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Anatomy of a Government Intervention in Index Stocks: Price Pressure or Information Effects?*

Official government intervention in the foreign exchange market and the money market is common practice, but intervention in the stock market is relatively rare. While there is no reported instance in Western economies, several Asian governments have intervened in the stock market in the last few years, with the Japanese government being the most recent to announce such plans.[1] To our knowledge, there is no empirical study that has documented the impact of these stock market interventions.[2] Among the Asian instances, the intervention in Hong Kong during August 1998 stands out by its sheer magnitude. The government purchases accounted for more than 75% of market trading volume during the intervention period. In this paper, our objective is to document the impact

In a massive intervention designed to deter speculators, the Hong Kong Monetary Authority (HKMA) bought Hang Seng index stocks in August 1998. These stocks experienced a 24% abnormal return during the intervention period. The abnormal returns are not reversed over the next eight weeks, refuting the hypothesis that returns are due to temporary liquidity effects. Cross-sectional analysis of daily abnormal returns during the intervention period reveals that these returns are related to overall intervention activity rather than stock-specific intervention. This evidence is consistent with information effects rather than price pressure effects.

1. The Japanese government announced a plan on February 9, 2002, to provide 2 trillion yen to a fund that will buy shares from its banks. Thailand announced plans to intervene in 2002, following an intervention in 1999. South Korea and Taiwan have also intervened in their stock markets in the last three years. Taiwan has a corpus of funds called the National Stabilization Fund used to shore up stock prices. Other governments have resorted to intervention through intermediaries such as government-run funds and financial institutions.
2. Miller, Weller, and Zhang (2002) explore a theory of intervention in the context of the U.S. stock market.

of the Hong Kong intervention on the returns of targeted stocks and assess whether this impact is due to temporary liquidity-based price pressure effects or information effects associated with a credible signal from the government.

The Hong Kong Monetary Authority (HKMA) intervened in the stock market over the period August 14 to August 28, 1998. The intervention operation involved purchases of 33 large-capitalization stocks that comprised the Hang Seng index. The stated objective of HKMA was to counteract the coordinated activity of speculators who had taken large short positions in Hang Seng stocks and index futures as part of their attacks against the Hong Kong dollar as explained in Section I. The Hang Seng stock market index declined by 30% in the month preceding intervention. In response, over 10 trading days, the monetary authority purchased HK$118 billion worth of shares in the 33 Hang Seng stocks. This amount was very large relative to the typical total daily trading volume in the Hong Kong market of HK$6 billion during 1998. At the end of the intervention period, the HKMA was a major shareholder in each of the Hang Seng stocks. In some cases, the individual stockholding exceeded 10% of the total outstanding shares in the corporation. The government did not liquidate any shares before the end of 1998.

Given the selective intervention in Hang Seng stocks, the first issue we consider is whether there was a price impact on these stocks relative to other Hong Kong stocks that did not experience intervention.[3] We find that an equally weighted portfolio of Hang Seng stocks yielded an excess return of 24% over the 10-day intervention period relative to an equally weighted index of all stocks. The assessment is robust to the use of alternative control portfolios. This result indicates that stockholders in targeted firms experienced a sizable wealth gain.

The next question is the reason for these sizable gains. We consider three possible explanations: temporary price pressure effects, permanent price pressure effects, and information effects arising from a credible government signal to defend a floor for the Hang Seng index. Many critics contend that intervention is futile, since it artificially inflates market prices due to liquidity effects, and prices eventually slide down to fundamental values.[4] Our analysis fails to find evidence of such temporary price pressure effects. The abnormal intervention period returns are not reversed over subsequent intervals. Furthermore, returns over postintervention periods are not negatively correlated with intervention period returns.

Another possible explanation for positive intervention period returns is a

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3. The price effect of sudden changes in demand is an issue that is previously analyzed in the context of index additions. The intervention size here is much larger than changes in supply/demand triggered by index additions. Studies on index additions provide evidence about the slope of the demand curve that in turn is relevant for understanding the impact of corporate events such as stock repurchases and equity issuances (see, e.g., Loderer, Cooney, and Drunen 1991; Bagwell 1992).

4. See the text of Milton Friedman's interview on this subject published in the *Wall Street Journal* (September 3, 1998).

permanent price pressure effect (reduced supply coupled with a downward-sloping demand curve) arising from the Hong Kong government's decision to hold the acquired shares for an extended period. Under this explanation, excess returns are expected to be higher in stocks experiencing a larger intervention.[5]

A final explanation of the excess returns is information effects associated with intervention. The stock market intervention by the government to defend the Hang Seng index value provides a costly and, therefore, credible signal of the seriousness of stated exchange rate policies and intentions. Miller et al. (2002) provide a theoretical model wherein the possibility of intervention provides a perceived put option to market participants. The HKMA believed that coordinated attacks by speculators had driven stock prices below fair values, and it intervened in the stock market to defend stock prices and relieve pressure on exchange rates. This objective was communicated widely and reiterated after the intervention through press statements and interviews of HKMA executives. For example, in an interview in *Asia Week* (dated October 23, 1998) in the aftermath of the intervention, the finance secretary stated that if there were to be another speculative attack, the HKMA would likely intervene again. The availability of a large corpus of funds in the Exchange Fund (HK$718 billion) for further interventions provided significant credibility to these statements.

We do not find evidence of a permanent price pressure effect when we relate total stock-wise intervention measures to overall intervention period returns (from August 14 to August 28). Analysis of daily returns and proxies for daily intervention reveals that the daily return on an individual Hang Seng index stock during the intervention period is driven by the average intervention across all the index stocks rather than the amount of intervention in that specific stock. This evidence provides support for information effects of the intervention rather than price pressure effects.

The information hypothesis is bolstered by a case study of Swire Pacific stock. Swire Pacific has two classes of shares, A and B. The two securities are near-perfect substitutes except that the government bought class A shares and not class B shares. Under the information hypothesis, the government's decision to defend the value of class A stock provides a valuable signal to the stockholders of class A stock. The evidence shows that class A and class B experienced sizable gains, but class A shares outperformed class B shares by a total of 6.7% over 10 days. We argue that the additional return reflects the greater value of the signal to class A shareholders.

The remainder of the paper is organized as follows. Section I details the economic background in which the government made the decision to intervene. Section II gives the theoretical background and outlines the three hy-

5. Consequently, there is a potential for favoritism when the government selects stocks to emphasize in the intervention. Media articles suggested that the intervention greatly benefited wealthy individuals who controlled a few of the targeted firms. These individuals were reported to have a close relationship with government officials.

potheses. Section III describes the data and methodology, and Section IV provides evidence on the effects of intervention and some policy implications. Section V presents concluding comments.

I.   Background on Speculative Activities and the Economic Environment

Hong Kong follows a monetary system (called a currency board system) that provides for a fixed exchange rate linked to the U.S. dollar (see the Appendix for more details). Prior to the intervention period, large hedge funds had bet that if the HKMA supported the Hong Kong dollar by letting interest rates increase, then the Hong Kong stock market would fall in reaction. These speculators took large short positions in Hang Seng stocks and futures while at the same time selling the Hong Kong dollar (referred to as a "double play"). The sales of Hong Kong dollars by these funds were designed to drive up interest rates.

