

User's Guide

Seven Simple Monetary Policy Rules Spreadsheet

The Excel workbook contains four worksheets. Two worksheets, **Parameters** and **Forecasts**, contain the inputs that go into calculating the federal funds rates from seven simple monetary policy rules. These federal funds rates are in the worksheet **Policy Rule Funds Rates**. Finally, in the worksheet **Make Your Own Rule**, you can see how inputting your own forecasts changes the federal funds rates from the seven simple monetary policy rules, and you can customize your own simple monetary policy rule, which will generate a federal funds rate path using forecasts and parameters that you enter.

Worksheet: Parameters

	A	B
1	Key Parameters for the Seven Simple Monetary Policy Rules	
2		Value
3	π^* , target inflation rate, median long-run value from Summary of Economic Projections (SEP) (%)	2
4	r^* , median implied long-run value from SEP (%)	1
5	r_{alt}^* , Laubach-Williams one-sided estimate, most recent value (%)	0.186546761
6	$1/b$, inverse Okun's coefficient	-1.8
7	u_{SPF}^* , Survey of Professional Forecasters' natural rate of unemployment (UBAR), median, most recent observation (%)	5
8	u_{SEP}^* , median long-run value from SEP (%)	4.8
9	ρ , interest rate inertia/smoothing parameter	0.8
10		
11	Sources: Board of Governors of the Federal Reserve System; Federal Reserve Bank of Cleveland; Federal Reserve Bank of Philadelphia; Federal Reserve Bank of San Francisco; Congressional Budget Office; and Haver Analytics.	
12		
13	Based on data and forecasts available as of June 23, 2016.	

The **Parameters** worksheet contains the notation, definitions, and values of the parameters used in the seven simple monetary policy rules. Each row corresponds to a different parameter. Definitions and notation for the parameters are found in column A, cells **A3:A9**, while the corresponding values assigned to each parameter are found in column B, cells **B3:B9**. For example, the value for the parameter defined in **A9** (ρ , interest rate inertia/smoothing parameter) is 0.8, the value found in cell **B9**.

Worksheet: Forecasts

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Key Forecast Variables from Three Sources															
2		Date (YYYY.Q format)	2015.4	2016.1	2016.2	2016.3	2016.4	2017.1	2017.2	2017.3	2017.4	2018.1	2018.2	2018.3	2018.4	2019.1
3	Data	Federal funds rate	0.16	0.36												
4	Survey of Professional Forecasters	PCE inflation (Y/Y)	0.5	1.0	0.9	1.0	1.4	1.8	1.8							
5		PCE inflation (Q/Q, SAAR)	0.3	0.3	1.6	1.8	1.9	1.8	1.9							
6		Core PCE inflation (Y/Y)	1.4	1.7	1.6	1.7	1.8	1.7	1.8							
7		Unemployment rate	5.0	4.9	4.9	4.8	4.7	4.7	4.6							
8	Congressional Budget Office	PCE inflation (Y/Y)	0.5	1.1	0.9	1.1	1.5	1.8	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0
9		PCE inflation (Q/Q, SAAR)	0.3	0.5	1.7	1.8	1.9	1.9	2.0	2.0	2.0	2.0	1.9	2.0	2.0	2.0
10		Core PCE inflation (Y/Y)	1.4	1.5	1.4	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.0	2.0	2.0
11		Output gap	-2.0	-1.7	-1.4	-1.2	-0.9	-0.7	-0.5	-0.4	-0.2	-0.1	0.0	0.0	-0.1	-0.1
12		Unemployment rate	5.0	4.9	4.7	4.6	4.5	4.4	4.4	4.4	4.5	4.5	4.5	4.6	4.7	4.7
13		Natural rate of unemployment	4.9	4.9	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
14	FRBC staff small BVAR model	PCE inflation (Y/Y)	0.5	1.0	1.0	1.1	1.4	1.8	2.0	2.1	2.2	2.2	2.2	2.3	2.3	2.3
15		PCE inflation (Q/Q, SAAR)	0.3	0.3	2.1	1.6	1.7	1.9	2.1	2.2	2.2	2.3	2.3	2.3	2.3	2.3
16		Core PCE inflation (Y/Y)	1.4	1.7	1.6	1.7	1.8	1.7	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1
17		Unemployment rate	5.0	4.9	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.1	5.1	5.2	5.2	5.2
18																
19	Sources: Data and/or forecasts from Federal Reserve Bank of Philadelphia; Congressional Budget Office; Federal Reserve Bank of Cleveland; Bureau of Economic Analysis; Bureau of Labor Statistics; Board of Governors of the Federal Reserve System; and Haver Analytics.															
20	Notes: All numbers are expressed as percentages. Y/Y denotes year-over-year inflation rates. Q/Q, SAAR denotes quarter-over-quarter inflation rates at a seasonally adjusted annualized rate. Because the Cleveland Fed staff consult a variety of forecasting models, the FRBC staff small BVAR model forecast does not necessarily represent the official forecast of Cleveland Fed staff or the president of the Cleveland Fed.															
21																
22	Based on data and forecasts available as of June 23, 2016.															

