Online Appendix - MARTIN Has Its Place: A Macroeconometric Model of the Australian Economy

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Contents

1 The Equations

This appendix presents the model equations in detail. Most behavioural equations have been estimated on data starting in the early 1990s and ending in 2018Q2; further details are provided for each equation. Standard errors are shown in parantheses for coefficients that are estimated.

1.1 Trends

1.1.1 Trend labour productivity

$$tlla_t = tlla_{t-1} + tdlla_t + \varepsilon_t \tag{1}$$

1.1.2 Trend labour productivity growth

$$tdlla_t = 0.95 \times tdlla_{t-1} + 0.05 \times \overline{tdlla} + \varepsilon_t \tag{2}$$

where $\overline{tdlla}$ is the long-run steady state of labour productivity growth.

1.1.3 Trend average hours worked

$$tllhpp_t = tllhpp_{t-1} + tdllhpp_t + \varepsilon_t \tag{3}$$

1.1.4 Trend average hours worked growth

$$tdllhpp_t = 0.95 \times tdllhpp_{t-1} + \varepsilon_t \tag{4}$$

1.1.5 Trend population

$$tllpop_t = tllpop_{t-1} + tdllpop_t + \varepsilon_t \tag{5}$$

1.1.6 Trend population growth

$$tdllpop_t = 0.95 \times tdllpop_{t-1} + 0.05 \times \overline{tdllpop} + \varepsilon_t \tag{6}$$

where $\overline{tdllpop}$ is the long-run steady state of population growth.

1.1.7 Trend inflation expectations

$$pi\_e_t = 0.9 \times pi\_e_{t-1} + 0.1 \times \overline{\pi} + \varepsilon_t \tag{7}$$

where $\overline{\pi}$ is the inflation target.

1.2 The Household Sector

1.2.1 Household consumption

$$\begin{aligned}\Delta rc_t =& \alpha_0 + \gamma \left[rc_{t-1} - \beta_1 hdy_{t-1} - (1-\beta_1) * (hnw_{t-2}) + 0.5 \times RCR_{t-1}/100\right] + 0.15 \times \Delta hcoe_t \\ & + \alpha_1 \Delta hoy_{t-2} + \alpha_2 \Delta hnw_{t-1} + \alpha_3 \Delta LUR_{t-2}/100 + \alpha_4 * D_{t<2008Q2} \\ & + (1 - 0.15 - \alpha_1 - \alpha_2)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \tag{8}$$

where

$\alpha_0 = 0.30\ (0.12)$ $\alpha_3 = -0.42\ (0.15)$ $\beta_1 = 0.84\ (0.05)$
$\alpha_1 = 0.01\ (0.01)$ $\alpha_4 = 0.01\ (0.00)$
$\alpha_2 = 0.06\ (0.02)$ $\gamma = -0.08\ (0.03)$

Regression Statistics

R^2	0.32	S.E. of regression	0.006
Adjusted R^2	0.28	Durbin-Watson	2.17
Sample: 1989Q1 - 2018Q2			

1.2.2 Household non-labour income

$$\begin{aligned}\Delta nhoy_t = & \alpha_0 + \gamma\,[nhoy_{t-1} - \ln(NY_{t-1} - NHCOE_{t-1})] + \alpha_1 \Delta NCR_t/100 \\ & + (tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + pi\_e_{t-1}/400) + \varepsilon_t\end{aligned} \tag{9}$$

where

$\alpha_0 = -0.28\ (0.07)$ $\alpha_1 = -1.94\ (1.13)$ $\gamma = -0.26\ (0.06)$

Regression Statistics

R^2	0.17	S.E. of regression	0.052
Adjusted R^2	0.16	Durbin-Watson	2.56
Sample: 1985Q2 - 2018Q2			

1.2.3 Household other income

$$HOY_t \equiv NHOY_t/PC_t \tag{10}$$

1.2.4 Nominal household disposable income

$$NHDY_t \equiv NHCOE_t + NHOY_t \tag{11}$$

1.2.5 Household disposable income

$$HDY_t \equiv NHDY_t/PC_t \tag{12}$$

1.2.6 Nominal household saving

$$NHS_t \equiv NHDY_t - NC_t - KIDC_t \tag{13}$$

1.2.7 Household saving ratio

$$NHSR_t \equiv NHS_t/(NHDY_t - KIDC_t) \tag{14}$$

1.2.8 Expected earnings

$$\begin{aligned}\Delta eq\_e_t =& \alpha_0 + \gamma\left[eq\_e_{t-1} - \log(NY_{t-1} - NHCOE_{t-1})\right] + \alpha_1 \Delta(wpcom_t - wp_t) \\ &+ \alpha_2 \Delta eq\_e_{t-1} + (1-\alpha_2)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + pi\_e_t/400)\end{aligned} \tag{15}$$

where

$\alpha_0 = -0.03\ (0.02)$ $\alpha_2 = 0.31\ (0.13)$
$\alpha_1 = 0.29\ (0.08)$ $\gamma = -0.04\ (0.02)$

Regression Statistics

R^2	0.20	S.E. of regression	0.006
Adjusted R^2	0.18	Durbin-Watson	2.04
Sample: 1985Q1 - 2018Q2			

1.2.9 Household financial assets

$$\begin{aligned}\Delta nhfa_t =& \alpha_0 + \gamma\left[nhfa_{t-1} - peqi_{t-1}\right] + \alpha_1 \Delta peqi_t \\ &+ (1-\alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + pi\_e_{t-1}/400) + \varepsilon_t\end{aligned} \tag{16}$$

where

$\alpha_0 = 0.01\ (0.01)$ $\alpha_1 = 0.22\ (0.02)$ $\gamma = -0.01\ (0.01)$

Regression Statistics

R^2	0.60	S.E. of regression	0.011
Adjusted R^2	0.60	Durbin-Watson	1.64
Sample: 1992Q1 - 2018Q2			

1.2.10 Household non-financial assets

$$\Delta nhnfa_t = \Delta(ph_t + kid_t) + \varepsilon_t \tag{17}$$

1.2.11 Household assets

$$NHA_t \equiv NHFA_t + NHNFA_t \tag{18}$$

1.2.12 Household credit

$$\begin{aligned}\Delta nhc_t =& \alpha_0 + \gamma\left[nhc_{t-1} - ph_{t-1} - kid_{t-2} - \beta_1 RMR_{t-1}\right] + \alpha_1 \Delta nhc_{t-1} + \alpha_2 \Delta ph_{t-1} \\ &+ (1-\alpha_1)\Delta kid_{t-2} + \alpha_3 \Delta NMR_{t-1} + (1-\alpha_1-\alpha_2) pi\_e_{t-1}/400 \end{aligned} \quad (19)$$

where

$\alpha_0 = -0.04\ (0.02)$	$\alpha_2 = 0.04\ (0.02)$	$\gamma = -0.01\ (0.00)$
$\alpha_1 = 0.83\ (0.06)$	$\alpha_3 = -0.00\ (0.00)$	$\beta_1 = -0.05 (0.03)$

Regression Statistics

R^2	0.87	S.E. of regression	0.004
Adjusted R^2	0.86	Durbin-Watson	2.46
Sample: 1993Q1 - 2018Q2			

1.2.13 Household credit to the financial sector

$$\Delta nhcl_t = \Delta nhc_t + \varepsilon_t \quad (20)$$

1.2.14 Household other liabilities

$$\Delta nhol_t = \alpha_1 \Delta nhol_{t-1} + (1-\alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + pi\_e_{t-1}/400) + \varepsilon_t \quad (21)$$

where

$\alpha_1 = -0.18\ (0.09)$

Regression Statistics

R^2	0.00	S.E. of regression	0.060
Adjusted R^2	0.00	Durbin-Watson	2.08
Sample: 1989Q4 - 2018Q2			

1.2.15 Household liabilities

$$NHL_t \equiv NHCL_t + NHOL_t \quad (22)$$

1.2.16 Household net worth

$$NHNW_t \equiv NHA_t - NHL_t \quad (23)$$

1.2.17 Real household net worth

$$HNW_t \equiv NHNW_t/PC_t \tag{24}$$

1.2.18 Consumption of fixed capital

$$\Delta kidc_t = 0.95\Delta kidc_{t-1} + 0.05(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t \tag{25}$$

1.3 The Housing Sector

1.3.1 Dwelling investment

$$\begin{aligned}\Delta id_t =& \alpha_0 + \gamma\left[id_{t-1} - rc_{t-1} + pid_{t-1} - pc_{t-1} + 0.3 \times RMR_{t-1}/100\right] \\ &+ \frac{\alpha_1}{4}\Delta_4 NMR_{t-1}/100 + \frac{\alpha_2}{3}\Delta_3 rph_{t-1} + \alpha_3 D_{2000Q4} + \alpha_4 D_{2001Q1} \\ &+ \alpha_5 D_{2001Q2} + \alpha_6 D_{2001Q3} + tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + \varepsilon_t\end{aligned} \tag{26}$$

where

$\alpha_0 = -0.21\ (0.05)$ $\alpha_3 = -0.15\ (0.00)$ $\alpha_6 = 0.08\ (0.00)$
$\alpha_1 = -2.65\ (0.67)$ $\alpha_4 = -0.25\ (0.00)$ $\gamma = -0.09\ (0.02)$
$\alpha_2 = 0.88\ (0.14)$ $\alpha_5 = 0.06\ (0.00)$

