

Original Paper

Why is the Capital Market Opening up and Stock Price Linkage?—Empirical Research Based on “Land-Hong Kong Stock Connect”

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Abstract

Based on the quarterly data of all A-share listed companies from 2011 to 2019, this article uses the multi period double difference model to explore the causes and transmission mechanism of the linkage effect of the stock prices of the two cities after the implementation of the “Land-Hong Kong Stock Connect”. The results show that: first, after the implementation of “Land-Hong Kong Stock Connect”, the degree of herd behavior of domestic investors as a whole becomes higher, and the larger the company scale is, the higher the degree of herd behavior of investors is; secondly, after the implementation of “Land-Hong Kong Stock Connect”, all listed companies have the behavior of internal investors imitating external investors, especially small and medium-sized companies; finally, from the overall sample From the point of view, the imitation behavior of internal investors is indeed conducted through the investor network, but it is divided into three categories: large, medium and small companies. Only the imitation transmission path of large companies is the investor network, and small and medium companies do not realize the imitation behavior through the network. The research of this article is helpful to appeal for rational investment of investors and provide empirical evidence support for further opening of capital market.

Keywords

Land-Hong Kong Stock Connect, herd behavior, imitation theory, investor network density

1. Introduction

Herding behavior in financial market is a kind of special irrational behavior, which means that investors tend to ignore their valuable private information and follow the decision-making mode of most people in the market. Herding behavior shows that in a certain period, a large number of investors adopt the

same investment strategy or have the same preference for specific assets. One of the biggest characteristics of herding behavior is that investors imitate each other. The imitation theory was first developed by Jean Gabriel Tarde pointed out that imitation is the most basic social relationship, and society is a group of individuals who imitate each other. Because of the characteristics of China's capital market, herd behavior is very significant in China.

In order to promote the opening of the capital market and improve the phenomenon of irrational imitation in China, China has successively promulgated the Interim Measures for the administration of domestic securities investment by qualified overseas institutional investors (referred to as QFII), the pilot measures for domestic securities investment by fund management companies and RMB qualified overseas institutional investors of securities companies (referred to as RQFII), and officially launched in November 2014 Shanghai Hong Kong Stock Exchange interconnection mechanism pilot (hereinafter referred to as the "Shanghai-Hong Kong stock connect") was officially launched in December 2016 (hereinafter referred to as the "Shenzhen-Hong Kong stock connect"). In this article, the "Shanghai Hong Kong stock connect" and "Shenzhen-Hong Kong stock connect" is collectively referred to as "Land-Hong Kong stock connect", which will not be described in detail later). The implementation of "Land-Hong Kong stock connect" is another important attempt and Exploration on the road of capital market opening in China after QFII, RQFII and other systems. At the same time, it also provides a good quasi natural experimental environment for the study of the effect of capital market opening. Although the implementation of "Land-Hong Kong Stock Connect" is conducive to promoting the integration of China's capital market and international capital market, it also inevitably brings about the problem of volatility risk of stock price linkage. Now a large number of literature studies have shown that the implementation of "Land-Hong Kong Stock Connect" will increase the stock price linkage between land port and Hong Kong, but the research on the underlying causes of stock price linkage between the two places still exists There is a certain blank. At the same time, overseas institutional investors are considered to have professional teams and have strong ability to obtain and analyze information. Under the condition of information asymmetry, domestic investors may choose to imitate the investment behavior of overseas investors. Is the reason for the stock price linkage after the implementation of "Land-Hong Kong Stock Connect" due to the increase of domestic herding behavior? Is it true that domestic investors imitate foreign investors? This is an important issue in this article.

At the same time, the investor network is one of the important ways for investors to obtain information. Investors can obtain information through the network, observe and imitate the investment behavior of others. Foreign institutional investors have strong ability to obtain and analyze information, which makes it possible for domestic investors to imitate the investment behavior of foreign investors through the network. Therefore, this article further studies whether the internal investors realize their own imitation behavior through the transmission mechanism of investor network.

The results of this study show that: after the implementation of Land-Hong Kong Stock Connect, the degree of herd behavior of the whole investors in China has become higher, and the larger the company

scale is, the higher the degree of herd behavior of investors is; at the same time, there are behaviors of internal investors imitating external investors in all listed companies, but only the imitation transmission path of large companies is the investor network, and the imitation path of small and medium-sized companies has not yet been. It can be seen that further research is needed.

The contribution of this article is as follows: firstly, this article deeply studies the causes of stock price linkage between Hong Kong and land, fills in the gap in the causes of linkage effect, and further deepens the understanding of stock price linkage effect between Hong Kong and land; secondly, this article further explores the transmission path of imitation behavior, and provides some ideas and methods for the follow-up study of this issue. In addition, as an important national pilot project, it is of great practical significance to comprehensively analyze its policy effect. The conclusion of this article provides some enlightenment for calling for rational investment of investors and further opening of capital market.

The follow-up arrangement of this article is as follows: the second part reviews relevant literature and puts forward hypothesis, the third part describes model and research design, the fourth part is empirical results and analysis, and the last part is conclusion and enlightenment.

