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Factors affecting the formation of copper international trade community: Based on resource dependence and network theory

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ABSTRACT

Communities are important as they may help to reveal an unknown functional module in international trade. By combining the resource dependence and network theory, we analyze the international trade community formation of copper concentrates and scrap copper from 2007 to 2015. The network position and resource dependence of a country both have positive effects on community formation, and they complement each other. Countries can choose proper trade partners according to its main influencing factor. JPN, NLD and SGP, can improve their copper trade power through connecting with resource-based countries. Similarly, FRA, CAN, and ESP can choose to form the same community with countries of central network position to improve international copper trade. Based on these considerations, countries can reduce or manage the dependence on other countries.

1. Introduction

Trade organizations, such as the World Trade Organization, European Copper Institute (ECI) and Organization of the Petroleum Exporting Countries (OPEC), are common communities established by trade agreements or political strategies. These organizations address the global rules of trade between countries to ensure that trade flows smoothly. Similarly, in the international copper trade network, countries also cluster into different communities. These communities are formed based on trade relationships. Countries in the same community have a close trade relationship, while in different communities, they have a loose trade relationship, which manifests a phenomena of cluster effect in the field of resources international trade. Those communities also significantly promote free trade among members, improve trade security and obtain favorable trade terms (Smith and Dorward, 2014; Zhong et al., 2017). For countries that heavily rely on external resources, forming or joining a trade community is vital for their long-term development (Hillman et al., 2009). There is a rich body of literature on the structures and functions of communities in network (An et al., 2014b; Barigozzi et al., 2011; Feijoo et al., 2016; Zhu et al., 2014). Garlaschelli (Garlaschelli et al., 2007) argued that the division of communities in the trade network is based on geographic location or GDP rather than on regional trade agreements. Certain scholars explored the evolution features of communities and analyzed the stability

of international trade (Ji et al., 2014; Zhang et al., 2014). Meantime, several researchers argued that communities in international trade enhance the trade power by stabilizing resource flows (Huang et al., 2017; Westphal et al., 2006; Zhong et al., 2017) and improve their international position by collaborating with other countries (JF Brakeland, 1997; Trojan, 1986). These studies provided rich knowledge on the community and structural features of an international trade network, but few scholars have studied the formation of a trading community and what prompted the formation of a trading community. However, this research is very important as well. Because the current international trade cooperation is becoming more and more important. All countries are looking for suitable trading partners and upgrading their trade status in the world. Formatting the community could be a strategy to reduce the constraints and increase trade security through a close connection among the countries. Only when we analyze clearly what motivates a country to form a community, can we better understand the role played by the community of this country in international trade. Therefore, we propose two main questions to be answered: 1) How does the trade community form, and 2) what factors affect trade community formation?

According to previous research, resource dependence theory (RDT) and complex network theory (CNT) can explain these questions well. RDT states that if a firm is heavily dependent on a given market, it will be constrained by the actors in that market (Xia et al., 2016; Zheng and

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Xia, 2017). Similarly, if a country is dependent on trade for particular resources, then it will be affected by other relevant countries in the trading segment. In international trade, the most important goal of an organization's survival is to find means to reduce the reliance on an external resource supply and find a way to affect the critical resources of these supply organizations. Not coincidentally, forming the community could be a strategy to reduce the constraints and increase trade security through close connection among the countries (Shipilov, 2009). On the other hand, CNT is a useful tool to analyze the interactions between countries systemically, particularly when the number of countries and that of the ties linking the countries is huge (An et al., 2014a; Gao et al., 2014; Milo et al., 2002; Rubinov and Sporns, 2010). Due to the increase of trading partners, the formation and management of trade community become a complex issue. When confronting the increasing complexity of the trade community, countries have increasingly more factors to consider how to access more external resources and increase its trade advantage through network positions in the community. In general, within the community of trade network, one country probably obtains extra trade advantages through its core or central position (Burt, 2010; Dong et al., 2017). Countries in central position can usually bridge the role of communication and shorten the exchange distance among member countries to improve trade cohesion (Guan et al., 2016). The centrality of countries is particularly significant for those trade groups that are very complex in cooperation and control. Thus, a country's network position (e.g., centrality or core importers) is very critical to pay more sufficient attention.