The monetary authority was aware of the speculative activities taken by hedge funds. The HKMA believed that the economic fundamentals of Hong Kong were strong and did not warrant a dramatic realignment of the exchange rate or an adjustment of equity prices.[6] The HKMA decided that at this stage an intervention in the Hang Seng stocks would provide a *credible deterrent to speculators* in Hang Seng stocks. In a surprise move, the HKMA bought Hang Seng stocks over the period August 14 to August 28, 1998, and announced these actions after the first day of intervention. The market was therefore aware of the intervention in the index stocks, but the quantum of stock-wise intervention was not made public immediately. However, given the magnitude of the intervention, daily volume numbers provided ample clues about the intervention activity. Even if the volume of intervention is not directly observed by market participants, speculators can extract some information about the volume of intervention and consequently the target of authorities from the behavior of prices (see, e.g., Bhattacharya and Weller 1997).

Details on the exact magnitude of the stock-wise interventions were officially released on October 26, 1998, although the government's holdings in the Hong Kong and Shanghai Banking Corporation were disclosed as early as September 1, 1998. The shares were held as a part of the assets of the Exchange Fund. The government intention was to sell these shares when the stock market stabilized. In fact, the HKMA holdings show that these stock purchases were held for well over a year.

From an external economic environment standpoint, most Asian economies witnessed poor macroeconomic performance during 1998. The pre- and post-

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6. See the text of the speech by the HKMA chief on October 26, 1998, available on the Web site http://www.info.gov.hk/hkma. The HKMA announced after the intervention that speculators had bet HK$30 billion against Hong Kong markets, and their positions would have yielded profits of HK$4 billion for every 1,000-point drop in the Hang Seng index. Government officials claimed that the intervention had inflicted considerable losses on the speculators.

intervention window does not reveal any unusual returns in Hong Kong relative to the other markets in general. Even though most of the economies experienced slow growth and depreciation in exchange rates, there was no general depreciation in currencies during the event. During the event window there was an appreciation in interest rates in Hong Kong (overnight rates between 8.25% and 19.25%) consistent with severe pressures on the Hong Kong dollar. The overnight interest rates declined to around 5% within two days after the intervention.

II. Theoretical Background and Hypotheses

This section provides a theoretical background for the empirical tests. Following Wurgler and Zhuravskaya (2002), consider a model for the demand for and supply of a stock (fig. 1a). The intersection of the total demand curve (*TD*) and total supply curve (*TS*) of a stock gives the equilibrium price (*P*) and quantity traded (*Q*). The difference between total demand and total supply at a given price is termed the "excess demand." Therefore, by definition, excess demand is zero at the equilibrium price.

We consider four types of market participants: regular investors, arbitrageurs, the government, and speculators. The *excess demand* of a regular investor depends on his belief about the fundamental value of an asset. This class of investors has heterogeneous beliefs about the value of an asset. In contrast, arbitrageurs have correct and homogeneous beliefs about the value of an asset but are subject to a zero net investment constraint. In general, these two classes of investors absorb demand and supply shocks. A positive demand shock because of government intervention causes the demand curve to shift upward (e.g., fig. 1b), whereas a negative supply shock from speculators shifts the supply curve to the left (e.g., fig. 1c). The demand shock is the demand from government intervention net of the supply from speculators.

Wurgler and Zhuravskaya (2002) show that the return due to a demand shock (*D*) is approximated by

$$\overline{R} \approx \frac{D}{(1/h) + (N/kA)}, \tag{1}$$

where $\overline{R}$ is the expected return on a stock, h is a parameter that indexes the heterogeneity of beliefs of regular investors, k is a parameter of risk aversion of arbitrageurs, A is the minimized variance of the arbitrageur's portfolio with a zero net investment constraint, and N is the number of arbitrageurs. They point out that demand shocks induce higher returns, the greater the heterogeneity of beliefs (larger h). Also, a better possibility for arbitrage (a lower value for the variance parameter A) causes a smaller response to a demand shock.

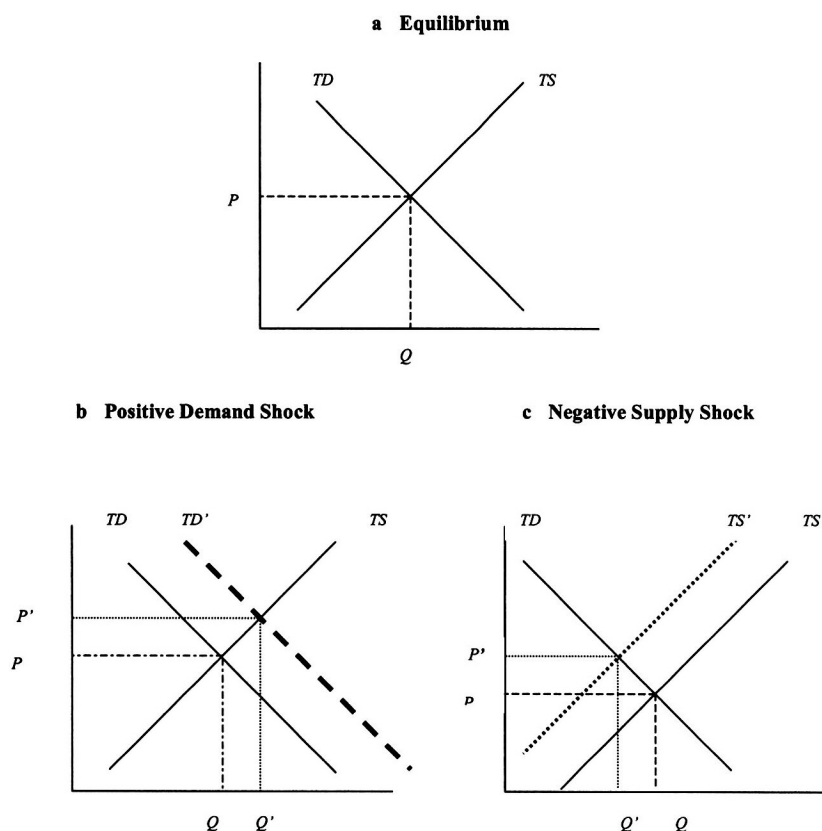We now discuss the three primary sources of influence from intervention:

a Equilibrium

b Positive Demand Shock   c Negative Supply Shock

FIG. 1.—Demand and supply curve for a stock. The intersection of the total demand curve (*TD*) and total supply curve (*TS*) for a stock determines the equilibrium price (*P*) and demand (*Q*) at any time (fig. 1a). A demand shock shifts the demand curve (*TD'*) and a supply shock shifts the supply curve (*TS'*). Figure 1b gives the price response to a positive demand shock and figure 1c gives the price response to a negative supply shock.

two price pressure channels (temporary and permanent) and a signaling channel (these are collected in table 1 for convenience). Higher intervention results in a larger net demand shock (parameter D in eq. [1]) and a correspondingly larger return. Cross-sectionally, the price pressure effect will induce a positive correlation between return and intervention after the presence of arbitrageurs and heterogeneity of beliefs among regular investors are controlled for.

