Credit Cycles, Fiscal Policy, and Global Imbalances*

Appendix

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A Additional Tables

Tables A.1 to A.3 provide additional empirical results on the correlation between credit-to-GDP and the current account and different horizons.

Table A.1: Correlation Between 1Y Δ in Credit-to-GDP at t+k and the Current Account at t

Country \ k	-3	-2	-1	0	1	2	3
Argentina	0.00	-0.20	-0.37	-0.17	-0.02	-0.17	-0.14
Australia	0.22	0.07	-0.12	-0.48	-0.46	-0.25	-0.19
Austria	-0.12	-0.14	-0.11	-0.07	0.02	-0.02	-0.06
Belgium	-0.10	-0.04	0.02	-0.31	-0.08	-0.08	-0.10
Brazil	0.02	0.06	0.25	0.17	-0.10	-0.22	-0.03
Canada	-0.08	0.01	0.01	-0.29	-0.41	-0.37	-0.40
Chile	-0.28	-0.11	-0.06	-0.55	-0.40	-0.06	-0.23
China	0.17	0.17	0.05	-0.21	-0.42	-0.49	-0.30
Colombia	0.11	-0.02	-0.42	-0.63	-0.61	-0.36	-0.29
Czech Republic	0.08	0.26	0.15	0.05	0.31	0.45	0.40
Denmark	-0.07	-0.09	-0.20	-0.28	-0.24	-0.21	-0.08
Finland	0.29	0.15	-0.05	-0.22	-0.31	-0.41	-0.38
France	-0.14	-0.16	-0.38	-0.49	-0.55	-0.52	-0.62
Germany	-0.19	-0.23	-0.28	-0.35	-0.42	-0.45	-0.41
Greece	-0.64	-0.69	-0.72	-0.73	-0.67	-0.49	-0.33
Hungary	-0.73	-0.64	-0.60	-0.49	-0.28	-0.01	0.11
India	0.56	0.46	0.32	0.08	0.19	-0.05	-0.14
Indonesia	0.12	0.03	-0.27	-0.44	-0.53	-0.48	-0.39
Ireland	0.53	0.20	-0.09	-0.41	-0.49	-0.61	-0.65
Italy	-0.01	-0.28	-0.61	-0.74	-0.79	-0.73	-0.61
Korea	0.22	-0.02	-0.47	-0.41	0.00	0.10	-0.01
Japan	0.07	0.32	0.38	0.00	-0.11	-0.25	-0.49
Malaysia	-0.09	-0.28	-0.51	-0.59	-0.47	-0.26	-0.23
Mexico	0.49	0.32	0.08	-0.44	-0.64	-0.61	-0.55
Netherlands	-0.01	-0.21	-0.39	-0.31	-0.14	-0.11	-0.12
Norway	0.36	0.44	0.34	0.06	-0.02	0.19	0.43
Peru	-0.01	-0.06	-0.30	-0.50	-0.43	-0.36	-0.25
Poland	-0.24	-0.32	-0.20	-0.44	-0.52	-0.46	-0.02
Portugal	-0.35	-0.59	-0.63	-0.66	-0.57	-0.50	-0.35
Russia	0.36	0.32	0.13	-0.10	0.09	0.09	-0.20
South Africa	0.27	0.23	0.05	-0.22	-0.25	-0.09	0.09
Spain	-0.21	-0.42	-0.66	-0.83	-0.91	-0.83	-0.66
Sweden	0.39	0.42	0.38	0.23	0.14	0.02	-0.08
Switzerland	0.15	0.02	-0.38	-0.34	0.04	-0.10	-0.07
Thailand	-0.18	-0.44	-0.70	-0.69	-0.46	-0.28	-0.11
Turkey	-0.55	-0.54	-0.50	-0.78	-0.63	-0.49	-0.59
United Kingdom	0.47	0.33	0.22	0.11	0.15	0.30	0.20
United States	0.07	-0.18	-0.46	-0.51	-0.48	-0.46	-0.45
Full sample, Mean	0.03	-0.05	-0.19	-0.34	-0.30	-0.25	-0.22
Full sample, Median	0.01	-0.03	-0.20	-0.38	-0.40	-0.25	-0.21
AEs, Mean	0.04	-0.04	-0.18	-0.32	-0.27	-0.24	-0.23
AEs, Median	0.03	-0.03	-0.16	-0.33	-0.27	-0.25	-0.26
EMDEs, Mean	0.00	-0.07	-0.19	-0.37	-0.34	-0.27	-0.21
EMDEs, Median	0.01	-0.04	-0.24	-0.44	-0.42	-0.27	-0.21

Sources: IMF World Economic Outlook database, Bank for International Settlements, World Development Indicators and authors' calculations.

