

Outsourcing And Productivity Growth Sectoral Evidence From Germany

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Motivation

- **Decomposition of industry-level productivity and gross output growth**
 - Which sectors are the leaders?
 - Which sectors are the laggards?
 - Which input factors drive sectoral gross output growth in Germany
- **Highlight differences between value added and gross output productivity measures**
 - Exploit differences to illuminate contribution of outsourcing

Results

- Outsourcing is major source of output growth
- Outsourcing and TFP growth are highly correlated
- Clear Evidence for New Economy in the data
- Growth Accounting methodology matters

Literature I (gross output)

- Jorgensen, Gollop, Fraumeni (1987) (US)
- Gullickson and Harper (1999b) and (2002) (US)
- Oulton and O'Mahony (1994) (UK)
- Gu, Lee and Tang (2001) (Canada)
- Crafts and Mills (2001) (UK and West Germany)

Literature II (value added)

- Van Ark and Pilat (1993) (OECD)
- Van Ark et al. (2000) and (2003)
- Bernard and Jones (1996a,b) (OECD)
- Harris and Trainor (1997) (UK)
- Gumbau-Albert and Maudos (1996) (Spain)
- Hernando and Nuñez (2002)

Literature II

(Gross Output vs. Value Added)

- Oulton and O'Mahony (1994) (UK)
- Van der Wiel (1999) (Netherlands)
- Sichel (2001) (US communications industry)
- Harchaoui, Kaci and Maynard (2001) Canada
- Goerlich and Orts (1994, 1996) (Spain)

Ifo Productivity Database I

	GGDC (1980-2001)	Ifo Prod. Database (1960-2001)
Output measure (sectoral)	Value Added	Value Added Gross Output
Inputs (sectoral)	Capital, Labor	Capital, Labor, Intermediate inputs
Capital Stocks	Sectoral capital stocks ICT, non-ICT assets as estimates	Sectoral capital stocks 52 industries 11 investment assets

Ifo Productivity Database II

	GGDC (1980-2001)	Ifo Prod. Database (1960-2001)
Depreciation rates	Uniform depreciation rates across industries, Equal to US rates	Survey-based depreciation rates, 52 industries 11 investment assets
Hedonic price deflators	Applied for ICT assets	Not used (planned)
Investment prices	Aggregate prices, 8 asset types	Sectoral prices, 52 industries, 11 investment types

GA Methodologies

Gross Output:

$$\Delta \ln Y_{it} = \bar{v}_{it}^{-L} \Delta \ln L_{it} + \bar{v}_{it}^{-K} \Delta \ln K_{it} + \bar{v}_{it}^{-M} \Delta \ln M_{it} + \Delta \ln TFP_{Yi}$$

Value Added:

$$\Delta \ln VA_{it} = \tilde{v}_{it}^L \Delta \ln L_{it} + \tilde{v}_{it}^K \Delta \ln K_{it} + \Delta \ln TFP_{VAi}$$

Value Added Concept

- Low data requirements (on factors and prices)
- Popular for international comparisons
- May reflect gross output *trend*
- Direct relation between sectoral and aggregate TFP
- Problems
 - No real life analogy to value-added
 - Production function must be additively separable
 - Technological change affects only L and K
 - input substitution is reflected as change in TFP

Gross Output Growth Accounting 1993-2001 Leaders

		Average Contributions to Output Growth 1993 – 2001					
	Output Growth	Other Capital	ICT Capital	Hours	Labor Quality	Inter-med.	TFP
Communi-cations	13.31	2	0	-7	0	56	48
Transport Equipment	3.99	7	-1	7	4	104	-20
Financial Intern.	3.71	5	4	6	28	58	-1
Real Estate Activ.	3.49	69	3	23	13	20	-29
Chemicals	3.48	12	1	-16	2	82	19

Growth Accounting Results - Laggards

		Average Contributions to Output Growth 1993 – 2001					
	Output Growth	Other Capital	ICT Capital	Hours	Labor Quality	Inter-med.	TFP
Furniture, Misc. Manuf.	-2.52	-10	0	26	-8	32	60
Hotels & Catering	-2.68	-11	0	-25	-12	75	73
Text., Leath., Footwear	-3.47	-1	1	35	3	50	12
Mineral Oil Ref., Coke	-4.03	-5	0	2	0	118	-15
Mining and Quarrying	-9.62	0	0	16	4	53	27

Advantage of Ifo Productivity Database: *REAL* Gross Output Measures

Gross output productivity

$$\hat{TFP}_Y = \frac{Y + \Delta\tilde{Y}}{M + L + K} \bigg/ \frac{Y}{M + L + K} = 1 + \frac{\Delta\tilde{Y}}{Y}$$

