
A Addendum and additional information

A.1 Update of table 6.2 basic model results

The basic R&D model results presented in table 6.2, page 106, were based on the following equation:

$$K^F = \ln\left(\frac{m}{y} \cdot \sum_{i=1}^n \frac{s_i}{\sum s_i} K_i\right)$$

where K^F is the foreign knowledge stock or potential spillover pool to Australia and is based on either foreign BERD or GERD, $\frac{m}{y}$ is the ratio of intermediate and capital good imports to Australia over GDP, i represents a country, n is the number of countries included in the construction of the foreign knowledge stocks which is fourteen, $\frac{s_i}{\sum s_i}$ is each country's share of Australian imports of capital and intermediate inputs, and K_i is the knowledge stock of country i constructed using the perpetual inventory method.

Coe and Helpman's preferred specification was:

$$K^F = \frac{m}{y} \cdot \ln\left(\sum_{i=1}^n \frac{s_i}{\sum s_i} K_i\right)$$

The log of the import share weighted stocks are scaled by Australia's import intensity. Updated results based on this formulation are presented in table A.1 below.

Evaluated at the mean import intensity from 1968-69 to 2002-03, the foreign elasticity is 0.067 in model CH3, which is a much smaller foreign effect than is commonly found for most countries. If the foreign effect was to be evaluated at the mean import intensity for later sub-samples of the data, then the elasticity would be larger as import intensities have increased over time.

Under either formulation of the foreign knowledge stock, the estimates from the regressions are unreliable. The residuals display a high degree of serial correlation and each model fails the functional form and heteroskedasticity tests.

Table A.1 **Basic MFP and business R&D (BRD) model in levels**

Stocks depreciated at 5 per cent. Foreign business R&D stock is log of sum of bilateral import share weighted stocks multiplied by Australian import intensity.^a

