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## The effect of exchange rate volatility on fragmentation in East Asia: Evidence from the electronics industry

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### ABSTRACT

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East Asia is characterized by intricate production and distribution networks that allow fragmented production blocks to be allocated across countries based on comparative advantage. These networks have produced enormous efficiency gains. Exchange rate volatility, by increasing uncertainty, may reduce the locational benefits of cross-border fragmentation. This paper presents evidence that exchange rate volatility decreases the flow of electronic components within East Asia. Electronic components is by far the largest category of intermediate goods traded within these networks. These results imply that policy makers should consider how to maintain stable exchange rates in the region in order to provide a steady backdrop for East Asian production networks. *J. Japanese Int. Economies* 22 (4) (2008) 535–544. Research Institute of Economy, Trade, and Industry, Tokyo, Japan; Department of Economics, George Mason University, Fairfax, VA, USA.

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### 1. Introduction

East Asia is characterized by intricate production and distribution relationships, constituting part of a global triangular trading network. Japan, South Korea, Taiwan and multinational companies located in ASEAN produce sophisticated technology-intensive intermediate goods and capital goods and ship them to China and ASEAN for assembly by lower-skilled workers. The finished products are then

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exported throughout the world. These production and distribution networks have promoted economic efficiency and helped to make East Asia the manufacturing center of the world.

This slicing up of the value-added chain in East Asia is particularly intricate and well-developed. It involves complicated combinations of intra-firm trade, arms-length transactions, and outsourcing (Kimura and Ando, 2005). These networks have allowed firms to exploit comparative advantage by breaking up long production processes and allocating the production blocks created in this way throughout Asia. The resulting production–distribution networks can be characterized as vertical intra-industry trade (VIIT).

This VIIT differs both from the exchange of final goods emphasized by traditional trade theory for vertical inter-industry trade between the North and the South (e.g., between capital goods and apparel) and for horizontal intra-industry trade between the North and the North (e.g., between two differentiated types of automobiles). As Fukao et al. (2002) discuss, the production processes of an industry (e.g., the electronics industry) have been split into fragmented production blocks that can be located in different countries and the new VIIT is essentially based on differences in factor endowments in the fragmented production blocks between developing, emerging, and developed economies in the region.

In order to decide on the optimal degree of fragmentation firms must weigh benefits and costs along the locational, ownership, and internalization dimensions (Kimura and Ando, 2005). Locational considerations include wage levels, factor endowments, technology transferability, physical and human infrastructure, and the existence of market-supportive institutions and political regimes. Ownership considerations are based upon technological and managerial differences between home and host country firms. The home country's advantage in this area must be sufficient to overcome the extra costs arising from differences in business customs, formal and informal norms, languages, etc. Internalization considerations refer to the net benefits obtained by FDI firms through more captive and integrated business activities conducted by parent firms. The optimal degree of internalization is determined by balancing the costs of asymmetric information, incomplete contracts, and ineffective dispute settlement mechanisms with the efficiency gains from complete outsourcing and deverticalization.

When considering how exchange rate changes affect a firm's incentive for cross-border fragmentation, locational considerations are central. Exchange rate volatility, by increasing uncertainty, may reduce the locational benefits of cross-border fragmentation. In addition, an appreciation in the level of the exchange rate in the home country may cause firms or affiliates abroad to source from the host country rather than the home country.

These effects have been discussed by the IMF (2005) and Yoshitomi (2007). The IMF argues that the flow of imports for processing will be driven by the demand for final exports in the rest of the world, and that the exchange rate elasticity for imports for processing will be small (about 0.1). Yoshitomi argues that exchange rate volatility will hinder the expansion of East Asian production and distribution networks.

To understand Yoshitomi's argument the theoretical framework of Ando and Kimura (2007) is useful. They show that the service link cost for production blocks separated by national borders is an increasing function of risk and uncertainty. Kiyota and Urata (2004) note that exchange rate volatility may increase risk and uncertainty in East Asia. Thus volatility may interfere with the slicing up of the value-added chain in East Asia.

In the case of Japan, parts and components for assembly flow in approximately equal quantities to China, ASEAN-5, and South Korea and Taiwan.<sup>1</sup> Once a Japanese firm has invested in another East Asian country and established a cross-border production network it does not withdraw from that country. However, the volume of new FDI, capital goods, and parts and components that flows to a particular country may decrease if the country's locational advantages fall relative to other countries.<sup>2</sup>

<sup>1</sup> According to the CEPII-CHELEM data base, Japan in 2005 shipped \$9.4 billion in electronic components to China, \$9.6 billion to ASEAN-5, and \$10.1 billion to South Korea and Taiwan. It shipped \$26.3 billion in intermediate goods to China, \$25.3 billion to ASEAN-5, and \$23.9 billion to South Korea and Taiwan.

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