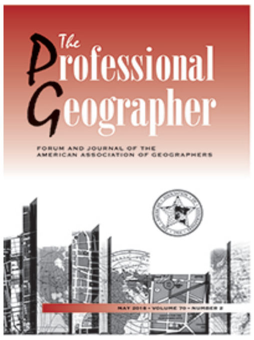

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Chinese Trade in Latin America Compared to the European Union and the United States: The Case of Technology-Intensive Exports

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Using trade data submitted by United Nations member states from 1995 to 2013, this article contributes to understanding China's trade with Latin America. By employing and building on the TECH score methodology, this project highlights China's growing economic connectivity with nine large and important Latin American economies. The analysis conducted here shows that compared with exports originating from other, more traditional foreign investors (i.e., the United States and the European Union member states), Chinese exports to these Latin American countries—although growing in sophistication over time—are relatively less technologically sophisticated during the study period. This work clarifies that in spite of these Latin American economies being highly complementary (for their natural resources and consumer markets) to China's manufacturing-intensive economy and despite the rapid growth in bilateral and biregional trade, China's displacement of traditional foreign actors, in terms of its technology-intensive exports to the region, is not supported by the data to date. **Key Words: China, exports, Latin America, South–South trade, technology-intensive goods.**

本文运用联合国成员国自 1995 年至 2013 年提交的贸易数据，促进我们对中国与拉丁美洲贸易的理解。本计画藉由运用并根据 TECH 评分方法，强调中国与拉丁美洲九大重要经济体逐渐成长中的经济连结。本处所进行的分析显示，这段期间，与来自其他更为传统的外国投资者 (例如美国与欧盟成员国) 的出口相较之下，中国对这些拉丁美洲国家的出口在技术上较不复杂——尽管复杂性随着时间增加。本研究澄清，尽管这些拉丁美洲经济体与中国製造业密集的经济具有高度互补性 (因其具有自然资源与消费市场)，且即便双边贸易与两大区域间的贸易快速成长，截至目前的数据并不支持中国在对该区域的技术密集出口上取代传统外国行动者的说法。**关键词: 中国, 出口, 拉丁美洲, 南–南贸易, 技术密集货物**。

Mediante el uso de datos sobre comercio suministrados por estados miembros de las Naciones Unidas de 1995 a 2013, este artículo contribuye a comprender el comercio de China con América Latina. Empleando la metodología de puntajes TECH y construyendo sobre la misma, este proyecto destaca la creciente conectividad económica de China con nueve economías latinoamericanas grandes e importantes. El análisis que se realiza aquí muestra que en comparación con las exportaciones que se originan desde otros inversionistas extranjeros más tradicionales (i.e., los Estados Unidos y los estados miembros de la Unión Europea), las exportaciones chinas a estos países latinoamericanos—aunque aumentando en sofisticación a través del tiempo—estaban relativamente menos sofisticados tecnológicamente durante el período del estudio. En el trabajo se aclara que a pesar de que estas economías latinoamericanas se comportan como altamente complementarias (por sus recursos naturales y mercados de consumo) con la economía china, intensiva en manufacturas, y a pesar del rápido crecimiento en comercio bilateral y birregional, el desplazamiento por China de actores extranjeros tradicionales, en términos de sus exportaciones intensivas en tecnología hacia la región, hasta la fecha no están apoyados por los datos. **Palabras clave: China, exportaciones, América Latina, comercio Sur–Sur, bienes intensivos en tecnología.**

During the past three decades, the world's economic center of gravity has shifted away from Organization for Economic Cooperation and Development (OECD) economies toward emerging economies—a phenomenon sometimes referred to as *shifting wealth* (OECD/ECLAC/CAF 2015). In the process, integration, flattening, and geographic particularities have combined to move the global economy toward increasing complexity. The rise in world economic complexity has also provided novel trajectories for different players to emerge. The shifting axes of global trade moving from the North–South toward the South–South has become one of the defining features of contemporary globalization. Part of this shift has involved the simultaneous increase of connectivity between regional development and globalizing business processes such as global production networks. Coe et al.'s (2004) conceptualization of the relationship between the two is helpful here: "regional development is conceptualized as a dynamic outcome of the complex interaction between territorialized relational networks and global production networks within the context of changing regional governance structures" (469). In this context, South–South relations, particularly South–South trade, help us think about the reorientation of the global economy. Recently, the increase of South–South trade has gained particular importance (see, e.g., de la Torre et al. 2015) with developing countries accounting for 50 percent of the increase in global exports between 1995 and 2012 (United Nations Conference on Trade and Development 2013). Since joining the World Trade Organization

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(WTO) in 2001, China has played a key role in driving South–South trade both as a site of production and as a source of demand (see Horner 2015, 2–5). Much less is known, however, about how China's engagement with developing world regions is shaping its role within the global economy.