Regression Statistics

R^2	0.67	S.E. of regression	0.03
Adjusted R^2	0.65	Durbin-Watson	2.21
Sample: 1985Q2 - 2018Q2			

1.3.2 Housing prices

$$\begin{aligned}\Delta ph_t =& \alpha_0 + \gamma\left[ph_{t-1} - prt_{t-1} - \beta_1 RMR_{t-1}\right] \\ &+ \alpha_1 \Delta ph_{t-1} - 0.3 \times \Delta NMR_{t-1}/100 + (1-\alpha_1)pi\_e_t/400 + \varepsilon_t\end{aligned} \tag{27}$$

where

$\alpha_0 = 0.02\ (0.00)$ $\gamma = -0.02\ (0.01)$
$\alpha_1 = 0.66\ (0.06)$ $\beta_1 = -0.18\ (0.03)$

Regression Statistics

R^2	0.70	S.E. of regression	0.01
Adjusted R^2	0.69	Durbin-Watson	1.09
Sample: 1988Q3 - 2018Q2			

1.3.3 Consumer Price Index Rents

$$\begin{aligned}\Delta prt_t =& \alpha_0 + \gamma\left[prt_{t-1} - pc_{t-1} - hcoe_{t-4} + kid_{t-5}\right] \\ &+ \alpha_1 \Delta prt_{t-1} + \frac{\alpha_2}{2}\Delta_2 hcoe_{t-1} + (1-\alpha_1)pi\_e_t/400 \\ &- \alpha_2(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t \end{aligned} \tag{28}$$

where

$\alpha_0 = 0.23\ (0.07)$	$\alpha_2 = 0.07\ (0.02)$
$\alpha_1 = 0.79\ (0.05)$	$\gamma = -0.03\ (0.01)$

Regression Statistics

R^2	0.84	S.E. of regression	0.00
Adjusted R^2	0.84	Durbin-Watson	2.60
Sample: 1993Q1 - 2018Q2			

1.3.4 Ownership transfer costs

$$\begin{aligned}\Delta otc_t =& \alpha_0 + \gamma\left[otc_{t-1} - id_{t-1} + \beta_1(potc_{t-1} - pid_{t-1})\right] \\ &+ \alpha_1(\Delta ph_t - \bar{\pi}/400) + \alpha_2 \Delta NMR_{t-1}/400 + \alpha_3 D_{2000Q3} \\ &+ tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + \varepsilon_t \end{aligned} \tag{29}$$

where

$\alpha_0 = -0.22\ (0.04)$	$\alpha_2 = -11.43\ (3.59)$	$\gamma = -0.17\ (0.03)$
$\alpha_1 = 1.64\ (0.20)$	$\alpha_3 = -0.17\ (0.01)$	$\beta_1 = 0.67\ (0.06)$

Regression Statistics

R^2	0.49	S.E. of regression	0.04
Adjusted R^2	0.47	Durbin-Watson	2.13
Sample: 1983Q1 - 2018Q2			

1.3.5 Real housing prices

$$RPH_t \equiv PH_t/PTM_t \tag{30}$$

1.3.6 Dwelling stock depreciation rate

$$IDDR_t = IDDR_{t-1} + \varepsilon_t \tag{31}$$

1.3.7 Dwelling stock

$$KID_t = (1 - IDDR_t) \times KID_{t-1} + ID_t + \varepsilon_t \tag{32}$$

Note that we include an error term in this equation to account for the fact that the stock-flow identity does not hold exactly in the data.

1.4 Business Investment

1.4.1 Non-mining investment

$$\begin{aligned}\Delta ibn_t =& \alpha_0 + \gamma[ibn_{t-1} - gne_{t-1} + 0.4(ibcr_{t-1} + (pgne_{t-1} - pibn_{t-1}))\\ &+ (pibn_{t-1} - pgne_{t-1}) - (tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + IBNDR_{t-1}/100)\\ &- \beta_1(nibre_{t-1} - ny_{t-1})] + 0.5\Delta_2 gne_{t-1} + \alpha_1 D_{2000Q4} + \varepsilon_t\end{aligned} \tag{33}$$

where

$\alpha_0 = -0.01\ (0.02)$ $\quad\beta_1 = -0.26\ (0.11)$

$\gamma = -0.07\ (0.03)$ $\quad\alpha_1 = -0.13\ (0.01)$

Regression Statistics

R^2	0.14	S.E. of regression	0.046
Adjusted R^2	0.13	Durbin-Watson	2.18
Sample: 1979Q4 - 2018Q2			

1.4.2 Mining investment

$$\begin{aligned}\Delta ibre_t =& \alpha_0 + \gamma[ibre_{t-1} - y_{t-1} - \beta_1(pxre_{t-1} - pgne_{t-1}) + (pibre_{t-1} - pgne_{t-1})\\ &- (tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1} + IBREDR_{t-1}/100)]\\ &+ \frac{\alpha_1}{4}\Delta_4(pxre_t - pgne_t) + \frac{\alpha_2}{2}\Delta_2 ibre_{t-1}\\ &+ (1-\alpha_2)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \alpha_3 D_{1999Q4} + \alpha_4 D_{2001Q4}\\ &+ \alpha_5 D_{2002Q1} + \alpha_6 D_{2002Q2} + \alpha_7 D_{2002Q3} + \varepsilon_t\end{aligned} \tag{34}$$

where

$\alpha_0 = 0.02\ (0.01)$
$\alpha_1 = 0.31\ (0.14)$
$\alpha_2 = 0.25\ (0.08)$
$\alpha_3 = -0.38\ (0.01)$
$\alpha_4 = -0.17\ (0.01)$
$\alpha_5 = 0.36\ (0.01)$
$\alpha_6 = -0.26\ (0.01)$
$\alpha_7 = 0.13\ (0.01)$
$\gamma = -0.05\ (0.02)$
$\beta_1 = 2.04\ (0.64)$

Regression Statistics

R^2	0.52	S.E. of regression	0.067
Adjusted R^2	0.48	Durbin-Watson	2.27
Sample: 1986Q3 - 2018Q2			

1.4.3 Private business investment

$$IB_t = IBN_t + IBRE_t + \varepsilon_t \tag{35}$$

1.4.4 Stock price-to-earnings yield

$$\begin{aligned} IBEY_t =& \alpha_0 + \alpha_1 IBEY_{t-1} + \frac{(1-\alpha_1)\times\alpha_2}{\theta}(N2R_t - pi\_e_t + (NBR_t - NCR_t)) \\ & - \frac{1-\alpha_1}{\theta}(tdllа_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) \times 400 + \alpha_3 D_{2008Q4} + \varepsilon_t \end{aligned} \tag{36}$$

where

$\alpha_0 = 1.95\ (0.51)$
$\alpha_1 = 0.78\ (0.05)$
$\alpha_2 = 0.38\ (0.10)$
$\alpha_3 = 2.93\ (0.15)$
$\theta = 0.7$ (Calibrated)

Regression Statistics

R^2	0.83	S.E. of regression	0.816
Adjusted R^2	0.83	Durbin-Watson	1.95
Sample: 1985Q1 - 2018Q2			

1.4.5 Price-to-earnings ratio

$$IBPER_t \equiv 100 \times \frac{1}{IBEY_t} \tag{37}$$

1.4.6 Market price of equities

$$PEQI \equiv EQ\_E \times IBPER \tag{38}$$

1.4.7 Cost of capital

$$IBCR_t \equiv (RBR_t \times IBDSR_t + IBEY_t(1 - IBDSR_t) + IBNDR_t)(1 - IBCTR_t \times T_t) \\ \frac{1}{1 - IBCTR_t} \times (PIBN_t/PGNE_t) + \varepsilon_t \quad (39)$$

where

$$T \equiv (IBNDR_t \times (1 + N10R_t))((N10R_t + IBNDR_t))$$

1.4.8 Debt share of firms' financing

$$IBDSR_t = IBDSR_{t-1} + \varepsilon_t \quad (40)$$

1.4.9 Corporate tax rate

$$IBCTR_t = IBCTR_{t-1} + \varepsilon_t \quad (41)$$

1.4.10 Non-mining capital stock

$$KIBN_t = (1 - IBNDR_t)KIBN_{t-1} + IBN_t + \varepsilon_t \quad (42)$$

1.4.11 Non-mining depreciation rate

$$IBNDR_t = IBNDR_{t-1} + \varepsilon_t \quad (43)$$

1.4.12 Mining capital stock

$$KIBRE_t = (1 - IBREDR_t)KIBRE_{t-1} + IBRE_t + \varepsilon_t \quad (44)$$

1.4.13 Mining depreciation rate

$$IBREDR_t = IBREDR_{t-1} + \varepsilon_t \quad (45)$$

1.4.14 Inventories

$$\Delta kv_t = \alpha_0 - 0.001 \times [kv_{t-1} - y_{t-1}] + \alpha_1 \Delta kv_{t-1} \\ + (1 - \alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t \quad (46)$$

where

$\alpha_0 = -0.003\ (0.001)$ $\alpha_1 = 0.39\ (0.07)$

Regression Statistics

R^2	0.16	S.E. of regression	0.007
Adjusted R^2	0.16	Durbin-Watson	2.07
Sample: 1980Q3 - 2018Q2			

