

Appendix B. Data, Calibration, Prior Distributions and Posterior Estimates

(for online publication)

To estimate the model I use 10 data series for each region. These are the gross domestic product, consumption, government and investment expenditures, import price index, GDP deflator, interbank short-term interest rate, wage rate, number of employed and the stock market index. The common variable is the U.S. dollar per national currency nominal exchange rate. Each series is seasonally adjusted, demeaned and log-differenced (except for the interest rate that is linearly detrended). The data definitions and sources are provided in Table B.1.

Some of the parameters in the model can be computed from the steady state values of state variables that can in turn be estimated by the mean values of the observable variables. Since the observables are demeaned, however, these parameter values cannot be estimated. These parameter values are instead calibrated to fixed values throughout the estimations. The time discount parameter, $\tilde{\beta}$, is set equal to 0.995, implying a 2 percent annualized real interest rate. The intertemporal elasticity parameter, σ , is set equal to 1 so that there is unit elasticity. The population and per-capital output growth rate parameters, η and γ , are set equal to 1.0025 and 1.005, implying a 1 percent and 2 percent annualized growth rate of population and output along the balanced growth path. The share of capital income and the depreciation rate parameters, α and δ , are fixed to the standard values of 0.3 and 0.0025, respectively. The price and wage mark-up parameters, ϕ_p and ϕ_w , are set equal to 1.25 and 1.5 respectively following Smets and Wouters (2007). The domestic consumption and investment share parameters, γ_c and γ_i , take the values of 0.9 implying a 10 percent of imports in the steady state. The entrepreneurial survival rate, γ_e , is set equal to usual value of 0.97 so that there is a 3 percent chance that the entrepreneurs will not

survive. The level parameter, ξ , is set equal to $\xi = \frac{(1-\alpha)}{\phi_w (1-\lambda/\gamma)(C/Y)}$ to ensure that labor supply is equal to 1 at the steady-state.

The prior distributions for the parameters are provided in Table B.2 for home-country and foreign-country parameters. The priors here are very similar to Smets and Wouters (2007) and Gilchrist et al. (2009) for the parameters that are not related to the open economy features of the model. The habit parameter, λ , has a beta-distribution prior with a mean of 0.7 and a standard deviation of 0.1. The parameter σ_l has a normal prior with a mean of 2 (reflecting a Frisch-elasticity of labor supply of 0.5) and a standard deviation of 0.75. The capacity utilization elasticity parameter, ψ , has a beta prior with mean 0.5 (which implies unit elasticity of utilization with respect to the marginal product of capital) and standard deviation 0.1. The investment adjustment-cost parameter, ϕ , has a normal prior with mean 4 and standard deviation 1.5. The Calvo parameters, ξ_h , ξ_f and ξ_w , all have beta priors with mean 0.5 (i.e. an average of 2-quarter price and wage stickiness) and standard deviation 0.1. The price and wage indexation parameters, ι_h , ι_f and ι_w , have beta priors with a mean 0.5 and standard deviation of 0.15. The price mark-up at the steady-state, ϕ_p , is assumed to have a normal prior with mean 1.25 and standard deviation 0.1. As in Gilchrist et al. (2009), the elasticity of the external finance premium to leverage, χ , is assumed to be beta-distributed with a mean of 0.07 and a standard deviation of 0.02.

For the Taylor rule parameters, I assume that the prior for the long-run inflation reaction coefficient, r_π , has a normal distribution with a mean of 1.5 and standard deviation 0.25. Similarly, the long-run reaction coefficient on output and output growth, r_y and $r_{\Delta y}$, have normal

distributions with mean 0.25 and standard deviation 0.12. The prior for the interest rate smoothing parameter, ρ , has a normal distribution with mean 0.75 and standard deviation 0.1.

The priors for the autoregressive and moving average terms in all shocks have beta distributions with mean 0.5 and standard deviation 0.2. The priors for the standard deviations of all the shocks are also fairly uninformative, with inverse-gamma distributions with mean 0.5% and infinite variance.