  If the demand shock does not contain any new information about the stock, the excess demand curve for a stock should revert to its equilibrium position and the observed price pressure effects would be *temporary*. Kaul, Mehrotra, and Morck (2000) argue that *reductions in the float* of stocks induce a "per-

TABLE 1   Alternate Hypotheses

	Stocks with Intervention		
Hypothesis	Intervention Period Abnormal Return	Postintervention Period Abnormal Return	Cross-Sectional Correlation between Abnormal Return and Intervention
Temporary price pressure	+	−	+
Permanent price pressure (downward-sloping demand curve)	+	0	+
Information (signal) (government will intervene in Hang Seng stocks)	+	0	0

NOTE.—This table gives an overview of the alternate hypotheses examined in this article and their impact on stock prices. A plus sign (+) indicates a positive reaction and a negative sign (−) indicates a downward change.

manent price pressure effect" (leftward shift in the supply curve [fig. 1c]).[7] The Hong Kong government's intention was to hold the stocks acquired in the intervention until the market had stabilized. Owing to the uncertainty about the duration of the government ownership, traders will be discouraged from arbitraging away this price increase. Under the *permanent* pressure hypothesis, the price increase is not reversed immediately after the intervention period.

The stated objective of the government was to deter a speculative attack. If government intervention provides new *information* (a signal) to investors, stock prices must adjust because of a reassessment of the risk and return trade-offs.[8] The HKMA stock intervention was restricted to the Hang Seng stocks because most speculators used these assets for their activities. Hence, any signaling influences are restricted only to Hang Seng stocks and manifested in each of them. If this deterrence is effective, the postintervention period abnormal returns should be zero rather than negative as in the case of the temporary pressure hypothesis. If the intervention provides a signal common to all Hang Seng index stocks, the return on any Hang Seng stock will be related to the overall intervention rather than intervention in that specific stock. Thus, in contrast to the permanent price pressure hypothesis, we do not expect

7. Several other studies have examined price pressure effects in the context of additions and deletions from equity indexes. For example, Harris and Gurel (1986) find significant positive abnormal returns for additions and negative abnormal returns for deletions. They interpret these results as price pressure effects. Lynch and Mendenhall (1997) find that returns are partially reversed. Other recent studies that examine this issue include Beneish and Whaley (1996) and Wurgler and Zhuravskaya (2002).

8. In effect, intervention to support Hang Seng stocks provides a valuable implicit put option to stock holders (as in Miller et al. [2002]).

a significant relationship between abnormal return and stock-specific intervention activity.[9]

Outline of tests.—The purpose of this paper is to try to sort out the three price effects that could result in positive intervention period returns (collected in table 1). If the price pressure effect were transient (temporary price pressure), it would reverse itself as soon as intervention stops. This reversal implies that abnormal returns after the intervention will be negative. Furthermore, the magnitude of the cumulative abnormal returns on a stock in the postintervention period should be negatively related to that stock's cumulative abnormal returns during intervention (row 1 of table 1).

Both permanent price pressure and signal effects imply positive returns that are not reversed. To differentiate between these effects, we examine the sensitivity of stock returns to intervention activity by estimating the following relationship:

$$AR_i = \beta_0 + \beta_1 \cdot \text{PSB}_i + \beta_2 \cdot \text{Slope}_i + \beta_3 \cdot \text{Sig}_i + \beta_4 \cdot \text{Indxwt}_i$$
$$+ \beta_5 \cdot \text{PriorRet}_i + \varepsilon_i, \tag{2}$$

where $AR_{i,t}$ is the abnormal return on stock i on day t and ε_i constitutes other firm-specific shocks. Our primary metric of intervention activity, PSB_i (a proxy for D), computes the ratio of dollar intervention in each stock to the market value of the stock at the end of July 1998. A positive coefficient for PSB_i provides support for price pressure effects. Following equation (1), we control for the heterogeneity of beliefs of regular investors (h) and the variance of the arbitrageurs' portfolio (A). A natural proxy for h, the slope of the excess demand curve, is obtained by aggregating bid and ask quotes in the electronic limit order book (denoted Slope_i and described in more detail later). We expect a negative coefficient on Slope_i because a steeper excess demand curve will result in a larger price reaction (note that the Slope_i variable is negative). Wurgler and Zhuravskaya (2002) argue that the nonsystematic risk of a stock (denoted Sig_i) is a convenient proxy for A in equation (1). We expect a positive coefficient on Sig_i because higher nonsystematic risk diminishes the ability to arbitrage away price pressure effects.

The net demand shock D is determined by the demand from intervention (PSB_i) minus the supply from speculators. Speculators with short positions in index futures are more concerned about stocks with a greater impact on the index. Thus the weight of a firm in the Hang Seng index (Indxwt_i) should be a good proxy for selling by speculators. We would expect a negative sign on the Indxwt_i, variable, since greater selling by speculators will lead to lower returns. Finally, it is possible that speculative activity artificially depressed stock prices prior to the intervention period. The onset of government intervention may correct this undervaluation, resulting in positive returns during

9. If the signal is stock specific, there will be a positive relationship between abnormal returns and intervention activity in that stock. Empirically, this will be indistinguishable from price pressure effects.

the intervention period. Under this explanation, intervention period returns should be negatively related to PriorRet$_i$, the abnormal return during the six weeks before intervention. We select this period because HKMA authorities indicated that they suspected speculative attacks at the beginning of July 1998.

III. Data

A. Price Data

The stock market data for Hong Kong are obtained from the Pacific Basin Capital Markets (PACAP) database compiled at the University of Rhode Island. The database contains daily stock returns, closing transactions prices, and volume data for all exchange-listed firms. The Hong Kong government made a public disclosure of the exact level of intervention in each stock on October 26, 1998. This information is collected from the text of the speech by HKMA chief on October 26, 1998, available on the HKMA Web site cited previously. An electronic search was conducted using the LEXIS/NEXIS database to identify other news events pertaining to the Hang Seng stocks during the intervention period. This information is used to screen out daily observations that might be subject to other confounding influences such as earnings announcements.

B. Abnormal Return Computations

The tests are based on an examination of Hang Seng stocks *relative* to returns on an equally weighted control portfolio of all stocks that are traded on the Hong Kong stock exchange. Because the government intervened in the Hang Seng stocks, any price pressure and signal effects should be primarily restricted to the Hang Seng stocks. We assess the relative impact on Hang Seng stocks by computing their abnormal returns.