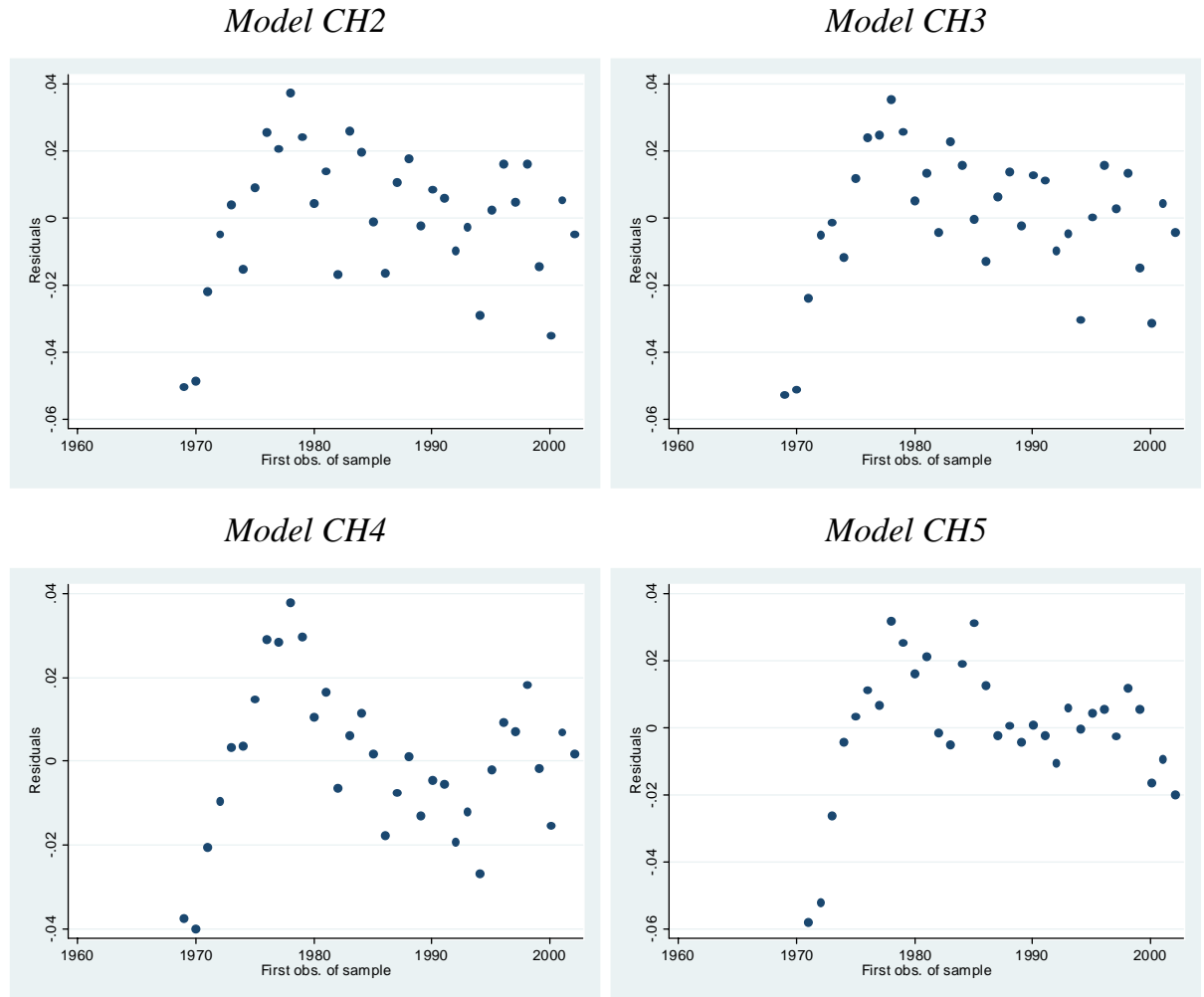
	<i>Coe and Helpman's original results for OECD</i> ^b	<i>Update of Coe and Helpman</i>	<i>Test: add cyclical variable</i>	<i>Test: add time trend</i>	<i>Test: alternative lag structure</i>
<i>Lag structure</i>	<i>Aus.=(t-1) For.=(t-1)</i>	<i>Aus.=(t-1) For.=(t)</i>	<i>Aus.=(t-1) For.=(t)</i>	<i>Aus.=(t-1) For.=(t)</i>	<i>Aus.=(t-2) For.=(t-3)</i>
<i>Dep. Var. = ln(MFP)</i>	<i>CH1</i>	<i>CH2</i>	<i>CH3</i>	<i>CH4</i>	<i>CH5</i>
Domestic BRD stock	0.078*** (9.5)				
Aus. BRD stock		0.055*** (2.8)	0.056*** (3.1)	0.024 (1.1)	0.132*** (8.3)
Foreign BRD stock	0.294*** (7.0)	0.377*** (7.6)	0.371*** (7.5)	0.195*** (2.9)	0.185*** (4.3)
Cycle (growth of real GDP)			0.133 (1.2)	0.196** (2.3)	0.280*** (3.1)
Time trend				0.005*** (3.0)	
Constant		3.976*** (87.1)	3.969*** (96.5)	4.095*** (79.3)	3.835*** (91.6)
Foreign elasticity at mean m/y = 0.18		0.068	0.067	0.035	0.033
Test statistics					
# of observations	440	34	34	34	32
Time period	1971-90	69/70-02/03	69/70-02/03	69/70-02/03	71/72-02/03
R ²	0.630	0.954	0.956	0.965	0.951
Durbin-Watson (d)		0.960	0.733	0.517	0.447
White test $\chi^2(p)$ for heteroskedasticity		18.7 (0.002)	20.3 (0.016)	24.1 (0.044)	20.2 (0.017)
RESET F(3,Z)		9.5 (0.000)	15.5 (0.000)	27.6 (0.000)	19.0 (0.000)

^a *** statistical significance at 1 per cent or greater. ** significance at 5 per cent or greater. * significance at 10 per cent or greater. Heteroskedasticity-consistent t-statistic in brackets. ^b Equation (iii), table 3, pp. 869, Coe, D. and E. Helpman 1995, 'International R&D spillovers', *European Economic Review*, 39, pp. 859-887.

Source: Commission estimates.

The high degree of serial correlation is evident in the residual plots (figure A.1).

