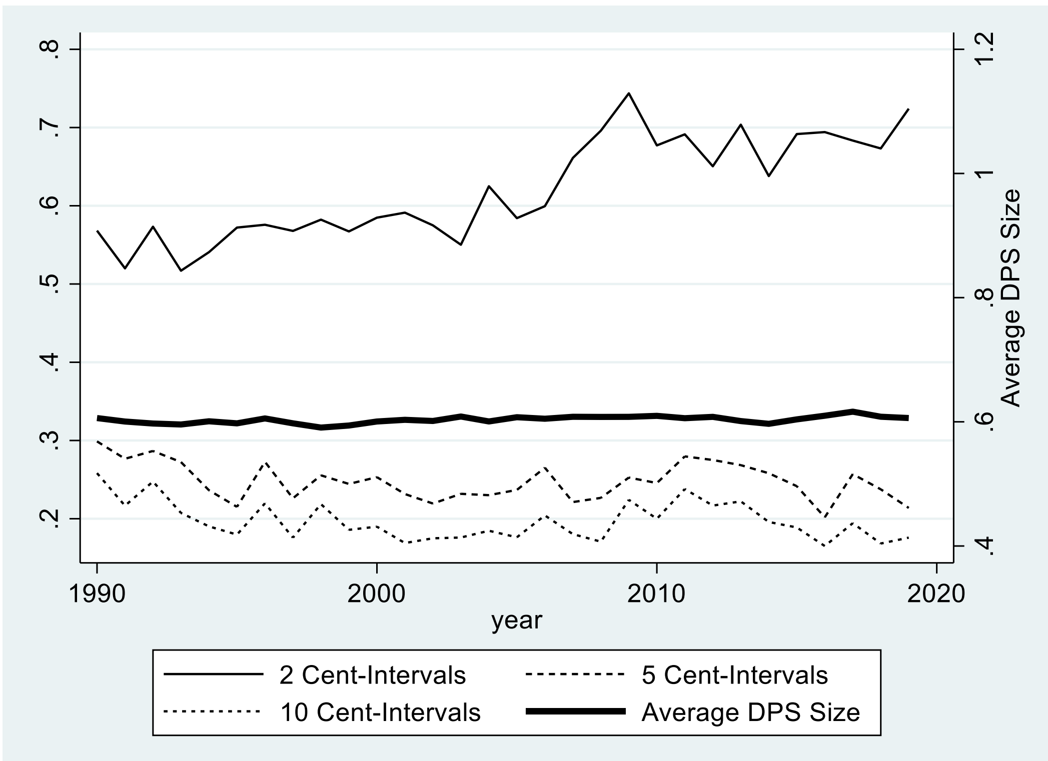

Figure 3. Heaping of Dividends of Regular and Non-Regular Payers

We present the evolution of the proportion of firms that heap dividends grouping them in two categories: regular payers and non-regular payers. Regular payers are those firms that regularly pay dividends (those who paid more than 15 dividends over the whole study period). Non regular payers are those firms that do not pay dividends regularly (those who paid 15 dividends or less over the whole study period).