The control period is set to the first six months of the calendar year (January 1 to June 30, 1998) and the last one and a half months (November 15 to December 31, 1998). The choice was motivated by the fact that there were no intervention-related announcements in this period and to also allow examination of postintervention returns over a reasonably long window. The following cross-sectional regression is run using returns over the control period for each stock:

$$R_{i,t} = \alpha_i^r + \beta_i^r \cdot R_{m,t} + \varepsilon_{i,t}, \tag{3}$$

where $R_{i,t}$ is the raw return of stock i on day t, $R_{m,t}$ is the return on the equally weighted portfolio of all stocks traded on the Hong Kong stock exchange on day t, and α_i^r and β_i^r are constants. The abnormal return for each day in the event period is then computed as

$$AR_{i,t} = R_{i,t} - (\alpha_i^r + \beta_i^r \cdot R_{m,t}). \tag{4}$$

We chose the equally weighted index rather than the value-weighted index

TABLE 2   Pattern of Government Intervention

	Mean	Standard Deviation	High	Low
Intervention (in HK$ millions)	4,320	1,562	40,772	162
Percentage of shares bought* (PSB_i)	6.31	2.47	12.28	2.49
Relative intervention†	74.41	1.64	86.69	54.28
Normalized intervention‡	88.99	8.06	260.92	25.74

NOTE.—This table gives a summary of intervention by the Hong Kong Monetary Authority. The intervention period is August 14 to August 28, 1998. Data are obtained from the Web site of the HKMA.

* Value of shares bought during intervention normalized by July 31, 1998, firm equity value.

† Value of shares bought during intervention normalized by the value of trading volume during the intervention period.

‡ Value of shares bought during intervention normalized by July 1998 value of trading volume.

to minimize the impact of the Hang Seng stocks on the index. Although Hang Seng stocks account for roughly 70% of the market capitalization, they account for less than 10% of the listed stocks in terms of numbers. In addition to the equally weighted index, we employed other indices to measure the performance of the overall market. We reconstructed the index returns by explicitly excluding the impact of the Hang Seng stocks on the index. We also used an index of the 33 largest firms that are not included in the Hang Seng index. Finally, we constructed an index of 33 firms matched by size and industry with the Hang Seng index. The reported conclusions are the same if the equal-weighted index is replaced by any of these indices. We report the results using the equal-weighted index since this index is readily available in the PACAP database.

C. Pattern of Government Intervention

Table 2 provides summary statistics of the intervention data. The first row shows the wide variation in the amounts spent on the 33 Hang Seng stocks. Row 2 presents details on normalized intervention activity (PSB_i) measured as the ratio of amount of purchase to the firm equity value on July 31, 1998. The intervention resulted in the government holding anywhere from 3% to 12% of the outstanding shares in a particular stock. The volume of intervention amounted to an average of 75% of the total trading volume in the intervention period (row 3). The last row of table 2 presents another measure of intervention. This metric gives the purchases in each firm relative to the trading volume in the firm shares during the month of July 1998. The data reveal that the intervention purchases were very large relative to the average trading volume in the preceding month of July. The data also indicate that the government purchased more in bigger firms.

In order to better understand the pattern of intervention, we estimate the relationship between the primary metric of intervention activity, PSB_i (percentage of outstanding shares bought), and variables such as the average firm weight in the Hang Seng index over the intervention period ($Indxwt_i$), the

return on a stock during the 30-day window before intervention (PriorRet_i), and the slope of the excess demand curve (Slope_i)[10]. Note that the slope of the excess demand curve is always negative. We obtain the following estimates for the regression parameters (figures in paretheses indicate *t*-statistics based on White's correction for heteroscedasticity):

$$PSB_i = 0.06 + 0.17\text{Indxwt}_i - 0.03\text{PriorRet}_i + 31.28\text{Slope}_i + \varepsilon_i,$$
$$\quad\;\; (7.34)\;\;\; (4.65) \qquad\quad (-1.40) \qquad\qquad\; (3.66) \qquad\qquad\qquad (5)$$

($R^2 = 0.52$). The regression shows that the government intervened more in firms with a higher index weight, consistent with greater vulnerability of these stocks to speculators who had short positions in Hang Seng futures. The intervention is not related to poor performance in the previous month. A more liquid firm will have a flatter excess demand curve and hence a less negative slope. Consequently, a large amount of intervention is required to induce a small change in price. The regression, consistent with this notion, reveals that there is larger intervention in firms with a flatter excess demand curve.

D.   Generating Measures of Daily Intervention

In our analysis of the impact of intervention, we are hampered by the lack of data on daily intervention activity. Fortunately, the intervention is on such a massive scale that it is feasible to obtain a reasonably good proxy for the daily intervention activity by analyzing daily volume data. For each stock, the following cross-sectional regression is run using dollar trading volume over the control period:

$$V_{i,t} = \alpha_i^v + \beta_i^v \cdot V_{m,t} + \varepsilon_{i,t}, \qquad\qquad (6)$$

where $V_{i,t}$ is the dollar volume of stock i on day t, $V_{m,t}$ is the total dollar volume on all stocks traded on the Hong Kong stock exchange excluding Hang Seng stocks on day t, and α_i^v and β_i^v are constants. The abnormal volume for the event period is then computed as

$$AV_{i,t} = V_{i,t} - (\alpha_i^v + \beta_i^v \cdot V_{m,t}). \qquad\qquad (7)$$

The sum of the dollar abnormal volumes over the 10-day intervention period has a cross-sectional correlation of 1.0 with the dollar intervention in each stock. This correlation may reflect a firm size effect captured by both variables. When both the volume variables are normalized by July market value to remove the firm size effect, the correlation is 0.94 and is very highly significant. Thus the procedure described produces a very good estimate of the daily intervention activity and enables us to analyze the relationship between

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10. The slope of the bid (ask) curve is computed as the ratio of the percentage change in price (for the best five quotes) to the change in the percentage of shares bid (offered). The difference between the slopes of the bid curve and the ask curve is the excess demand, and the average of these slopes over the last one hour of the trading day gives the average slope for that day. The slopes of the curves are computed as the averages of the slopes over the first two weeks of August.

returns and intervention activity using 10 daily observations on the 33 stocks, for a total of 330 observations compared to 33 observations on reported intervention amounts.

Note that the volume of government intervention is not directly observable by the market participants, which raises the question of whether there is still information content in the signal of intervention. Bhattacharya and Weller (1997) analyze the impact of intervention when the monetary authority has a target for the exchange rate and trades with speculators who have private knowledge about fundamentals. In this setting, the equilibrium price conveys information about the fundamentals and the target price. Then speculators can extract information about the volume of intervention and so the target of authorities from the behavior of prices. A similar argument applies in this case too.

IV. Empirical Analysis

Subsection A details the returns and volume around government intervention. Subsections B and C provide evidence on the temporary price pressure and the permanent price pressure hypotheses.

A. Returns and Volume around Government Intervention

Table 3 gives a day-by-day overview of returns around intervention (cols. 1 and 2). Raw returns were largely negative in the period prior to intervention. However, intervention was accompanied by a sharp increase in both raw and abnormal returns over the period August 14 to August 28. The average abnormal return is 24% during the intervention period. The median abnormal intervention period return is 23.3%, and the standard deviation is 7.57%. The daily abnormal returns are statistically significant on each day of the intervention period except August 20 and August 21. The largest abnormal return of 4.8% occurred on the first day of intervention. On the last day of the intervention, the abnormal return was 3.6%, although the raw return was negative. This observation points to the importance of reliance on abnormal returns rather than raw returns. The huge increase in the size of the intervention on August 28 helped to hold the raw returns on the index stocks to −1.29%, compared to a drop of −4.99% on the control portfolio.

