



International cross-listing and price discovery under trading concentration in the domestic market: Evidence from Japanese shares



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ABSTRACT

This study examines the role for the Tokyo and the New York Stock Exchange in price discovery for Japanese shares. A structural approach is employed to investigate the efficiency and contribution in price discovery separately. We find that the speed of incorporating information into prices is faster in New York than in Tokyo. Three approaches are taken to control the size of information and confirm that New York is the efficient side in information assimilation. We also find that the observable liquidity measures such as trade frequency, bid–ask spread, volume per trade and return variance, explain the price discovery efficiency.

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1. Introduction

Since 1970, when Sony listed its shares on New York Stock Exchange (NYSE), Japanese companies have been listing their shares in U.S. markets and traded as American Deposit Receipts (ADR). There exist many explanations for cross-listings, but in this paper we focus on its effect on price informativeness. Literatures suggest that cross-listing enhances price informativeness.¹ But is this also the case for two markets not having overlapped trading hours such as the case of Tokyo and New York?

Literatures of price discovery across markets are initiated by studies on U.S. stocks cross-listed in central and regional markets. Articles in that line of studies include Hasbrouck (1995), Harris et al. (1995) and Harris et al. (2002) for example.² Studies of price discovery across international markets have been increasingly shown its presence. Kleidon and Werner (1996) analyze intraday patterns for U.K. and U.S. trading of British cross-listed stocks. They focus on studying price volatility, volume and liquidity during overlapping period of New York and London market. Menkveld (2008) extends the model of Chowdhry and Nanda (1991) to analyze British and Dutch ADRs. Eun and Sabherwal (2003) examine the price discovery of Canadian stocks listed on both the Toronto Stock Exchange and U.S. exchange. The markets examined in those studies share their trading hours.

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¹ Foucault and Gehrig (2008), Foucault and Fresard, 2013 and Fernandes and Ferreira (2008) for example.

² Hasbrouck (1995) and Harris et al. (2002) introduced the widely used reduced model methods. Baillie et al. (2002) show that the two measures can be obtained by estimating a vector error correction model.

In contrast, this paper examines the price discovery between two markets without overlapped trading hours.³ If the two markets' operating hours do not at all overlap, trading period of the cross-listed stocks would be simply doubled (or more), which would increase the opportunity of incorporating information to its price. However during the NYSE trading hours, it is midnight in Tokyo and the business operations of the Japanese firms are inactive and changes in the value of the firms would be moderate. In fact, the trading volume of Japanese shares in NYSE amounts only for 3% of trading volume in Tokyo. Despite the small trading volume, is New York still an exchange worth cross-listing for Japanese firms? Does the price informativeness of Japanese shares enhanced? The present paper attempts to answer these questions by investigating the efficiency of price discovery and the magnitude of information arrival in the two markets.

Despite their strong presence in the global market, price discovery of cross listed stocks in the two markets has been little studied in the literature. [Lau and David Diltz \(1994\)](#) use the opening and closing stock prices of seven Japanese cross-listed firms and find bidirectional causality but a stronger impact of NYSE returns on Tokyo returns than the reverse. [Karolyi and Stulz \(1996\)](#) use open-to-close and close-to-open returns of eight Japanese ADRs to investigate the determinants of U.S. and Japanese stock return comovements.

This article is the first to study the dynamic aspect of the price discovery of cross listed stocks in the Tokyo Stock Exchange (TSE) and NYSE using high-frequency data. We extend the price discovery literature by distinguishing the two aspects of the price discovery, the efficiency (or speed) and the magnitude of information arrival. The distinction of the two features is crucial in a non-overlapped trading hours setting, such as the case of TSE and NYSE. When two markets do not share their trading hours, faster information assimilation does not necessarily mean a larger size of information incorporation. Even a market is efficient in information assimilation, if the size of the change in the fundamental, i.e., the magnitude of information arrival, is small, the ultimate size of information incorporated during its trading hours may be limited. On the other hand, even if a market is less efficient in information assimilation, if the magnitude of information arrival during its trading hours is large, the ultimate size of information incorporated may be large. The reduced model approaches widely employed in existing literatures do not, and do not need to, consider the potential difference in the magnitude of information arrival as their subject markets under study share their trading hours.

We develop a methodology based on a state space model to explore the speed of price discovery and the magnitude of information arrival. The unobserved efficient price process is modeled as a random walk with deterministic, market-dependent volatility. We model the observed traded price as the adjustment to the efficient price plus temporal microstructural noises. Microstructural noises include errors in analysis or interpretation of information, transitory liquidity needs of traders and asymmetric information. The price adjustment term captures the tendency of the reaction of market participants. The observed price may adjust partially to information or it may overreact to news. Hence even there is no stochastic noise, by this under- or over-reaction of traders, prevents market prices from immediate adjustment on the new information. The model is estimated using by numerically maximizing the likelihood evaluated by the Kalman filter.

The state space model is estimated based on the intraday data of cross-listed Japanese stock in TSE and NYSE over the period September 2007–April 2008. Our findings indeed suggest that the difference in the magnitude of information arrival must be considered. The estimated price discovery measure shows that the speed of incorporating information into prices is faster in New York than in Tokyo. More than 80% of the information arrived in New York is immediately incorporated into prices while it is only 17% in Tokyo. On the other hand, we find that the magnitude of information arrival observed at Tokyo is four times greater than in New York.

As the magnitude of information arrival greatly differs between the two markets, we attempt to control it and obtain a standardized measure of efficiency of information assimilation.⁴ Three approaches are taken to control the size of information arrival. The first approach uses the estimates of the speed of information incorporation in order to derive the size of information incorporated per hour. The results imply that price discovery in New York is three times faster than Tokyo.

The second and third approach estimate regressions to test whether the price discovery inefficiency measure is significantly smaller in New York when the size of information is controlled. The results also confirm the informational efficiency of New York. The last approach also allows us to consider whether the observable liquidity measures, such as trade frequency, bid–ask spread, volume per trade and return variance, explain the price discovery efficiency. We find that the measures explain the price discovery efficiency up to 68%.

The benefit for Japanese firms of cross-listing from the improvement in price informativeness seems to be very limited. However, although the direct contribution is restricted, trade activities in the foreign market may indirectly contribute by enhancing the efficiency of the domestic market's price discovery process. Thus, lastly, we ask whether liquidity measures of New York explain efficiency in price discovery of Tokyo. The results show that the provision of liquidity in the foreign market contributes to enhance the price discovery process in the domestic market. The liquidity measures for New York explain 43% of the price discovery efficiency of Tokyo.

The rest of this paper is organized as follows. [Section 2](#) introduces the structural model employed in the present study followed by the methods to measure efficiency in price discovery and the magnitude of information arrival. [Section 3](#) describes

³ [Wang and Yang \(2011\)](#) examine the FX markets in non-overlapping markets setting. Their structural VAR approach with open-to-close returns does not capture the dynamic aspect of the price discovery. The study applying the most similar approach to the present research is done by [Menkveld et al. \(2007\)](#). Based on partial price adjustment model, they investigate around-the-clock price discovery for Amsterdam–New York cross-listed stocks.

⁴ The terms "price discovery," "information assimilation" and "information incorporation" will be used interchangeably.

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