

The Industry Sources of Australia's Productivity Slowdown

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Overview

- Background
 - Current debate on sources of productivity slowdown in Australia
 - Aim of this study
- Methodology
 - Labour v MFP
 - Link between aggregate & industry MFP statistics
- Empirical results
 - Decomposition of aggregate LP
 - Capital deepening, labour quality and MFP
 - Decomposition of aggregate MFP
- Concluding remarks

Productivity Debates

- Key issues
 - Is there a productivity slowdown and how severe
 - Which industries to blame
 - What are the underlying forces dragging down productivity
 - Is slowdown cyclical or due to structural change
- What is inadequate or missing
 - Consensus on standard frameworks and methods
 - Statistical evidence
- Contribution of this study
 - Well accepted frameworks and methods
 - Quantitative assessments of key drivers underlying productivity performance

Decomposition of ALP (Stiroh 2002)

- Aggregate output growth

$$\Delta \ln V = \sum_i w_i \Delta \ln V_i$$

- Industry gross output

$$\Delta \ln Y_i = (1 - v_{x,i}) \Delta \ln V_i + v_{x,i} \Delta \ln X_i$$

- Decomposition of ALP

$$\Delta \ln ALP = \sum_i w_i \Delta \ln LP_i^Y - \left[\sum_i m_i (\Delta \ln M_i - \Delta \ln Y_i) \right] + \sum_i (w_i - h_i) \Delta \ln H_i$$

Industry Contributions to Aggregate Productivity Growth (Timmer et al. 2010)

- Industry labour productivity

$$\Delta \ln LP_i^v = s_{ik} \Delta \ln k_i + s_{il} \Delta \ln LQ_i + MFP_i^v$$

- Contribution of capital deepening

$$LPcon_i^k = w_i s_{ik} \Delta \ln k_i$$

- Contribution of labour quality

$$LPcon_i^{LQ} = w_i s_{il} \Delta \ln LQ_i$$

- Contribution of MFP

$$LPcon_i^{MFP} = w_i MFP_i^v$$

Link between Two MFP Estimates

$$\Delta \ln MFP^{DAAI} = \sum_j \bar{w}_j \Delta \ln V_j - \sum_j \bar{w}_j \frac{\bar{v}_{K,j}}{\bar{v}_{V,j}} \Delta \ln K_j - \sum_j \bar{w}_j \frac{\bar{v}_{L,j}}{\bar{v}_{V,j}} \Delta \ln L_j$$

$$\Delta \ln MFP^{APF} = \Delta \ln V^{APF} - \bar{v}_K \Delta \ln K - \bar{v}_L \Delta \ln L$$

$$MFP^{APF} = MFP^{DAAI} + REALL_V + REALL_K + REALL_L$$

Data

- ABS Industry MFP datacube
- Confined to 12 industries
- Cover the period 1995-96 to 2009-10
 - Two sub-periods: 1995-96 to 2003-2004 and 2003-04 to 2009-10
- Separate measures of IT capital assets
- Measures of quality adjusted labour input at industry level