2. Literature Review and Research Hypotheses

2.1 Herd Behavior in China's Capital Market

Compared with overseas developed capital markets, China's capital market has its own characteristics: the information disclosure system is not perfect, the information is severely asymmetric (Peng, 2000), there are more retail investors among investors, and the speculative atmosphere is heavier (Guo & Wu, 2004), in addition to the fund manager's pursuit of reputation, herd instincts (Song & Wu, 2001), these have provided a petri dish for the breeding of herd behavior, so in China, blindly imitating the trend Phenomenon occurs from time to time. In order to promote the opening of China's capital market and improve domestic irrational investment behavior, on November 5, 2002, the "Interim Measures for the Administration of Domestic Securities Investment by Qualified Foreign Institutional Investors" was officially promulgated. The scale of assets managed by institutional investors began to increase. Its market share is also increasing. Institutional investors are generally considered to have a professional team and strong information analysis and processing capabilities, which can improve the efficiency of stock pricing (Li et al., 2011; Bae et al., 2012; Shi et al., 2009; Rao, 2013), This can alleviate domestic herd behavior, but existing research shows that QFII's entry into the Chinese market has not eased herd behavior in China. Like domestic institutional investors, QFII's herd behavior is also very significant (Liu et al., 2007; Li et al., 2008), the reason why QFII showed significant herd behavior may be that China's capital market was not yet open, the channels for foreign investors to collect information were single, and the information disclosure system of domestic listed companies was incomplete, which led to the concentration of external investors. Invest in listed companies with more standard information disclosure (Liu et al., 2007). Compared with small companies, large companies generally have more

standardized information disclosure and are more inclined to voluntary information disclosure due to high agency costs, large information requirements, and lower costs of preparing and publishing information (Zhong et al., 2005; Liu, 2008; Fang et al., 2009), so foreign capital will also tend to invest in larger companies. This may lead to the phenomenon of “grouping together” by external investors after the implementation of the land-port link mechanism to promote the further opening of the domestic capital market. Therefore, this article proposes the hypothesis H1.

H1: After the implementation of Land-Hong Kong Stock Connect, the degree of domestic herd behavior has increased, and the larger the company scale, the higher the herd behavior.

2.2 Imitation Theory and Land-Hong Kong Stock Connect Mechanism

The founder of imitation theory Jean Gabriel Tarde proposed the following imitation laws in 1890: the law of distance, the closer the distance, the stronger the imitation; the top-down law, the inferior imitates the superior, the lower-level characters imitate the upper-level characters; This opposite style prevails at the same time. One style can replace the other style. Once the old style declines, the new style rises. These three laws also apply in the capital market.

In order to promote the joint development of the mainland and Hong Kong capital markets and the further opening up of the domestic capital market, on April 10, 2014, the China Securities Regulatory Commission officially approved the Shanghai-Hong Kong Stock Connect pilot. On November 17, 2014, the Shanghai-Hong Kong Stock Connect trading system was officially implemented. The first batch of Shanghai-Hong Kong Stock Connect stocks included the SSE 180 Index, SSE 380 Index constituent stocks, and 568 eligible stocks of A + H listed companies. Since the launch of the Shanghai-Hong Kong Stock Connect pilot, the overall operation has been stable and orderly, which has provided valuable experience for the implementation of the Shenzhen-Hong Kong Stock Connect trading system. On December 5, 2016, Shenzhen-Hong Kong Stock Connect was officially launched. The first list of Shenzhen-Hong Kong Stock Connect includes the Shenzhen Component Index, SZSE Small and Medium Innovation Index and 882 eligible stocks listed in the A + H shares. At present, the number of stocks that comply with the land-port link is continuously expanding.

The implementation of the land-port link will help attract foreign capital to flow into the A-share market, improve the valuation system that differs significantly between A-shares and overseas markets, and further increase the vitality of the A-share market. The Hong Kong stock market can be said to be one of the more mature overseas markets. After Shenzhen-Hong Kong Stock Connect cooperates with Shanghai-Hong Kong Stock Connect to fully open the A-share and H-share channels, it is more conducive to the introduction of overseas institutional investors and gradually change the market structure and training led by retail investors. Long-term investment concept. This will promote the integration of domestic capital markets and overseas capital markets (Pang et al., 2017), but this may also enhance the linkage between a country's economy and the international market. Liu et al. (2016) applied the dual differential model to Shanghai-Hong Kong Stock Connect A study on the volatility of A-share prices shows that the Shanghai-Hong Kong Stock Connect trading mechanism not only did not

stabilize the stock price at the beginning of the policy, but played a negative role of “chasing up and down”. This phenomenon is no longer significant after the policy has been fully advanced, Zhang et al. (2014) and Feng et al. (2016) use Granger causality test to confirm that the implementation of the Shanghai-Hong Kong Stock Connect has significantly enhanced the volatility spillover effect of the Shanghai stock market on the Hong Kong stock market, while the implementation of the Shenzhen-Hong Kong Stock Connect has played a role in diverting funds, making Shanghai The correlation between Hong Kong and Hong Kong has been reduced (Pang et al., 2017), but Tang et al. (2018) used Gaussian Copula function and t-Copula function to fit stock index returns. The research results show that in Shanghai-Hong Kong Stock Connect and Shenzhen-Hong Kong Stock Connect Under the China-Hong Kong Stock Connect policy, there is still a synergy effect between the stock markets of the two places. After the Shenzhen-Hong Kong Stock Connect was launched, it was more volatile than the Shanghai-Hong Kong Stock Connect (Duan, 2018, etc.), in the long run, the linkage effect between the two places can be enhanced more (Wang & Dong, 2018). The existing literature has conducted a very comprehensive study on the linkage between the stock markets of the two places after the implementation of the land-port link mechanism. Few literatures have explored the underlying causes of the linkage effect between the stock markets of the mainland and Hong Kong.