References

Gilchrist, S., Ortiz, A., Zakrajsek, E., 2009. "Credit Risk and the Macroeconomy: Evidence from an Estimated DSGE Model," mimeo, Boston University.

Smets, F., Wouters, R., 2007. "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach," *American Economic Review*, 97, 586-606.

Table B.1. Data definitions and sources

Variable	Description	Data Source
Output	Real Gross Domestic Product by Expenditure in Constant Prices, Gross Domestic Product, Index, Seasonally adjusted	Federal Reserve Economic Data
Consumption	Private Final Consumption Expenditure in Constant Prices, Seasonally adjusted, National currency	Federal Reserve Economic Data
Investment	Gross Fixed Capital Formation in Constant Prices, Seasonally adjusted, National currency	Federal Reserve Economic Data
Government Expenditures	Government Final Consumption Expenditure in Constant Prices, Seasonally adjusted, National currency	Federal Reserve Economic Data
Employment	Employed Population: Aged 15 and Over: All Persons, Seasonally adjusted	Federal Reserve Economic Data
Wages	Average Hourly Earnings: Private Sector, Index, Seasonally adjusted	Federal Reserve Economic Data
Net Worth	Total Share Prices for All Shares, Index	Federal Reserve Economic Data
GDP Deflator	Gross Domestic Product: Implicit Price Deflator, Index, Seasonally adjusted	Federal Reserve Economic Data
Inflation	Private Final Consumption Expenditure Implicit Price Deflator, Index, Seasonally adjusted	Federal Reserve Economic Data
Interest rate	Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate	Federal Reserve Economic Data
Import prices	Nominal Imports of Goods and Services / Real Imports of Goods and Services (in 2010 prices)	Federal Reserve Economic Data
Exchange rate	US Dollar to National Currency Spot Exchange Rate	Federal Reserve Economic Data

Table B.2. Prior distributions and posterior estimates of structural parameters

	Prior Densities	Posterior Means by model													
		CA	G-7	FR	G-7	DE	G-7	IT	G-7	JP	G-7	UK	G-7	US	G-7