Forecasts of different economic variables from each of three different forecast sources are presented in the **Forecasts** worksheet. Each row corresponds to a forecast source and a variable being forecasted, and it contains the forecast values for that particular variable. Rows 4-7 contain forecasts from the Survey of Professional Forecasters (SPF), rows 8-13 contain forecasts from the Congressional Budget Office (CBO), and rows 14-17 contain forecasts from the FRBC staff small BVAR model (FRBC BVAR). Cells **B4:B7** indicate the variable being forecasted by the SPF, while cells **B8:13** and **B14:B17** indicate the variable being forecasted by the CBO and FRBC BVAR, respectively. Forecasts for the variables are contained in columns C through P. For example, row 11 contains the CBO forecast for the output gap, which is found in cells **C11:P11** for quarters 2015.4 through 2019.1 (the dating convention is YYYY.Q format, e.g. 2015.4 is the fourth quarter of 2015).

Data on the federal funds rate in the first two quarters listed in the **Forecasts** worksheet (here 2015.4 and 2016.1) are found in cells **C3:D3**. Note that throughout the spreadsheet, cells pertaining to data are shaded in red.

Worksheet: Policy Rule Funds Rates

	A	B	C	D	E	F	G	H	I	J	K	L
1	Federal Funds Rates Based on Seven Simple Policy Rules (Percent)											
2		Date (YYYY.Q format)	2016.1	2016.2	2016.3	2016.4	2017.1	2017.2	2017.3	2017.4	2018.1	2018.2
3	Survey of Professional Forecasters	Taylor (1993) rule	0.36	1.41	1.70	2.36	2.93	3.13				
4		Core inflation in Taylor (1999) rule	0.36	2.55	2.85	3.20	3.10	3.41				
5		Inertial rule	0.36	0.80	1.21	1.61	1.91	2.21				
6		Alternative r^* rule	0.36	0.64	0.92	1.21	1.43	1.66				
7		Forward-looking rule	0.36	2.75	2.95							
8		First-difference rule	0.36	0.09	-0.18							
9		Low weight on output gap rule	0.36	0.58	0.79	0.96	1.14					
10	Congressional Budget Office	Taylor (1993) rule	0.36	0.67	0.99	1.72	2.38	2.59	2.74	2.85	2.93	2.96
11		Core inflation in Taylor (1999) rule	0.36	0.67	1.02	1.49	1.85	2.18	2.44	2.64	2.80	2.90
12		Inertial rule	0.36	0.42	0.54	0.73	0.96	1.20	1.45	1.69	1.91	2.11
13		Alternative r^* rule	0.36	0.26	0.25	0.34	0.48	0.65	0.85	1.05	1.23	1.40
14		Forward-looking rule	0.36	2.03	2.25	2.44	2.60	2.72	2.80	2.87	2.92	2.96
15		First-difference rule	0.36	0.19	0.26	0.28	0.35	0.46	0.43	0.41	0.26	0.24
16		Low weight on output gap rule	0.36	0.56	0.75	0.94	1.11	1.27	1.43	1.57	1.69	1.81
17	FRBC staff small BVAR model	Taylor (1993) rule	0.36	1.41	1.50	1.99	2.61	2.60	2.79	2.96	3.04	3.05
18		Core inflation in Taylor (1999) rule	0.36	2.24	2.31	2.45	2.34	2.37	2.42	2.46	2.48	2.46
19		Inertial rule	0.36	0.74	1.05	1.33	1.53	1.70	1.85	1.97	2.07	2.15
20		Alternative r^* rule	0.36	0.58	0.76	0.93	1.05	1.15	1.25	1.33	1.39	1.45
21		Forward-looking rule	0.36	2.66	2.64	2.84	3.03	3.12	3.15	3.17	3.17	3.15
22		First-difference rule	0.36	0.15	-0.10	-0.17	0.00	0.31	0.67	1.07	1.51	1.96
23		Low weight on output gap rule	0.36	0.54	0.71	0.91	1.11	1.30	1.48	1.64	1.80	1.93
24	Summary	Maximum	0.36	2.75	2.95	3.20	3.10	3.41	3.15	3.17	3.17	3.15
25		75th Percentile	0.36	1.41	1.70	2.18	2.49	2.60	2.66	2.80	2.89	2.94
26		Median	0.36	0.67	0.99	1.33	1.53	1.94	1.66	1.83	1.99	2.13
27		25th Percentile	0.36	0.54	0.71	0.92	1.08	1.22	1.29	1.39	1.55	1.84
28		Minimum	0.36	0.09	-0.18	-0.17	0.00	0.31	0.43	0.41	0.26	0.24
29			Data									
	Sources: Federal Reserve Bank of Cleveland calculations based on data and/or forecasts from Federal Reserve Bank of Philadelphia; Congressional Budget Office; Federal Reserve Bank of Cleveland; Bureau of Economic Analysis; Bureau of Labor Statistics; Board of Governors of the Federal Reserve System; Federal Reserve Bank of San Francisco; and Haver Analytics.											
30	Notes: All federal funds rates are expressed as quarterly average percentages.											
31												
32	Based on data and forecasts available as of June 23, 2016.											

