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ORIGINAL RESEARCH

Inclusions and Exclusions of Stocks in Cross-Border Investments: The Case of Stock Connect

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Abstract
How does the market react when more or fewer investors are allowed to trade certain stocks? Stock Connect, a cross-border investment channel between mainland China and Hong Kong, provides a natural testing ground. Investors are allowed to trade a list of qualified stocks from the stock market on the other side, and when a stock is removed from the list, investors can only sell but cannot buy that stock. We find that the inclusion of stocks is correlated with abnormal returns, implying downward-sloping demand curves for stocks. The effect weakens over time and disappears in about 40 trading days. There are no abnormal returns when stocks are removed from the list. On the other hand, when investors can only sell some stocks, they have a significantly higher propensity to sell. Their trading style becomes more contrarian for such stocks, and they tend to trade in small amounts. After 6 months, their investment behavior returns to that before the removal.

Keywords Cross-border investment · Demand curves for stocks · Slow moving capital · Stock connect

JEL Classification F21 · G12 · G14

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1 Introduction

What happens to a stock when its number of potential investors increases? How do investors behave when they are only allowed to sell what they own but not to buy more? Usually, we are not able to answer such unusual questions: the openness of a stock market does not change much over time, and investors, if they are permitted to trade at all, can both buy and sell a stock. Stock Connect, the cross-border investment channel between mainland China and Hong Kong, is an exception. Under the arrangement, investors from one side of the border can trade some but not all stocks on the other side. The list of qualified stocks changes over time, and if a stock is removed from the list, cross-border investors can only sell but not buy more of it.

Focusing on the direction from mainland China to Hong Kong as the data are more available than the other direction, we find some empirical regularities under the unusual setting. First, positive abnormal returns appear around the announcement dates of stock inclusions, and they are positively related to the realized demand changes observed afterwards. It takes about 40 trading days for the abnormal returns to disappear. Second, when stocks are removed from the list and can only be sold by investors from mainland China, they have a much higher propensity to be sold in the first six months after the removal. Investors from mainland China tend to sell in smaller amounts, and in terms of investment style, they also become more contrarian toward such stocks.

Our paper contributes to three different research topics. First, we add to the classic literature on whether demand curves for stocks are downward-sloping. Theoretically, the slope of the demand curve for a stock depends on arbitrage, but in practice, arbitrage is limited by several reasons. Shleifer and Vishny (1997) present a limits-to-arbitrage model to illustrate how capital constraints of arbitrageurs and incomplete information of investors can restrict arbitrage activities. In addition to the balance sheet constraints of financial intermediaries, Duffie (2010) includes search frictions and inattention of investors in the list of explanations for slow-moving capital for arbitrage. Some empirical studies estimate the slope of demand curves by making use of supply shock; examples include secondary equity distribution (Scholes, 1972), expiration of a lockup period (Schultz, 2008), and forced sale of shares under a new public shareholding regulation (Jain et al., 2019). While all these studies offer a clear and measurable increase in supply, they may be endogenous and correlated to the performance of the stocks.[1] Other studies use changes in stock index compositions as demand shocks (Shleifer, 1986; Liu, 2000; Wurgler & Zhuravskaya, 2002; Biktimirov et al., 2004; Petajisto, 2009; Ahern, 2014), and the related theories explaining such price effects are summarized in Afego (2017). One potential problem with using composition changes is that they are not always information free and may be associated with changes in fundamentals. For example, Denis et al. (2003) find that the analysts' earnings per share forecasts around S &P 500 Index revisions and that companies newly added to the Index experience

[1] Stock supply in these studies is not restricted to increase in a short period of time. For example, the secondary distributions used in Scholes (1972) were initiated by shareholders, while the change of regulation used in Jain et al. (2019) allowed blockholders to reduce their shareholding in three years.

significant increases in earnings per share forecasts as well as realized earnings. Merton (1987) and Chen et al. (2004) also argue that index inclusion and deletion change the awareness of investors and thus the required risk premium.

Our study is closer to Kaul et al. (2000) and Neumann and Voetmann (2003) which attempt to investigate the effect of selling or buying pressure on the price under information-free events. Both studies use index weight adjustments instead of changes in stock index compositions as natural experiments. In our case, stocks included in Stock Connect are subject to demand shocks from the mainland Chinese investors that are free from simultaneous changes in fundamentals. As we will discuss in more details later, nearly all stocks in the Hang Seng Composite Index, a broad market benchmark covering about the top 95th percentile of the total market capitalization of companies listed on the Main Board of the Stock Exchange of Hong Kong, are included in the schemes gradually without much selection.

While the demand curves for stocks is a topic that is intensely studied for decades, we think that our papers still makes a significant contribution to the literature. As we will argue below, the cross-border investment channel between Hong Kong and mainland China has many unique features, one of which is the frequent inclusions and exclusions of eligible stocks. They are much “cleaner" than other demand measures used in previous studies, and we think it is worthwhile to point out a new approach to the old question.

The second literature that we contribute is the characterization of investors' behavior. Most studies focus on the differences among domestic, foreign, and institutional investors (see (Grinblatt et al., 1995; Grinblatt & Keloharju, 2000; Choe et al., 1999; Dahlquist & Robertsson, 2004)). In particular, Ng and Wu (2007) find that individual investors in mainland China are mostly contrarian, purchasing more whenever past returns are negative. To our best knowledge, there is no empirical study on how investment style is changed by investment restrictions.[2]

Despite the limitation, our study still extends our understanding of the concept of investment style. We show that the characterization of investors as contrarians or trend followers is not fixed: when constraints are changed, such as when buying is longer possible, investors may become more or less contrarians. The finding implies that investment style is likely to be a choice rather than a constant, and it is particularly relevant for policymakers that try to compare the behavior of domestic and foreign investors.

Our paper also adds to the literature of Stock Connect. Huo and Ahmed (2017), Wang and Chong (2018), Ma et al. (2019) and Li and Chen (2021) examine the stock market co-movement and spillover effect after its implementation.[3] As a related question, Fan and Wang (2017), Burdekin and Siklos (2018), Pan and Chi (2021) and Zhang et al. (2021) investigate whether the strengthened connection can correct

[2] There are studies in behavioural finance that suggest sell-only restrictions matter. For example, neural evidence on regret in investment provided by Frydman et al. (2014) and Frydman and Camerer (2016) imply that not being able to buy will induce anticipated regret, changing the deposition effect of such stocks. Since we do not have investor-level transaction data, we are not able to explore in this direction.

[3] In turn, they are part of a large literature on the co-movement between stock markets in China and Hong Kong, such as Kim and Shin (2000).

the long existing price differential between AH shares, the shares of the same company listed in mainland stock markets and Hong Kong stock market respectively. More recent studies focus on the effect of this partial stock market liberalization on Chinese stock markets, which are largely closed and still developing. Xu et al. (2020), Zhao et al. (2021), Liu et al. (2021) and Li et al. (2022) study the effect on stock market quality including information efficiency, institutional herding and other indicators of market efficiency. Wang (2021), Xiong et al. (2021), Yang et al. (2022), Yang et al. (2022), Sha et al. (2022) examine how listed firms responded to emergence of foreign investors through Stock Connect.

