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Business Groups and Herding Behavior during the COVID-19 Pandemic

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Abstract

This article studies whether herding behavior is present in stock returns of business groups during the COVID-19 pandemic in Latin American Integrated Market (MILA), composed by Chile, Colombia, Mexico, and Peru. Using the series of daily prices and daily traded volumes of the shares of the companies affiliated with a business group and that are included in the stock market indices S&P/IPSA (Chile), COLCAP (Colombia), IPC (Mexico) and S&P/BVL (Peru), from January 1, 2010 to October 27, 2021, with the exception of Mexico, we observe herding behavior during COVID-19 in businesses affiliated with business groups in MILA. In addition, from May 2020 onwards, stock behavior shifts to reverse herding. This study also reports that when the market is up herding is stronger during COVID-19. Something similar occurs for low market volatility and low volume of trading.

1. Introduction

Since Goodell (2020), began looking into how COVID-19 might affect financial markets, several studies have been conducted. According to Baig et al. (2020), the rise in COVID-19 instances and fatalities is connected to a notable rise in the illiquidity and volatility of the American stock market. The increase in volatility during this period is confirmed by Albulescu (2020) for this market and by David et al. (2020), who consider 11 major stock indices around the world. Accordingly, Erdem (2020) finds a negative and considerable impact on returns as well as an increase in volatility, contending that investors interpret coronavirus data based on the degree of flexibility that the capital market offers. However, after examining the performance of the US stock market at the industry level, Mazur et al. (2021) find that while the values of stocks in the oil, real estate, entertainment, and hospitality sectors decline, those in the economic sectors of natural gas, food, healthcare, and software experience high positive returns. Nadeem (2020) reports decreasing stock returns for 64 countries as the number of confirmed cases increased. Goodell and

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Duc (2020) study whether US lawmakers traded stocks from late January to February 2020 anticipating that COVID-19 would have a significant impact on the financial market, finding little evidence of abnormal returns until February 26, 2020. According to Topcu and Gulal (2020), the pandemic's negative effects started to progressively fade in mid-April in emerging countries. Akhtaruzzman et al. (2020), report that companies from China and G7 countries have shown significant increases in the conditional correlations for market returns, which means a clear transmission of financial contagion.

Regarding the financial literature on the present pandemic, it has been documented not just how COVID-19 has affected the financial markets but also how participants' behavior has changed as a result. Accordingly, Espinosa-Méndez and Arias (2020) find that COVID-19 boosted herding behavior in the European capital markets, implying that during the pandemic, less informed investors tended to follow the more informed.[1]. This result is in line with the fact that investors, who participate in financial markets, can overcome periods of crisis by adopting herding behavior (Andrikopoulos et al., 2017; Omay and Iren, 2019). However, this behavior may be different in economies with weak internal governance standards and the institutional environment in which companies operate, such as emerging economies in general. Indeed, Indārs et al. (2019) point out that herding behavior is more pronounced in emerging economies compared to developed economies, given that the information in emerging economies is less reliable and less transparent, (Balcilar et al., 2013; Balcilar et al., 2014). Bouri et al. (2021) study 49 global stock markets and report a strong relation between herding behavior and COVID-19 induced market uncertainty. There is a growing literature which links COVID-19 with an increase in volatility and uncertainty in financial markets while others test the presence of herding behavior (Alexakis et al., 2021; Aslam et al., 2021, Fang et al., 2021; Fernandez-Perez et al., 2020; Ferreruela and Mallor, 2021; Sharif et al., 2020; Haldar and Sethi, 2020; Luu and Luong, 2020; Kizys et al., 2021; Milcheva, 2021; Ozkan, 2021; Salisu et al., 2021; Scherf et al., 2021; Wen et al., 2021).

Business groups have some advantages such as: low information asymmetry; low coordination cost and low financial constraints. Furthermore, they overcome market failures. These qualities increase the appeal of their shares on the stock market. The pyramidal ownership structure used by corporate groupings to invest, however (Almeida and Wolfenson, 2006), creates incentives for the major shareholders to drain capital from the minority stockholders (Shleifer and Vishny, 1997). Therefore, we can anticipate investors demanding these stocks in times of significant uncertainty like the COVID-19 pandemic if the advantages of business groups outweigh the disadvantages (wealth transfer).

[1] Herding behavior has been widely studied in different places around the world such as the United States (Nicolis and Sumpter, 2011), Central and East European (Pochea et al., 2017), Germany (Mueller and Brettel, 2012), Spain (Blasco et al., 2012), China (Yao et al., 2014; Xie et al., 2015), South Africa (Guney et al., 2017), Malaysia (Pitluck, 2014), Pakistan (Chaudhry and Sam, 2018), the Gulf Arab stock markets Abu Dhabi, Dubai, Kuwait, Qatar and Saudi Arabia (Balcilar et al., 2013; Balcilar et al., 2014), Poland (Voronkova and Bohl, 2005), the Asian and Latin American markets (Kabir and Shakur, 2018), Israel (Andronikidi and Kallinterakis, 2010), Russia (Indārs et al., 2019) and Greek (Economou et al., 2016), among many others. More recently has emerged various studies that analyze the behavior of financial markets during COVID-19.

