Competition in manufacturing and service content of manufactured products

Carolina Lennon[1] Robert Stehrer [2]

[2]The Vienna Institute
for International Economic Studies (wiiw)

[1]Paris School of Economics (PSE) and wiiw

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The main question

An empirical work

Does the **service content of manufactured products** increase with **competition in manufacturing?**

- Post-sales services (repairing, product's guarantee, call centers)
- Distribution (home delivery, distribution points, virtual shops, phone sales etc)
- Marketing (advertisement, brand differentiation and loyalty programs),
- Finance (credit schemes)

Main result

Positive relationship between the **service content** and **competition in manufacturing**

$\Uparrow$ competition in the car industry in the USA in 2001

$\Rightarrow$

$\Uparrow$ services in the car industry in the USA in 2001

The beginnings of the idea

inspired by Horn and Shy (1996) "Bundling and International Market Segmentation"

- Analytical framework
- Oligopoly game
- In which manufacturers can choose whether to bundle their products with services or not

Trade liberalization ($\Uparrow$ competition) $\Rightarrow \Uparrow$ service content.

- Since bundling products with services allows them to segment the market and to reduce competition.

$\Rightarrow$ Losses for the firm offering only the base product
$\Rightarrow$ Profit gains for the firm bundling its products with services

The beginnings of the idea
in marketing

Marketers say:

- Product features can be easily duplicated by competitors
  - Monopolistic power eroded quickly
- The service content fosters consumers' loyalty
  - Monopolistic power lasts over time
- As competition increases, the speed with which physical features can be copied also increases, implying that the only remaining source of firms' sustainable differentiation might be the service content of their products.

Previous literature

Competition in services	$\Rightarrow$	performance in manufacturing productivity exports

- Francois and Woerz (2008), Amiti and Wei (2009) and Debaere et al. (2010).

Our work

Competition in manufacturing import competition trade liberalization concentration	$\Rightarrow$	Use of services in manufacturing input share employment share

Baseline model

Does the service content increase with competition?

$$S^s_{mit} = \beta_0 + \beta_1 C_{mit} + FE_{...} B + \mu_{mit} \quad (1)$$

$S^s_{mit} \Rightarrow$ **service content of manufactured products**

- Service input share $\Rightarrow$ outsourced
- Service employment share $\Rightarrow$ in-house

$C_{mit} \Rightarrow$ **competition in the manufacturing sector**
$FE_{...} \Rightarrow$ **diff. sets of fixed effects to account for unobserved**

- Three dimensions:
  - m: manufacturing sector
  - i: country
  - t: time

Data - dependent variable
(1) Service input share

- Input-output data
  - IO data, STAN Input Output database
  - years: 1995, 2000, 2005
  - countries: 42
  - sectors: based on ISIC Rev.3, 2-digit sectors, Total (37), Manufacturing (18), and services (10).

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- Service input share
  1. over material inputs
  2. over manufactured inputs
  3. over total input

	Average annual percentage change (1995-2005)			
	Value added	**Gross output**	**Intermediate use**	**Household consumption**
Total economy	**3.7%**	**4.0%**	**4.3%**	**4.2%**
Primary	3.1%	2.9%	4.9%	1.2%
Manufacturing	1.1%	2.4%	2.6%	3.3%
Other	4.2%	4.2%	2.4%	8.5%
Total Services	**4.4%**	**4.9%**	**5.9%**	**4.3%**

Note =at basic prices. Countries: Austria, Belgium, Brazil, Canada, Chile, Germany, Denmark, Spain, Estonia, Finland, France, United Kingdom, Greece, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, Portugal, Slovak Republic, Sweden, Turkey, United States and South Africa

	Share in total economy							
	Value added		**Gross output**		**Intermediate use**		**Household consumption**	
	1995	**2005**	**1995**	**2005**	**1995**	**2005**	**1995**	**2005**
Total economy	100%	100%	100%	100%	100%	100%	100%	100%
Primary	3%	3%	3%	3%	7%	7%	2%	2%
Manufacturing	20%	16%	31%	27%	41%	36%	24%	22%
Other	16%	16%	16%	16%	9%	7%	4%	5%
Total Services	**60%**	**64%**	**50%**	**54%**	**43%**	**50%**	**70%**	**71%**

Countries: Austria, Belgium, Brazil, Canada, Chile, Germany, Denmark, Spain, Estonia, Finland, France, United Kingdom, Greece, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, Portugal, Slovak Republic, Sweden, Turkey, United States and South Africa

Sectoral use of intermediate inputs by manufacturers

	Value *(US dollar, million)*		**Growth** *Annual(%)*	**Share (%)**	
Type of input	**1995**	**2005**	**1995-2005**	**1995**	**2005**
Total	8,564,648	11,214,361	3.0	100.0	100.0
Material inputs	5,991,546	7,651,286	2.7	70.0	68.2
Other inputs	364,614	383,699	0.6	4.3	3.4
Services inputs	**2,208,488**	**3,179,376**	**4.0**	**25.8**	**28.4**

Countries: Austria, Belgium, Brazil, Canada, Chile, Germany, Denmark, Spain, Estonia, Finland, France, United Kingdom, Greece, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, Portugal, Slovak Republic, Sweden, Turkey, United States and South Africa

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Data - dependent variable
(2) Service employment share

- Employment by occupation
  - European Labour Force Survey (EU LFS)
  - countries: EU-27 + Switzerland and Norway
  - years: 1995-2007 (though better quality since 1999)
  - occupations: ISCO 3-digit categories
  - sectors: NACE rev. 1.1, 2-digit sectors.

