Testing for Manufacturing's Special Role

By:

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Structure of presentation

- Role of Manufacturing
- Methodology
- Data sources
- Data analysis and results
- Conclusion

Role of Manufacturing

- Special features of manufacturing
  - Structural Change models
    - Dynamic, innovative
    - Source of Technological change
    - Externalities and return to scale
- Implications for industrial policy
  - Shift resources into manufacturing
    - Kaldor's law, Rodrik
- Recent view
  - Role of service sub-sectors

Methodology

- Our interest is to test for:
  1. Extent of association between sector output and growth in the economy
  2. Sectoral productivity catch-up and convergence
  3. Presence of externalities between a sector and the rest of the economy

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- To test for (1) we apply Kaldor's Law
  - Dasgupta and Singh (2006)
    - $gVA_{ti} = a + b_1 gVA_{mi} + b_2 gL_{nmi}$

- To test for (2) we apply the following:
  - Unconditional convergence:
    - $cg_j = \alpha + \beta \ln y_{0j}$
  - Conditional convergence:
    - $cg_j = \alpha + \beta \ln y_{0j} + \mu Z$

Cont…

- To test for (3) we apply Augmented Solow
  - $Y_{it} = A_{it} K_{jit}^{\alpha_j} L_{it}^{\left(1-\sum \alpha_j\right)}$
- Applying usual augmented Solow assumptions leads to the following GDP per capita growth relationship:
  - $g_{it} = \phi/(1 - \sum \alpha_j)[ln\, A_{it} + \alpha_j ln(s_{jit}/(n_{it} + \delta_{it} + \gamma_{it})] - \phi ln y_{i0}$ (1)
- Capturing the impact of sectoral output through total factor productivity:
  - $A_{it} = f(Q_{ijt}, Z_{it})$
- Assuming a log linear relationship between A and its determinants and substituting for A in (1):
  - $g_{it} = \theta_1 ln\, A_{i0} + \theta_2 ln(s_{1it}/(n_{it} + \delta_{it} + \gamma_{it})) + \theta_3 ln(s_{2it}/(n_{it} + \delta_{it} + \gamma_{it})) - \theta_4 ln y_{i0} + \theta_5 Q_{it} + \theta_m Z_{mit}$ (2)

Data sources

- Rodrik and MacMillan (2011)
  - Expanded Groningen Growth and Development Centre database
    - Covering value-added and employment
      - For 38 countries and 8 sectors
        - » A mixture of developed and developing
      - Time series data, 1990-2005
  - Complemented with data from
    - WDI
    - Penn World Table (2011)
    - Kaufman and Kraay (2011)

Data analysis and results

- Data conversion
- Descriptive analysis
  - Correlation coefficient matrix
- Regressions
  - For convergence
    - OLS
  - For externalities
    - Panel
      - Hausmann test suggests Fixed effect
      - Test also suggest variation in time

- **Correlation coefficient matrix-Interaction between sectoral growth and initial level of labour productivity (includes all countries)**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	cgagr	1.00																	
2	cgmin	0.12	1.00																
3	cgman	0.19	-0.10	1.00															
4	cgpu	-0.01	0.32	-0.15	1.00														
5	cgcon	0.01	0.10	0.47	0.02	1.00													
6	cgwrt	0.12	-0.24	0.40	-0.02	0.28	1.00												
7	cgtcs	0.11	0.08	0.34	0.07	0.39	0.62	1.00											
8	cgfin	0.01	-0.04	0.09	0.38	0.21	0.34	0.33	1.00										
9	cgsum	0.41	-0.02	0.63	0.08	0.34	0.56	0.42	0.30	1.00									
10	lagr90	***0.05***	-0.12	0.40	-0.14	-0.08	0.15	-0.01	-0.07	0.09	1.00								
11	lmin90	0.02	***-0.17***	0.16	-0.04	-0.08	0.29	0.28	0.03	-0.03	0.56	1.00							
12	lman90	0.08	-0.14	***0.16***	-0.10	-0.22	0.01	-0.12	0.02	-0.11	0.78	0.49	1.00						
13	lpu90	0.15	-0.06	0.27	***-0.31***	-0.20	0.00	-0.16	-0.26	0.09	0.75	0.23	0.66	1.00					
14	lcon90	0.07	-0.14	0.12	-0.01	***-0.29***	-0.05	-0.14	-0.13	-0.03	0.74	0.38	0.71	0.72	1.00				
15	lwrt90	0.01	-0.14	0.28	-0.16	-0.16	***0.06***	-0.06	0.00	0.06	0.80	0.28	0.82	0.67	0.61	1.00			
16	ltcs90	0.05	-0.16	0.17	-0.16	-0.26	-0.09	***-0.22***	-0.13	-0.03	0.81	0.27	0.82	0.82	0.80	0.88	1.00		
17	lfin90	0.01	-0.12	-0.13	0.02	-0.26	0.00	-0.02	***-0.11***	0.04	0.22	0.08	0.13	0.22	0.49	0.24	0.36	1.00	
18	lsum90	0.04	-0.14	0.36	-0.14	-0.12	0.10	-0.05	-0.05	***0.03***	0.95	0.53	0.89	0.76	0.76	0.87	0.86	0.20	1.00

