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**Has Political Instability Contributed to Price  
Clustering on Fiji's Stock Market?**

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# HAS POLITICAL INSTABILITY CONTRIBUTED TO PRICE CLUSTERING ON FIJI'S STOCK MARKET?

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## ABSTRACT

The goal of this paper is to examine evidence of stock price clustering on the South Pacific Stock Exchange, located in Fiji, and explore its determinants. We find that stock prices cluster at the decimal of 0 and 5, with almost half of prices settling on these two decimals. Upon investigating the determinants of price clustering on the South Pacific Stock Exchange we find that price level and volume of trade have a statistically significant positive effect on price clustering. We also propose and test a 'panic trading' hypothesis which states political instability induces price clustering. We find evidence that political instability in Fiji induces price clustering behaviour.

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## **1. Introduction**

When prices are more frequently observed at some numbers than others this is tantamount to the phenomenon of price clustering. An understanding of share price clustering is important because its existence is inconsistent with economic rationality and certainly inconsistent with the notion that share prices follow a random walk. Clustering of bid and ask (offer) prices also raises important issues about the potential for optimal order placement strategies (Aitken *et al.*, 1996). The existence of price clustering in share prices was first observed by Osborne (1962) and Niederhoffer (1965, 1966). Since then, price clustering has been observed on several stock markets around the world as well in exchange rate markets, options and futures markets, the gold market and retail banking market. In an early study of the determinants of price clustering, Harris (1991) found price clustering was contingent on the price level and volatility. In a more comprehensive analysis of the determinants of price clustering, Aitken *et al.* (1996) found that price clustering increases with the price of the stock, market volatility, own stock volatility, trade size and the size of the bid-ask spread. With a few exceptions for predominantly Asian markets, there is a lack of studies of price clustering and its determinants in stock markets in developing countries.

In this study we examine the extent of price clustering and its determinants on the South Pacific Stock Exchange (SPSE) – the stock exchange of Fiji. Examining Fiji's stock market is interesting because Fiji is not only a developing country, but is a small island economy with a population of around 800,000 people. While the SPSE is small on a global scale, in 2007 the 16 listed companies had a stock market capitalization of around 25 per cent of GDP. In studying the SPSE we make two contributions to the literature on price clustering. First, the study offers an opportunity to ascertain whether the phenomenon of price clustering so widely found in stock markets in

many developed countries exists in a relatively small and new island economy stock market. Second, for the first time, we examine the impact of political instability on price clustering behaviour in the stock market. Fiji is an ideal candidate for this exercise since over the period considered in this study (2000-2008), Fiji has experienced two coups as well as ongoing sustained periods of political instability.

The balance of the paper is organised as follows. In the next section we discuss the recent political history of Fiji and present an overview of the SPSE. In Section 3 we outline three well-known hypotheses in the price clustering literature – the attraction hypothesis, the price resolution hypothesis and the negotiation cost hypothesis – and propose a fourth hypothesis, the panic trading hypothesis, which states that political instability results in price clustering. A brief literature review is presented in Section 4. The model and data are presented in Section 5 and the results in Section 6. Foreshadowing the main findings, we find evidence of price clustering in the SPSE. There is a clear tendency for prices to cluster on 0 and 5; around 48 per cent of prices cluster on 0 or 5. This result is consistent with the attraction hypothesis. We examine the determinants of price clustering and find that the price level has a statistically significant positive effect on clustering, consistent with the price resolution hypothesis. We also find a positive and significant relationship between volume traded and clustering, consistent with the negotiation cost hypothesis. However, the size effects for both price and volume are smaller than suggested by previous studies. When we model the relationship between political instability and price clustering we find that political instability leads to price clustering, consistent with our proposed panic trading hypothesis. In the final section we provide some concluding comments.