χ	B (0.07, 0.02)	0.0223	0.0198	0.0126	0.0263	0.0113	0.0258	0.0172	0.0337	0.0121	0.0240	0.0620	0.1171	0.0149	0.0379
λ	B (0.7, 0.1)	0.8245	0.8347	0.9146	0.9763	0.9382	0.9899	0.8927	0.9828	0.8266	0.9886	0.9332	0.9916	0.9124	0.9143
σ_i	N (2, 0.75)	1.3699	1.3733	1.6327	1.1132	1.5060	1.1197	1.6351	1.4733	1.6971	0.6092	1.8437	1.1921	1.6174	1.3038
ψ	B (0.5, 0.2)	0.5347	0.3271	0.6272	0.2406	0.7016	0.0329	0.6919	0.1293	0.4409	0.2323	0.6414	0.2040	0.5419	0.4020
φ	N (4, 1.5)	8.1570	3.2804	6.6313	4.0955	7.5006	2.8872	6.6899	3.0964	5.8151	3.3233	7.0271	3.0481	7.3521	2.7952
l_h	B (0.5, 0.15)	0.4540	0.5320	0.4920	0.5328	0.4263	0.4869	0.4252	0.5860	0.4618	0.6166	0.4028	0.4001	0.4982	0.4723
l_f	B (0.5, 0.15)	0.4325	0.5564	0.4755	0.4773	0.5418	0.4877	0.5284	0.5080	0.4185	0.5197	0.4884	0.5352	0.4778	0.5081
l_w	B (0.5, 0.15)	0.2605	0.0638	0.1594	0.0108	0.0848	0.1315	0.0195	0.1165	0.2369	0.0129	0.2083	0.1496	0.1000	0.0548
ξ_{η}	B (0.5, 0.1)	0.8595	0.5989	0.7793	0.5633	0.7637	0.5905	0.7714	0.5682	0.7377	0.5480	0.9398	0.5610	0.7115	0.5822
ξ_{γ}	B (0.5, 0.1)	0.6084	0.5062	0.6350	0.5087	0.6858	0.5500	0.6917	0.5003	0.6889	0.4983	0.6515	0.3800	0.7227	0.4725
ξ_w	B (0.5, 0.1)	0.8501	0.9140	0.7970	0.9452	0.8367	0.9207	0.8161	0.8981	0.7370	0.9508	0.8644	0.9517	0.8748	0.9175
λ_c	G (1, 0.2)	0.3651	4.7936	0.1985	5.0211	0.3893	4.9534	0.3722	5.3072	0.8165	4.7185	0.4067	5.1943	0.3876	5.2068
λ_i	G (0.25, 0.2)	0.1876	0.1426	0.1975	0.2283	0.2458	0.1799	0.2084	0.2076	0.2867	0.2844	0.2373	0.3002	0.2251	0.1497
ρ	N (0.75, 0.1)	0.7160	0.7898	0.7641	0.8690	0.7807	0.8629	0.7531	0.8782	0.8194	0.8849	0.7689	0.7892	0.7062	0.8718
r_{π}	N (1.5, 0.25)	1.3479	1.5070	1.3574	1.2640	1.3269	1.2974	1.6148	1.2186	1.3986	1.2286	1.3972	1.1119	1.5192	1.3634
r_y	N (0.25, 0.12)	0.1922	0.0124	0.1571	0.0054	0.2156	0.0837	0.1644	0.0307	0.1631	0.0190	0.1979	0.1619	0.2753	0.0240
$r_{\Delta y}$	N (0.25, 0.12)	0.5327	0.5888	0.5374	0.6253	0.5417	0.6016	0.4362	0.6504	0.5568	0.5955	0.4926	0.7077	0.5085	0.6646