According to Tarde’s “Three Laws of Imitation”, the implementation of the land-port link allows a large amount of external funds to flow into the country, and there is no obstacle to the interaction between internal and external funds, so there will be internal and external imitations; external investors are mostly developed market institutional investors with strong information. The ability to collect, analyze, and process, while domestic investors are mainly retail, and the ability to collect, analyze, and process information is weak, so internal investors will imitate the investment behavior of external investors. Due to the imitating behavior of internal investors to external investors, the stock prices of the two places are linked. Therefore, this article proposes hypothesis H2:

H2: One of the reasons for the linkage effect after the implementation of Land-Hong Kong Stock Connect is the existence of internal investors imitating the behavior of external investors.

2.3 Inter-organizational Imitation via Investor Networks

The investor network is an important way to pass information between investors. Investors can not only pass information through the network, but also observe the behavior of other investors through the network. They can influence their investment decisions through their own rational analysis or emotional perception (Xiao et al., 2012). Closely connected investors have stronger correlations in their investment behaviors and are more likely to have herd behavior (Pareek, 2012). They participate in the market through the Internet and observe and imitate each other (Liu & Su, 2016). In fact, inter-organizational imitation is a very common way of organizational behavior. Emerging technologies, management methods, and choices for entering new markets all have inter-organizational imitation (Li-ebberman & Asaba, 2006). For example, in sociology, “Isomorphism of Institutions” (DiMaggio & Powell, 1983), “Embedded Networks” (Granovetter, 1985), Management Cost and Risk Sharing (Levitt

& March, 1988), also in Economics There are also studies such as “herd behavior”-(Chang et al., 1997). For example, Xiao et al. (2012) confirmed that the herd behavior of fund managers in the same network is obvious. Although the subject areas involved are different, these studies have tried to answer the following three questions: imitation motivation, imitation information channels, and imitation behavior patterns. The motivation for imitation has been described above. Since external investors are mostly institutional investors in developed markets and have strong information collection, analysis, and processing capabilities, while domestic investors are mainly retail investors, whose ability to collect, analyze, and process information is weak. In the case of asymmetric market information, internal investors will imitate the behavior of external institutional investors in order to reduce the risk of uncertainty in decision-making. And this article tries to focus on answering the question about imitating information channels: internal investors observe the investment behavior of institutional investors through the investor network to imitate and make their own investment decisions based on the information transmitted on the network, so this article proposes hypothesis H3:

H3: Internal investors imitate external investors through the investor network.

3. Model Description and Research Design

3.1 Sample Selection and Data Source

This article uses the “Top Ten Mobile Shareholder Details” reported in all A-share listed companies from the 2011 mid-term report to the 2019 third quarter report as the initial sample. The data comes from the Choice financial terminal, and the data is processed according to the following steps: First, remove Financial industry, ST company, * ST company sample data; second, remove missing data samples; third, in order to reduce the impact of extreme values, this article performs a winsorize processing on all continuous variable data at the level of 1%, while controlling the industry and quarterly Fixed effects. The standard error of all regression analysis in this article is adjusted at the company level by Cluster-robust. The final sample size was 80,104.

3.2 Herd Behavior

One of the main variables in this article is to use the standard commonly used in the study of herd behavior: standard deviation. This index is used in many literatures such as Song and Wu (2001), Hwang and Salmon (2004), Li, Rhee and Wang (2009) and Li Yu and Yang (2010), etc.

The herd behavior of an investor is defined as the standard deviation of the investor’s holding of each stock position $Herd_{j,t}$, as shown in formula (1). The more consistent investor behavior, the more obvious herd behavior, and the smaller the standard deviation $Herd_{j,t}$.

$$Herd_{j,t} = \sqrt{\frac{\sum_{j=1}^N (\Delta Investors_{j,t} - \overline{\Delta Investors_{j,t}})^2}{N-1}} \quad \#(1)$$

In formula (1), $\Delta Investors_{j,t}$ represents the change in the position of the investor holding the j -th stock in the t -th quarter compared to the previous quarter, $\overline{\Delta Investors_{j,t}}$ indicates the average position change of investors holding the j -th stock in the t -th quarter compared to the previous quarter,

and N indicates non-new investors who hold the j -th stock in the t -th quarter.