Because Latin America in particular provides a highly compatible match for China's "going out" strategy in that "Latin America is a source of key commodities that China needs at its present stage of development" (Gallagher 2016, 73), postmillennial studies on Chinese–Latin American trade can contribute to further explaining China's influencing role in South–South trade. The purpose of this article is to show that as the Chinese economy internationalizes (Gonzalez-Vicente 2011) and as Chinese state-owned enterprises seek out diverse resource inputs for China's manufacturing-intensive economy (see, e.g., Brautigam 2011; Economy and Levi 2014; Gallagher 2016), Chinese trade with Latin America is becoming increasingly higher in value over time, although not in relation to more traditional trading partners. Although Chinese exports to Latin America are increasing over time, their relative technological sophistication is lower compared with European and U.S. exports to the region. This article demonstrates these trends by employing the TECH score technique to measure the overall sophistication of an individual country's cumulative export basket to a particular target country in a given year and reflects on the governance structures within Latin America that influence trade with China.

In trying to understand the technology-intensiveness of the Chinese–Latin American trading relationship, it is first useful to ask to what extent technological upgrading of Chinese exports to Latin America occurred from 1995 to 2013. Did Chinese exports to Latin America serve to complement or compete with the range of advanced exports from European Union (EU) and U.S. economies? Using models developed and refined by Hausmann, Hwang, and Rodrik (2007); Xu (2007); Schott (2008); and Kemeny (2011), this work examines the relative technology content of Chinese exports entering nine distinct Latin American economies from 1995 to 2013. The economies of Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, and Venezuela[1] are examined for each of five years (1995, 2000, 2005, 2010, and 2013) to shed light on two broad questions relating to China's exports to Latin America—the first temporal, the second spatial.

First, are Chinese exports to Latin America becoming relatively more technologically advanced over time as China integrates with Global South trading and manufacturing regimes? Answering this question will provide evidence supporting the attractiveness of one aspect of the Chinese economy in Latin America and would add further credibility to the viability of the Chinese state capitalist model, which has fostered the development of new international export markets. The second major question is this: Are Chinese exports to Latin America becoming relatively more technologically advanced compared to those commodity exports originating in the economies of more traditional Latin American trading partners such as the United States and the EU,[2] both of which have been the region's traditional source of highly sophisticated goods? The answer to this question might offer the possibility that Chinese economic engagement with Latin America is on a trajectory to displace (or replace) the United States and Europe as the region's principle trade partner of highly sophisticated (high-technology content) goods. It might also allow for the possibility that a growing sophistication level of Chinese exports to the region portends a sea change in Latin America's foreign and economic relations away from its traditional trading partners (the United States and Europe) toward China.

Between 2000 and 2013, the value of China–Latin America trade increased by a factor of twenty-four, climbing from $12 billion to $289 billion (Americas Society/Council of the Americas 2015). Increased regional economic integration holds the potential to offer mutual benefit to both China and Latin America (Ellis 2009; Fornés and Butt Philip 2012). In addition, China's manufacturing firms in particular are seeking to expand globally and are actively targeting regions, such as Latin America, that are home to a concentration of middle-income countries. Latin American economies' institutional maturity might help to explain Chinese actors' affinity for economic engagement—including trade—with developing countries in the Americas compared with economies in Africa (Narins 2016).

Beginning in the early 1980s, China's economy was known as a manufacturing and export hub for products characterized by low levels of technological sophistication. Low wages combined with massive amounts of inbound foreign direct investment, coupled with a Chinese government policy requiring foreign multinationals to partner with domestic Chinese companies, has encouraged a transformation of Chinese manufacturing toward the production of higher level technology exports. Chinese exports have increased in technological complexity and value to some regions, but not others. Therefore, this article seeks to bring clarity to the trade dynamics involving Chinese exports to Latin America from 1995 to 2013. This period precedes and includes Latin America's China Boom (2003–2013)—a phase, by the end of which "most countries in the region had China as their number one or two trading partner" (Gallagher 2016, 42). This study aims to contribute to geographers' efforts to more accurately determine Chinese economic actors' actual involvement beyond China's borders using Latin America as a framework through which to examine Chinese exports and Chinese development more broadly in the context of growing South–South trade (Pieterse 2012; Nadvi 2014).

Trade as a Proxy for Development

The growth of economic globalization and international trade has spurred a "new economic geography" discourse that has sought to bring attention to the location of economic activity as a central focus of study (Fujita, Krugman, and Venables 1999). Ideas of "flatness in economic geography" have been debated (Leamer 2007) in relation to economic globalization (e.g., Friedman 2005). Ultimately, the relationship between trade, technology, and development has remained geographically relevant.

Newer theoretical work in the geography of trade has built on earlier models of the international exchange of goods that typically did not capture product fragmentation and considerations of intermediate goods (e.g., Kemeny and Rigby 2012). It is in this vein that these new conceptions of spatial geography can be employed when examining the degree of sophistication of Chinese exports to developing world regions such as Latin America.

Simply put, trade—along with the technology and development associated with trade—is a proxy for development. Understanding the relative sophistication of Chinese exports to Latin America, therefore, can help us better clarify China's economic development.

