Effect of preferential trade agreements on China's energy trade from Chinese and exporters' perspectives

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Abstract

Purpose – China is a major energy import powerhouse, its trade deals have significant impact on international energy trade and global energy markets. The purpose of this paper is to explore the role of energy in China's preferential trade agreements (PTAs) and their impact on Chinese imports of oil, gas and coal.

Design/methodology/approach – An extended trade gravity model framework is applied to explore the dynamics of China's annualized energy import flows from the 22 economies that have PTAs with it for the period 1995–2015.

Findings – The effect of PTAs on trade patterns varies across the product groups and agreement clauses. The dominant factor affecting trade flows of coal, crude oil and oil products is the average tariff level. Its impact is less significant for gas imports, which are more affected by policy arrangements represented by a PTA variable. The depth and scope of a PTA do not affect Chinese energy imports patterns.

Research limitations/implications – This paper is focused on exploring the effect of China's trade and foreign relations strategies on its energy imports through the prism of its PTAs. Estimating the direct impact of China's initiatives in the areas of trade, investment, security, culture, etc., on its trade flows of energy products and other product groups using the methodological framework proposed in this study would contribute to better understanding of the issue.

Practical implications – The findings can assist both China and energy exporting countries that target Chinese market in better understanding the drivers of trade flows of energy products and design their PTA strategies accordingly.

Originality/value – This study applies the trade gravity model framework to assess the impact of specific components of preferential trade agreements – tariff reduction and depth and scope of agreement – on energy trade flows differentiated by product group.

Keywords China, Energy trade, Trade agreements

Paper type Research paper

1. Assessing the role of PTAs in foreign trade and energy flows

Proliferation of multilateral and bilateral preferential trade agreements (PTAs), which started in the early 1990s and continued into the 2000s has triggered a substantial body of literature on the subject. Predominantly, the focus was on the impact of PTAs on trade flows and the welfare of participating economies (see Plummer *et al.*, 2010 for detailed review).

Other studies also examined the effects of PTAs on foreign direct investment (Berger *et al.*, 2010), demographics (Orefice, 2012), policy reforms (Galal and Tohamy, 1998) and other socio-economic and development indicators.

The qualitative assessment of the impact of the PTAs is usually performed by comparing the values of chosen indicators before and after the agreements came into force. For the purpose of trade flow analysis, exports and imports can be examined in natural units and monetary values, as well as the share in the partner's global exports and imports. However, this approach does not quantify the effects of PTAs nor does it isolate such effects from the impact of other factors.

The trade gravity model addresses both these issues. It estimates the trade flows and the PTA effect through an econometric equation (or set of equations). Unlike Viner's model and its extensions (Johnson, 1960; Krueger, 1995) or general equilibrium models (Ciuriak, 2007; Kiyota and Stern, 2007), it allows for the isolation of the PTA effect on trade by introducing a set of control variables that represent other potential trade determinants. In its initial formulation Tinbergen (1962) defines the trade flow between two countries as a function of their gross domestic product (GDP) and the geographical distance between them. Other factors, such as exchange rates, common borders and membership of political and economic associations, have been added to the equation in subsequent studies, attesting to the flexibility of the model.

There are ample examples in the literature quantitatively analyzing the role of PTA using gravity models. Cardamone (2007) established an extensive survey of these valuations finding that in most studies there was a noted positive relationship between PTAs and trade volumes. However, dummies and several other outlying independent variables have reflected limited explanatory power. More recently, Baltagi *et al.* (2014) reiterated the various examples of econometric gravity models including structural and reduced form estimations. Previously, Magee (2003) looked at a potential endogenous role played by the preferential agreements focusing on trade volumes and political regimes. He finds that such relationship only exists when trade is endogenous to the political interactions between trade block members. Martinez-Zarzoso (2003) replicated the same exercise on a country bloc level between the EU and MERCOSUR. By comparing it to a panel analysis, the author finds that fixed effect results have more explanatory power to the gravity model mostly delaminated by random effects. Moreover, by trying to adapt gravity models within the context of Indian and Chinese relations globally, Sen *et al.* (2015) faced extensive missing trade flows data and zero numbers. They build on the traditional regression model by applying an improved zero inflated negative binomial model that decoupled effect of agreements on activities within intra-and extra trading blocs.

The trade gravity model framework can also be applied to sector specific and product-specific analyses of trade flows including international trade in fuels and energy. In particular, it enables the identification of the different effects that PTAs have on the energy trade compared with other product groups (see Balassa, 1967; Hakimian and Nugent, 2003) and the exploration of cross-sectoral effects (Makochekeanwa, 2006). However, the modest number of studies that explore product-specific trade flows suggests relatively limited application of the trade gravity model in this domain compared with the analyses of aggregated trade flows.

Regardless of the study scope – aggregated or sectoral trade flows – the PTA factor in the formulation of the trade gravity model is generally represented as a dummy variable, assigned the value of 1 if two or more economies are engaged in a PTA and 0, if not. This proxy method does not capture the impact of specific PTA components such as the tariff regime and a variety of institutional and policy arrangements, which significantly limits the scope of analysis. Reduction in tariff rates and its implementation schedule stipulated in PTAs usually vary significantly across product groups. Moreover, every PTA is different in terms of its scope, structure and priorities.

This study intends to contribute to the understanding of the effects of PTAs on international energy trade by disaggregating them into specific components. We modify the trade gravity model formulation by representing the PTA effect through the Average Tariff and depth index (DI) variables and apply this method to explore the impact of China's bilateral and multilateral trade agreements on its energy import flows.

Specifically, we examine the following questions: what defines China's approach to PTAs and how energy imports fit within its trade patterns? Do the PTAs have a significant impact on Chinese energy imports, or energy exports to China, and does the impact vary by particular product group? Which PTA component – tariff reduction or institutional arrangements – is more important in facilitating energy trade with China? What are the implications for China and its existing and potential energy exporting PTA partners?