Table 3 (cols. 3, 4, and 5) also gives an overview of trading volume around intervention. The table reports both the dollar volume and the relative volume on Hang Seng stocks and an industry-matched portfolio. Relative volume for a stock i is computed as a percentage of the raw volume in the 22 trading days of July 1998. Table 3 shows that total volume in Hang Seng stocks had a sharp increase during the intervention period from August 14 to August 28 (cols. 3 and 4). In particular, the average relative volumes on August 27 and August 28, the last two days of the intervention period, were 7.7 times and 27.3 times the normal volume, respectively. A large part of the increased

TABLE 3   Returns and Volume around Government Intervention

Date	Raw Return (%) (1)	Abnormal Return (%) (2)	Total Volume (HK$ Millions) (3)	Average Relative Volume (4)	Industry Matched Average Relative Volume (5)
7/31/98	−.556	−1.019	2,491	.89	.74
8/3/98	−4.518	−1.597	3,597	1.28	.63
8/4/98	1.597	1.289	3,814	1.36	.73
8/5/98	−.423	−.095	3,659	1.30	.60
8/6/98	−3.127	−1.319	3,463	1.23	1.07
8/8/98	−3.654	−2.032	3,897	1.38	1.68
8/10/98	−.456	−.066	2,402	.85	.41
8/11/98	−3.220	−.541	3,811	1.35	.95
8/12/98	.674	.348	4,298	1.53	1.21
8/13/98	−2.746	−1.544	3,772	1.34	.96
8/14/98	7.909	4.849	6,686	2.38	1.23
8/18/98	1.121	2.785	4,270	1.52	.85
8/19/98	5.294	3.498	5,616	2.00	1.65
8/20/98	1.470	−.551	5,046	1.79	2.38
8/21/98	−1.757	−.275	3,603	1.28	1.05
8/24/98	.906	2.497	8,691	3.09	.92
8/25/98	4.330	3.847	8,903	3.16	1.07
8/26/98	.532	1.512	8,334	2.96	.96
8/27/98	.955	2.260	21,602	7.68	1.14
8/28/98	−1.299	3.699	76,908	27.33	3.36
8/31/98	−6.767	−6.542	5,345	1.90	1.26
9/1/98	−2.497	−1.178	4,799	1.71	.98
9/2/98	3.580	2.498	4,730	1.68	.80
9/3/98	2.539	1.571	4,946	1.76	2.34
9/4/98	4.702	.051	4,421	1.57	2.58
9/7/98	10.240	2.505	6,785	2.41	3.78
9/8/98	1.307	−.221	5,381	1.91	4.28
9/9/98	−3.726	−1.600	2,792	.99	2.15
9/10/98	−.647	−2.259	2,006	.71	2.30
9/11/98	−4.248	−1.499	3,651	1.30	1.68

NOTE.—This table provides an overview of returns on an equally weighted portfolio and the trading volume in 33 Hang Seng index stocks. Data are obtained from the PACAP database compiled by the University of Rhode Island and cover the period July 31, 1998, to September 11, 1998. Abnormal return is computed relative to an equally weighted portfolio of all traded stocks. Relative volume for each stock is computed as the ratio of the trading volume for a stock on a given day divided by the average daily trading volume for that stock during July 1998. The intervention period is August 14 to August 28, 1998.

volume on August 28 was a result of the expiration of futures and options. Speculators who were short futures contracts attempted to drive down equity prices, and the government intervened to support the Hang Seng stocks. Of the HK$118 billion spent by HKMA during the intervention, newspapers reported that HK$70 billion was spent on August 28. The massive and unprecedented intervention on August 28 was unable to prevent a decline in stock prices, although it reduced the downward slide in stock prices. The control portfolio (industry-matched portfolio) had a relatively modest uptick in volume on a few days in the intervention period.

The trading volume in the Hang Seng stocks tapered off following the cessation of government intervention. However, volume remained at higher

levels compared to the average July daily volume. In summary, the data show both increased volumes and large positive abnormal returns during the intervention period.

B. Rejecting the Temporary Price Pressure Hypothesis

If intervention effects were due to temporary liquidity pressures, then there should be a negative reaction in prices as soon as intervention stops. Accordingly, we examine abnormal returns in the eight weeks following the intervention window. As figure 2 indicates, the Hang Seng index continued to appreciate in the weeks following the intervention. Table 4 displays the abnormal returns and cumulative abnormal returns on the Hang Seng stocks after the intervention period. Recall that the cumulative excess return for all Hang Seng stocks is 24% for the event window. The following three weeks (weeks 1, 2, and 3) display negative returns for a cumulative retracement of 9.3%. However, abnormal returns are once again positive for weeks 4–7. In other words, there is no evidence that the abnormal returns generated during the event window reversed in the weeks following intervention.

We also test a more powerful prediction of the temporary price pressure hypothesis: namely, that the price increase *for each stock* during the event period is reversed over the subsequent weeks. In other words, for every Hang Seng stock i in the test sample, we run the following regression:

$$\mathrm{CAR}_{i,1-T} = \alpha + \theta \cdot \mathrm{IPAR}_{i,t=IP} + \varepsilon_{i,t-T}, \qquad (8)$$

where $\mathrm{CAR}_{i,1-T}$, is the cumulative abnormal stock return after intervention beginning in week $+1$ through week $+T$ inclusive, and $\mathrm{IPAR}_{i,t=IP}$ is the cumulative abnormal return in the intervention period. Under a complete reversal of intervention returns, the intercept is zero and the slope is negative one. Under a partial reversal, the slope coefficient will be negative. Table 4 presents the results. The reported t-statistic for the coefficient of the intervention period cumulative abnormal return is based on White's correction for heteroscedasticity. The table (cols. 5 and 6) shows that none of the coefficients is significantly different from zero. Thus the evidence does not support temporary price pressure effects.[11]

