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Do order imbalances predict Chinese stock returns? New evidence from intraday data

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ABSTRACT

In this paper we examine whether order imbalances can predict the Chinese stock market returns. We use intraday data, a panel data predictive regression model that accounts for persistent and endogenous order imbalances and cross-sectional dependence in returns, and show that order imbalances predict stock returns from 1-minute trading to 90-minute trading. On the basis of this predictability evidence using multiple trading strategies we show that profits persist during the day. These results imply that a source of Chinese market inefficiency is order imbalances.

1. Introduction

The literature on stock return predictability is large and growing. A plethora of studies exists which show that financial ratios, in particular dividend yield, book-to-market ratio, cash flow-to-price ratio, and price-earnings ratio predict stock returns (Westerlund and Narayan, 2012; Marquering and Verbeek, 2004; Lewellen, 2004; Campbell and Yogo, 2006). While some tensions exist when it comes to in-sample versus out-of-sample evidence of predictability, as demonstrated in the work of Welch and Goyal (2008), relatively recent evidence shows greater consensus on predictability (see Campbell and Thompson, 2008; Rapach et al., 2010; Westerlund and Narayan, 2012). With consensus on return predictability more or less reached, there is a need to look beyond financial ratio predictors. This point is made strongly by Ferreira and Santa-Clara (2011, p. 515) when they write: "The predictability of stock market returns … remains an open question".

In this regard, several directions have been explored by researchers using time-series and panel data models. Some studies have considered the role of oil price as a predictor of stock returns (see Driesprong et al., 2008; Narayan and Sharma, 2011); some have considered macroeconomic variables as predictors of returns (see Ferson and Harvey, 1994, 1998); some (see Chordia et al., 2002;

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Shenoy and Zhang, 2007) have considered order imbalance as a predictor of returns; and the relatively recent studies have considered institutions (Narayan et al., 2014c) and mutual fund flows (Narayan et al., 2014b) as predictors of stock returns.

Our goal in this paper is to demonstrate the relevance of order imbalance as a predictor of returns. Our motivation for choosing order imbalance as a predictor is two-fold. First, when compared to financial ratio-based predictive regression models, order imbalance has received the least attention, mainly because of data limitations. In this paper, we have reasonable high frequency (intraday) data on order imbalances and stock returns for China, allowing us to provide not only evidence of stock return predictability, but also evidence of predictability at different time frequencies of trading during a day. Second, the existing studies that motivate us to consider the order imbalance predictor are Chordia et al. (2002, 2008), Chordia and Subrahmanyam (2004), and Shenoy and Zhang (2007). From Chordia et al. (2008), we learn that order imbalances become a less potent predictor on days when market liquidity is high; from Chordia et al. (2002), we know that order imbalances predict market returns in a multivariate model that controls for trading volume; and from Chordia and Subrahmanyam (2004), we learn that when order imbalances predict returns, investors make statistically significant profits from order imbalance-based trading strategies. By comparison, from Shenoy and Zhang (2007), we learn that unlike the evidence from the US market, order imbalances do not predict Chinese stock market returns.

Our study extends the work of Chordia et al. (2002, 2008), Chordia and Subrahmanyam (2004), and Shenoy and Zhang (2007). Our contribution involves a concrete examination of three statistical features of the data set that, in our interpretation, the literature has not paid full attention to. First, order imbalances are likely to be persistent. In fact, Chordia et al. (2002) do find that daily order imbalances are very persistent. In predictive regression models, as is now well-known, persistent predictors cause biased inferences on the null hypothesis of no predictability (see Westerlund and Narayan, 2014a). Second, order imbalances are also likely to be endogenous. Chordia et al. (2002) show that market returns do predict order imbalances, which can be interpreted as evidence that order imbalances are indeed endogenous. Third, when considering a cross-section of stocks, stock returns can potentially be cross-sectional dependent. If so, this will again lead to bias (see Westerlund and Narayan, 2014b). Since the literature has not discussed these issues from a modeling/estimation point of view, we progress this idea further in terms of motivation. The literature typically assumes that the individual stocks in a panel are cross-sectionally independent. Indeed, the more heterogeneous the stocks in a panel, the more the pair-wise cross-section covariances of the error terms will differ across individual stocks. As we show later, despite our attempt to make stocks homogeneous by forming panels based on stock size, we still find strong evidence of cross-section dependence. This outcome is not surprising as even with size-based panels, stocks tend to be heterogeneous, as demonstrated for instance by Narayan and Sharma (2011). The main implication here is that the literature has not modeled order imbalance-based return predictability in a manner that addresses all these salient features of the data. Since this is not a trivial matter and not something that should be ignored, we use a panel data predictive regression approach that accounts for the persistence and endogeneity of the predictor variable, and cross-sectional dependence in returns in a coherent manner. Given this, our test of return predictability based on the order imbalance predictor should be free of criticism associated with lack of accounting for salient features of the data.

For these data, foreshadowing the main findings, we discover that while order imbalances are less persistent they are strongly endogenous at all four trading frequencies considered (1-min, 5-min, 60-min, and 90-min) on the Chinese stock exchange. Our findings reveal strong evidence of cross-sectional dependence in stock returns. Motivated by these statistical features of the data, we apply the Lagrange multiplier (LM) test for panel predictability proposed by Westerlund and Narayan (2014b). We find evidence that order imbalance predicts returns at all four trading frequencies. When we categorize stocks into different sizes, evidence of predictability holds across all trading frequencies. Out-of-sample forecasting evaluation also evinces strong evidence of predictability, in that the order imbalance-based predictive regression model consistently outperforms the constant returns model. Finally, we devise multiple trading strategies based on return forecasts obtained from order imbalance predictors, and show that investors can make statistically significant profits by tracking order imbalances. Interestingly, we find that profits persist during the day, suggesting that market inefficiency holds regardless of the trading frequency. Moreover, our results are robust on two fronts. First, the evidence that stock returns are predictable across trading frequencies is true for both Shanghai and Shenzhen stock exchanges. Second, our finding that Chinese stock exchanges are profitable holds across multiple trading strategies.

2. Empirical framework

2.1. Panel predictive regression model

The panel data predictive regression model is typically an extension of the popular bivariate time-series predictive regression model, and can be written as

$$y_{it} = \alpha_i + \beta_i x_{it-1} + e_{it} \tag{1}$$

where y_{it} is the stock return, $i = 1, \ldots, N$ and $t = 1, \ldots, T$ indexes the cross-section and time series dimensions, respectively, and x_{it} is the order imbalance. Order imbalance is modeled as a first-order autoregressive process;

$$x_{it} = \delta_i(1-\theta_i) + \theta_i x_{it-1} + u_{it}. \tag{2}$$