Technological Sophistication of Exports to Latin America

Despite recent setbacks in the growth of the Chinese economy, with overall exports decreasing by more than 6 percent during the year ending in April 2015, China remains a major exporter of a range of manufactured goods. By empirically measuring and analyzing the nature of Chinese exports, I measure the *relative technological sophistication* of Chinese exports to Latin America. At present, only a handful of countries in Latin America compete with China in world and regional manufacturing markets (Gallagher and Porzecanski 2010). For this reason, examining Chinese companies' exports to Latin America can help inform the extent to which China's manufacturing-intensive economy is inserting itself in a region that, because of its complementary economic characteristics (e.g., the presence of natural resources) might be predisposed to attracting "Chinese-type" economic activities (e.g., those characterized by small and medium manufactures).

In general, data availability for imports and exports is more widely accessible than actual production data. Furthermore, although trade in services—including service exports from advanced economies like the United States and the EU—has become an increasingly large and significant part of international trade (Sauvé and Roy 2016), comprehensive data related to the trade in services are difficult to obtain and are often incomplete, and for these reasons they have been excluded from this project (see, e.g., United Nations Service Trade Statistics Database 2010). Because manufactured commodities make up a large percentage of China's exports, coupled with the fact that manufactured products tend to have a higher value than primary commodities or natural resources, assessing the degree to which the Chinese economy's "export basket"[3] is composed of sophisticated goods can help to explain Chinese economic engagement in the region in comparison to that of the EU and the United States. Therefore, this work looks at Chinese exports to Latin America during a phase of rapid internationalization of the Chinese economy between 1995 and 2013. This period starts prior to China's 2001 entry into the WTO and includes annual data through 2013.[4] Examining these data reveals Chinese export behavior with each of the target economies and in each case will clarify the technological sophistication (using TECH scores as a proxy for value) of Chinese exports versus that of exports originating in the EU and United States.

Method

This work borrows Kemeny's (2011) Technology (TECH) scores methodology as a foundation on which to determine the comparative rankings of major exporters of technologically sophisticated products to the region (i.e., the EU and the United States) along with exporters of goods considered to be of more moderate sophistication (i.e., China). As will be discussed in detail later, the original TECH score methodology is repurposed into three separate iterations. First, I calculate TECH scores as they change during each of the study years (1995, 2000, 2005, 2010, and 2013). Next, I calculate TECH scores holding constant the revealed productivity at its initial 1995 level. Finally, I calculate TECH scores while holding each country's unit price (for a particular export) fixed over time, again using the initial 1995 price level.

To address the question of whether or not Chinese exports to Latin America demonstrate higher technological content ratios over time, I employ the original TECH score technique (Kemeny 2011). This technique considers a combination of the following variables: an exporting country's gross domestic product (GDP) per capita, a particular export's revealed productivity, and the quality of a commodity exported to one of the targeted countries in this study. Evidence of an observed trend of technological advancement of Chinese exports to Latin America would lend empirical weight to the idea that Chinese products are (or might become) potential replacements for similarly advanced products that are currently exported to Latin America from the United States and the EU.

In this analysis, a TECH score is a measure of the overall sophistication of an individual country's cumulative export basket to a particular Latin American economy in a given year. The TECH score technique is one way to assess the overall competitiveness and attractiveness of a trading partner. Irregularities in the data aside, the technique also benefits from being comprehensive in its coverage of all commodities exported from a country of origin to a destination country.

Using TECH scores to compare the export sophistication of Chinese exports with those of Latin America's traditional trading partners not only clarifies the relative gain of Chinese higher value exports to Latin American economies over time but also offers information on the relative decline of the technology levels of already established trading partners. This technique can provide further insights into the shifting geo-economic importance of China as a trading partner in the region versus that of the United States and the EU.

To determine the TECH scores for China, the EU, and the United States, I first calculated the revealed productivity of a commodity (the product to be exported) based on income. Revealed productivity is a weighted average of GDP per capita of the exporting country. I then calculated the quality of a commodity based on relative price. Here I assume that higher priced items are of higher quality than lower priced items. Determining relative price involves comparing the price of a good exported by one country relative to the price of the same good exported by all countries. In sum, there are three components involved in the calculation of a TECH score. The first of these three components is revealed productivity, denoted here as P_{gt}:

$$P_{gt} = \sum_{c} \left\{ \frac{x_{gct} / \sum_{k} x_{kct}}{\sum_{m} \left(x_{gmt} / \sum_{k} x_{kmt} \right)} Y_{ct} \right\} \tag{1}$$

In Equation (1), the revealed productivity of a good g is expressed as the weighted average of GDP per capita (Y_c) of all countries that export good g, the weights indicating the importance of each exporting country in world exports of good g. The assumption here relating to revealed productivity is that the higher the GDP per capita of an export country, the higher the "per capita income content" (Xu 2007) of the good being exported. The fraction in front of Y_{ct} serves as a weight ratio. The numerator in this fraction adjusts for the export share of good g in that country's "export basket" ($\sum_k x_{kc}$). The denominator in this fraction is the sum of all export shares of good g across all countries. Here k takes the value for each good and m takes the value for each country. The equation employs time t to denote the export year being analyzed. P_{gt} is good specific for a particular year across all countries.