1.4.15 Change in inventories

$$V_t \equiv \Delta KV_t \tag{47}$$

1.5 Public sector

1.5.1 Public investment

$$\begin{aligned}\Delta gi_t =& \alpha_0 + \gamma[gi_{t-1} - y_{t-1} - \ln(1 - 2 \times LURGAP_{t-1}/100)] \\ & + \alpha_1 \Delta gi_{t-1} + (1 - \alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \tag{48}$$

where

$\alpha_0 = -0.42\ (0.13)$ $\quad\gamma = -0.14\ (0.04)$ $\quad\alpha_1 = -0.37\ (0.09)$

Regression Statistics

R^2	0.23	S.E. of regression	0.068
Adjusted R^2	0.22	Durbin-Watson	2.10
Sample: 1986Q1 - 2018Q2			

1.5.2 Public consumption

$$\begin{aligned}\Delta gc_t =& \alpha_0 + \gamma[gc_{t-1} - y_{t-1} - \ln(1 - 2 \times LURGAP_{t-1}/100)] \\ & + \alpha_1 \Delta gc_{t-1} + (1 - \alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \tag{49}$$

where

$\alpha_0 = -0.22\ (0.09)$ $\quad\gamma = -0.13\ (0.05)$ $\quad\alpha_1 = -0.17\ (0.08)$

Regression Statistics

R^2	0.10	S.E. of regression	0.013
Adjusted R^2	0.08	Durbin-Watson	2.07
Sample: 1985Q3 - 2018Q2			

1.5.3 Public demand

$$G_t = GC_t + GI_t + \varepsilon_t \tag{50}$$

1.6 Foreign Trade

1.6.1 Imports

$$\begin{aligned}\Delta m_t =& \alpha_0 + \gamma[m_{t-1} - iad_{t-1} - \frac{\beta_1}{4}\sum_{i=1}^{4}(pm_{t-i} - pdfd_{t-i})] \\ & + \alpha_1 \Delta iad_t + \alpha_2 \Delta iad_{t-1} + \alpha_3 \Delta iad_{t-2} + \alpha_4 \Delta(pm_{t-1} - pdfd_{t-1}) \\ & + (1 - \alpha_1 - \alpha_2 - \alpha_3)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t \end{aligned} \tag{51}$$

where

$\alpha_0 = 0.05\ (0.02)$
$\alpha_1 = 0.57\ (0.11)$
$\alpha_2 = 0.28\ (0.07)$
$\alpha_3 = 0.20\ (0.09)$
$\alpha_4 = -0.34\ (0.08)$
$\gamma = -0.13\ (0.04)$
$\beta_1 = -0.98\ (0.06)$

Regression Statistics

R^2	0.46	S.E. of regression	0.021
Adjusted R^2	0.43	Durbin-Watson	2.39
Sample: 1990Q1 - 2018Q2			

1.6.2 Import-adjusted demand

$$IAD_t \equiv RC_t^{\omega_t^c} + IB_t^{\omega_t^i} + G_t^{\omega_t^g} + X_t^{\omega_t^x} \tag{52}$$

1.6.3 Manufactured Exports

$$\begin{aligned}\Delta xm_t =& xm\_c_t + \gamma[xm_{t-1} - wy_{t-1} + 0.5 \times rewi_{t-1}] \\ & + \alpha_1 \Delta wy_{t-1} + \frac{\alpha_1}{2}\Delta wy_{t-2} + \\ & + (1 - \alpha_1 - \frac{\alpha_1}{2})(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t \end{aligned} \tag{53}$$

where

$\gamma = -0.39\ (0.06)$
$\alpha_1 = 1.31\ (0.43)$

Regression Statistics

R^2	0.52	S.E. of regression	0.030
Adjusted R^2	0.52	Durbin-Watson	1.98
Sample: 1986Q2 - 2018Q2			

1.6.4 Manufactured Exports Time-varying Constant

$$xm\_c_t = xm\_c_{t-1} + \varepsilon_t \tag{54}$$

1.6.5 Services Exports

$$\begin{aligned}\Delta xs_t =& xs\_c_t + \gamma[xs_{t-1} - wy_{t-1} - \beta_1 rewi_{t-1}] \\ &+ \frac{\alpha_1}{4}\Delta_4 wy_t + \alpha_2 \Delta rewi_t + \alpha_3 D_{2000Q3} \\ &+ (1-\alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \tag{55}$$

where

$\alpha_1 = 1.84\ (0.47)$ $\quad\alpha_3 = 0.15\ (0.01)$ $\quad\beta_1 = -0.42\ (0.00)$

$\alpha_2 = -0.15\ (0.05)$ $\quad\gamma = -0.22\ (0.00)$

Regression Statistics

R^2	0.58	S.E. of regression	0.023
Adjusted R^2	0.57	Durbin-Watson	2.40
Sample: 1981Q1 - 2018Q2			

1.6.6 Services Exports Time-varying Constant

$$xs\_c_t = xs\_c_{t-1} + \varepsilon_t \tag{56}$$

1.6.7 Agricultural Exports

$$\begin{aligned}\Delta xag_t =& \alpha_0 + \gamma[xag_{t-1} - wy_{t-1} - \beta_1 rewi_{t-1}] \\ &+ \alpha_1 \Delta xag_{t-4} + (1-\alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \tag{57}$$

where

$\alpha_0 = 0.91\ (0.39)$ $\quad\gamma = -0.15\ (0.05)$

$\alpha_1 = -0.25\ (0.10)$ $\quad\beta_1 = -0.38\ (0.20)$

Regression Statistics

R^2	0.15	S.E. of regression	0.059
Adjusted R^2	0.13	Durbin-Watson	1.82
Sample: 1985Q3 - 2018Q2			

1.6.8 Other Exports

$$\begin{aligned}\Delta xo_t =& \alpha_0 + \gamma[xo_{t-1} - wy_{t-1} - \beta_1 rewi_{t-1}] \\ &+ \frac{\alpha_1}{2}(xo_{t-1} - xo_{t-3}) + (1-\alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \quad (58)$$

where

$\alpha_0 = 0.73\ (0.18)$ $\quad\gamma = -0.05\ (0.03)$
$\alpha_1 = -0.54\ (0.11)$ $\quad\beta_1 = -2.71\ (2.08)$

Regression Statistics

R^2	0.16	S.E. of regression	0.080
Adjusted R^2	0.14	Durbin-Watson	2.24
Sample: 1986Q2 - 2018Q2			

1.6.9 Resource export volumes

$$\begin{aligned}\Delta xre_t = xre\_c_t + \gamma(xre_{t-1} - kibre_{t-6}) + \alpha_1 \Delta xre_{t-1} + \\ \alpha_2 D_{1997Q2} + (1-\alpha_1)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t\end{aligned} \quad (59)$$

where

$\alpha_1 = -0.23\ (0.06)$ $\quad\gamma = -0.19\ (0.06)$
$\alpha_2 = -0.22\ (0.00)$

Regression Statistics

R^2	0.32	S.E. of regression	0.036
Adjusted R^2	0.31	Durbin-Watson	1.94
Sample: 1986Q1 - 2018Q2			

1.6.10 Resource export volumes time-varying constant

$$xre\_c_t = xre\_c_{t-1} + \varepsilon_t \quad (60)$$

1.6.11 Export volumes

$$X_t = XM_t + XAG_t + XS_t + XRE_t + XO_t + \varepsilon_t \tag{61}$$

1.7 National Accounts Aggregates

1.7.1 Net asset transfers between the public and private sectors

$$AT_t = AT_{t-1} + \varepsilon_t \tag{62}$$

1.7.2 Domestic final demand

$$DFD_t = RC_t + ID_t + IB_t + G_t + OTC_t + AT_t + \varepsilon_t \tag{63}$$

1.7.3 Domestic final demand plus exports

$$DFDX_t = RC_t + ID_t + IB_t + G_t + OTC_t + AT_t + X_t + \varepsilon_t \tag{64}$$