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11. The mean abnormal return is -6.54% on August 31, 1998, the first day after the intervention. The sizable average negative return raises the issue of a partial reversal of intervention period returns. However, there is no significant cross-sectional relationship of these returns with either the intervention period abnormal returns or the intervention amounts. Thus we need to be cautious about interpreting the abnormal returns on August 31 as a partial reversal of positive intervention period returns. The negative returns on August 31 for index stocks could possibly be a delayed adjustment to factors that affected the rest of the market on August 28. In this case, the abnormal returns on these two days are expected to have a negative correlation, since stocks that were propped up more by intervention on August 28 should fall more on August 31 when intervention stops. However, they are positively correlated.
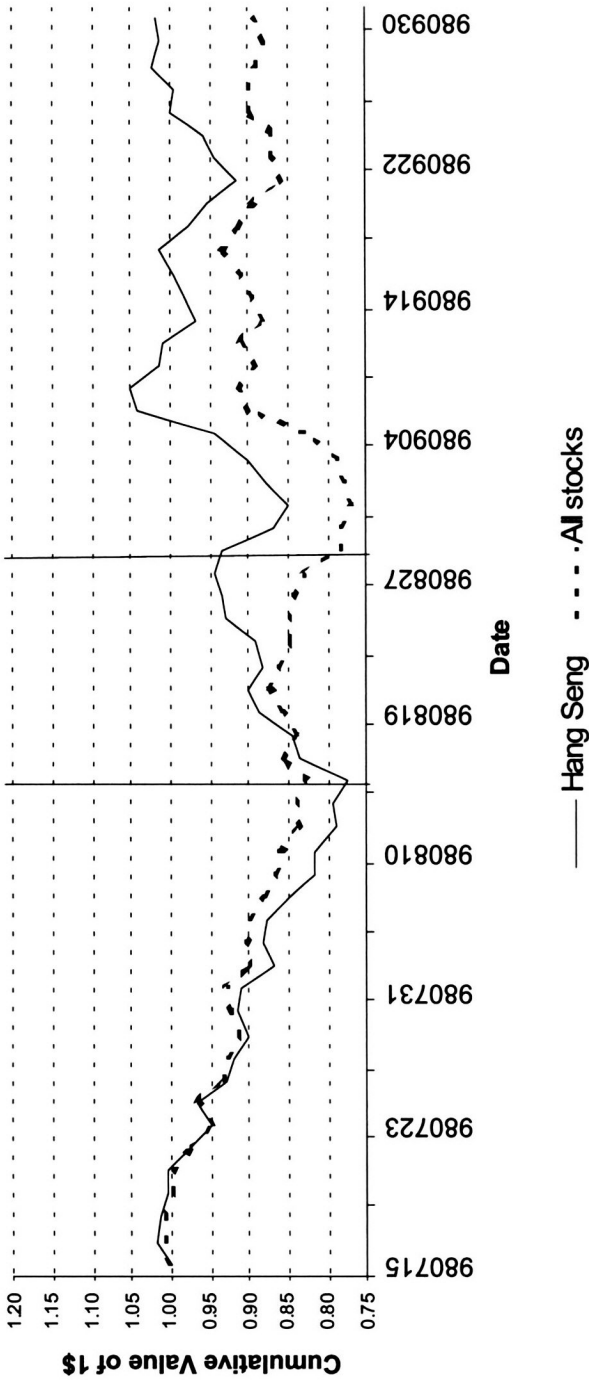
FIG. 2.—Cumulative returns on the Hang Seng index and an equally weighted portfolio of all stocks around intervention This figure depicts the cumulative value of $1 invested in an equally weighted index of Hang Seng stocks and an equally weighted portfolio of all stocks (control stocks) traded on the Hong Kong Stock Exchange. The sample period is June 15, 1998, to September 30, 1998. Data are obtained from the PACAP database compiled by the University of Rhode Island. The vertical lines mark out the intervention window.

TABLE 4   **Price Reversals after Intervention**

Week	Mean Abnormal Return (1)	Cumulative Abnormal Return from Week 1 (2)	α (3)	θ (4)	t-Statistic of θ (5)	R^2 (6)
+1	−.03 (.10)	−.03 (.10)	−.07	.14	.59	.01
+2	−.03 (.06)	−.06 (.10)	−.11	.20	1.11	.02
+3	−.02 (.06)	−.09 (.12)	−.07	−.07	−.26	.00
+4	.03 (.05)	−.05 (.15)	−.07	.07	.21	.00
+5	.02 (.03)	−.02 (.15)	−.05	.10	.28	.00
+6	.08 (.07)	.05 (.15)	.06	−.03	−.07	.00
+7	.02 (.08)	.08 (.16)	−.15	−.31	−.66	.01
+8	−.02 (.06)	.05 (.17)	.05	.02	.05	.00

NOTE.—For varying postevent windows, the following cross-sectional regression is estimated for the 33 Hang Seng stocks in which there was intervention:

$$CAR_{i,1-T} = \alpha + \theta \cdot IPAR_{i,t=IP} + \varepsilon_{i,t-T}.$$

The dependent variable, $CAR_{i,1-T}$, is the cumulative abnormal stock return beginning after intervention in week +1 through week +T inclusive. The dependent variable $AR_{i,t=IP}$ is the abnormal return in the intervention period of August 14 to August 28, 1998. The coefficient on $AR_{i,t=IP}$ equals negative one under the price pressure prediction and is equal to zero under the hypothesis of no reversals. Column 1 reports the mean of the weekly returns and col. 2 reports the cumulative return on the equally weighted Hang Seng portfolio from week 1 to week 8 after intervention. Standard deviations are in parentheses. The t-statistics are based on White's correction for heteroscedasticity. Data are obtained from the PACAP database compiled by the University of Rhode Island.

C.   Evidence on the Permanent Price Pressure Hypothesis

Given that the evidence points against temporary price pressure, we seek to distinguish between the permanent price pressure and information hypotheses. In other words, we want to discern whether the mere fact that the government was buying and its promise to support stocks led to a change in equity prices (signaling) or whether it occurred because of the demand for stocks from intervention (price pressure). The price pressure hypothesis posits a positive cross-sectional relationship between abnormal returns and intervention amounts. In this subsection, we present evidence on this cross-sectional relationship.

1.   Overall Intervention Period Results

To investigate the presence of permanent price pressure effects, we estimate equation (2) using data for the entire intervention period, 33 observations, and obtain the following estimates for the regression parameters (figures in

parentheses indicate t-statistics based on White's correction for heteroscedasticity):[12]

$$IPAR_{i,t=IP} = 0.21 - 0.33PSB_i - 3.1Slope_i$$
$$(2.95) \quad (-0.69) \quad (-0.05)$$

$$+ 1.92Sig_i - 0.19Indxwt_i - 0.004PriorRet_i + \varepsilon_i.$$
$$(0.72) \quad (-1.08) \quad (-0.05) \quad \quad (9)$$

Under the price pressure hypothesis, larger intervention amounts lead to larger intervention returns. Contrary to this prediction, we find that the abnormal return on a stock is *not positively related* to intervention in that stock. The reported results are not affected by the exclusion of the control variables in the regression. Another possible reason for the reported results is that the signal effect and price pressure effects are cumulated over the 10 days, leading to a potential loss of information.

2. Results Based on Daily Abnormal Volume Measures

The next test uses measures of daily abnormal volume as described by equation (7) in Section III.*D* as a proxy for intervention. Unlike the previous regression (eq. [9]) that used 33 observations, this regression uses 330 daily observations. We then exclude observations coinciding with major corporate announcements that might contaminate abnormal returns. During the 10-day intervention period, six firms reported earnings. We excluded the earnings announcement day and the next day, since it was unclear whether the announcements were made before or after close of trading on the announcement day. This procedure led to the exclusion of 12 observations (retention of these observations does not materially alter the results). The daily abnormal volume measure is standardized by market value at the end of July 1998 to yield comparable measures across firms ($AV_{i,t}$).

Panel A of table 5 reports regression estimates of the following equation:

$$AR_{i,t} = \beta_0 + \beta_1 \cdot AV_{i,t} + \beta_2 \cdot Slope_i + \beta_3 \cdot Sig_i + \beta_4 \cdot Indxwt_{i,t}$$
$$+ \beta_5 \cdot PriorRet_i + \varepsilon_{i,t}. \quad \quad (10)$$

Here, abnormal return, $AR_{i,t}$, constitutes the gross effect of intervention, which includes both the signal and price pressure components. The slope coefficient

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12. Kaul et al. (2000) use prior price run-up to account for capital gains tax–induced frictions on trading. There are no such taxes in Hong Kong. We include prior returns to investigate whether positive intervention period returns are a correction of prior abnormal negative returns.