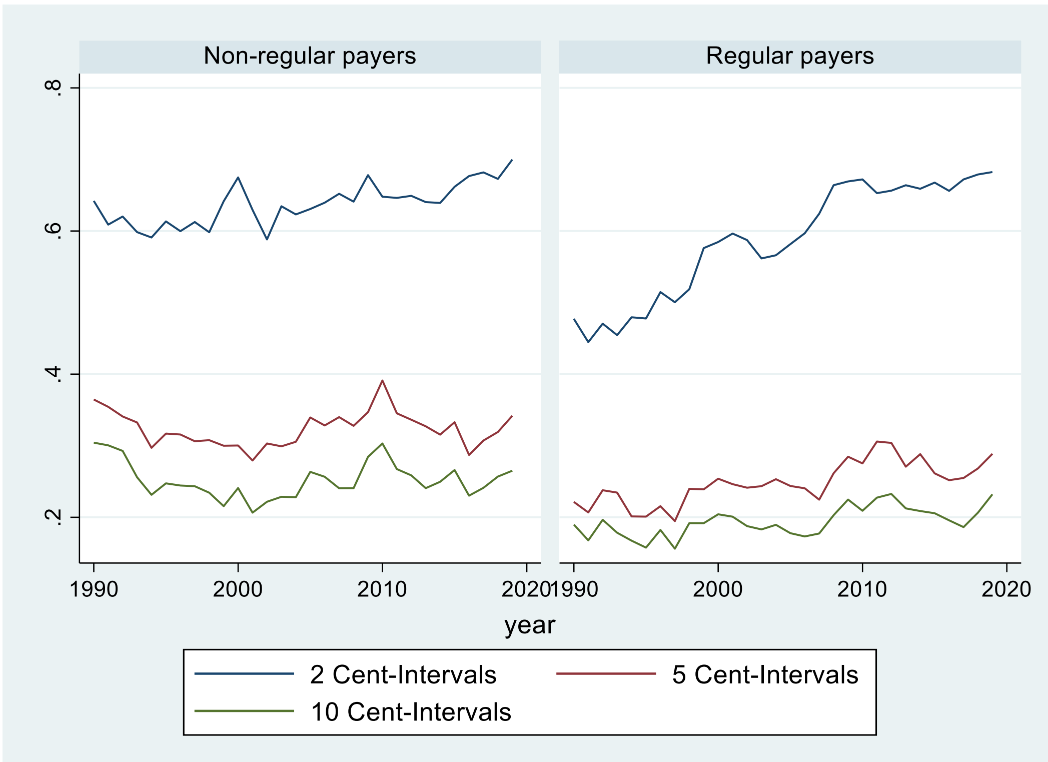

Table 1. Heaping of Dividends and Dividend Size

In Panel A, we report heaping of dividends for each of the three intervals considered, grouping the sample by dividend magnitude. In Panel B, we report heaping of dividends over time, grouping the sample into three periods of ten years each. The average of DPS are expressed in US dollars.

Panel A: By size

	n	Average DPS	2 cent Intervals	5 cent Intervals	10 cent Intervals
< 50 cents	21,585	0.26	59%	26%	19%
50 to <100 cents	14,227	0.71	61%	27%	22%
>= 100 cents	15,160	1.73	62%	31%	25%

Panel B: By period

	n	Average DPS	2 cent Intervals	5 cent Intervals	10 cent Intervals
from 1990 to 1999	18,209	0.76	55%	27%	21%
from 2000 to 2009	16,542	0.74	61%	27%	21%
from 2010 to 2019	16,221	0.97	66%	30%	23%

Table 2. Heaping, Dividend Size and Information Uncertainty Variables

In Panel A we report the statistical summary of the information uncertainty variables considered We report in Panel B the result of logit regressions performed. The dependent variable is a variable taking value of 1 if the dividend is heaped based on each of the three different heaping categories considered: (1) multiples of 2 cents ($0.02, $0.04, $0.06, etc.), (2) multiples of 5 cents ($0.05, $0.10, $0.15, etc.), (3) multiples of 10 cents ($0.10, $0.20, $0.30, etc.), and zero otherwise. The explanatory variables are inverted dividend size (1/DPS), and information uncertainty variables. RET_{t0} computed as the stock return in the year of the dividend. RET_{t1} computed as the stock return of the year following the dividend. Inverted company size (1/MV) computed as the inverse of the market capitalization of the Equity in the year of the dividend. Stock volatility (SIGMA) computed as the monthly stock standard deviation on the year of the dividend. Inverse of company age (1/AGE) represents the inverse of the number of years since the firm was listed. Volatility of cash flows (CVOL) represents the standard deviation of operational cash flows over assets in the last 5 years. Analyst coverage (COV) is the number of analysts following the firm in the year of the dividend. Forecast dispersion (DISP) is computed as the coefficient of variation of all the Forecasted EPS. Stocks with a price below $5, and DPS higher than $5, are excluded from the sample. All the explanatory variables have been standardized. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively. Fix effects: Industry and year. All variables relative to information uncertainty have been winsorized at the 1% level to reduce the influence of outliers.