1.7.4 Gross national expenditure

$$GNE_t = DFD_t + V_t + \varepsilon_t \tag{65}$$

1.7.5 Gross domestic product

$$GDP_t = GNE_t + X_t - M_t + SD_t + \varepsilon_t \tag{66}$$

1.7.6 Statistical discrepancy

$$SD_t = SD_{t-1} + \varepsilon_t \tag{67}$$

1.7.7 Nominal household consumption expenditure

$$NC_t \equiv PC_t \times RC_t/100 \tag{68}$$

1.7.8 Nominal dwelling investment

$$NID_t \equiv PID_t \times ID_t/100 \tag{69}$$

1.7.9 Nominal ownership transfer costs

$$NOTC_t \equiv POTC_t \times OTC_t/100 \tag{70}$$

1.7.10 Nominal private investment

$$NIB_t \equiv NIBN_t + NIBRE_t \tag{71}$$

1.7.11 Nominal private business investment

$$NIBN_t \equiv PIBN_t \times IBN_t/100 \tag{72}$$

1.7.12 Nominal mining investment

$$NIBRE_t \equiv PIBRE_t \times IBRE_t/100 \tag{73}$$

1.7.13 Nominal public demand

$$NG_t \equiv PG_t \times G_t/100 \tag{74}$$

1.7.14 Nominal change in inventories

$$NV_t = PG_t \times V_t/100 + \varepsilon_t \tag{75}$$

1.7.15 Nominal resource exports

$$NXRE_t \equiv PXRE_t \times XRE_t/100 \tag{76}$$

1.7.16 Nominal manufacturing exports

$$NXM_t \equiv PXM_t \times XM_t/100 \tag{77}$$

1.7.17 Nominal services exports

$$NXS_t \equiv PXS_t \times XS_t/100 \tag{78}$$

1.7.18 Nominal other exports

$$NXO_t \equiv PXO_t \times XO_t/100 \tag{79}$$

1.7.19 Nominal agicultural exports

$$NXAG_t \equiv PXAG_t \times XAG_t/100 \tag{80}$$

1.7.20 Nominal exports

$$NX_t \equiv NXM_t + NXS_t + NXRE_t + NXO_t + NXAG_t \tag{81}$$

1.7.21 Nominal imports

$$NXM_t \equiv PM_t \times M_t/100 \tag{82}$$

1.7.22 Nominal net asset transfers between the public and private sectors

$$NAT_t = NAT_{t-1} + \varepsilon_t \tag{83}$$

1.7.23 Nominal domestic final demand

$$NDFD_t \equiv NC_t + NID_t + NIB_t + NG_t + NOTC_t - NAT_t \tag{84}$$

1.7.24 Nominal gross national expenditure

$$NGNE_t \equiv NDFD_t + NV_t \tag{85}$$

1.7.25 Nominal statistical discrepancy

$$NSD_t = NSD_{t-1} + \varepsilon_t \tag{86}$$

1.7.26 Nominal GDP

$$NY_t \equiv NGNE_t + NX_t - NM_t + NSD_t \tag{87}$$

1.8 Prices and Wages

1.8.1 Wage price index

$$\begin{aligned}\Delta pw_t =& \theta_{pw} \times (tdlla_t \times (\alpha_3 + \alpha_4)) + \alpha_1 \times (LUR_{t-1} - TLUR_{t-1})/(LUR_{t-1})/100 \\ &+ \alpha_2 \Delta LUR_{t-1}/100 + \alpha_3 \times pi\_e_{t-1}/400 + \frac{\alpha_4}{8}\Delta_8 py_{t-1} \\ &+ (1 - \alpha_3 - \alpha_4)\Delta pw_{t-1} + \varepsilon_t\end{aligned} \tag{88}$$

where

$\theta_{pw} = 0.43\ (0.04)$ $\alpha_2 = -0.15\ (0.06)$ $\alpha_4 = 0.14\ (0.04)$
$\alpha_1 = -0.53\ (0.13)$ $\alpha_3 = 0.74\ (0.08)$

Regression Statistics

R^2	0.75	S.E. of regression	0.001
Adjusted R^2	0.74	Durbin-Watson	2.04
Sample: 1998Q1 - 2018Q2			

1.8.2 Average earnings national accounts

$$\Delta pae_t = tdlla_t + pi\_e_{t-1}/400 + \alpha_1 \times (\Delta pw_t - \theta_{pw} tdlla_t + pi\_e_{t-1}/400) + \varepsilon_t \tag{89}$$

where

$\alpha_1 = 1.51\ (0.40)$ $\theta_{pw} = 0.43$ (Calibrated)

Regression Statistics

R^2	0.14	S.E. of regression	0.001
Adjusted R^2	0.14	Durbin-Watson	2.05
Sample: 1997Q4 - 2018Q2			

1.8.3 Nominal household compensation of employees

$$\Delta nhcoe_t \equiv \Delta pae_t + \Delta le_t + tdllhpp_t + \varepsilon_t \tag{90}$$

1.8.4 Compensation of employees

$$HCOE_t \equiv NHCOE_t/PC_t \tag{91}$$

1.8.5 Nominal unit labour cost

$$\Delta nulc_t \equiv \Delta nhcoe_t - \Delta y_t \tag{92}$$

1.8.6 Nominal unit labour cost - Balassa Samuelson adj.

$$NULCBS_t \equiv NULC_t/NULC_{t-1} \times NULCBS_{t-1} + \varepsilon_t \tag{93}$$

1.8.7 Real labour cost

$$RLC_t \equiv PAE_t/PGNE_t \tag{94}$$

1.8.8 Real unit labour cost

$$RULC_t \equiv NULC_t/PGNE_t \tag{95}$$

1.8.9 Import price deflator

$$\begin{aligned}\Delta pm_t =& \alpha_0 + \gamma\left[pm_{t-1} - \beta_1 wpx_{t-1} + ntwi_{t-1} - (1-\beta_1) * wpoil_{t-1} - \beta_2 TADP_t/100\right] \\ &+ \alpha_1 \Delta pm_{t-1} + \alpha_2 \Delta ntwi_t + \alpha_3 \Delta ntwi_{t-1} + \alpha_4 \Delta wpx_t + \alpha_5 \Delta wpx_{t-1} \\ &+ \alpha_6 \Delta poil_t + (1 - \alpha_1 - \alpha_4 - \alpha_5 - \alpha_6) * \Delta poil_{t-1} \\ &+ \alpha_7 D_{1997Q3} + \alpha_8 D_{1997Q4} + \alpha_9 D_{1998Q1} + \alpha_{10} D_{1998Q2} + \alpha_{11} D_{1998Q35} + \varepsilon_t\end{aligned} \tag{96}$$

where $TADP_t$ is a linear trend from 1984Q2 to 2011Q4 and constant thereafter and

$\alpha_0 = 0.64\ (0.16)$	$\alpha_5 = 0.59\ (0.13)$	$\alpha_1 0 = 0.03\ (0.01)$
$\alpha_1 = -0.30\ (0.07)$	$\alpha_6 = 0.03\ (0.01)$	$\alpha_1 1 = 0.02\ (0.01)$
$\alpha_2 = -0.67\ (0.02)$	$\alpha_7 = 0.00\ (0.01)$	$\gamma = -0.14\ (0.04)$
$\alpha_3 = -0.33\ (0.06)$	$\alpha_8 = 0.03\ (0.01)$	$\beta_1 = 0.90\ (0.02)$
$\alpha_4 = 0.67\ (0.10)$	$\alpha_9 = 0.07\ (0.01)$	$\beta_2 = -0.16\ (0.03)$

Regression Statistics

R^2	0.94	S.E. of regression	0.008
Adjusted R^2	0.93	Durbin-Watson	1.95
Sample: 1984Q2 - 2018Q2			

1.8.10 Consumer good import price

$$\Delta pmcg_t = \alpha_1 \Delta pm + (1 - \alpha_1 - \alpha_2 - \alpha_3)\Delta pmcg_{t-1} + \alpha_2 \Delta poil_t + \alpha_3 \Delta poil_{t-1} + \alpha_4 D_{t<2000Q1}/100 + \varepsilon_t \tag{97}$$

where

$\alpha_1 = 0.93\ (0.03)$ $\alpha_3 = -0.03\ (0.01)$
$\alpha_2 = -0.04\ (0.01)$ $\alpha_4 = 0.38\ (0.12)$

Regression Statistics

R^2	0.91	S.E. of regression	0.008
Adjusted R^2	0.91	Durbin-Watson	2.07
Sample: 1984Q2 - 2018Q2			

1.8.11 Trimmed mean CPI

$$\Delta ptm_t = \alpha_0 + \gamma\left[pex_{t-1} - \beta_1 nulcbs_{t-1} - (1 - \beta_1)pmcg_{t-1}\right] + \alpha_1 \Delta ptm_{t-1} + (1 - \alpha_1)pi\_e_{t-1}/400 + \alpha_2 LURGAP_t/100 + \varepsilon_t \tag{98}$$

where

$\alpha_0 = 0.16\ (0.05)$ $\alpha_2 = -0.08\ (0.01)$ $\beta_1 = 0.78\ (0.03)$
$\alpha_1 = 0.23\ (0.08)$ $\gamma = -0.03\ (0.01)$

Regression Statistics

R^2	0.45	S.E. of regression	0.001
Adjusted R^2	0.43	Durbin-Watson	2.04
Sample: 1993Q1 - 2018Q2			

1.8.12 Consumer Price Index

$$\Delta p_t = (1 - \alpha_1 - \alpha_2) * \Delta ptm_t + \alpha_1 \Delta poil_t + \alpha_2 \Delta poil_{t-1} + \varepsilon_t \tag{99}$$

where

$\alpha_1 = 0.01\ (0.00)$ $\alpha_2 = 0.01\ (0.00)$

Regression Statistics

R^2	0.78	S.E. of regression	0.002
Adjusted R^2	0.77	Durbin-Watson	2.04
Sample: 1987Q1 - 2018Q2			