Value added productivity

$$\hat{TFP}_{VA} = \frac{Y + \Delta\tilde{Y} - M}{L + K} \bigg/ \frac{Y - M}{L + K} = 1 + \frac{\Delta\tilde{Y}}{Y - M}$$

$$\hat{TFP}_{VA} = (Y / VA) \hat{TFP}_G$$

TFP Comparison

	Output Avg Growth	VA Avg Growth	Output TFP	VA TFP	Y/VA Average	TFP Ratio TFP _{VA} /TFP _Y
Communications	13.31	9.75	6.41	10.91	3.00	1.70
Transport Equipment	3.99	0.53	-0.79	-0.02	1.32	0.03
Financial Intermediation	3.71	2.89	-0.04	3.98	2.69	-99.50
Real Estate Activities and Business Services	3.49	3.81	-1.01	-0.86	1.62	0.85
Chemicals	3.48	1.84	0.65	3.32	3.53	5.11
Transport	3.39	3.52	0.57	2.23	1.36	3.91
Electrical and Electronic Equipment; Instr.	3.29	-0.67	-0.13	1.66	2.44	-12.77
Rubber & Plastics	2.42	1.61	0.10	1.67	1.37	16.70
Electricity, Gas and Water Supply	2.41	1.78	0.08	0.89	7.28	11.13
Wood & Products of Wood and Cork	1.77	-0.10	0.01	1.47	1.41	147.00
Basic Metals & Fabricated Metal Products	1.77	0.65	0.27	2.00	2.55	7.41
Agriculture, Forestry and Fishing	1.45	1.63	0.16	1.89	2.05	11.81
Non-Market Services	1.44	1.35	-0.51	0.10	2.55	-0.20

Impact of Outsourcing

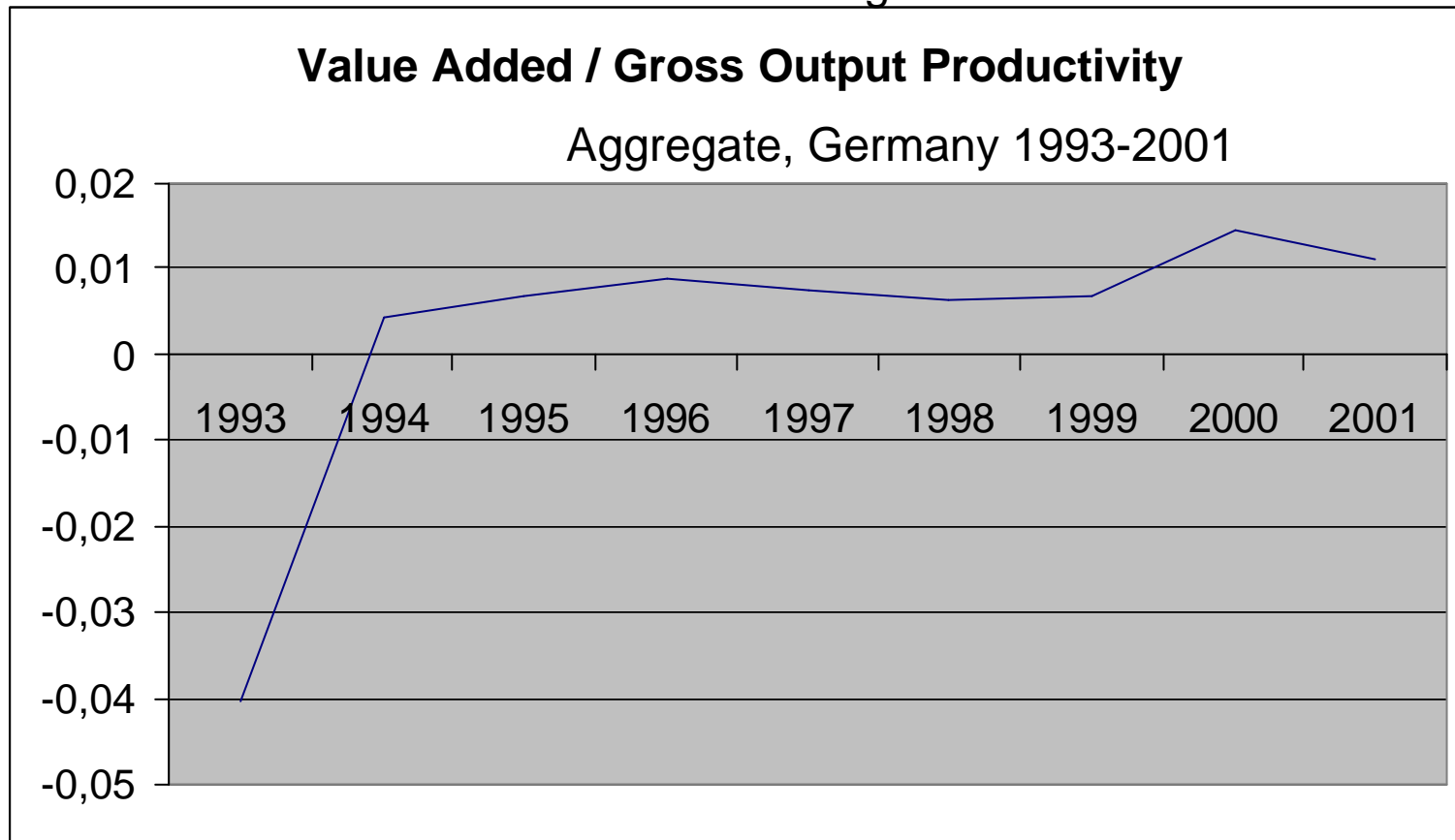
Gullickson and Harper (1999b, p. 18):