The second component, the quality of a commodity, which I call Q_{gct}, is a variable that seeks to address the variation in product quality arising from an export originating in different countries. Borrowing again from Xu (2007), to capture this quality dimension, the following equation seeks to account for country c's quality of an exported good g by addressing that good's unit price.

$$Q_{gct} = \frac{u_{gct}}{\sum_{n} \left\{ \frac{x_{gnt}}{\sum_{k} x_{gkt}} u_{gnt} \right\}} \tag{2}$$

Here u_{gct} represents the unit price of good g from country c for year t. The denominator of the function Q_{gct}, ($\sum_n \left\{ \frac{x_{gnt}}{\sum_k x_{gkt}} u_{gnt} \right\}$), is the weighted unit price of good g (in 2013 U.S. dollars) exported across all countries. This weight refers to country n's export share of good g with respect to total exports of good g. Here k and n take the value for each country.

The final component, the export share for a country (or E_{gt}), across all products can be expressed as:

$$E_{gt} = x_{gct} / \sum_{k} x_{kct} \tag{3}$$

The actual TECH score of individual countries is computed as the product of the three aforementioned variables:

$$TECH\ Score = P_{gt} * Q_{gct} * E_{gt} \tag{4}$$

Data Description Used for Calculating TECH Scores

This study uses United Nations Commodity Trade Statistics Database (UNCOMTRADE) data for commodities imported into Latin American economies in the years 1995, 2000, 2005, 2010, and 2013. The data are coded using the six-digit, 1992 Harmonized System (HS92) format. The HS92 commodities classification system offers benefits over other systems such as Standard International Trade Classification because the former system provides more detailed, disaggregated commodity data than the latter. Although the time period selected for this study is not as expansive as previous studies (e.g., Kemeny 2011), it does examine the increasing technological sophistication of more recent export activity (1995–2013)—a period of rapid Chinese economic engagement in Latin America.

I employ World Bank data for GDP per capita (in current U.S. dollars) for all countries listed. Because some countries do not report these data to the World Bank, such data are not available for all countries. To adjust for inflation, I use the U.S. Bureau of Labor Statistics Consumer Price Index (CPI) with a base year of 2013 to convert all export dollar amounts to real dollars (Bureau of Labor Statistics 2014).

To calculate P_{gt} (the revealed productivity of a good g at time t), I multiply the exporting county's GDP per capita by a weighted average ratio based on the share of a particular export across all countries. When calculating Q_{gct} (the relative unit price), I look at the variation in product quality based on relative unit price of an export. After calculating Q_{gct}, I removed outliers typically found below the 1st percentile and above the 99th percentile. When calculating Q_{gct}, I set natural resource commodities equal to one to try to mitigate the (sometimes wild) fluctuations of such products over time. In addition, I also removed export data when the quantity was not available or not provided in the UNCOMTRADE data.[5] I chose to focus the study only on those commodities that had both a cumulative export value above US$10,000 and that were exported in amounts greater than 100 units of a particular export. This decision was intended to remove data that were misreported to UNCOMTRADE that could potentially cause unduly large variation in relative price calculations. Finally, I used the statistical program R (Version 3.0.2; R Core Team n.d.) to run a script that takes the variables described earlier as inputs and calculates the TECH scores for the countries that export to the target Latin American economies.

Methodological Drawbacks and Robustness Checks

There are several potential drawbacks to using the TECH score method in its original format as a way of determining the technological sophistication of Chinese exports versus that of traditional traders (EU and United States). One possible drawback is that by focusing on "the income of major exporters of any given product," the original TECH score technique shifts "the focus away from technological characteristics to similarities of the export profiles of high-income countries" (Gallagher and Porzecanski 2010, 71). The primary concern, for our purposes, is that if there is a product initially made exclusively by rich countries, that product will initially be classified as "high tech." If China completely takes over the market for the product, however, then that product will, gradually, start to be considered "low tech" as it is now being produced by China, an emerging but still relatively poor country. Simply put, employing the original TECH score methodology assumes that if a country has a high GDP that it exports more technologically advanced products than do poorer countries.

A fixed productivity robustness check is employed to correct for the blanket assumption that there is a positive relationship between GDP and an export's technology level. This check makes use of P_{g1995} (the value of revealed productivity in 1995) instead of P_{gt} for each year when computing the TECH scores for each period. Fixing the value of revealed productivity in 1995 adjusts for the bias that if China (instead of advanced countries) exports a product, that this is likely due to China having a lower cost, thereby making it seem like the product is becoming less advanced over time. Although it is not possible to capture the increased sophistication from products that are able to be offshored, it is possible to avoid considering those products as automatically being "less sophisticated" as soon as they are, in fact, offshored. This fixed productivity robustness check, then, considers only how advanced each product is as measured during the base period. The sophistication of each product is therefore not influenced by changes based on who exports it over the period.

As a second robustness check, I also run the TECH score calculations using Q_{gc1995} (the unit price of an export held fixed at its 1995 level). I do this in an attempt to avoid devaluing China's TECH scores for increases in productivity. This check seeks to address the potential bias of a good being considered less technologically advanced the cheaper it is to produce.

