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## Firm and Product Heterogeneity in China's Automotive Exports\*

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### ABSTRACT

The main purpose of this paper is to provide an in-depth analysis of the anatomy of China's automotive exports, relying on the literature on firm and product heterogeneity. For this purpose, we use highly disaggregated HS 8-digit product-category level data collected by the Chinese Customs Office for 2000 and 2008, and we distinguish between foreign firms, domestic public firms, and domestic private firms. We also decompose automotive products into autos and auto parts and components (P/C). We then calculate both the extensive margins – number of products exported – and intensive margins – average value of exports per product – of China's automotive exports. We estimate gravity equations to assess the determinants of China's exports of autos and auto P/C. Overall, our analysis yields a number of new, interesting stylized facts about China's automotive exports by confirming the need for taking into account different types of heterogeneity in analyzing international trade.

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### 1. Introduction

The automotive industry is an important symbol of modern industry. It has important linkages to several key segments of the economy, and it is often an important component of the industrialization process. The industry contributes not only to the development of manufacturing and transportation but also creates large number of jobs in a wide range of

industries: metal materials, mechanical equipment, fixtures, electronics, rubber, engineering plastics, textiles, glass, automotive oil, and so forth.

One significant feature of the auto industry is that a small number of global mega-sized firms from few countries dominate the market. Since the late 1980s, large carmakers shifted their parts and components (P/C)

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factories and production bases to developing countries to lower production costs or seek markets. Likewise, large automakers increasingly outsource the production of P/C to outside suppliers to lower their costs.<sup>1</sup> Today, the global automotive industry is geographically fragmented, and the production process is split into different phases carried out in different countries. This geographical fragmentation of global auto production is driven by global mergers, direct investment and international outsourcing.<sup>2</sup>

Fragmentation has resulted in an explosive expansion in the trade of P/C due to the expansion of back-and-forth transactions in vertically fragmented cross-border production processes (Amighini, 2012). Thus, Kierzkowski (2011) notes that vertical product differentiation, intra-industry trade and fragmentation of production leading to international outsourcing are important features of the existing global automotive sector. Empirical studies on automotive trade have concentrated on these features.<sup>3</sup>

First, many studies have examined intra-industry trade. Montout, et al. (2002) consider the determinants of intra-industry trade (IIT) for autos and auto parts and components (P/C) in NAFTA. Türkcan and Ates (2010; 2011) also examine auto P/C for the US by breaking down the bilateral trade flows into inter-industry trade, vertical IIT and horizontal IIT. Leitão, et al. (2010) also utilize panel data to examine the determinants of vertical intra-industry trade (VIIT) in the auto P/C industry between Portugal and the 27 European Union and the 4 BRIC countries. Ito and Umemoto (2004) investigate recent trends and patterns of intra-regional trade and IIT, focusing on the auto and auto P/C industries in the ASEAN-4 countries. Umemoto (2005) investigates auto P/CIIT between Korea and Japan. Lefilleur (2008) confirms that the high levels of IIT between core CEECs and their neighboring countries in the ex-EU-15 are due to the decomposition of production processes within the central basin, initiated by significant relocation of foreign direct investment. All these studies conclude that intra-product specialization or vertical specialization has become an essential part of the regional integration of automobile production.

Second, from the perspective of recent research on international trade and firm heterogeneity,<sup>4</sup> some studies have begun to use micro-datasets to analyze the global fragmentation of automobile production and intra-firm trade between parents firms and affiliates. Using data from Toyota and Honda, Yoshida (2005) examines regional trade in auto parts and components (P/C) trade between Japan and other Asian countries. The results show that FDI by the Japanese automakers contribute to promoting

regional trade of intermediate goods in the case of Japanese exports, but not in the case of Japanese imports. Since extensive margin versus intensive margin is a key conceptual distinction in the theoretical model of Melitz (2003) on firm heterogeneity, some studies estimate extensive and intensive margins of automotive trade. For example, Swenson (2012) uses Chinese product trade data for 1997 to 2009 to find that foreign-affiliated firms have mitigated the effects of China's content-based auto import trade policy by reducing import transaction prices and by reducing import quantities on the extensive margin. Using US auto industry data from 1996 to 2008, Türkcan and Yoshida (2010) examine the contribution of extensive and intensive margins to variation in intra-industry trade (IIT). They find that intensive margins have positive effects on the IIT of both auto industry and auto P/C industry.