1.8.13 Consumer price index - excluding volatile items

$$\Delta pex_t = \Delta ptm_t + \varepsilon_t \tag{100}$$

1.8.14 Domestic oil price

$$POIL_t = WPOIL_t / NUSD_t + \varepsilon_t \tag{101}$$

1.8.15 Household consumption deflator

$$\begin{aligned}\Delta pc_t =& \alpha_0 + \gamma \left[pc_{t-1} - ptm_{t-1} - \beta_1 PCTREND_t/100\right] + \alpha_1 \Delta ptm_t \\ &+ (1-\alpha_1)\Delta pm_t + \alpha_2 D_{2000Q3}\end{aligned} \tag{102}$$

where PCTREND is a linear trend and

$\alpha_0 = 0.01\ (0.00)$
$\alpha_1 = 0.97\ (0.01)$
$\alpha_2 = 0.02\ (0.00)$
$\gamma = -0.08\ (0.04)$
$\beta_1 = -0.09\ (0.01)$

Regression Statistics

R^2	0.89	S.E. of regression	0.002
Adjusted R^2	0.89	Durbin-Watson	1.68
Sample: 1982Q1 - 2018Q2			

1.8.16 Dwelling investment deflator

$$\begin{aligned}\Delta pid_t =& \alpha_0 + \gamma \left[pid_{t-1} - \beta_1 pc_{t-1} - (1-\beta_1) pm_{t-1} - \beta_2 PIDTREND_t/100\right] \\ &+ \alpha_1 \Delta pid_{t-1} + (1-\alpha_1)\Delta pc_t + \alpha_2 D_{2000Q3} + \alpha_3 D_{2000Q4}\end{aligned} \tag{103}$$

where PIDTREND is a linear trend and

$\alpha_0 = -0.03\ (0.01)$
$\alpha_1 = 0.84\ (0.05)$
$\alpha_2 = 0.06\ (0.01)$
$\alpha_3 = -0.08\ (0.01)$
$\gamma = -0.04\ (0.01)$
$\beta_1 = 0.83\ (0.20)$
$\beta_2 = -0.35\ (0.13)$

Regression Statistics

R^2	0.86	S.E. of regression	0.004
Adjusted R^2	0.85	Durbin-Watson	1.69
Sample: 1982Q1 - 2018Q2			

1.8.17 Non-mining business investment deflator

$$\Delta pibn_t = \alpha_0 + \gamma[pibn_{t-1} - pc_{t-1} - \beta_1 * PIBNTREND_t - \beta_2 * PIBNTREND2_t] + \alpha_1 \Delta pibn_{t-1} + \alpha_2 \Delta pibn_{t-2} + (1 - \alpha_1 - \alpha_2)\Delta pm_t + \alpha_3 D_{t=2000Q3} \quad (104)$$

where PIBNTREND is a kinked linear trend that is increasing until 2012Q3 and constant thereafter and PIBNTREND2 is a kinked linear trend that is constant until 2012Q3 and increasing thereafter.

$\alpha_0 = 0.19\ (0.04)$
$\alpha_1 = 0.41\ (0.06)$
$\alpha_2 = 0.43\ (0.06)$
$\alpha_3 = -0.02\ (0.00)$
$\gamma = -0.22\ (0.05)$
$\beta_1 = -0.74\ (0.01)$
$\beta_2 = -0.26\ (0.04)$

Regression Statistics

R^2	0.25	S.E. of regression	0.011
Adjusted R^2	0.22	Durbin-Watson	2.39
Sample: 1986Q1 - 2018Q2			

1.8.18 Mining investment deflator

$$\Delta pibre_t = \alpha_0 + \gamma\,[pibre_{t-1} - pc_{t-1}] + \alpha_1 \Delta pc_t + (1 - \alpha_1)\Delta pibre_{t-1} + \alpha_2 D_{2000Q4} + \alpha_3 D_{2001Q1} + \alpha_4 D_{2001Q2} + \alpha_5 D_{2001Q3} \quad (105)$$

where

$\alpha_0 = 0.00\ (0.00)$
$\alpha_1 = 0.72\ (0.11)$
$\alpha_2 = 0.09\ (0.01)$
$\alpha_3 = -0.13\ (0.01)$
$\alpha_4 = 0.03\ (0.01)$
$\alpha_5 = 0.04\ (0.00)$
$\gamma = -0.09\ (0.03)$

Regression Statistics

R^2	0.83	S.E. of regression	0.007
Adjusted R^2	0.82	Durbin-Watson	1.86
Sample: 1990Q1 - 2018Q2			

1.8.19 Public demand deflator

$$\Delta pg_t = \alpha_0 + \gamma \left[pg_{t-1} - pc_{t-1} \right] + \alpha_1 \Delta pg_{t-1} + (1 - \alpha_1) \Delta pc_t + \varepsilon_t \tag{106}$$

where

$\alpha_0 = 0.00\ (0.00)$ $\alpha_1 = -0.32\ (0.12)$ $\gamma = -0.06\ (0.02)$

Regression Statistics

R^2	0.13	S.E. of regression	0.011
Adjusted R^2	0.11	Durbin-Watson	2.18
Sample: 1986Q1 - 2018Q2			

1.8.20 Exports deflator

$$PX_t \equiv \frac{NX_t}{X_t} \times 100 \tag{107}$$

1.8.21 Private business investment deflator

$$PIB_t \equiv \frac{NIB_t}{IB_t} \times 100 \tag{108}$$

1.8.22 Domestic final demand deflator

$$PDFD_t \equiv \frac{NDFD_t}{DFD_t} \times 100 \tag{109}$$

1.8.23 Gross national expenditure deflator

$$PGNE_t \equiv \frac{NGNE_t}{GNE_t} \times 100 \tag{110}$$

1.8.24 Gross domestic product deflator

$$PY_t \equiv \frac{NY_t}{Y_t} \times 100 \tag{111}$$

1.8.25 Resource exports deflator

$$\begin{aligned} \Delta pxre_t = &\alpha_0 + \gamma \left[pxre_{t-1} - wpcom_{t-1} + nusd_{t-1} \right] + \alpha_1 \Delta nusd_{t-1} + \\ &\alpha_2 \Delta wpcom_t + (1 - \alpha_2) pi\_e_t / 400 + \varepsilon_t \end{aligned} \tag{112}$$

where

$\alpha_0 = -0.02\ (0.01)$ $\alpha_2 = 0.95\ (0.02)$
$\alpha_1 = -0.92\ (0.04)$ $\gamma = -0.11\ (0.05)$

Regression Statistics

R^2	0.94	S.E. of regression	0.016
Adjusted R^2	0.94	Durbin-Watson	2.08
Sample: 1985Q4 - 2018Q2			

1.8.26 Manufactured exports deflator

$$\Delta pxm_t = \alpha_0 + \gamma \left[pxm_{t-1} - \beta_1 pc_{t-1} - (1-\beta_1)pm_{t-1} - \beta_2 PXMTREND_t\right] + \alpha_1 \Delta pm_{t-1}(1-\alpha_1)pi\_e_t/400 \quad (113)$$

where PXMTREND is a linear trend between 1986Q1 and 2000Q4 and constant thereafter and

$\alpha_0 = 0.05\ (0.02)$ $\gamma = -0.13\ (0.03)$
$\alpha_1 = 0.66\ (0.05)$ $\beta_1 = -0.27\ (0.05)$

Regression Statistics

R^2	0.72	S.E. of regression	0.011
Adjusted R^2	0.70	Durbin-Watson	2.18
Sample: 1986Q1 - 2018Q2			

1.8.27 Services exports deflator

$$\Delta pxs_t = \alpha_0 + \gamma \left[pxs_{t-1} - pc_{t-1} - \beta_1 PXSTREND_t - \beta_2 PXSTREND2_t\right] + \alpha_1 \Delta pc_t + (1-\alpha_1)\Delta pxs_{t-1} + \varepsilon_t \quad (114)$$

where PXSTREND is a kinked linear trend that increases between 1986Q1 and 2000Q4 and is constant thereafter and PXSTREND2 is a kinked linear trend that is constant before 2000Q4 and increasing thereafter.