Table A.2: Correlation Between 2Y Δ in Credit-to-GDP at t+k and the Current Account at t

Country \ k	-3	-2	-1	0	1	2	3
Argentina	-0.18	-0.50	-0.47	-0.17	-0.17	-0.28	-0.20
Australia	0.16	0.00	-0.30	-0.55	-0.42	-0.23	-0.20
Austria	-0.16	-0.15	-0.10	-0.03	0.01	-0.05	-0.14
Belgium	-0.15	-0.05	-0.27	-0.32	-0.12	-0.14	-0.14
Brazil	0.04	0.21	0.29	0.07	-0.18	-0.14	-0.01
Canada	-0.05	0.01	-0.21	-0.51	-0.57	-0.57	-0.50
Chile	-0.26	-0.11	-0.40	-0.60	-0.29	-0.18	-0.35
China	0.22	0.13	-0.14	-0.42	-0.60	-0.52	-0.31
Colombia	0.04	-0.28	-0.59	-0.73	-0.56	-0.36	-0.36
Czech Republic	0.23	0.28	0.13	0.24	0.50	0.57	0.58
Denmark	-0.07	-0.16	-0.24	-0.29	-0.25	-0.16	0.02
Finland	0.28	0.06	-0.17	-0.33	-0.45	-0.49	-0.50
France	-0.17	-0.31	-0.51	-0.61	-0.64	-0.69	-0.69
Germany	-0.35	-0.39	-0.46	-0.52	-0.59	-0.58	-0.50
Greece	-0.76	-0.81	-0.84	-0.82	-0.68	-0.48	-0.29
Hungary	-0.77	-0.68	-0.60	-0.45	-0.18	0.05	0.17
India	0.62	0.48	0.23	0.17	0.09	-0.12	-0.34
Indonesia	0.08	-0.15	-0.44	-0.59	-0.61	-0.53	-0.41
Ireland	0.45	0.06	-0.31	-0.49	-0.60	-0.69	-0.68
Italy	-0.14	-0.46	-0.71	-0.82	-0.82	-0.73	-0.58
Japan	0.23	0.40	0.14	-0.10	-0.22	-0.43	-0.49
Korea	0.14	-0.31	-0.55	-0.24	0.09	0.05	-0.03
Malaysia	-0.22	-0.46	-0.65	-0.61	-0.42	-0.28	-0.30
Mexico	0.41	0.22	-0.18	-0.59	-0.69	-0.65	-0.59
Netherlands	-0.14	-0.39	-0.45	-0.29	-0.16	-0.15	-0.20
Norway	0.51	0.48	0.30	0.07	0.15	0.42	0.58
Peru	-0.05	-0.19	-0.45	-0.52	-0.46	-0.32	-0.24
Poland	-0.31	-0.29	-0.35	-0.54	-0.55	-0.27	0.14
Portugal	-0.53	-0.68	-0.72	-0.69	-0.60	-0.49	-0.31
Russia	0.44	0.27	0.00	-0.01	0.11	-0.08	-0.34
South Africa	0.30	0.17	-0.09	-0.29	-0.21	0.01	0.24
Spain	-0.31	-0.55	-0.77	-0.90	-0.90	-0.78	-0.63
Sweden	0.48	0.47	0.38	0.24	0.12	0.00	-0.09
Switzerland	0.10	-0.22	-0.42	-0.16	-0.01	-0.07	-0.08
Thailand	-0.34	-0.64	-0.77	-0.63	-0.41	-0.21	-0.02
Turkey	-0.64	-0.61	-0.76	-0.81	-0.64	-0.62	-0.57
United Kingdom	0.44	0.29	0.16	0.14	0.27	0.31	0.21
United States	-0.06	-0.35	-0.53	-0.54	-0.52	-0.51	-0.50
Full sample, Mean	-0.01	-0.14	-0.31	-0.38	-0.32	-0.27	-0.23
Full sample, Median	-0.05	-0.16	-0.37	-0.47	-0.41	-0.28	-0.30
AEs, Mean	0.01	-0.13	-0.29	-0.34	-0.29	-0.27	-0.23
AEs, Median	-0.06	-0.15	-0.30	-0.32	-0.34	-0.33	-0.24
EMDEs, Mean	-0.04	-0.15	-0.34	-0.42	-0.36	-0.28	-0.22
EMDEs, Median	0.00	-0.17	-0.42	-0.53	-0.41	-0.28	-0.31