Another potential problem inherent with the TECH score methodology is that it might not adequately account for the fragmentation of production processes. Although it would be ideal to have access to value-added trade data that only capture the value added to goods within a country before export, in practice this is very difficult to achieve (see Johnson and Noguera 2012; Johnson 2014). Processing trade—especially in China—is widespread with some estimates placing the domestic value added (dva) of its higher sophisticated, electronic devices at 30 percent or lower (Koopman, Wang, and Wei 2008). Therefore, although fragmentation will inflate and bias China's TECH scores in the upward direction—because products that make use of advanced inputs are likely to have relatively high unit prices (which lead to a high Q_{gc0} term in the TECH score)—this inflation of TECH scores is partially adjusted by considering the P_{gt} term, which adjusts for which countries export a given product and is not directly affected by the inputs. Despite this bias, because TECH scores in this study are not dramatically increasing over time, this suggests that increased fragmentation is not leading to massive changes in the sample examined here.

Results

For the data examined during the study period, China has remained an exporter of commodities of low to moderate sophistication to Latin America—compared with United States and EU exports to the region. This trend has occurred even as the absolute sophistication of China's exports to Latin America has increased over time. In general, the EU and the United States have been and continue to be the main exporters of highly sophisticated products to the region. Although this analysis indicates that, over time, Chinese exports have increased in sophistication within the target Latin American economies, in general, there is an observable stasis in the trends of TECH scores across the five years examined (Figure 1) in comparison to the TECH scores of more traditional foreign trade partners. The one exception to this stasis is the significant increase of China's TECH scores in Venezuela from 1995 through 2011. The nine graphs in Figure 1 detail China's annual TECH scores (in green) for the nine target Latin American countries and compare these TECH scores with those of the EU (in red) and the United States (in blue).

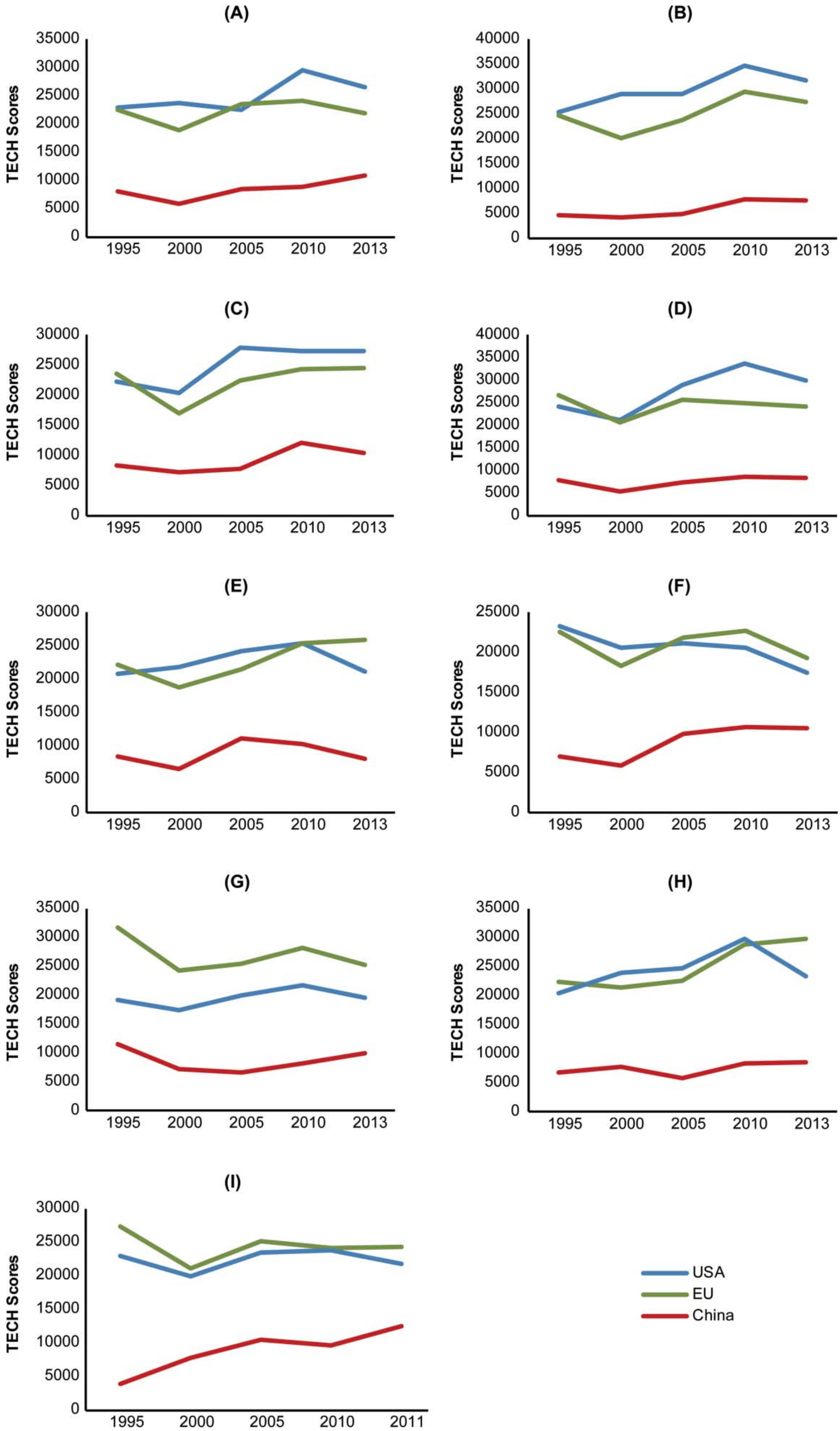

Figure 1 *TECH scores for the United States, European Union (EU) countries, and China in nine target Latin American countries: (A) Argentina, (B) Bolivia, (C) Brazil, (D) Chile, (E) Colombia, (F) Ecuador, (G) Mexico, (H) Peru, (I) Venezuela in 1995, 2000, 2005, 2010, and 2013 (Venezuela uses 2011 data rather than 2013 data). Source: United Nations Commodity Trade Statistics Database (UN COMTRADE) data with author's elaboration. (Color figure available online.)*

