Australian Government
Department of the Prime Minister and Cabinet

Estimating Equilibrium Labour Underutilisation in Australia

Timothy Watson and Leanne Neo
Department of the Prime Minister and Cabinet
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1. Motivation

Milton Friedman (1968):

- Natural rate of unemployment: The equilibrium level of unemployment consistent with real wages growing in line with productivity
  - Taking into account the structural characteristics of labour and commodity markets including the efficiency of search and matching in the labour market

1. Motivation

Paul Krugman (May 6, 2018)

- 'Is the natural rate hypothesis dead? Maybe. Probably'

Olivier Blanchard (JEP, Winter 2018)

- 'Policymakers should keep the natural rate hypothesis as their null hypothesis, but keep an open mind and put some weight on the alternatives'

1. Motivation

- To develop a new method of deriving equilibrium labour underutilisation for Australia consistent with Friedman's (1968) idea of the `natural rate'
- Why?
  - Policy-makers continue to use variants of the Gruen, Pagan, Thomson (1999) Phillips curve for policy analysis. Almost two decades on, is this still the best approach?
  - To explore some of the factors that may drive equilibrium underutilisation
  - To help inform macroeconomic policy

2. The Phillips curve and the Beveridge Curve

- Many empirical strategies have been proposed in the literature to derive the equilibrium unemployment rate, or closely related Non-accelerating Inflation Rates of Unemployment (NAIRUs)

    1. Phillips curve based approaches
    2. Beveridge curve based approaches
    3. SVARs with long-run restrictions
    4. Other system of equations or model based methods

- Our approach combines the Phillips curve and Beveridge curve literatures.
    - We derive the equilibrium underutilisation rate as a common factor in a linear Gaussian state space system including both the Phillips curve and the Beveridge curve

2. Phillips curve approaches

- Time varying NAIRU (see Layard *et al.*, 1991; and Gordon, 2011)

$$w\downarrow t = p\downarrow t\uparrow e + \beta\downarrow 1\ (U\downarrow t\uparrow * - U\downarrow t\ ) + \beta\downarrow 2\ Z\downarrow t + e\downarrow t$$

$$U\downarrow t\uparrow * = U\downarrow t-1\uparrow * + v\downarrow t$$

Where $e\downarrow t \sim N(0,\sigma\downarrow e\uparrow 2\ )$ and $v\downarrow t \sim N(0,\sigma\downarrow v\uparrow 2\ )$

$Z\downarrow t = 0$ and $w\downarrow t = p\downarrow t\uparrow e \Longrightarrow U\downarrow t\uparrow * = U\downarrow t$

2. Australian applications

- Gruen, Pagan and Thompson (1999)

$$\Delta_4 lnULC_t - \Delta_4 LnP_{t-1} = \alpha_0 (\Delta_4 p_t^e - \Delta_4 LnP_{t-2}) + \alpha_1 (MA_4(U_t) - U_t^* / MA_4(U_t)) + \alpha_1 (\Delta MA_4(U_t) / MA_4(U_t)) + \alpha_2 (\Delta_4 lnULC_{t-1} - \Delta_4 LnP_{t-2}) + \alpha_2 (\Delta_4 lnULC_{t-1} - \Delta_4 LnP_{t-2}) + e_t$$

$$U_t^* = U_{t-1}^* + v_t \text{ where } e_t \sim N(0, \sigma_e^2) \text{ and } v_t \sim N(0, \sigma_v^2)$$

- Convoluted definition of labour market equilibrium, identification issues and imprecise estimation
- Matching efficiency in the labour market is left out *contra* Friedman (1968)
- Missing deflation- Unemployment is consistently above the NAIRU despite relatively stable inflation

2. Australian applications

- Lim, Dixon, Tsiaplias (2009)(1999)

$$w_t = \beta_{0,t} + p_t^e + h_t + \beta_{1,t} U_t + e_t$$

$$\boldsymbol{\beta}_t = \boldsymbol{\beta}_{t-1} + \boldsymbol{v}_t$$

$$e_t \sim N(0, \sigma_e^2) \text{ and } v_t \sim N(0, \Omega)$$

Where $p_t = p_t^e$ and $w_t - h_t - p_t = 0$

$$U_t^* = \beta_{0,t} / \beta_{1,t}$$

- U_t^* could be I(0) contradicting the presumption that U_t^* summarises the non-transitory component of U_t
- Efficiency of matching left out
- The Phillips curve is imprecisely estimated, especially relative to the Beveridge curve

2. Beveridge Curve approaches

- Fahrer and Pease (1993): Equate labour market inflows and outflows. Set vacancy rate equal to a period average and solve for $U{\downarrow}t{\uparrow}*$
- Groenewold (2003) and Kennedy *et al.* (2008). Estimate Beveridge curve, set vacancies to a value consistent with `output near potential', and solve for $U{\downarrow}t{\uparrow}*$
  - Aggregate labour market equilibrium? All points on the Beveridge curve describe an `equilibrium' mapping between unemployment and vacancies. However, what about wage/ price setting and productivity?
  - `Equilibrium' vacancy rates are arbitrarily selected.

2. Jointly estimating the Phillips and Beveridge curves

- Dickens (2009) proposes a method to jointly estimate a standard expectations augmented price Phillips curve with the Beveridge curve
- If the shifts in the Beveridge curve reflect changes in the efficiency of matching in the labour market, then these shifts should provide information useful for identifying the natural rate of unemployment
  - However, the relationship between real wages and productivity is not explicitly modelled *contra* Friedman (1968)
  - On average not necessarily an issue; however, can be long periods of time where growth in nominal unit labour costs do not grow in line with price inflation

3(a). Model: The wage curve

$$w_t = p_t^e + h_t + \beta_1 (U_t^* - U_t) + e_{wt}$$

$$e_{wt} \sim N(0, \sigma_w^2)$$

$$p_t = p_t^e \text{ and } w_t - h_t - p_t = 0 \Rightarrow U_t^* = U_t$$

- w_t is the through-the-year growth in non-farm compensation per employee
- h_t is through-the-year growth in labour productivity (output per worker)
- Price expectations p_t^e are modelled as a weighted average of lagged wage inflation which I define as the difference between lagged through-the-year growth in wages and output per worker ($w_{t-1} - h_{t-1}$) and lagged through-the-year growth in consumer price index inflation (p_{t-1})
- U_t is the quarterly labour underutilisation (seasonally adjusted)

3(a). Model: the Beveridge curve

1. Relation between labour market flows:

$$s_t (1-U_t) = m_t F(U_t, V_t)$$

2. Cobb-Douglas matching technology

$$F(U_t, V_t) = V_t^{b} U_t^{1-b}$$

3. Substituting (2) into (1) and rearranging yields the Beveridge curve

$$(1-U_t)/U_t = (m_t/s_t)(V_t/U_t)^{b}$$

4. By the method of undetermined coefficients, equilibrium labour underutilisation is defined as a function of matching efficiency and the separation rate

$$U_t^{*} = \gamma_0 + \gamma_1 \ln(m_t/s_t)$$

5. Taking logs of both sides of (3) and substituting into (4)

$$\ln((1-U_t)/U_t) = \gamma_0/\gamma_1 + 1/\gamma_1 U_t^{*} + (V_t/$$

3(a). Model: Equilibrium conditions

$$p_t = p_t^e \text{ and } w_t - h_t - p_t = 0$$

$$U_t^* = U_t = \gamma_1 [\ln((1-U_t)/U_t) + \gamma_0/\gamma_1 + b(V_t/U_t)]$$

- When inflation is equal to expectations and real wages are growing in line with productivity growth, underutilisation is equal to equilibrium underutilisation (Friedman, 1968); and
- equilibrium underutilisation is proportional to the Beveridge curve residual in expectation scaled by parameter γ_1 (Blanchard and Diamond, 1989)

3(a). Model: System for estimation

Wage curve

$$w\downarrow t - h\downarrow t = \varphi(w\downarrow t-1 - h\downarrow t-1) + (1-\varphi)p\downarrow t-1 + \beta(U\downarrow t\uparrow * - U\downarrow t-1) + e\downarrow wt$$

Beveridge curve

$$\ln((1-U\downarrow t / U\downarrow t) = \delta + \gamma ln(V\downarrow t-1 / U\downarrow t-1) + \kappa U\downarrow t\uparrow * + e\downarrow bt$$

State equation

3(b). Estimation: State space representation

$$y_t = HU_t^* + Az_t + e_t$$

$$U_t^* = FU_{t-1}^* + v_t$$

$$e \sim i.i.d.N(0,R)$$

$$v_t \sim i.i.d.N(0,Q)$$

$$y_t = [w_t - h_t - p_{t-1} \ \ln((1-U_t)/U_t)]$$

$$H = [\beta \ \kappa] \quad A = \begin{bmatrix} 0 & \delta \\ \varphi & 0 \end{bmatrix} \begin{bmatrix} 0 & \beta \\ 0 & \gamma \end{bmatrix}$$

$$z_t = [\iota_T \ w_{t-1} - h_{t-1} - p_{t-1} \ U_{t-1} \ ln(V_{t-1}/U_{t-1})] \quad e_t = [e_{wt} \ e_{bt}]$$

3(b). Estimation: Implementation

- Kalman Filter/ Smoother algorithm.
- Initial conditions: Diffuse prior for $U\downarrow t\uparrow *$, and the standard errors from the following least squares regressions are used to initiate the covariance matrix of $U\downarrow t\uparrow *$ conditional on information up to time *t*-1 (the `prediction').