Sources: IMF World Economic Outlook database, Bank for International Settlements, World Development Indicators and authors' calculations.

Table A.3: Correlation Between 3Y Δ in Credit-to-GDP at t+k and the Current Account at t

Country \ k	-3	-2	-1	0	1	2	3
Argentina	-0.46	-0.60	-0.45	-0.29	-0.27	-0.33	-0.30
Australia	0.09	-0.15	-0.45	-0.56	-0.35	-0.23	-0.21
Austria	-0.16	-0.13	-0.05	-0.01	-0.02	-0.11	-0.16
Belgium	-0.11	-0.29	-0.28	-0.36	-0.19	-0.19	-0.24
Brazil	0.22	0.37	0.24	-0.12	-0.23	-0.17	-0.06
Canada	-0.04	-0.15	-0.40	-0.63	-0.70	-0.63	-0.56
Chile	-0.26	-0.39	-0.55	-0.55	-0.36	-0.32	-0.38
China	0.20	-0.04	-0.36	-0.65	-0.68	-0.55	-0.26
Colombia	-0.22	-0.48	-0.74	-0.72	-0.55	-0.40	-0.24
Czech Republic	0.26	0.23	0.26	0.43	0.55	0.64	0.68
Denmark	-0.09	-0.21	-0.26	-0.30	-0.22	-0.08	0.15
Finland	0.17	-0.06	-0.27	-0.43	-0.50	-0.56	-0.57
France	-0.28	-0.43	-0.60	-0.68	-0.74	-0.74	-0.73
Germany	-0.48	-0.54	-0.60	-0.64	-0.68	-0.63	-0.60
Greece	-0.83	-0.87	-0.87	-0.78	-0.62	-0.41	-0.19
Hungary	-0.77	-0.67	-0.56	-0.35	-0.10	0.09	0.17
India	0.60	0.39	0.24	0.09	0.00	-0.27	-0.43
Indonesia	-0.07	-0.32	-0.59	-0.69	-0.66	-0.54	-0.41
Ireland	0.31	-0.14	-0.43	-0.60	-0.69	-0.73	-0.75
Italy	-0.31	-0.59	-0.80	-0.86	-0.82	-0.70	-0.49
Japan	0.33	0.19	0.00	-0.20	-0.36	-0.44	-0.46
Korea	-0.14	-0.48	-0.44	-0.12	0.06	0.01	-0.15
Malaysia	-0.40	-0.63	-0.70	-0.58	-0.42	-0.35	-0.43
Mexico	0.32	-0.04	-0.50	-0.68	-0.70	-0.65	-0.51
Netherlands	-0.30	-0.44	-0.38	-0.27	-0.17	-0.20	-0.30
Norway	0.58	0.51	0.32	0.21	0.38	0.61	0.63
Peru	-0.16	-0.37	-0.52	-0.56	-0.41	-0.32	-0.22
Poland	-0.31	-0.39	-0.47	-0.58	-0.42	0.02	0.18
Portugal	-0.62	-0.74	-0.73	-0.70	-0.58	-0.44	-0.23
Russia	0.45	0.12	0.00	0.02	-0.02	-0.24	-0.52
South Africa	0.23	0.01	-0.22	-0.29	-0.13	0.13	0.27
Spain	-0.43	-0.68	-0.86	-0.92	-0.87	-0.74	-0.59
Sweden	0.55	0.51	0.40	0.25	0.12	0.01	-0.06
Switzerland	-0.12	-0.29	-0.26	-0.13	0.02	-0.04	-0.17
Thailand	-0.54	-0.76	-0.75	-0.57	-0.34	-0.13	0.08
Turkey	-0.67	-0.78	-0.81	-0.78	-0.70	-0.61	-0.51
United Kingdom	0.40	0.22	0.16	0.25	0.32	0.31	0.21
United States	-0.24	-0.47	-0.59	-0.59	-0.58	-0.57	-0.60
Full sample, Mean	-0.09	-0.25	-0.37	-0.39	-0.33	-0.28	-0.24
Full sample, Median	-0.13	-0.30	-0.44	-0.55	-0.36	-0.32	-0.25
AEs, Mean	-0.07	-0.23	-0.32	-0.35	-0.30	-0.27	-0.25
AEs, Median	-0.12	-0.25	-0.39	-0.40	-0.35	-0.32	-0.24
EMDEs, Mean	-0.11	-0.29	-0.42	-0.46	-0.38	-0.29	-0.22
EMDEs, Median	-0.19	-0.38	-0.51	-0.57	-0.39	-0.32	-0.28