It can be argued that China represents a very specific case, where the government's impact on foreign trade and energy imports in particular expands beyond conventional tariff and non-tariff measures. The examples of such interventions, which are determined by the country's economic development path, ongoing transition from a centrally planned to a market-based economy and its current energy balance, include: currency and exchange rate interventions (Kupchan *et al.*, 2010; Tang, 2017), energy security perception (Efird *et al.*, 2014; Cao and Bluth, 2013), the "going out" policy that promotes overseas investment in energy resources (The Economist, 2009; Wang, 2016), regulated domestic prices in certain energy markets (Rioux *et al.*, 2017), restrictions on foreign investment in domestic energy sector (Davies, 2013), the dominating role of state-owned enterprises in oil and gas markets (Cendrowski, 2015), direct and indirect subsidies for domestic producers (Anderlini, 2013). However, given that a vast majority of countries to varying degrees apply trade protectionism measures (Riley and Miller, 2015), the proposed approach, which helps assess how the reduction or elimination of such measures within a PTA framework affects the trade flows of particular product groups, is generalizable across both importing countries and imported products.

The rest of the paper is structured as follows: Section 2 explores China's PTA strategy and how it aligns with the country's foreign trade policy. In section 3, we focus on China's energy imports and relevant tariff policies. Our method and used datasets are described in the Section 4. The next section presents our estimation results and analysis of the impact that PTAs have on China's energy imports. Finally, in Section 6 we state our conclusions and implications for China and its existing and potential energy exporting partners.

2. China's PTA Strategy

Chinese engagement in trade agreements – both the selection of potential PTA partners and the scope of resulting agreements – is defined by a broad range of economic and political motives and can be better understood within the general context of its foreign trade strategies and their evolution.

As a developing country that embarked on the export-oriented growth path, in the early 1990s, China prioritized export promotion accompanied by marginal import liberalization. Pursuit of the membership in the General Agreement on Tariffs and Trade (GATT) and World Trade Organization (WTO) later in this decade increased pressure to reduce tariffs and non-tariff barriers and to increase transparency in regulations. In 1996, China cut tariffs on 5,000 items reducing the average tariff rate to 23 percent (Prime and Park, 1997).

Accession to WTO in 2001 boosted China's exports and economic growth. However, the deadlock in multilateral trade liberalization process instigated China to pursue its market access strategy through bilateral and regional PTAs (Mercurio, 2016). This shift triggered a wave of PTA's in the 2000s. During this period, China's primarily focus was on the Asia-Pacific region, most notably, the ASEAN members, Hong Kong and Macao. Later agreements expanded the geographical scope to the economies in South Asia, Europe and

Despite the strategy of sustaining export growth and securing market access, China does not have PTAs with many of its top trading partners including the US, members of the EU, Japan, India, Brazil and Russia. PTAs with two major trading partners – Australia and Republic of Korea – only came into force in 2015. On the other hand, some of the partner economies cannot be deemed significant in terms of their market size. However, they tend to have a strategic advantage of a PTA hub – that is a gateway to strategic larger markets for China. For example, Costa Rica is a member of the Central American Common Market and has free trade agreements with Mexico, Colombia, Venezuela and the CARICOM countries; Chile has FTAs or PTAs with all major North and South American economies; and Switzerland has FTAs with the EU, a number of Eastern European countries and key economies in the Mediterranean basin.

As China's growth accelerated during the 2000s, securing natural resources needed to sustain it became an increasingly important consideration in developing economic and trade policies. In particular, imports have played an increasingly important role in China's energy balance. In 2014, the country sourced from abroad 7 percent of its coal needs. Imported natural gas and crude oil accounted for 32 and 60 percent of consumption, respectively (CEIC, 2016). Accordingly, energy – along with other mineral resources, raw materials and agricultural products – has been one of China's PTA driving factors (People's Daily, 2007; Pett, 2012). However, the economic structure and trade patterns of Chinese PTA partners suggest that Chinese engagement in trade agreements is driven not only by a desire to secure imports of energy and other natural resources. In 2015, only 11 PTA partners recorded exports exceeding \$1m for coal, \$12m for oil and \$15m for gas/other gaseous hydrocarbons (NGLs) (UN Comtrade, 2016).

Source: Ministry of Commerce, People's Republic of China; Asian Development Bank

A number of scholars and analysts claim that political considerations are at least as important as economic ones in defining China's PTA agenda (Song and Yuan, 2012; Baker, 2016). The country's initial focus on the Asia-Pacific region was driven by two major considerations. First, China sought to expand its influence in the region through the "soft power" by enhancing economic, political and security cooperation and demonstrate responsible leadership through granting its partners beneficial trade terms (Zhao and Webster, 2011). Second, it aspired to contain the influence of major regional competitors, notably, Japan and the USA (Hoadley and Yang, 2007).

Having established its presence in the region and gained necessary negotiation skills in the process, China became more direct in using the PTA framework as one of the tools to assert regional and global influence (Mercurio, 2016), and turned its attention to negotiating trade deals with major regional economies. These efforts, along with its other strategic initiatives, such as the "One Belt, One Road" and the Asian Infrastructure Investment Bank, and the vacuum created by the US withdrawal from the Trans-Pacific Partnership agreement, give China an opportunity to assume a leading role in shaping the Asia-Pacific trade landscape.

When it comes to the scope, structure and specific clauses of trade agreements, China does not apply a particular template. The agreements are designed on an individual basis depending on the partner's trade patterns and economic development. As a rule, in the initial phase China tends to prioritize trade in goods, primarily, through tariff reduction mechanisms. Later, as relationships progress, additional agreements on trade in services and investments are likely to be signed. This approach has been criticized by a number of scholars for not being comprehensive and, hence, economically less meaningful (Nakagawa and Wei, 2016; Song and Yuan, 2012). Recent PTAs, however, especially those with developed economies such as Australia or Korea, tend to be more comprehensive. Also, a number of addenda to existing PTAs have recently been signed to add depth and breath.