- **Correlation coefficient matrix-Interaction between sectoral growth and initial level of labour productivity (excluding Africa)**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Cgagr	1.00																	
2	cgmin	0.27	1.00																
3	cgman	0.09	-0.03	1.00															
4	cgpu	0.02	0.16	0.30	1.00														
5	cgcon	0.21	0.00	0.49	0.27	1.00													
6	cgwrt	0.03	-0.20	0.55	0.18	0.54	1.00												
7	cgtcs	0.21	0.06	0.41	0.16	0.36	0.60	1.00											
8	cgfin	0.08	-0.11	0.25	0.06	0.28	0.38	0.37	1.00										
9	cgsum	0.29	0.06	0.73	0.32	0.64	0.69	0.62	0.48	1.00									
10	lagr90	***-0.09***	-0.22	0.04	-0.08	-0.10	0.15	-0.03	-0.03	-0.25	1.00								
11	lmin90	-0.14	***-0.21***	-0.22	-0.06	-0.19	0.06	-0.05	0.02	-0.34	0.61	1.00							
12	lman90	0.04	-0.26	***-0.23***	-0.22	-0.17	-0.06	-0.13	-0.09	-0.43	0.81	0.63	1.00						
13	lpu90	0.08	-0.11	-0.11	***-0.21***	-0.14	0.07	0.03	-0.17	-0.23	0.72	0.37	0.75	1.00					
14	lcon90	0.01	-0.20	-0.03	-0.16	***-0.10***	0.09	-0.02	-0.19	-0.28	0.82	0.47	0.78	0.80	1.00				
15	lwrt90	-0.10	-0.26	0.01	-0.15	-0.14	***0.05***	0.03	-0.08	-0.18	0.81	0.43	0.72	0.65	0.73	1.00			
16	ltcs90	-0.03	-0.29	-0.04	-0.18	-0.14	0.02	***-0.05***	-0.17	-0.26	0.84	0.45	0.81	0.78	0.79	0.90	1.00		
17	lfin90	0.00	-0.18	0.12	-0.05	-0.03	0.22	0.13	***-0.03***	0.10	0.49	0.18	0.27	0.35	0.48	0.56	0.46	1.00	
18	lsum90	-0.08	-0.27	-0.04	-0.12	-0.14	0.09	-0.05	-0.09	***-0.31***	0.94	0.62	0.88	0.79	0.87	0.87	0.91	0.50	1