Sources: IMF World Economic Outlook database, Bank for International Settlements, World Development Indicators and authors' calculations.

B Equilibrium of the Model

The equilibrium consists of the following equations for the home and foreign economies.

1) Consumption choices are optimized

$$c_t(v) = \min\left[\frac{v}{\frac{\beta}{q_t}P_t\mathbb{E}_t\mu_{t+1}}, x_t\right] \tag{B.1}$$

$$c_t^*(v) = \min\left[\frac{v}{\frac{\beta}{q_t}P_t^*\mathbb{E}_t\mu_{t+1}^*}, x_t^*\right] \tag{B.2}$$

2) Funds allocated to the goods market are optimized

$$P_t\mu_t = \frac{\beta}{q_t}P_t\mathbb{E}_t\mu_{t+1} + P_t\int_0^1 \xi_t(v)dF(v) \tag{B.3}$$

$$P_t^*\mu_t^* = \frac{\beta}{q_t}P_t^*\mathbb{E}_t\mu_{t+1}^* + P_t^*\int_0^1 \xi_t^*(v)dF(v) \tag{B.4}$$

3) Gross savings are allocated

$$a_{t+1} = \frac{P_t}{q_t}(x_t - c_t) \tag{B.5}$$

$$a_{t+1}^* = \frac{P_t^*}{q_t}(x_t^* - c_t^*) \tag{B.6}$$

4) Optimal private debt choice

$$q_t\mu_t = \beta\mathbb{E}_t\mu_{t+1} + q_t\lambda_t \tag{B.7}$$

$$q_t\mu_t^* = \beta\mathbb{E}_t\mu_{t+1}^* + q_t\lambda_t^* \tag{B.8}$$

5) Intermediate home goods markets demand

$$y_t^H = \kappa\left(\frac{P_t^H}{P_t}\right)^{-\sigma} y_t \tag{B.9}$$

$$y_t^{*H} = (1-\kappa^*)\left(\frac{P_t^H}{P_t^*}\right)^{-\sigma} y_t^* \tag{B.10}$$

6) Intermediate foreign goods markets demand

$$y_t^F = (1-\kappa)\left(\frac{P_t^F}{P_t}\right)^{-\sigma} y_t \tag{B.11}$$

$$y_t^{*F} = \kappa^*\left(\frac{P_t^F}{P_t^*}\right)^{-\sigma} y_t^* \tag{B.12}$$

7) Intermediate goods markets clear

$$\tilde{y}_t = y_t^H + y_t^{H*} \tag{B.13}$$

$$\tilde{y}_t^* = y_t^F + y_t^{*F} \tag{B.14}$$

8) Intermediate goods market production

$$\tilde{y}_t = \xi_{z,t} k_{t-1}^{\omega} n_t^{1-\omega} \tag{B.15}$$

$$\tilde{y}_t^* = \xi_{z,t}^* (k_{t-1}^*)^{\omega} (n_t^*)^{1-\omega} \tag{B.16}$$