Given the above arguments, the main objective of this study is to investigate herding behavior in the stocks of companies controlled by business groups[2] during the COVID-19 pandemic. This article studies business group stocks from regional stock indices of the Latin American Integrated Market make up the sample (MILA). The countries included in MILA are Chile, Colombia, Mexico and Perú. There is empirical evidence that shows integration among stock markets in these countries (Espinosa-Mendez et al., 2017; Godeiro et al., 2017; Sandoval et al., 2016; Mellado and Escobari, 2015) and therefore we may observe some similarities in investing strategies. The data includes only the stocks of firms that belong to business groups and that are indexed in local stock market.

Countries from MILA are chosen because of four major reasons. First, the four Latin American countries grouped in MILA are emerging economies who are primarily financed by commercial banks, institutions that play an important role in the creation of business groups, generating internal capital markets (Jara-Bertín et al., 2015). Second, the business groups in each one of the countries have a high level of ownership concentration (Gonzalez et al., 2017; Lefort and González, 2008: La Porta et al., 1999) but pyramidal ownership structure is not as common as in other countries (Khanna and Yafeh, 2005). Third, the four countries chosen, the French civil law prevails (La Porta et al., 1998; Chong and Lopez-de-Silanes, 2007), which entails weak protection for minority investors, facilitating the formation of business groups. Fourth, a large part of the companies is controlled by family business groups (Duran et al., 2017). All these features make the MILA business groups a conducive setting to study whether these groups are attractive to invest in, during COVID-19.

In order to test the presence of herding behavior in business groups we employ CSAD methodology proposed by Chang et al. (2000) which is widely use in the literature.

Herding behavior in business groups stocks is present in three of the four countries (the exception is Mexico) during COVID-19. Furthermore, all countries exhibit reverse herding during the period in which COVID-19 is absent, with the exception of Peru, which exhibits herding. To corroborate the results, robustness tests are applied. In doing so, three conditions are considered: asymmetric effects of market return, high and low volatility states, and domestic market trading volume (Tan et al., 2008; Mobarek et al., 2014). Results reported are similar to the ones obtained at the beginning. Peruvian firms report non-significant results for high and low volatility. Furthermore, to observe how herding behavior evolves during the presence of COVID-19 pandemic, a rolling estimation is performed using a 100-day window. The findings indicate that beginning in May 2020, herding behavior in the business groups reverses. To investigate this aspect, econometric tests are carried out to observe if the advance of COVID-19 (considering the number of reported cases and the number of deaths) influences the level of herding behavior of business groups. It is found that herding behavior is positively associated to the number of cases and deaths during the COVID-19 window.

[2] In this study we use the definition of business group employed by Jara et al. (2019). business groups are defined as any business organization in which a number of firms are linked through ownership or where a single individual, family, or coalition of families own a number of different firms.

The remainder of the study is structured as follows. Section 2 reviews the literature. Section 3 presents the data and methodology used in the study. Section 4 presents the results and discusses the empirical findings. Section 5 concludes the article.

2. Literature Review

2.1 Herding Behavior during COVID-19

As mentioned by Spyrou (2013) herding behavior concept is present not only in economics and finance but also in other fields, including neurology, psychology, sociology, and zoology. There are several possible explanations for herding, ranging from rational to irrational behavior. Agents may want to preserve their reputation, this could be either rational or irrational (Graham,1999; Rajan, 2006; Scharfstein and Stein, 1990; Trueman, 1994). On the other hand, irrational investors may herd due to their psychological state of mind and sentiments (Baddeley et al., 2004; Keynes, 1936; Barberis et al., 1998). On the other hand, it could also be motivated by rational arbitrage strategies (Shleifer and Summers, 1990) or as a rational choice (Devenow and Welch, 1996; Froot et al., 1992). Finally, Bikhchandani and Sharma (2000) distinguish "spurious herding". This occurs when investors make similar decisions based on a similar set of fundamental information and "intentional herding", when investors mimic the actions of other investors on purpose. These are potential explanations to herding behavior but most of the literature in finance has been focused on detecting the presence of herding behavior, particularly when the world economy faces periods of crisis, showing an important increase in the empirical studies (Choijil et al., 2022).

The focus of this paper is to explore if herding behavior is present during COVD-19 pandemic. Numerous studies have been published since the virus first appeared, and they mostly differ in terms of the area or nation researched. The most relevant articles are Bouri et al. (2021), 49 global markets; Kizys et al. (2021), 72 countries from both developed and emerging economies; Wu et al. (2020), China; Luu and Luong (2020), Taiwan and Vietnam; Espinosa-Méndez and Arias (2020, 2021), Europe and Australia; Fang et al. (2021), Eastern Europe; Wen et al. (2021), Hong Kong; Jabeen et al. (2021), Pakistan. Most of these studies report herding behavior during COVID-19. Wu et al. (2020) report a lower level of herding during COVID-19 for the Chinese stock market compared to other time periods. In Pakistan during the epidemic, Jabeen et al. (2021) did not notice any herding behavior in individual stocks, but they did observe it when they looked at specific economic sectors.