Panel A: Statistical summary.

		n	Mean	Std. Dev.	Min	Max
RET_{t0}	*%*	45,554	11.67	29.83	-53.66	133.33
RET_{t1}	*%*	47,018	10.25	29.86	-63.95	119.71
MV	*mill USD*	48,609	4,551	11,100	18	106,000
SIGMA	*%*	47,927	7.63	3.50	2.21	21.68
AGE	*years*	42,697	30	27	0	124
CVOL	*%*	32,259	4.48	4.05	0.17	27.49
COV	*u*	39,244	9	8	1	53
DISP	*%*	34,212	4.83	8.34	0.00	83.87

Panel B: Logit regressions.

	2 Cent. Intervals	5 Cent. Intervals	10 Cent. Intervals
1/DPS	-0.131***	-0.282***	-0.574***
RET_{t0}	-0.097***	-0.01	-0.03
RET_{t1}	-0.112***	-0.034*	-0.038*
1/MV	0.08	-0.116*	-0.03
SIGMA	0.129***	0.133***	0.169***
1/AGE	0.01	0.084***	0.090***
CVOL	0.02	0.041**	0.03
COV	0.074***	0.01	0.01
DISP	0.077***	0.088***	0.099***
Intercept	-1.10	-1.12	-1.28
Pseudo R2	0.023	0.017	0.024
N	18566	18566	18566

Table 3. Heaping, Dividend Size and the Firm Characteristics

In Panel A we report the statistical summary of the firm characteristics variables considered. Panel B reports logit regressions. The dependent variable is a variable taking value of 1 if the dividend is heaped based on each of the following three different heaping categories: (1) multiples of 2 cents ($0.02, $0.04, $0.06, etc.), (2) multiples of 5 cents ($0.05, $0.10, $0.15, etc.), (3) multiples of 10 cents ($0.10, $0.20, $0.30, etc.), and zero otherwise. The explanatory variables are inverted dividend size (1/DPS), and the characteristics of the firms. ROA is measured as the ratio of earnings before interests but after tax to the book value of average of last year's and current year's total assets. ROE is measured as the ratio of earnings to the book value of average of last year's and current year's common equity. P/B is measured as the ratio of the market price (year-end) of the firm to book value per share of total equity. Firm size Ln(Asset) is measured as log normal value of the book value of total assets in millions of US dollars. Earned equity (RE/BE) is measured as the ratio of retained earnings to total book equity. Stocks with a price lower than $5, and DPS higher than $5, are excluded from the sample. All the explanatory variables have been standardized. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively. Fix effects: Industry and year. All variables relative to the characteristics of the firms have been winsorized at the 1% level to reduce the influence of outliers.

Panel A: Statistical summary.

		n	Mean	Std. Dev.	Min	Max
ROA	*%*	47,985	5.53	5.34	-9.60	31.57
ROE	*%*	48,020	12.88	12.33	-33.95	97.24
P/B		47,859	2.49	2.17	0.47	20.20
Asset Growth	*%*	46,187	10.12	17.86	-26.73	131.31
Total Assets	*mill USD*	49,426	7,172	17,800	27	187,000
RE/EB	*%*	47,316	58.77	50.14	-150.71	285.40

Panel B: Logit regressions.

	2 Cent. Intervals	5 Cent. Intervals	10 Cent. Intervals
1/DPS	-0.163***	-0.292***	-0.561***
Ln(Asset)	0.053***	0.070***	0.041***
P/B	-0.091***	-0.122***	-0.144***
Asset Growth	-0.059***	-0.049***	-0.059***
ROA	-0.009	0.039*	-0.004
ROE	-0.147***	-0.096***	-0.083***
RE/EB	0.013	-0.096***	-0.088***
Intercept	0.163**	-0.933***	-1.343***
Pseudo R2	0.027	0.020	0.028
N	40353	40353	40353

Table 4. Heaping, Dividend Size, Information Uncertainty Variables, and Firm Characteristic Variables.