Growth Accounting Results for Aggregate Labour Productivity

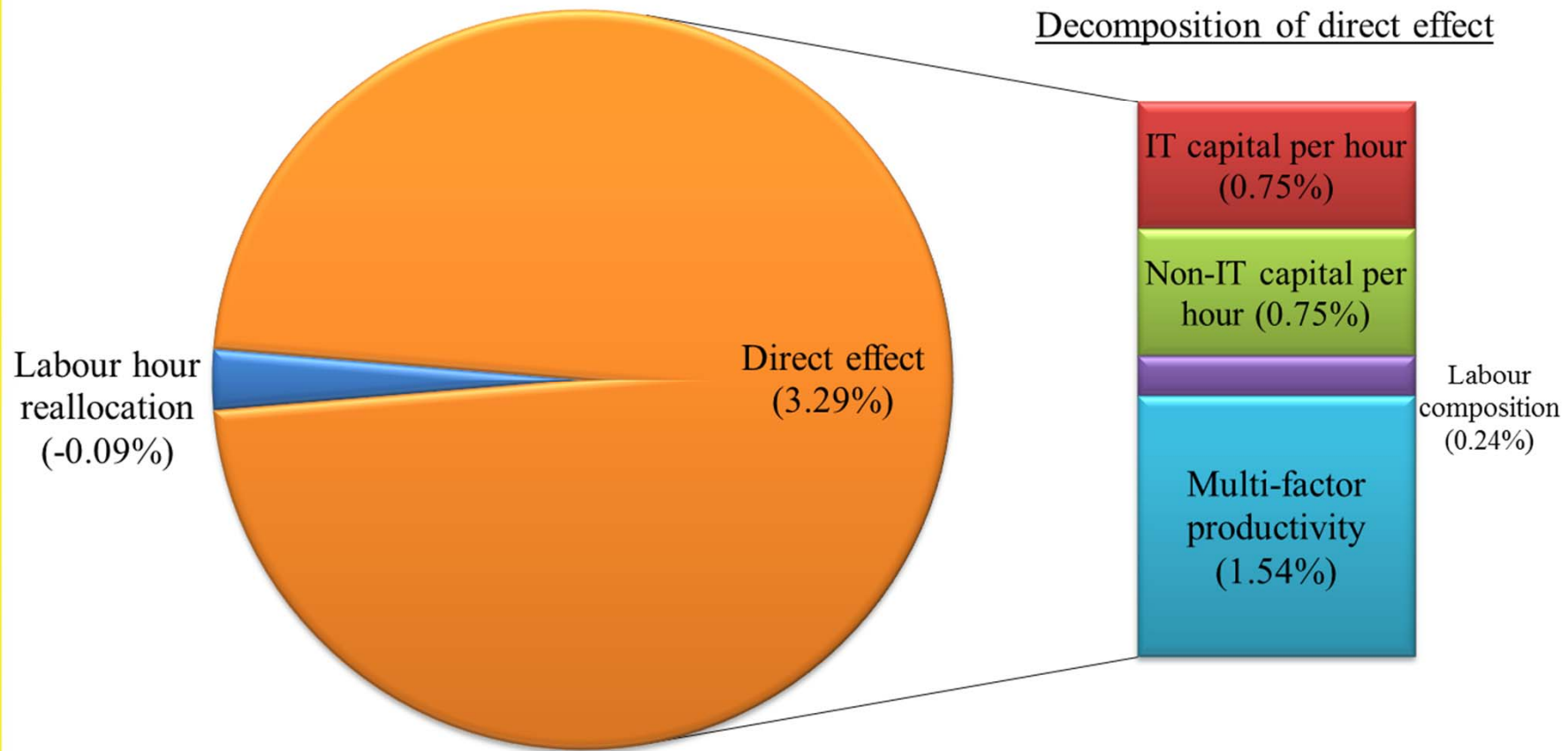
	1995-96 to 2003-04	2003-04 to 2009-10	1995-96 to 2009-10	2003-04 to 2009-10 less 1995-96 to 2003-04
Aggregate labour productivity growth	3.20	1.84	2.53	-1.36
Decomposition using gross output productivity				
Weighted $\Delta \ln(LP_i^Y)$	2.92	1.08	2.00	-1.85
Material reallocation	-0.36	0.00	-0.25	0.36
Hours reallocation	-0.09	0.76	0.29	0.85
Decomposition using value added productivity				
Weighted $\Delta \ln(LP_i^V)$	3.29	1.08	2.24	-2.21
Hours reallocation	-0.09	0.76	0.29	0.85
Contribution of industry weighted				
IT capital per hour	0.75	0.55	0.65	-0.20
Non-IT capital per hour	0.75	0.67	0.71	-0.08
Labour composition	0.24	0.20	0.23	-0.05
Multi-factor productivity	1.54	-0.34	0.66	-1.88

Notes: All figures are average annual percentages. The weights used to calculate the direct industry contributions are industry shares in aggregate nominal value added. IT capital includes computer software and computers.