- **Correlation coefficient matrix-Interaction between potential factors that affect growth (includes all countries)**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	gdp15yg1	1.00																						
2	rlks	0.40	1.00																					
3	rlpseg	0.18	0.43	1.00																				
4	lgdp1in5y	0.08	0.49	0.61	1.00																			
5	cgagr	0.38	0.08	0.14	0.11	1.00																		
6	cgmin	0.02	0.11	-0.01	-0.05	0.02	1.00																	
7	cgman	0.43	0.29	0.42	0.40	0.23	-0.06	1.00																
8	cgpu	-0.03	-0.06	-0.21	-0.13	-0.03	0.38	-0.19	1.00															
9	cgcon	0.13	-0.14	0.11	-0.13	0.01	0.15	0.47	0.02	1.00														
10	cgwrt	0.24	-0.03	0.15	0.09	0.14	-0.22	0.34	-0.03	0.26	1.00													
11	cgtcs	0.17	-0.24	-0.03	-0.05	0.07	0.08	0.34	0.06	0.42	0.63	1.00												
12	cgfin	0.16	0.00	0.09	-0.04	-0.02	-0.07	0.09	0.39	0.23	0.37	0.33	1.00											
13	cx1	0.06	0.31	0.42	0.82	0.15	-0.06	0.29	-0.08	-0.05	0.14	0.00	0.00	1.00										
14	cx2	0.04	-0.26	0.10	0.21	0.13	-0.10	0.10	-0.05	0.06	0.33	0.31	0.03	0.32	1.00									
15	cx3	0.05	0.36	0.50	0.87	0.18	-0.09	0.30	-0.13	-0.13	0.09	-0.02	-0.01	0.86	0.22	1.00								
16	pcx48	0.11	0.46	0.37	0.85	0.07	-0.12	0.26	-0.08	-0.19	0.09	-0.06	-0.06	0.85	0.14	0.83	1.00							
17	polsta	0.09	0.44	0.37	0.67	0.04	0.03	0.27	0.00	0.01	0.03	-0.05	0.04	0.66	0.13	0.59	0.59	1.00						
18	voice	0.07	0.42	0.50	0.80	0.14	-0.04	0.29	-0.11	-0.11	0.04	-0.11	-0.07	0.80	0.12	0.78	0.71	0.81	1.00					
19	govern	0.16	0.49	0.49	0.86	0.10	0.01	0.35	-0.10	-0.12	0.11	-0.08	-0.05	0.86	0.23	0.81	0.83	0.78	0.88	1.00				
20	regul	0.13	0.47	0.53	0.86	0.08	0.04	0.37	-0.07	-0.07	0.11	-0.09	-0.01	0.80	0.20	0.75	0.80	0.76	0.83	0.94	1.00			
21	law	0.16	0.51	0.41	0.77	0.11	-0.01	0.34	-0.05	-0.07	0.12	-0.03	-0.01	0.80	0.14	0.73	0.76	0.87	0.91	0.94	0.88	1.00		
22	corrupt	0.15	0.44	0.44	0.80	0.08	0.01	0.34	-0.08	-0.08	0.10	-0.06	-0.02	0.83	0.23	0.74	0.77	0.82	0.87	0.96	0.93	0.94	1.00	
23	institution	0.14	0.49	0.48	0.84	0.09	0.01	0.34	-0.07	-0.08	0.09	-0.07	-0.02	0.84	0.19	0.77	0.79	0.89	0.93	0.97	0.94	0.98	0.98	1.00

- Testing for Kaldor's Law

Independent variables:	*Cgagr* [1]	*cgmin*	*cgman*	*cgpu*	*cgcon*	*cgwrt*	*cgtsc*	*cgfin*
First law: Dependent variable is Growth of GDP per labour								
Estimation technique: OLS								
1. Sectoral value added growth	0.01***[2]	0.00	0.01***	-0.00	0.00	0.01***	0.00*	0.00
Estimation technique: Fixed panel								
2. Sectoral value added growth	0.01***	-0.00	0.01**	-0.00	0.00	0.01**	0.00	0.01*
Second law: Dependent variable is Growth of total labour productivity								
Estimation technique: OLS								
3. Sectoral value added growth	0.27***[2]	-0.01	0.32***	0.02	0.13***	0.30***	0.22***	0.13**
4. Sectoral employment growth	-0.23**	0.04	-0.08	0.00	-0.03	-0.07	0.01	0.06
5. Sectoral value added growth	0.25***	-0.02	0.31***	0.02	0.15***	0.31***	0.22***	0.14***
Growth of agriculture sector employment	-0.05	-0.25**	-0.15*	-0.23**	-0.28***	-0.26***	-0.23***	-0.25***
6. Sectoral value added growth	0.21***	-0.03	0.31***	0.01	0.11***	0.28***	0.18***	0.12**
Growth of non-manufacturing employment	-0.48**	-0.73***	-0.57***	-0.67***	-0.61***	-0.54***	-0.49**	-0.64***

Cont…

	Estimation technique: Fixed panel							
7. sectoral value added growth	0.32***	-0.04	0.25***	0.01	0.13***	0.27***	0.18**	0.18***
8. Sectoral employment growth	-0.19*	0.05*	0.00	-0.02	0.00	-0.04	0.09	-0.01
9. sectoral value added growth	0.40***	-0.05*	0.25***	0.01	0.14***	0.28***	0.17**	0.18***
Growth of agriculture sector employment	0.16	-0.24**	-0.20*	-0.19*	-0.21*	-0.21**	-0.17*	-0.18*
10. sectoral value added growth	0.28***	-0.06**	0.25***	0.00	0.11***	0.25***	0.11	0.16***
Growth of non-manufacturing sector employment	-0.47**	-0.75***	-0.66***	-0.65***	-0.53**	-0.54***	-0.50**	-0.55***