2.2 Business Groups and Herding Behavior

Latin American economies are characterized by weak institutional environments (Singh and Gaur, 2009) and by highly concentrated ownership structure, mainly in the hands of individual shareholders, families, and business groups. They control companies through direct ownership and / or pyramid structures (Buchuk et al., 2014; Silva and Majluf, 2008). Business groups have the advantage of overcoming market failures (e.g., Khanna and Palepu 2000; Khanna and Tice, 2001;

Masulis et al., 2011). Thus, in these economies, business groups dominate the economic scenario (Gaur and Delios, 2015) by mitigating the inefficiencies of the external market and therefore relying on the internal capital market, products, and labor through a network of affiliated but legally independent companies (Pattnaik et al., 2018). Firms that are under the same chain of corporate management in this situation can share information and coordinate both long-term and short-term decisions, as well as transfer resources within the group of companies to which they belong. These elements contribute to a better performance of these firms which is the case of Latin America (Rodriguez and Torres, 2020; Torres et al., 2017). The results provided by Torres et al. (2017) corroborate the bright side theory of internal capital markets for business groups (Khanna and Palepu, 2000; Khanna and Tice, 2001). On the other hand, under the agency theory there are disincentives for investors to buy stocks from business group firms since they will be afraid of wealth redistribution from minority shareholder to major shareholders (Khanna and Yafeh, 2005; Mao et al., 2013). Unfortunately, up to the best of our knowledge, we do not find a theoretical model in the literature which directly tackles the herding behavior associated to business group stocks, considering benefits and costs for minority investors. Nevertheless, we can infer the impact on herding behavior considering market friction reduction, mitigation of asymmetric information problems, good coordination, better resource allocation and wealth transfer among shareholders. Empirical evidence shows a better stock performance in business groups (Guillén, 2000; Khanna and Tice, 2001; Torres et al., 2017). This study hypothesizes that herding is prevalent in the stocks of business groups firms during COVID-19 because the advantages to investing in business group stocks appear to be stronger than the downsides.

COVID-19 shock induces people to be more risk averse. According to Huber et al. (2021), professional investments in the same risky asset were 13% lower in March 2020 than they were in December 2019. They argue that the change in the investment strategy is not explained by changes in believes but by increases in risk aversion.

Business groups have advantages to face better the negative effects associated to the current pandemic compared to those firms that are not controlled by business groups. The fact that businesses have fewer resources accessible and more financial restrictions is a significant issue that arises during this crisis. Since business groups develop internal capital markets then the problem at hand is less severe to them compared to companies which are not affiliated to business groups. Additionally, business groups are well-coordinated, enabling them to react more quickly when their companies need resources. (Gama et al., 2021). On the other hand, firms controlled by business groups have the advantage of sharing information regarding different industries, allowing business groups to make decisions to mitigate the adverse impact of the pandemic on stock returns. In this sense, investors who want stocks from businesses owned by business groups would include higher resource management flexibility, better coordination, and reduced information asymmetry into their expectations. All these characteristics make these types of firms, during pandemic, less risky and more suitable for investors with higher levels of risk aversion given that investors will assume that it is convenient to keep onto their shares during the crisis after they are aware of the identity of the business groups and

are aware of the benefits they give, suggesting the existence of herding behavior in the stocks of these organizations. Herding behavior should not exist in these types of stocks when the market is not in a state of crisis, and it can even be seen reverse herding behavior.

3. Data and Methodology

3.1 Data

The data corresponds to the series of daily prices and daily traded volumes of the shares of the companies listed on the Chilean, Colombian, Mexican and Peruvian stock exchanges and that are part of the main stock market indices of each country: S&P/IPSA, COLCAP, IPC and S&P/BVL Peru, respectively. From this group of companies, only those affiliated to a business group were selected. The time period covers from January 4, 2010 to October 27, 2021. The data begins in 2010 to isolate the effect of the subprime crisis. Thus, the final sample consists of 25 companies and 2,945 observations for Chile, 26 companies and 2,884 observations for Colombia, 28 companies and 2,974 observations for Mexico, and 27 companies and 2,970 observations for Peru.

3.2 Methodology

Following Tan et al. (2008), who argue that herding is more evident with daily data than with weekly or monthly data, daily stock returns are computed as $\mathrm{R_{it}} = \log\left(\frac{P_t}{P_{t-1}}\right) * 100$ from the daily closing price of the shares of the companies in the sample. To detect herding behavior, we use the model proposed by Chang et al. (2000), which is a modification of the original model proposed by Christie and Huang (1995). Chang et al. approach has been widely used in the financial literature (Batmunkh et al., 2020; Espinosa-Méndez and Arias, 2020; Mobarek et al., 2014; Yao et al., 2014; Lao and Singh, 2011; Tan et al., 2008, among other articles). Specifically, Chang et al. (2000) suggest the following cross-sectional absolute deviation (CSAD) model:

$$CSAD_t = \alpha + \gamma_1 \left|R_{m,t}\right| + \gamma_2 \left(R_{m,t}\right)^2 + \varepsilon_t \tag{1}$$

where $R_{m,t}$ is the market return (equal-weighted average stock return) and $CSAD_t$ is a measure of return dispersion computed as:

$$CSAD_{m,t} = \frac{1}{N}\sum_{i=1}^{N}\left|R_{i,t} - R_{m,t}\right| \tag{2}$$

where $\left|R_{i,t} - R_{m,t}\right|$ is the absolute value of the difference between the individual stock return of stock *i*, and the market return. If herding behavior is present in business groups stocks then γ_2 has to be negative and statistically significant.