We report here logit regressions. The dependent variable is a variable taking value of 1 if the dividend is heaped based on each of the following heaping categories: (1) multiples of 2 cents ($0.02, $0.04, $0.06, etc.), (2) multiples of 5 cents ($0.05, $0.10, $0.15, etc.), (3) multiples of 10 cents ($0.10, $0.20, $0.30, etc.), and zero otherwise. Stocks with a price less than $5, and DPS higher than $5, are excluded from the sample. All the explanatory variables have been standardized. *'s are based on t-statistics. ***, **, * each represents 1%, 5%, and 10% statistical significance, respectively. Fix effects: Industry and year. All variables relative to information uncertainty have been winsorized at the 1% level to reduce the influence of outliers.

	2 Cent. Intervals		5 Cent. Intervals		10 Cent. Intervals	
	Base	Adjusted	Base	Adjusted	Base	Adjusted
1/DPS	-0.155***	-0.154***	-0.358***	-0.357***	-0.640***	-0.635***
Ln(Asset)	-0.110***	-0.089***	0.156***	0.138***	0.105**	0.075**
P/B	-0.079***	-0.086***	-0.077***	-0.068***	-0.106***	-0.103***
Asset Growth	-0.055***	-0.055***	-0.030	-0.029	-0.029	-0.028
ROA	-0.057*	-0.073***	0.026	0.015	-0.001	-0.009
ROE	-0.041		0.000		0.000	
RE/EB	0.006	-0.002	-0.073***	-0.070***	-0.080***	-0.074***
RET t0	-0.077***	-0.079***	0.000	-0.003	-0.027	-0.029
RET t1	-0.105***	-0.103***	-0.035	-0.038	-0.032	-0.035
1/MV	-0.089		-0.014		0.037	
SIGMA	0.103***	0.105***	0.134***	0.134***	0.165***	0.164***
1/AGE	0.082**	0.079**	0.121***	0.123***	0.134***	0.137***
CVOL	0.041**	0.040**	0.050**	0.049**	0.043*	0.042*
COV	0.146***	0.144***	-0.075**	-0.068**	-0.032	-0.025
DISP	0.099***	0.102***	0.087***	0.086***	0.097***	0.097***
Intercept	-1.251	-1.178	-0.959	-0.972	-1.190	-1.214
Pseudo R2	0.030	0.029	0.022	0.022	0.030	0.029
N	15942	16215	15942	16215	15942	16215

Table 5. Wald Chi-square statistic.

In this table we present the Wald chi-square statistic of the regressions performed in table 4, for the set of variables related to the dividend size (1/AGE), characteristics of the firm and for the set of information uncertainly variables. The set of characteristics of the firms correspond to: Ln(Asset), P/B, Asset Growth, ROA, ROE, and RE/EB. The information uncertainly variables correspond to: RET t0, RET t1, 1/MV, SIGMA, 1/AGE, CVOL, COV, and DISP. ***: Wald Chi-square statistic is significant at the 1 percent level.

Set of variables tested	2 Cent. Intervals		5 Cent. Intervals		10 Cent. Intervals	
	Base	Adjusted	Base	Adjusted	Base	Adjusted
Dividend size	36.88***	36.73***	68.87***	69.06***	115.70***	115.86***
Characteristics of the firms	120.93***	126.37***	80.68***	81.77***	87.65***	89.51***
Information uncertainly variables	53.60***	50.90***	46.76***	44.72***	45.04***	41.01***

Table 6. Heaping of the Regular and Non Regular Payers of Dividends

In Panel A, we present the firms that are regular payers of dividends (defined as those that pay dividends in more than 15 years of the whole period) and those that are not regular payers (defined as those who pay dividends in one to 15 years). In Panel B, as a robustness test, we split the sample in three groups: (1) those that pay dividends in one to 10 years, (2) those that pay dividends in 11 to 20 years, and (3) those that pay dividends in 21 to 30 years. Finally, in Panel C, we present the likelihood of heaping dividends for regular and non-regular payers but splitting the sample in three decade periods: 1990-1999; 2000-2009 and 2010-2019.