The PTA DI introduced by Dür *et al.* (2014) can be applied to compare various PTAs that have Chinese participation in a consistent way. DI captures whether a trade agreement contains substantive provisions in the spheres of services trade, investments, standards, public procurement, competition and intellectual property rights and also whether all the tariffs in the agreement are eventually planned to be reduced to zero.

On average across all signed PTAs, China's DI is 4.8 out of 7, signaling that its approach to trade deals is not as superficial as some researchers suggest. However, these scores differ significantly by partner groups: average DI for Hong Kong, Macao and Taiwan is only 2.3; for developing economies it is 3.9 and 5.3 for developed ones. The most frequently applied clauses across Chinese trade agreements cover full tariff elimination and standards, whereas such issues as public procurement, competition and intellectual property protection are generally omitted.

Chinese tariff concessions also depend heavily on the negotiating counterparty. As a rule, China commits to a greater percentage of zero-tariff products with partners that make similar commitments. As a result, Chinese trade agreements with developing economies generally have higher tariff levels than those with developed economies (see Table I).

Table I.
Average tariff
reduction
commitments by
China and its partners

Partner category	China's average initial 0-tariff product percentage	Partner's average initial 0-tariff product percentage	China's average target 0-tariff product percentage	Partner's average target 0-tariff product percentage
Developed (%)	71.5	88.5	93.3	97.4
Developing (%)	51.0	44.3	92.3	90.0

Source: Ministry of Commerce, People's Republic of China

Note that on average China commits to more significant tariff cuts than its partners from developing economies and less cuts compared to that undertaken by developed economies.

Unlike the trade agreement provisions, represented by DI, which affect a broad range of bilaterally traded products, the tariff regime differs significantly not only by trading partner, but also by product group. In the next section we take a more detailed look at China's tariff regime for major energy-related product groups and their role in bilateral trade with existing PTA partners.

3. China's energy imports and its role in Foreign trade

For the purpose of this study, we define energy imports as the volumes or values of imported goods classified under article 27 (mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes) of the Harmonized System Classification of Goods (HS Code). This paper comprises heterogeneous energy fuels that are traded at international/global markets with varied geographical, pricing and contract patterns. They are also used in different supply chains and their imports account for different shares of Chinese total consumption. Therefore, we focus our analysis on the specific subgroups:

- 2701: coal; briquettes, ovoids and similar solid fuels manufactured from coal;
- 2709: petroleum oils and oils obtained from bituminous minerals; crude;
- 2710: petroleum oils and oils from bituminous minerals, not crude; preparations, containing by weight 70 percent or more of petroleum oils or oils from bituminous minerals; these being the basic constituents of the preparations; waste oils[1]; and
- 2711: petroleum gases and other gaseous hydrocarbons (NGLs).

China's energy imports represent a substantial share of the global energy markets. Combined import value of the four HS Code groups that we focus on in this study reached \$184bn, or 11 percent of global imports in 2015, while imports of coal and crude oil accounted for 18 percent and 15 percent of global imports, respectively (World Bank, 2016a). This makes China one of the major players in the global energy markets and a lucrative target market for energy exporters.

Despite the country's position as a major energy consumer, its energy imports accounted for 13 percent of its total imports in 2015 declining from 17–18 percent in 2011–2014 (World Bank, 2016a). If we isolate trade flows with existing PTA partners, the share of energy products drops to 7 percent of total imports from these economies. These numbers support the thesis that securing energy imports is not the exclusive motivation of China's trade deals. The dynamics of energy imports from Chinese PTA partners is presented in Figure 2.

As China increased the number of its preferential trade deals, energy imports from PTA participants also rose. It peaked at about \$35.5bn in 2015 when trade agreements with such substantial energy trade partners as Australia and Republic of Korea came into enforce. However, the percentage of energy products in total import flows from PTA partners shows a declining trend, which can be attributed to the recent price reduction in global energy markets. This trend, though, would be partially reversed if China signed those PTAs that are currently being negotiated with major energy exporters such as South Africa and the Gulf Cooperation Countries.

Disaggregation of energy imports from China's PTA partners by product group reveals a relatively balanced structure (see Figure 3 below). The noticeable exception is the relatively modest value of crude oil imports sourced from the PTA partner economies, especially compared with its total imported volume. This can be explained by the fact that China does not have trade agreements with major oil exporters, nor with its oil exporting neighbors – Kazakhstan and Russia – with which it shares pipeline infrastructure.

Figure 2.
Dynamics of China's
energy and
non-energy imports
from its PTA partners

Source: National Bureau of Statistics of China, World Bank, ITC Trade Map

Figure 3.
Comparison of China's
energy imports
structure from PTA
and non-PTA partners

Source: National Bureau of Statistics of China, World Bank, ITC Trade Map

Disparity in crude oil imports from PTA and non-PTA countries is the main factor contributing to the dominance of the latter in China's total energy imports. In 2015 only 18 percent of energy imports were sourced from PTA partners, which still represents an increase from the 8–9 percent level of the previous years. However, the dynamics of imports of other energy products – except for crude oil – are more favorable to exporters that have PTAs with China.

The import of coal (2701 HS article), oil products (2710 HS article), natural gas/NGLs (2711 HS article) and other energy products from PTA partners show an upward trend (see Figure 4). The increasing number of free trade agreements has positively affected this trend, but was this the only contributing factor? Presumably, a PTA should provide conditions favorable to the energy exporting economy leading to increased trade flows and market share in China's total energy imports. The recent dynamics of Chinese energy imports seem to support this hypothesis. A sharp reduction in imports of the energy product groups presented in Figure 4, which occurred in 2014–2015, was mostly absorbed by non-PTA trading partners, while the economies that had a trade agreement with China kept and, in some cases, increased their market share despite an oversupply/depressed prices in the global markets and reduced total Chinese energy imports.