Figure A.1 **Plot of residuals from basic models, 1969-70 to 2002-03**
Actual MFP less predicted MFP



Financial years beginning 1 July of year specified.

Data source: Commission estimates.

Re-estimating the above models with a more rapid assumed decay rate of knowledge does not significantly improve the models. The results are similarly rejected as tests and residual plots point to substantial mis-specification.

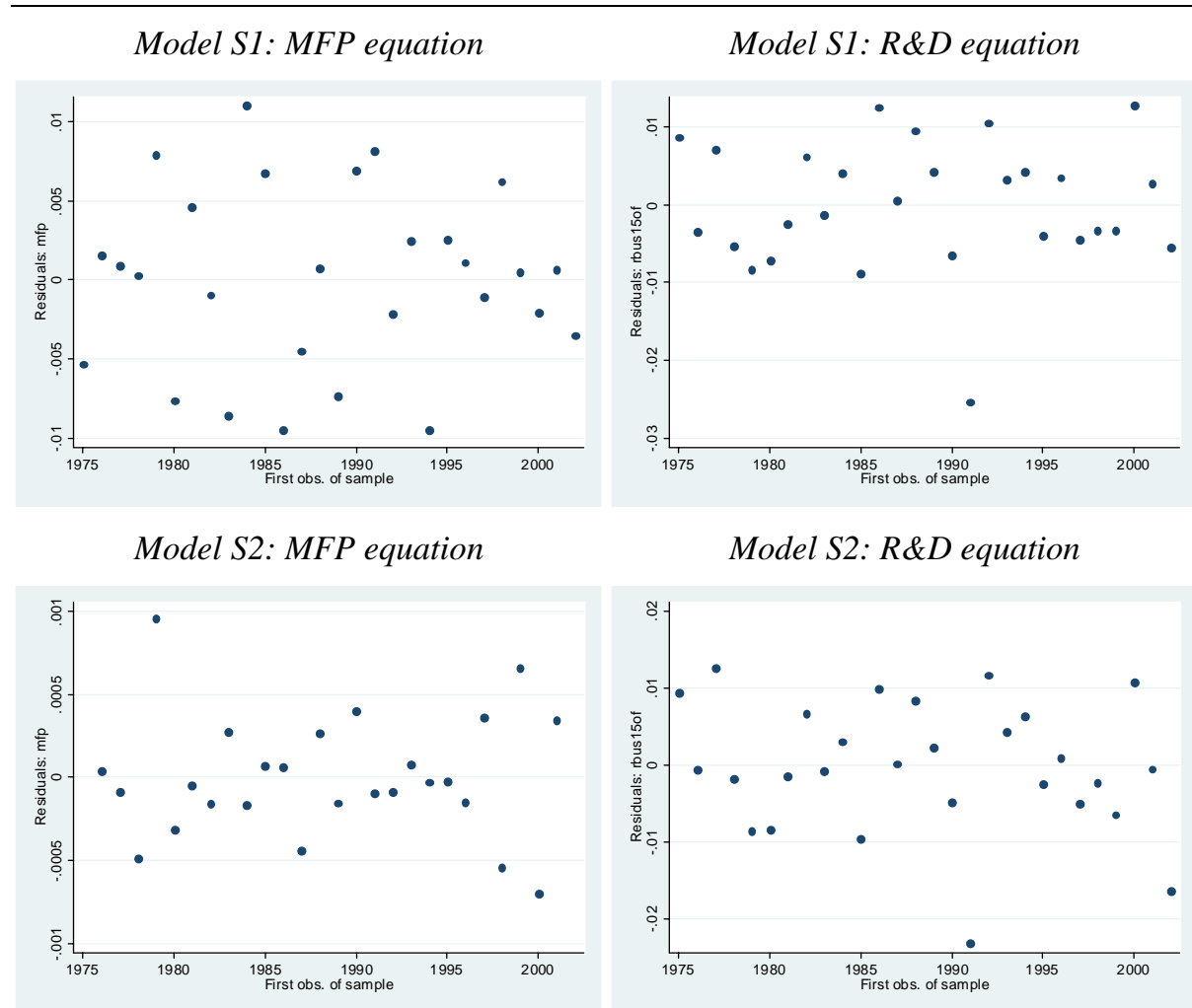
A.2 Residual plots and test statistics for chapter 10 2-equation models

The information below supplements information provided in chapter 10 and appendix E on the 2-equation models of chapter 10.