Federal funds rates from each of seven simple monetary policy rules are presented in the [Policy Rule Funds Rates](#) worksheet. Column C contains the average federal funds rate for the previous quarter. Calculated policy rule federal funds rates can be found in columns D-L and rows 3-23. Each row corresponds to a forecast source, a policy rule, and the federal funds rate path for the current quarter through eight quarters ahead. The rules in rows 3-9 use forecasts from the SPF; the rules in rows 10-16 use CBO forecasts; and the rules in rows 17-23 use FRBC BVAR forecasts. These forecasts can be found in the worksheet [Forecasts](#). For example, row 3 shows federal funds rates from the Taylor (1993) rule using SPF forecasts, while rows 10 and 17 show the federal funds rates from the same rule using CBO and FRBC BVAR forecasts, respectively. Across each forecast source, a particular rule has the same general form, but may be parameterized differently. For example, the SPF-Taylor (1993) rule and the FRBC BVAR-Taylor (1993) rule both use an unemployment rate gap term, but u^* in the SPF-Taylor (1993) rule is u_{SPF}^* , whereas the FRBC BVAR-Taylor (1993) rule uses u_{SEP}^* (see the [Parameters](#) worksheet for definitions of each). The exact formula for a given rule across each of the three forecast sources can be found in a table located on the right-hand side of the [Policy Rule Funds Rates](#) worksheet (pictured below).

N	O	P	Q	R	S	T	U	V	W	X
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SPF: Simple Policy Rule Formulae

1. Taylor (1993) rule	$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5(1/b)(u_t - u_{SPF}^*)$
2. Core inflation in Taylor (1999) rule	$i_t = r^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (1/b)(u_t - u_{SPF}^*)$
3. Inertial rule	$i_t = \rho i_{t-1} + (1-\rho)[r^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (1/b)(u_t - u_{SPF}^*)]$
4. Alternative r^* rule	$i_t = \rho i_{t-1} + (1-\rho)[r_{alt}^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (1/b)(u_t - u_{SPF}^*)]$
5. Forward-looking rule	$i_t = r^* + \pi_{t+3}^F + 0.5(\pi_{t+3}^F - \pi^*) + 0.5(1/b)(u_t - u_{SPF}^*)$
6. First-difference rule	$i_t = i_{t-1} + 1.74(\pi_{t+3}^F - \pi^*) - 1.19(u_{t-1} - u_{t-2})$
7. Low weight on output gap rule	$i_t = 0.9i_{t-1} + (1-0.91)[r^* + \pi^* + 1.58(\pi_{t+1}^{Q,F} - \pi^*) + 0.14(1/b)(u_{t+1}^F - u_{SPF}^*)]$

