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Export upgrading and environmental performance: Evidence from China

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ABSTRACT

This study argues that export upgrading can, but does not necessarily, lead to environmental improvement. A synergy between global and local linkage determines the likely disjuncture between export upgrading and environmental improvement. On the basis of the panel data covering 261 prefectural-level cities in China during 2003–2011, this study applies the decomposition of export sophistication to quantify diverse upgrading types. It also divides the sample cities into groups and uses the fixed-effect regression by groups to investigate the role of local linkages. Empirical findings indicate that environmental improvement associated with export upgrading in China has largely relied on changing product mix to avoid environmental costs, exhibiting a significant displacement effect. The role of efficiency promotion of production process is still insignificant. Local linkage may alter the environmental effects of export upgrading. Specialisation in polluting production can help cities to change product mix through the agglomeration of related firms. Stringent environmental regulation protects cities from the export–environment disjuncture through imposing additional costs. These findings suggest that the greening efforts of China should take one step further from export restructuring to efficiency promoting.

1. Introduction

Does a region have better environmental performance over time when it turns into a more sophisticated production site for export? It is conditional. Although previous studies have reported an unambiguously positive 'technique effect' of international trade on the environment (Antweiler et al., 2001; Copeland and Taylor, 2004), a key concern is that an increasing level of export sophistication (export upgrading) does not necessarily suggest a genuine technological development. To some extent, this discrepancy is due to the diverse channels of export upgrading, including increasing the product quality, improving the efficiency of production, and replacement by higher value-added products (Kaplinsky, 2000; Kemeny, 2011). However, an emerging strand of the literature has highlighted that export upgrading relies on the synergy between global and local linkage (Humphrey and Schmitz, 2002). Following this perspective, we argue that the likely disjuncture between export upgrading and environmental improvement depends on the local linkage.

In fact, export upgrading has its own geographical properties. Upgrading relies on place-specific 'fundamentals', including the physical endowment and the human capital (Hausmann et al., 2007). Highly sophisticated production requires more exclusive capabilities and then becomes less reproducible everywhere (Hidalgo and Hausmann, 2009; Maggioni et al., 2016). Hence, export upgrading is likely to make the production more embedded within the local production network. In turn, the local embeddedness is important for capacity building to achieve substantial 'technique effect' associated with upgrading (Poncet and Waldemar, 2013). To be specific, local embeddedness refers to the interactions between local firms and with local institutions. These interactions may determine very different ways for local-level upgrading (Humphrey and Schmitz, 2002), thus enabling or disabling the co-evolution between export upgrading and environmental improvement.

China is a developing country with a huge territory, which has rested its rapid economic growth on the export-oriented strategy and tremendous environmental costs. It offers an ideal case to examine the role of local linkage in the likely disjuncture between export upgrading and environmental improvement. Moreover, previous studies have identified China as an outlier in the growth-upgrading relationship because its income level is not comparable with highly sophisticated exports (Rodrik, 2006; Schott, 2008). Empirical evidence has shown that a considerable share of upgrading originates from foreign-owned firms, where processing trade contributes to a large portion (Jarreau and Poncet, 2012; Wang and Wei, 2010). However, neither the processing trade nor the foreign-owned exporters will be growth enhancing (Jarreau and Poncet, 2012; Poncet and Waldemar, 2013). In such a

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case, it is necessary to recognise the difference between processing trade and general trade for investigating the environmental impacts of China's export.

From a sample of 261 prefectures in China during 2003–2011, this study investigates how global linkage and local linkage work together to enable or disable the conductive effect of export upgrading on the environment. In this study, global linkage refers to the diverse types of export upgrading. By applying the *TECH* index proposed by Kemeny (2011), we decompose the export upgrading and identify four likely environmental effects of export upgrading, namely the quality effect, the technique effect, the transfer effect and the displacement effect. In addition, we capture the pollution-relevant local linkages by dividing the sample cities into different groups. A regional division of labour on pollution-intensive production represents the inter-firm linkage, and the stringent–lax division of environmental regulation denotes the institutional linkage.

From a set of regressions controlling the year- and city-fixed effects, our empirical results clearly reveal that the environmental effect of export upgrading varies from one type to another. In addition, the local linkage alters the environmental effect of a particular upgrading type. Overall, the environmentally benign types of upgrading are product upgrading (through quality improvement) and inter-sectoral upgrading (through product displacement). The 'quality effect' (environmental improvement by product upgrading) remains weak and sensitive to the local linkage, while the 'displacement effect' (environmental improvement by inter-sectoral upgrading) contributes to the largest portion of upgrading.