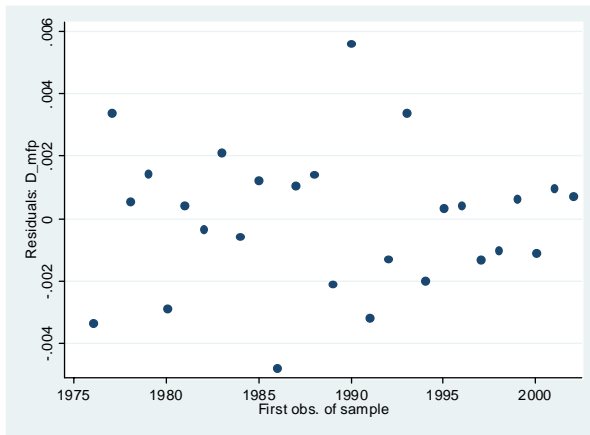
2-equation 'Extended' Models

The residual plots for the 'extended' two-equation or system models in chapter 10 do not point to model mis-specification (figure A.2).

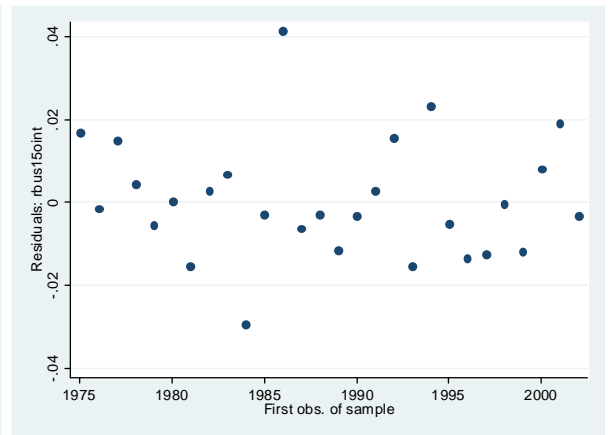
Figure A.2 **Scatterplot of residuals for table 10.2 models, page 191-92**
Actual MFP less predicted MFP.