We expect a positive relationship with Sig_i since it proxies for the difficulty of arbitrage. However, arbitrageurs who believe that the government intervention will fail are more likely to trade the index rather than individual stocks. The insignificance of the term Sig_i lends support to this view.

TABLE 5   **Cross-Sectional Regressions**

β_0	$AV_{i,t}$	Slope$_i$	Sig$_i$	Indxwt$_{i,t}$	PriorRet$_i$	R^2
		A. August 14–August 28				
.009	.0004**	−3.358	.474	−.027	.00003	.03
(.942)	(4.197)	(−.535)	(1.162)	(−.671)	(.002)	
		B. August 14				
.022	.007**	−25.322	.089	.055	−.012	.12
(.855)	(2.350)	(−.971)	(.076)	(.331)	(.292)	

β_0	$\overline{AV}_t$	Adj $AV_{i,t}$	Slope$_i$	Sig$_i$	Indxwt$_{i,t}$	PriorRet$_i$	R^2
			C. August 14–August 28				
.009	.0004**	.0004	3.311	.474	−.026	−.00001	.03
(.940)	(3.826)	(1.827)	(.521)	(1.161)	(−.658)	(−.00037)	

NOTE.—For the intervention period, the cross-sectional regression in eq. (10) is estimated for the 33 Hang Seng stocks in which there was intervention (panels A and B). The dependent variable, $AR_{i,t}$, is the abnormal return on stock i on day t. The dependent variable, $AV_{i,t}$, is the abnormal volume in stock i on day t. The independent variables are daily proxies of intervention ($AV_{i,t}$), index weight (Indxwt$_{i,t}$, market capitalization of a stock divided by the total market capitalization of all 33 Hang Seng stocks based on the previous day closing prices), nonsystematic risk of a stock (Sig$_i$), slope of the excess demand curve (Slope$_i$; see n. 10 for details), and prior period returns over a 30-day window preceding intervention (PriorRet$_i$). The t-statistics are based on White's correction for heteroscedasticity. Data are obtained from the PACAP database compiled by the University of Rhode Island. Panel A reports results for the entire intervention period August 14–August 28. Panel B reports results for August 14 only. Since the news of intervention was disclosed only after close of trading on August 14, signaling effects should be minimal on this day. Panel C runs the same regression but divides the abnormal volume into two parts: the average abnormal volume across stocks on a day $\overline{AV}_t$ and the stock-specific abnormal volume: Adj $AV = AV_{i,t} - \overline{AV}_t$.

** Significant at the 5% level.

for abnormal volume is significant (t-statistic of 4.197).[13] This result can be interpreted as evidence consistent with price pressure effects. The low R^2 is consistent with the poor explanatory power of the variable measuring these effects.

The abnormal returns on August 14, 1998, provide a unique set of observations. The government disclosed its intervention only after close of trading on that day. Although news reports indicate that market participants speculated about government activity, the signaling content of the intervention should have been milder, if not nonexistent, since it was unannounced. Thus the positive abnormal returns on August 14 can be interpreted as evidence of price pressure effects. Furthermore, consistent with such effects, panel B of table 5 reveals a significant positive correlation between abnormal returns and abnormal volume on August 14. However, it could well be that the positive returns were due to the market's interpretation that the buying was being driven by private information. The explanatory power remains low in this case too.

To further investigate the signaling impacts of the intervention, we reestimate equation (10) with two proxies for intervention: $\overline{AV}_t$, which is the

13. It is possible that the results are driven in part by speculative activity over the last two days of intervention. However, we get a similar result even if we drop the observations from the last two days.

average abnormal volume on day t, and Adj $AV_{i,t}$ calculated as: Adj $AV_{i,t} = AV_{i,t} - \overline{AV}_{i,t}$. The average abnormal volume across all Hang Seng stocks on a given day $(\overline{AV})$ is a proxy for the strength of the government intervention on that day. This average should not be influenced by abnormal volume driven by stock-specific private information, and it should be related to the signal content of the intervention on that day. The adjusted abnormal volume (Adj $AV_{i,t}$) captures the cross-sectional variation in abnormal volume on day t and should be more directly related to price pressure and private information effects in individual stocks. Panel C of table 5 reports that the coefficient of Adj $AV_{i,t}$ is insignificant, suggesting minimal price pressure effects. However, the coefficient of $\overline{AV}_t$, a measure of the common signal component, is significant and provides support for signaling effects of the intervention.

In summary, even though we would expect that intervention measures should explain return behavior to a large extent, the overall evidence provides only mild support consistent with the price pressure hypothesis and points to the alternative information hypothesis, which argues that the government credibly signaled the granting of an implicit put option to holders of Hang Seng stocks.[14]

D. The Case of Swire Pacific

Swire Pacific offers a unique case study. Swire Pacific has two classes of shares, A and B. Only class A shares are a part of the Hang Seng index. The risk assessment of both these shares is similar except for differences in voting rights; class A shares have different voting power than class B shares. The two securities are near-perfect substitutes except that the government intervened in one and not in the other. Wurgler and Zhuravskaya (2002) argue that stocks with close substitutes are more resilient to price pressure effects. This reasoning would suggest that in the case of Swire Pacific A shares, the availability of very close substitute class B shares should have immunized them from price pressure effects. However, under the signaling hypothesis, the government's decision to defend the value of Hang Seng stocks provides a valuable put option to the stockholders of Swire Pacific A. The consequent bolstering of the firm's equity value should also be beneficial to class B shareholders, although the impact will be more direct for class A shareholders.

Table 6 gives an overview of the return behavior of these two shares. The differential in returns between class A and class B shares is statistically insignificant during the control period as well as periods immediately before and after the intervention. This evidence confirms that these two securities

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14. The average interest rate during July 1998 is 10%. The annual volatility of realized weekly returns on the Hang Seng index during the year preceding intervention is 45%. With these parameter estimates, the Black-Scholes formula yields a premium of 13.4% for one-year at-the-money put options. In comparison, average intervention abnormal returns are 24%. If the returns of −6.5% on August 31, 1998, are included, the average abnormal return to stockholders drops to 17.5%. The Black-Scholes estimate does not account for perceptions of increased volatility around intervention.

TABLE 6   Swire Pacific Returns—Class A and Class B Shares

Period	Daily Average	N	Swire A	Swire B	Difference (Swire A − Swire B)
July 1–August 13	Raw returns ($R_{i,t}$)	44	−.59	−.52	−.07
	Abnormal returns ($AR_{i,t}$)	44	−.43 (−.80)	−.27 (−.46)	−.17 (−.52)
August 14–August 28	Raw returns ($R_{i,t}$)	10	1.91	1.15	.76
	Abnormal returns ($AR_{i,t}$)	10	2.33** (2.34)	1.67** (2.29)	.66 (1.22)
August 31–October 26	Raw returns ($R_{i,t}$)	38	1.00	1.00	.00
	Abnormal returns ($AR_{i,t}$)	38	.19 (.22)	.26 (.32)	−.07 (.29)
Control period[a]	Raw returns ($R_{i,t}$)	155	−.16	−.25	−.09

NOTE.—This table provides average daily percentage returns on Swire Pacific class A and class B shares. Data are obtained from the PACAP database compiled by the University of Rhode Island. The sample period is divided into three event windows: a window preceding intervention (July 1–August 13), the intervention period (August 14–August 28), and a window succeeding intervention (August 31–October 26). The control period is January 1–June 30 and November 16–December 31. The numbers in parentheses below the abnormal returns are the corresponding t-statistics.