Relatively few studies look at the Hong Kong stock market. For example, Li et al. (2022) show that eligible stocks in Hong Kong do not comove less (i.e., reflect more firm-specific information) after the Stock Connect, implying that stocks in Hong Kong are already informational efficient. We are not using Stock Connect as an event to test for market efficiency, and instead we are focusing on the slope of the demand curve and investors' behavior. Another example is Bai and Chow (2017) who study the market-level reaction of Hong Kong stock market to Stock Connect. We are clearly different by looking at individual stocks.

Despite the different focus, we hope that our paper can encourage more research on the unique features of Stock Connect. As Hong Kong is a financial center that is open to capital flows from all over the world, our paper is also inform policymakers who need to understand how the Hong Kong stock market reacts to demand changes from mainland investors. Our result shows that despite the limited size of capital flow from mainland China, it still makes a noticeable impact on the "global" Hong Kong stock market. If the financial markets in mainland China are liberalized further, policymakers may want to extrapolate our results to a Stock Connect of a larger scale.

2 Institutional Background

Some institutional facts are necessary to understand our empirical strategies. In 2014, China took a major step in liberalizing its financial market. Under the Shanghai-Hong Kong Stock Connect, investors from the two sides are allowed to trade certain securities listed in the other market. A similar arrangement was launched for the Shenzhen Stock Exchange in 2016. As of October 31, 2019, shareholding value of mainland investors was US$129 billion, which was about 3% of the market capitalization of the Hong Kong stock market.[4] The trading is subject to quota limits. An aggregate quota was imposed for Shanghai-Hong Kong connect since inception but was abolished on August 17, 2016 when the usage of aggregate quota for Southbound trading reached around 80%. A daily quota based on a net buy basis is imposed but is rarely binding.

All Hong Kong and other non-mainland investors from the rest of the world are allowed to trade eligible securities in the two Chinese stock exchanges (northbound

[4] The numbers come from The Stock Connect Fact Sheet (November 17, 2014–October 31, 2019) issued by Hong Kong Exchanges and Clearing Limited.

trading) while only institutional investors and individual investors who have an aggregate balance of at least RMB500,000 in their securities and cash accounts can trade in Hong Kong (southbound trading). We focus on the case of Hong Kong stock market as data are more available. In addition, as Chinese stock markets are highly restricted to foreign investors before the launch of the channel, any abnormal returns resulted from Stock Connect can be a result of revaluations to the fair price levels rather than reflecting downward sloping demand curves. In contrast, the Hong Kong stock market is widely considered as more open and efficient.[5]

Eligible stocks in Hong Kong that mainland Chinese investors can trade through Stock Connect mainly come from the Hong Kong Composite Index. Unlike the Hang Seng Index, which is the more well-known market benchmark, whose constituents are selected based on financial performance, Hang Seng Composite Index and its Size Indexes (i.e. LargeCap Index, MidCap Index and SmallCap Index) follow relatively mechanic rules based on turnover and market valuation. Therefore, inclusion in the Hang Seng Composite Index, and hence in Stock Connect, can be viewed as largely information-free.[6]

The criteria for being on the list were jointly announced by The China Securities Regulatory Commission and The Securities and Futures Commission of Hong Kong on April 10, 2014 for the Shanghai-Hong Kong channel and on August 16, 2016 for Shenzhen-Hong Kong channel. The two initial lists of eligible shares were later announced by the corresponding stock exchanges on November 10, 2014 and November 25, 2016 respectively, a few days before the official launch of mutual trading. Hence the announcement effect on returns of stocks included in the initial lists is a market response to the expected, rather than realized, demand shocks. For the rest of the paper, we assume that the demand shocks are largely expected in initial inclusions (more evidence to support this assumption later). After the launch, the lists of eligible shares for the two channels are changed occasionally. Most of these changes are triggered by changes in the constituents of indexes. Hang Seng Family of Indexes are reviewed quarterly and changes of constituents, if any, are effective about three months after. In practice, the mainland exchanges usually announce the change of their inclusion lists on the effective date of constituent changes with immediate effect.[7]

Stocks are removed from the eligible list for several reasons, mostly due to a low market capitalization that results in the stock being dropped from the relevant

[5] Moreover, the foreign shareholding of a stock listed in Chinese stock markets is subject to a limit of 30%. Excess shares are subject to forced sale. This poses an additional uncertainty for foreign investors to trade securities in Northbound trading and thus makes corresponding abnormal returns less clear evidences on the slope of demand curves.

[6] In particular, under the Shanghai-Hong Kong Connect, eligible securities include all the constituent stocks of the Hang Seng Composite LargeCap Index and Hang Seng Composite MidCap Index, and all H-shares that are not included as constituent stocks of the relevant indexes but which have corresponding shares in the form of A-shares listed on SSE (with certain exceptions). The Shenzhen-Hong Kong Connect has nearly the same arrangement, with additional eligible stocks from constituent stocks of the Hang Seng Composite SmallCap Index which have a market capitalization of not less than HK$5 billion (which is roughly US$0.5 billion).

[7] The Shanghai Stock Exchange usually announces changes after the market close on Friday while the Shenzhen Stock Exchange usually announces before the market open on Monday.

indexes. Once a stock is removed from the eligible list, investors can only sell but cannot buy more of it. However, there is no restriction on how long investors can hold on to such stocks. Other investors in the Hong Kong stock market are not subject to the sell-only restriction.

Both channels were subject to an initial daily quota for southbound flow of RMB10.5 billion, which was increased fourfold to RMB42 billion on April 11, 2018. Since the daily quota is based on net buy basis, its usage usually stays at the low side and the quota is rarely binding. The loose quota has an important implication on the current study: since fund flow from mainland rarely hits the quota, only fund flow on the first trading day after inclusion is clearly exogenous. Fund flow in later periods, similar to trading volume, is likely to be related to changes of fundamentals.

3 Data and Methodology

Our data covers all stocks in the Hang Seng Composite Index, including those included under Stock Connect from April 10, 2014 to January 30, 2019. During that period, there are 57 inclusion announcements involving 579 stocks. Since it is typical for stocks being included for both Shenzhen and Shanghai, there are 992 stock-inclusion observations in the sample period. In the sample period, we observe 188 stock-removal involving 142 stocks (a few stocks are removed, re-included and removed again during the sample period).

Equity characteristics including market capitalization, liquidity (a ratio of trading volume to market capitalization), and stock price level are controlled in various estimations. The averages of these variables over a 150-day period ending 30 days before the announcement date of inclusion and removal. All market data are from Bloomberg. We estimate the demand shocks resulted from inclusion and selling strategy from the Central Clearing and Settlement System (CCASS) data. The shareholdings of all mainland investors on a stock are aggregated and reported to the public under the account of CCASS. Therefore, the changes of shareholding of a particular stock by mainland investors can be accurately inferred from the change of daily shareholdings of CCASS. The computation of demand shocks and identification of selling strategy based on the changes of CCASS shareholding would be further discussed in the later sections.

