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The friction-free weighted price contribution

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ABSTRACT

We introduce a methodology to obtain friction-free estimates of Barclay and Warner's (1993) Weighted Price Contribution (WPC). With this new approach, we verify recent simulation results suggesting that trading frictions may severely bias the WPC approach. We use high frequency data from a European electronic order-driven market to show that frictions generate a sizable downward bias in the WPC of non-aggressive small-size trades. The bias increases in periods of significant price discovery, and is due to both bid-ask bounce and serial correlation in the quote-midpoint changes. We show that our results extend to the US case.

1. Introduction

It is widely accepted that private information in financial markets is revealed through trading and that information-motivated traders, in an attempt to delay the full revelation of their information, look for ways to conceal their trading intentions.[2] Barclay and Warner (1993) (hereafter, BW93) study the trade-size choices of strategic informed traders. They introduce the Weighted Price Contribution (WPC) approach to test the so-called stealth trading hypothesis (STH).[3] The WPC measures how much of a stock's cumulative price change over a given time period is attributable to trades grouped into particular trade-size categories. The WPC has become the standard tool to study strategic fragmentation of orders, and is frequently used as an alternative to parametric methods to measure price leadership (e.g., Hasbrouck, 1995).[4]

The WPC assumes that price changes are primarily information-driven. The existence of a noisy component in price changes, one of the milestones of market microstructure research (e.g., Hasbrouck, 2007), challenges the WPC approach. BW93 (p. 300) state that

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[2] For example, strategic informed traders may obscure their positions by breaking up large trades and spreading them through time (Kyle, 1985); trading when liquidity-motivated volume is high (Admati & Pfleiderer, 1988); acting as passive liquidity providers (Harris, 1998, and Kaniel & Liu, 2006) or using undisclosed limit orders (e.g., Bessembinder, Panayides, & Venkataraman, 2009).
[3] The STH reads: "[…] if informed traders concentrate their trades in medium sizes, and stock-price movements are mainly due to private information revealed through these investors' trades, then most of the stocks cumulative price change will take place on medium size trades" (BW93, p. 282).
[4] A few examples include Cao, Ghysels, and Hatheway (2000), Huang (2002), Barclay and Hendershott (2003, 2008), and Ellul, Shin, and Tonks (2005).

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the WPC should allow for trading frictions so long as the temporary components of the price change are not systematic. Some recent studies cast some doubt on their claim. van Bommel (2011) studies the statistical properties of the WPC using simulated daily series. He finds that the WPC is an inconsistent and biased estimator of price discovery when prices deviate from a martingale process due to serial correlation. Likewise, Wang and Yang (2010) uses low-frequency data to show that the WPC approach deviates from the information share approach of Hasbrouck (1995) in the presence of return serial correlation. At best, these studies stress the need to control for trading frictions when implementing the WPC approach.

In this paper, we propose a simple procedure to obtain friction-free WPC estimates using high (trade-by-trade) frequency data. The procedure consists of three steps: firstly, we replace trade prices by quote midpoints to control for the bid-ask bounce; secondly, we apply standard time series techniques to extract the friction-related dynamics in the quote-midpoint changes; thirdly, we use the estimated friction-unrelated component of the quote-midpoint changes to obtain the friction-free WPC estimate ($\overline{\text{WPC}}$).[5] By means of our $\overline{\text{WPC}}$ estimates, we provide empirical evidence of the friction-related bias in the standard WPC when applied to high-frequency-data.

We begin by reporting a significant friction-driven downward bias in the standard WPC of small-size trades for the most liquid and active stocks of the electronic order-driven platform of the Spanish Stock Exchange (SSE) between July 2000 and December 2006. Ignoring trading frictions, the daily WPC of medium-size trades is 83%, while the daily WPC of small-size trades is −1.6%. In contrast, the $\overline{\text{WPC}}$ of medium (small) size trades is 55.4% (37.1%). Next, we test if this friction-related downward bias for small-size trades increases with the likelihood of information-motivated trading. As we restrict ourselves to days with open-to-close returns above 1%, the downward bias of the small-size trades increases, from −38.7% to −72.71%. We show that negative WPCs for small size trades, which are frequently taken as evidence of underperformance by retail traders, are rather due to trading frictions. We also document that this friction-related bias can significantly distort formal tests of the STH.