CBO: Simple Policy Rule Formulae

1. Taylor (1993) rule	$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5(\text{output gap}_t)$
2. Core inflation in Taylor (1999) rule	$i_t = r^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (\text{output gap}_t)$
3. Inertial rule	$i_t = \rho i_{t-1} + (1-\rho)[r^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (\text{output gap}_t)]$
4. Alternative r^* rule	$i_t = \rho i_{t-1} + (1-\rho)[r_{alt}^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (\text{output gap}_t)]$
5. Forward-looking rule	$i_t = r^* + \pi_{t+3}^F + 0.5(\pi_{t+3}^F - \pi^*) + 0.5(\text{output gap}_t)$
6. First-difference rule	$i_t = i_{t-1} + 1.74(\pi_{t+3}^F - \pi^*) - 1.19(u_{t-1} - u_{t-2})$
7. Low weight on output gap rule	$i_t = 0.9i_{t-1} + (1-0.91)[r^* + \pi^* + 1.58(\pi_{t+1}^{Q,F} - \pi^*) + 0.14(\text{output gap}_{t+1}^F)]$

FRBC BVAR: Simple Policy Rule Formulae

1. Taylor (1993) rule	$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5(1/b)(u_t - u_{SEP}^*)$
2. Core inflation in Taylor (1999) rule	$i_t = r^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (1/b)(u_t - u_{SEP}^*)$
3. Inertial rule	$i_t = \rho i_{t-1} + (1-\rho)[r^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (1/b)(u_t - u_{SEP}^*)]$
4. Alternative r^* rule	$i_t = \rho i_{t-1} + (1-\rho)[r_{alt}^* + \pi_t^{Core} + 0.5(\pi_t^{Core} - \pi^*) + (1/b)(u_t - u_{SEP}^*)]$
5. Forward-looking rule	$i_t = r^* + \pi_{t+3}^F + 0.5(\pi_{t+3}^F - \pi^*) + 0.5(1/b)(u_t - u_{SEP}^*)$
6. First-difference rule	$i_t = i_{t-1} + 1.74(\pi_{t+3}^F - \pi^*) - 1.19(u_{t-1} - u_{t-2})$
7. Low weight on output gap rule	$i_t = 0.9i_{t-1} + (1-0.91)[r^* + \pi^* + 1.58(\pi_{t+1}^{Q,F} - \pi^*) + 0.14(1/b)(u_{t+1}^F - u_{SEP}^*)]$

For parameter definitions, see the 'Parameters' tab of the spreadsheet.

Each cell in the range **D3:L23** contains a formula which calculates a federal funds rate by referring back to the worksheets **Parameters** and **Forecasts**. For example, the following formula calculating the SPF-Taylor (1993) rule federal funds rate for 2016.2 can be found in cell **D3**:

=Parameters!\$B\$4+Forecasts!E4+0.5*(Forecasts!E4-Parameters!\$B\$3)+0.5*Parameters!\$B\$6*(Forecasts!E7-Parameters!\$B\$7)

The terms **Parameters!\$B\$3**, **Parameters!\$B\$4**, **Parameters!\$B\$6**, and **Parameters!\$B\$7** refer to the parameter values found in cells **B3**, **B4**, **B6**, and **B7** in the **Parameters** worksheet, while **Forecasts!E4** and **Forecasts!E7** refer to the forecast values in cells **E4** and **E7** of the **Forecasts** worksheet.

Finally, the federal funds rates in **D3:L23** are summarized in the **Summary** portion of the table. The maximum, 75th percentile, median, 25th percentile, and minimum of all federal funds rates calculated for a given quarter are presented in rows 24-28 in the range **D24:L28**. For example, cell **D24** contains the maximum of all federal funds

rates calculated for 2016.2 (i.e., those in cells **D3:D23**); **D25** contains the 75th percentile of these same federal funds rates; and cells **D26**, **D27**, and **D28** contain the median, 25th percentile, and minimum of these same federal funds rates, respectively.