3.1 Demand Shocks, Abnormal Returns Under Inclusions

There are 690 stock-inclusion observations with available data for estimating the baseline model. Table 1 provides some more detail of them. As mentioned, a stock could be included for both Shenzhen and Shanghai. For example, a stock that has been included in Shanghai-Hong Kong Stock Connect can be included in Shenzhen-Hong Kong Stock Connect later. In our sample, we definite the first-time inclusion as first inclusion and the second-time inclusion in another Stock Connect as second inclusion. Out of 690 observations, 429 of them are

Table 1 Summary statistics

All inclusions	690
Times of inclusion	
First inclusion	429
Second inclusion	261
Round of inclusion	
Initial inclusion	583
Subsequent inclusion	107
Included in	
Shenzhen-HK connect	386
Shanghai-HK connect	314
Firm characteristics	
H-share	104
with A-share	80
Avg. H/A premium, 2013	−0.171
Red chip	64
Mainland private enterprise	94
Equity characteristics	
Avg. market capitalization	HK$ 72,746 million
Avg. liquidity (daily trading volume/Mkt Cap)	0.160%
Avg. First-day fund flow	HK$ 4.8 million

*The sum of inclusions for Shenzhen-HK connect and Shanghai-HK connect is greater than the number of all inclusions as some subsequent inclusions are announced for Shenzhen-HK connect and Shanghai-HK connect at the same time

first inclusion while 261 of them are second inclusion. Moreover, Stock Connect started with a long list of included stocks initially and continued to update the list with much smaller number of stocks regularly. We distinguish these two types of inclusions as initial inclusion and subsequent inclusion. In our dataset, majority of observations is the intial inclusion (i.e. 583). Inclusion observations under the two Connects are relative balance. These 690 stock-inclusion observations involved 429 stocks, with many of them are mainland-related companies. We distinguish stocks by the following categories: Hang Seng Index constituent stock, H-share, red chip stock, and non-H-share mainland private enterprises. Lists of corresponding stocks are available in the index company or the stock exchange, except for the status of non-H-share mainland private enterprises. In this case, we use the list prepared by Peng (2015) for listed companies that are incorporated outside mainland China and controlled by mainland individuals. These dummies are included in the estimations for controlling firm characteristics.

The effect of demand shocks from inclusions on abnormal returns is estimated with the following baseline model:

$$AbnRet_i = \alpha + \beta_1 Demand_i + \theta X_i + \epsilon_i. \tag{1}$$

Since market prices should respond to a shock once it is expected, abnormal returns are estimated at the announcement of inclusion (whether the demand shock of the capital influx from Stock Connect was expected, of course, is subject to empirical examination). In particular, abnormal returns in this paper are computed as the difference between the actual returns and expected returns predicted by the CAPM estimated over 150 days ending 30 days before the announcement date. To minimize the noises before the announcement, the cumulative abnormal returns $AbnRet_i$ for firm i for a period over the announcement day and one day after the announcement is used.

The primary variable of interest, $Demand_i$ for firm i is the demand shock. The acquisition of a particular stock by mainland investors can be computed from the change of daily shareholdings of CCASS. We prefer using shares acquisition to fund flow (i.e. shares acquisition multiplied by the stock price) to avoid endogeneity arising from the correlation between stock return and stock price. In this paper, the demand shock of a stock is measured by a ratio of the number of shares acquired under CCASS to its mean daily trading volume to reflect the relative magnitude of demand shocks. To account for the skewness, the square root of the relative demand shocks is used across this study. In particular, the demand shock of stock i is computed as:

$$DemandShock_i = \sqrt{\frac{CCASS_t - CCASS_t - 1}{Avg.TradingVolume}}.$$

As discussed in the later section, we argue that the demand shocks on the first day after inclusion are exogenous and therefore used in the estimations. Such reasoning also applies to demand shocks for a second inclusion. For example, for a stock that has already been included in Shanghai-Hong Kong stock connect and is newly included in Shenzhen-Hong Kong stock connect, only a new acquisition via the Shenzhen-Hong Kong connect is counted as a new acquisition. Since the beginning shareholding must be zero, the shock must be non-negative.

Three sets of control variables are included as X_i in the estimation. First, the momentum effect on demand shock is controlled by the return of the last trading day before the inclusion is announced. The second set of control variables is firm characteristics, including the dummies for Hang Seng Index Constituent, H-share, H-share with A-share issued in Mainland, red-chip, and mainland private enterprise. The final set of control variables includes equity characteristics, including the logarithm of market capitalization, trading volume, and stock price level measured as the average figures before the scheme.

3.2 Trading Style Under Exclusions

The number of removals and removed stocks vary in different specifications due to data availability. We examine two aspects of trading style under exclusions using the CCASS data. Since we do not have the shareholdings of individual mainland investors, and we use changes in the aggregated shareholdings of all mainland investors obtained from CCASS.

We estimate the propensity to sell by comparing the proportion of stocks sold for sell-only stocks and other stocks under Stock Connect.[8] If the net change in shareholding of a stock on a day is negative, it is counted as a net sale of the stock on that day. If the fraction of time for which stocks sold for sell-only stocks is greater goes beyond 50%, the statistic will be above 0.5. More specifically, we define

$$PropensityToSell = \frac{1}{T}\sum_{t=1}^{T} S_t \tag{2}$$

where

$$S_t = \begin{cases} 1, \text{ if } \frac{1}{I}\sum_{i=1}^{I} Sale_{sell-only,i} - \frac{1}{J}\sum_{j=1}^{J} Sale_{other,j} < 0 \\ 0, \text{ otherwise} \end{cases}$$

and $Sale_{sell-only}$ and $Sale_{other}$ are dummy variables.

To characterize investment style, we follow the approach of Grinblatt and Keloharju (2000) and first measure the difference in the average sale between the winner and loser stocks. A negative difference reflects that sales of past loser stocks by mainland investors exceed those of past winner stocks, and it is defined as momentum trading. A positive difference reflects that sales of past winner stocks by mainland investors exceed those of past loser stocks, and it is defined as contrarian trading. Trading strategies generated by returns up to 3 months in the past are reported, and we also look at various percentiles to determine winner and loser stocks. More specifically, a dummy variable D_t is defined as below for time t:

$$D_t = \begin{cases} 1, \text{ if } \frac{1}{N}\sum_{i=1}^{N} Sale_{winner,n} - \frac{1}{M}\sum_{j=1}^{M} Sale_{loser,m} < 0 \\ 0, \text{ otherwise} \end{cases}$$

where $Sale_{winner}$ ($Sale_{loser}$) is a dummy variable that is equal to 1 when a winner stock n (losing stock m) has a negative change in CCASS shareholding, and N and M are the total numbers of winner and loser stocks.

Next, the daily difference of average sale between winner and loser stocks over the sample period is computed as follow:

$$InvestmentStrategy = \frac{1}{T}\sum_{t=1}^{T} D_t. \tag{3}$$

[8] In particular, each day's sell ratio is generated by subtracting the average sell ratio of sell-only stocks with past returns in the winner and loser quartile from the average sell ratio of other stocks with past returns in the winner and loser quartile.