$$w\downarrow t - h\downarrow t - p\downarrow t-1 = \varphi(w\downarrow t-1 - h\downarrow t-1 - p\downarrow t-1) + \beta\downarrow 1 (U\downarrow t\uparrow hp1600 - U\downarrow t-1) + e\downarrow wt$$

$$\ln((1-U\downarrow t / U\downarrow t) = \delta + \gamma ln(V\downarrow t-1 / U\downarrow t-1) + \kappa U\downarrow t\uparrow HP1600 + e\downarrow bt$$

$$U\downarrow t = \beta\downarrow 0 + \beta\downarrow 1 U\downarrow t-1 + e\downarrow u$$

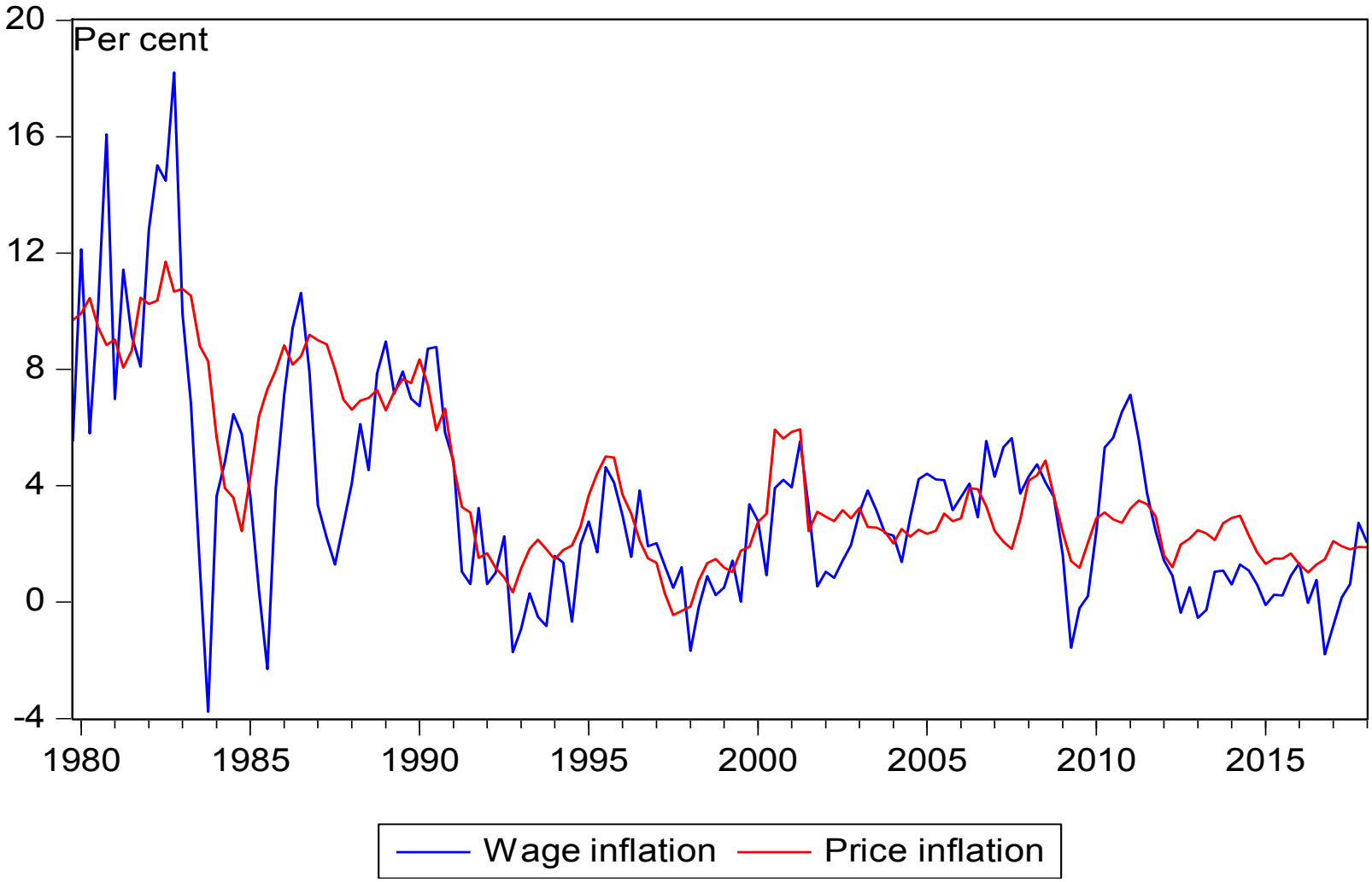
- Where observations are assumed to be normally distributed we can derive a prediction error ($\eta\downarrow t/t-1$) and its variance ($f\downarrow t/t-1$).
- Unknown parameters in *H* and *A* estimated by maximising:

$$lnL = -1/2 \sum t=1\uparrow T \ln(2\pi f\downarrow t/t-1) - \sum t=1\uparrow T \eta\downarrow t/t-1\uparrow' f\downarrow t/t-1\uparrow -1 \eta\downarrow t/t-1$$

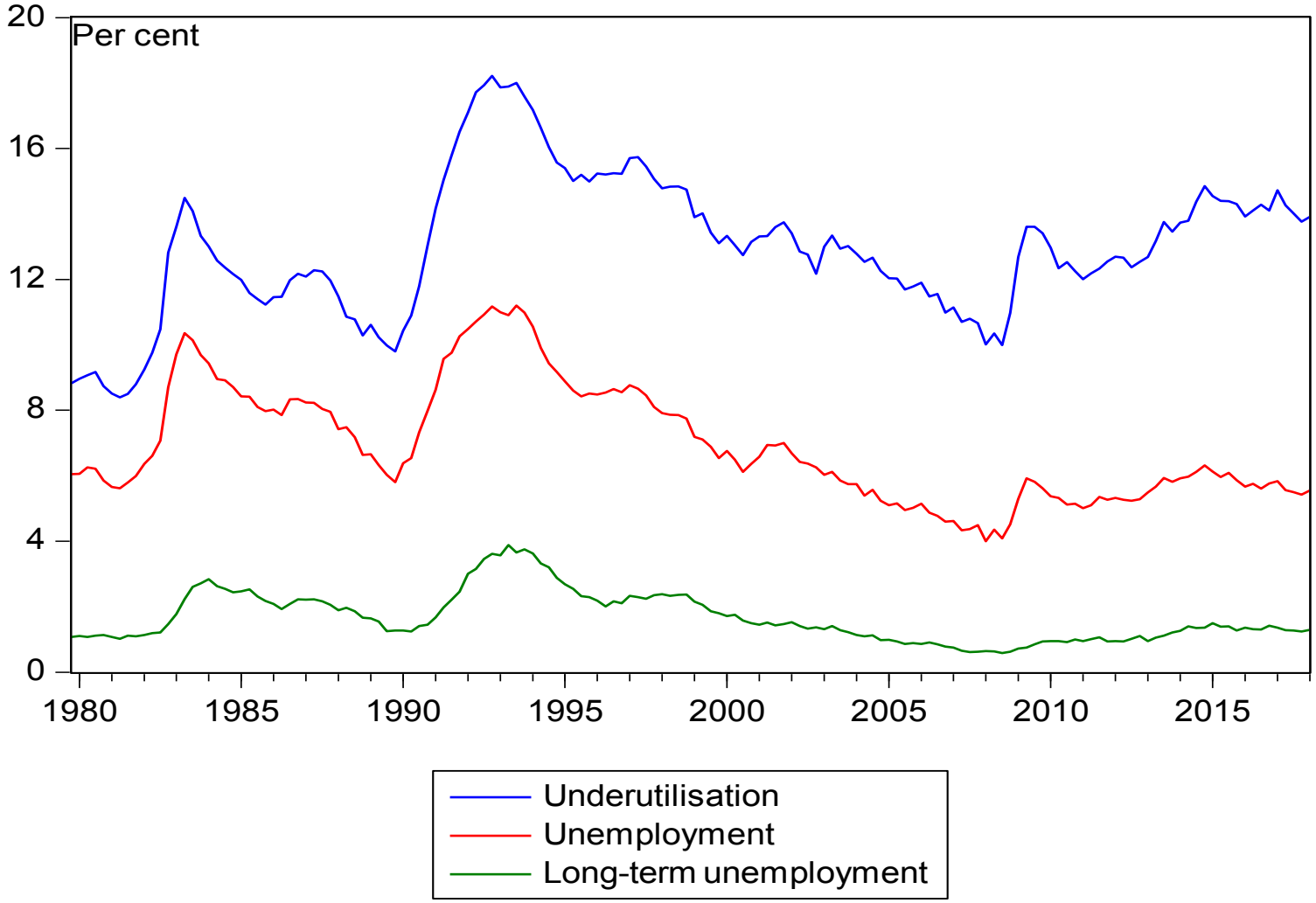
3(c). Data

- Sample period 1979:4 to 2018:1
- **ABS Consumer Price Index Database:** CPI, import price index
- **ABS Labour Force statistics:** Vacancy rate, unemployment and employment rates, labour force, hours worked, labour underutilisation
- **ABS National Accounts Database:** Non-farm average compensation per employee (AENA); Real GDP (CVM), GDP implicit price deflator, output per hour worked.
- **Bray (2013):** Historical Australian minimum wage series
- **Department of Social Services:** Historical unemployment benefit rates
- **Department of Jobs and Small Business:** Long-term unemployment rate (Connolly, 2016), enterprise bargaining and individual agreement coverage
- **Reserve Bank of Australia:** Real trade weighted index, official cash rate