One of the factors that can help explain this dynamic is the difference in tariffs that China applies to its preferential trade partners (PTA tariffs) and the most-favored nation (MFN) tariff applied to other WTO members. The difference between the average PTA and applied MFN tariffs in 2015 reached 3.4 percent for coal, 2.4 percent for oil products and 3.1 percent for gas/NGLs (World Bank, 2016a) which gave a competitive advantage to exporters from PTA partner economies. The notable exception is the crude oil tariff regime, which has been set – at zero level – for all importers since 2002.

Figure 4.
Chinese imports of
specific energy
products

Source: National Bureau of Statistics of China, World Bank, ITC Trade Map

However, it is difficult to draw conclusions on the effects of preferential tariffs based on qualitative observations alone. The institutional and policy arrangements of PTAs, such as standards, fair competition and investment facilitation clauses, can also affect energy trade flows and product market shares. Other factors, including the distance between countries, size of their economy, energy production levels, etc., can also determine energy trade patterns. In addition, each of these factors may have a different effect on various energy product groups.

In the next section we describe the framework that helps isolate the impact of PTAs with China on its energy products import flows and market shares. This approach can be used not only to understand the effect of existing PTAs, but also for evaluating the potential impact of future trade agreements from the perspective of an energy exporting economy and providing insights into China's strategy in securing foreign trade deals.

4. Data and estimation method

The drivers of Chinese foreign trade policy discussed in the previous sections – including those seemingly unrelated to energy – have significant impact on its energy trade. However, for the purpose of this study, we limit the scope to exploring their indirect effect on China's energy trade, which manifests itself through the selection of a PTA partner as well as the structure and content of the resulting agreement. In this paper, we do not estimate direct impact of other China's trade policy components (political, security, cultural, etc.) on its energy imports.

Our analysis covers China's annualized energy import flows from the 22 economies that have PTAs with it for the period 1995-2015. Although majority of the PTAs came into effect during 2003-2015, extending the data set back to 1995 allows to capture the dynamics of import tariffs that were set by China for its future PTA partners in a unilateral order.

The data set used for the estimation is organized as a panel of countries and time series, i.e. China's imports from 22 partner economies over 21 years, for a total 462 observations.

Operationally, we construct the data for the estimation taking the import flows in volumes (Kg) and values (1,000 USD) of the four product groups analyzed above

(coal, oil products, natural gas/NGLs and other energy products). We label volume variables *ImpFlUn* and value variables *ImpFlVal*. We also constructed share variables in both volume and values, *ImpShUn* and *ImpShVal*, as the import share in total Chinese imports for the respective products.

In addition, we constructed export flow data, approaching the problem from the exporting economies' perspective, looking at the annual energy export flows to China and China's share in the economies' total energy exports (*ExpFlUn*, *ExpFlVal*, *ExpShUn* and *ExpShVal* variables). Finally, we assess the dynamics of the trade intensity indices (TII) for selected energy product flows.

We also collected a set of exogenous and control variables to be used in the equation estimation, which can be distinguished into two main groups, labeled *Z* variable and *X* variables. The *Z* matrix of variables captures the effect of PTAs and includes: PTA, which is a dummy variable that captures whether an economy has a PTA with China; *DI*, which is the value of the DI that characterizes a PTA between China and partner economy (if in any given year *t* there was no PTA, then $DI_t = 0$). The *DI* scores for specific PTAs are provided in Appendix 2; *TarAvg*, which represents the simple average import tariff for a particular product group applied by China to a partner economy[2].

The *X* matrix of variables includes other control variables, such a GDP of China, GDP of partner economy, exchange rate of Chinese yuan and partner's currency to USD, the distance between China and partner economy and domestic production of exporting economy.

The primary source for the import and export trade flow data is the World Integrated Trade Solutions (WITS) database produced by the World Bank. Where necessary, missing values were sourced from the UN Comtrade database, ITC Trade Map, and national statistics and customs departments. Export and import shares as well as the TII values were calculated based on the trade flow data. The texts and tariff schedules of PTAs were obtained from the Ministry of Commerce of PRC and ADB Asia Regional Integration Center. Depth indices were sourced from the DESTA database; where certain PTAs were missing, DI's were derived by us using the DESTA methodology (Dür *et al.*, 2014; DESTA, 2016). The data for control variables were obtained from a variety of sources including the World Bank, CEPII and Enerdata. Detailed descriptions of the data sources used for the model variables is provided in Appendix 3.

This data set allows to analyze the trade determinants from the perspective of both China, which can be interested in securing sufficient supply quantities and diverting the export flows of its trading partners and energy exporting economies looking to increase their export revenues and capture the share of Chinese imports market. In addition, comparison of the model output for export and import flows provides an extra robustness check.

We estimate a general import demand function, at the disaggregate level, following the current literature, which derives import demand from a standard optimization framework (see among others: Bussière *et al.*, 2013; Giansoldati and Tullio, 2017; Kabir *et al.*, 2017).

In this framework, the background optimization follows a cost minimization approach, whereby imports are driven by activity variables, price variables and possibly also gravity effects, captured by distance. In particular, note that the literature has shown that the gravity model is consistent with several theoretical and empirical features of international trade flows, such as monopolistic competition Heckscher–Ohlin model and intra-industry trade patterns (see among others Kee *et al.*, 2008; Soderbery, 2015; Gozgor, 2014; Fukumoto, 2012).

The general model that we apply to the problem is represented by:

$$Y = F(X, Z, \varepsilon), \quad (1)$$

where *Y* is the relevant import variable, *F*(.) is the functional form, *X* is the set of activity variables which drive imports, namely, GDP, relative prices and a distance measure, *Z* is a

set of specific variables representing the effects of PTA on trade flows. Equation (1) is generally non-linear according to the theoretical specification (for instance, exponential in the original Tinbergen (1962) gravity model, CES in the Bergstrand *et al.*, 2013 model and so on). For the estimation, equation (1) can be linearized under the assumption of a Taylor approximation of the original function and can be represented the following way:

$$Y = Z^*\beta + X^*\alpha + \varepsilon, \quad (2)$$

Operationally, we estimate nine different specifications of Equation (2) for each of the four product for a total of 36 equations. Y represents the dependent variable of each specification of Equation (2), which are the values and volumes of import flows (*ImpFUn*, *ImpFVal*), import shares (*ImpShUn*, *ImpShVal*), export flows and shares (*ExpFUn*, *ExpFVal*, *ExpShUn* and *ExpShVal*) and the TII for the four categories of energy products. The matrices X and Z contain the exogenous variables defined above.