Panel A

	Firms	Obs.	2 cent Intervals	5 cent Intervals	10 cent Intervals
Non-regular payer	3,056	20,037	63.1%	34.2%	26.0%
Regular payer	1,284	30,935	59.1%	25.4%	19.7%
Difference			3.9%	8.8%	6.3%
p-value			0.001	0.000	0.000

Panel B

	Firms	Obs.	2 cent Intervals	5 cent Intervals	10 cent Intervals
from 1 to 10 years (group 1)	2,518	13,169	63.1%	35.0%	26.5%
from 11 to 20 years (group 2)	938	13,949	62.3%	29.2%	22.9%
from 21 to 30 years (group 3)	884	23,854	58.1%	24.1%	18.7%
Difference between group 1 and group 2			0.9%	5.8%	3.6%
p-value			0.486	0.000	0.002
Difference between group 2 and group 3			4.2%	5.1%	4.2%
p-value			0.001	0.000	0.000

Panel C

	Firms	Obs.	2 cent Intervals	5 cent Intervals	10 cent Intervals
Period 1:					
Non-regular payer	1615	8624	61.2%	33.5%	25.6%
Regular payer	1169	9585	48.6%	21.9%	17.5%
Difference			12.6%	11.6%	8.2%
p-value			0.000	0.000	0.000
Period 2:					
Non-regular payer	1279	4875	63.5%	32.8%	24.4%
Regular payer	1282	11667	60.6%	25.6%	19.6%
Difference			2.9%	7.2%	4.7%
p-value			0.031	0.000	0.000
Period 3:					
Non-regular payer	1242	6538	64.8%	34.3%	26.0%
Regular payer	1124	9683	67.4%	28.1%	21.7%
Difference			-2.6%	6.2%	4.4%
p-value			0.059	0.000	0.000

Table 7. Evolution of the Propensity to Heap Dividends on Each Decade

We perform a logit regression over a base period compose by years 1990 to 1999 and use the estimated parameters of that regression to obtain the "expected likelihood of heaping" using out of sample data for the set of dependent variables already described before. Then we compare the "actual likelihood of heaping" observed for those periods against the "expected likelihood of heaping" to verify if the evolution of the likelihood of heaping is fully explained by how the dependent variables evolve from one period to the other. We define two out of sample periods which are 2000-2009 and 2010-2019.

	2 cent-intervals		5 cent-intervals		10 cent-intervals	
	Period 2000-2009	Period 2010-2019	Period 2000-2009	Period 2010-2019	Period 2000-2009	Period 2010-2019
Number of firms	5658	7693	5658	7693	5658	7693
Expected likelihood	18.1%	17.5%	25.7%	26.2%	27.4%	28.1%
Actual likelihood	61.4%	68.6%	24.6%	28.4%	19.3%	22.4%
Expected - actual	-43.2%	-51.1%	1.2%	-2.1%	8.1%	5.7%
p-value	0.000	0.000	0.051	0.000	0.000	0.000

Table 8. Dynamic Evolution of the Propensity to Heap Dividends from 1995 to 2019

We report the results of defining our out of sample period as each year from 1995 to 2019 and defining in each case the base period as the five-year period before each of those years. We compute for each out of sample year the expected likelihood of heaping dividends and compare it against the actual likelihood of heaping those dividends observed to verify if the evolution of the likelihood of heaping is fully explained by how the dependent variables evolve from one period to the other or not.