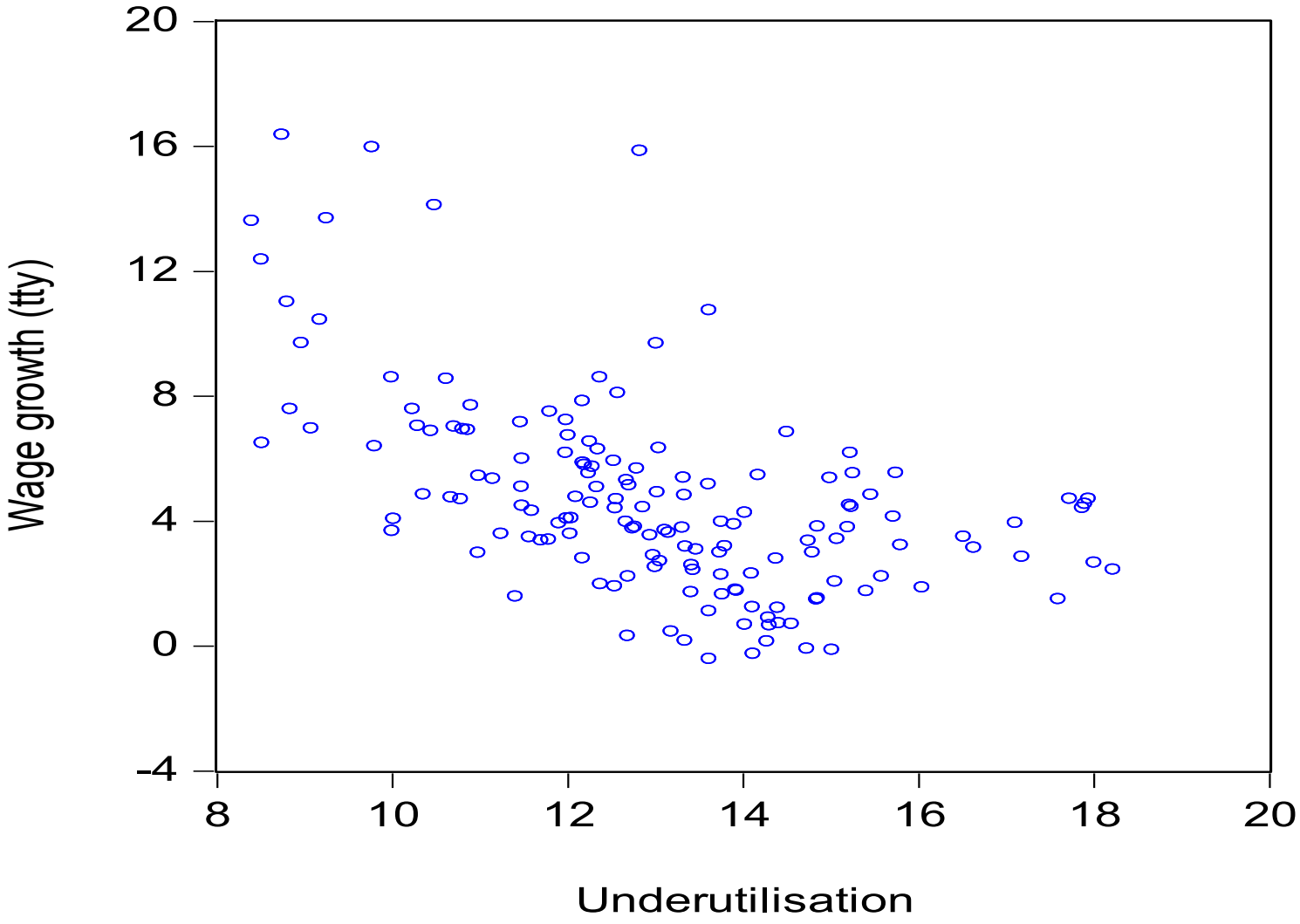
3(c). Data: Wages and prices



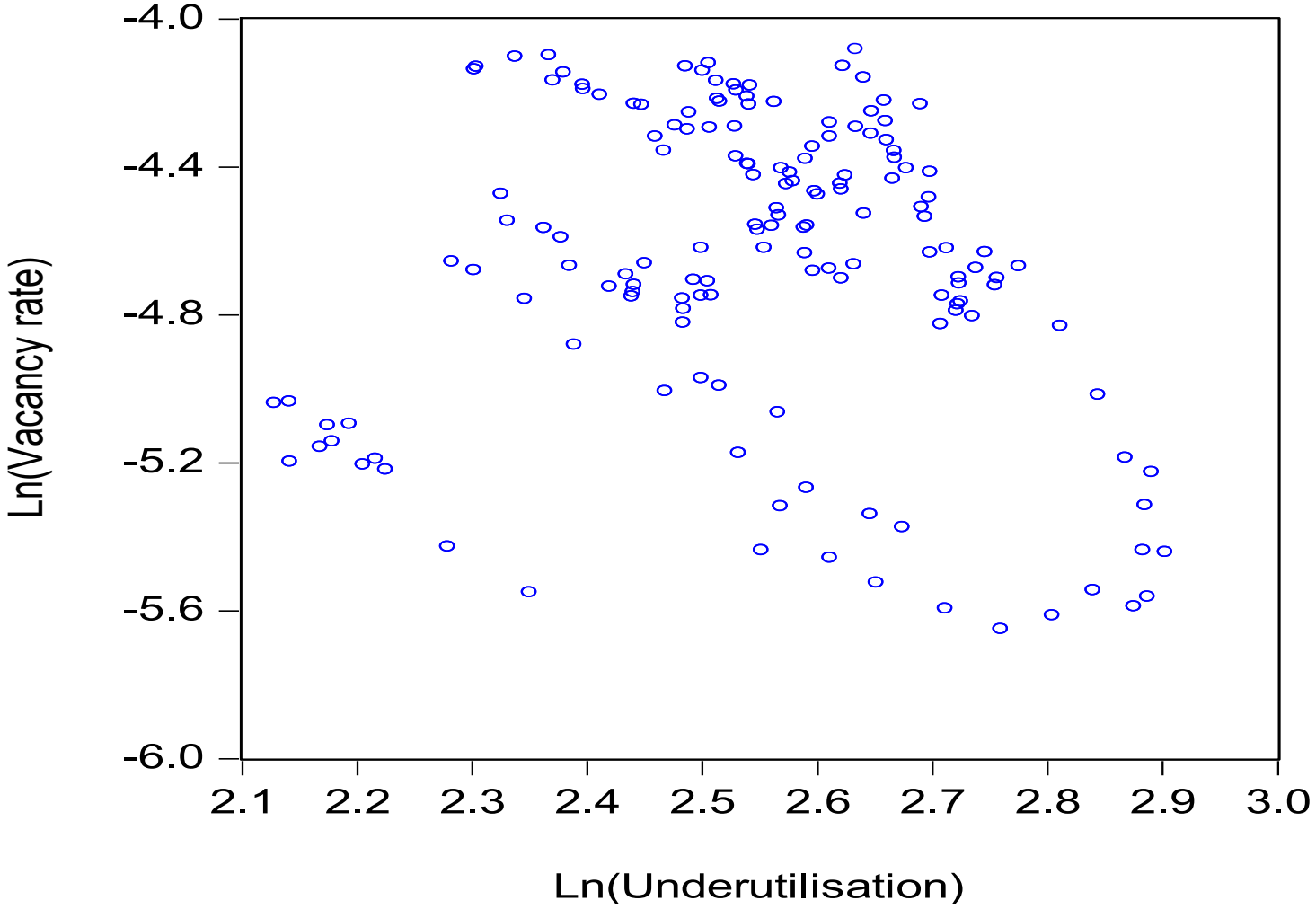
3(c). Data: Labour underutilisation



3(c). Data: Phillips curve



3(c). Data: Beveridge curve



4(a). Results: Basic model

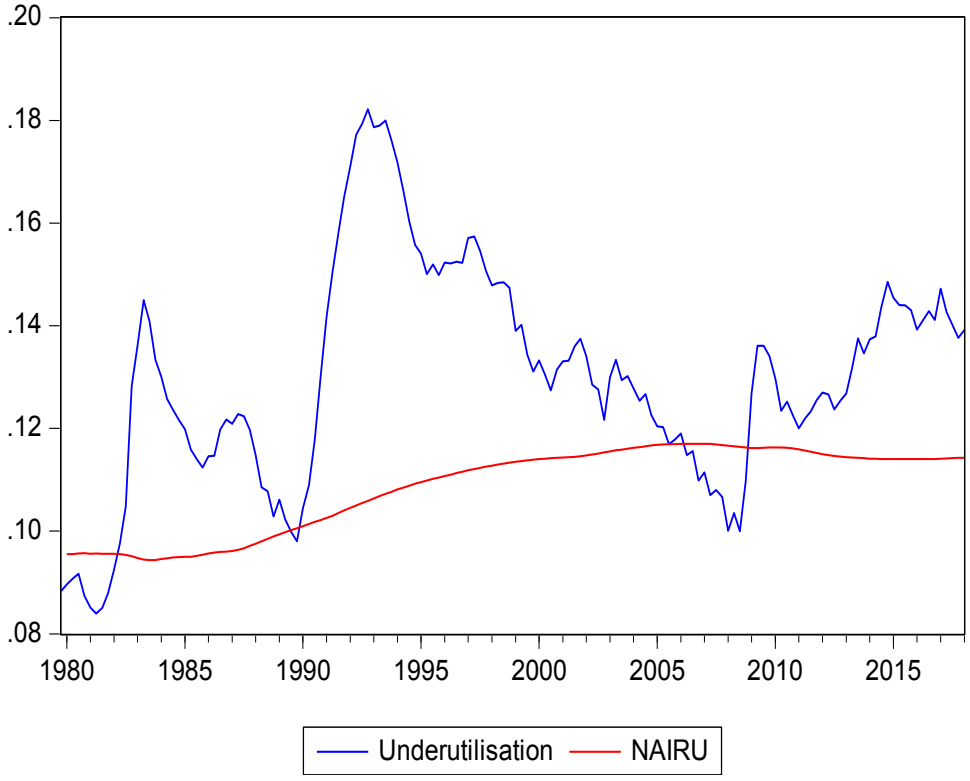
Table 1: Baseline State-space models

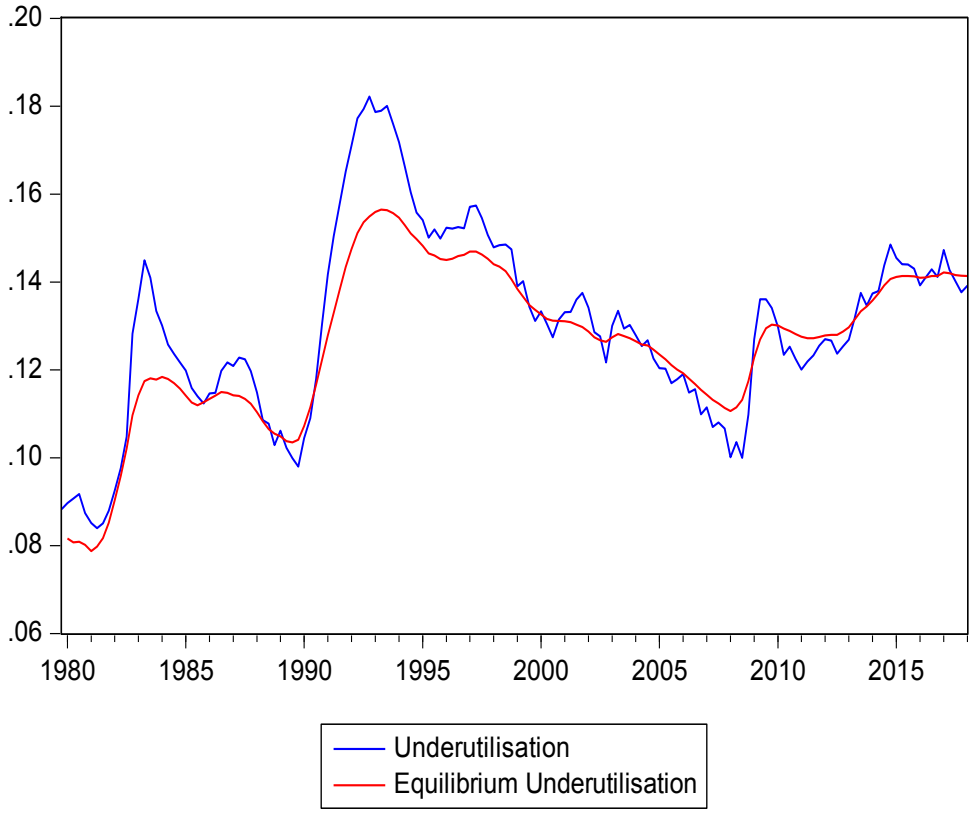
$$w_t - h_t - p_{t-1} = \varphi(w_{t-1} - h_{t-1} - p_{t-1}) + \beta(U_t^* - U_{t-1}) + e_{wt}$$
$$e_{wt} \sim N(0, \sigma_w^2)$$
$$\ln((1 - U_t)/U_t) = \delta + \gamma\, ln(V_{t-1}/U_{t-1}) + \kappa U_t^* + e_{bt}$$
$$e_{bt} \sim N(0, \sigma_b^2)$$
$$U_t^* = U_{t-1}^* + v_t$$
$$v_t \sim i.i.d.\, N(0, \sigma_v^2)$$

Parameter	Wage curve	Z statistic	Wage/ Beveridge Curve	Z statistic