We have preliminarily tested for integration of the import variables for all products and we obtain rejection of the Dickey-Fuller and Weighted Symmetric tests, so that we can conclude in favor of stationarity.

We use a seemingly unrelated regression (SUR) method to estimate Equation (2), considering that the error term, represented by ε , is not serially correlated in time, but that there may be contemporaneous correlation across countries, since a global macroeconomic shock can hit all countries.

For a broad discussion of the definition and justification of the macro variables in the import estimation, see Bussière *et al.* (2013); for the importance of the exchange rate variable in the case of China, see Gozgor (2014); for a discussion of the relevance of trade policies effects on imports in the case of China, see Fukumoto (2012).

In the specification (2), the α coefficients represent the effect of the structural (control) variables. The β coefficients represent the effect of the PTA-related variables. The estimation results are satisfactory, with more than 90 percent of the single coefficients significant at 5 percent level and with acceptable measure of goodness of fit (r^2 values), as shown in Table AV in Appendix 3.

For the purpose of this study, we are interested mainly in the directional variations of the parameters (whether a variable has a positive, negative or no effect), rather than commenting the quantitative values of the effects on the dependent variables. The complete model output is available upon request.

5. Estimating the effects of PTAs

5.1 Effects of PTA, DI and average tariff rates on China's energy imports

The first set of models evaluates the effect of PTAs on Chinese energy imports. Table II shows the effect of the PTA dummy variable (*PTA*), DI and average tariff rates (*TarAvg*) on energy import flows and corresponding import shares.

Decrease in average tariff rate has a positive effect on trade flows across all major energy product groups. This effect is more explicit when the import flows are measured in natural units. The impact on the import values is to some degree alleviated because tariff payments are included in the CIF import price reported on the Chinese border. By contrast, institutional and policy arrangements of PTAs – presented in the form of a PTA dummy variable and the DI – have no impact on China's energy import flows. These results suggest that China does not require a policy framework to drive an increase in its energy imports. Instead, it can unilaterally reduce the average MFN tariff applied to a particular product group.

From the perspective of an energy exporting economy aiming to increase its share in Chinese imports, the strategy has to be different. A preferential tariff regime is expected to

Table II.
Effect of PTAs on
China's import of
energy products

Product groups	Dependent variable	Estimated coefficients	Significance	Estimated coefficients	Significance	Estimated coefficients	Significance
		PTA		DI		TarAvg	
2701 (Coal)	<i>ImpFIUn</i>	—		—		−254,671	**
	<i>ImpFIVal</i>	—		—		−236,892	*
	<i>ImpShUn</i>	34,635	*	—		—	
	<i>ImpShVal</i>	46,437	*	—		—	
2709 (Crude oil)	<i>ImpFIUn</i>	—		—		−18,691	***
	<i>ImpFIVal</i>	—		—		−75,530	*
	<i>ImpShUn</i>	—		—		−0.000002	*
	<i>ImpShVal</i>	—		—		−0.000006	***
2710 (Oil products)	<i>ImpFIUn</i>	—		—		−2,994	*
	<i>ImpFIVal</i>	—		—		−2	**
	<i>ImpShUn</i>	—		—		−0.000008	***
	<i>ImpShVal</i>	—		—		−0.000005	***
2711 (Gas/NGLs)	<i>ImpFIUn</i>	—		—		−4,140	**
	<i>ImpFIVal</i>	—		—		−1	*
	<i>ImpShUn</i>	—		—		−0.000008	*
	<i>ImpShVal</i>	—		—		−0.000003	*

Note: *, **, *** Denotes statistical significance at 10, 5 and 1 percent levels, respectively

facilitate the growth in market share only for the oil products group and, to a lesser extent, for gas/NGLs. If China decides to raise the import tariff for crude oil from the current zero level, the preferential (better than MFN) tariff terms would also probably lead to the capture of additional market share. The 2701 (Coal) group stands out from the general pattern. The share in coal imports is not affected by the average tariff level, but tends to be higher if the exporting economy has a PTA with China. The signs for DI are not statistically significant. Therefore, this variable is unlikely to have any substantial impact on shares in Chinese energy imports as a whole.

5.2 Effects of PTA, DI and average tariff rates on energy exports to China

The second set of models explore the behavior of two types of dependent variables: energy export flows to China and Chinese shares in PTA partners' total energy product export. The output of these models (see Table III below) also highlights the prevalent role of tariff reduction in increasing energy trade flows with China. For the export flow values of coal, crude oil and oil products groups, the coefficient of the *TarAvg* variable is negative and statistically significant. The notable exception is the 2711 (gas/NGLs) group, where an increase in exports to China is more likely to be stimulated by a PTA represented by the PTA dummy variable.

Similar to the results of the import flow analysis, the DI variable is not statistically significant. The insignificance of the DI in combination with significance of the *PTA* dummy variable suggests that the presence of specific non-tariff clauses in a PTAs is more important for increasing energy trade with China and/or capturing respective market shares than the broader scope of such agreements. The binary structure of DI (see Appendix 1 for details) does not allow us to capture the relative effect of specific PTA clauses and identify those with the most impact.

The export share variables (*ExpShUn*, *ExpShVal*) represent China's ability to capture a larger proportion of energy exports from a PTA partner economy. The model's results suggest that a reduction in the average tariff level would probably result in the export flows of crude oil and oil products being diverted to China and would have no significant effect on the other two groups. On the contrary, a PTA policy framework would likely increase China's share in its partner's exports of coal and gas/NGLs.