Table 2 Variation in shares acquisition under stock connect

	Equity characteristics			
	Intercept	Market capitalization	Trading volume	Stock price level
Coefficient	0.242***	– 0.093***	– 0.046**	– 0.091***
	(0.013)	(0.010)	(0.019)	(0.010)

	Firm characteristics					
	Mainland Related Enterprises	Red Chip	Mainland Private Enterprises	H-share	H-share with A-share	HA Premium
Coefficient	0.048*	– 0.024	0.032	0.065**	0.103**	– 0.300***
	(0.025)	(0.026)	(0.035)	(0.033)	(0.037)	(0.111)

Regressions in this table are estimated with cross-sectional data including stocks that are included under Stock Connect in the sample period. Demand shocks are regressed on corresponding variable of interests. Variables of interests in the upper and lower panels are equity characteristics and firm characteristics respectively. To isolate the effect of firm characteristics on demand shocks, equity characteristics are controlled in all estimations in the lower panel

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

If the fraction of time for which the net sale difference is negative exceeds 50%, mainland investors are considered to be trading by momentum. Otherwise, they are contrarian.

4 The Effect of Demand Shocks on Abnormal Return

4.1 Abnormal Returns and Expected Demand Shocks

We first examine the demand shocks resulting from the influx of capital under Stock Connect. Table 2 presents the cross-sectional regression results for the demand shocks. We start with the average shares acquisition in the first column of the upper panel. A stock included in Stock Connect had a shares acquisition equals to 5.9% (i.e. 0.242^2) of its trading volume from mainland investors on the first day on average. The rest of the upper panel presents the relationship between equity characteristics and demand shocks. Consistent with an early market report, mainland investors seem more interested in small-cap and mid-cap stocks.

The lower panel of Table 2 explores how demand shocks varies with firm characteristics. To isolate the effect of firm characteristics on demand shocks, equity characteristics are controlled in all estimations in the lower panel. There are three types of mainland-related enterprises listed in Hong Kong stock market according to the classification of HKSE. As shown in the first column of the lower panel,

Table 3 Abnormal returns surrounding the inclusion announcements

	− 2	− 1	Announcement date	+ 1	+ 2
Abnormal returns	0.031 (0.072)	0.328*** (0.080)	0.334*** (0.0122)	0.382*** (0.095)	0.057 (0.085)

This table reports the estimated abnormal returns of the 694 inclusions around the announcement dates. Abnormal returns are computed as the difference between the actual returns and expected returns predicted by the CAPM estimated over 150 days ending 30 days before the announcement date

*significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

Mainland-related enterprises did receive 2.6% points more shares acquisition under Stock Connect with average equity characteristics. Further investigations from the second to the last columns reveal that such a finding is likely a result of arbitrage. In the last column, it is found that a 10% discount of a stock's H-shares over its A-shares results in 1.5% point higher demand shock. Considering the average demand shock was 5.9% of trading turnover, the effect of H/A premium on the demand shock is quite significant. This finding has an important implication for this paper. Since the historical H/A premium is public information at announcements, it is reasonable to assume that demand shocks are widely expected at the announcement dates.

We then examine the abnormal return of inclusion announcement and its relationship with demand shocks. Table 3 presents the average abnormal returns of the 690 inclusions around the announcement dates. Significant abnormal returns are found at the announcement of inclusions and the trading day before and after the announcement. The mean cumulative abnormal return for these three trading days is 1%. Are abnormal returns reported around the announcement dates resulting from a market-wide liquidity effect? If the demand shocks were expected and the demand shocks rather than a market-wide liquidity effect were behind the abnormal returns, abnormal returns should vary with the magnitude of the demand shocks. To formally examine whether expected demand shocks drive abnormal returns, we estimate Eq. 1.

Table 4 presents the estimation results. In the first column, we first estimate the effect of H/A premium on the demand shock with the three sets of controls as in the abnormal return equation. Previous findings on arbitrage-driven demand shock remain valid, although the magnitude with effect is reduced. The second column reproduces the cumulative abnormal returns for a period over the announcement day and one day after the announcement, which is 0.7%. We have already shown that demand shocks are, at least, partly driven by arbitrage motive. As expected, the result in the third column suggests that such arbitrage motive is incorporated in the abnormal return determination. A 1% discount of a firm's H-shares over its A-shares is related to a 2.3% higher abnormal return. To see whether the H/A premium may influence the abnormal returns via channels other than demand shocks, estimation in the fourth column provides a horserace test, and the result supports that the impact of H/A premium on abnormal returns works through demand shocks only. Thus, the H/A premium variable is removed from the estimation in the last column. The

Table 4 Variations in abnormal returns and demand shocks

	Demand shock	(2)	(3)	(4)	(5)
Intercept	1.618*** (0.224)	0.716*** (0.145)	4.486 (2.070)	1.644 (2.067)	2.519 (2.016)
H/A premium	– 0.209** (0.103)		– 2.302* (1.288)	– 1.713 (1.156)	
Demand shock				2.933*** (0.643)	2.992*** (0.650)
Previous return	Y	N	Y	Y	Y
Firm characteristics	Y	N	Y	Y	Y
Equity characteristics	Y	N	Y	Y	Y
Adjusted R^2	0.198	–	0.054	0.109	0.107
# Of observations	690	690	690	690	690

Regression in the first column estimates the effect of H/A premium on the demand shocks while other regressions estimate the effect of demand shocks on abnormal returns by regressing abnormal returns on demand shocks. All regressions except the one in second column are estimated with three sets of control variables. First, the momentum effect on demand shock is controlled by the return of the last trading day before the inclusion is announced. The second set of control variables is firm characteristics, including the dummies for Hang Seng Index Constituent, H-share, H-share with A-share issued in Mainland, red chip, and mainland private enterprise. The final set of control variables includes equity characteristics, including the logarithm of market capitalization, trading volume, and stock price level measured as the average figures before the scheme

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

greater explanatory power of the model estimated in the last column compared to the model in the third column also suggests that the variable of demand shocks is more informative than the H/A premium. It is likely because the demand shocks are driven by arbitrage as well as other motives.

Across the estimations from the third column to the fifth column, intercepts are found to be insignificant. It suggests that a stock included in Stock Connect does not naturally come with an abnormal return unless the inclusion comes with a positive demand shock.

4.2 How Long Do Abnormal Returns Last?

Findings in the literature suggest that buying pressure eases in longer term, but the time horizon varies in different markets. Shleifer (1986), Kaul et al. (2000), and Neumann and Voetmann (2003) find that abnormal returns become insignificant in 4 to 9 weeks in the developed stock markets, but Jain et al. (2019) report a short-lived price pressure in around three weeks in the case of a supply shock in Indian stock market.