Note: The table displays the prior distributions and the posterior mean estimates of model parameters. The prior distributions denoted by B, N and G are the Beta, Gamma and Normal distributions, respectively.

Table B.3. Prior distributions and posterior estimates of shock process parameters

		Posterior mean values of shock parameters by model											
	Prior Density	CA	G-7	Common	FR	G-7	Common	DE	G-7	Common	IT	G-7	Common
<u>Persistence parameters</u>													
consumption	B (0.5, 0.2)	0.68	0.45	0.72	0.65	0.56	0.72	0.49	0.51	0.72	0.67	0.37	0.72
investment	B (0.5, 0.2)	0.27	0.53	0.38	0.31	0.25	0.38	0.41	0.24	0.18	0.24	0.34	0.28
government exp.	B (0.5, 0.2)	0.92	0.79	0.51	0.88	0.62	0.58	0.97	0.69	0.48	0.92	0.60	0.63
productivity	B (0.5, 0.2)	0.72	0.63	0.62	0.62	0.69	0.64	0.63	0.70	0.59	0.64	0.69	0.63
interest rate	B (0.5, 0.2)	0.50	0.49	0.70	0.56	0.48	0.49	0.69	0.49	0.54	0.62	0.34	0.66
price, domestic	B (0.5, 0.2)	0.31	0.44	0.18	0.22	0.38	0.20	0.24	0.29	0.17	0.20	0.35	0.31
price, foreign	B (0.5, 0.2)	0.71	0.81	0.79	0.71	0.76	0.78	0.84	0.84	0.83	0.79	0.73	0.71
wage	B (0.5, 0.2)	0.80	0.09	0.33	0.71	0.02	0.37	0.82	0.01	0.45	0.89	0.12	0.50
credit spread	B (0.5, 0.2)	0.27	0.35	0.28	0.27	0.26	0.36	0.17	0.29	0.41	0.27	0.27	0.22
net worth	B (0.5, 0.2)	0.29	0.31	0.17	0.12	0.26	0.31	0.31	0.18	0.31	0.07	0.23	0.34
depreciation	B (0.5, 0.2)	0.80			0.65			0.77			0.73		
<u>Shock standard deviations</u>													
consumption	IG (0.5%, inf)	0.0017	0.0023	0.0013	0.0015	0.0007	0.0008	0.0026	0.0008	0.0008	0.0018	0.0008	0.0008
investment	IG (0.5%, inf)	0.0060	0.0046	0.0022	0.0033	0.0118	0.0045	0.0036	0.0142	0.0018	0.0056	0.0115	0.0043
government exp.	IG (0.5%, inf)	0.0034	0.0054	0.0021	0.0047	0.0093	0.0018	0.0030	0.0077	0.0019	0.0051	0.0095	0.0018
productivity	IG (0.5%, inf)	0.0015	0.0008	0.0008	0.0010	0.0008	0.0007	0.0007	0.0009	0.0008	0.0009	0.0009	0.0009
interest rate	IG (0.5%, inf)	0.0021	0.0019	0.0010	0.0013	0.0018	0.0010	0.0012	0.0020	0.0009	0.0015	0.0022	0.0008
price, domestic	IG (0.5%, inf)	0.0020	0.0013	0.0008	0.0009	0.0015	0.0008	0.0010	0.0015	0.0009	0.0022	0.0017	0.0008
price, foreign	IG (0.5%, inf)	0.0023	0.0014	0.0010	0.0013	0.0016	0.0012	0.0010	0.0011	0.0010	0.0016	0.0015	0.0013
wage	IG (0.5%, inf)	0.0015	0.0008	0.0008	0.0010	0.0008	0.0007	0.0007	0.0009	0.0008	0.0009	0.0009	0.0009
credit spread	IG (0.5%, inf)	0.0043	0.0082	0.0029	0.0367	0.0046	0.0030	0.0038	0.0023	0.0126	0.0468	0.0107	0.0029
net worth	IG (0.5%, inf)	0.0320	0.0114	0.0025	0.0039	0.0025	0.0126	0.0400	0.0076	0.0021	0.0042	0.0028	0.0096
depreciation	IG (0.5%, inf)	0.0036			0.0124			0.0056			0.0066		
<u>Shock correlations</u>													
consumption	B (0.5, 0.2)	0.3435			0.2481			0.1773			0.3813		
investment	B (0.5, 0.2)	0.0054			0.2041			0.2303			0.0254		
government exp.	B (0.5, 0.2)	0.0177			0.1120			0.0349			0.1758		
productivity	B (0.5, 0.2)	0.6937			0.6517			0.5814			0.7641		
interest rate	B (0.5, 0.2)	0.3330			0.1673			0.3875			0.2886		
price, domestic	B (0.5, 0.2)	0.5764			0.4475			0.3254			0.2699		
price, foreign	B (0.5, 0.2)	0.2995			0.2830			0.1653			0.3512		
wage	B (0.5, 0.2)	0.6937			0.6517			0.5814			0.7641		
credit spread	B (0.5, 0.2)	0.4961			0.4666			0.6026			0.5050		
net worth	B (0.5, 0.2)	0.8184			0.6657			0.7467			0.7015		

Notes: The table displays the prior distributions and the posterior mean estimates of the parameters governing the shock processes. The prior distributions denoted by B and IG are the beta and inverse gamma distributions, respectively. Shock correlation values displayed at the bottom of the table represent the correlation coefficients of the shocks measured across a country and the rest of G-7.

