Decomposition of Average Propagation Length

Topic: 809W Methodological Aspects of MRIO Analysis
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[Background]

Dietzenbacher proposed the concept of Average Propagation Length (APL) (Dietzenbacher et al (2005) and Dietzenbacher et al (2007)). APL has been used as length of production process or length of supply chain. On the other hand, international division of labor in the production process is getting focused in face to globalization. The phenomenon of increasing cross-border transaction of intermediate inputs is called the fragmentation of production process. APL is used as index of fragmentation of production process (Romero et al (2009), Escaith et al (2013)).

[Research Question]

Since APL includes both propagation in domestic transaction and that in cross-border transaction, two propagations should be separated in order to analyze fragmentation. In this presentation, I propose cross-border APL (APLxB) and the method of APL decomposition in general.

[Method used]
Letâ€™s assume world input-output table with R country an N sector (RN x RN matrix). Let a(i,j,r,s) be a input coefficient of s-th country j-th sector purchase of r-th country i-th sector commodity. The input coefficient matrix (A: (RN x RN)) can be divided into two sub-matrices, international transaction matrix Af and domestic transaction matrix Ad. The size of both matrices is (RN x RN). Ad includes factors a(i,j,s,s) and zeros for all r ><s. Af includes factors a(i,j,r,s) for r><s and zeros for all r=s. Then, it holds A=Ad+Af.

APL is the fraction of the sum of (k*A^k for k=1,2,3â€¦) and the sum of (A^k for k=1,2,3â€¦). The numerator of the cross-border APL is sum of following T(k), for k=1,2,3â€¦

T(1)=1*Af + 0*Ad
T(2)=2*Af^2 + 1*(Af*Ad+Ad*Af)+0*Ad^2
T(3)=3*Af^3 + 2*(Af^2*Ad+Af*Ad*Af+Ad*Af^2) + 1*(Af*Ad^2+Ad*Af*Ad+Ad^2*Af) + 0*Ad^3
â€¦.

These terms T(k) look very complicated and difficult to calculate when k goes large. However, T(k) can be expressed as rather simple difference equation and its proof is given the paper.
More in general, let Aq be sub-matrices of A and sum of Aq equals to A. Then the same method above can be applied. Therefore, APL can be decomposed to the length passing through Aq.

[Data used]

WIOD data is applied to show the result of APLxB and decomposition of APL. Main result is that most of the APL is passing through the country of demand origin or the country of production.

[Novelty of the Research]

(1) It proposes the concept of cross-border APL
(2) It proposes the decomposition of APL
(3) It shows cross border and domestic APL using WIOD.

Reference

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Escaith,H. and S.Inomata (2013), "Geometry of global value chains in East Asia: the role of industrial networks and trade policies",Global value chains in a changing world(D.K.Elms and P. Low eds.) WTO, pp.135-157

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