## **2. Fiji Context**

Fiji is a small island nation with less than 1 million people and with a land area of about 18,000 square kilometres. Fiji gained independence in 1970 and the transition was initially peaceful with a multiracial society comprising the indigenous Fijian community and a significant Indo-Fijian population with minorities including Chinese and Europeans. Fiji had its first coup in 1987 when an indigenous Fijian dominated military took power in the name of protecting indigenous rights which it felt were being threatened by the newly elected government which had several members of the Indo-Fijian community in cabinet. An interim government ran the country between 1987 and 1992 when a new general election was held under a new constitution which excluded non-indigenous Fijians from becoming prime minister and from holding key government positions. This constitution was changed to remove some of the overt racist elements and a new general election was held in 1999, again producing a multi-ethnic government with a prime minister from an Indo-Fijian background. In 2000, just 12 months later, the democratically elected government was overthrown in another military supported coup. While democracy was restored in 2001; the military overthrew the government formed after the 2006 general election and Fiji has since been under military rule with a promise of elections to be held in the future. The three military coups since 1987 have had a negative economic impact with average growth rates of about 2 percent over the 20 year period (Narayan & Prasad, 2008).

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Insert Table 1  
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The SPSE, which was formed in 1978 as the Suva Stock Exchange, is located in Suva in Fiji. For a couple of decades it was miniscule with four listed companies and an annual share transfer that totalled US\$30,000 to US\$40,000. The SPSE started to grow in the mid-1990s and in 1998 a Capital Markets Development Authority

commenced operating. In 2002, the market capitalisation of SPSE more than doubled from US\$121 million to US\$373 million with the listing of Amalgamated Telecom Holdings, owner of the Fiji telecommunications monopoly (Keith-Reid, 2002).

Table 1 gives some key indicators for SPSE. While SPSE is one of the smallest stock exchanges in the world, market capitalisation as a percentage of GDP has increased markedly over time. In the mid-1990s with four listed public companies, the SPSE had the world's smallest bourse. It now has 16 listed companies. In 2006, the average size of companies listed on the SPSE was US\$39.8 million (96<sup>th</sup> in the world) and the turnover ratio was 0.5 (108<sup>th</sup> in the world). Trading is conducted through a call market. The call market session is conducted at 10.30am each business day with brokers submitting their orders and the caller matching these orders and executing the trades on a price time priority basis. The transactions are paper based and call sessions occur on a physical trading floor (SPSE, 2006). However, as of 2007, moves were being made to shift towards an electronic trading platform (SPSE, 2007).

### **3. Hypotheses**

Several hypotheses have been proposed to explain price clustering. Three hypotheses which are often used to motivate empirical analysis of the determinants of price clustering are the attraction, price resolution and negotiation cost hypotheses. The attraction hypothesis states that discrete trading prices are obtained from continuously distributed underlying values by rounding to the nearest available final unit (Gottlieb & Kalay, 1985; Goodhart & Curcio, 1991). The rounding depends not only on linear distance, but also on the basic attraction of each integer. This implies prices with final digits of 0 are more 'attractive' than those ending with 5, which, in turn, are more popular than other final digits (ap Gwilym *et al.* 1998; ap Gwilym & Alibo, 2003).

The negotiation cost hypothesis states clustering exists because traders use a discrete grid of prices to simplify their information set, leading to lower negotiation costs (Harris, 1991). The rationale for the negotiation cost hypothesis is that a smaller price set limits the number of bids and asks that can be made and thus lowers the costs of negotiation, which are an increasing function of the time taken to consummate the transaction. This hypothesis suggests we should expect greater price clustering when negotiation costs are high, such as with higher volume and higher price volatility.

The price resolution hypothesis states that clustering results from realizing the optimal degree of price resolution or desired level of price accuracy (Ball *et al.*, 1985). Price discovery occurs when traders attempt to ascertain an asset's true price. Grossman *et al.* (1997) suggest that clustering will be less severe in liquid markets because the value of the asset is more easily ascertainable if quotes and trades are more frequent. Higher price volatility will also result in more clustering since traders can reduce their exposure by transacting quickly and to do so may involve a less precise valuation.