- Service employment share
  1. Customer services
  2. R&D
  3. Transport and logistics
  4. Production (for comparison)

Different measures of competition

Independent variables

1. **Import competition** $\Rightarrow imports_{mit}/production_{mit}$
   - Imports
     - Imports
     - Imports excluding imported inputs
     - Imports destined to household consumption
2. **Other variables, of the type** C_{mit}
   - Tariff t-1 (simple average and weighted average - WB)
   - Concentration,
     - Large firms share in sectoral production t-1 (SDBS Structural Business Statistics -OECD)
     - Number of enterprises t-1
     - Number of enterprises over manufacturing n. of enterprises t-1

Regressions and results

1. Service input share
   - Results and robustness checks
     - Different measures of competition here
     - Different sets of FE here
     - Different samples here
     - Different definitions of import competition
   - Further analysis
     - Manufacturing sectors here
     - Service sectors here
2. Service employment share here
3. Conclusions here

Table: Diff. variables of competition

	Service input over material inputs					
	1	2	3	4	5	6
	0.253***	-0.846**	-0.882**	-0.248*	0.127***	0.694**
	[0.051]	[0.320]	[0.335]	[0.134]	[0.043]	[0.304]
Beta coeff	0.15	-0.19	-0.18	-0.06	0.04	0.09
Constant	38.252***	43.840***	43.670***	64.389***	41.461***	38.676***
	[0.041]	[2.008]	[1.952]	[11.688]	[0.295]	[1.695]
Sector FE	NO	NO	NO	NO	NO	NO
*Country * year FE*	YES	YES	YES	YES	YES	YES
Observations	1910	996	996	620	707	694
R-squared	0.02	0.01	0.01	0	0	0.01
Number of groups	110	57	57	39	42	40
R-sq: overall	0.02	0.03	0.03	0	0	0.01
R-sq: within	0.02	0.01	0.01	0	0	0.01
R-sq: between	0.01	0.18	0.17	0.07	0	0.01
Rho	0.14	0.1	0.1	0.18	0.14	0.14

Independent var. (1) :	Import compet., imports by Households
Independent var. (2) :	Tariff t-1, simple average
Independent var. (3) :	Tariff t-1, weighted average
Independent var. (4) :	Large firms share in sectoral production t-1
Independent var. (5) :	Number of enterprises (000) t-1
Independent var. (6) :	Number of enterprises over manufacturing n. of enterprises t-1

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Different sets of FE

year	$\Rightarrow$	trend, global shocks
country	$\Rightarrow$	level of development
sector	$\Rightarrow$	technology
year*country	$\Rightarrow$	country specific business cycle shocks, relative services' prices
year*sector	$\Rightarrow$	sectors that are doing particularly well, diff. impact of third sector's (i.e. primary)
country*sector	$\Rightarrow$	country-sector specific characteristics

Errors clustered by within estimation groups

Different sets of FE

Service input over material inputs										
	1	2	3	4	5	6	7	8	9	10
Import compet.	0.257***	0.235***	0.253***	0.231***	0.238***	0.238***	0.093***	0.087***	0.235***	0.076**
(households)	[0.049]	[0.047]	[0.051]	[0.048]	[0.047]	[0.048]	[0.032]	[0.033]	[0.051]	[0.035]
Beta coeff	0.15	0.14	0.15	0.14	0.14	0.14	0.05	0.05	0.14	0.04
Obs.	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910
R2	0.15	0.26	0.02	0.15	0.02	0.16	0	0.02	0.17	0.17
Sector FE		YES		YES						
Country FE	YES	YES				YES				
Year FE	YES	YES						YES		
*Country*year FE*			YES	YES					YES	YES
N. of groups			110	110					110	110
*Sector*Year FE*					YES	YES			YES	YES
N. of groups					54	54				
*Country*Sector FE*							YES	YES		YES
N. of groups							734	734		

*Robust errors clustered. Constant estimated but not reported * significant at 10%; ** significant at 5%; *** significant at 1%*

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Different samples

1. **All observations - 1,900** $\Rightarrow$ beta coeff. 0.14
2. Excluding outliers by leverage $\Rightarrow$ beta coeff. 0.22
3. 22 countries with the best data $\Rightarrow$ beta coeff. 0.29