Table 1. Variable Definition

variable	meaning	Detailed definition
$\Delta Investors_{j,t}$	Changes in positions of all investors	Investor's position of the j -th stock in the t -th quarter. (unit:%)
$\overline{\Delta Investors}_{j,t}$	Average change in positions of all investors	The average position held by investors in the t -th quarter compared to the previous quarter (unit:%)
$\Delta Ex_investors_{j,t}$	Position changes by outside investors	Positions of external investors in the t -th quarter compared to the previous quarter (unit:%)
$\Delta In_investors_{j,t}$	Changes in positions of internal investors	Positions of internal investors in the t -th quarter compared to the previous quarter for the j -th stock (unit:%)
$Open$	Policy effect	When the company is on the list of dry ports, it is 1 after the year of implementation, otherwise it is 0
$CR_{j,t}$	Current ratio	Current assets divided by current liabilities
$CFO_{j,t}$	Cash flow ratio	Net cash flow from operating activities divided by operating income
$Larshare_{j,t}$	Shareholdings of the top ten shareholders	(Total number of shares held by the top ten shareholders / total share capital) \times 100%
$Ins_{j,t}$	Institutional investor shareholding	(Total number of institutional shares held / total equity) \times 100%
$EPS_{j,t}$	Earnings per share	$\frac{\text{Current net profit attributable to ordinary shareholders}}{\sum(\text{Number of common shares outstanding} \times \text{Number of months issued})/12}$
$TOIPS_{j,t}$	Total operating income per share	Total operating income / end-period paid-in capital (unit: yuan)
$Turnover_{j,t}$	Stock turnover	$\sum \left[\frac{\text{Volume on a single trading day (shares)}}{\text{Total number of current shares (shares)}} \right] \times 100\%$
$ROA_{j,t}$	Return on assets	$\frac{EBIT \times 2}{\text{Total assets at the beginning of the period} + \text{total assets at the end of the period}} \times 100\%$
$Liquidity_{j,t}$	Current assets ratio	Non-current assets divided by total assets
$Lev_{j,t}$	Assets and liabilities	Total liabilities divided by total assets
$Dual$	Two jobs in one	If the chairman and the general manager are the same person, the value is 1; otherwise, it is 0.
$Bsize_{j,t}$	Board size	Natural logarithm of the total number of board members.
$Indep_{j,t}$	Independent director ratio	The number of independent directors divided by the total number of board members.
SOE	Property right	The value is 1 when the company's actual controller is state-owned, otherwise it is 0.
$Age_{j,t}$	Time to market	The natural logarithm of the number of years the company has been listed in the current period.

<i>Brg4</i>	Four audit dummy variables	When the accounting firm hired is “Big Four”, the value is 1; otherwise, it is 0.
<i>size</i>	Asset size	Natural logarithm of total market value of listed companies
<i>Quarter</i>	Quarter dummy variable	
<i>Industry</i>	Industry dummy variables	

3.3 Exploration on the Causes of the Linkage between the Stock Markets of the Mainland and Hong Kong

Before the implementation of Land-Hong Kong Stock Connect mechanism, the inflow of overseas funds into China was only through the QFII mechanism. After the implementation of the Land-Hong Kong Stock Connect mechanism, Hong Kong Securities Clearing Co., Ltd. could be entrusted as a nominal holder. Therefore, the definition of an external investor as a shareholder is “QFII”, “Hong Kong Securities Clearing Co., Ltd.” and “Hong Kong Securities Clearing (Agent) Co., Ltd.” terms, internal investors are defined as all other investors who do not contain these terms in the nature of shareholders. This article uses Li et al. (2010) to study whether there is an indicator of imitation in investors in herd behavior: changes in investor positions to study imitation between internal investment and external investors. For the study of imitation behavior, all investors are divided into external investors and internal investors. Since the implementation of the two policies of Shanghai-Hong Kong Stock Connect and Shenzhen-Hong Kong Stock Connect from 2011 to 2019, that is, the implementation time of the policies is different, a multi-period double difference model is considered, referring to the multi-period DID analysis method of Beck et al. (2010). Its basic form is as follows:

$$\Delta In_investors_{j,t} = \beta_0 + \beta_1 Open \times \Delta Ex_investors_{j,t-1} + \beta ControlVariables_{j,t} + \sum Industry + \sum Quarter + \varepsilon_{j,t} (2)$$

In formula (2), $\Delta In_investors_{j,t}$ represents the change in the position of the internal investor holding the j -th stock in the t -th quarter compared to the previous quarter. $\Delta Ex_investors_{j,t-1}$ represents the change in the position of an external investor holding the j -th stock in the $t - 1$ quarter compared to the previous quarter. $Open$ refers to the effect of the implementation of the land-port link policy. The latter is 1, otherwise it is 0, which indicates the net effect of the policy. In the multi-period DID, due to the different time of policy implementation, there are no *Treat* and *Post* in the model, and the interaction terms $Open$ and $\Delta Ex_investors_{j,t-1}$ can explore the effect of the independent variable on the dependent variable before and after the policy is implemented, which makes the multi-period double difference more flexible. $ControlVariables_{j,t}$ represents a series of control variables, $\sum Industry_i$ and $\sum Quarter_t$ represent the industry and quarterly fixed effects, and $\varepsilon_{j,t}$ represents the residual term. β_1 is the coefficient of main concern. If β_1 is significantly positive, it indicates that one of the reasons for the linkage effect between the stock markets of the two places after Land-Hong Kong Stock Connect is that internal investors imitate external investors; otherwise, it indicates that the linkage effect between the two stock markets is not due to internal investors. Imitation of external

investors.

This article chooses the lagging term of external investors to prevent “pseudo-herd” behavior. “Pseudo-herd” behavior refers to investors taking similar decisions when facing similar decision problems and information sets. Such situations can be understood as investors It happens to be similar decisions, not to imitate each other. Considering that the data selected by Li et al. (2010) is daily data, the data comes from TopView. The data was born on June 1, 2007, and disappeared on January 1, 2009. This article cannot obtain daily data in the same way. Therefore, quarterly data was used instead. Li et al. (2010) adopted data lagging five periods and lagging to eight periods in empirical tests. The conclusion remains unchanged. Considering that quarterly data is used in this article, data lagging one period are selected for research.