Although each target country has a distinct pattern of EU, United States, and Chinese TECH scores, several interesting trends emerge from these data. First, EU and U.S. TECH scores are consistently larger than those of China by (as much as) a factor of three. Second, in no case do Chinese TECH scores equal or surpass those of the EU or the United States. Third, the years 1995 and 2010 stand out as being the years that have the highest overall TECH scores among the three sets of exporting countries examined in this series of graphs. Finally, in general, it is the more left-leaning, nationalist countries (Argentina, Ecuador, and Venezuela) that have the sharpest increase in Chinese TECH scores during the years examined in this study. For each of these three countries, China's TECH score surpassed 10,000 in the year 2000. The highest overall Chinese TECH score (>12,400) can be observed for Venezuela in 2011.

During the study years and within the nine Latin American target countries, however, there has been a general trend of increasing technological sophistication in Chinese exports over time (Figure 2). Figure 2 highlights the growth of China's TECH scores calculated using the standard methodology, and, as a fixed productivity robustness check, calculated using two alternative specifications for the TECH score to account for potential biases discussed earlier. First, the blue curve in each of the nine graphs in Figure 2 represents China's TECH score for a target country using Kemeny's (2011) original TECH score method. Second, the red curve illustrates China's TECH scores when the value of revealed productivity is fixed to 1995 (P_{g1995}) to adjust for the bias that exists if China (instead of advanced countries) exports a product. This is likely due to China having a lower cost, thereby making it appear as if the product is becoming less advanced over time. Finally, the green curve illustrates China's TECH score when the unit price of an export is held constant at 1995 levels, using Q_{gc1995}. This is done in an attempt to avoid devaluing China's TECH scores for increases in productivity. The nine graphs in Figure 2 indicate an overall mixed trend of higher Chinese TECH scores across the target countries. This indicates that, to date, Chinese exports are not overtaking technologically sophisticated exports from the EU and the United States to this region.

Employing the TECH score methodology, Table 1 highlights China's top five most technologically valuable commodities exported to these nine Latin American countries in 2013. Although Table 1 highlights the variety of manufactured components exported by China to the targeted economies, groupings of commodity types can be seen emerging across the nine countries. There is a great deal of similarity in the technological sophistication of China's top exports to the different countries in the region. Chinese exports of telecommunications equipment and components, transportation machinery and equipment, electrical parts, toys, and other manufactured equipment to Latin America serve to identify and characterize the recent Chinese–Latin American bilateral trade relationship. Table 1 highlights the TECH scores that were calculated (by commodity) prior to country-level aggregation. This is done to understand the technology sophistication of a product at the commodity level.

Figure 3 displays Chinese TECH scores in Latin America in 2013 and shows three indicators of Chinese economic connectivity with the region. First, the x-axis highlights the U.S. dollar value (in US$ millions) of Chinese commodities exported to a target country in that year. Second, the y-axis shows the TECH scores for China's overall exports to that economy in the year 2013. Third, the size (i.e., the diameter) of each circle represents the export share of Chinese commodities into a target Latin American country in the same year. A larger circle means China accounted for a higher percentage of world exports to that economy in 2013.

Figure 3 reveals several interesting trends. First, the Chinese products with the highest technological sophistication (TECH score) are the commodities that China exports to Venezuela. The next highest valued Chinese commodity exports (in terms of technology sophistication) are those products that are exported to Ecuador and Argentina. Along with Figure 1, Figure 3 illustrates that China's most technologically sophisticated exports during the study period tend to be exported to those countries that have state-controlled economies. These findings suggest that leftist, more nationalist Latin American economies might be increasing their reliance on highly sophisticated, Chinese commodity imports as they decrease their acceptance of similar imports from the EU and the United States. This result might be attributable to the high-level government-to-government trade and multisector investment agreements that have been signed between Chinese and left-leaning Latin American leaders. Many of the aforementioned countries also have a history of expressing anti-Washington Consensus remarks (e.g., Hakim 2006; Rodrik 2006). Interestingly, although Bolivia belongs to the group of countries whose leadership plays a strong role in the regional Latin American economy, the overall value and levels of technological sophistication of Chinese exports shipped to Bolivia are comparatively low/small. Another noteworthy trend is that the countries—Peru, Colombia, and Chile—for which Chinese imports make up a sizeable percentage (>19 percent) of total imports all import Chinese commodities with relatively low TECH scores, implying that these three countries' Chinese imports are technologically relatively nonsophisticated. Finally, Chinese exports to the region's two largest economies—Brazil and Mexico—can be characterized by their relatively moderate level of technological sophistication. Nevertheless, Chinese exports to these two countries comprise a substantial share of Brazil's and Mexico's total imports, approximately 16 percent for both countries.