Worksheet: Make Your Own Rule

In **Step 1**, you can input your own forecasts for the inflation and unemployment rate variables that go into policy rule calculations (the table has been initialized with the FRBC BVAR forecasts). Cells in red denote data on these variables and the federal funds rate over three prior quarters. You may enter in your own forecasts by overwriting the cells in white. In particular, a forecast for PCE inflation (year-over-year percent change) may be entered in row 3, cells **F3:Q3**; core PCE inflation (year-over-year percent change) in row 4, cells **F4:Q4**; and the unemployment rate in row 5, cells **F5:Q5**. Note that you only need to enter a forecast for PCE inflation in year-over-year percent changes and not in quarter-over-quarter percent changes. In row 6, cells **F6:Q6**, the forecast for PCE inflation in quarter-over-quarter percent changes is automatically calculated based on the forecast for PCE inflation in year-over-year percent changes that you enter in row 3.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		Date (YYYY.Q format)	2015.3	2015.4	2016.1	2016.2	2016.3	2016.4	2017.1	2017.2	2017.3	2017.4	2018.1	2018.2	2018.3	2018.4	2019.1
2	Step 1: Overwrite this forecast with yours	Federal funds rate (quarterly average, percent, data)	0.14	0.16	0.36												
3		PCE inflation (year-over-year, percent)	0.3	0.5	1.0	1.0	1.1	1.4	1.8	1.8	2.0	2.1	2.2	2.2	2.2	2.3	2.3
4		Core PCE inflation (year-over-year, percent)	1.3	1.4	1.7	1.6	1.7	1.8	1.7	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1
5		Unemployment rate (percent)	5.2	5.0	4.9	4.9	4.9	4.9	5.0	5.0	5.0	5.0	5.1	5.1	5.2	5.2	5.2
6		We compute the quarter-over-quarter PCE inflation rate for you:	1.3	0.3	0.3	2.1	1.6	1.7	1.9	2.1	2.2	2.2	2.3	2.3	2.3	2.3	2.3

In **Step 2**, we present the following general policy rule:

$$i_t = \rho i_{t-1} + (1-\rho)[r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta(1/b)(u_t - u^*)]$$

which takes in seven parameters: π^* , r^* , $1/b$, u^* , ρ , α , and β . You can customize this rule by specifying the values of these parameters. The definitions of these parameters are in column B, cells **B10:B16**. The parameter values have been initialized with α , β , and ρ chosen to match the Taylor (1993) rule, while the remaining parameter values are initialized using the values from the **Parameters** worksheet (from the SEP in the case of π^* , r^* , and u^*). You can change the values of these parameters by changing the numbers in column C, cells **C10:C16**. The rule also takes in your forecasts of π_t (year-over-year PCE inflation) and u_t (the unemployment rate). Federal funds rates are computed using this rule in **Step 3**.

8	Step 2: Customize a general policy rule with your values for the parameters	$i_t = \rho i_{t-1} + (1-\rho)[r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta(1/b)(u_t - u^*)]$	
9		Parameter	Value
10		π^* , target inflation rate (%)	2
11		r^* , natural real federal funds rate (%)	1
12		$1/b$, inverse Okun's coefficient	-1.8
13		u^* , natural/long-run rate of unemployment (%)	4.8
14		ρ , interest rate inertia/smoothing parameter (should be < 1)	0
15		α , weight on inflation gap	0.5
16	β , weight on output gap	0.5	

In **Step 3**, rows 20-26 calculate federal funds rates from the seven simple monetary policy rules using your forecasts from **Step 1** and the parameter values found in the **Parameters** worksheet. Rule labels ('Taylor (1993) rule' through 'Low weight on output gap rule') are found in column B, cells **B20:B26**. All of these rules are calculated using the unemployment rate gap and u_{SEP}^* . For example, the federal funds rate for 2016.2 found in cell **D20** is generated using the following formula for calculating the Taylor (1993) rule:

$$=Parameters!\$B\$4+'Make Your Own Rule'!F3+0.5*('Make Your Own Rule'!F3-Parameters!\$B\$3)+0.5*Parameters!\$B\$6*('Make Your Own Rule'!F5-Parameters!\$B\$8)$$

The terms Parameters!\\$B\\$3, Parameters!\\$B\\$4, Parameters!\\$B\\$6, and Parameters!\\$B\\$8 refer to the parameter values found in cells B3, B4, B6, and B8 in the Parameters worksheet, while 'Make Your Own Rule'!F3 and 'Make Your Own Rule'!F5 refer to the forecast values in cells F3 and F5 of the table in Step 1 where you put in your own forecast.

Finally, row 27 (labeled 'Your Customized Policy Rule' in cell B27) calculates federal funds rates from the general policy rule whose parameters you specified in Step 2. The rule also uses the forecasts you specified in Step 1. For example, the federal funds rate for 2016.2 found in cell D27 is generated using the following formula for calculating your customized policy rule:

$$=\$C\$14*C27+(1-\$C\$14)*(\$C\$11+F3+\$C\$15*(F3-\$C\$10)+\$C\$16*\$C\$12*(F5-\$C\$13))$$

where all of the cells referenced correspond to either parameter values that you entered in Step 2 or forecast values you entered in Step 1.

The federal funds rate paths from the seven simple monetary policy rules using your forecasts and the customized policy rule using your forecasts and your parameters are depicted graphically below the table.