Growth Accounting Results for Aggregate Labour Productivity

Decomposition using value added productivity, from 1995-96 to 2003-04

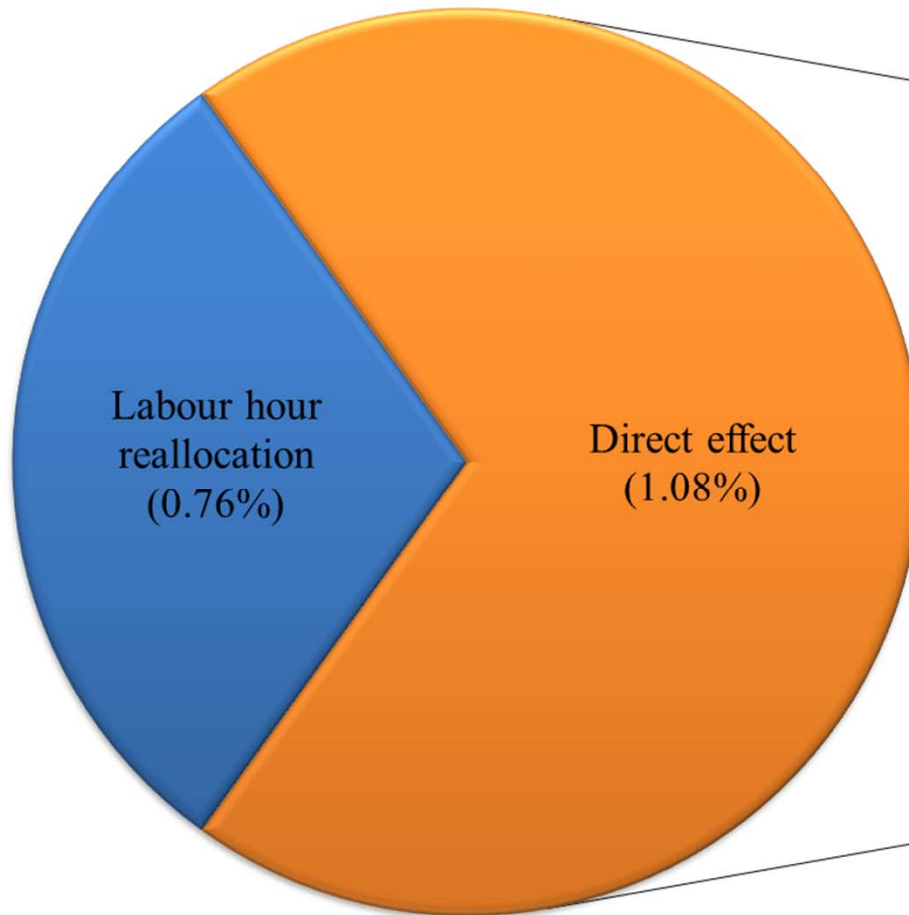
Decomposition of aggregate labour productivity growth (3.20%)



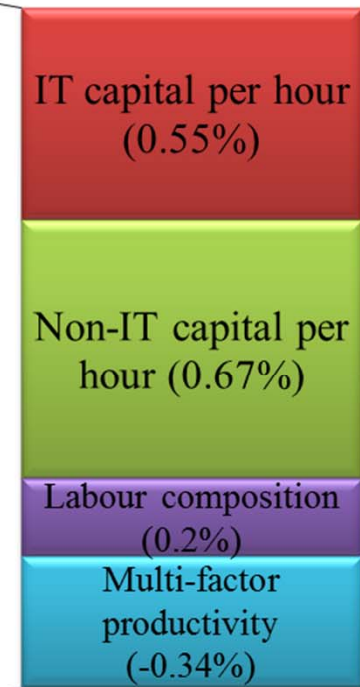
Growth Accounting Results for Aggregate Labour Productivity

Decomposition using value added productivity, from 2003-04 to 2009-10

Decomposition of aggregate
labour productivity growth (1.84%)