To assess the effect of COVID-19 the following specification of Eq. (1) is estimated:

$$CSAD_t = \alpha + \gamma_1 D^{covid}\left|R_{m,t}\right| + \gamma_2 D^{covid}\left(R_{m,t}\right)^2 + \gamma_3(1 - D^{covid})\left|R_{m,t}\right| + \\ + \gamma_4(1 - D^{covid})\left(R_{m,t}\right)^2 + \varepsilon_t \quad (3)$$

where $CSAD_t$ is the cross-sectional absolute deviation define in Equation (2), $R_{m,t}$ is the market return, D^{covid} is a dummy variable that takes the value of 1 as of February 28, 2020 (first cases of COVID-19 in MILA markets) onwards and zero in any other date. A negative and statistically significant value of γ_2 would indicate the presence of herding behavior due to COVID-19. In the period where COVID-19 is not present we may expect γ_4 to be either non-significant or positive and significant. In this last case, the stocks exhibit reverse herding behavior. For robustness of the results, other variables are analyzed since they can affect herding behavior: asymmetric effects of market return; high and low volatility states; and high and low domestic market trading volume. First, Demirer and Kutan (2006) point out that dispersions in equity returns are significantly higher during periods of large changes in the aggregate market index. Different authors find that herding behavior is higher when the market is down (Demirer et al., 2010; Lao and Singh, 2011). More recently, Batmunkh et al. (2020) report for Mongolia an asymmetric herding behavior which is more pronounced when the market is down. Second, studies analyze herding behavior in states of high and low volatility (Lam and Qiao, 2015; Vo and Phan, 2019). For example, Tan et al. (2008) find herding behavior in periods of high volatility in the Chinese stock market and Batmunkh et al. (2020) meanwhile find the opposite for Mongolia. Finally, the literature has reported that the level of herding behavior may be associated to trading volume (Tan et al., 2008; Lao and Singh, 2011). They find a stronger herding behavior is higher when the trading volume is high.

Two asymmetric effects of market return are examined, namely rising and falling of stock markets: pre and during COVID-19. In the case of high and low volatility states, it is considered high volatility when the observed volatility becomes higher than the moving average of volatility over the previous 30 days and low volatility when it does not exceed the moving average over the same period (Chang et al., 2000). The volatility is computed as the standard deviation of market return times the square root of 252 trading days. Finally, trading volume is high when the observed volume is higher than the moving average of volume trading over the previous 30 days and low volume when it does not exceed the moving average over the same period.

4. Results

4.1 Descriptive Statistics of the Sample

Table 1 reports the descriptive statistics for the CSAD measure and the market return for the full sample, business groups, and companies that are not affiliated with business groups. The mean values and standard deviations of CSAD are the highest during COVID-19 for all three groups. A higher mean value of CSAD suggests significantly higher market variations across stock returns which may suggest that markets have unusual cross-sectional variations due to unexpected events (Chiang and Zheng, 2010), which is consistent with the significant increase in the standard

deviation of CSAD in the full sample, business groups and companies that are not affiliated with business groups. In the period before COVID-19 the CSAD of business group is statistically and significantly lower than the non-business group, while during COVID-19 there is not significant difference in CSAD between both groups.

Table 1 Descriptive Statistics of CSAD and Market Stock Returns (%)

	Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Chile					
Before COVID-19	CSAD	0.992	0.367	0.001	5.631
	$R_{m,t}$	0.017	1.04	-6.611	7.434
During COVID-19	CSAD	1.586	0.623	0.531	5.695
	$R_{m,t}$	0.059	2.087	-14.154	8.972
Colombia					
Before COVID-19	CSAD	0.931	0.580	0.001	18.130
	$R_{m,t}$	0.044	0.808	-3.271	18.438
During COVID-19	CSAD	1.332	0.905	0.018	7.710
		-0.019	1.568	-11.907	10.329
Mexico					
Before COVID-19	CSAD	1.178	0.517	0.327	9.777
	$R_{m,t}$	0.0383	1.091	-9.028	6.993
During COVID-19	CSAD	1.474	0.746	0.569	8.783
	$R_{m,t}$	0.0408	0.850	-3.807	2.816
Peru					
Before COVID-19	CSAD	1.279	0.594	0.215	7.409
	$R_{m,t}$	0.035	1.123	-13.082	9.392
During COVID-19	CSAD	1.713	0.984	0.485	8.001
	$R_{m,t}$	-0.042	1.888	-10.921	7.045

Notes: This Table reports descriptive statistics of CSAD and y $R_{m.t}$, market return (equal-weighted average stock return) and $CSAD_t$ is the measure of return dispersion defined in equation (2).

4.2 Effect of COVID-19 on Herding Behavior in Business Groups Stocks

Table 2 shows for the period prior to pandemic that three countries show reverse herding (Υ_4 is statistically significant and positive), the exception is Peru that report herding behavior. During COVID-19, herding behavior is present in Chile, Colombia, and Peru. Mexico does not report herding during COVID-19 window.

Table 2 Effect of COVID-19 on Herding Behavior in Business Groups

VARIABLES	*Chile*	*Colombia*	*Mexico*	*Peru*
Y_1	0.449***	0.674***	0.752***	0.682***
	(0.028)	(0.042)	(0.088)	(0.037)
Y_2	-0.016***	-0.012**	-0.019	-0.014*
	(0.005)	(0.006)	(0.037)	(0.007)
Y_3	0.183***	0.473***	0.157***	0.537***
	(0.027)	(0.033)	(0.035)	(0.023)
Y_4	0.020**	0.028***	0.073***	-0.017***
	(0.010)	(0.003)	(0.012)	(0.006)
A	0.854***	0.688***	0.981***	0.892***
	(0.013)	(0.014)	(0.014)	(0.015)
Observations	2,944	2,883	2,973	2,969
R-squared	0.403	0.654	0.484	0.527
t-stat1 (H0:Y1=Y3)	131.6***	182.1***	38.78***	332.9***
t-stat2(H0:Y2=Y4)	7.988***	49.70***	18.67***	5.127***