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Table: Diff. samples

	Service input over material inputs		
	1	2	3
Import compet,	0.231***	0.689***	0.232***
Imports by households	[0.048]	[0.032]	[0.045]
Beta coeff	0.14	0.22	0.29
Constant	42.253***	39.154***	16.311***
	[2.456]	[1.678]	[2.005]
Observations	1910	1880	1112
R-squared	0.15	0.4	0.37
Sector FE	YES	YES	YES
*Country * year FE*	YES	YES	YES
Number of groups	110	110	62
R-sq: overall	0.13	0.29	0.3
R-sq: within	0.15	0.4	0.37
R-sq: between	0.04	0.03	0.05
Rho	0.16	0.4	0.27

*Robust errors clustered by Country*year group, * significant at 10%; ** significant at 5%; *** significant at 1%*

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Which Sectors

1. Manufacturing
   - Pulp, paper, paper products, printing and publishing
   - Wood and products of wood and cork
   - Textiles, textile products, leather and footwear
2. Services
   - Other Business Activities (professional services, marketing ..)

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Service employment share

Service employment share

Competition in manufacturing $\Uparrow$

Import competition

$\Rightarrow$

Service share in employment

$\Uparrow$ Customer services

$\Uparrow$ R&D

$\Uparrow$ Transport and logistics

Production

Table: Share in total employment

Dep. Var :	Service share in total employment							
Indep. Var :	Import comp (imports by Households)							
	all obs. Beta coeff.		Obs.	R-2	2005 Beta coeff.		Obs.	R-2
Customer services	0.25	1.056***	786	0.44	0.34	1.920***	325	0.56
R&D	0.22	0.972***	1001	0.68	0.3	0.926***	400	0.71
Transport and logistics	0.09	1.027**	974	0.42	0.15	1.463***	389	0.49
Production	0.03	0.463	1034	0.68	0.04	0.896	404	0.72
	Model: country, sector and year FE				Model: country and sector FE			

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Conclusions

Positive relationship between the **service content** of manufactured goods and **competition in manufacturing**

Robust to...

- Different measures of service content
- Different measures of competition
- Different sets of FE
- Different samples

Conclusions

Need for further investigation

- Analytical framework
  - Industrial Organization: bundling, quality, advertisement.
- More work on the occupation database.
- Causality (explore other databases - WIOD)

Implications

- explanation for the increasing role played by services in national economies
- measures to increase competition do not necessarily lead to more competitive markets

Annex

Table: Countries IO (42)

High income: OECD		High income: nonOECD	Lower middle income	Upper middle income
26		3	3	10
AUS	HUN	EST	CHN	ARG
AUT	IRL	ISR	IDN	BRA
BEL	ITA	SVN	IND	CHL
CAN	JPN			MEX
CHE	KOR			POL
CZE	LUX			ROU
DEU	NLD			RUS
DNK	NOR			TUR
ESP	NZL			ZAF
FIN	PRT			TWN
FRA	SVK			
GBR	SWE			
GRC	USA			

Table: Countries IO (22)

22	
AUT	HUN
BEL	ITA
CZE	JPN
DEU	LUX
DNK	NLD
ESP	PRT
EST	ROU
FIN	SVK
FRA	SVN
GBR	TUR
GRC	TWN

Table: Countries (occupation)

Countries (occupation) 29	
AUT	IRL
BEL	ITA
BGR	LTU
CHE	LUX
CYP	LVA
CZE	MLT
DEU	NLD
DNK	NOR
ESP	POL
EST	PRT
FIN	ROU
FRA	SVK
GBR	SVN
GRC	SWE
HUN	

Table: Sectors' classification (NACE)

Manufacturing (18)	**Services** (10)
Food products, beverages and tobacco	Wholesale and retail trade; repairs
Textiles, textile products, leather and footwear	Hotels and restaurants
Wood and products of wood and cork	Transport and storage
Pulp, paper, paper products, printing and publishing	Post and telecommunications
Coke, refined petroleum products and nuclear fuel	Finance and insurance
Chemicals and chemical products	Real estate activities
Rubber and plastics products	Renting of machinery and equipment
Other non-metallic mineral products	Computer and related activities
Basic metals	Research and development
Fabricated metal products except machinery and equipment	Other Business Activities
Machinery and equipment n.e.c	
Office, accounting and computing machinery	
Electrical machinery and apparatus n.e.c	
Radio, television and communication equipment	
Medical, precision and optical instruments	
Motor vehicles, trailers and semi-trailers	
Other transport equipment	
Manufacturing n.e.c; recycling	

Table: Service occupations

Customer services	**Transport. Logistics**
Business services agents and trade brokers	Ship and aircraft controllers and technicians
Cashiers, tellers and related clerks	Material-recording and transport clerks
Client information clerks	Library, mail and related clerks
Fashion and other models	Locomotive engine drivers and related workers
Shop, stall and market salespersons and demonstrators	Motor vehicle drivers
R&D	Ships' deck crews and related workers
Physicists, chemists and related professionals	Transport labourers and freight handlers
Mathematicians, statisticians and related professionals	
Computing professionals	
Architects, engineers and related professionals	
Life science professionals	
Health professionals (except nursing)	
Physical and engineering science technicians	
Life science technicians and related associate professional	

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