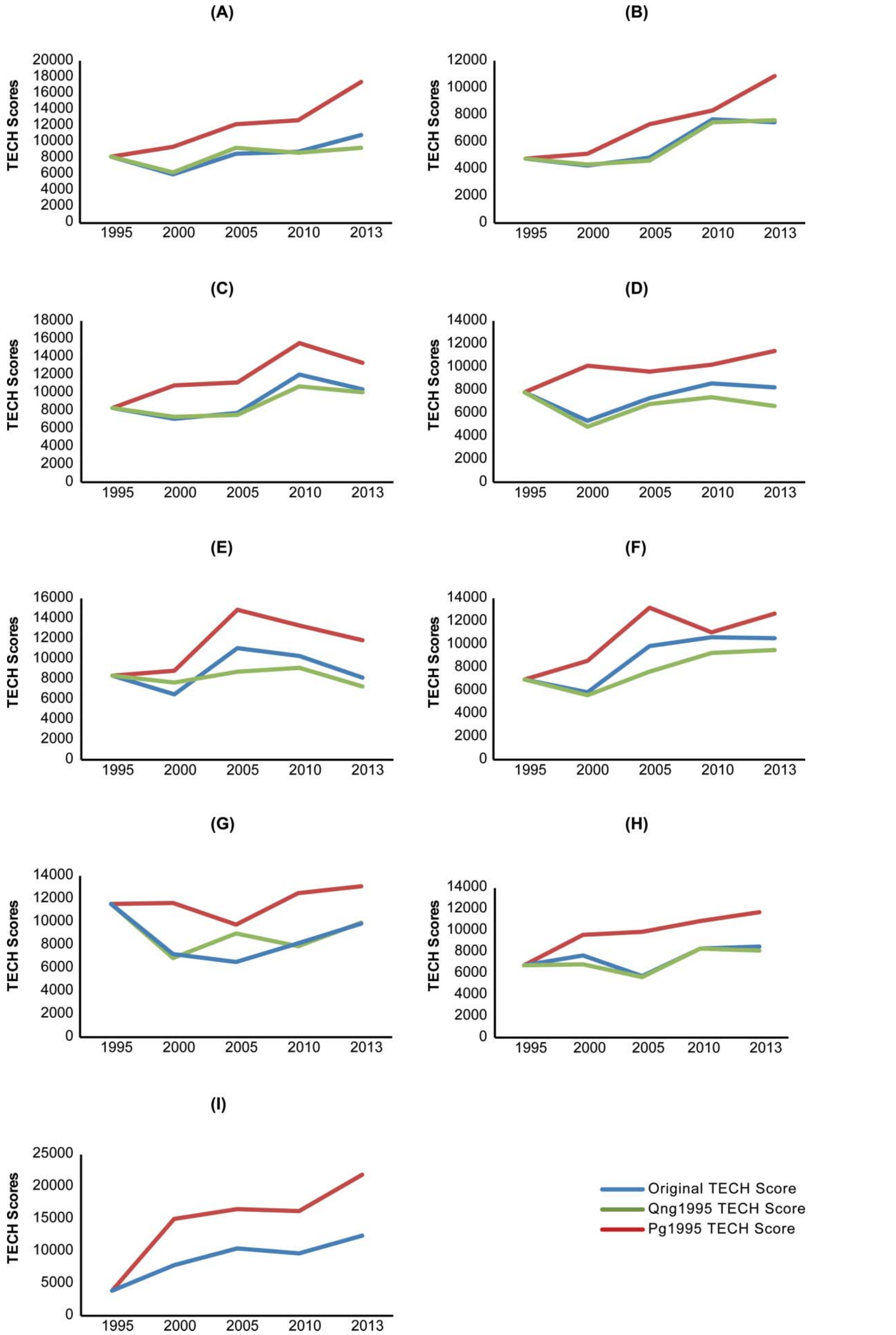

Figure 2 *Three Chinese TECH score trends in nine target countries: (A) Argentina, (B) Bolivia, (C) Brazil, (D) Chile, (E) Colombia, (F) Ecuador, (G) Mexico, (H) Peru, (I) Venezuela in 1995, 2000, 2005, 2010, and 2013 (Venezuela uses 2011 data rather than 2013 data). Red curve: P_g 1995 TECH score; Blue curve: Original TECH score; Green curve: Q_{ng} 1995 TECH score. Note: Venezuela's original and Q_{ng} 1995 TECH scores are nearly identical/overlapping Source: UNCOMTRADE data with author's elaboration. (Color figure available online.)*