φ	0.54***	12.88	0.54***	11.13
β	0.15**	2.05	0.61***	37.57
δ			3.31***	20.98
γ			0.10**	2.16
κ			-8.96***	-10.09
σ_w	0.02***	21.35	0.02***	18.76
σ_b			0.08***	8.40
σ_v	0.00	0.51	0.00***	4.33
Log-likelihood	366.83		545.07	
AIC	-4.71		-6.97	
U_t^* 2018:1	11.43%	5.73	14.13%	20.62

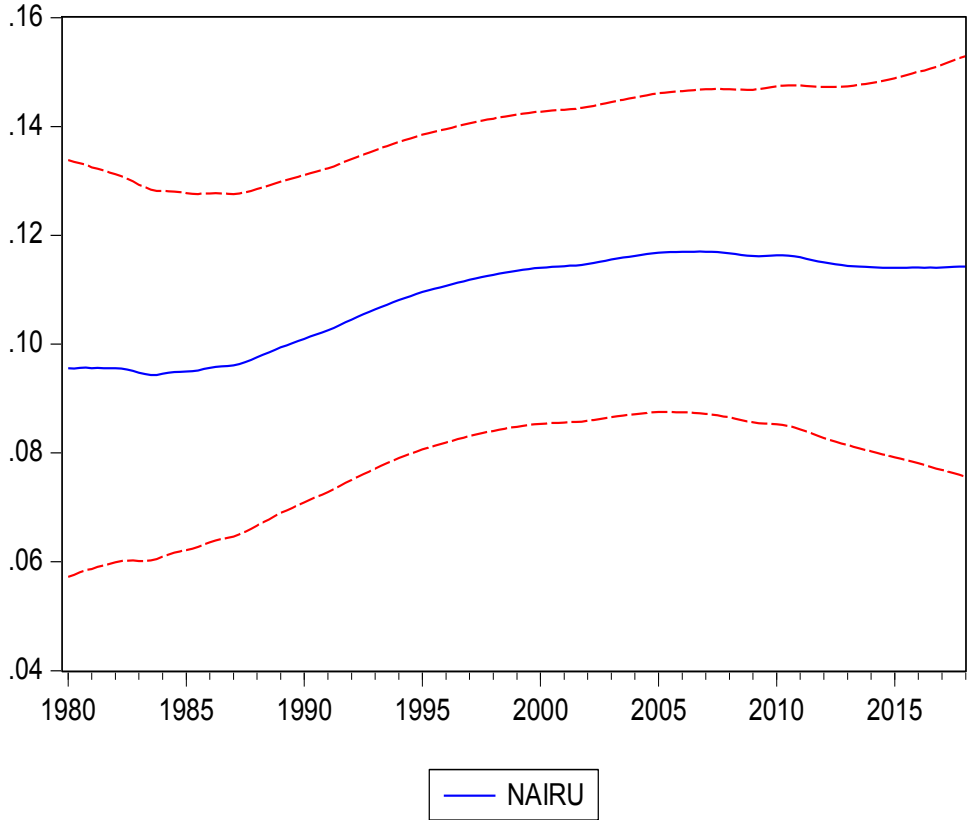
Notes: ***, **, * Denotes significance at the 1%, 5%, and 10% significance levels respectively.
Sample period 1979:4 to 2018:1. AIC: Akaike Information Criteria.

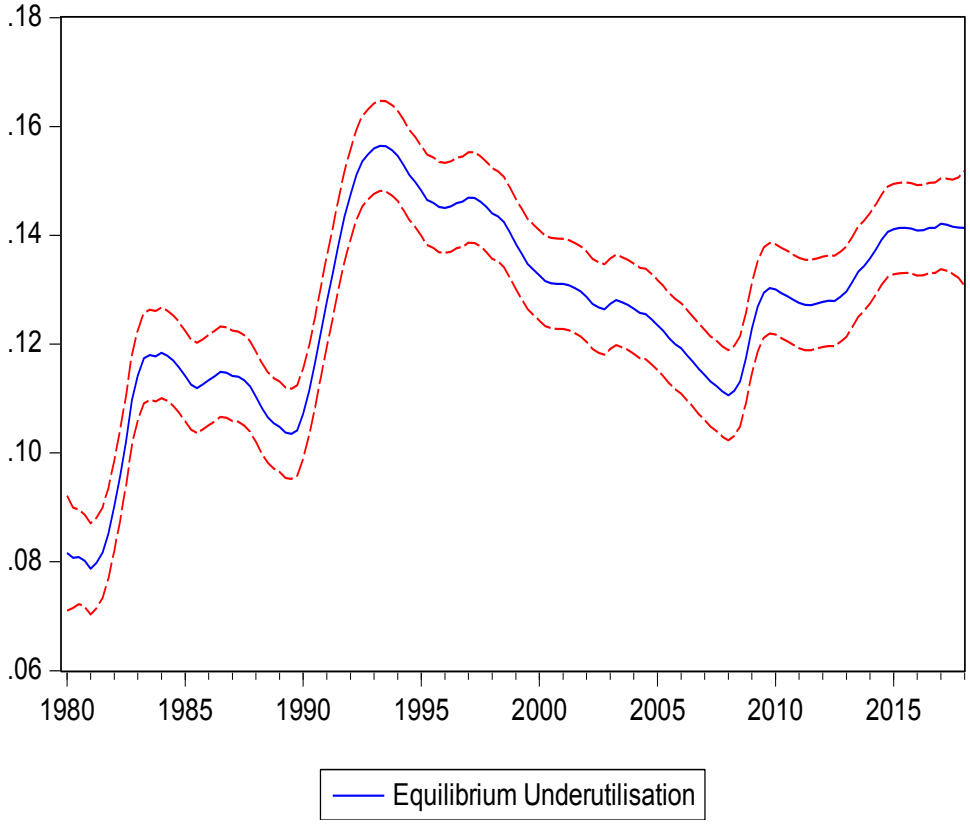
4(a). Time-varying equilibrium underutilisation rates





4(a). Standard 95 per cent confidence intervals





- Wage/Beveridge curve model confidence intervals almost three-quarters narrower on average.