		Effect of preferential trade agreements	
Product groups	Dependent variable	Estimated coefficients PTA Significance	Estimated coefficients DI Significance
		Estimated coefficients TarAvg Significance	
2701 (Coal)	<i>ExpFlUn</i>	—	—
	<i>ExpFlVal</i>	—	—
	<i>ExpShUn</i>	0.26	***
	<i>ExpShVal</i>	0.14	***
2709 (Crude oil)	<i>ExpFlUn</i>	—	—
	<i>ExpFlVal</i>	—	—
	<i>ExpShUn</i>	—	—
	<i>ExpShVal</i>	—	—
2710 (Oil Products)	<i>ExpFlUn</i>	—	—
	<i>ExpFlVal</i>	—	—
	<i>ExpShUn</i>	—	—
	<i>ExpShVal</i>	—	—
2711 (Gas/NGLs)	<i>ExpFlUn</i>	217,860	**
	<i>ExpFlVal</i>	133707	**
	<i>ExpShUn</i>	0.01	*
	<i>ExpShVal</i>	0.03	*

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Table III.
Effect of PTAs on export of energy products to China

Note: *, **, ***Denotes statistical significance at 10, 5 and 1 levels, respectively

Assuming China is more interested in securing the share of its partner's export in natural units (*ExpShUn* variable) and its partner targets Chinese import share in monetary values (*ImpShVal* variable), PTAs tend to have a homogeneous effect on the goals of the parties. Both *ExpShUn* and *ImpShVal* tend to increase when the average import tariff is reduced for crude oil and oil products and when there is a general policy arrangement in the case of the coal trade. The 2711 group (gas/NGLs), however, displays the opposite pattern. The general effect of PTAs on the group's export and import share is weak. Moreover, this effect is heterogeneous: tariff reduction drives imports and the presence of a PTA affects exports. A similar discrepancy is observed when comparing factors that impact export and import flows for this product group. The other product groups, however, display homogenous patterns in export and import flows as well as in the factors that affect them, namely, average tariff levels. Understanding these links and potential effects could facilitate trade agreement negotiations between China and the exporters of these products.

As of 2015, China maintained significant advantage over its PTA partners in terms of export/import shares of energy product trade. On average, exports to China accounted for 7 percent of its partner's total coal exports, 4 percent of crude oil export, 9 percent of oil products and 10 percent of gas/NGLs. However, the partner's average share in Chinese imports for these products totaled 4, 1, 3 and 1 percent, respectively. Such disparity can be explained by the size of the Chinese economy and attests to its strategy of energy import diversification. The 2015 data on shares in total exports/imports with selected PTA partners are given in the Table IV.

5.3 Effects of PTA, DI and average tariff rates on the intensity of bilateral energy trade with China

Finally, to confirm our findings, we assess the impact of PTAs on the trade intensity index for the selected product groups. The results presented in the Table V confirm the conclusions of trade flow analysis. For all product groups studied, the average import tariff level is the only component of preferential trade deals that has significant impact on the TII. It should also be noted that the average TII values in all cases are higher than 1, ranging from 1.86 for crude oil to 10.58 for gas/NGLs. This suggests that energy export flows to China from its PTA partners are larger than expected based on the countries' share in world economy.

Table IV.
Shares of selected
PTA partners in
China's total imports
and of China in
partner's total
exports in 2015

PTA partners	2701 (Coal)		2709 (Crude oil)		2710 (Oil products)		2711 (Gas/NGLs)	
	IMP share (%)	EXP share (%)	IMP share (%)	EXP share (%)	IMP share (%)	EXP share (%)	IMP share (%)	EXP share (%)
Brunei			0.04	2.30				
Indonesia	15.34	10.49	0.43	9.78	0.83	7.19	5.01	10.53
Malaysia	0.01	2.24	0.08	1.62	2.80	3.25	6.02	8.23
Myanmar							6.36	32.73
Philippines	0.02	89.61			0.10	4.67	0.01	37.47
Singapore					14.27	7.67	0.10	8.66
Thailand					1.55	3.44	0.14	17.82
Australia	52.35	16.70	0.75	1.57%	0.34	2.72	6.97	0.46
Republic of Korea					30.46	10.78	0.46	44.82
Taiwan					2.57	3.35	0.13	77.51
Pakistan	0.00	7.10			0.00	11.54		
Vietnam	0.43	15.83	0.69	25.42				

Table V.
Effect of PTAs on
trade intensity in
energy products trade
with China

Product groups	Dependent variable	Estimated coefficients	Significance	Estimated coefficients	Significance	Estimated coefficients	Significance
		PTA		DI		TarAvg	
2701 (Coal)	TII	–		–		–0.0002	**
2709 (Crude oil)	TII	–		–		–4.43	**
2710 (Oil products)	TII	–		–		–0.001	***
2711 (Gas/ NGLs)	TII	–		–		–0.004	**

Note: *, **, *** Denotes statistical significance at 10, 5 and 1 percent levels, respectively

6. Conclusions

China's example illustrates that PTAs can have a significant impact on the energy trade patterns of the parties involved. They can be instrumental in increasing trade flows, capturing market shares and diverting energy exports from other importers.

Existing trade partnerships and flows as well as economic structures of partner economies suggest that China's PTA strategy is driven by a complex set of incentives that extend beyond securing supply of raw materials and mineral resources, including fuels and energy products. The range of such incentives encompasses gaining access to substantial or strategically important markets, benefiting from complementary economic and trade structures and extending political influence and "soft power". These drivers of Chinese foreign trade policy – seemingly unrelated to energy – nonetheless have significant impact on energy trade, since they ultimately define the selection of a PTA partner as well as the structure and content of the resulting agreement.

Analysis of Chinese energy imports requires a disaggregated approach. PTAs with China tend to be tailored individually and therefore vary greatly in terms of scope and degree of liberalization. In addition, its trade flows demonstrate varying patterns depending on the specific energy product group.