3.4 Further Research: The Transmission Path of Herd Imitation—Investor Information Network

In order to explore the transmission path of internal investors imitating external investors, referring to the methods of Xiao (2012) and Crane et al. (2017), whether any two investors jointly hold a large number of shares of any company to establish institutional investors Information networks, specifically, between any two investors, if they jointly hold at least the shares of any of the same companies at the end of the t quarter and the proportion of shares in circulation is 5% or more, they There is an association between them (in the network, two investors are connected by a straight line) to define the network $S(I)$ of this investor I as a set of other investors that are associated with it.

The degree $D(I)$ of the investor I is defined as the number of elements in the investor network $S(I)$. The investor I holding stock j is $I(j)$, and the information network $T(j)$ of stock j is defined as the collection of elements K in the investor information network $S(I(j))$, that is, $T(j) = \{K, I(j) : K \in S(I(j))\}$; for example, stock j was held by two investors at the same time in a quarter with more than 5% of the number of shares outstanding. If you have your own network, then define the stock information network as a collection of these two investor networks.

The network density of stock j is defined as the ratio of the number of edges actually connected between nodes in the network $T(j)$ of stock j to the maximum number of possible edges. The network density of stock j can be expressed as:

$$D_j = \frac{2E_j}{k_j(k_j - 1)} \#(3)$$

Among them, E_j is the number of edges actually connected in the stock information network $T(j)$; k_j is the number of investors in the stock information network $T(j)$.

In order to eliminate the impact of stock market value, this article uses the method of Hong et al. (2000) and Nagel (2005) to perform regression analysis on the stock network density value and its own circulating market value. The specific form is as follows:

$$\ln\left(\frac{D_{jt}}{D_{jt} - 1}\right) = \alpha_t + \beta_t \ln(M_j) + \varepsilon_t \#(4)$$

$$RC_j = \varepsilon_t \#(5)$$

Among them, D_{jt} represents the network density value of each quarter of stock j , and M_j represents the circulating market value of stock j at the end of each quarter. As this article focuses on the information transmission path between domestic and foreign investors after the implementation of Land-Hong Kong Stock Connect, the stocks with external investors from the second quarter of 2014 to the third quarter of 2019 are selected for analysis. The influence of investors is not the influence between internal investors or between external investors, so this article only calculates the network density of stocks containing external investors, and defines RC_j as quarterly stocks containing external investors. The market value adjusted residual network density value is used to measure the degree of information connection and diffusion of external investors in the investor information network. The model established is as follows:

$$\Delta In_investors_{j,t} = \beta_0 + \beta_1 RC_j + \beta_2 Open \times \Delta Ex_investors_{j,t-1} + \beta ControlVariables_{j,t} + \sum Industry + \sum Quarter + \varepsilon_{j,t\#} \quad (6)$$

In formula (6), $\Delta In_investors_{j,t}$ represents the change in the position of the internal investor holding the j -th stock in the t -th quarter compared to the previous quarter, and RC_j is the Stock network density, other variables have the same meaning as in formula (2). β_1 is the main coefficient concerned in this article. If β_1 is not significant, it means that internal investors imitate external investors to increase or decrease their holdings of shares are not related to the information of external investors in the investor network. If β_1 is significant, it means that internal investors imitate external investments. Investors do obtain external investor information through the investor network.

4. Empirical Results and Analysis

4.1 Descriptive Statistics

Table 2. Descriptive Statistics of the Main Variables

Variable	Obs.	Mean	St.dev.	Min	Max
$\Delta Investors_{j,t}$	608,259	0.0944921	1.0988	-59.02	65.2
$\Delta Ex_investors_{j,t}$	14,586	0.0123056	1.33152	-49.61	59.43
$\Delta In_investors_{j,t}$	593,673	0.0965114	1.09238	-59.02	65.2
$CR_{j,t}$	80,104	2.933982	16.71739	-60.95686	4010.502
$CFO_{j,t}$	80,104	0.0778562	1.0543	-171.6743	60.54544
$Larshare_{j,t}$	80,104	59.27207	15.38798	1.310332	244.2684
$Ins_{j,t}$	80,104	30.37312	23.43992	0	113.6913
$EPS_{j,t}$	80,104	0.2405875	0.478414	-7.8872	28.02
$TOIPS_{j,t}$	80,104	3.976601	8.245211	-0.8716874	603.5945
$Turnover_{j,t}$	80,104	166.2583	185.6589	0.0098	2103.539
$ROA_{j,t}$	80,104	3.927247	7.522341	-186.8086	1061.563

$Liquidity_{j,t}$	80,104	42.58784	20.72152	0	99.1321
$Lev_{j,t}$	80,104	41.85416	29.38944	-68.38275	3443.177
SOE	80,104	0.3569565	0.479105	0	1
$Indep_{j,t}$	80,104	18.3547	3.784363	1.904762	46.66667
$Brg4$	80,104	0.0621934	0.241508	0	1
$Dual$	80,104	0.2549029	0.435809	0	1
$Age_{j,t}$	80,104	2.491108	0.63417	0	3.401197
$Bsize_{j,t}$	80,104	2.84886	0.214941	2.079442	4.65396