4(b). Results: Robustness and extensions

Table 2: Model Robustness and extensions

Variable	(1) ACC PC	(2) IPD	(3) Y/hr	(4) Imps	(5) Speed limit	(6) Non-linear
$w_{t-1} - h_{t-1} - p_{t-1}$		0.61***	0.45***	0.49***	0.55***	0.55***
		(14.08)	(7.03)	(9.87)	(12.70)	(11.65)
$U_t^* - U_{t-1}$	0.13*	0.11	0.53***	0.64***	0.28***	
	(1.77)	(1.08)	(16.65)	(6.02)	(33.62)	
$imps_t$				-0.07		
				(-0.38)		
$\frac{U_{t-1} - U_{t-4}}{U_{t-4}}$					-0.05	
					(-0.46)	
$\frac{U_t^* - U_{t-1}}{U_{t-1}}$						0.07***
						(41.13)
$bc\ cons$	3.42***	3.91***	3.31***	3.31***	3.31***	3.31***
	(27.08)	(8.02)	(21.01)	(17.53)	(11.84)	(16.39)
$ln(V_{t-1}/U_{t-1})$	0.17***	0.32***	0.09	0.10***	0.09	0.09*
	(3.50)	(10.40)	(1.49)	(2.35)	(1.16)	(1.82)
U_t^*	-8.90***	-9.91**	-8.94***	-8.94***	-8.94***	-8.94***
	(-224.79)	(-2.20)	(-11.38)	(-8.41)	(-5.30)	(-6.45)
σ_w	0.01***	0.02***	0.03***	0.02***	0.02***	0.02***
	(214.74)	(20.26)	(19.02)	(20.06)	(19.25)	(19.35)
σ_b	0.05***	0.01	0.08***	0.08***	0.08***	0.08***
	(9.20)	(0.92)	(8.68)	(9932292)	(6.64)	(550.25)
σ_v	0.00***	0.00*	0.00***	0.00***	0.00***	0.04***
	(5.68)	(2.11)	(4.32)	(4.47)	(2.75)	(4.02)
lnL	733.17	645.57	510.20	544.98	540.60	541.49
AIC	-9.43	-8.28	-6.52	-6.96	-6.90	-6.93
U_t^* 2018:1	13.75	14.14	14.50	14.16	14.47	14.46
	(26.35)	(37.26)	(19.81)	(20.70)	(19.70)	(19.79)

Notes: ***, **, * Denotes significance at the 1%, 5%, and 10% significance levels respectively. Sample period 1979:4 to 2018:1. AIC: Akaike Information Criteria. z statistics in brackets.

4(c). Drivers of equilibrium underutilisation

$$\Delta_4 Ln(U_t^*) = \beta_0 + \beta_1 \Delta_4 Ln(LTU_{t-1}) + \beta_2 \Delta_4 Ln(UBRR_{t-1}) + \beta_3 \Delta_4 \ln(RMW_{t-1}) - \beta_4 \Delta_4 \ln(RTWI_{t-1}) + + \beta_5 \Delta_4 Ln(EBA_{t-1}) + \varepsilon_t$$

- ***LTU***: Unemployed (> 52) adjusted for ABS labour force redefinitions.
- **UBRR**: Unemployment benefits divided by the minimum wage. Between 1979:IV and the 1985:III the benefit rate is the over 18 single (no child) unemployment benefit. From 1985:IV to the present it is the over-21 single unemployment benefit or equivalent payment. National minimum wage case post-April 1997, Bray (2013) minimum wage series beforehand.
- **RMW**: Updated Bray's (2013) minimum wages series, deflated using CPI
- **RTWI**: Real exchange rate as determined by the real trade weighted index
- ***EBA***: percentage of employees covered by enterprise and registered individual agreements

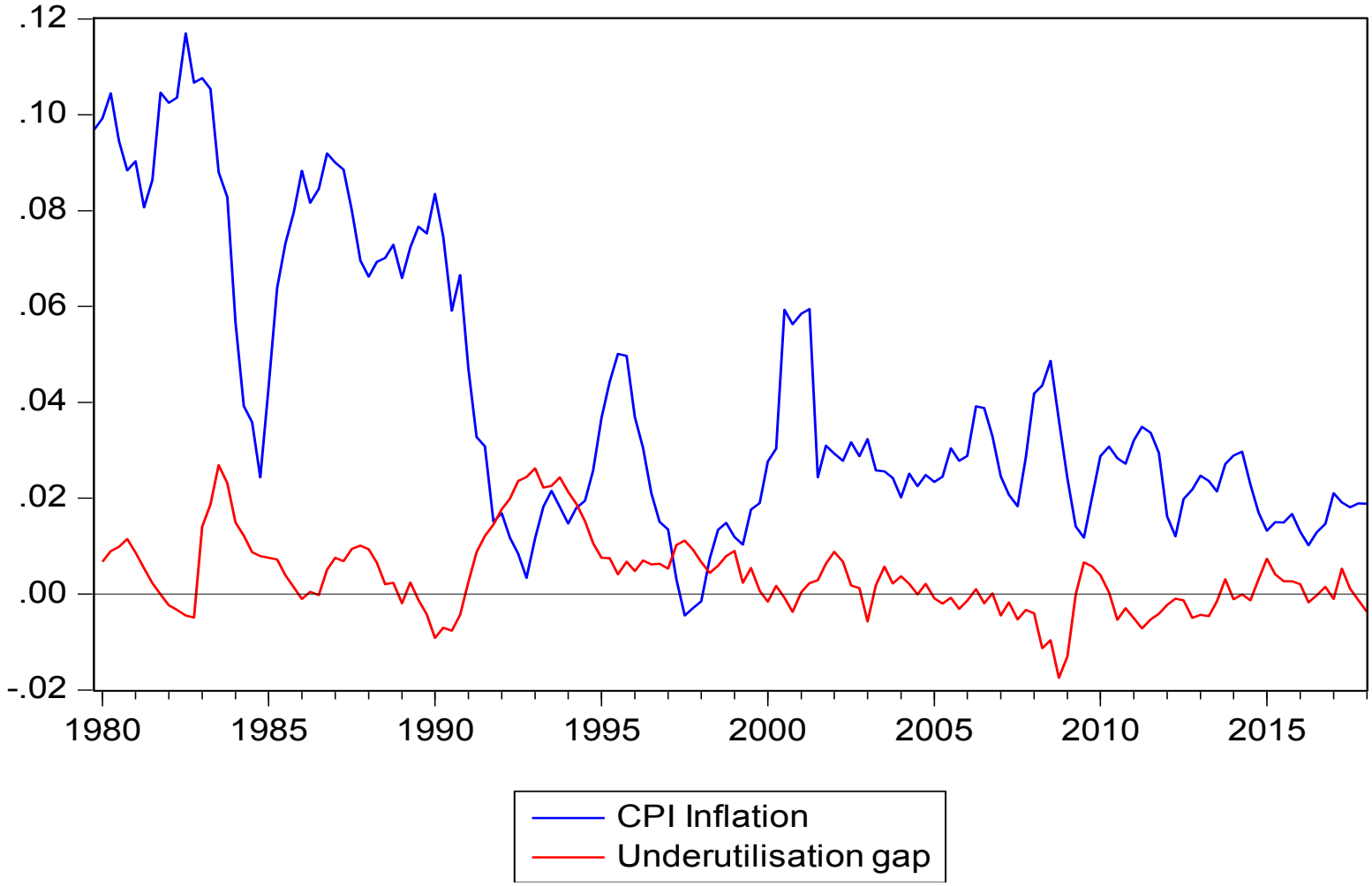
For sample period 1986:1-2018:1

$$\beta_0 = 0.01\ (1.41);\ \beta_1 = 0.18\ (5.40);\ \beta_2 = 0.49\ (2.48);\ \beta_3 = 0.32\ (1.18);\ \beta_4 = -0.09\ (-1.37);\ \beta_5 = -0.01\ (-0.61)$$

$$R^2 = 0.50;$$ Breusch-Godfrey LM(4), F=126.99.