9) Marginal product of capital

$$r_t = \omega\left(\frac{P_t^H}{P_t}\right)\xi_{z,t}\left(\frac{n_t}{k_{t-1}}\right) \tag{B.17}$$

$$r_t^* = \omega\left(\frac{P_t^F}{P_t^*}\right)\xi_{z,t}^*\left(\frac{n_t^*}{k_{t-1}^*}\right)^{1-\omega} \tag{B.18}$$

10) Marginal product of labor

$$w_t = (1-\omega)\left(\frac{P_t^H}{P_t}\right)\xi_{z,t}\left(\frac{n_t}{k_{t-1}}\right)^{-\omega} \tag{B.19}$$

$$w_t^* = (1-\omega)\left(\frac{P_t^F}{P_t^*}\right)\xi_{z,t}^*\left(\frac{n_t^*}{k_{t-1}^*}\right)^{-\omega} \tag{B.20}$$

11) Final goods price indices

$$P_t = \left[\kappa \left(P_t^H\right)^{1-\sigma} + (1-\kappa)\left(P_t^F\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{B.21}$$

$$P_t^* = \left[(1-\kappa^*)\left(P_t^H\right)^{1-\sigma} + \kappa^*\left(P_t^F\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{B.22}$$

12) Final good market clearing condition

$$y_t = c_t + i_t + g_t \tag{B.23}$$

$$y_t^* = c_t^* + i_t^* + g_t^* \tag{B.24}$$

13) Investment dynamics

$$i_t = k_t - (1-\delta)k_{t-1} + \frac{\phi_k}{2}k_{t-1}\left(\frac{k_t}{k_{t-1}} - 1\right)^2 \tag{B.25}$$

$$i_t^* = k_t^* - (1-\delta)k_{t-1}^* + \frac{\phi_k}{2}k_{t-1}^*\left(\frac{k_t^*}{k_{t-1}^*} - 1\right)^2 \tag{B.26}$$

14) Household budget constraints are satisfied

$$P_t x_t + e_t(h_{t+1} - h_t) + P_t i_t = w_t n_t + q_t b_{t+1} - b_t + a_t + r_{kt}k_{t-1} - P_t \text{tax}_t + b_t^g - \frac{1}{R_t}b_{t+1}^g \tag{B.27}$$

$$P_t^* x_t^* + e_t^*(h_{t+1}^* - h_t^*) + P_t^* i_t^* = w_t^* n_t^* + q_t b_{t+1}^* - b_t^* + a_t^* + r_{kt}^* k_{t-1}^* - P_t^* \text{tax}_t^* + b_t^{g*} - \frac{1}{R_t^*}b_{t+1}^{g*} \tag{B.28}$$

15) Housing choices are optimized

$$\lambda_t m_t e_t + \beta\eta^h \mathbb{E}_t \frac{1}{h_{t+1}} = \mu_t e_t - \beta\mathbb{E}_t e_{t+1}\mu_{t+1} \tag{B.29}$$

$$\lambda_t^* m_t^* e_t^* + \beta\eta^h \mathbb{E}_t \frac{1}{h_{t+1}^*} = \mu_t^* e_t^* - \beta\mathbb{E}_t e_{t+1}^*\mu_{t+1}^* \tag{B.30}$$

16) Capital stock choices are optimized

$$P_t\mu_t + \phi_k P_t\mu_t \left(\frac{k_t}{k_{t-1}} - 1\right) =$$
$$\beta \mathbb{E}_t \mu_{t+1} \left[P_{t+1}\left(1-\delta\right) + r_{k,t+1}\right] + \beta \frac{\phi_k}{2} \mathbb{E}_t P_{t+1}\mu_{t+1} \left(\frac{k_t^2}{k_{t-1}^2} - 1\right) \quad \text{(B.31)}$$

$$P_t^*\mu_t^* + \phi_k P_t^*\mu_t^* \left(\frac{k_t^*}{k_{t-1}^*} - 1\right) =$$
$$\beta \mathbb{E}_t \mu_{t+1}^* \left[P_{t+1}^*\left(1-\delta\right) + r_{k,t+1}^*\right] + \beta \frac{\phi_k}{2} \mathbb{E}_t P_{t+1}^*\mu_{t+1}^* \left(\frac{(k_t^*)^2}{(k_{t-1}^*)^2} - 1\right) \quad \text{(B.32)}$$