$$\hat{TFP}_{VA} = (1 + M / VA) \hat{TFP}_G$$

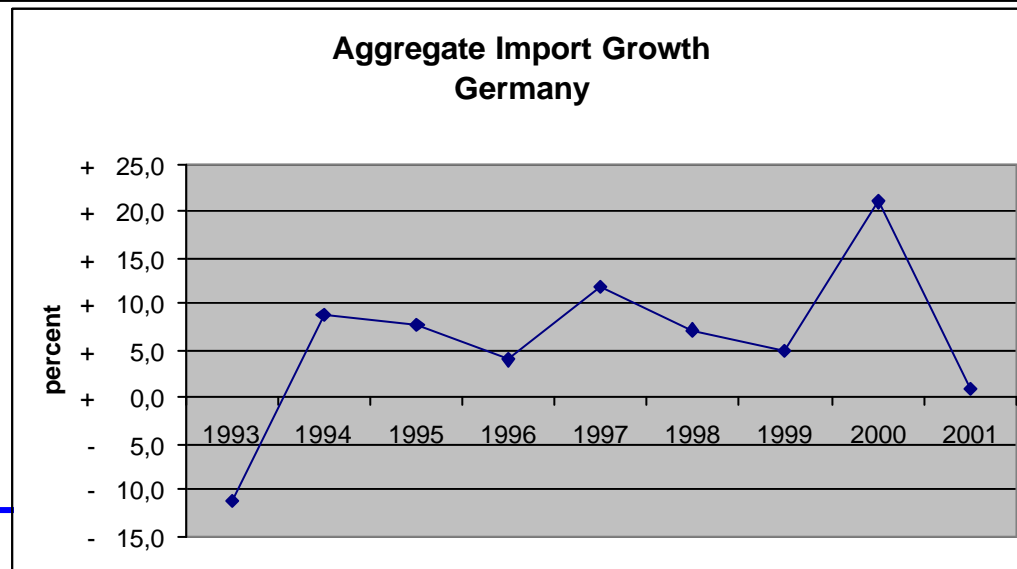
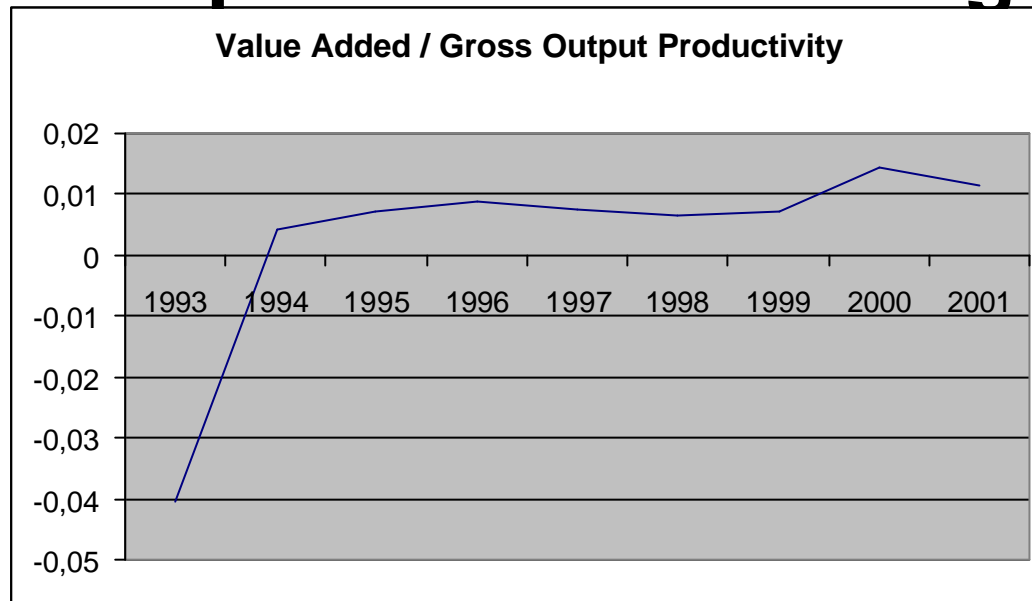
- Increasing share of outsourcing exaggerates TFP biases between the two productivity concepts
- On aggregate level, TFP bias can be seen as indicator for (international) outsourcing activity

Impact of Outsourcing

- No stable relationship between the two measures (intertemporal)
- Could the difference be outsourcing



Impact of Outsourcing



Conclusions

- New Ifo database allows German Sectoral Gross Output productivity measurement
- Growth leaders are also intermediate growth leaders
- Correlations between intermediates and TFP and output are high
- Input growth driven by imports?

Conclusions

- Major differences between gross output and value-added productivity concepts
 - Intersectorally
 - Intertemporally TFP_{VA}/TFP_Y is not constant over time
- Indications that for Germany value-added estimates
 - overstate TFP
 - Cannot account for changes of factor substitution, especially intermediates