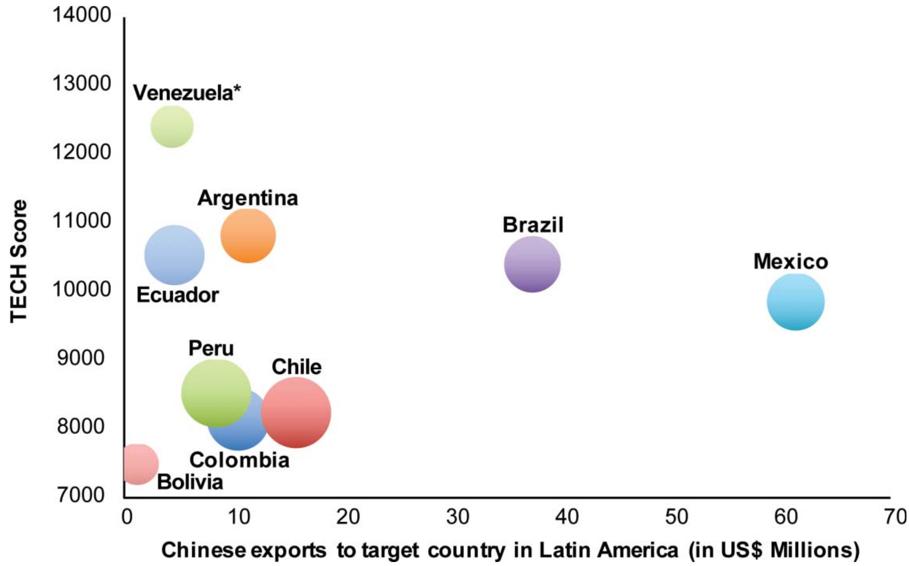

Figure 3 *Chinese TECH scores, export values, and percentage of total exports to selected Latin American countries in 2013. Note: Circle size = China's exports to country X / Total exports to country X in 2013. * = Venezuela uses 2011 UNCOMTRADE data. (Color figure available online.)*

Table 1 *Top five commodities (using TECH score values) exported by China to selected Latin American countries in 2013*

	Rank				
Country	**1**	**2**	**3**	**4**	**5**
Argentina	Electric parts for telephony	Other organo-inorganic compounds	Radar/TV receiver parts	Automatic data processing machines	Compressors for refrigeration equipment
Bolivia	Other transport/ passenger motor vehicles	Motor vehicles (for transport of 5–20 tons)	Herbicides, etc.	Other boring/sinking machinery	Transmission/reception apparatus
Brazil	Radar/TV receiver parts	Electric parts for telephony	Fluorescent lamps, hot cathode	Other organo-inorganic compounds	Other toys
Chile	Transmission/ reception apparatus	Other video/ reproducing apparatus	Other toys	Other flat rolled products (width > 600 mm)	Other bars & rods
Colombia	Transmission/reception apparatus	Other nitrogen compounds	Other toys	Air-conditioning (self-contained)	Other elevators & conveyors
Ecuador	Other vehicles spark ignition engine	Generating sets for engines	Transmission/ reception apparatus	Other toys	Rubber tires for buses
Mexico	Transmission/reception apparatus	Other devices, appliances, instruments	Parts of printing machinery	Optical parts & accessories	Rubber tires for buses
Peru	Transmission/reception apparatus	Polyethylene terephthalate	Other vehicles spark ignition engine	Other toys	Parts of printing machinery
Venezuela	Transmission/reception apparatus	Printing-related machines	Air-conditioning (self-contained)	Parts of agricultural, horticultural, beekeeping machinery	Rubber tires for buses

Note: Venezuela uses 2011 data rather than 2013 data.

Conclusions

This article contributes to explaining the evolution of South–South relations through an examination of Chinese–Latin American trade. Trade, along with the technological enhancements associated with trade, is a proxy for development. An understanding of the relative sophistication of Chinese exports to Latin America, as shown in this study, helps to better clarify China's economic development stage and its comparative economic standing versus more traditional trading partners such as the United States and the EU.

By examining the relative technology content of the Chinese economy's overall "export basket" to nine large Latin American economies from 1995 to 2013, it is possible to observe the variation in the advance of the technological sophistication of Chinese exports spatially and temporally. Despite China's top trading position (in terms of dollar value) with many Latin American countries, and despite the absolute trend of the increasing technological sophistication of Chinese exports to Latin America during the study period, the technological sophistication of Chinese exports—compared with U.S. and European exports to the region—remains low to moderate. Chinese exports, therefore, are far from displacing more traditional technology-intensive trade partners such as the EU and the United States in Latin America.

Whether the increasing trend in the growing sophistication level of Chinese exports to certain left-leaning, nationalist countries in the region portends a sea change in Latin America's foreign and economic relations remains to be seen. The empirical work presented here together with recent political events in countries such as Bolivia, Ecuador, and Venezuela suggest that technologically sophisticated Chinese exports might in fact one day displace similar products made in the EU and United States, due in part to the political connections and contracts signed between the leaders of China and the nationalist regimes in the region. ■

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Notes

[1] Henceforth, in this article, Latin America refers specifically to these nine economically important countries.
[2] Latin America's traditional and historically largest trading partners.
[3] Here *export basket* refers to all commodities exported from one country (i.e., China) to another country (i.e., Brazil).
[4] Data for Venezuela were only available through 2011.
[5] It is important to note that UNCOMTRADE data are provided voluntarily to the United Nations by participating countries. Not all countries provide trade data each year. Those countries that did not provide any trade data to UNCOMTRADE have been removed from this study.

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