$\alpha_0 = 0.05\ (0.01)$ $\gamma = -0.34\ (0.08)$ $\beta_2 = -0.03\ (0.01)$
$\alpha_1 = 0.88\ (0.08)$ $\beta_1 = -0.24\ (0.01)$

Regression Statistics

R^2	0.44	S.E. of regression	0.001
Adjusted R^2	0.42	Durbin-Watson	2.24
Sample: 1986Q1 - 2018Q2			

1.8.28 Other exports deflator

$$\Delta pxo_t = \alpha_0 + \gamma\left[pxo_{t-1} - \beta_1 pc_{t-1} - (1-\beta_1)(wpcom_{t-1} - nusd_{t-1})\right] + \alpha_1 \Delta pc_t + (1-\alpha_1)(\Delta wpcom_t - \Delta nusd_t) + \varepsilon_t \quad (115)$$

where

$\alpha_0 = 0.00\ (0.00)$ $\quad\gamma = -0.15\ (0.04)$
$\alpha_1 = 0.55\ (0.04)$ $\quad\beta_1 = 0.76\ (0.09)$

Regression Statistics

R^2	0.48	S.E. of regression	0.038
Adjusted R^2	0.46	Durbin-Watson	2.06
Sample: 1990Q1 - 2018Q2			

1.8.29 Agricultural exports deflator

$$\Delta pxag_t = \alpha_0 + \gamma\left[pxag_{t-1} - wpag_{t-1} + nusd_{t-1}\right] + \alpha_1 \Delta nusd_t + \alpha_2 \Delta wpag_t + \alpha_3 \Delta wpag_{t-1} - (1-\alpha_2-\alpha_3) pi\_e_{t-1}/400 + \varepsilon_t \quad (116)$$

where

$\alpha_0 = -0.01\ (0.00)$ $\quad\alpha_2 = 0.27\ (0.04)$ $\quad\gamma = -0.04\ (0.02)$
$\alpha_1 = -0.57\ (0.05)$ $\quad\alpha_3 = 0.31\ (0.06)$

Regression Statistics

R^2	0.70	S.E. of regression	0.021
Adjusted R^2	0.69	Durbin-Watson	1.87
Sample: 1985Q2 - 2018Q2			

1.8.30 Ownership transfer costs deflator

$$\Delta potc_t = \alpha_0 + \gamma \left[potc_{t-1} - pc_{t-1} - \beta_1 POTCTREND - \beta_2 POTCTREND2\right] + pi\_e_{t-1}/400 + \varepsilon_t \tag{117}$$

where POTCTREND is a kinked linear trend that increases before 2007Q4 and is constant thereafter and POTCTREND2 is a kinked linear trend that is constant before 2007Q4 and increasing thereafter and

$\alpha_0 = -0.33\ (0.07)$ $\beta_1 = -1.61\ (0.08)$
$\gamma_1 = -0.30\ (0.06)$ $\beta_2 = -0.18\ (0.11)$

Regression Statistics

R^2	0.16	S.E. of regression	0.041
Adjusted R^2	0.14	Durbin-Watson	2.18
Sample: 1990Q1 - 2018Q2			

1.8.31 Terms of trade

$$TOT_t \equiv \frac{PX_t}{PM_t} \times 100 \tag{118}$$

1.9 The Labour Market

1.9.1 Employment

$$\begin{aligned}\Delta le_t = &\alpha_0 + \gamma \left[le_{t-1} - y_{t-1} + 0.4 \times (rlc_{t-1} - tlla_{t-1}) + tlla_{t-1} + tllhpp_{t-1}\right] \\ &\alpha_1 \Delta le_{t-1} + \alpha_2 \Delta y_t + \alpha_3 \Delta y_{t-1} + \alpha_4 \Delta(rlc_t - tdlla_{t-1}) + \alpha_5 D_{2003Q2} \\ &- (\alpha_2 + \alpha_3)(tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) \\ &+ (1 - \alpha_1) tdllpop_{t-1} + \varepsilon_t\end{aligned} \tag{119}$$

where

$\alpha_0 = 0.10\ (0.03)$ $\alpha_3 = 0.09\ (0.04)$ $\gamma = -0.05\ (0.01)$
$\alpha_1 = 0.49\ (0.06)$ $\alpha_4 = -0.17\ (0.07)$
$\alpha_2 = 0.18\ (0.08)$ $\alpha_5 = -0.01\ (0.00)$

Regression Statistics

R^2	0.57	S.E. of regression	0.003
Adjusted R^2	0.55	Durbin-Watson	2.12
Sample: 1980Q1 - 2018Q2			

This equation is estimated using two stage least squares. The instruments used are: le_{t-1}, y_{t-1}, rlc_{t-1}, $tlla_{t-1}$, $tllhpp_{t-1}$, Δle_{t-1}, Δy_{t-1}, $tdlla_{t-1}$, $tdllpop_{t-1}$, $tdllhpp_{t-1}$, Δrlc_{t-1}, ΔLUR_{t-1}, ΔLUR_{t-2}, Δle_{t-2}, Δrlc_{t-1}, D_{2003Q2}.

1.9.2 Unemployment rate

The unemployment equation is estimated via maximum likelihood using a state space model. The signal equation is:

$$\Delta LUR_t = LOKLAG_t \times \Delta LUR_{t-1} + \alpha_1(\Delta_2 y_t/2 - ty_t) + \alpha_2 2\Delta_2 rulc_{t-2}/2 + \varepsilon_t \quad (120)$$

The state equations are:

$$LOKLAG_t = LOKLAG_{t-1} + \omega_t$$

$$ty_t = ty_{t-1} + \mu_t$$

where

$\alpha_1 = -20.04\ (3.33)$ $\qquad$ $\alpha_2 = 8.34\ (2.07)$

Regression Statistics

R^2	0.51	S.E. of regression	0.23
Adjusted R^2	0.51	Durbin-Watson	2.04
Sample: 1960Q3 - 2018Q2			

The state variable LOKLAG evolves according to:

$$LOKLAG_t = LOKLAG_{t-1} + \varepsilon_t \quad (121)$$

The state variable TY evolves according to:

$$\begin{aligned} ty_t = & tdlla_t + tdllpop_t + tdllhpp_t \\ & + 0.95 \times (ty_{t-1} - tdlla_{t-1} + tdllpop_{t-1} + tdllhpp_{t-1}) + \varepsilon_t \end{aligned} \quad (122)$$

1.9.3 Non-Accelerating Inflation Rate of Unemployment

$$TLUR_t = TLUR_{t-1} + \varepsilon_t \quad (123)$$

1.9.4 Unemployment gap

$$LURGAP_t \equiv LUR_t - TLUR_t \quad (124)$$

1.9.5 Labour force

$$LF_t \equiv LE_t/(1 - LUR_t/100) \quad (125)$$

1.9.6 Labour force participation rate

$$LPR_t \equiv LF_t/LPOP_t \tag{126}$$

1.9.7 Working age population

$$\Delta lpop_t = tdllpop_t - 0.005 \times (lpop_{t-1} - tllpop_{t-1}) + \varepsilon_t \tag{127}$$

1.10 Interest and Exchange Rates

1.10.1 Cash Rate

$$\begin{aligned} NCR_t = & 0.7 \times NCR_{t-1} + \\ & 0.3 \times \left[RSTAR_t + 2 \times \left(\frac{PTM_t}{PTM_{t-1}} \times 100 - 100 \right) - \bar{\pi} - 2 \times LURGAP_t \right] \\ & - \Delta_2 LUR_t + \varepsilon_t \end{aligned} \tag{128}$$

1.10.2 Real cash rate

$$RCR_t \equiv 100 \times \left(\frac{1 + NCR_t/100}{PTM_t/PTM_{t-4}} \right) - 100 \tag{129}$$

1.10.3 Nominal 2-year bond yield

$$N2R_t = \alpha_1 N2R_{t-1} + (1 - \alpha_1)\left(\alpha_2 + RSTAR_t + pi\_e_t + 0.52 \times (NCR_t - RSTAR_t - pi\_e_t)\right) + \varepsilon_t \tag{130}$$

where

$\alpha_1 = 0.83\ (0.07)$ $\alpha_2 = -0.15\ (0.30)$

Regression Statistics

R^2	0.93	S.E. of regression	0.497
Adjusted R^2	0.93	Durbin-Watson	1.14
Sample: 1993Q1 - 2018Q2			

1.10.4 Real 2-year bond yield

$$R2R_t \equiv 100 \times \left(\frac{1 + N2R_t/100}{PTM_t/PTM_{t-4}} \right) - 100 \tag{131}$$

1.10.5 Nominal 10-year bond yield

$$N10R_t = \alpha_0 N10R_{t-1} + (1-\alpha_0)\left(\alpha_1 + RSTAR_t + pi\_e_t + 0.25*(NCR_t - RSTAR_t - pi\_e_t)\right) + \varepsilon_t \quad (132)$$

$\alpha_0 = 0.90\ (0.07)$ $\alpha_1 = 0.16\ (0.43)$

Regression Statistics

R^2	0.94	S.E. of regression	0.44
Adjusted R^2	0.94	Durbin-Watson	1.24
Sample: 1993Q1 - 2018Q2			

1.10.6 Nominal business rate

$$NBR_t \equiv NCR_t + NBRSP_t \quad (133)$$

1.10.7 Nominal business rate spread

$$NBRSP_t = \alpha_0 + \alpha_1 NBRSP_{t-1} + \alpha_2 LURGAP_t \quad (134)$$

where

$\alpha_0 = 0.45\ (0.14)$ $\alpha_1 = 0.79\ (0.07)$ $\alpha_2 = 0.09\ (0.04)$

Regression Statistics

R^2	0.91	S.E. of regression	0.21
Adjusted R^2	0.91	Durbin-Watson	2.13
Sample: 1993Q1 - 2018Q2			

1.10.8 Real business rate

$$RBR_t \equiv 100 * \left(\frac{(1-CTR_t)NBR_t/100}{PTM_t/PTM_{t-4}}\right) - 100 \quad (135)$$

1.10.9 Mortgage rate spread

$$NSP_t = (1-\alpha_2)(\alpha_0 + \alpha_1 D_{t<2008Q1}) + \alpha_2 NSP_{t-1} \quad (136)$$

where

$\alpha_0 = 3.69\ (0.10)$ $\alpha_1 = -1.86\ (0.10)$ $\alpha_2 = 0.91\ (0.02)$

Regression Statistics

R^2	1.00	S.E. of regression	0041
Adjusted R^2	1.00	Durbin-Watson	1.68
Sample: 1998Q1 - 2018Q2			

1.10.10 Nominal mortgage rate

$$NMR_t \equiv NCR_t + NSP_t \tag{137}$$

1.10.11 Real mortgage rate

$$RMR_t \equiv 100 * \left(\frac{1 + NMR_t/100}{PTM_t/PTM_{t-4}} \right) - 100 \tag{138}$$

1.10.12 Neutral interest rate

$$RSTAR_t = 0.95 \times RSTAR_{t-1} + 0.05 \times \overline{RSTAR} + \varepsilon_t \tag{139}$$

where $\overline{RSTAR}$ is the long-run steady state of the neutral interest rate.