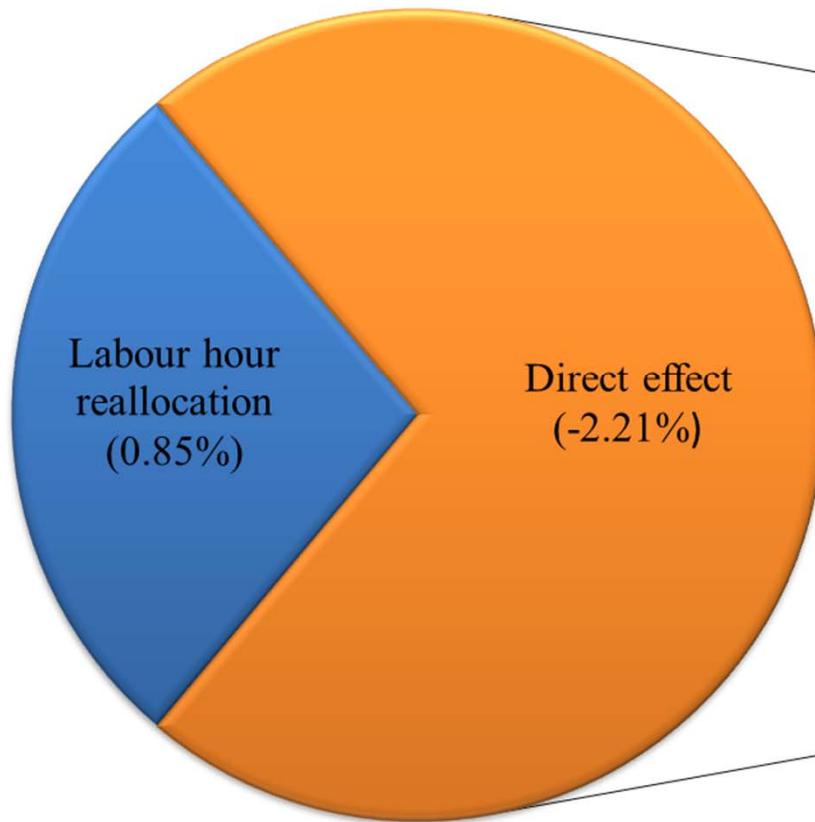
Decomposition of direct effect



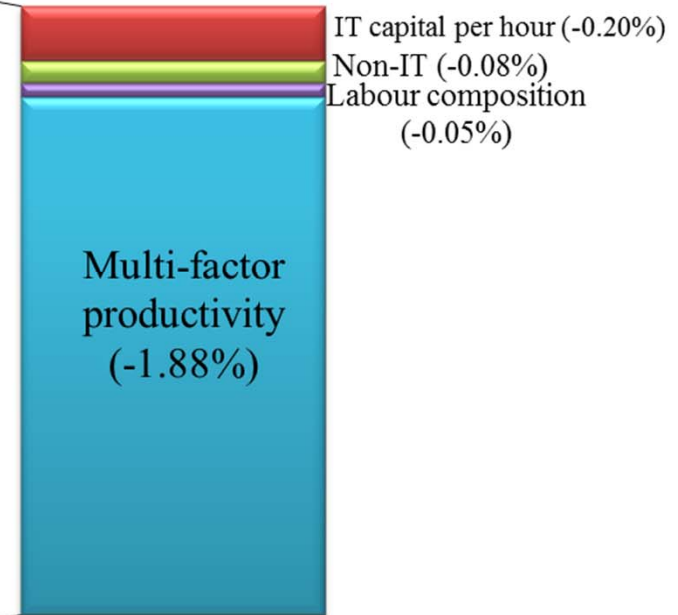
Sources of Slowdown in Labour Productivity Growth

Differences in contributions (2003-04 to 2009-10 less 1995-96 to 2003-04)

Decomposition of decline in aggregate labour productivity growth (-1.36%)



Decomposition of decline in direct effect



Industry Decomposition of Aggregate Labour Productivity Growth 1995-96 to 2003-04

Industry	Direct effect (GO labour productivity) $w_i \Delta \ln ALP_i^Y$	Material reallocation $m_i (\Delta \ln M_i - \Delta \ln Y_i)$	Direct effect (VA labour productivity) $w_i \Delta \ln ALP_i^V$	Labour hour reallocation $c_i \Delta \ln H_i$	Aggregate labour productivity growth
A Agriculture, Forestry and Fishing	0.28	-0.09	0.38	0.04	0.41
B Mining	0.09	-0.05	0.13	0.05	0.18
C Manufacturing	0.74	0.08	0.65	0.00	0.66
D Electricity, Gas, Water and Waste Services	0.06	-0.01	0.07	-0.01	0.07
E Construction	0.11	-0.09	0.20	-0.08	0.12
F Wholesale Trade	0.39	0.08	0.32	0.00	0.32
G Retail Trade	0.05	-0.18	0.23	-0.12	0.10
H Accommodation and Food Services	0.13	0.04	0.09	-0.08	0.01
I Transport, Postal and Warehousing	0.13	-0.10	0.22	0.00	0.22
J Information, Media and Telecommunication	0.30	0.04	0.27	0.03	0.29
K Financial and Insurance Services	0.61	-0.08	0.69	0.10	0.79
R Arts and Recreation Services	0.03	0.00	0.03	-0.01	0.02
12 industries	2.92	-0.36	3.29	-0.09	3.20