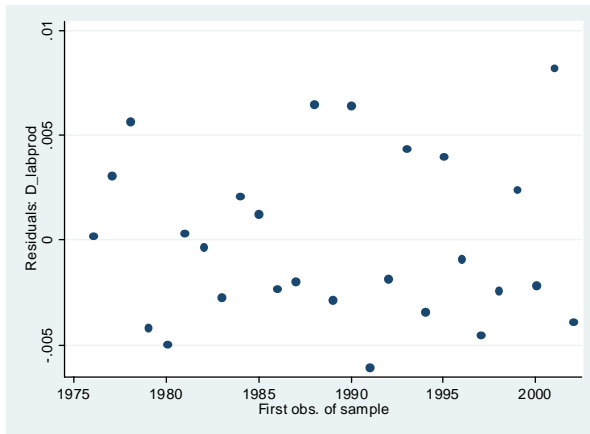
Model S3: MFP equation



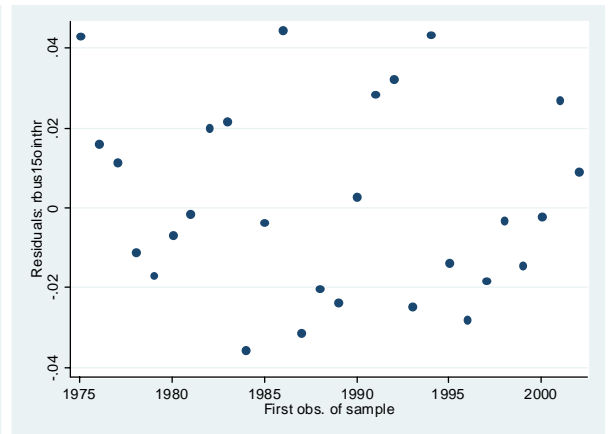
Model S3: R&D equation



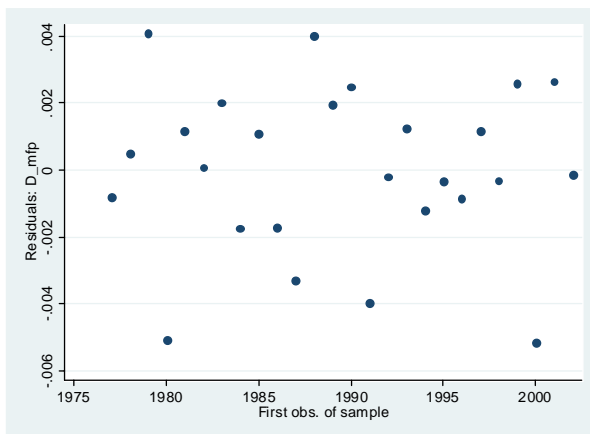
Model S3LP: LP equation



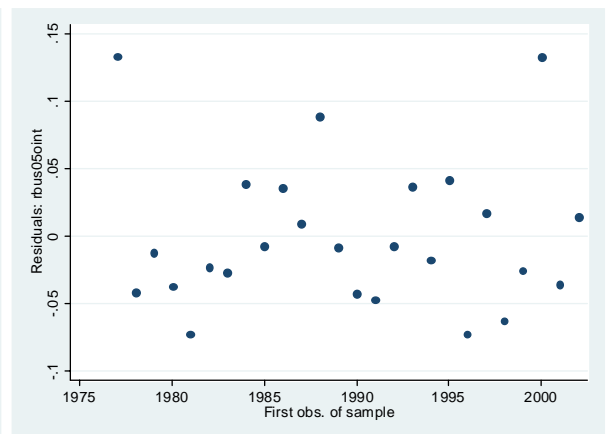
Model S3LP: R&D equation



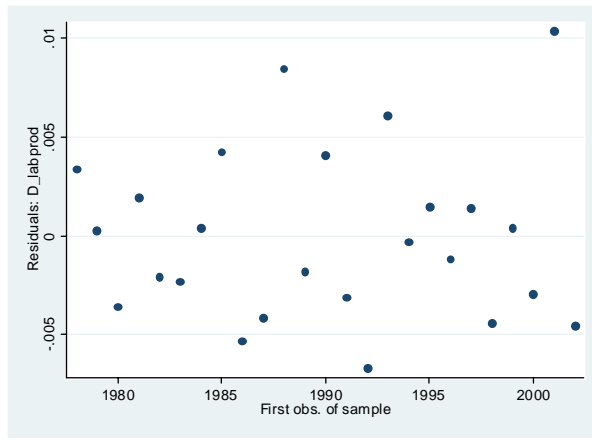
Model S4: MFP equation



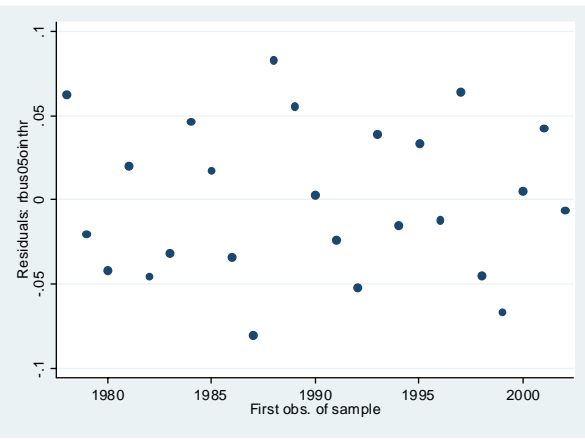
Model S4: R&D equation



Model S4LP: LP equation



Model S4LP: R&D equation



Financial years beginning 1 July of year specified.

Data source: Commission estimates.