We provide some insights on the sources of the friction-related WPC bias. Firstly, we estimate that 85.6% of the daily WPC downward bias for small-size trades is driven by the bid-ask bounce, but serial correlation significantly adds to the bias. So, the friction-related bias of the standard WPC cannot be fully corrected by simply replacing the trade price by the quote midpoint. Secondly, trade aggressiveness helps to explain the bias. The downward bias of small-size trades only affects to non-aggressive trades (−49.1%) – the WPC of aggressive small-size trades is actually upward biased (11%).

We conduct a number of robustness tests. We start by showing that the magnitude of the WPC friction-related bias depends on the time resolution of the analysis. In particular, the downward bias in the WPC of small size trades increases when computed over monthly rather than daily intervals. Quite the opposite, $\overline{\text{WPC}}$ s computed at different frequencies and/or minimum daily return cutoffs converge. We also show that our results are not market-specific. For two representative samples of 1995 and 2005 NYSE-listed US common stocks, we corroborate the downward bias in the WPC of small-size trades. Yet, the estimated bias for US markets is of smaller magnitude than for the SSE. In days with positive returns and with consolidated (NYSE-NASDAQ-Pacific/Arca) trades and quotes, we document a −12.35% bias in 1995 and a −16.78% bias in 2005. The friction-related bias decreases when we use NYSE trades and quotes only (−4.8% in 1995 and −12.83% in 2005).

Overall, we show that the WPC approach can be seriously biased by the presence of the friction-related component in the time series of the trade price change. In contrast, the $\overline{\text{WPC}}$ approach provides accurate and reliable estimates.

The rest of the paper proceeds as follows. In Section 2, we summarize the stealth trading literature. In Section 3, we review the WPC approach. In Section 4, we describe the SSE database. In Section 5, we present $\overline{\text{WPC}}$ approach. In Section 6, we report our main findings. In Section 7, we provide robustness tests. In Section 8, we conclude.

2. Strategic fragmentation of orders

Studies about US markets during the 1980s and 1990s, spearheaded by BW93 seminal work, support the STH. With a sample of tender-offer target firms, BW93 find that 99% of the cumulative price change during the pre-announcement period occurs on medium sizes. Chakravarty (2001) uses TORQ data to show that nearly 80% of the cumulative price change is due to medium-size trades by institutional investors. Chakravarty, Chiyachantana, and Jiang (2008) report a disproportionately large WPC for mid-size trades in the 2-day interval immediately after (before) positive (negative) earnings surprises in the 1990s. Furthermore, institutional trading increases in the exact same intervals dominated by stealth traders.

More recently, price discovery in US markets has apparently shifted away from medium sizes and into small sizes. Using NASDAQ data, Choe and Hansch (2005) find support to the STH from 1993 to 1998, but from 1999 to 2003 about 70–85% of the cumulative price change is due to small trades. They attribute this reversal to microstructure changes.[6] Chakravarty, Van Ness, and Van Ness (2005) show that, after NYSE decimalization in 2001, the dollar adverse selection costs for medium-size trades decreased, which is compatible with informed traders shifting to smaller sizes. Using 2005 data from NASDAQ, Blau, Van Ness, and Van Ness (2009b) show that small short sales drive the short sales' predictability of negative next-day returns. Finally, O'Hara, Yao, and Ye (2014) use 2008–2009 NASDAQ data to show that more than 80% of the cumulative price change is accounted for trades of 100-shares or less. They point to the raise of high frequency trading as the most likely explanation. The 2000s evidence for US markets suggests

[5] Here and in the rest of the text we use an overscore to indicate that a measure is friction-free.

[6] Higher transparence, lower tick sizes, and enhanced competition have reduced transaction costs, most notably for small-size orders (e.g., Chung, Chuwonganant, & McCormick, 2004; Smith, 1998).