- Equilibrium underutilisation is positively related to long-term unemployment and the replacement ratio.
  - Gruen, Pagan and Thompson (1999) describe the lack of relationship between their NAIRU and these variables as disappointing.

4(d). Equilibrium underutilisation and monetary policy



4(d). Equilibrium underutilisation and monetary policy

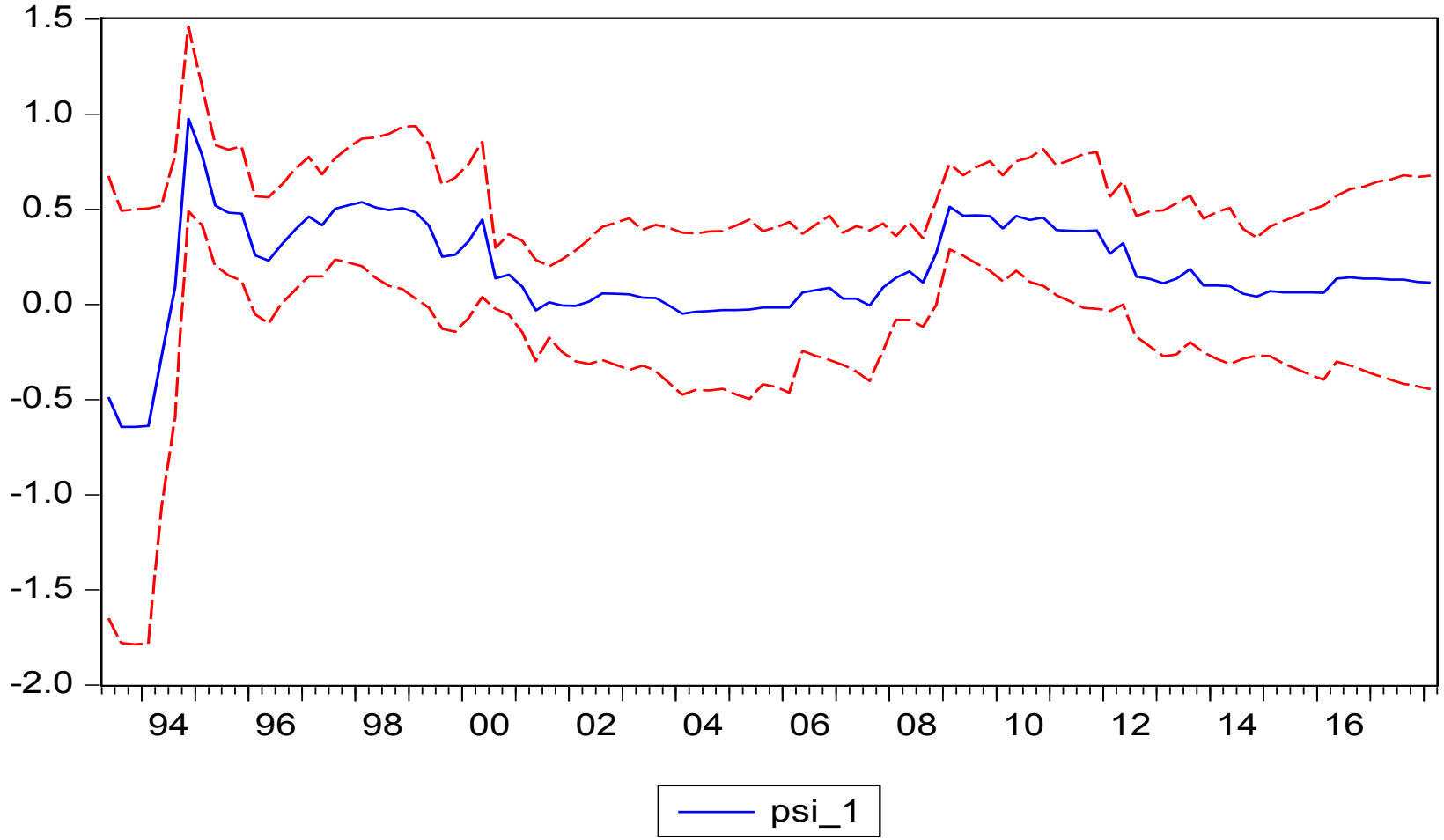
- Monetary policy reaction function (Lim, Dixon, Tsiaplias, 2009):

$$R_t = \psi_0 + \psi_1 (p_t - 2.5) + (1 - \psi_1)(U_t - U_t^*) + \epsilon_t; \quad \epsilon_t \sim N(0, \sigma_\epsilon^2)$$

$$\boldsymbol{\psi} = \boldsymbol{\psi}_{t-1} + \boldsymbol{v}_t; \quad \boldsymbol{v}_t \sim N(0, \Omega)$$

- R_t is the cash rate
- ψ_1 indicates the relative weight placed on the infation gap in setting the cash rate.

4(d). Monetary policy and equilibrium underutilisation



4(e). Equilibrium underutilisation gender gap

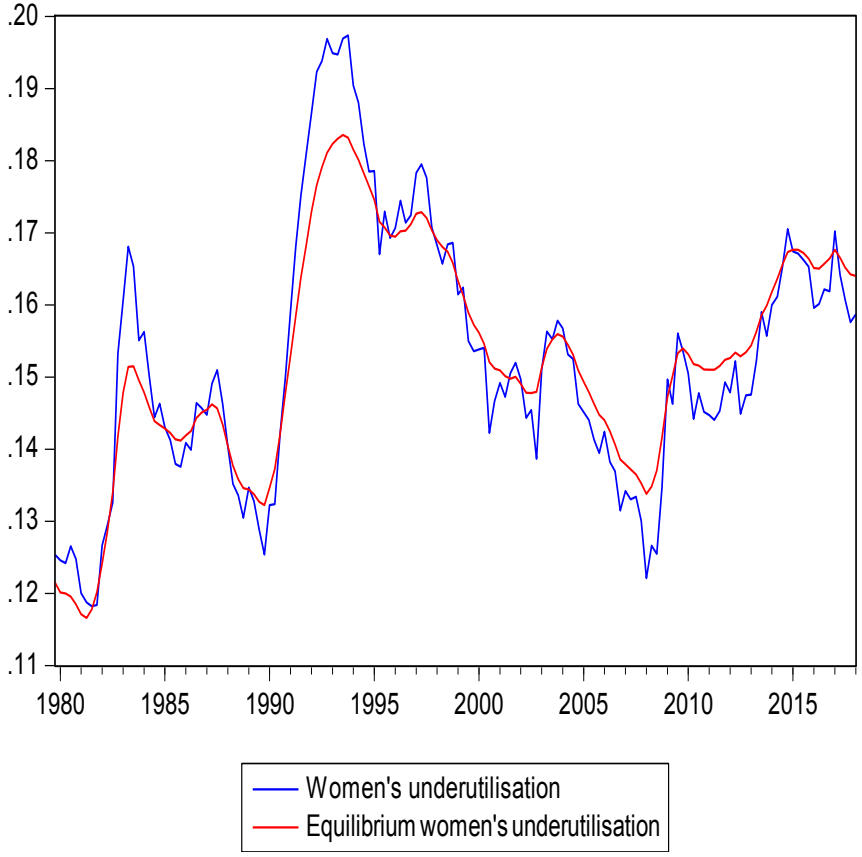
Table 3: Equilibrium underutilisation by gender

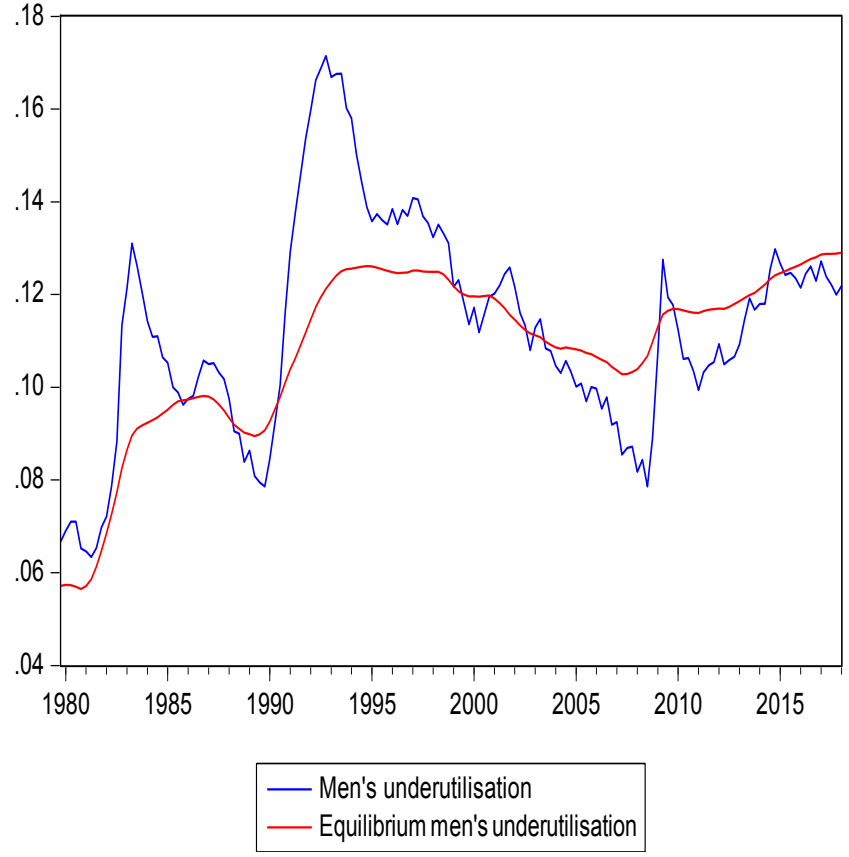
$$p_t - p_{t-1} = \beta(U_t^* - U_{t-1}) + e_{pt}$$
$$e_{wt} \sim N(0, \sigma_w^2)$$
$$\ln((1 - U_t)/U_t) = \delta + \gamma \ln(V_{t-1}/U_{t-1}) + \kappa U_t^* + e_{bt}$$
$$e_{bt} \sim N(0, \sigma_b^2)$$
$$U_t^* = U_{t-1}^* + v_t$$
$$v_t \sim i.i.d.\, N(0, \sigma_v^2)$$