Notes: This Table reports the results of estimating the Equation (3) $\mathrm{CSAD_t} = \alpha + \gamma_1 \mathrm{D^{covid}}\left|\mathrm{R_{m,t}}\right| + \gamma_2 \mathrm{D^{covid}}\left(\mathrm{R_{m,t}}\right)^2 + \gamma_3\left(1 - \mathrm{D^{covid}}\right)\left|\mathrm{R_{m,t}}\right| + \gamma_4\left(1 - \mathrm{D^{covid}}\right)\left(\mathrm{R_{m,t}}\right)^2 + \varepsilon_t$ where $\mathrm{CSAD_t}$ is the cross-sectional absolute deviation define in Equation (2), $\mathrm{R_{m,t}}$ is the market return calculated as the equal-weighted average stock return, $\mathrm{D^{covid}}$ is a dummy variable that takes the value of 1 from February 28, 2020 onwards and zero in any other case. Between parentheses robust standard errors (Huber-White) are reported. ****, ** and * represent statistically significance at the 1%, 5%, and 10% levels, respectively.

4.2.1 Robustness of the Results

Table 4 reports the results of estimating Equation (3) incorporating the asymmetric effects of market return, high and low volatility state, and high and low domestic market trading volume. Thus, columns 1 and 2 report the results considered asymmetric effects of market return ($Rm_{HIGH}>0$ and $Rm_{LOW}<0$, called "Market Up" and "Market Down" respectively). Column 3 and 4 show the results considered high and low volatility state ($\sigma_{HIGH}>\sigma_{MAt-30}$ and $\sigma_{LOW}<\sigma_{MAt-30}$, called High Volatility and Low Volatility respectively). Column 5 and 6 report the results considering asymmetric effects of high and low domestic market trading volume ($vol_{HIGH}>vol_{MAt-30}$ and $vol_{LOW}<vol_{MAt-30}$, called High Volume and Low Volume respectively). The errors are computed using Huber-White robust standard errors. In general, previous results are confirmed. In business groups herding behavior is present during COVID-19. Regarding the asymmetric effect of market return, it is observed that herding behavior is greater when the market is up compared to when it is down only for Chile and Mexico. The other countries report herding behavior when the market is down. For the asymmetric effect of volatility herding behavior is stronger in the case of low volatility, except for Peru and Mexico. They do not have significant results in both volatility states. Finally, regarding volume trading, herding behavior is stronger when the volume traded are smaller, except for Mexico which is not statistically significant.

Table 3a COVID-19 Asymmetric Effects on Herding Behavior in Business Groups (Chile and Colombia)

	Chile						Colombia					
Coefficients Estimate	*Market Up*	*Market Down*	*High Volatility*	*Low Volatility*	*High Volume*	*Low Volume*	*Market Up*	*Market Down*	*High Volatility*	*Low Volatility*	*High Volume*	*Low Volume*
Y_1	0.520***	0.449***	0.412***	0.781***	0.454***	0.467***	0.667***	0.674***	0.620***	0.827***	0.603***	0.696***
	(0.049)	(0.028)	(0.034)	(0.082)	(0.039)	(0.036)	(0.052)	(0.042)	(0.051)	(0.125)	(0.052)	(0.060)
Y_2	-0.024*	-0.016***	-0.012**	-0.164***	-0.014***	-0.035***	-0.006	-0.012**	-0.008	-0.186**	-0.010	-0.010*
	(0.013)	(0.005)	(0.005)	(0.037)	(0.005)	(0.007)	(0.006)	(0.006)	(0.007)	(0.073)	(0.008)	(0.006)
Y_3	0.202***	0.183***	0.145***	0.123*	0.235***	0.033	0.512***	0.473***	0.288***	0.526***	0.286***	0.528***
	(0.030)	(0.027)	(0.033)	(0.069)	(0.040)	(0.045)	(0.050)	(0.033)	(0.030)	(0.067)	(0.031)	(0.053)
Y_4	0.021**	0.020**	0.024**	0.099**	0.007	0.076***	0.026***	0.028***	0.072***	-0.004	0.069***	0.023***
	(0.009)	(0.010)	(0.011)	(0.041)	(0.012)	(0.022)	(0.003)	(0.003)	(0.007)	(0.051)	(0.004)	(0.003)
a	0.864***	0.854***	0.932***	0.797***	0.899***	0.865***	0.666***	0.688***	0.813***	0.637***	0.797***	0.647***
	(0.016)	(0.013)	(0.019)	(0.020)	(0.023)	(0.017)	(0.021)	(0.014)	(0.018)	(0.015)	(0.019)	(0.018)
Observations	1,509	2,944	1,529	1,166	1,106	1,838	1,533	2,883	1,309	1,325	1,125	1,758
R-squared	0.411	0.403	0.432	0.316	0.435	0.345	0.732	0.654	0.637	0.337	0.575	0.705
t-stat1 (H0:Y1=Y3)	65.47***	131.6***	72.43***	46.61***	70.30***	93.13***	103.3***	182.1***	99.74***	41.83***	101***	89.65***
t-sat1 (H0:Y2=Y4)	5.173***	7.988***	6.027***	15.09***	3.912**	20.14***	32.88***	49.70***	56.57***	3.338**	132.5***	43.15***