Notes: All figures are average annual percentages. GO stands for gross output; VA stands for value added. c_i is the difference between an industry's share in aggregate value added and its share in aggregate labour hours. m_i is the two-period moving average ratio of nominal industry intermediate inputs to nominal aggregate value added. Contributions to labour productivity may not sum to totals due to rounding errors.

Industry Decomposition of Aggregate Labour Productivity Growth 2003-04 to 2009-10

Industry	Direct effect (GO labour productivity) $w_i \Delta \ln ALP_i^Y$	Material reallocation $m_i (\Delta \ln M_i - \Delta \ln Y_i)$	Direct effect (VA labour productivity) $w_i \Delta \ln ALP_i^V$	Labour hour reallocation $c_i \Delta \ln H_i$	Aggregate labour productivity growth
A Agriculture, Forestry and Fishing	0.17	-0.10	0.27	0.00	0.26
B Mining	-0.59	0.03	-0.62	0.78	0.15
C Manufacturing	0.55	0.28	0.27	0.02	0.29
D Electricity, Gas, Water and Waste Services	-0.19	-0.01	-0.19	0.13	-0.06
E Construction	0.12	0.07	0.04	-0.18	-0.14
F Wholesale Trade	0.17	0.04	0.13	0.01	0.14
G Retail Trade	0.11	-0.12	0.23	-0.05	0.18
H Accommodation and Food Services	0.00	0.00	0.00	-0.06	-0.07
I Transport, Postal and Warehousing	0.08	0.01	0.06	-0.01	0.05
J Information, Media and Telecommunication	0.23	-0.03	0.27	-0.02	0.25
K Financial and Insurance Services	0.43	-0.17	0.61	0.19	0.79
R Arts and Recreation Services	0.02	0.00	0.02	-0.03	-0.01
12 industries	1.08	0.00	1.08	0.76	1.84

Notes: All figures are average annual percentages. GO stands for gross output; VA stands for value added. c_i is the difference between an industry's share in aggregate value added and its share in aggregate labour hours. m_i is the two-period moving average ratio of nominal industry intermediate inputs to nominal aggregate value added. Contributions to labour productivity may not sum to totals due to rounding errors.

Contribution of IT Capital Deepening

	1995-96 to 2003-04	2003-04 to 2009-10	1995-96 to 2009-10	2003-04 to 2009-10 less 1995-96 to 2003-04
12 industries	0.749	0.550	0.649	-0.198
Contribution of:				
A Agriculture, Forestry and Fishing	0.006	0.003	0.005	-0.003
B Mining	0.020	0.011	0.016	-0.010
C Manufacturing	0.134	0.090	0.111	-0.044
D Electricity, Gas, Water and Waste Services	0.043	0.020	0.032	-0.024
E Construction	0.034	0.032	0.033	-0.002
F Wholesale Trade	0.064	0.066	0.063	0.002
G Retail Trade	0.053	0.055	0.052	0.003
H Accommodation and Food Services	0.009	0.010	0.009	0.001
I Transport, Postal and Warehousing	0.025	0.030	0.027	0.005
J Information, Media and Telecommunication	0.097	0.044	0.073	-0.053
K Financial and Insurance Services	0.251	0.181	0.218	-0.070
R Arts and Recreation Services	0.012	0.009	0.011	-0.004

Notes: All figures are average annual percentages. The contributions are share-weighted growth rates.