4.2 Herd Behavior

In order to verify the hypothesis H1, grouping according to *Open*, and then calculating according to formula (1), the value of $Herd_{j,t}$ under the full sample is obtained. This article groups according to the previous literature experience and divides the sample into large Small, medium, and small companies: Sort according to the natural logarithm of the total market capitalization at the end of 2019, and calculate based on the natural logarithm. The natural companies with the largest third in the ranking are large companies, and those with the middle third are For the Chinese company, the lower third is the small company, and calculate the $Herd_{j,t}$ of each group, as shown in Table 3. As shown in Table 3, the value of $Herd_{j,t}$ in the full sample was 35.83879 before the land-port link, and the value of $Herd_{j,t}$ was 31.07442 in the full sample after the land-port link. After the implementation of the Hong Kong Stock Connect mechanism, the overall herd behavior was higher. From the grouping results, the value of the $Herd_{j,t}$ of the three types of companies before the implementation of the land-port link is greater than the value after the implementation of the land-port link, indicating that the degree of herd behavior of these three types of companies is higher than before. The values of $Herd_{j,t}$ for large, medium, and small companies are: 29.49098, 31.05645, and 33.22599 in sequence, indicating that the larger the company size, the higher the degree of herd behavior. This result supports Hypothesis H1: After the implementation of Land-Hong Kong Stock Connect mechanism, the larger the company, the higher the herd behavior's degree.

Table 3. Comparison of Herd Behavior

	Mean	Obs.
<i>Open</i> = 0		
Full sample	35.83879	63,966
Small	35.43541	46,382
Medium	37.0896	14,849
Big	35.88868	2,735
<i>Open</i> = 1		

Full sample	31.07442	16,139
Small	33.22599	2,574
Medium	31.05645	10,183
Big	29.49098	3,382

4.3 Imitation Effect

Because the hypothesis of the dual-slave difference model is the parallel trend, this article uses PSM (Preference Score Matching) to perform one-to-one nearest neighbor matching within the caliper from the control group of the sample and the processing group. The matching radius is 0.01, The balance effect is shown in Table 4.

Table 4. PSM Matching Balance Effect

Variable	Obs.	Mean Difference Test			Standardized Difference Test	
		Treated	Control	T-test	%bias	bias
$CR_{j,t}$	U	2.1073	2.8456	-28.09***	-27.7	95.8
	M	2.1073	2.0762	1.38	1.2	
$CFO_{j,t}$	U	0.11816	0.071	16.91***	15.2	98.1
	M	0.11816	0.11725	0.28	0.3	
$Larshare_{j,t}$	U	63.101	58.314	36.09***	31.4	87.6
	M	63.101	62.506	3.46***	3.9	
$Ins_{j,t}$	U	37.754	28.451	45.87***	39.8	98.2
	M	37.754	37.918	-0.61	-0.7	
$EPS_{j,t}$	U	0.37614	0.20032	61.16***	48.9	88.2
	M	0.37614	0.35534	4.53***	5.8	
$TOIPS_{j,t}$	U	5.0356	3.3656	39.02***	31.1	94.7
	M	5.0356	4.9466	1.34	1.7	
$Turnover_{j,t}$	U	124.25	173.69	-33.08***	-30.8	94.9
	M	124.25	121.74	1.62	1.6	
$ROA_{j,t}$	U	5.0861	3.6291	38.93***	33.1	99
	M	5.0861	5.1007	-0.28	-0.3	
$Liquidity_{j,t}$	U	44.783	42.021	15.22***	13.2	98.6
	M	44.783	44.744	0.16	0.2	
$Lev_{j,t}$	U	45.973	40.345	30.39***	27.3	93.6
	M	45.973	46.334	-1.61	-1.7	
$Indep_{j,t}$	U	18.097	18.405	-9.62***	-8.5	75.1
	M	18.097	18.02	1.92*	2.1	

$Age_{j,t}$	U	2.5334	2.4865	8.6***	7.4	-10.9
	M	2.5334	2.5855	-7.72***	-8.2	
$Bsize_{j,t}$	U	2.9035	2.8338	38.09***	33.2	90.9
	M	2.9035	2.9099	-2.67***	-3	

It can be seen from Table 4 that the difference in the mean value of the feature variables of the two groups after the matching are significantly reduced, and the absolute value of the standardized difference is within 10%. Statistically speaking, the matching satisfies the balance assumption well. At the same time, only a small number of samples (2 in the treat group and 13 in the control group) fell outside the common support domain, which also satisfactorily satisfied the common support hypothesis.

Next, this article performs regression according to formula (2). After the full sample regression, it is also divided into small, medium and large companies according to the scale, and the regression is performed. The results are shown in Table 5.