In the upper panel of Table 5, the average cumulative abnormal returns of various horizons are presented. The cumulative abnormal return peaked at the 10-day horizon, suggesting a post-inclusion announcement drift beyond the two-day event

Table 5 Long-term abnormal returns

	CAR [0,1]	10-day CAR	15-day CAR	20-day CAR	25-day CAR	30-day CAR	40-day CAR
	Average abnormal returns						
Intercept	0.716***	0.756***	0.488	− 0.174	− 0.151	− 0.231	− 0.038
	(0.145)	(0.267)	(0.343)	(0.388)	(0.465)	(0.508)	(0.617)
	Demand elasticity						
Demand shock	2.992***	6.386***	5.416***	3.653**	4.003**	2.234	0.296
	(0.650)	(1.412)	(1.585)	(1.576)	(1.855)	(1.783)	(2.123)

This table reports the estimated cumulative abnormal returns for various horizons. Demand elasticities for various cumulative abnormal returns are estimated with controls for momentum effect, firm characteristics and equity characteristics

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

window. Then, average cumulative abnormal returns after the 10-day horizon gradually decreased economically and statistically. In the lower panel, the demand elasticity is estimated with the full model. Similar to the result of the average cumulative abnormal return, the demand elasticity further escalates with the post-inclusion drift in the 10-day horizon. The demand curves for included stocks continued to flatten after that and became economically and statistically insignificant in the 40-day horizon. Surprisingly, this result suggests that demand curves are flattened at a similar time horizon across different markets documented in more recent studies:Kaul et al. (2000) find price reversed in 9 weeks in the U.S. market while the estimate of Neumann and Voetmann (2003) is eight weeks for the European market.

4.3 Slopes of Demand Curves

The previous section's main findings support that effect of demand shocks on stock prices cannot be completely arbitraged away, and therefore demand curves for stocks are downward sloping. Previous studies suggest several reasons why arbitrage is not perfect. In this section, to further support our findings, we take a further step to investigate the variation in the slope of the demand curve or price elasticity of demand with several factors suggested in the literature.

4.3.1 Does the Slope Depend on Investor Attention?

Investor attention is suggested as a crucial factor for the initial response to supply and demand shocks (see, for example, the summary provided in (Duffie, 2010)). Simply speaking, investor attention implies that the demand shocks could be absorbed by a limited set of investors. It suggests that investor inattention should result in a more inelastic demand and, thus a greater abnormal return for the same magnitude of a demand shock.

Stocks studied in the previous section were included in Stock Connect differently. These differences can result in different levels of investor attention. First, most of our observations are for first inclusion, but there are also second inclusions in our sample. For example, a stock that has been included in Shanghai-Hong Kong Stock Connect can be included in Shenzhen-Hong Kong Stock Connect later. Mainland investors can invest in included stocks trading in Hong Kong through either stock connect regardless of residency. In this regard, the second inclusion should receive less attention than the first inclusion. Second, the initial inclusions of both cross-border investment channels came with much more included at the same time than the subsequent inclusions. On the one hand, the long list of stocks can draw greater investor attention. On the other hand, a larger number of stocks included simultaneously can also dilute investor attention. Therefore, we investigate whether such a difference in investor attention influences the demand elasticity using the inclusion events of Stock Connect.

Table 6 reports the variations in demand shock, abnormal returns and the effect of demand shock on abnormal return in different types on inclusions. A dummy for a second inclusion and its interaction with the demand shock is included in the first three columns, while the effect of subsequent inclusion is studied in the last three columns. The first two columns in the table confirm that second inclusions receive a much smaller demand shock and report lower abnormal returns. We examine whether there is a difference in demand elasticity between two types of inclusions by including an interaction term of demand shock and dummy of second inclusion. Second inclusions are found to have a much higher demand elasticity on average. However, the difference in demand elasticity cannot be precisely estimated, and the interaction term is not statistically significant. In the fourth column, subsequent inclusion is found to come with greater demand shock. However, we are unable to obtain statistically significant results on abnormal return and demand elasticity in the fifth and sixth columns. Suppose that the finding in the sixth column is a result of limited difference in investor attention between initial inclusion and subsequent inclusion. It suggests that the greater attention that comes with a long list of included stocks seems to be offset by the dilution effect of a larger number of stocks included. As shown in the results in the third and sixth columns, both types of inclusions do not directly affect abnormal returns outside the demand shock channel.

4.3.2 Does the Slope Depend on Arbitrage Risks?

Arbitrage plays a crucial role in the shape of demand curves for stocks. Demand shocks induce arbitrageurs to buy or sell corresponding stocks for abnormal returns. Meanwhile, arbitrageurs will attempt to reduce their risk with offsetting positions in highly correlated securities. Greenwood (2005) provides a formal limits-to-arbitrage model for this setting and tests his model with the implied spillover effect. Wurgler and Zhuravskaya (2002) and Ahern (2014), on the other hand, directly examine the relationship between the arbitrage risk of a stock and the shape of its demand curve. They found that the higher a stock's arbitrage risk, the greater its abnormal return is resulting from a positive demand shock.

Two measures of arbitrage risk are used to investigate how it influences the shape of demand curves for stocks under Stock Connect. The first one is the idiosyncratic

Table 6 Inclusions with various inattentions

	Second inclusion			Subsequent inclusion		
	Demand shock	Abnormal return	Abnormal return	Demand shock	Abnormal return	Abnormal return
Intercept	0.337*** (0.018)	1.036*** (0.213)	2.644 (1.992)	0.229*** (0.0128)	0.660*** (0.350)	2.686 (2.029)
Type of inclusion	− 0.252*** (0.021)	− 0.851*** (0.259)	− 0.311 (0.331)	0.110** (0.045)	0.350 (0.614)	− 0.163 (0.666)
Demand shock			2.787*** (0.700)			3.019*** (0.655)
Type of inclusion × demand shock			2.756 (2.63)			− 0.070 (1.777)
Previous return	N	N	Y	N	N	Y
Stock status	N	N	Y	N	N	Y
Stock characteristics	N	N	Y	N	N	Y
Adjusted R^2	0.129	0.010	0.109	0.013	0.000	0.105
# Of observations	690	690	690	690	690	690

This table reports the estimated effects of different types of inclusions on demand shocks (the first and fourth columns) and demand elasticities (in other columns). The dummy of type of inclusion is equal to 1 for observations in second inclusion in the first three columns, while the dummy is equal to 1 for observations in subsequent inclusion in the last three columns

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

risk estimated by the variance of residuals of the Capital Asset Pricing Model. In estimating CAPM, we follow the same methodology used for obtaining the abnormal returns in previous section. Similar CAPM-based approaches are widely used in the literature including Wurgler and Zhuravskaya (2002) and Ahern (2014). Smaller co-movement between an individual stock and the market portfolio (i.e. a greater variance of residuals) suggests that a smaller proportion of its return can be replicated by other stocks in the market portfolio and thus a higher arbitrage risk. We also include another straight forward approach to measure the arbitrage risks based on the availability of substitutes measured by the number of equities in the same industrial sector according to the Bloomberg Industry Classification System. This approach may not measure the actual arbitrage risk of a stock accurately, but it can be more relevant in the examination if firms in the industrial sector are perceived as having similar risk and return characteristics and thus close substitutes by investors. To provide a clearer picture for comparison, a dummy for high arbitrage risk based on the median of the risk measure (that is, a dummy of high arbitrage risk is equal to one when the idiosyncratic risk (availability of substitutes) is above (below) the median) is used in the estimations.