Parameter	Women	Z statistic	Men	Z statistic
β	0.11	1.64	0.13***	46.83
δ	3.08***	6.61	3.80***	13.85
γ	0.07	1.08	0.26***	4.49
κ	-7.70***	-2.61	-9.87***	-4.77
σ_w	0.01***	25.59	0.01***	26.37
σ_b	0.06***	6.40	0.10***	290556.53
σ_v	0.00**	2.00	0.00***	2.92
Log-likelihood	722.80		665.51	
AIC	-9.30		-8.55	
U_t^* 2018:1	16.4%	22.68	12.9%	20.40

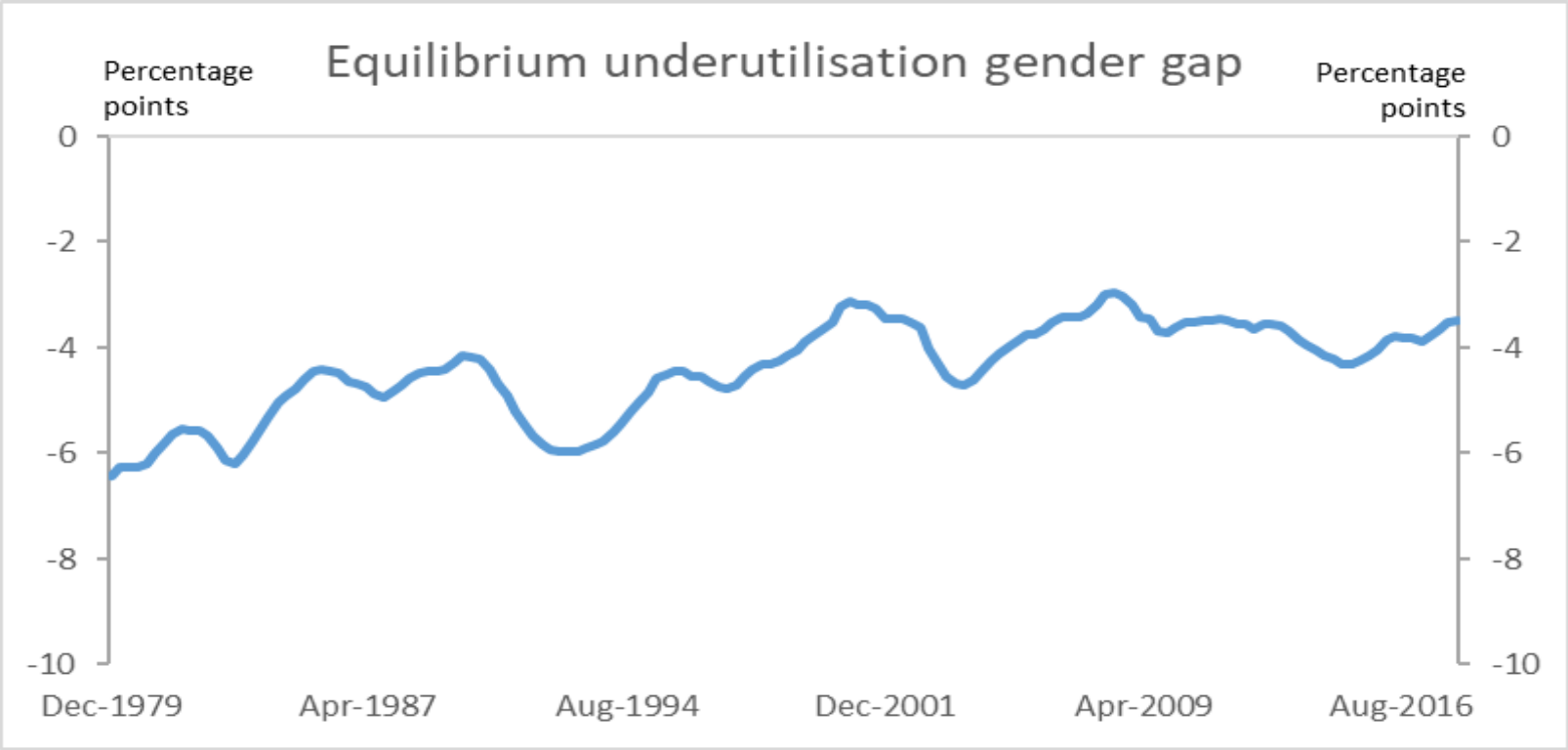
Notes: ***, **, * Denotes significance at the 1%, 5%, and 10% significance levels respectively.
Sample period 1979:4 to 2018:1. AIC: Akaike Information Criteria.

4(e). Equilibrium underutilisation gender gap





4(e). Equilibrium underutilisation gender gap



- if the equilibrium underutilisation gender gap continues to close at the 1979:4-2018:1 trend rate, we would close the gap around 2071 (53 years time).
  - However, this may be optimistic given the gap has barely moved since the turn of the century. The post-2000 trend implies no convergence.

