Analyzing the productivity contribution of intangible assets and participation in global value chains

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Artificial intelligence and the next generation of competences :
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Introduction

- Organization of production through global value chains (GVCs)
- GVCs definition: “all the activities contributing to the product creation from its initial conception to its final distribution are usually referred as global value chains
- GVCs can be seen as huge networks of exchanges of materials, intermediate inputs and information that connect industries and firms located in different countries
- Role of intangibles: more productivity and more participation to GVC
- How do intangibles, GVCs and their relationship affect productivity?

Literature review

Two strands of literature:

- GVCs
- GVCs as driver to productivity (e.g. Baldwin and Yan, 2014).
- Factors facilitating countries participation in GVC (Jona-Lasinio et al., 2016)
- Measuring GVC participation (Johnson and Noguera, 2012; Daudin et al., 2011) → Network analysis

- Intangibles
- Contribution to productivity (Corrado *et* al., 2005, Piekkola, 2016)

Data

- Industry level panel data from 2000 to 2014 for 18 countries and 18 sectors.
- GVC data. Input output tables on bilateral trade (WIOD)
- Intangibles data. Investment on R&d, software and computers, design, brand and economic competencies (INTAN-Invest)
- Productive factors (OECD/EU Klems data)

Empirical method

Two stage procedure

First stage: compute a TFP measure with production function specific methods

$$log\, Y_{c,i,t} = b_1 log K_{c,i,t} + b_2 log L_{c,i,t} + e_{c,i,t}$$

→instrumental variables

→Levinsohn and Petrin (2003)

→Wooldridge (2009)

Empirical method

Second stage

Panel regression with fixed effects to evaluate GVC and intangibles

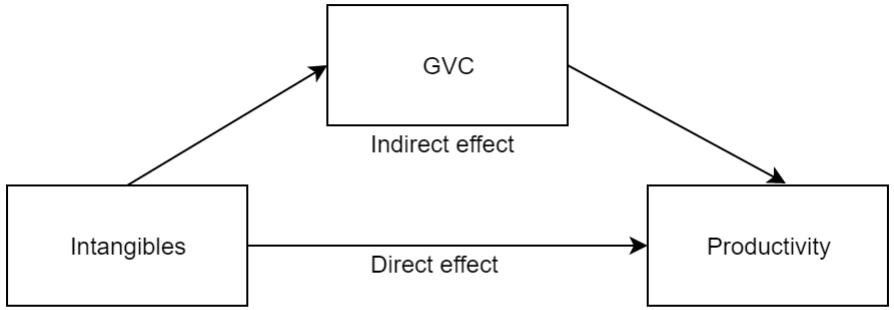
→combined effect on productivity

$$log\,TFP_{c,i,t} = \gamma_1 logGVC_{c,i,t} + \gamma_2 logINT_{c,i,t} + \mu_{c,i,t}$$

Empirical method

Second stage

- →two channels



- Estimate (via SEMs) the system:

$$log\,TFP_{c,i,t} = \gamma_1 logGVC_{c,i,t} + \gamma_2 logINT_{c,i,t} + \xi_{c,i,t}$$
$$logGVC_{c,i,t} = \gamma_2 logINT_{c,i,t} + \varepsilon_{c,i,t}$$

Results – Production function

	(1)	(2)	(3)
Dep. Variable: Value added	IV	LP	WRDG
Labor	0.389***	0.306***	0.312***
	(0.0241)	(0.0454)	(0.00608)
Capital	0.996***	0.421***	0.429***
	(0.00936)	(0.0871)	(0.0937)
Observations	3724	3281	3058
R^2	0.814		

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1: Production function estimation