Both measures of arbitrage risk offer very similar results as shown in Table 7. Observations with higher arbitrage risk had greater demand shocks, higher abnormal returns and greater demand elasticity on average. The higher abnormal returns estimated by both measures are significant as reported in the second and fifth columns. However, we are unable to reject that the higher returns are results of greater demand shocks (results are reported in the first and fourth columns, even though the effect of arbitrage risk on demand shock using the availability of substitutes is marginally rejected) since the interaction term of demand shock and arbitrage risk is not statistically significant in both cases (results are reported in the third and sixth columns). Similar to the types of inclusions, we do not find a difference in abnormal returns between stocks with different level of arbitrage risks outside the demand shock channel as reported in the third and sixth columns. Other specifications have been used to estimate the relationship based on these two measures, such as quartile of measure, the value of measure and its transformations. However, the main finding of a positive and insignificant relationship remains.

4.4 Robustness Tests

To test the robustness of our main finding, we include observations that were not newly included in various announcement dates for comparison. These additional observations come from two sets of observations. The first set of observations are stocks which are not included in Stock Connect. The second set of observations are stocks that have already been included in the scheme in previous rounds and therefore are not newly included in later announcement dates, except for the case of second inclusion. Table 8 presents the results for several comparisons. In the first column, new inclusion observations are compared to the all non-new-inclusion observations. Consistent with our previous results, significant abnormal returns are reported for new inclusion across various estimations. As shown in the first

Table 7 Demand elasticity and arbitrage risk

	Idiosyncratic risk			Availability of substitutes		
	Demand shock	Abnormal returns	Abnormal returns	Demand shock	Abnormal returns	Abnormal returns
Intercept	0.199*** (0.015)	0.430*** (0.126)	2.222 (2.105)	0.222** (0.016)	0.343** (0.148)	2.324 (2.077)
Arbitrage risk	0.104*** (0.027)	0.691** (0.325)	− 0.118 (0.376)	0.042 (0.026)	0.747*** (0.289)	− 0.060 (0.339)
Demand shock			2.346*** (0.540)			2.026*** (0.776)
Arbitrage risk × demand shock			1.212 (1.214)			1.583 (1.303)
Previous return	N	N	Y	N	N	Y
Stock status	N	N	Y	N	N	Y
Stock characteristics	N	N	Y	N	N	Y
Adjusted R^2	0.022	0.007	0.108	0.002	0.008	0.111
# Of observations	690	690	690	690	690	690

This table reports the estimated effects of arbitrage risk on demand shocks (in first and fourth columns) and demand elasticities (in other columns). Arbitrage risk is measured by idiosyncratic risk and availability of substitutes. A dummy for high arbitrage risk based on the median of the risk measure is used in the estimations, that is, a dummy of high arbitrage risk is equal to 1 when the idiosyncratic risk in the first three columns (or availability of substitutes in the last three columns) is above (below) the median

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

Table 8 Inclusion, post-inclusion and non-included

	Pooling model			Fixed effects model		
	(1)	(2)	(3)	(4)	(5)	IV
Intercept	– 0.057 (0.084)	– 0.053 (0.084)	0.541 (0.478)			
Inclusion	0.972*** (0.209)	0.963*** (0.209)	0.800*** (0.092)	0.850*** (0.236)	– 0.164 (0.281)	– 0.545 (0.707)
Post inclusion		0.091 (0.079)	0.165 (0.116)	– 0.078 (0.700)	0.054 (0.196)	0.089 (0.201)
H/A premium			0.304 (0.312)			
Demand shock					3.291*** (0.610)	4.755** (1.902)
Previous Return	N	N	Y	Y	Y	Y
Stock Status	N	N	Y	–	–	–
Stock characteristics	N	N	Y	Y	Y	Y
Adjusted R^2	0.133	0.133	0.136	0.116	0.121	0.120
# Of observations	28,273	28,273	22,628	28,628	28,628	28,628

Regressions in this table are estimated with additional observations that were not newly included in various announcement dates. These additional observations come from two sets of observations. The first set of observations are stocks which are not included in Stock Connect. The second set of observations are stocks that have already been included in the scheme in previous rounds and therefore are not newly included in later announcement dates, except for the case of second inclusion. In all regressions, the independent variable is abnormal returns and the dummy of inclusion is equal to 1 for new inclusion observations. Pooling Model is used in the first three columns and fixed effect model is used in the last three columns. Time-specific effect is controlled in all estimations

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

and second columns, no abnormal return is reported for non-new-inclusion observations no matter post-inclusion observations and non-included observations are grouped together or estimated separately. In the third column, we include all controls for momentum effect, firm characteristics and equity characteristics as well as the arbitrage motive measured by H/A premium in the estimation. Additional controls slightly reduce the abnormal return of new inclusion to 0.8%. Meanwhile, arbitrage motive is found to have no effect on the abnormal return in general. This result is not surprising as the H/A premium is only associated with abnormal return if it can predict or reflect the expected demand shock. Obviously, the same stock with same level of H/A premium was subject to a demand shock at a particular point of time when it was included in the Stock Connect and was not subject to any demand shock at other points of time (e.g. in the post inclusion period). Since these observations are pooled together for estimations, the connection between H/A premium and demand shock is broken in the pooling model.

The longitudinal data also allows us to better control unobserved stock-specific effect with a fixed-effect model. We report the results from the fourth to sixth column. An abnormal return still exists for stocks included in the Stock Connect when firm-specific effect is controlled for as reported in the fourth column and

Table 9 Abnormal returns and removals

	Removals only	Pooled	Fixed effect
Removal	– 1.270** (0.607)	– 1.289*** (0.494)	– 1.232*** (0.355)
Adjusted R^2	–	0.057	0.035
# Of observations	102	29,488	29,488

This table reports the estimated effects of stock removal on abnormal returns. In the first column, the average abnormal returns of all removal observations is estimated. Stocks that are not removed and included on the removal announcement day are used as the control group for the estimations in the second and third column. Regressions in the second and third columns are estimated by regressing the abnormal returns on a dummy of removal observations. Time-specific effect is controlled in the pooled and fixed effect models

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

varies with the demand shock as reported in the fifth column. Using new shares acquisition to measure demand shock can subject to reverse causality if such acquisition is return-driven, that is, mainland investors put more money to those stocks which have higher abnormal returns. To address this concern, H/A premium and dummy for second inclusion are used as instrumental variables for the new shares acquisition in the estimation reported in last column. Previous investigations already showed that second inclusion influences demand shock and do not impact abnormal return outside the demand shock channel. The effect of demand shock on abnormal return is reduced but remains significant.

5 Investment Behavior Under a Sell-Only Restriction

In this section, we focus on the stocks which are removed from Stock Connect. As explained in the previous section, mainland investors are not forced to liquidate their position within a specific time limit. They are only restricted to further purchasing those removed stocks. Furthermore, investors who are not trading under Stock Connect are not affected. To understand the effect of removal on stock return, we follow a similar methodology in the previous section to test the abnormal returns for a period over the announcement day and one day after the announcement. The results are presented in Table 9. In the first column, the average abnormal return of all stock-removal observations is – 1.2%. Majority of the negative return happened on the announcement day (– 0.9%), and similar to the inclusion effect, a statistically significant negative return is estimated up to one day before the announcement. Stocks that are not removed and included on the removal announcement day are used as the control group for the estimations in the second and third column[9].