We propose and test a fourth hypothesis which is the panic trading hypothesis. The panic trading hypothesis states that when political instability in the form of a coup is present, there will be a tendency on the part of investors to settle quickly on a rounded price. The presence of a coup will generate uncertainty, resulting in lower investor confidence and slower business activity. Depending on the severity of the impact of the coup in the stock market there will exist 'panic trading', which instigates the desire to agree on some common numbered price such as 0 or 5.

#### **4. Existing Studies**

There is a large literature which has tested the attraction, price resolution and negotiation cost hypotheses for stock markets in developed countries. There are several studies for the New York Stock Exchange and/or American Stock Exchange (Osborne, 1962; Niederhoffer, 1965; Harris, 1991; Huang & Stoll, 2001). There are also studies for stock markets in western European and Scandinavian countries including Finland (Booth *et al.*, 2000); the Netherlands (Sonnemans, 2006) and the United Kingdom (ap Gwilym *et al.*, 1998; Huang & Stoll, 2001). Among developed markets in the Asia-Pacific there are studies for Australia (Aitken *et al.*, 1996; Brown *et al.*, 2002); Japan (Ascioglu *et al.* 2007) and Singapore (Hameed & Terry 1998).

Compared with studies for stock markets in developed countries, there are few studies for stock markets in developing countries. Booth and Yuksel (2006) examine price clustering on the Istanbul Stock Exchange. Chung *et al.* (2005) investigate price clustering on the Kuala Lumpur Stock Exchange and Ahn *et al.* (2005) consider price clustering on the Hong Kong Stock Exchange. Brown *et al.* (2002) investigate price clustering in several emerging Asia-Pacific markets (Hong Kong, Indonesia, Philippines and Taiwan). There are several studies that consider the impact of cultural considerations, such as the importance of the number 8 in Chinese culture, on price clustering on the Shanghai and Shenzhen stock markets in China (He & Wu, 2006; Cai *et al.*, 2007; Brown & Mitchell, 2008). Overall, existing studies have found that price clustering is a widespread phenomenon in share markets across time and institutional arrangements. Almost all studies provide at least some support for the existence of price clustering, such that the existence of price clustering has become a 'stylized fact' (Booth & Yuksel, 2006 p.138). Booth and Yuksel (2006), though, fail to find evidence of price clustering on the Istanbul Stock Exchange. There is no



consensus, about the reasons why prices cluster with mixed support for the three hypotheses (see ap Gwilym *et al.*, 1998, 1998a; Mitchell, 2001). As discussed above, there are no studies for the small stock markets on the small island countries and there are no studies which consider the effect of political instability on price clustering.

## **5. Model and Data**

To search for the existence of price clustering, in the first stage we examine the number of times the last decimal place of the share price has been each value between 0 and 9. In the second step, we examine the common number(s) on which share prices tend to settle. To examine the determinants of price clustering, following the extant literature, we posit a probit regression model which takes the following form:

$$PC_t = \alpha_0 + \alpha_1 P_t + \alpha_2 Vol_t + \alpha_3 Coup_t \quad (1)$$

Here,  $PC$  is a dummy variable taking the value 1 if prices appear with the last decimal place on 0 or 5, and zero otherwise;  $P$  is the share price;  $Vol$  is the volume of shares traded; and  $Coup$  is a dummy variable that takes the value 1 for the month of the coup and zero otherwise. This approach is crucial given that prior to the coups in Fiji there has always been speculation that a coup is pending. Thus, specifying a value 1 for the entire month in which the coup takes place captures the period of intense political instability. The data used in the empirical analysis is daily data, spanning the period 4 January 2000 to 10 June 2008. The data was obtained from the SPSE.

## **6. Empirical Results and Discussion**

### **6.1. Results**

Table 2 reports the frequency with which the last decimal point on the share price fell on each of 0 to 9. In column 2 the number of times the price ends on each of 0 to 9 is reported. Column 3 shows the corresponding percentages. The null hypothesis that

the relative frequency is equal to 10 per cent and its t-statistic is reported in the second last column, while its associated probability value is reported in the final column.