1.10.13 Real trade-weighted index

$$\begin{aligned}\Delta rtwi_t =& \alpha_0 + \gamma \left[rtwi_{t-1} - \beta_1 tot_{t-1} + 3.5 \left(WRSP_{t-1} - W\bar{R}SP \right) /100 \right] \\ &+ \alpha_1 \Delta tot_t - 5 \Delta WR2SP_t/100 + \varepsilon_t \end{aligned} \tag{140}$$

where $\overline{WRSP}$ is the long-run steady state of the spread between Australian and overseas 2-year government bond yields and

$\alpha_0 = 0.43\ (0.13)$ $\gamma = -0.22\ (0.06)$
$\alpha_1 = 0.22\ (0.11)$ $\beta_1 = 0.65\ (0.06)$

Regression Statistics

R^2	0.24	S.E. of regression	0.04
Adjusted R^2	0.22	Durbin-Watson	1.65
Sample: 1990Q1 - 2018Q2			

1.10.14 Nominal trade-weighted index

$$\Delta ntwi_t \equiv \Delta rtwi_t + \Delta wp_t - \Delta ptm_t \tag{141}$$

1.10.15 Nominal AUD/USD exchange rate

$$\Delta nusd_t = \Delta ntwi_t + \varepsilon_t \tag{142}$$

1.10.16 Real export weighted exchange rate

$$REWI_t = \frac{RTWI_t}{RTWI_{t-1}} \times REWI_{t-1} + \varepsilon_t \tag{143}$$

1.11 World

1.11.1 Major trading partner GDP

$$\Delta wy_t = \overline{tdllpop} + \overline{tdlla} + 0.9 \times (\Delta wy_{t-1} - (\overline{tdllpop} + \overline{tdlla})) + \varepsilon_t \tag{144}$$

1.11.2 Major trading partner CPI

$$\Delta wp_t = 0.1 \times \overline{\pi}/400 + 0.9 \times \Delta wp_{t-1} \tag{145}$$

1.11.3 World export price

$$\Delta wpx_t = 0.25 \times \Delta wpx_{t-1} + 0.75 \times \Delta wp_{t-1} \tag{146}$$

1.11.4 World agricultural price

$$\Delta wpag_t = \alpha_0 + \gamma\,[wpag_{t-1} - wp_{t-1}] + \alpha_1 \Delta wpag_{t-1} + (1-\alpha_1) * pi\_e_t/400 + \varepsilon_t \tag{147}$$

where

$\alpha_0 = -0.03\ (0.01)$ $\alpha_1 = 0.38\ (0.09)$ $\gamma = -0.06\ (0.02)$

Regression Statistics

R^2	0.16	S.E. of regression	0.06
Adjusted R^2	0.15	Durbin-Watson	1.98
Sample: 1985Q1 - 2018Q2			

1.11.5 World commodity price

$$\Delta wpcom_t = 0.2 \times \Delta_4 wpcom_{t-1}/4 + 0.8 \times \overline{\pi}/400 + -0.05 \times [wpcom_{t-1} - wp_{t-1} - \overline{rwpcom}] + \varepsilon_t \tag{148}$$

where $\overline{rwpcom}$ is the long run steady state real world price of commodities.

1.11.6 World oil price

$$\Delta wpoil_t = \alpha_0 + \gamma \left[wpoil_{t-1} - wp_{t-1} \right] + \alpha_1 \Delta wpoil_{t-1} + (1 - \alpha_1) * pi\_e_t / 400 + \varepsilon_t \quad (149)$$

where

$\alpha_0 = -0.06\ (0.04)$ $\alpha_1 = 0.23\ (0.08)$ $\gamma = -0.05\ (0.03)$

Regression Statistics

R^2	0.06	S.E. of regression	0.15
Adjusted R^2	0.05	Durbin-Watson	1.90
Sample: 1985Q1 - 2018Q2			

1.11.7 World real policy rate

$$WRR = 0.95 \times WRR_{t-1} + 0.05 \times \overline{WRR} + \varepsilon_t \quad (150)$$

where $\overline{WRR}$ is the long-run steady state of the world real interest rate.

1.11.8 World real policy rate spread to the real cash rate

$$WRSP_t \equiv WRR_t - RCR_t \quad (151)$$

1.11.9 World real two-year rate

$$WR2R = WRR + 0.99 \times (WR2R_{t-1} - WRR_t) + 0.01 \times \overline{WR2GAP} + \varepsilon_t \quad (152)$$

where $\overline{WR2GAP}$ is the long-run steady state of the spread between the world real policy rate and the world two-year government bond rate.

2 The Model Variables

Name	Description
pi_e	Trend inflation expectations
AT	Net asset transfers between private and public sectors
DFD	Domestic final demand
$DFDX$	Domestic final demand plus exports
EQ_E	Expected firm earnings
G	Public demand
GC	Public consumption
GI	Public investment
GNE	Gross national expenditure
$HCOE$	Compensation of employees
HDY	Household disposable income
HNW	Household net worth
HOY	Household other income
IAD	Import-adjusted demand
IB	Private business investment
$IBCR$	Firms' cost of capital
$IBCTR$	Corporate tax rate
$IBDSR$	Debt share of firms' funding
$IBEY$	Stock price-to-earnings yield
IBN	Real private non-mining investment
$IBNDR$	Non-mining capital depreciation rate
$IBPER$	Stock price-to-earnings ratio
$IBRE$	Real mining investment
$IBREDR$	Mining capital depreciation rate
ID	Dwelling investment
$IDDR$	Dwelling stock depreciation rate
$KIBN$	Non-mining capital stock
$KIBRE$	Mining capital stock
KID	Dwelling stock
$KIDC$	Consumption of fixed capital
KV	Stock of inventories
LE	Employment
LF	Labour force
$LOKLAG$	Coefficient on lagged unemployment rate in Okun's law equation
$LPOP$	Working age population
LPR	Labour force participation rate
LUR	Unemployment rate
$LURGAP$	Unemployment gap
M	Import volumes
$N2R$	Nominal two-year government bond yield
$N10R$	Nominal ten-year government bond yield
NAT	Nominal net asset transfers between the public and private sectors
NBR	Nominal business borrowing rate

$NBRSP$	Nominal business borrowing rate spread to the cash rate
NC	Nominal household consumption expenditure
NCR	Nominal cash rate
$NDFD$	Nominal domestic final demand
NG	Nominal public demand
$NGNE$	Nominal gross national expenditure
NHA	Nominal household assets
NHC	Nominal household credit
$NHCL$	Household debt to financial sector
$NHCOE$	Nominal compensation of employees
$NHDY$	Nominal household disposable income
$NHFA$	Nominal household financial assets
NHL	Nominal household liabilities
$NHNFA$	Nominal household non-financial assets
$NHNW$	Nominal household net worth
$NHOL$	Nominal household other debt
$NHOY$	Nominal household other income
NHS	Nominal household saving
$NHSR$	Household saving ratio
NIB	Nominal private business investment
$NIBN$	Nominal private non-mining business investment
$NIBRE$	Nominal mining investment
NID	Nominal dwelling investment
NM	Nominal imports
NMR	Nominal mortgage rate
$NOTC$	Nominal ownership transfer costs
NSD	Nominal statistical discrepancy
NSP	Spread between nominal mortgage rate and cash rate
$NTWI$	Nominal trade-weighted index
$NULC$	Nominal unit labour costs
$NULCBS$	Nominal unit labour costs (Balassa-Samuaelson adjusted)
$NUSD$	Nominal AUD-US dollar exchange rate
NV	Nominal change in inventories
NX	Nominal exports
$NXAG$	Nominal agricultural exports
NXM	Nominal manufactured exports
NXO	Nominal other exports
$NXRE$	Nominal resource exports
NXS	Nominal services exports
NY	Nominal gross domestic product
OTC	Ownership transfer costs
P	Consumer price index
PAE	Average earnings national accounts
PC	Household consumption deflator
$PDFD$	Domestic final demand deflator
$PEQI$	Market price of equities
PEX	Consumer price index - ex volatile items