Third, some studies have begun to look at emerging markets that may benefit from the new trade patterns in the automotive industry. In the next few decades, the major sources of growth in the automotive industry are predicted to lie in the emerging markets, such as China and India (Kierzkowski, 2011). A study by Nag, et al. (2007) on China, India, Indonesia and Thailand examines the growth patterns, changes in ownership structures, trade patterns, and the role of government. They distinguish trade in auto P/C from auto trade to help explain the different features of the auto trade of different countries. Amighini (2012) compares the relative positions of China and India in the international fragmentation of auto production, and highlights the unique characteristics of the Chinese auto industry. Noble (2006) also offers a summary of how the Chinese and Indian auto industries have emerged. China opened its domestic market to foreign automakers in the 1980s. Through the extensive use of the joint venture form cooperation, the government hoped that the Chinese domestic firms would learn from foreign firms and eventually become internationally competitive.<sup>5</sup> Only very few scholars use micro data to analyze China's automotive industry. For example, as noted above, Swenson (2012) uses China's micro trade data for 1997 to 2009 to assess whether foreign-affiliated firms differentially changed their input sourcing, in response to content-based import tariffs China imposed on imported auto parts. Amighini (2012) also uses micro data, to highlight the unique characteristics of the Chinese auto industry.

The main purpose of this paper is to analyze the determinants of China's automotive exports, using highly disaggregated HS 8-digit product-category level data collected by the Chinese Customs Office for 2000 and 2008. Following Lee et al. (2013), we distinguish firms by forms of ownership, foreign versus domestic firms, which are then further divided into public firms and privately-owned firms. While Lee et al (2003) focus on China's aggregate imports, decomposed into imports of final products and imports of intermediate products, this paper focuses on China's automotive trade.

Like our paper, Amighini (2012) analyzes China's automotive trade pattern by distinguishing auto P/C from autos, and compares it with India's automotive trade patterns. However, our paper differs from Amighini (2012) in that he uses the SITC rev.3 classification code but we use the 8-digit Harmonized System (HS) of China to analyze not only differences between autos and auto P/C but also differences among firm types. The present paper is also different from Amighini (2012) in that we estimate a gravity equation to examine the determinants of China's exports of both autos and auto P/C. As noted above, Swenson (2012) also differentiates P/C from final products in China's auto imports to assess the

<sup>1</sup>For an overview of global automotive industry, see Sturgeon, et al. (2009) and Kierzkowski (2011).

<sup>2</sup>International fragmentation of production and global value chain has drawn a lot of attention from scholars. See for example, Arndt and Kierzkowski eds. (2001), Athukorala (2005, 2009, 2010), Athukorala and Yamashita (2006), Ando and Kimura (2003, 2009) and Kimura (2009).

<sup>3</sup>In this paper, automotive trade refers to both trade in automobiles and trade in auto parts and components (P/C). Also, trade in automobiles is referred to as auto trade and trade in auto parts and components are referred to as auto P/C.

<sup>4</sup>Since the seminal paper by Melitz (2003), the focus of international trade research has changed to firm heterogeneity, as well summarized in Bernard, et al. (2011). Empirical studies confirmed that when compared with domestic firms, foreign-invested firms are more productive and often generate productivity "spillover" to the host country (Lu, et al., 2010). Using data from China, a number of recent empirical studies have described the different characteristics of different ownership firms in China's trade (Lee, et al., 2013; Manova, et al., 2011 and Du, et al., 2012).

<sup>5</sup>See Chu (2011) for a comprehensive summary of how the Chinese government promoted its automotive industry.

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