Hence, RDT can better explain the promotion effect of the trade community formation and enable countries to conduct favorable trade activities and allocate resources rationally. CNT and econometric analysis can characterize the network structure and analyze the impact of various factors on the formation of trade community. As such, by integrating the resource dependence theory and complex network theory into a new analysis framework, this paper addresses the dependency of one country on other partners, the structure of the community and factors affecting its formation based on the copper concentrates and scrap copper (CCSC) international trade model. The main contributions of this paper lies in two aspects. Firstly, we analyzed factors affecting the community formation of international copper trade, which is a new sight of this field. Secondly, we extend the application of resource dependence theory at the firm level to the national level, and combine econometrics and social networks to analyze it, which adds new knowledge to the understanding of national strategy and to the behavior of the macro organization.

This paper is organized as follows. Section 2 presents the theoretical hypotheses. Section 3 describes the method and data to test these hypotheses. Section 4 provides the results and corresponding discussions. The last section is our concluding remarks and policy implications.

2. Resource dependence theory development and hypotheses

The resource dependence theory has been applied broadly across the research domain to explain how organizations reduce environmental interdependence and uncertainty (Hillman et al., 2009). Although the resource dependence theory and complex network theory have provided distinct approaches to explain organization decisions, some work only illustrates certain basic assumptions and concepts of them (Pfeffer, 1987; Yin and Shanley, 2008). According to the assumptions, the most important thing about organizations is survival. In order to survive, organizations need resources, especially for what the organizations usually cannot produce alone. Thus they must interact with other organizations in the environment on which it depends. However, organizational survival is based on a capacity to control the organization's relationship with other organizations. Therefore, scholars have developed and improved the understanding regarding the capabilities that enable firms to be successful in dyadic network relationships (Anderson and Narus, 1990; Dyer and Singh, 1998), joint

ventures (Merchant and Schendel, 2000; Xia et al., 2016), strategic alliances (Anand and Khanna, 2000; Kale et al., 2002) and industry networks (An et al., 2015; Gulati and Gargiulo, 1997). Most of these research focus on firm level and optimize the allocation of enterprise resources, but it is also crucial to consider resources allocation from national level.

In order to answer the above question, we extend the application of resource dependence theory to national level, and combine econometrics and social networks to analyze it, which is the second innovation. The three hypotheses also put forward around the theory of resource dependence and international trade. Countries form a series of relationships with other organizations such as customers and suppliers that create a wider network structure (Tehseen and Sajilan, 2016). As such, we can apply complex network to build a CCSC international trade model and an econometric model to analyze the structure of the community and factors that lead a country how to choose a partner. As mentioned above, the community is built based on trade relationships rather than agreements, such as Free Trade Agreement (FTA) and Comprehensive Economic and Trade Agreement (CECA). Although certain countries are not in the same trade organization based on the Trade Agreement, they join the same community based on the trade relationship, which also enhances their power in international trade. Therefore, the study of which factor or factors can affect the formation of a country's trading community, that is, affect the allocation of resources or combination. This also corresponds to the three hypotheses we have made and analyzes our innovation.

2.1. Resource dependence and trade community

A country in an open trade environment can access the necessary resources for survival and development through exchange. To seek complementary resources and avoid uncertainty, these countries usually join a trade community. RDT argues that the country always strives to reduce its dependence on external economies and increase the dependence on other countries. Thus, by forming a trade community with other countries, it can access key resources that are controlled by other countries. Ozmel et al. (2013) applied this logic to the study of the formation of bilateral alliances and found that the higher the interdependence of the two organizations in the same situation, the more likely it is to integrate the resources and capabilities of both parties through strategic alliances. Moreover, Xia et al. (2016) considers that, among various alliance forms, joint ventures reflect the firms' strong commitments in the target industry and are also more effective in reducing resource constraints from partners.

We argue that interdependence and power avoidance logic can also be used to explain the formation of a trade community. As noted by Pfeffer and Salancik (1978), an organization may cooperate with multiple organizations to obtain complementary assets and compensate for their own lack of resources. Similarly, a country may cooperate with many countries to obtain multiple resources, to enhance their international competitiveness and avoid trade risks. In other words, by participating in a trade community, the country may reduce its reliance on the external environment and avoid threats from other competitors. The empirical research on multi-party strategic alliance provides support for this possibility. For example, when the research and development (R&D) alliance is very necessary to the members, they more likely continue to remain in the league. Therefore, we propose the following hypothesis:

Hypothesis 1. The greater a country depends on other countries' resources, the more likely it is to join the same trade community with other countries.

2.2. Network position and trade community

RDT argues that the power of an organization is derived from the

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