Results – Eingenvalue and Random Walk

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	TFP	TFP	TFP	TFP	TFP
Eigencentrality	0.0239***	0.0260***	0.0143***	0.0145***	0.0137***
	(0.00401)	(0.00382)	(0.00322)	(0.00309)	(0.00323)
R&d	0.617***				
	(0.0193)				
Computer software		0.541***			
		(0.0175)			
Design			0.522***		
			(0.0182)		
Econ. competencies				0.633***	
				(0.0191)	
Brand					0.526***
					(0.0178)
Other intangibles	0.619***	0.439***	0.491***	0.301***	0.479***
	(0.0201)	(0.0208)	(0.0184)	(0.0233)	(0.0199)
Constant	-1.009***	-0.0986	-0.207	-0.878***	-0.191
	(0.162)	(0.148)	(0.143)	(0.146)	(0.141)
Observations	2614	2912	2861	2951	2936
R^2	0.305	0.297	0.248	0.294	0.252

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: GVC effect with eigenvalue centrality

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	TFP	TFP	TFP	TFP	TFP
RW centrality	0.320***	0.319***	0.321***	0.250***	0.312***
	(0.0295)	(0.0284)	(0.0284)	(0.0283)	(0.0293)
R&d	0.570***				
	(0.0195)				
Computer software		0.497***			
		(0.0177)			
Design			0.478***		
			(0.0183)		
Econ. competencies				0.582***	
				(0.0198)	
Brand					0.475***
					(0.0182)
Other intangibles	0.570***	0.397***	0.444***	0.298***	0.458***
	(0.0203)	(0.0209)	(0.0185)	(0.0230)	(0.0196)
Constant	-3.202***	-2.331***	-2.307***	-2.454***	-2.243***
	(0.235)	(0.221)	(0.217)	(0.211)	(0.222)
Observations	2615	2912	2866	2956	2941
R^2	0.327	0.317	0.277	0.307	0.277

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: GVC effect with random walk closeness centrality

Results - Betweenness

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	TFP	TFP	TFP	TFP	TFP
Betweenness	0.00408	-0.000949	-0.000281	-0.00305	-0.00218
	(0.00469)	(0.00446)	(0.00463)	(0.00442)	(0.00455)
R&d	0.615***				
	(0.0195)				
Computer software		0.534***			
		(0.0178)			
Design			0.520***		
			(0.0185)		
Econ. competencies				0.628***	
				(0.0196)	
Brand					0.526***
					(0.0181)
Other intangibles	0.614***	0.438***	0.487***	0.307***	0.471***
	(0.0203)	(0.0211)	(0.0188)	(0.0237)	(0.0204)
Constant	-1.282***	-0.343*	-0.355*	-1.009***	-0.327*
	(0.162)	(0.147)	(0.145)	(0.148)	(0.143)
Observations	2549	2830	2771	2858	2843
R^2	0.296	0.278	0.239	0.282	0.244

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: GVC effect with betweenness centrality

Results

- Both eigenvalue and random walk centrality have positive effect
- Betweenness not significant
- Having many connections matters for productivity, while being a "bridge" for other industries does not seem to matter

Results – GVC as mediator

	(1)	(2)
Dep. Variable:	Eigencentrality	TFP
Intangibles	0.9151***	0.1039***
	(0.0579)	(0.0094)
Eigencentrality		0.9205***
		(0.0124)
Constant	-18.1823***	3.8519***
	(0..4793)	(0.1980)
Observations	2951	2951

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Mediation analysis

	(1)	(2)
	Intangibles	Eigencentrality
Direct effect	0.1039***	0.9205***
	(0.0094)	(0.0124)
Indirect effect	0.8423***	
	(0.0071)	
Total effect	0.9462***	
Proportion total effect mediated	0.8902***	
Ratio indirect/direct effect	8.1068***	
Ratio total/direct effect	1.1234***	

Table 6: Direct, indirect and total effect

Conclusions

- We empirically investigated the impact of intangibles and GVC participation on productivity for the period 2000-2014
- We found evidence in favor of an effect of intangibles and GVCs as drivers for productivity
- Also two two different channels through which intangibles affect productivity: one direct and one indirect, via the mediation of GVC.

Thank you