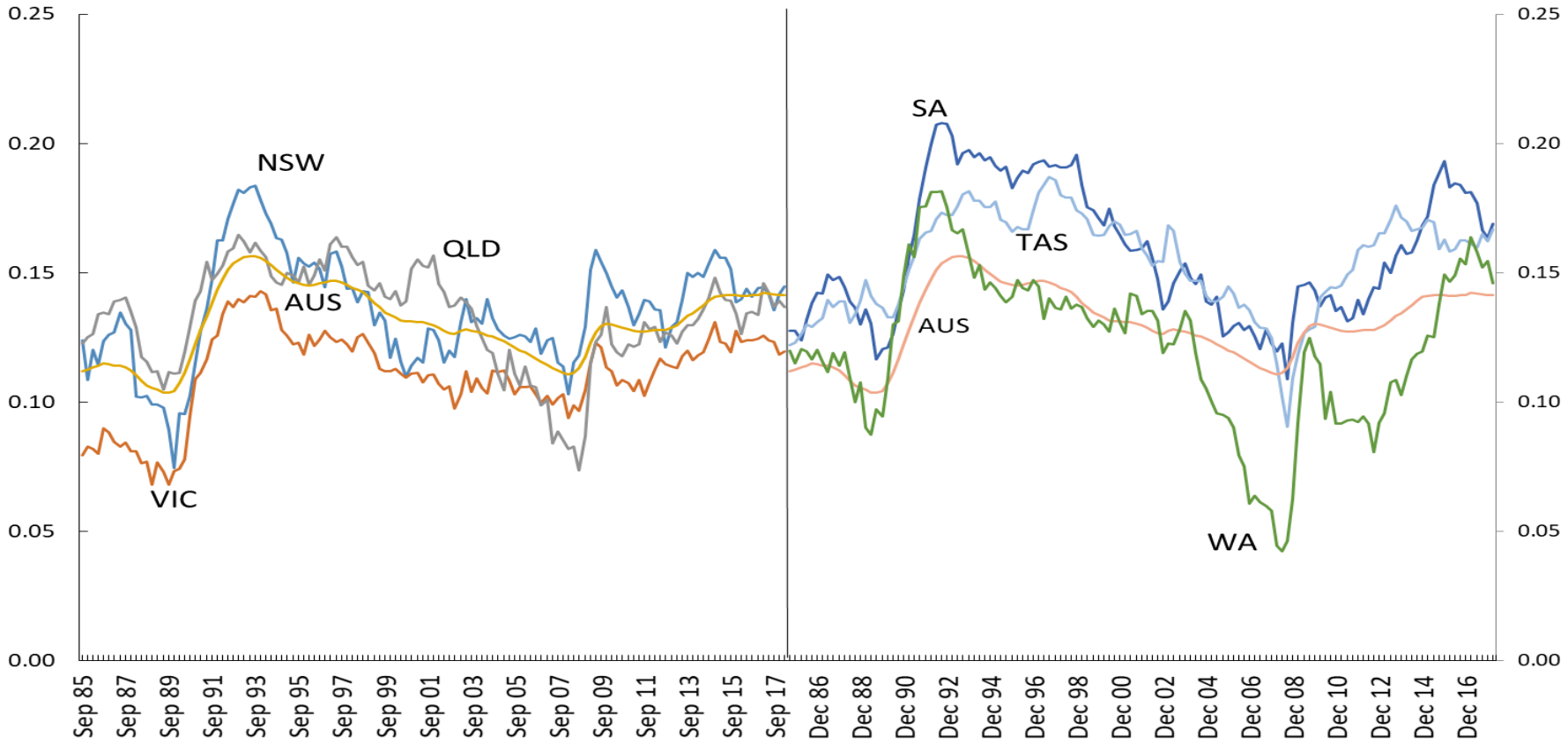
4(f). States and territories

Table 5: State and territory equilibrium underutilisation

Variable	(1) NSW	(2) VIC	(3) QLD	(4) SA	(5) WA	(6) TAS	(7) ACT
$w_{t-1} - h_{t-1} - p_{t-1}$	0.70***	0.28***	0.51***	0.44***	0.52***	0.55***	0.51***
	(10.89)	(3.42)	(5.85)	(5.95)	(7.14)	(7.06)	(6.99)
$U_t^* - U_{t-1}$	-0.30	0.29	0.29	-0.92**	0.09	0.59	0.39
	(1.21)	(1.37)	(0.84)	(-2.11)	(0.22)	(1.45)	(0.93)
$bc\ cons$	2.90***	3.44***	3.03***	2.82***	2.91***	3.18***	3.97***
	(17.57)	(6.69)	(7.20)	(22.52)	(3..14)	(9.28)	(4.96)
$ln(V_{t-1}/U_{t-1})$	0.06*	0.08***	0.04	0.02	0.00	0.07**	0.00
	(2.00)	(2.75)	(1.06)	(0.96)	(0.47)	(2.44)	(0.94)
U_t^*	-6.06***	-12.02**	-8.40***	-6.43***	-7.81	-8.38***	-16.52**
	(-4.52)	(-2.13)	(-2.64)	(-6.92)	(-1.19)	(-3.67)	(-2.35)
σ_w	0.02***	0.02***	0.03***	0.03***	0.04***	0.03***	0.04***
	(17.56)	(16.09)	(14.93)	(13.74)	(17.67)	(16.33)	(14.09)
σ_b	-0.01	0.00	-0.01	-0.03***	0.00	0.04***	0.04***
	(-0.95)	(0.00)	(-1.01)	(-5.75)	(0.00)	(9.64)	(4.89)
σ_v	0.01***	0.00**	0.01***	0.01***	0.01	0.01***	0.00**
	(4.13)	(2.10)	(2.73)	(5.49)	(1.19)	(3.31)	(2.15)
lnL	549.98	486.16	461.07	454.67	406.76	402.99	355.13
AIC	-7.91	6.98	-6.92	-6.52	-5.82	-5.77	-5.07
U_t^* 2018:1	14.47%	11.96%	13.67%	16.88%	14.60%	16.68%	10.58%
	(18.28)	(25.60)	(20.37)	(20.85)	(16.78)	(21.95)	(22.71)

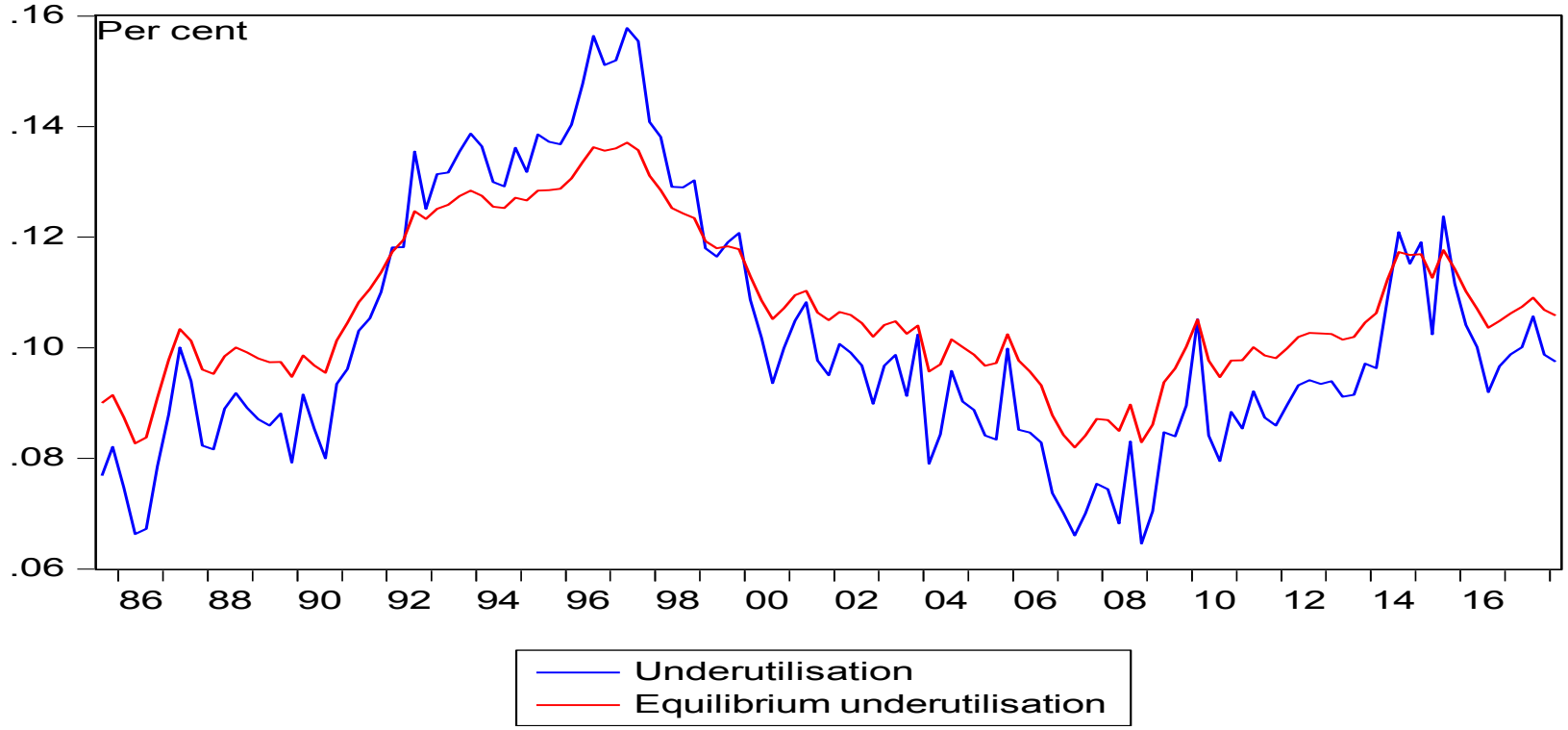
Notes: ***, **, * Denotes significance at the 1%, 5%, and 10% significance levels respectively. Sample period 1983:4 to 2018:1. AIC: Akaike Information Criteria. h_t is real state final demand per worker. z statistics in brackets.

4(f). States



- Although estimates are quite imprecise, there appears to be persistent disequilibrium at state level, with underutilisation:
  - Significantly above equilibrium in Victoria since the early 1990s recession;
  - just above but close to equilibrium in Queensland;
  - inline with equilibrium in Tasmania and Western Australia (although very imprecisely estimated in the case of WA); and
  - close to, but just below, equilibrium in New South Wales, the Australian Capital Territory and South Australia;

4(f). Territories



- The ACT has a business cycle and a political cycle
- The best model for the NT was a simple accelerationist Phillips curve which yielded a constant non-accelerating inflation rate of underutilisation of 5.1 per cent in state space estimation (and 8.9 per cent using OLS estimation)
  - However, very imprecisely estimated with 95 per cent confidence interval encompassing -8 to 18 per cent in the state space model

5. Conclusions

- The Equilibrium underutilisation rate is generally higher than that estimated in Phillips curve only frameworks, closer to actual underutilisation, and estimated more precisely
  - It displays similar dynamic properties to that derived by Kennedy *et al* (2008) using a Beveridge curve framework despite the very different modelling approach
- Changes in the equilibrium underutilisation rate are found to be related to changes in long-term unemployment and the unemployment benefit replacement rate; but unrelated to changes in the real minimum wage, enterprise bargaining and Australia's international competitiveness
  - The significant relationship between equilibrium underutilisation and long-term unemployment suggests the presence of hysteresis effects, given the very high correlation between long-term unemployment and unemployment ($\rho = 0.95$)
  - The significant relationship between the unemployment benefit replacement rate and equilibrium underutilization also points towards the market failure that generates multiple equilibria (hysteresis) in the Farmer model (2010)

5. Conclusions

- An estimated monetary policy reaction function suggests that the equilibrium underutilisation rate usefully summarises information relevant to setting the cash rate
- Related to the flexibility gap, there is a gender gap in equilibrium labour underutilisation
  - Based on the 1979:4-2018:1 trend, it will take over 50 years to close this gap
  - However, since 2000 the gap has actually increased, suggesting that based on more recent experience 50 years could be optimistic
- Tentative evidence suggesting some state and territory labour markets could be in persistent disequilibrium, in contrast to the national labour market where underutilisation is generally close to equilibrium
  - However; estimation imprecise and declining precision with population size

5. Conclusions

- The new framework raises some interesting questions for macroeconomic policy.
- Monetary policy:
  - Is Australia an optimal currency area/monetary union?
  - Flexible inflation targeting has been highly successful in stabilizing prices, but underutilisation and unemployment still fluctuate considerably.
    - Are there potentially better instruments or targets available to simultaneously stabilise real variables like unemployment?
  - Optimal monetary policy under hysteresis (Blanchard, Summers Cerutti, 2015)?
- Fiscal policy:
  - Efficacy of fiscal stimulus under hysteresis (Summers and Delong, 2012)?
  - Is there a role for HFE to help states and territories achieve labour market equilibrium?