17) Housing markets clear

$$h_{t+1} = 1 \quad \text{(B.33)}$$

$$h_{t+1}^* = 1 \quad \text{(B.34)}$$

18) Borrowing constraints bind

$$q_t b_{t+1} = m_t e_t h_{t+1} \quad \text{(B.35)}$$

$$q_t b_{t+1}^* = m_t^* e_t^* h_{t+1}^* \quad \text{(B.36)}$$

19) Optimal labor choices

$$n_t^\nu = w_t \mu_t \quad \text{(B.37)}$$

$$(n_t^*)^\nu = w_t^* \mu_t^* \quad \text{(B.38)}$$

20) Optimal government debt choice

$$\frac{1}{R_t}\mu_t = \beta \mathbb{E}_t \mu_{t+1} \quad \text{(B.39)}$$

$$\frac{1}{R_t^*}\mu_t^* = \beta \mathbb{E}_t \mu_{t+1}^* \quad \text{(B.40)}$$

21) Government budget constraints bind

$$\frac{1}{R_t} b_{t+1}^g - b_t^g = P_t g_t - P_t \text{tax}_t \tag{B.41}$$

$$\frac{1}{R_t^*} b_{t+1}^{g*} - b_t^{g*} = P_t^* g_t^* - P_t^* \text{tax}_t^* \tag{B.42}$$

22) Government spending rule

$$g_t = \frac{g}{y} y_t + \xi_{g,t} \tag{B.43}$$

$$g_t^* = \frac{g^*}{y^*} y_t^* + \xi_{g,t}^* \tag{B.44}$$

23) Government lump-sum tax rule

$$\frac{\text{tax}_t}{y_t} = \frac{\text{tax}}{y} + \phi_b \left(\frac{b_{t+1}^g}{P_t y_t} - \frac{b^g}{Py} \right) \tag{B.45}$$

$$\frac{\text{tax}_t^*}{y_t^*} = \frac{\text{tax}^*}{y^*} + \phi_b^* \left(\frac{b_{t+1}^{g*}}{P_t^* y_t^*} - \frac{b^{g*}}{P^* y^*} \right) \tag{B.46}$$

Note that the global asset market clearing condition is $b_t + b_t^* = a_t + a_t^*$ which follows from the household and government budget constraints, the optimal savings allocations, goods market clearing conditions, and housing market clearing conditions.

B.1 Solution for Consumption

To solve for consumption c_t, we have, from $c_t(v) = \min \left[\frac{v}{\frac{\beta}{q_t} P_t \mathbb{E}_t \mu_{t+1}}, x_t \right]$,

$$c_t = \int_0^\infty c_t(v) f(v) dv = \int_1^{\bar{v}} \frac{v}{\frac{\beta}{q_t} P_t \mathbb{E}_t \mu_{t+1}} \alpha v^{-\alpha-1} dv + \int_{\bar{v}}^\infty x_t \alpha v^{-\alpha-1} dv,$$

and since $\bar{v} = \frac{x_t}{\frac{\beta}{q_t} P_t \mathbb{E}_t \mu_{t+1}}$, evaluating this expression gives

$$\frac{c_t}{\underline{c}_t} = \frac{\alpha}{\alpha - 1} \left[1 - \frac{1}{\alpha} \left(\frac{\underline{c}_t}{x_t} \right)^{\alpha - 1} \right].$$

So we can substitute the expressions for consumption above with the ratio of consumption to minimum consumption and use the definitions for minimum consumption

$$\underline{c}_t = \frac{1}{\frac{\beta}{q_t} P_t \mathbb{E}_t \mu_{t+1}}.$$

C Additional Results on Macroprudential Rules

C.1 Welfare Function

The household's utility function is

$$U = \max \sum_{t=0}^{\infty} \beta^t \left(\int_0^1 v_{it} \log c_{it} \, \mathrm{d}i + \eta^h \log h_t - \frac{1}{1+\nu} n_t^{1+\nu} \right).$$