- Testing for convergence

Independent variables:	Dependent variable: Cumulative sectoral growth								
	cgagr	cgmin	cgman	cgpu	cgcon	cgwrt	cgtcs	cgfin	cgsum
All countries included									
Initial level of sectoral labour productivity	0.14	-1.23	0.92	-2.43***	-2.20**	0.28	-1.21*	-0.75	0.07
All countries, adding institutional proxy									
Initial level of sectoral labour productivity	-0.06	-1.11	-0.89	-3.64***	-3.24***	-0.69	-2.30**	-0.76	-0.35
Institute	0.14	-0.22	0.93***	1.09*	0.61	0.5	0.56*	0.02	0.26
All countries excluding those in Africa									
Initial level of sectoral labour productivity	-0.27	-1.69*	-1.18*	-1.46*	-0.62	0.24	-0.23	-0.20	-0.81**
All countries excluding those in Africa, adding institutional proxy									
Initial level of sectoral labour productivity	-1.00	-1.2	-3.06***	-2.16*	-0.86	-1.17	-1.04	-0.19	-1.90***
Institution	0.44	-0.58	0.84***	0.41	0.11	0.62**	0.36	0.00	0.54***

legend: * p<0.05; ** p<0.01; *** p<0.001

- **Role of sectoral growth or output in overall GDP per capita growth**

Dependent variable is the GDP per capita growth

Testing role of sectoral growth

Independent variables	**Agr.**	**Min**	**Man.**	**PU**	**Con.**	**WRT**	**TCS**	**Fin.**
Rlks	0.199***	0.216***	0.229***	0.214***	0.230***	0.218***	0.212***	0.219***
Rlpseg	0.083*	0.082*	0.096*	0.082*	0.080*	0.081*	0.088*	0.086*
lgdp1in5y	-0.600***	-0.629***	-0.632***	-0.628***	-0.624***	-0.644***	-0.644***	-0.637***
Sectoral growth	0.005*	0.000	-0.003	0.000	-0.001	-0.002	-0.002	-0.001
Year								
2000	0.069***	0.071***	0.071***	0.070***	0.069***	0.072***	0.074***	0.070***
2005	0.131***	0.135***	0.136***	0.136***	0.136***	0.141***	0.141***	0.139***
Constant	4.705***	4.946***	4.917***	4.942***	4.893***	5.076***	5.068***	5.000**
R-squared	0.82	0.80	0.81	0.80	0.81	0.81	0.81	0.83
No of observations	98	98	98	98	98	98	98	98
No of countries	36	36	36	36	36	36	36	36

- **Role of sectoral growth or output in overall GDP per capita growth**

Dependent variable is the GDP per capita growth

Testing the role of cumulative sector output per worker

Independent variables	Agr.	Min	Man.	PU	Con.	WRT	TCS	Fin.
Rlks	0.22***	0.21***	0.21***	0.21***	0.21***	0.20***	0.20***	0.23***
Rlpseg	0.08*	0.09*	0.08	0.09*	0.12**	0.09*	0.03	0.13*
lgdp1in5y	-0.64***	-0.64***	-0.72***	-0.67***	-0.64***	-0.67***	-0.71***	-0.62***
Sectoral output	1.29	-0.01	1.62*	0.14	1.46**	2.64	2.23***	0.02
Square of sectoral output	-3.61	0.00	-2.38*	-0.04	-2.45**	-7.55	-3.23***	0.13
Year								
2000	0.07***	0.07***	0.07***	0.07***	0.07***	0.07***	0.06***	0.07***
2005	0.13***	0.13***	0.13***	0.12***	0.14***	0.15***	0.12***	0.14***
Constant	4.99***	5.01***	5.53***	5.20***	4.80***	5.10***	5.56***	4.73***
R-squared	0.81	0.81	0.82	0.81	0.84	0.82	0.84	0.82
No of observations	98	98	98	98	98	98	98	98
No of countries	36	36	36	36	36	36	36	36

Conclusion

- Growth enhancing role of manufacture is not unique
  - Some service that sub-sectors also play a role
- Evidence of convergence for manufacture and some service sub-sectors
  - Stronger evidence when Africa is excluded
- Difficult to argue that Manufacture has special role

Cont…

- Limitations
  - Data
  - Modelling
    - Return to scale
    - Externalities
    - Service sector’s role
  - Estimation
    - Endogeneity