** Significant at 5%.

[a] Abnormal returns during control period are zero by definition, since the market model regression is estimated using the control period window.

are very good substitutes. During the intervention period, both classes experience highly significant average abnormal returns: 2.33% for class A and 1.67% for class B. These positive returns for the two close substitutes provide evidence against the price pressure hypothesis. The difference between the average return on class A and class B is 0.66% for a cumulative total of 6.7% over 10 days. The additional return reflects the greater value of the put option to the class A shareholders. These excess returns were not reversed in the weeks following intervention. The Swire Pacific case lends credence to the presence of a signal component implicit in the stock prices.

E. Additional Remarks

The considerable reduction in trading volume on August 31 compared to the previous day provided clear clues that the government withdrew from intervention on that day. The government issued statements in which it asserted that it would continue to monitor the stock market and would intervene if the stability of the market were threatened. Consistent with the information hypothesis, the negative returns on August 31 can be interpreted as a reaction to clues about the limits of the government's involvement. Under the permanent price pressure hypothesis, stock prices should stay up as long as the government holds the stock. Thus this hypothesis cannot explain the observed negative return on this day.

Finally, we address whether the intervention was bound to increase stock prices given its sheer magnitude. One view of the success of an intervention is the profits garnered by the intervening authority. HKMA reported the average purchase price for each of the stocks in its disclosure on October 26, 1998. At the conclusion of the intervention, the government had a meager profit of only 1.4%. The low profits are consistent with the bulk of the purchases occurring at the end of the intervention. In fact, on the day after the intervention concluded, the government faced a loss of 6.9% on its portfolio, which worsened to a loss of 9.8% on the following day. The government faced a loss on each of the acquired stocks at some point during the two months after the intervention. Nevertheless, by October 23, 1998, these losses had been erased (see fig. 1), and the government enjoyed a profit of 24.7%.[15] The government profits tended to cast the intervention in a positive light. However, the variability of profits suggests that net government profits were not a foregone conclusion despite the massive intervention.

F. Policy Implications

There are two possibilities in relation to this intervention. One is that the Hang Seng index had been driven down below a level consistent with fundamentals by the concerted actions of speculators, in which case the inter-

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15. The government announced intervention details after close of trade on October 26, 1998. The abnormal return on the next day is an insignificant 0.11%. Further, the returns on October 27 are not related to intervention amounts.

vention transmitted to the market a willingness on the part of the authorities to expend resources to protect investors against the effects of such actions. The other possibility is that speculators were reacting to fundamentals, implying that the market was correctly valued before intervention. Then the beliefs created by the intervention would have driven the market above the level consistent with fundamentals.

The HKMA publicly stated its view that speculators had driven the market below a value warranted by fundamentals. The Hang Seng stocks lost more than a quarter of their value in the month before intervention even though other Asian economies with similar economic performance did not experience such declines in equity prices. As table 4 reveals, the positive returns generated during the intervention were not reversed after the intervention ceased. Although not conclusive, the overall evidence is consistent with the view that the government intervention corrected an undervaluation induced by speculative attacks on the currency and the stock market.

Under the alternative view that the speculators were merely forcing the stock prices to their correct values based on fundamentals, the government intervention results in overvaluation of the stocks. Miller et al. (2002) analyze how regulators should unwind investors' expectations in such circumstances. If the government unwinds such expectations rapidly, stock prices are likely to drop sharply and even fall below prices based on fundamentals. Such a sharp correction could be associated with real effects in the economy. In this context, they develop important policy implications for the government's management of investor expectations.

The HKMA unwound a large proportion of its holdings in one instance on November 12, 1999 (in the form of an exchange-traded fund). This was one of the largest and most successful offerings ever in Asia, with approximately HK$33 billion raised from 180,000 participants, the vast majority of whom were local retail investors. The liquidation by the government of its stockholdings did not have any adverse impact on the market either on the offering day or around the announcement day (October 11, 1999). This evidence supports the HKMA view that the intervention increased market efficiency by protecting investors against the effects of market manipulation rather than the view that the intervention artificially inflated stock prices.

V.   Conclusion

Should governments intervene in the stock market, and what are the effects of intervention? These questions of vital importance to policy makers and monetary authorities have not been explored in the literature. To our knowledge, this is the first study that explores the effects of stock market intervention. We analyze the case of Hong Kong, where the monetary authority intervened in the Hang Seng index stocks over the period August 14 to August 28, 1998. The intervention was aimed at deterring speculators via a credible

signal that the monetary authority would use available funds to buy index stocks in the event of a speculative attack.

The intervention had a salutary effect immediately, and an equal-weighted portfolio of Hang Seng stocks experienced significant abnormal returns to the tune of 24%. These abnormal returns were not reversed in the weeks following the intervention and cannot be attributed to temporary price pressure effects. Using daily data on individual stocks, we investigate whether relative price changes were a result of a credible signal or permanent price pressure effects that arose when the government bought and held large amounts of stock. The overall intervention period results do not provide any evidence of price pressure effects. Analysis of daily data and intervention proxies reveals that individual stock returns are related to the overall intervention activity rather than stock-specific intervention. This and related evidence on dual-class shares points to an information effect of intervention on stock returns.

The lessons from the Hong Kong intervention must be carefully considered and are not directly transferable to other stock markets. The Hong Kong government had considerable credibility since it had large reserves relative to trading activity in the Hong Kong stock market. Some countries (the most recent being Japan) have taken a cue from the successes in Hong Kong and have proposed a large intervention program. When and if such interventions should be orchestrated are questions of crucial importance that are left to future research.

Appendix

The Hong Kong Exchange Fund

The HKMA is the government authority in Hong Kong responsible for maintaining monetary and banking stability. Under the currency board system, the stability of the Hong Kong dollar exchange rate is maintained through an automatic interest rate adjustment mechanism. When there is a decrease in demand for Hong Kong dollar assets and the Hong Kong dollar exchange rate weakens, the HKMA stands ready to purchase Hong Kong dollars from banks, leading to a contraction of the monetary base. Interest rates then rise, creating the monetary conditions conducive to capital inflows so as to maintain exchange rate stability. Conversely, if there is an increase in the demand for Hong Kong dollar assets, leading to a strengthening of the exchange rate, banks may purchase Hong Kong dollars from the HKMA. The monetary base correspondingly expands, exerting downward pressure on interest rates and so discouraging continued inflows. The Exchange Fund carries the official reserves of the government. The aggregate balance of this fund will vary in accordance with the flow of funds into and out of the Hong Kong dollar. The Exchange Fund was used for intervention in the stock markets.

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