[9] Other control variables are not included in the estimations as it would greatly reduce the number of stock-removal observations from 102 to 48. In regressions with the other control variables, the estimated abnormal returns for pooled and fixed effect models are −0.186 and −0.025, respectively. Both estimated results are statistically insignificant due to the limited number of observations.

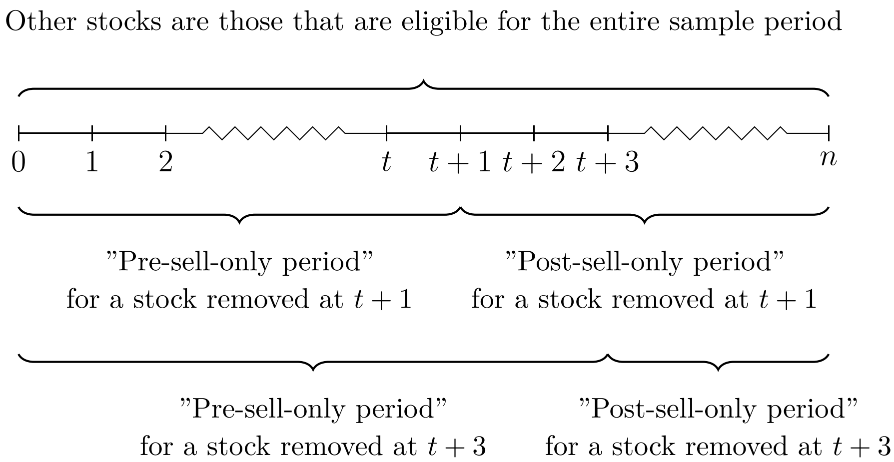

Fig. 1 Definition of sell-only stocks

Table 10 Equity characteristics of sell-only stocks

	Shareholding	Liquidity (in%)	Market capitalizaion (in mn, upper panel)/daily return (in %, lower panel)
	Differences between sell-only stocks and other stocks		
Constant (Sell-only stocks)	0.0381*** (0.0076)	0.3014*** (0.1050)	27,354*** (6350)
Other stocks	– 0.0063 (0.0079)	– 0.1179 (0.1053)	100,931*** (17,474)
	Changes in post-sell-only period		
Post-sell-only period	– 0.0078*** (0.0018)	– 0.0252 (0.0204)	0.009 (0.0736)
First 20 days	– 0.0009 (0.0010)	– 0.0142 (0.0190)	– 0.1405 (0.1141)
The 21st day to 120th day	– 0.0048*** (0.0016)	– 0.0200 (0.0217)	0.0106 (0.0801)
The 121st day to 240th day	– 0.0092*** (0.0022)	– 0.0237 (0.0226)	0.0426 (0.0765)
After the first 240 days	– 1.159*** (0.2177)	– 0.0003 (0.0002)	0.0246 (0.0825)

Regressions in the upper panel is estimated with cross-sectional data including stocks that become sell-only in 20 days or less and other stocks under Stock Connect. The changes in sell-only periods are estimated with fixed effect models. Observations in the 20-day pre-sell-only period is used as the base case. Shareholding is measured as a ratio of total amount of issued shares and liquidity is measured as a ratio of trading value to market capitalization

*Significant at 10%, **significant at 5%, ***significant at 1%. Robust standard errors are reported

The negative abnormal returns estimated in both models are similar to the previous result.

5.1 Comparing Sell-Only and Other Stocks

We attempt to explore the investment behavior when stocks are excluded from the eligible list and only allowed to sell. From now on, sell-only stocks refer to stocks that are removed from the eligible list during the sample period. Later, observations of the sell-only stocks are further separated into a pre-sell-only period and a post-sell-only period. Figure 1 provides an illustration to clarify the timeline and the terminology.

We begin with some main characteristics in Table 10 where sell-only stocks in the pre-sell-only period and post-sell-only period are compared with other stocks under Stock Connect.

In the upper panel, we examine the difference between sell-only stocks and other stocks under Stock Connect with the following OLS regression:

$$y_i = \alpha_0 + \beta_1 Others_i + \epsilon_i.$$

where $y_{i,t}$ is the characteristic (shareholding of mainland investors, liquidity, and market capitalization) of stock i at time t, and $Others_{,i,t}$ is a dummy variable that has a value of 1 for other stocks under Stock Connect. The regression is run with cross-sectional data, including stocks that become sell-only within 20 days and other stocks under Stock Connect[10]. The constant α_0 captures the fixed effects of other stocks, and β_1 is the difference sell-only stocks and other stocks.

Sell-only stocks and other stocks under Stock Connect mainly differ in size, which is not surprising as stocks are often removed from the eligible list for low market capitalization. We do not find the shareholding of mainland investors and liquidity significantly different between the two types of stocks.

In the lower panel of Table 10 we look at how sell-only stocks change before and after the sell-only restriction is applied. We run the following regression for sell-only stocks with a stock fixed effect:

$$y_{i,t} = \alpha_i + \beta_1 PostPeriod_{i,t} + \epsilon_{i,t}.$$

where $y_{i,t}$ is the equity characteristic of stock i at time t and $PostPeriod_{i,t}$ is a dummy variable has a value of 1 if the stock i is removed from the eligible list at time t. At the bottom of the lower panel, we further divide the post-sell-only period into several sub-periods:

$$y_{i,t} = \alpha_i + \beta_1 D20_{i,t} + \beta_2 D21to120_{i,t} + \beta_3 D121to240_{i,t} + \beta_4 D241_{i,t} + \epsilon_{i,t}.$$

[10] Using the whole pre-sell-only period does not affect the comparison for liquidity and market capitalization. However, mainland investors; the holding of the sell-only stocks will be underestimated as pre-sell-only period has a greater weight on the initial inclusion period when the holding is small. We, therefore, prefer using a shorter pre-sell-only period for comparison.

Table 11 Propensity to sell under sell-only restriction

	Last day	Last week	Last month	Last quarter
Post-sell-only period	0.476 (0.169)	0.461** (0.023)	0.447*** (0.002)	0.493 (0.711)
Post sell-only sub-periods				
First 20 days	0.814*** (0.000)	0.817*** (0.000)	0.748*** (0.036)	0.697*** (0.000)
The 21st day to 120th day	0.706*** (0.000)	0.680*** (0.000)	0.672*** (0.000)	0.709*** (0.000)
The 121st day to 240th day	0.450*** (0.000)	0.452** (0.010)	0.425*** (0.000)	0.454** (0.014)
After the first 240 days	0.180*** (0.000)	0.158*** (0.000)	0.184*** (0.000)	0.168** (0.014)

The table reports the fraction of positive daily sell ratio for mainland investors in trading stocks under Stock Connect with and without sell-only restriction from a dataset of 405,161 sock-day observations. A positive difference reflects that sales of sell-only stocks exceed other stocks. Each day's sell ratio is generated by subtracting the average sell ratio of sell-only stocks with past returns in the winner and loser quartile from the average sell ratio of other stocks with past returns in the winner and loser quartile. The past returns used for ranking a stock are based on various prior return intervals, which are given as the column heads. In the absence of difference in the propensity to sell, the average difference in sell ratio should be zero and the fraction of measured positive sell ratio one-half. Binomial test p value in parentheses

*Significant at 10%, **significant at 5%, ***significant at 1%

where $D20$, $D21to120$, $D121to240$ and $D241$ are dummy variables for the corresponding days of removal for sell-only stock i at time t. In both regressions, $alpha_{0,i}$ is the stock fixed effect. Again, we use a 20-day pre-removal period.