In order to facilitate the required granularity of analysis, we extended the general framework of the trade gravity model by representing the effect of PTAs on trade flows using the Average Tariff and DI variables and applied this formulation to the analysis of

specific product trade flows within the energy domain. While the model inputs – specific PTA components and import patterns – may vary across countries, this framework can be applied to the analysis of trade flows of other energy importing countries who are engaged in bilateral and multilateral PTAs.

In the case of China, reduced average tariff rates are instrumental in increasing trade flows of coal, crude oil and oil products. Their impact is less significant in the case of gas/NGLs imports: this group is more affected by policy arrangements (presence of an operational PTA). The comprehensiveness of a trade agreement, as measured by its DI, does not affect Chinese energy imports. The dominant effect of the tariff component on energy trade with China is confirmed by the analysis of the TII. The TII for every energy product group studied is higher than expected, and is significantly affected by the average tariff rate.

Besides affecting trade flows, a PTA can facilitate increasing or securing a share in Chinese energy imports or – from the Chinese perspective – diverting energy exports from other importers. Policy arrangements, represented by a PTA dummy variable, facilitate a mutual increase in export/import shares in coal trade and help China secure a larger share in its partners' gas exports. The market share of export/import of crude oil and oil products, on the other hand, are affected by the tariff level.

These findings indicate that the balance of power in bilateral energy trade is skewed towards China. It can increase energy imports and divert its partner's energy exports without engaging in a PTA – by merely applying unilateral tariff cuts for a particular product group. Thus, PTAs can hardly be viewed as an instrument of China's energy security strategy. Energy exporters that target the Chinese market, on the other hand, would benefit from a PTAs, which gives China a leverage in the negotiation process. However, the suggested strategy of focusing on import tariff reduction for the target product groups rather than on negotiating a comprehensive in-depth agreement, in general, matches China's approach to developing preferential trade relationships.

Though, across the board, the tariff level has a higher impact on energy trade with China and therefore, should probably be prioritized in PTA negotiations by interested parties, the ability of institutional/policy arrangements to facilitate the capture of a partner's market share should not be underestimated. In this regard, the insignificant effect of the DI, which assigns similar weight to the major components of a PTA, suggests a possible area for further research: which specific clauses of a PTA have the most significant impact on energy trade?

Other potential research directions emerge from the limitations imposed by the scope of this study. This paper is focused on exploring the effect of China's trade and foreign relations strategies on its energy imports through the prism of its PTAs. Estimating the direct impact of China's initiatives in the areas of trade, investment, security, culture, etc., on its trade flows of energy products and other product groups using the methodological framework proposed in this study would contribute to better understanding of the issue. Finally, applying the proposed analytical framework to other major energy importing countries could provide grounds for more general conclusions on how trade flows of specific energy products respond to tariff and non-tariff components of PTAs and whether China's economic development and foreign trade policies make it a unique case in this pattern.

Notes

1. We distinguish the crude oil and refined oil products markets because they have varied patterns that rarely overlap. While the crude oil market is a mature global commodity market with several large players, the refined products market is more diversified and horizontal.
2. While the DI and PTA variables may imply a tariff-related component, they may not represent it correctly for particular product groups and time periods: the *full_fta* variable of DI is not bound by

time limits and, thus, might not affect the trade flows within the time frame of this study. The PTA dummy variable, depending on the scope of a particular agreement, may not include tariff reduction for the energy product groups. Therefore, the *TarAvg* variable is required to correctly capture the tariff reduction dynamics.

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Appendix 1. The structure of the depth index

The depth index is an additive index of seven variable that represents key provisions of a preferential trade agreement.

Effect of
preferential
trade
agreements

Variable	Description	Value
<i>Full_fta</i>	More than a partial scope agreement?	[0; 1]
<i>Services</i>	Substantive provision on services?	[0; 1]
<i>Investments</i>	Substantive provision on investments?	[0; 1]
<i>Standards</i>	Substantive provision on standards?	[0; 1]
<i>Procurement</i>	Substantive provision on public procurement?	[0; 1]
<i>Competition</i>	Substantive provision on competition?	[0; 1]
<i>Iprs</i>	Substantive provision on intellectual property rights?	[0; 1]
Total range		[0; 7]
Source: Dur <i>et al.</i> (2014)		

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Table AI.
Components of the
depth index

Table AII.
Depth index scores for
China's preferential
trade agreements

Partner	Partner code	Agreement type	Signed	In Effect	Full_fta	Iprs	procurement	standards	services	Investments	competition	DI
Iceland	11	Bilateral	1994	1997	0	0	0	0	0	1	0	1
Hong Kong	21	investmentagreement	2003	2004	1	0	0	0	1	0	0	2
SAR												
Macao SAR	22	CEPA	2003	2004	1	0	0	0	1	0	0	2
Brunei	1	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Cambodia	19	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Indonesia	2	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Lao PDR	18	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Malaysia	3	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Myanmar	4	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
The Philippines	5	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Singapore	6	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Thailand	7	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Vietnam	20	ASEAN FTA	2004	2005	1	0	0	1	0	0	0	2
Chile	9	FTA	2005	2006	1	1	0	1	0	0	0	3
Pakistan	17	FTA	2006	2007	1	0	0	1	0	1	0	3
Brunei	1	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Cambodia	19	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Indonesia	2	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Lao PDR	18	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Malaysia	3	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Myanmar	4	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
The Philippines	5	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Singapore	6	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Thailand	7	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Vietnam	20	ASEAN FTA Services	2007	2008	1	0	0	1	1	0	0	3
Chile	9	FTA Services	2008	2008	0	0	0	0	1	0	0	1

(continued)