Table 5. Internal Investors Imitate External Investors

	Full sample	Small	Medium	Big
	$\Delta Investors_{j,t}$			
$Open \times \Delta Ex_investors_{j,t-1}$	0.0353*** (0.00645)	0.0555*** (0.0195)	0.0468*** (0.00759)	0.0259* (0.0132)
$CR_{j,t}$	0.0309 (0.0656)	0.0240 (0.0796)	0.0859 (0.126)	0.133 (0.192)
$CFO_{j,t}$	1.270*** (0.415)	1.019** (0.490)	1.789** (0.825)	0.984 (1.486)
$Larshare_{j,t}$	-0.0541*** (0.0121)	-0.0517*** (0.0175)	-0.0175 (0.0190)	0.00490 (0.0348)
$Ins_{j,t}$	0.108*** (0.00795)	0.119*** (0.0111)	0.117*** (0.0127)	0.0684*** (0.0211)
$EPS_{j,t}$	-2.345*** (0.680)	-2.043* (1.121)	-0.996 (1.008)	-1.456 (1.427)
$TOIPS_{j,t}$	-0.0207 (0.0350)	-0.123** (0.0529)	0.00969 (0.0524)	0.199** (0.0794)
$Turnover_{j,t}$	0.0182*** (0.000827)	0.0170*** (0.000949)	0.0194*** (0.00178)	0.0269*** (0.00469)
$ROA_{j,t}$	-0.0138 (0.0491)	0.0469 (0.0727)	0.0400 (0.0766)	-0.180 (0.126)

<i>Liquidity_{j,t}</i>	0.00574 (0.00838)	0.00346 (0.0108)	0.00615 (0.0145)	0.0352 (0.0249)
<i>Lev_{j,t}</i>	0.0173* (0.0102)	0.0249* (0.0131)	0.0352** (0.0178)	-0.0187 (0.0315)
<i>SOE</i>	1.785*** (0.387)	1.559*** (0.525)	1.856*** (0.626)	1.132 (1.198)
<i>Indep_{j,t}</i>	-0.0944 (0.0574)	0.0238 (0.0760)	-0.207** (0.0914)	0.0425 (0.172)
<i>Brg4</i>	-1.399** (0.653)	0.685 (1.343)	-1.823* (1.031)	0.682 (1.187)
<i>Dual</i>	0.0116 (0.365)	0.698 (0.440)	-0.529 (0.660)	-4.127*** (1.375)
<i>Age_{j,t}</i>	1.854*** (0.344)	2.539*** (0.471)	1.006* (0.563)	2.489** (1.152)
<i>Bsize_{j,t}</i>	-8.216*** (1.016)	-4.902*** (1.414)	-8.697*** (1.645)	-6.433** (2.805)
Constant	134.3*** (5.878)	133.8*** (7.883)	130.1*** (10.11)	49.80*** (19.02)
<i>Quarter</i>	yes	yes	yes	yes
<i>Industry</i>	yes	yes	yes	yes
Obs.	68,014	41,524	21,297	5,193
R ²	0.074	0.088	0.064	0.052

Note. The value of t in parentheses, *, **, *** represent significant levels of 10%, 5% and 1%, respectively, the same below.

As shown in Table 5, in the full sample regression, the coefficient of $Open \times \Delta Ex_investors_{j,t-1}$ is positive and significant at the 1% level, indicating that after the implementation of the land-port link, external investors in the previous period increased holdings, and the internal investors also increased their holdings in the current period. In the previous period, the external investors reduced their holdings, and the current internal investors also reduced holdings. That is, the internal investors did imitate external investments. The $Open \times \Delta Ex_investors_{j,t-1}$ coefficient of the medium company is positive and significant at the 1% level, and the $Open \times \Delta Ex_investors_{j,t-1}$ coefficient of the large company is positive and the 10% level is significant, indicating that small and medium-sized companies have more imitations, and large companies may have invested with qualified foreign institutional investors such as QFII before the implementation of the Shanghai-Hong Kong Stock Connect, and the large companies themselves have higher information collection and analysis capabilities. Although the imitation of newly entered external funds is not as strong as that of small and medium-sized companies,

there is also a more obvious imitation.

In summary, the hypothesis that H2 is confirmed indicates that after the implementation of Land-Hong Kong Stock Connect mechanism, internal investors have imitated the behavior of external investors.

4.4 Conduction of Imitation Behavior: Investor Network

Further research assumes H3. First, calculate the network density of stocks containing external investors according to equations (3), (4) and (5), and then perform regression based on equation (6). The regression results are shown in Table 6.

Table 6. Investor Network Density

Variable	Full sample	Small	Medium	Big
	$\Delta Investors_{j,t}$			
RC_j	1.981*** (-0.668)	1.498 (-1.182)	1.252 (-1.19)	3.388*** (-0.981)
$Open \times \Delta Ex_investors_{j,t-1}$	0.0420*** (-0.0131)	0.0752*** (-0.0242)	0.0226 (-0.0163)	0.0790** (-0.0342)
$CR_{j,t}$	-0.135 (-0.257)	-0.128 (-0.318)	-0.322 (-0.434)	1.059 (-1.141)
$CFO_{j,t}$	1.179 (-1.315)	0.294 (-1.649)	1.775 (-2.369)	5.291 (-4.527)
$Larshare_{j,t}$	-0.00872 (-0.0316)	-0.00198 (-0.0509)	0.0026 (-0.0511)	0.128 (-0.077)
$Ins_{j,t}$	0.0726*** (-0.0189)	0.0467* (-0.0259)	0.0993*** (-0.0307)	0.0278 (-0.0525)
$EPS_{j,t}$	-1.398 (-1.283)	-3.677* (-2.158)	-0.205 (-2.168)	0.491 (-2.039)
$TOIPS_{j,t}$	-0.0671 (-0.066)	-0.172** (-0.0789)	0.0588 (-0.13)	0.00825 (-0.152)
$Turnover_{j,t}$	0.0210*** (-0.00274)	0.0147*** (-0.00311)	0.0248*** (-0.00552)	0.0403** (-0.0154)
$ROA_{j,t}$	-0.104 (-0.119)	0.121 (-0.168)	-0.231 (-0.212)	-0.171 (-0.263)
$Liquidity_{j,t}$	0.0236 (-0.0212)	0.0139 (-0.029)	0.0242 (-0.0357)	0.0503 (-0.0575)
$Lev_{j,t}$	0.0397 (-0.0268)	0.0476 (-0.0359)	0.0367 (-0.0453)	0.0497 (-0.093)
SOE	2.707***	3.121**	2.132	2.46