Table A.2 Test statistics for table 10.2 models, page 191-92

Multi-factor productivity (MFP) and Labour Productivity (LP) models

Model -	S1	S2	S3	S3LP	S4	S4LP
Dep. Var. -	$\ln(mfp)$	$\ln(mfp)$	$\Delta\ln(mfp)$	$\Delta\ln(LP)$	$\Delta\ln(mfp)$	$\Delta\ln(LP)$
Know. Stock spec. -	$\ln(K)$	$\ln(K)$	$\ln(K/Y)$	$\ln(K/(Y*hrs))$	$\ln(\Delta K/Y)$	$\ln(\Delta K/(Y*hrs))$
No. of observations	29	26	27	27	26	25
Degrees of freedom	22	35	28	27	39	32
RMSE ^a -						
R&D eq'n	0.008	0.008	0.014	0.022	0.054	0.044
Productivity eq'n	0.005	0.000	0.002	0.004	0.002	0.004
Log Likelihood	213	260	205	176	159	152
AIC ^b	-382	-449	-353	-299	-240	-240
BIC ^b	-351	-405	-317	-264	-191	-201

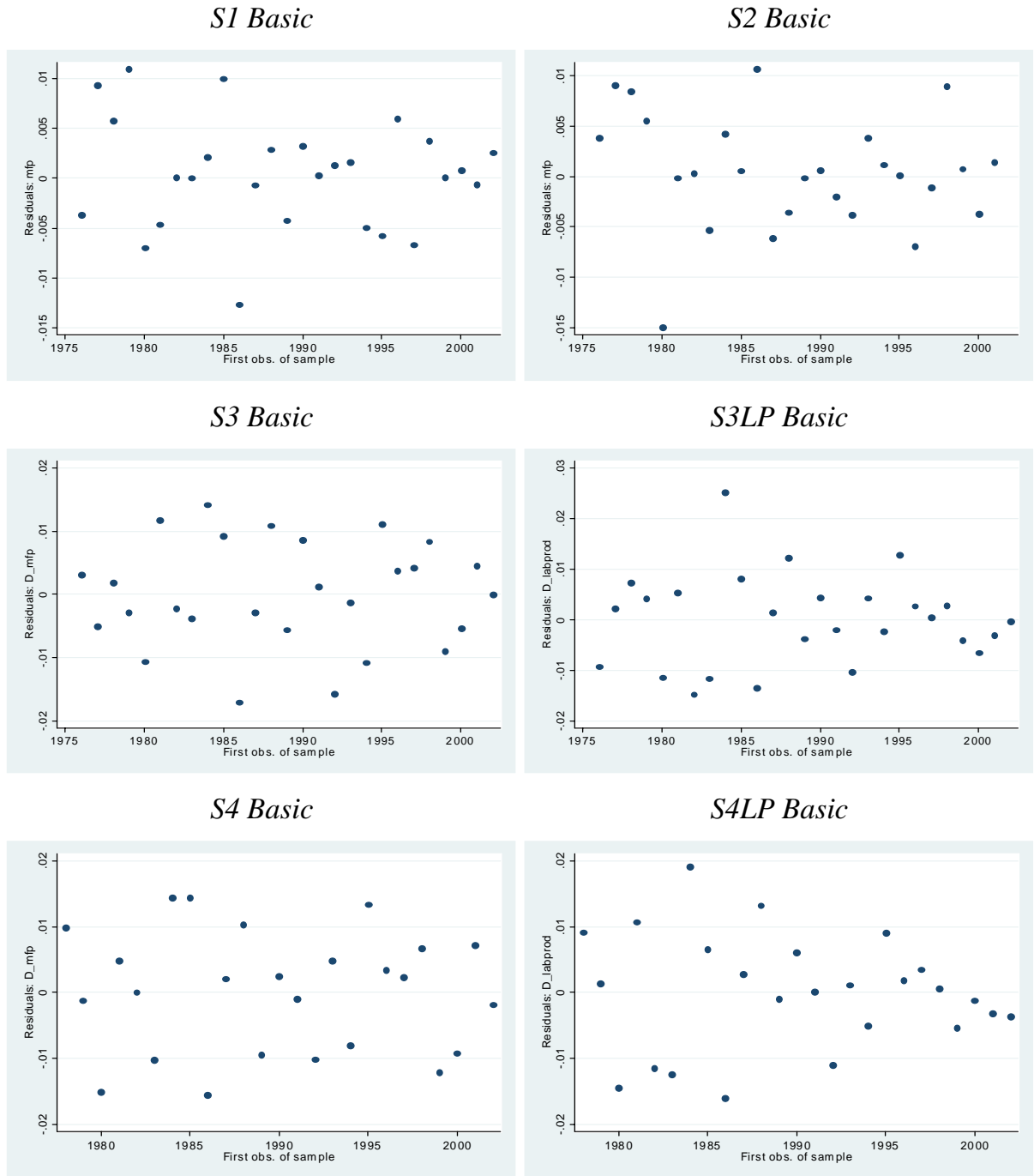
^a Root MSE is the standard deviation of the error term, and is the square root of the Mean Square Residual (or Error). ^b For the Akaike and Bayesian Information Criteria, a smaller statistic suggests better model fit (for example, model S2 fits the data better than model S1).

