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# Economies of scale and scope in financial market infrastructures ☆

## Shaofang Li [a], Matej Marinč [b],*

[a] Faculty of Economics and Management, Southeast University, 211189 Nanjing, China
[b] Faculty of Economics, University of Ljubljana, Kardeljeva ploščad 17, 1000 Ljubljana, Slovenia

A R T I C L E   I N F O

A B S T R A C T

This article confirms the existence of substantial economies of scale in trading and post-trading financial market infrastructures (FMI), using the panel data of thirty stock exchanges, twenty-nine clearing houses, and twenty-three central securities depositories from thirty-six countries. We show that economies of scale are positively related to size and vertical and horizontal integration of FMI providers. Economies of scale are significantly higher in North America than in other regions. When analyzing economies of scope, we show that the efficiency of FMI providers increases with vertical (but not horizontal) integration and with a focus on a narrow range of asset classes. We also analyze implications for systemic risk.

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## 1. Introduction

Financial market infrastructures (FMI) serve as a backbone for efficient and resilient financial markets. After the execution of a financial transaction on a stock exchange, several post-trade processes referred to as clearing and settlement are carried out. Clearing and settlement typically involves a clearing house and a central securities depository (CSD) and ensures that the obligations in trade are honored as agreed upon with as little execution risk for the counterparties and as efficiently as possible. FMI are increasingly seen as a crucial support for smooth functioning of the real economy.

The landscape of FMIs has changed dramatically in light of consolidation of stock exchanges, clearing houses, and CSDs. For example, Euroclear, the Belgium-based CSD, became the largest international CSD in the world through acquisitions of CSDs in France, the Netherlands, the UK, Belgium, Finland, and Sweden in 2001, 2002, 2007, and 2008. Merger activities between stock exchanges include the Euronext merger in 2000, the OMX merger in 2003, the NYSE-Euronext merger in 2007, the NASDAQ-OMX merger in 2007, and the merger between the London Stock Exchange and Borsa Italiana in 2007. Mergers between clearing houses, CSDs, and stock exchanges have created some of the largest FMI conglomerates.[1] In light of antiglobalization forces (e.g., the Brexit process and President Donald Trump's protectionist rhetoric), there is a possibility

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that further integration dynamics might be put on hold or even reversed. Understanding the consequences of consolidation is thus crucial in predicting the efficient and stable road ahead for FMI and for financial systems at large.

This article analyzes whether economies of scale and scope exist in the trading and post-trading FMI. We employ the translog cost function to examine the existence of economies of scale and data envelopment analysis (DEA) to estimate the efficiency of FMI. Our sample comprises eighty-two institutions, including thirty stock exchanges, twenty-nine clearing houses, and twenty-three CSDs from Europe, North America, the Asia-Pacific region, South America, and Africa from 2000 to 2015.

We aim to contribute to the existing literature in three ways. First, our focus is on both trade and post-trade FMI. This allows us to analyze the existence of economies of scale in increasingly integrated FMI, in which separation of trade and post-trade FMI becomes increasingly difficult. The past studies have looked at different industries separately when estimating economies of scale or scope (e.g., Hasan and Malkamäki, 2001; Hasan et al., 2003; Schmiedel et al., 2006; Van Cayseele and Wuyts, 2007; Beijnen and Bolt, 2009). The problem with analyzing CSDs, clearing houses, and stock exchanges separately is that such an approach may result in mis-estimation of economies of scale and scope. For example, the analysis could focus on stock exchanges only and estimate economies of scale on the basis of the sample of stock exchanges that do not diversify into other activities such as CSDs or clearing houses. However, such an analysis would cover mostly small stock exchanges and leave out bigger and potentially more efficient stock exchanges that diversify into custody, settlement, or clearing, resulting in an underestimated economies of scale. Alternatively, one could analyze together stock exchanges only and stock exchanges that diversify into other activities. In such a way, there is a missing reference point to estimate how diversification into other activities affects the scale economies and efficiencies. For example, the analysis that would not consider the additional business of diversified stock exchanges would overestimate their costs. To add the reference point and to estimate the effect of diversification into custody, clearing, and settlement, we need to add to the sample the clearing houses and CSDs. Therefore, our data cover all FMI providers—vertically integrated and non-vertically integrated stock exchanges, CSDs, and clearing houses.

Second, we evaluate the existence of economies of scope within FMI. We investigate the benefits of vertical integration (i.e., merger of a clearing house or a CSD with a stock exchange) and horizontal integration (i.e., merger of two FMI providers of the same type). We also analyze whether it is more efficient for an FMI to provide services for a broad range of asset classes or if it is preferable to focus on a narrow range of asset classes.

Third, we analyze whether efficiency of FMIs affect systemic risk in the financial system and the level of development of the financial system. Well-functioning FMI is crucial for stability and efficiency of the financial system at large (Committee on Payment and Settlement Systems, 2012). In addition, several regulators have required derivatives to be cleared under central clearing house with the intention to limit the systemic risk in the opaque derivatives market (as suggested by e.g. Acharya and Bisin, 2014; Li and Marinc, 2016a). However, broadening the range of products covered by the FMI providers may result in the concentration of systemic risk in the FMI (Heath et al., 2016). We analyze whether consolidation of FMI providers and broadening of the product coverage of the FMI providers is associated with a higher systemic risk in the financial system.

The results confirm the existence of substantial economies of scale in FMI. Using the multiple-inputs and multiple-outputs model to measure mean cost scale elasticity, we find that the operating cost increases only by 21.54% if the number of transactions and the value of transactions are doubled. We also show that economies of scale increase with the institution size and with vertical and horizontal integration. The expansion of clearing houses, CSDs, and stock exchanges strengthens cost savings, especially for large institutions. Economies of scale seem to be most pronounced in the North American markets compared to other regions.

We partially confirm the existence of economies of scope across trading and post-trading FMI. More specifically, we find that the efficiency of FMI providers is positively related to vertical integration but negatively to horizontal integration. This implies that economies of scope exist across different types of FMI providers. However, FMI providers that focus on a narrow range of asset classes are more efficient than FMI providers that focus on a broad range of asset classes. This indicates that diseconomies of scope exist across services provided for a broad range of asset classes.

We find some evidence that the efficiency of the FMI is negatively related to the systemic risk within the financial systems. The expansion of services of FMI providers to the broad range of asset classes is positively related to the systemic risk. However, the established relations are only weakly significant and further research is needed to confirm results.

The article is organized as follows. Section 2 reviews the functioning of FMI and the existing literature on economies of scale and scope in FMI. Section 3 describes the methodology and the data. Section 4 presents the empirical results. Section 5 investigates the factors affecting economies of scale and efficiency. Section 6 concludes the article.

## 2. Literature review

### 2.1. The functioning of FMI

FMI are crucial for smooth functioning of financial markets. We follow Lee (2010), who defines FMI as exchanges, clearing houses, and CSDs,[2] with the key functions that they provide as listing, trading, information dissemination, clearing, and settlement (see also Ferrarini and Saguato, 2015; Milne, 2016).

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[2] This definition of FMI is not universal. In the Swiss Financial Market Infrastructure Act, FMI are defined broadly as trading venues, central counterparties, CSDs, trade repositories, and payment systems. Others define FMI more narrowly as post-trade service providers only (see Committee on Payment and Settlement Systems, 2012).