Table B.3. Prior distributions and posterior estimates of shock process parameters, continued

		Posterior mean values of shock parameters by model								
	Prior Density	JP	G-7	Common	UK	G-7	Common	US	G-7	Common
<u>Persistence parameters</u>										
consumption	B (0.5, 0.2)	0.63	0.56	0.72	0.59	0.52	0.72	0.65	0.55	0.72
investment	B (0.5, 0.2)	0.01	0.47	0.39	0.41	0.34	0.38	0.42	0.26	0.38
government exp.	B (0.5, 0.2)	0.90	0.66	0.57	0.94	0.61	0.49	0.97	0.55	0.58
productivity	B (0.5, 0.2)	0.76	0.50	0.75	0.72	0.53	0.75	0.59	0.81	0.72
interest rate	B (0.5, 0.2)	0.48	0.54	0.68	0.53	0.46	0.68	0.58	0.42	0.60
price, domestic	B (0.5, 0.2)	0.24	0.30	0.17	0.25	0.36	0.25	0.28	0.41	0.36
price, foreign	B (0.5, 0.2)	0.79	0.72	0.74	0.75	0.73	0.72	0.80	0.91	0.87
wage	B (0.5, 0.2)	0.61	0.12	0.55	0.85	0.01	0.40	0.65	0.10	0.41
credit spread	B (0.5, 0.2)	0.05	0.06	0.37	0.25	0.31	0.21	0.24	0.23	0.01
net worth	B (0.5, 0.2)	0.03	0.32	0.13	0.19	0.35	0.30	0.07	0.35	0.10
depreciation	B (0.5, 0.2)	0.82			0.75			0.77		
<u>Shock standard deviations</u>										
consumption	IG (0.5%, inf)	0.0016	0.0008	0.0008	0.0027	0.0007	0.0008	0.0016	0.0017	0.0014
investment	IG (0.5%, inf)	0.0014	0.0115	0.0029	0.0056	0.0018	0.0028	0.0047	0.0017	0.0036
government exp.	IG (0.5%, inf)	0.0035	0.0089	0.0021	0.0078	0.0094	0.0021	0.0052	0.0258	0.0034
productivity	IG (0.5%, inf)	0.0011	0.0008	0.0006	0.0011	0.0007	0.0007	0.0009	0.0008	0.0008
interest rate	IG (0.5%, inf)	0.0008	0.0021	0.0008	0.0015	0.0013	0.0013	0.0024	0.0011	0.0010
price, domestic	IG (0.5%, inf)	0.0014	0.0022	0.0010	0.0021	0.0012	0.0009	0.0009	0.0029	0.0010
price, foreign	IG (0.5%, inf)	0.0041	0.0014	0.0018	0.0018	0.0019	0.0017	0.0019	0.0016	0.0012
wage	IG (0.5%, inf)	0.0011	0.0008	0.0006	0.0011	0.0007	0.0007	0.0009	0.0008	0.0008
credit spread	IG (0.5%, inf)	0.0049	0.0023	0.0028	0.0140	0.0064	0.0026	0.0297	0.0156	0.0033
net worth	IG (0.5%, inf)	0.0598	0.0151	0.0032	0.0255	0.0105	0.0025	0.0107	0.0036	0.0024
depreciation	IG (0.5%, inf)	0.0065			0.0057			0.0044		
<u>Shock correlations</u>										
consumption	B (0.5, 0.2)	0.3652			0.2683			0.3060		
investment	B (0.5, 0.2)	0.1808			0.1058			0.0145		
government exp.	B (0.5, 0.2)	0.0482			0.1314			0.0122		
productivity	B (0.5, 0.2)	0.5804			0.6694			0.4664		
interest rate	B (0.5, 0.2)	0.1641			0.0844			0.2062		
price, domestic	B (0.5, 0.2)	0.5070			0.3289			0.3655		
price, foreign	B (0.5, 0.2)	0.3224			0.2981			0.4740		
wage	B (0.5, 0.2)	0.5804			0.6694			0.4664		
credit spread	B (0.5, 0.2)	0.4385			0.5051			0.5048		
net worth	B (0.5, 0.2)	0.7125			0.7299			0.6881		

Notes: The table displays the prior distributions and the posterior mean estimates of the parameters governing the shock processes. The prior distributions denoted by B and IG are the beta and inverse gamma distributions, respectively. Shock correlation values displayed at the bottom of the table represent the correlation coefficients of the shocks measured across a country and the rest of G-7.