Source: Commission estimates.

2-equation Basic Models

Residual plots and test statistics for the 2-equation basic models of chapter 10, table 10.4, page 197, are provided in figure A.3 and table A.3.

Figure A.3 **Productivity equation residuals from basic 2-equation models**
Actual MFP less predicted MFP.



Financial years beginning 1 July of year specified.

Data source: Commission estimates.

Table A.3 Test statistics for table 10.4 basic models, page 197

Multi-factor productivity (MFP) and Labour Productivity (LP) models

	<i>S1</i> <i>Basic</i>	<i>S2</i> <i>Basic</i>	<i>S3</i> <i>Basic</i>	<i>S3LP</i> <i>Basic</i>	<i>S4</i> <i>Basic</i>	<i>S4LP</i> <i>Basic</i>
<i>Dep. Var. -</i>	<i>Ln(mfp)</i>	<i>Ln(mfp)</i>	$\Delta Ln(mfp)$	$\Delta Ln(LP)$	$\Delta Ln(mfp)$	$\Delta Ln(LP)$
<i>Know. Stock spec. -</i>	<i>Ln(K)</i>	<i>Ln(K)</i>	<i>Ln(K/Y)</i>	<i>Ln(K/(Y*hrs))</i>	<i>Ln($\Delta K/Y$)</i>	<i>Ln($\Delta K/(Y*hrs)$)</i>
No. of observations	29	28	27	27	26	26
Degrees of freedom	20	22	15	13	24	24
RMSE -						
R&D eq'n	0.008	0.008	0.014	0.024	0.054	0.045
Productivity eq'n	0.005	0.006	0.008	0.009	0.009	0.009
Log Likelihood	210	202	174	160	125	136
AIC	-380	-359	-318	-294	-202	-223
BIC	-353	-330	-298	-277	-172	-194

Source: Commission estimates.

A.3 Model S2, table 10.2, chapter 10

The MFP equation of model S2 investigated the relationship between the natural log of MFP, the natural log of the knowledge stocks, and other control variables. The equation also included a number of dummies and intercept shift parameters. The text on page 193 discusses the results from this model when the shift parameters are dropped. Own-financed business R&D becomes insignificant and also tests out of the model. The resulting elasticities and standard errors are:

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>
Trend	0.017	0.006
Cycle	0.425	0.018
Rfrg_te	0.492	0.044
Ci5iousage	-0.086	0.022
Nonggit	-0.146	0.018
Education	0.326	0.042
era	-0.068	0.010
Centbrg	-0.033	0.004
intercept	1.699	0.315

The elasticity and standard error for education was inadvertently left out of the text.

If communication infrastructure (ci5iousage) and private IT capital (nonggit) are further dropped from the model (on the basis of a rejection of the plausibility of the

negative coefficients), then the results are as below (as discussed in the text on page 193).

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>
Trend	-0.015	0.004
Cycle	0.497	0.028
Rfrg_te	0.335	0.067
Education	0.088	0.033
era	-0.101	0.016
Centbrg	-0.008	0.003
intercept	3.785	0.186

The residuals for this model are plotted in figure A.4. The log likelihood, AIC and BIC are 219, -389 and -355, respectively.

Figure A.4 **Residuals for model S2 without shifts, own-financed R&D, communication infrastructure or IT capital**