Notes: This Table reports the results of estimating Equation (3) $CSAD_t = \alpha + \gamma_1 D^{covid}|R_{m,t}| + \gamma_2 D^{covid}(R_{m,t})^2 + \gamma_3(1 - D^{covid})|R_{m,t}| + \gamma_4(1 - D^{covid})(R_{m,t})^2 + \varepsilon_t$ for Chile and Colombia. $CSAD_t$ is the cross-sectional absolute deviation defined in Equation (2), $R_{m,t}$ is the market return calculated as the equal-weighted average stock return, D^{covid} is a dummy variable that takes the value of 1 from February 28, 2020 onwards and zero in any other case. In each country, Column 1 (Market Up) and 2 (Market Down) report the results considerate asymmetric effects of market return (Rm,t>0 and Rm,t<0, respectively). Column 3 (High Volatility) and 4 (Low Volatility) show the results for high and low volatility state ($\sigma_{HIGH}>\sigma_{MAt\text{-}30}$ and $\sigma_{HIGH}<\sigma_{MAt\text{-}30,}$ respectively). Column 5 (High Volume) and 6 (Low Volume) report the results considering asymmetric effects of high and low domestic market trading volume ($vol_{HIGH}>vol_{MAt\text{-}30}$ and $vol_{LOW}<vol_{MAt\text{-}30,}$ respectively). Between parentheses it is reported robust standard errors (Huber-White). ***, ** and * represent statistically significance at the 1%, 5%, and 10% levels, respectively.

Table 3b COVID-19 Asymmetric Effects on Herding Behavior in Business Groups (Mexico and Peru)

Coefficients Estimate	Market Up	Market Down	High Volatility	Low Volatility	High Volume	Low Volume	Market Up	Market Down	High Volatility	Low Volatility	High Volume	Low Volume
Y_1	0.932***	0.752***	0.885***	0.298***	0.737***	0.756***	0.729***	0.682***	0.640***	0.522***	0.574***	0.751***
	(0.121)	(0.088)	(0.129)	(0.101)	(0.168)	(0.093)	(0.072)	(0.037)	(0.044)	(0.062)	(0.063)	(0.046)
Y_2	-0.145*	-0.019	-0.083	0.098	-0.045	0.018	-0.026	-0.014*	-0.010	-0.004	-0.005	-0.018**
	(0.086)	(0.037)	(0.052)	(0.098)	(0.065)	(0.058)	(0.020)	(0.007)	(0.007)	(0.015)	(0.013)	(0.008)
Y_3	0.236***	0.157***	0.103**	0.128**	0.169***	0.180***	0.513***	0.537***	0.522***	0.418***	0.524***	0.547***
	(0.030)	(0.035)	(0.045)	(0.056)	(0.045)	(0.027)	(0.061)	(0.023)	(0.026)	(0.039)	(0.038)	(0.031)
Y_4	0.050***	0.073***	0.080***	0.097***	0.044***	0.087***	-0.001	-0.017***	-0.022***	0.066***	-0.024***	-0.014
	(0.009)	(0.012)	(0.013)	(0.036)	(0.015)	(0.007)	(0.021)	(0.006)	(0.002)	(0.013)	(0.005)	(0.009)
a	0.952***	0.981***	1.074***	0.954***	1.073***	0.907***	0.900***	0.892***	1.002***	0.864***	1.029***	0.823***
	(0.016)	(0.014)	(0.023)	(0.016)	(0.022)	(0.013)	(0.027)	(0.015)	(0.022)	(0.019)	(0.027)	(0.019)
Observations	1,569	2,973	1,311	1,413	1,266	1,707	1,539	2,969	1,411	1,309	1,045	1,924
R-squared	0.434	0.484	0.526	0.228	0.333	0.627	0.510	0.527	0.559	0.414	0.471	0.572
t-stat1 (H0:Y1=Y3)	48.21***	38.78***	23.77***	4.874***	13.56***	44.38***	64.05***	332.9***	230.1***	73.60***	108.8***	211.5***
t-stat2 (H0:Y2=Y4)	17.36***	18.67***	21.45***	3.580**	5.027***	75.71***	0.807	5.127***	40.53***	12.72***	9.657***	3.606**

Notes: This Table reports the results of estimating Equation (3) $CSAD_t = \alpha + \gamma_1 D^{covid}|R_{m,t}| + \gamma_2 D^{covid}(R_{m,t})^2 + \gamma_3(1 - D^{covid})|R_{m,t}| + \gamma_4(1 - D^{covid})(R_{m,t})^2 + \varepsilon_t$ for Mexico and Peru. $CSAD_t$ is the cross-sectional absolute deviation defined in Equation (2), $R_{m,t}$ is the market return calculated as the equal-weighted average stock return, D^{covid} is a dummy variable that takes the value of 1 from February 28, 2020 onwards and zero in any other case. In each country, Column 1 (Market Up) and 2 (Market Down) report the results considerate asymmetric effects of market return (Rm,t>0 and Rm,t<0, respectively). Column 3 (High Volatility) and 4 (Low Volatility) show the results for high and low volatility state (σHIGH>σMAt-30 and σHIGH< σMAt-30, respectively). Column 5 (High Volume) and 6 (Low Volume) report the results considering asymmetric effects of high and low domestic market trading volume (volHIGH>vol MAt-30 and volLOW<vol MAt-30, respectively). Between parentheses it is reported robust standard errors (Huber-White). ***, ** and * represent statistically significance at the 1%, 5%, and 10% levels, respectively.