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Insert Tables 2 & 3  
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We find that the distributions are statistically significant at the 1 per cent level, except when the last decimal on the price series ends with 8. This suggests that the least common last decimal place on which the price settles is 8. The most popular last decimal place on which the price settles is 0 with around 27 per cent of prices having the last decimal settling on 0. The second most popular last decimal place on which the share price settles is 5 on which around 21 per cent of the prices settle. These results are consistent with the attraction hypothesis, which suggests there is a natural tendency to round off numbers or focus on more salient numbers. The preference can be identified as 0 and 5 as the two most common decimal places on which prices settle with approximately 48 per cent of prices settling on either decimal 0 or 5. Table 3 reports the mean and standard deviation of prices ending with the last decimal point on 0 to 9. The mean price is highest when the last decimal place is 0. Thus, at the clustered price of 0, the mean price is highest. The volatility, as measured by the standard deviation, is also the highest when the final decimal place ends with a zero.

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Insert Table 4  
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Next, we examine the determinants of price clustering. The results are reported in Table 4. Model 1 reports the results for Equation (1) without dummy variables for the two coups. Model 2 reports the results for Equation (1) with dummy variables for the two coups in May 2000 and December 2006. We find that price and volume has a statistically significant positive effect on price clustering around 0 and 5 in both models 1 and 2. We find that the coups have a statistically significant positive effect

on price clustering in model 2. The price level has a positive effect on rounding because larger price variation (more clustering) is often observed for higher price stocks. This finding is consistent with the price resolution hypothesis. Volume has a positive effect on price clustering because frequent trading tends to reveal stock values quickly by aggregating the information possessed by different traders. At higher volume, negotiation costs increase, which induce clustering consistent with the negotiation cost hypothesis. The result for the coup dummy variable is consistent with the panic trading hypothesis. The coups generate uncertainty and reduce investment, such that investors will be more likely to settle quickly on a rounded price.

## **6.2. Discussion**

One thing we notice about our results is that the impact of price and volume, while statistically significant, are extremely small. In other words, they have a very small impact on price clustering. This result is different from those obtained for other markets. In studies for the Chinese market (see, for instance, Brown and Mitchell, 2008) and more developed markets, such as the European markets (see, for instance, Capelle-Blancard & Chaudhury, 2007) prices have a bigger effect on price clustering than what we found to be the case in Fiji. However, our results for the price level for Fiji are not surprising. They can be explained by the fact that Fiji's stock market is relatively small based on the number of listed companies, which stands at 16. Similarly, with 16 listed companies, the volume of trade is not expected to be high. The SPSE (2007) reports that although the volume of trade in 2007 increased by 16.7 per cent, the value of trade fell 35.7 per cent. A similar pattern of trading was observed in 2001 following the 2000 coup. Overall, over the period 2000 to 2007, while the volume of trade has increased, the value of trade has fallen. For this reason, the relatively small impact of trading volume on price clustering is not surprising.

The performance of the market has been weak following the December 2006 coup. The market has been bearish. Many investors chose bank deposits for their funds rather than investing in the share market due to higher interest rates. Moreover, as noted by the SPSE (2007), retail investors are risk averse; they choose not to invest anywhere, but retain funds on hand for current and future consumption. In the 12-months following the December 2006 coup, share prices have fallen. This reflects in large part the need for cash amongst retail investors. SPSE (2007, p. 4) notes that “some [retail investors] were desperate enough to incur significant capital losses in the process of liquidating their shares. ... some of these price drops can also be attributed to price corrections by the market or poor performance by listed companies”. It follows that Fiji’s stock market is different because it is small, it is made up of only a very small number of listed companies (all of which are domestic firms), and it is intermittently shocked by coups. Thus, the market behaves differently as reflected in the small impact of price and volume on price clustering.