Contribution of Non-IT Capital Deepening

	1995-96 to 2003-04	2003-04 to 2009-10	1995-96 to 2009-10	2003-04 to 2009-10 less 1995-96 to 2003-04
12 industries	0.751	0.673	0.713	-0.079
Contribution of:				
A Agriculture, Forestry and Fishing	0.062	0.053	0.055	-0.009
B Mining	0.136	-0.067	0.069	-0.203
C Manufacturing	0.249	0.343	0.269	0.093
D Electricity, Gas, Water and Waste Services	0.050	-0.029	0.016	-0.079
E Construction	-0.035	0.005	-0.007	0.040
F Wholesale Trade	0.064	0.084	0.068	0.019
G Retail Trade	0.022	0.057	0.036	0.035
H Accommodation and Food Services	0.016	0.018	0.017	0.002
I Transport, Postal and Warehousing	0.031	0.079	0.054	0.048
J Information, Media and Telecommunication	0.133	0.191	0.150	0.058
K Financial and Insurance Services	0.005	-0.062	-0.025	-0.067
R Arts and Recreation Services	0.017	0.002	0.009	-0.015

Notes: All figures are average annual percentages. The contributions are share-weighted growth rates.

Contribution of Labour Quality Growth

	1995-96 to 2003-04	2003-04 to 2009-10	1995-96 to 2009-10	2003-04 to 2009-10 less 1995-96 to 2003-04
12 industries	0.244	0.196	0.225	-0.049
Contribution of:				
A Agriculture, Forestry and Fishing	0.009	0.004	0.007	-0.004
B Mining	0.008	0.000	0.005	-0.008
C Manufacturing	0.066	0.042	0.056	-0.024
D Electricity, Gas, Water and Waste Services	0.010	0.003	0.007	-0.007
E Construction	0.012	-0.001	0.007	-0.013
F Wholesale Trade	0.024	0.034	0.028	0.010
G Retail Trade	0.016	0.017	0.016	0.001
H Accommodation and Food Services	0.005	0.006	0.005	0.001
I Transport, Postal and Warehousing	0.019	0.011	0.016	-0.008
J Information, Media and Telecommunication	0.012	0.010	0.011	-0.002
K Financial and Insurance Services	0.061	0.068	0.064	0.007
R Arts and Recreation Services	0.004	0.002	0.003	-0.002

Notes: All figures are average annual percentages. The contributions are share-weighted growth rates.

Industry Decomposition of Domar-Weighted MFP

	1995-96 to 2003-04	2003-04 to 2009-10	1995-96 to 2009-10	2003-04 to 2009-10 less 1995-96 to 2003-04
Domar-Weighted MFP	1.540	-0.342	0.657	-1.882
Contributions				
A Agriculture, Forestry and Fishing	0.298	0.205	0.195	-0.093
B Mining	-0.032	-0.565	-0.242	-0.533
C Manufacturing	0.206	-0.207	0.015	-0.413
D Electricity, Gas, Water and Waste Services	-0.030	-0.178	-0.089	-0.148
E Construction	0.191	0.006	0.126	-0.185
F Wholesale Trade	0.167	-0.054	0.074	-0.221
G Retail Trade	0.137	0.102	0.109	-0.036
H Accommodation and Food Services	0.061	-0.038	0.019	-0.099
I Transport, Postal and Warehousing	0.148	-0.057	0.076	-0.205
J Information, Media and Telecommunication	0.024	0.024	0.014	0.000
K Financial and Insurance Services	0.372	0.418	0.364	0.046
R Arts and Recreation Services	-0.002	0.003	-0.005	0.005

Notes: All figures are average annual percentages.

Decomposition of APF based MFP Estimates

	1995-96 to 2003-04	2003-04 to 2009-10	1995-96 to 2009-10	2003-04 to 2009-10 less 1995-96 to 2003-04
	Growth rates			
APF MFP	1.76	-0.14	0.86	-1.90
	Components			
Domar-weighted MFP	1.54	-0.34	0.66	-1.88
Output reallocation	-0.03	-0.01	-0.02	-0.02
Capital reallocation	0.21	0.08	0.16	-0.13
Labour reallocation	0.04	0.13	0.07	0.09

Notes: APF = aggregate production function. All figures are average annual percentages.

Concluding Remarks

- Direct aggregation across industry approach is preferred for productivity analysis of the Australian economy
- The impact on aggregate productivity of the mining boom and structural change is significant. The shift to high-productivity-level mining industry accounted for more than 40% of ALP growth
- Slowdown since 2003-04 is widespread. Declining MFP is the key factor dragging down ALP
- There are enormous variation in productivity performance across industries in the Australian economy