Although the results generally support the existence of herding behavior in business groups after COVID-19, there are differences among countries. Mexico shows the weakest results, followed by Peru. One explanation may be that the dummy variable does not reflect the level of uncertainty in the market due to COVID-19, but other factors might be changing at the same time. For example, the coefficient (γ_2) that captures herding behavior is assumed to be constant (Tables 2 and 3) and it could be stochastic. It is also possible that other factors might be impacting stock prices in such a way that may not allow to clearly observe the herding behavior of investors in the time period called COVID-19. One important factor is how uncertainty may change during COVID-19. We will analyze how the herding behavior of business groups stocks behave through time and how it depends on two variables, namely number of cases and number of deaths.

4.3 Herding Behavior during COVID-19 in Business Group

With the aim of investigating herding behavior during COVID-19 in business groups, a rolling window regression methodology is used. A window of 100 days is used to estimate Equation (1). Errors are calculated using Huber-White robust standard errors. Interest is placed on the dynamics of γ_2 during the period from February 28, 2020, to October 27, 2021.

Once the herding coefficients (γ_2) are obtained from the rolling window regression methodology, they are related to the daily number of cases and number of deaths from COVID-19. Thus, specifically, the following model is applied:

$$HB_t = \alpha + \beta_1 HV_t + \beta_2 Vol_t + \beta_3 S\&PMILA_t + \beta_4 S\&P500_t + \varepsilon_t \qquad (4)$$

where HB_t corresponds to herding behavior coefficient (γ_2 from Equation (1)) estimated through rolling window regression methodology of size 100 days; HV_t corresponds to the number of cases (log (num cases)) and number of deaths (log (num deceased)); Vol_t is used to control for local effects and corresponds to the logarithm of the daily volume traded; $S\&PMILA_t$ is used to control for regional effects and corresponds to the return on MILA stock index; $S\&P500$ is used to control for global effects and corresponds to the return on S&P500. The stock market returns (regional and global) and volume traded are control variables. Errors are calculated using Huber-White robust standard errors. The results are shown in Table 4a and Table 4b.

Table 4a shows the results for Chile and Colombia. Models 1 and 2 consider number of cases as the main variable to explain herding sensitivity. As it is observed, only Chile shows a positive and statistically significant relation between the number of cases and herding. Regarding number of deaths (Model 3 and Model 4), Chile shows a positive relation with herding and again the results for Colombia are not statistically significant. Table 4b shows significant associations between number of cases and herding and the same occur with number of death, for both countries, Mexico and Peru. Regarding the control variables results are mixed.

Overall, results confirm that the higher the uncertainty (more cases and more deaths) the stronger becomes herding, showing investors with high risk aversion to protect their resources through investing in business groups stocks.

Table 4a Herding Behavior in Business Group: COVID-19 Cases and Deaths (Chile and Colombia)

	Chile				*Colombia*			
Variables	***Model 1***	***Model 2***	***Model 3***	***Model 4***	***Model 1***	***Model 2***	***Model 3***	***Model 4***
log_cases	0.458**	0.428**			0.470	0.380		
	(0.197)	(0.195)			(0.324)	(0.322)		
log_death			0.409***	0.397***			0.631***	0.484*
			(0.121)	(0.124)			(0.235)	(0.248)
log_volume		0.993**		1.352***		-1.505		-1.803*
		(0.385)		(0.391)		(0.965)		(0.988)
ret_S&PMILA		-0.0414		-0.0407		-0.362		-0.311
		(0.0949)		(0.112)		(0.268)		(0.383)
ret_S&P500		-0.0468		0.0495		0.197		0.244
		(0.119)		(0.154)		(0.361)		(0.446)
Constant	-0.896	-18.99***	1.020**	-23.88***	-2.590	25.57	-1.832*	31.71*
	(1.475)	(7.133)	(0.434)	(7.232)	(2.698)	(18.21)	(1.049)	(18.40)
Observations	412	412	396	396	396	396	386	386
R-squared	0.038	0.056	0.023	0.056	0.005	0.014	0.005	0.016

Notes: This Table reports the results for Chile and Colombia of estimating the Equation $HB_t = \alpha + \beta_1 HV_t + \beta_2 Vol_t + \beta_3 S\&PMILA_t + \beta_4 S\&P500_t + \varepsilon_t$where HB_t corresponds to herding behavior estimated through rolling window regression methodology of size 100 days; HV_t corresponds to the variables number of cases (log (num cases)), β_1, and number of deaths (log (num deaths)), β_2; Vol_t is a control variable corresponding to the logarithm of the daily volume traded, β_3. Robust standard errors (Huber-White) are in parentheses. ***, ** and * represent statistically significance at the 1%, 5%, and 10% levels, respectively.

