Specialization in Production Networks: Measuring Interdependence in Activities across China's Provinces

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The vertical specialization of countries in trade is by now a major established theme in international economics. A key outcome of this work is that production is fragmenting internationally and countries specialize in activities in global production networks (Baldwin, 2006; Grossman and Rossi-Hansberg, 2008). These activities include production activities as well as various support activities, including pre-production tasks, such as R&D and design, and post-production tasks, such as marketing and after-sales services. We follow Sturgeon et al. (2013) and Markusen and Venables (2013) and will refer to these activities as business functions or in short â€œfunctionsâ€•.

The measurement of vertical specialization in trade initiated with an influential paper by Hummels et al. (2001), who proposed to measure vertical specialization by the import content of exports. Johnson and Noguera (2012) extend this analysis to a multi-country setting by tracing value added in trade based on global input-output tables. Koopman et al. (2014) propose an accounting framework that integrates the measures developed by Hummels et al. (2001) and Johnson and Noguera (2012). In this framework, a countryâ€™s gross exports are split into domestic value added, foreign value added and (empirically small) â€œpure double-countingâ€• terms.

The contribution of this paper is to add new information on the functional distribution of jobs embodied in domestic value added exports. We distinguish four functions, namely R&D and technology development, manufacturing and assembly, sales and distribution, and other support activities. We focus on the job content of domestic value added exports. Los et al. (2015) provide a simple and intuitive approach to measure domestic value added exports and show this measure is theoretically grounded in a Leontief production model.

We identify the job content of domestic value added exports of a particular function by the number of workers that perform the function. For this, we use information on the occupation of workers from the Chinese population censuses. We map occupations to business functions and combine this new and detailed dataset on occupations of workers at the province-industry level with information on inter-industry and inter-regional trade flows from Inter-Regional Input-Output Tables.

The extension of the empirical model for measuring value added trade and the collection of new occupations data allows us to examine specialization patterns of Chinaâ€™s provinces in production networks. The standard tool to analyze specialization patterns is by means of revealed comparative advantage (RCA) analysis, which we adept to perform the RCA on the basis of the functional job content of domestic value added exports of activities. Thus the usefulness of RCA analysis is retained, albeit with a different interpretation. Based on the job content of value added exports in activities, an RCA for a particular activity, say R&D, larger than one indicates that the province in China derives a higher share of its overall domestic value added exports from adding R&D value to its exports relative to other Chinese provinces.

Based on activity shares in value added exports, we analyze shifting patterns of specialization and then explore how the activities in regions are interdependent using spatial econometric analysis. The key idea we would like to explore econometrically here is to examine how regions are involved in production networks and perform different activities. For example, firms in Hebei province might provide production activities for products that are exported from Guangzhou, Guangdong province, whereby firms in Guangzhou provide the logistics activities. Other regions in Chinaâ€™s might to different degrees and by undertaking different activities be involved in production networks. Our modeling of such spatial autoregressive relationships would allow us to uncover these linkages.