Integrating over the Pareto distribution of v_{it} and the solution for c_{it}, the first term is

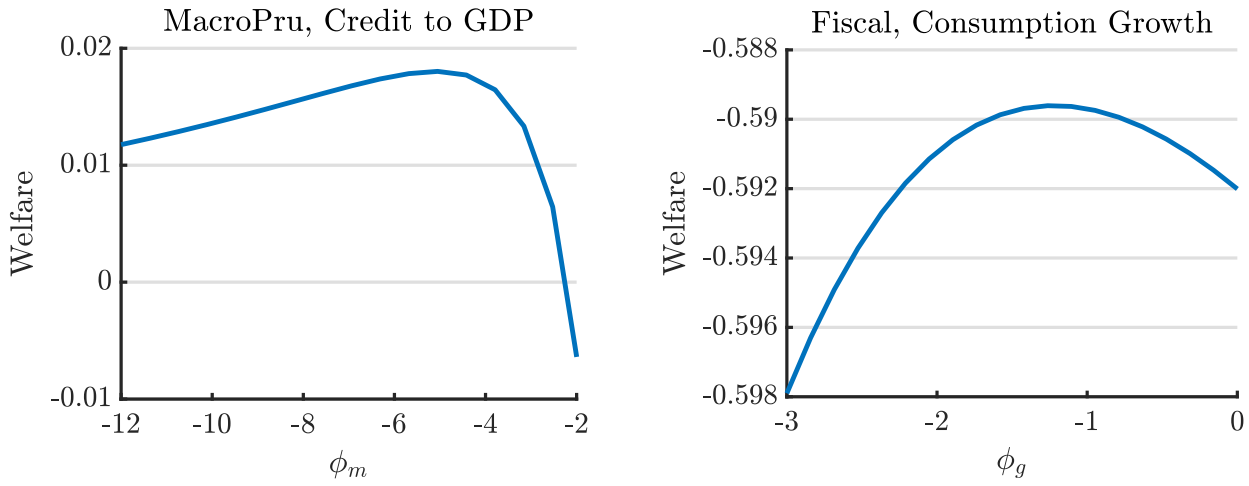
$$\int_0^1 v_{it} \log c_{it} \, \mathrm{d}i = \frac{\alpha}{\alpha - 1} \log \left(\underline{c}_t \right) \left(1 - \bar{v}_t^{1-\alpha} \right) + \frac{\alpha}{(\alpha - 1)^2} \left[1 - \bar{v}_t^{1-\alpha} \left(1 + (\alpha - 1) \log \bar{v}_t \right) \right] + \frac{\alpha}{\alpha - 1} \log \left[x_t \right] \bar{v}_t^{1-\alpha},$$

where $\bar{v} = \frac{x_t}{\frac{\beta}{q_t} P_t \mathbb{E}_t \mu_{t+1}}$. We can then write U in recursive form.

C.2 Welfare-Based Coefficients

Figure C.1 shows plots of the welfare function under a second-order approximation over values of the ϕ_m weight in the candidate macroprudential rule that responds to private credit-to-GDP relative to its steady-state value. Under the private credit-to-GDP rule, welfare is maximized at $\phi_m = -5.1$. The optimal coefficient for the fiscal policy rule in the response to the lagged

Figure C.1: Optimal Macroprudential and Fiscal Rule Coefficients



growth rate of consumption is shown in the right panel of Figure C.1, with welfare maximized around a coefficient of $\phi_g = -1.3$.

C.3 Joint Macroprudential and Fiscal Rules

To find the coefficients under the joint macroprudential and fiscal rules, we conduct a grid search across (ϕ_m, ϕ_g). Figure C.2 shows the theoretical mean of welfare in the second-order approximation of the model over (ϕ_m, ϕ_g) in the case where macroprudential policy reacts to the credit-to-output ratio. The optimal values in this case are $(\phi_m = -5.1, \phi_g = -1.1)$.

Figure C.2: Welfare Under Joint Rules, Macropru Reacts to Credit-to-GDP