Partner	Partner code	Agreement type	Signed	In Effect	Full_fta	Iprs	procurement	standards	services	Investments	competition	DI
New Zealand	13	FTA	2008	2008	1	0	0	1	1	1	0	4
Singapore	6	FTA	2008	2009	1	0	0	1	1	1	0	4
Brunei	1	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Cambodia	19	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Indonesia	2	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Lao PDR	18	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Malaysia	3	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Myanmar	4	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Pakistan	17	FTA Services	2009	2009	1	0	0	0	1	1	0	1
Peru	14	FTA	2009	2010	1	1	0	1	1	1	0	2
Philippines	5	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	5
Singapore	6	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Thailand	7	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Vietnam	20	ASEAN Investment	2009	2010	0	0	0	0	0	1	0	1
Costa Rica	10	FTA	2010	2011	1	1	0	1	1	1	0	5
Taiwan	16	ECFA	2010	2010	1	0	0	0	0	0	0	1
Chile	9	FTA Investment	2012	2012	0	0	0	0	0	1	0	1
Iceland	11	FTA	2013	2014	1	1	0	1	1	0	1	5
Switzerland	15	FTA	2013	2014	1	1	0	1	1	1	1	6
Taiwan	16	ECFA Investment	2013	2013	0	0	0	0	0	1	0	1
Australia	8	FTA	2015	2015	1	1	0	1	1	1	1	6
Korea	12	FTA	2015	2015	1	1	0	1	1	1	1	6
Macao	22	FTA Services	2015	2016	1	0	0	0	1	0	0	2

Source: Dur *et al.* (2014), KAPSARC research

Table AII.

Table AIII.
Data sources:
dependent variables

Appendix 3. Model variables, data sources and estimation results

Dependent variables	Description	Data sources
<i>ImpFlUn</i>	Annual import of China from a PTA partner in kilograms	World Bank (2016a), International Trade Centre (2016), CEIC (2016), UN Comtrade (2016), National Bureau of Statistics (2016)
<i>ImpFlVal</i>	Annual import of China from a PTA partner in thousand USD	
<i>ExpFlUn</i>	Annual export to China of a PTA partner in kilograms	
<i>ExpFlVal</i>	Annual import to China of a PTA partner in thousand USD	
<i>ImpShUn</i>	Share of import (in kilograms) from a PTA Partner in total Chinese import	Calculated based on the import/export flow data
<i>ImpShVal</i>	Share of import (in thousand USD) from a PTA partner in total Chinese import	
<i>ExpShUn</i>	Share of export (in kilograms) to China in total export of a PTA partner	
<i>ExpShVal</i>	Share of export (in thousand USD) to China in total export of a PTA partner	
<i>TII</i>	$TII_i = (xi / Xit) / (xw / Xwt)$ Where xi and xw are the values of economy <i>i</i> 's exports and of world exports to China and where Xit and Xwt are economy <i>i</i> 's total exports and total world exports, respectively	

Table AIV.
Data sources:
independent variables

Independent variables	Description	Data sources
PTA	Dummy variable: whether China and its trading partner were engaged in a PTA in a given year	Ministry of Commerce (2016), Asian Development Bank (2016)
TarAvg 2701	Aggregated tariff rate: simple average by tariff lines in a corresponding product group	Ministry of Commerce (2016), Asian Development Bank (2016), World Bank (2016a), UN Comtrade (2016)
TarAvg 2709		
TarAvg 2710		
TarAvg 2711		
DI	Depth index: quantitative measure of the non-tariff clauses of a PTA	Dür <i>et al.</i> (2014)
GDPImp	GDP of China, PPP adjusted in constant 2011 international thousand USD	Feenstra <i>et al.</i> (2015)
GDPPart	GDP of a PTA partner, PPP adjusted in constant 2011 international thousand USD	
ExRate1	Average yearly exchange rate of Chinese yuan to USD	World Bank (2016b)
ExRate2	Average yearly exchange rate of a PTA partner's currency to USD	
Dist	Geodesic distances between China and a PTA partner – latitudes and longitudes of the most important cities/agglomerations (in terms of population)	CEPII (2016)
ProdUn 2701	Domestic production of a corresponding product group in a PTA partner economy in natural units	IndexMundi (2016), EIA (2015), Enerdata (2016)
ProdUn 2709		
ProdUn 2710		
ProdUn 2711		

Product groups	Dependent variable	R^2	Perc. sign	Dependent variable	R^2	Perc. sign	Dependent variable	R^2	Perc. sign	Effect of preferential trade agreements
2701	<i>ImpFIUn</i>	0.64	**	<i>ExpFIUn</i>	0.59	*	TII	0.34	**	
	<i>ImpFIVaI</i>	0.45	**	<i>ExpFIVaI</i>	0.66	**				
	<i>ImpShUn</i>	0.44	*	<i>ExpShUn</i>	0.32	*				
	<i>ImpShVaI</i>	0.52	*	<i>ExpShVaI</i>	0.49	**				
2709	<i>ImpFIUn</i>	0.65	**	<i>ExpFIUn</i>	0.42	**	TII	0.35	**	1797
	<i>ImpFIVaI</i>	0.54	*	<i>ExpFIVaI</i>	0.4	**				
	<i>ImpShUn</i>	0.73	*	<i>ExpShUn</i>	0.6	**				
	<i>ImpShVaI</i>	0.24	**	<i>ExpShVaI</i>	0.41	**				
2710	<i>ImpFIUn</i>	0.27	*	<i>ExpFIUn</i>	0.35	**	TII	0.12	**	
	<i>ImpFIVaI</i>	0.59	**	<i>ExpFIVaI</i>	0.49	**				
	<i>ImpShUn</i>	0.66	**	<i>ExpShUn</i>	0.31	*				
	<i>ImpShVaI</i>	0.52	**	<i>ExpShVaI</i>	0.11	**				
2711	<i>ImpFIUn</i>	0.65	**	<i>ExpFIUn</i>	0.43	**	TII	0.34	**	
	<i>ImpFIVaI</i>	0.48	*	<i>ExpFIVaI</i>	0.38	**				
	<i>ImpShUn</i>	0.29	*	<i>ExpShUn</i>	0.29	*				
	<i>ImpShVaI</i>	0.25	*	<i>ExpShVaI</i>	0.25	*				

Note: R^2 values and percentage of significant coefficient at 5% level: * > 90; ** > 95%

Table AV.
Goodness of fit
of the 36 estimated
equations

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