Year	2 cent-intervals				5 cent-intervals				10 cent-intervals			
	n	Expected %	Actual %	Expected - Actual	n	Expected %	Actual %	Expected - Actual	n	Expected %	Actual %	Expected - Actual
1995	349	18.69%	56.16%	**-37.47%**	332	22.01%	22.29%	**-0.28%**	319	26.99%	18.18%	**8.81%**
1996	389	15.29%	55.27%	**-39.98%**	389	21.04%	22.11%	**-1.06%**	389	23.09%	17.99%	**5.09%**
1997	426	53.95%	55.40%	**-1.45%**	426	30.20%	23.71%	**6.49%**	426	28.87%	19.72%	**9.15%**
1998	443	48.51%	54.63%	**-6.12%**	443	28.67%	25.28%	**3.39%**	443	22.31%	19.86%	**2.45%**
1999	441	57.37%	61.90%	**-4.53%**	441	24.48%	24.04%	**0.44%**	441	20.91%	19.95%	**0.96%**
2000	399	62.37%	61.65%	**0.71%**	399	25.54%	26.07%	**-0.52%**	399	20.51%	21.30%	**-0.79%**
2001	441	56.01%	59.86%	**-3.86%**	441	23.62%	23.13%	**0.49%**	441	19.17%	18.37%	**0.80%**
2002	484	59.99%	56.82%	**3.17%**	484	28.93%	22.93%	**5.99%**	484	23.86%	17.56%	**6.30%**
2003	519	51.84%	59.54%	**-7.69%**	519	26.48%	23.89%	**2.59%**	519	21.75%	19.27%	**2.49%**
2004	621	58.78%	58.45%	**0.33%**	621	22.92%	23.67%	**-0.75%**	621	20.27%	18.68%	**1.59%**
2005	674	60.01%	60.98%	**-0.97%**	674	26.58%	23.89%	**2.69%**	674	22.31%	18.40%	**3.91%**
2006	719	56.94%	60.22%	**-3.28%**	719	24.53%	26.43%	**-1.90%**	719	19.11%	19.61%	**-0.50%**
2007	700	55.40%	61.71%	**-6.31%**	700	22.44%	22.57%	**-0.13%**	700	16.83%	16.86%	**-0.03%**
2008	591	76.64%	67.17%	**9.47%**	591	37.70%	24.87%	**12.82%**	591	35.01%	20.64%	**14.37%**
2009	510	69.89%	67.25%	**2.64%**	510	30.81%	28.63%	**2.18%**	510	27.89%	23.14%	**4.75%**
2010	648	59.55%	68.67%	**-9.13%**	648	24.83%	28.09%	**-3.25%**	648	18.99%	22.07%	**-3.08%**
2011	687	63.73%	65.50%	**-1.77%**	687	31.27%	30.57%	**0.70%**	687	24.19%	23.44%	**0.75%**
2012	739	62.05%	66.71%	**-4.66%**	739	22.01%	29.50%	**-7.49%**	739	17.48%	22.73%	**-5.25%**
2013	774	61.35%	66.93%	**-5.58%**	774	21.56%	26.74%	**-5.18%**	774	15.83%	20.80%	**-4.97%**
2014	791	65.39%	68.52%	**-3.13%**	791	26.18%	29.08%	**-2.90%**	791	19.21%	22.25%	**-3.04%**
2015	806	69.87%	68.86%	**1.01%**	806	29.91%	28.41%	**1.50%**	806	24.22%	23.08%	**1.14%**
2016	805	63.63%	68.70%	**-5.07%**	805	31.04%	25.34%	**5.70%**	805	24.64%	20.12%	**4.52%**
2017	798	65.30%	69.42%	**-4.12%**	798	30.39%	26.57%	**3.82%**	798	23.66%	21.18%	**2.48%**
2018	819	67.92%	72.16%	**-4.24%**	819	30.06%	29.06%	**1.00%**	819	23.11%	23.93%	**-0.82%**
2019	826	70.85%	70.10%	**0.75%**	826	30.08%	30.39%	**-0.31%**	826	23.70%	24.46%	**-0.76%**