	(-0.935)	(-1.299)	(-1.591)	(-1.964)
<i>Indep_{j,t}</i>	-0.0258	0.258	-0.142	0.152
	(-0.143)	(-0.223)	(-0.215)	(-0.358)
<i>Brg4</i>	-0.759	-1.068	0.174	3.529
	(-1.115)	(-3.363)	(-1.627)	(-2.726)
<i>Dual</i>	-0.519	-1.8	3.726*	-6.572***
	(-1.071)	(-1.297)	(-2.012)	(-2.271)
<i>Age_{j,t}</i>	0.108	-0.655	0.252	2.043
	(-0.846)	(-1.136)	(-1.329)	(-2.976)
<i>Bsize_{j,t}</i>	-2.993	1.535	-2.034	-4.005
	(-2.638)	(-3.705)	(-4.517)	(-6.193)
Constant	85.59***	115.4***	53.93*	-34.89
	(-18.61)	(-24.74)	(-31.94)	(-53.81)
<i>Quarter</i>	yes	yes	yes	yes
<i>Industry</i>	yes	yes	yes	yes
Obs.	8,602	4,303	3,283	1,016
R ²	0.049	0.066	0.047	0.092

It can be seen from Table 6 that under the entire sample, the residual network density coefficient is positive and significant at the level of 1%, indicating that overall internal investors do obtain external investor information through the investor network density to imitate external investment. However, it can be found that the network residual density coefficient of small and medium companies is positive but not significant, while the network residual density of large companies is significantly positive at the 1% level. The regression results show that the imitation behavior of small and medium-sized companies may not be transmitted through the investor network, but through other channels, the imitation behavior of large companies is indeed transmitted through the investor network.

The reason why the small and medium-sized company's network residual density regression results are not significant may be that there are fewer external institutional investors who invest in small and medium-sized companies. Small and medium-sized companies can obtain less external investor information through the network and have a slower acquisition speed. External investors, and the large companies themselves have a stronger ability to obtain and process information. In addition, external institutional investors are more willing to invest in large companies with more standardized information disclosure, and external investors available in the network. There is more information and the speed of acquisition is faster. Therefore, the investment behavior of internal investors through the network containing external investor information will inevitably exist in reference to the investment behavior of external investors. To sum up, the regression results partially support the hypothesis H3. As for how small and medium-sized companies obtain external investment information, further research is needed.

4.5 Robustness Test

1. The PSM matching radius of 0.01 is used in this article. The main results remain unchanged after changing to 0.005 matching radius.
2. In order to prevent the “pseudo herd” behavior, we use the data that is one period behind. In fact, we try to lag two periods in the test. It is found that the imitation behavior of small and medium-sized companies is still significant, but the imitation behavior of large companies is no longer significant. The possible reason is that due to the limitation of data, the lag period is too long, and large companies can obtain foreign capital information quickly fast response to foreign investment behavior, while the ability of small and medium-sized companies to obtain information is weak and slow, which leads to the situation that small and medium-sized companies are still significant but large companies are no longer significant.
3. In the quarterly reports of listed companies, there are some new investors, which will have a certain impact on the research of herding behavior. The main conclusions of this article remain unchanged after excluding the impact of new investors.

5. Conclusions and Implications

Based on the quarterly data of all A-share listed companies from 2011 to 2019, this article uses the multi period double difference model to explore the causes and transmission mechanism of the linkage effect of the stock prices of the two cities after the implementation of Land-Hong Kong Stock Connect. The results show that: first, after the implementation of “Land-Hong Kong Stock Connect”, the degree of herd behavior of domestic investors as a whole becomes higher, and the larger the company scale is, the higher the degree of herd behavior of investors is; secondly, after the implementation of “Land-Hong Kong Stock Connect”, all listed companies have the behavior of internal investors imitating external investors, and the imitation behavior of small and medium-sized companies is significant; finally, from the overall sample from the point of view, the imitation behavior of internal investors is indeed conducted through the investor network, but it is subdivided into three categories: large, medium and small companies. Only the imitation transmission path of large companies is the investor network, and the imitation path of small and medium companies is unknown, which needs further study.

According to the empirical results, the policy implications of this article are as follows: firstly, the government should further cultivate the investors’ rational investment awareness and reduce irrational imitation; secondly, the government should further standardize the information disclosure system of the company and improve the transparency of the company’s information; finally, the government should speed up the improvement of the supporting system of interconnection and maintain the two ports Stable development of the land.

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