Table 4b Herding Behavior in Business Group: COVID-19 Cases and Deaths (México and Perú)

	Mexico				*Peru*			
VARIABLES	***Model 1***	***Model 2***	***Model 3***	***Model 4***	***Model 1***	***Model 2***	***Model 3***	***Model 4***
log_cases	1.269***	1.508***			0.785***	0.785***		
	(0.458)	(0.432)			(0.165)	(0.168)		
log_death			1.563***	1.439***			0.836***	0.829***
			(0.488)	(0.507)			(0.177)	(0.179)
log_volume		0.970		0.397		0.493*		0.372
		(1.125)		(1.114)		(0.288)		(0.286)
ret_S&PMILA		-0.822**		-0.464		-0.0121		0.105
		(0.343)		(0.415)		(0.140)		(0.151)
ret_S&P500		-0.0494		-0.417		-0.00248		-0.0372
		(0.520)		(0.459)		(0.167)		(0.174)
Constant	-11.69***	-28.78	-10.75***	-16.08	-4.956***	-9.606***	-3.305***	-6.784**
	(3.809)	(18.15)	(2.926)	(17.87)	(1.116)	(3.148)	(0.782)	(2.800)
Observations	420	420	405	405	408	408	408	408
R-squared	0.025	0.047	0.017	0.026	0.042	0.049	0.047	0.052

Notes: This Table reports the results for Mexico and Peru of estimating the Equation $HB_t = \alpha + \beta_1 HV_t + \beta_2 Vol_t + \beta_3 S\&PMILA_t + \beta_4 S\&P500_t + \varepsilon_t$where HB_t corresponds to herding behavior estimated through rolling window regression methodology of size 100 days; HV_t corresponds to the variables number of cases (log (num cases)), β_1, and number of deaths (log (num deaths)), β_2; Vol_t is a control variable corresponding to the logarithm of the daily volume traded, β_3. Robust standard errors (Huber-White) are in parentheses. ***, ** and * represent statistically significance at the 1%, 5%, and 10% levels, respectively.

5. Discussion

Recent evidence shows that COVID-19 increased herding behavior in the capital markets of developed and emerging economies (Kizys et al., 2021; Bouri et al., 2021; Espinosa-Méndez and Arias, 2020) proving that our initial results are in line with the fact that, at a general level, COVID-19 has caused a behavioral change of the actors that participate in the capital market.

Since the companies affiliated with business groups are part of a network governance model (Singla and George, 2013) which are not only used to transfer resources, but also to seek and monitor strategies and actions of the companies (Lin et al., 2009), learn from other companies in the network (Singla and George, 2013), facilitate access to capital and in turn have greater access to labor and product markets in an easier way compared to companies that are not part of any business group (Khanna and Rivkin, 2001). It is to be expected that under this scenario business groups can make strategic decisions in order to protect the full value of the group by transferring resources and information and also by acting in a more coordinated manner among the companies that comprise it. This coordination is plausible given that several of the companies that belong to business groups participate in the stock market. On the other hand, the lower level of information asymmetry and the higher flexibility in the use of resources allow business group to mitigate the impact on the firm results due COVID-19, which make them to reduce uncertainty and even become more efficient. These particular characteristics are incorporated by investors in their portfolio decisions which is translated in herding behavior. A herding behavior will result from the majority of investors performing a similar analysis and rationally choosing to invest in these groups of companies.

As the uncertainty becomes greater (in the case of COVID-19: first, the number of cases increased; second, the number of deaths raised) herding behavior will increase. On the other hand, Investors interested in business groups' related companies confront less information asymmetry and more flexible resource allocation than investors interested in business groups' non-affiliated enterprises. Thus, under these circumstances, they might be better off following the behaviors of the “most informed”. In fact, under more uncertainty the greater the natural tendency of these investors to follow the beliefs of the market.

The investor will assess business groups considering asymmetric information, agency problems and resource allocation flexibility. Investors will be encouraged to purchase those stocks at times of high uncertainty, such as COVID-19, because the benefits of investing in company groups appear to outweigh the risks associated with wealth-extracting incentives from minority shareholders.

This study has at least two limitations. First, the study is focus on COVID-19 phenomenon and does not allow to generalize the conclusions in terms of herding behavior under pandemic. Second, with a bigger sample it is possible to include more variables that may better explain herding behavior.

6. Concluding Remarks

This article investigates whether herding behavior is present in firms controlled by business groups during the COVID-19 pandemic in four emerging economies like: Chile, Colombia, Mexico, and Peru. Using series of daily prices and daily traded volumes of the shares of the companies listed on the Chilean,

Colombian, Mexican and Peruvian stock exchanges and that are part of the main stock market indices of each country: S&P/IPSA, COLCAP, IPC and S&P/BVL Peru, respectively, from January 1, 2010 to October 27, 2021 and using the model proposed by Chang et al. (2000), which is a modification of the model proposed by Christie and Huang (1995), it is found that herding behavior exists in some Latin American stock markets during COVID-19. The results are robust to different tests (asymmetric market return, asymmetric volatility, and asymmetric volume trading). To analyze in more detail how herding behavior evolves during COVID-19 period we perform a rolling estimation using a 100-day window for business groups, it is found a reverse herding behavior from May 2020 onwards.

This work contributes to the financial literature reporting evidence of how investors in companies controlled by business groups react to an uncertain scenario such as the current COVID-19 pandemic in Latin America. Future lines of research in this area could be focused on better understanding the motives, incentives and determinants that lead to investors to show herding behavior on business groups firms during periods of uncertainty. Others may look other countries, outside Latin America, to observe if the results of this study hold. Finally, the findings of this study are relevant for the financial sector (investors, regulators, brokers), the political sector (government, congress), analysts and academics. In terms of policy making the regulation should not discourage the existence and growth of business groups in Latin America. Some may argue that they destroy wealth of minority shareholders due to agency problem in terms of wealth transfer. However, the literature demonstrates not only the overall advantages of having business groups but also how they can lessen the adverse effects of uncertainty during times of crisis like the COVID-19 pandemic. The regulator can better control the agency issue, for instance, by requiring greater information regarding the ownership pyramid (transparency) and by enforcing larger fines for misconduct.

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