Empirical results further support the role of the local linkage. For cities specialised in polluting production, their environment will gain more from product displacement in processing trade. In contrast, cities specialised in non-polluting production primarily gain from general trade, thereby exhibiting a considerable displacement effect and a fledgeling quality effect. Moreover, stringent environmental regulation can promote the quality effect and the displacement effect of general trade on the environment. Concerning the processing trade, stringent environmental regulation keeps the upgrading of export from downgrading the environment by controlling the structural transformation of export.

Our findings may contribute to the literature in two ways. First, there remains a considerable ambiguity in the literature about the relationship between processing trade and pollution emissions. Although some empirical studies have reported a positive relationship (Sousa et al., 2015), our findings reveal that the positive relationship has a precondition. It is valid only in regions specialised in polluting production, where a displacement effect of processing trade and a composition effect of industrial restructuring have been witnessed. In addition, compared with the general trade, our findings also reveal that the current processing trade in China has very limited capacity to contribute to the environmental improvement through technological development. Either the technique effect or the quality effect of processing trade is absent. If the current growth model holds, China has to inevitably face the consequences of the tremendous environmental costs due to the increasing share of processing trade.

Second, our findings support that local linkage may alter the environmental effect of export upgrading, thereby leading to a disjuncture between export upgrading and environmental improvement. Previous studies have clearly revealed that the local linkage affects the upgrading impacts, which then enables or disables the growth-driven process of upgrading (Humphrey and Schmitz, 2002; Poncet and Waldemar, 2013). Our findings show that this holds for the trade–environment relationship also. Cities specialised in polluting production are less likely to achieve better environmental performance through export upgrading because of the strong pollution base in these cities. However, stringent environmental regulation may help in such cases. It is effective for both general and processing trades in different ways.

The remainder of this paper is structured as follows. In Section 2, we briefly outline the theoretical framework. Section 3 describes the data and methods used in this study. Section 4 describes the relationship between export upgrading and environmental performance. Section 5 presents the empirical model and the results of the estimation. The last section concludes the main findings and their policy implications.

2. Export upgrading: A synergy between global and local linkage

2.1. Synergy between global and local linkage

Engaging with the global market brings both opportunities for and competition to regional development. To benefit from such an engagement, one of the most viable strategies is product upgrading (Kaplinsky, 2000). Export upgrading allows trading regions to move from primary and simple production to more sophisticated and challenging ones (Hausmann and Klinger, 2006). Because sophisticated production may have greater potential for knowledge spillovers or backward/forward linkages (Anand et al., 2012), increasing the sophistication of exports is likely to foster regional development largely.

In its early stage, the literature of upgrading was stimulated by the success of industrial districts. It seeks to answer how the local cluster helps firms located in the cluster to grow and participate in the distant market. Its rationale refers to the external economies originated from Marshall's theory, which investigates the positive effects of increasing local interactions due to geographical proximity. Schmitz further proposed the term 'collective efficiency' (1999), defined as the competitive advantage derived from external economies and joint action, to explain how firms located in the cluster become and remain competitive. In practice, there is a wealth of empirical evidence supporting that firms will gain from geographical proximity through effective interactions (Rabellotti and Schmitz, 1999; Ivarsson, 1999).

However, data on whether a region can upgrade on its own are not clear. There is an increasing awareness of the importance of external linkages. In the global context of production fragmentation, a region is less likely to cover all the segments of production, thereby entailing inevitable outflows of finished products. That is, agglomeration and trade are mutually reinforcing phenomena (Scott, 2006). In such a case, the cluster-based view is internally complex but externally simple as described in a previous study (Humphrey and Schmitz, 2002). A notion of the value chain was proposed by Gereffi (1999) to materialise the value-added process of upgrading. It incorporates the stakeholders and their interactions to capture the unevenly distributed gains across countries and regions (Gereffi et al., 2001).

On the basis of the chain metaphor, a wide range of empirical studies have sought to answer how the diverse ways to insert into the global value chain will affect the upgrading and how upgrading ways and local linkages will mutually affect each other. Humphrey and Schmitz (2002) emphasised that different ways of insertion into the global value chain will enable or disable the local upgrading efforts. On the basis of the observations from Latin America, Giuliani et al. (2005) also confirmed that although collective efficiency affects the upgrading, its impact will follow different routes in different sectors.

Evidence from developing countries has revealed that the ways to upgrade may depend on the local linkage. From a dynamic perspective, Pietrobelli and Rabellotti (2011) revealed that the nature of local linkage affects the continuous adjustments of upgrading ways. Even for a certain upgrading way, e.g. quality upgrading by using foreign direct investment, inefficient local linkages can disable its upgrading efforts (Crespo and Fontoura, 2007).

Overall, the synergy between global linkage and local linkage has offered a synthesised framework to capture the process of upgrading and its multiple effects, especially its effects on economic growth and technological development. In analogy with the upgrading-growth linkage, this study argues that the disjuncture between export upgrading and environmental improvement may also be ascribed to the