Finally, what conclusions can we draw with respect to the impact of the coups on price clustering? We notice that coups have the biggest impact on price clustering. Coups have been common in Fiji. The main feature of coups in Fiji is that both prior to coups and following a coup, there is speculation. There is speculation regarding resultant economic policies and the perceived reaction of the international community to the coups. The common outcomes have been changes in economic policies and trade and travel bans imposed by the international community, which have a direct impact on business activities. Business activities came to a halt, at least on the day of the coup, and are substantially impeded in the surrounding period. Each of these

factors generates a sense of panic in investors. Our results reflect this. There is panic trading leading up to the coups in Fiji, whereby investors attempt to settle transactions quickly in order to avoid selling at a lower price following the coup.

## **7. Conclusions**

We find support for the three traditional hypotheses that have been tested in the literature on price clustering in stock markets; namely, the attraction, price resolution and negotiation cost hypotheses. This result for a small island stock market adds to the literature for larger stock markets in developing and developed countries. We also find support for the panic trading hypothesis, suggesting political instability has a positive effect on price clustering. These results have practical implications for traders. Some examples of how traders can take advantage of price clustering have been tested (Mitchell, 2001). Niederhoffer (1965, 1966) concluded that profitable trading rules existed based on the clustering of transaction frequencies after allowing for the bid-ask spread. These trading rules suppose that a reversal in the direction of the price of the financial asset becomes more probable once the price moves to a round number (Mitchell, 2001). Examples are provided in Niederhoffer (1965, 1966). Niederhoffer and Osborne (1966) also documented a dependent structure in the form of direction reversals in the movement of prices. Traders aware of clustering and these dependent effects could take advantage of this for trading (Mitchell, 2001). Future research could test the panic trading hypothesis through examining the effects of political instability on price clustering in other geographic locales such as Africa and Latin America or through examining the effects of terrorism on price clustering. Such an approach could use data from stock markets located in countries in which there have been repeated terrorist attacks such as Indonesia, Pakistan or Sri Lanka.

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**Table 1**  
**Key Indicators of the South Pacific Stock Exchange 1997-2006**

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Market Capitalisation (US\$ million)	93	88	108	244	121	373	433	539	587	637
Market Capitalisation as a % of GDP	4.7	4.1	6.5	14.5	7.3	20.2	18.8	19.8	19.6	20.3
Value Traded (US\$ million)	2	4	2	–	–	–	2	8	4	3
Number of Listed Domestic Companies	8	9	9	–	–	–	15	15	16	16
Average Company Size (US\$ million)									36.7	39.8
Turnover Ratio (%)									0.8	0.5

Source: Standard & Poors (2006, 2007); World Bank (2008).

**Table 2**  
**Frequency of the Last Decimal Point of the Share Price Being on 0 to 9**

Decimal	Frequency	Percentage	t-statistic	p-value
0	1702	26.6***	44.303	0.000
1	226	3.5***	-17.230	0.000
2	421	6.6***	-9.101	0.000
3	365	5.7***	-11.435	0.000
4	456	7.1***	-7.642	0.000
5	1326	20.7***	28.628	0.000
6	476	7.4***	-6.808	0.000
7	374	5.0***	-11.060	0.000
8	631	9.9	-0.346	0.729
9	416	6.5***	-9.309	0.000

Notes: \*\*\* denotes statistical significance at the 1 per cent level.

**Table 3**  
**Mean and Standard Deviation of Prices with the Last Decimal Point on 0 to 9**

Decimal	Mean	Standard Deviation
0	5.280	8.208
1	3.747	6.477
2	2.656	1.970
3	2.532	2.671
4	2.223	2.736
5	3.198	4.714
6	2.588	2.909
7	3.059	4.417
8	3.074	4.458
9	2.779	3.765

**Table 4**  
**Determinants of Price Clustering**

	Model 1	Model 2
Constant	-2.003*** (0.0000)	-0.2019*** (0.0000)
Price	0.0369*** (0.0000)	0.0364*** (0.0000)
Volume	0.00001** (0.0123)	0.000001** (0.0121)
Coup	—	0.4321** (0.0137)

Notes: \*\*\*(\*\*) denotes statistical significance at the 1(5) per cent level. Figures in parenthesis are p-values.