As expected, the shareholding of mainland investors declines during the sell-only period. However, mainland investors continue to maintain a large proportion of their shareholding in sell-only stocks for a substantial amount of time. Shareholding of mainland investors only drops by 1.2% from the pre-sell-only period of 3.8% after one year of sell-only restriction. The sell-only restriction for mainland investors does not seem to correlate with liquidity, which is again not surprising as most investors trading in the Hong Kong market are not under Stock Connect. Different from the results in Table 9, the daily returns of removed stocks in a longer post-sell-only period are not significantly different from the pre-period.

5.2 An Exploration of Investment Behaviour

We first look at the propensity to sell by comparing the proportion of stocks sold for sell-only stocks and other stocks under Stock Connect using Eq. 2. Table 11 presents the results. Again, the propensity to sell under the sell-only restriction is not that different from when there is no restriction. However, the propensity to sell changes dramatically over the sell-only period and sell-only stocks facing selling pressure up to the first six months of their removal from the eligible list. The proportion sold

Table 12 Behavior of mainland investors under stock connect

	Last day	Last week	Last month	Last quarter
Full sample	0.432***	0.309***	0.271***	0.288***
	(0.000)	(0.000)	(0.000)	(0.000)
Large market capitalization	0.521	0.410***	0.370***	0.351***
	(0.206)	(0.000)	(0.000)	(0.000)
Small market capitalization	0.433***	0.333***	0.298***	0.343***
	(0.000)	(0.000)	(0.000)	(0.000)
High liquidity	0.484	0.362***	0.339***	0.332***
	(0.347)	(0.000)	(0.000)	(0.000)
Low liquidity	0.460***	0.319***	0.275***	0.328***
	(0.005)	(0.000)	(0.000)	(0.000)

The table reports the fraction of negative daily sell ratio for mainland investors under Stock Connect in trading stocks with different characteristics from a dataset of 405,161 sock-day observations. A negative difference reflects that sales of past loser stocks by mainland investors exceed those of past winner stocks. Each day's sell ratio is generated by subtracting the average sell ratio for stocks with past returns in the loser quartile from the average sell ratio of stocks with past returns in the winner quartile. The past returns used for ranking a stock are based on various prior return intervals, which are given as the column heads. In the absence of momentum or contrarian behavior, the average difference in sell ratio should be zero and the fraction of measured negative sell ratio one-half. Binomial test p value in parentheses

*Significant at 10%, **significant at 5%, ***significant at 1%

for sell-only stocks is greater than other stocks over 70% of the time in most cases. Combined with the finding that the shareholding for such stocks only drops 1.2% after one year, it implies that mainland investors are initially more likely to sell those stocks, but only in small amounts.

The selling pressure drops significantly after six months. After a year, mainland investors become relatively passive in selling their remaining holdings, with the proportion of sell-only stocks sold less than the other stocks over 80% of the time.

After knowing whether mainland investors are more likely to sell the sell-only stocks, we look at the style they adopt by following the approach of Grinblatt and Keloharju (2000) as stated in Eq. 3. We first examine the trading behavior of mainland investors on stocks with different characteristics. As shown in Table 12, mainland investors are essentially contrarian regardless of the definition of past returns. The negative difference in net sale proportion is less than 0.5, suggesting that mainland investors tend to sell past winners more than past losers. The contrarian strategy is more apparent when past returns are measured in longer horizons. Using past returns computed over the previous quarter, mainland investors sell more winner stocks than loser stocks in over 70% of the sample. The result is consistent with Ng and Wu (2007), who conclude that mainland individual investors are mostly contrarian. Moreover, investors seem to be more contrarian in trading stocks with smaller market capitalization and less liquidity.[11].

[11] The 100 stocks with the largest market capitalization are grouped as large market capitalization stocks while others are classified as small market capitalization stocks. Liquidity is measured as the average ratio of trading value to market capitalization.

Table 13 Investor behavior for sell-only stocks

	Last day	Last week	Last month	Last quarter
Full sample	0.432***	0.309***	0.271***	0.288***
	(0.000)	(0.000)	(0.000)	(0.000)
Other stocks	0.444***	0.324***	0.273***	0.308***
	(0.001)	(0.000)	(0.000)	(0.000)
Sell-only stocks				
Pre-sell-only period	0.454***	0.361***	0.381***	0.457**
	(0.006)	(0.000)	(0.000)	(0.010)
Post-sell-only period	0.460***	0.429***	0.360***	0.353***
	(0.032)	(0.000)	(0.000)	(0.000)
Sell-only periods				
First 20 days	0.379*	0.346***	0.356**	0.121***
	(0.064)	(0.000)	(0.036)	(0.000)
The 21st day to 120th day	0.460	0.410***	0.318***	0.170***
	(0.1004)	(0.000)	(0.000)	(0.000)
The 121st day to 240th day	0.476	0.449**	0.415***	0.388***
	(0.354)	(0.043)	(0.000)	(0.000)
After the first 240 days	0.453*	0.425***	0.301***	0.313***
	(0.060)	(0.002)	(0.000)	(0.000)

The table reports the fraction of negative daily sell ratio for mainland investors in trading stocks under Stock Connect with and without sell-only restriction from a dataset of 405,161 sock-day observations. A negative difference reflects that sales of past loser stocks by mainland investors exceed those of past winner stocks. Each day's sell ratio is generated by subtracting the average sell ratio for stocks with past returns in the loser quartile from the average sell ratio of stocks with past returns in the winner quartile. The past returns used for ranking a stock are based on various prior return intervals, which are given as the column heads. In the absence of momentum or contrarian behavior, the average difference in sell ratio should be zero and the fraction of measured negative sell ratio one-half. Binomial test p value in parentheses

*Significant at 10%, **significant at 5%, ***significant at 1%

In Table 13, we examine the sell-only stocks and other stocks under Stock Connect to estimate the effect of the sell-only restriction on trading behavior. Mainland investors are less contrarian in trading sell-only stocks even before the restriction is applied, likely due to their equity characteristics. However, changes in trading strategies are obvious when we focus on the post-removal periods. Mainland investors become more contrarian when a stock is just removed from the list. Based on returns computed over the previous quarter, mainland investors sell past winners 88% of the time in the first month of removal. Investment behavior for sell-only stocks returns back to that of the pre-sell-only period after six months.

6 Conclusion

We believe that Stock Connect and other cross-border investment channels between mainland China and Hong Kong can answer more research questions that we have presented here. On the one hand, mainland China intends to liberalize its financial markets but also insists on maintaining various safeguards and restrictions. On the other hand, the financial markets Hong Kong are as laissez-faire as one can imagine and are subject to market forces from all around the world. When the two sides are connected, many unusual arrangements and constraints are created. We have shown how the influx of capital can tell us about demand curves for stocks and how a sell-only restriction can reveal investors' behavior. We look forward to more research that looks into the interplay of the two drastically different financial systems.

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