PG	Public demand deflator
$PGNE$	Gross national expenditure deflator
PH	Housing prices
PIB	Private business investment deflator
$PIBN$	Private non-mining investment deflator
$PIBRE$	Mining investment deflator
PID	Dwelling investment deflator
PM	Import price deflator
$PMCG$	Import price deflator for consumer import goods
$POIL$	Oil price in Australian dollars
$POTC$	Ownership transfer costs deflator
PRT	Consumer price index rents
PTM	Trimmed mean consumer price index
PW	Wage price index
PX	Export price index
$PXAG$	Agricultural export deflator
PXM	Manufactured exports deflator
PXO	Other exports deflator
$PXRE$	Resources exports deflator
PXS	Services exports deflator
PY	GDP deflator
$R2R$	Real two-year bond yield (ex-post)
RBR	Real business borrowing rate
RC	Real household consumption
RCR	Real cash rate (ex-post)
$REWI$	Real export-weighted exchange rate
RLC	Real labour costs
RMR	Real mortgage rate (ex-post)
RPH	Real housing prices
$RSTAR$	Neutral interest rate
$RTWI$	Real trade-weighted index
$RULC$	Real unit labour costs
SD	Statistical discrepancy
$THPP$	Log of trend average hours worked
$TLLA$	Log of trend labour productivity
$TPOP$	Log of trend population
$TDLLHPP$	Trend change in average hours worked per employee
$TDLLA$	Trend labour productivity growth
$TDLLPOP$	Trend population growth
$TLUR$	Non-accelerating Inflation Rate of Unemployment (NAIRU)
TOT	Terms of trade
TY	Trend growth in the Okun's law equation
V	Real change in inventories
WP	Major trading partner consumer price index
$WPAG$	World agricultural price index
$WPCOM$	RBA commodity price index in US dollars
$WPOIL$	World oil price

WPX	World export price
$WR2R$	World real two-year rate
WRR	World real policy rate
$WRSP$	Real cash rate to real world policy rate spread
WY	Major trading partner GDP
X	Export volumes
XAG	Agricultural export volumes
XM	Manufactured export volumes
XM_C	Manufactured export volumes time-varying constant
XO	Other export volumes
XRE	Resource export volumes
XRE_C	Resource export volumes time-varying constant
XS	Services export volumes
XS_C	Services export volumes time-varying constant
Y	Real gross domestic product

3 Equilibrium Errors

The figures below plot the equilibrium errors from MARTIN's key error correction equations.

Figure 1: Equilibrium errors

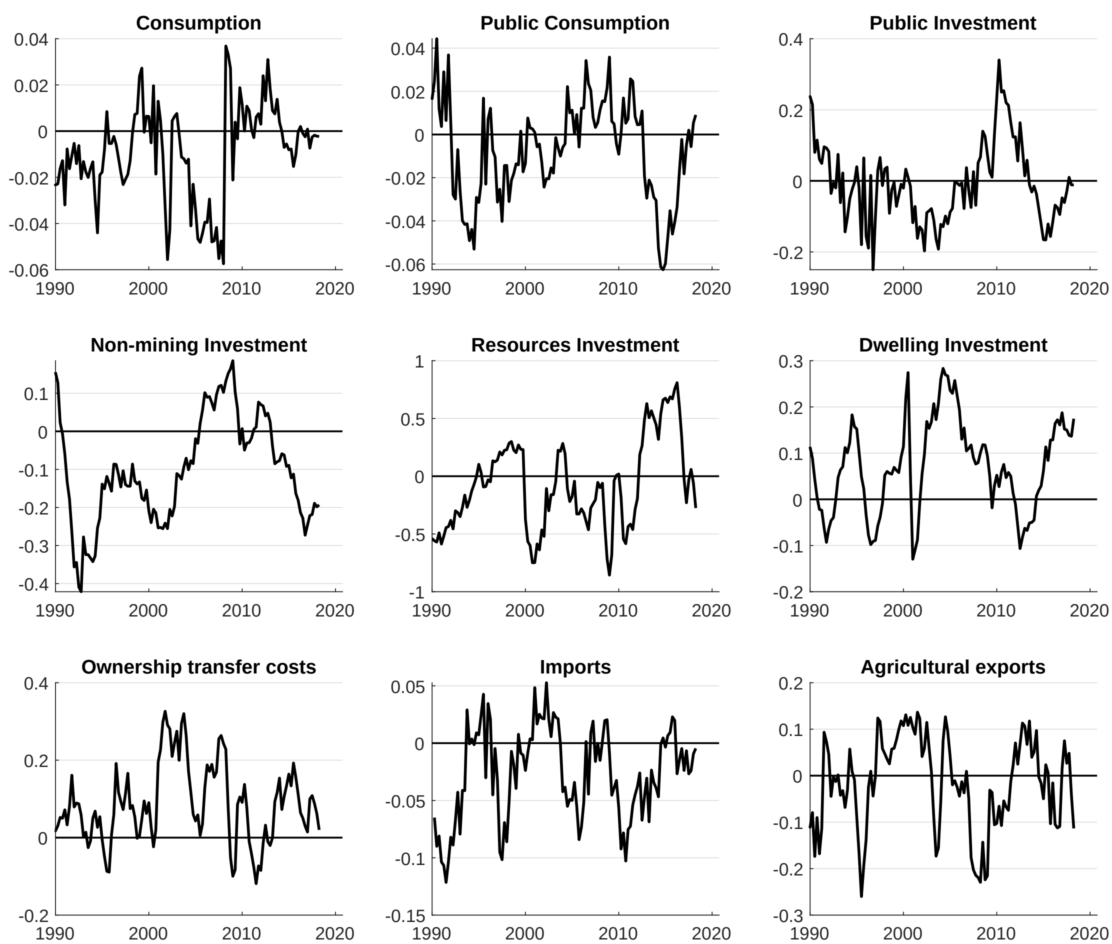

Figure 1: Equilibrium errors cont.

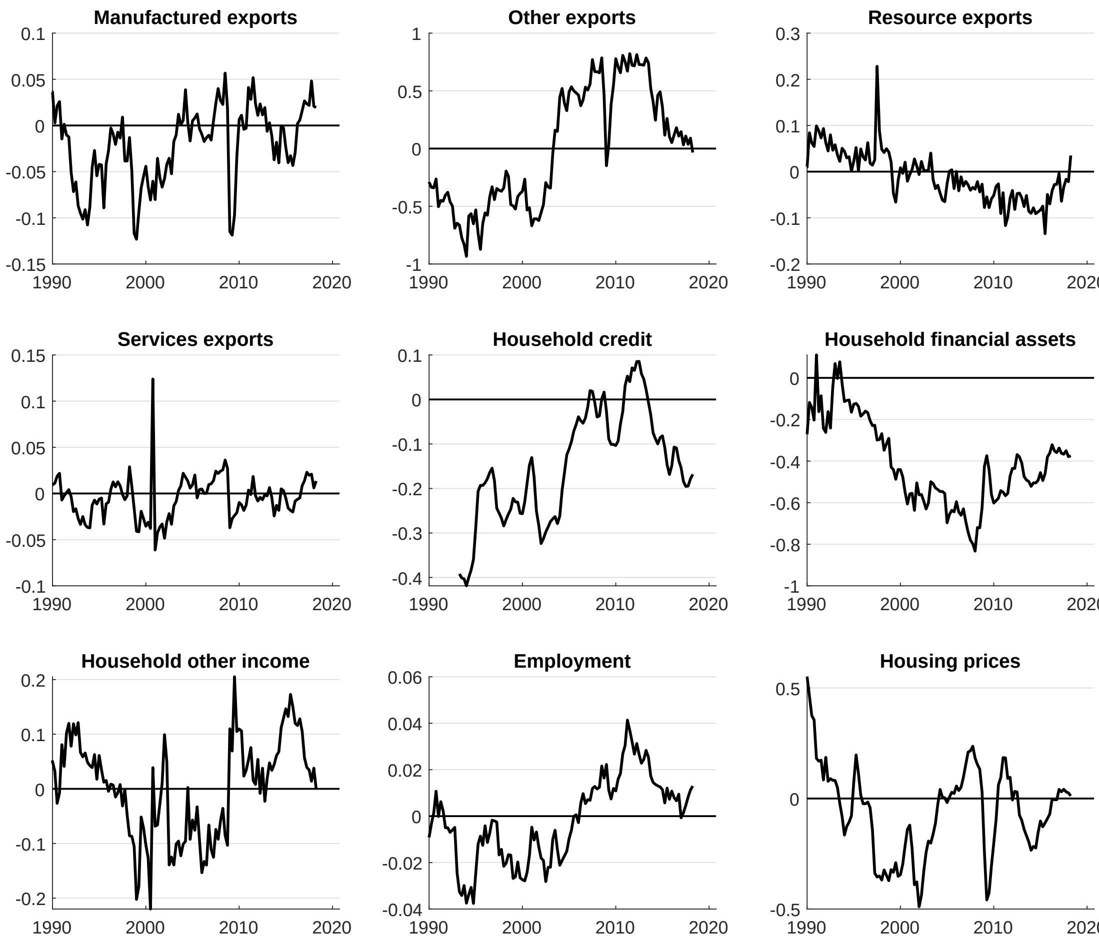

Figure 1: Equilibrium errors cont.