Online Appendix to "Have Inflation Expectations Become Un-anchored? The Role of Oil Prices and Global Aggregate Demand"

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A.1 Copper Price Decomposition

Our analysis focuses on the increased correlation between inflation expectations and oil prices, which was prominent in the public debate. However, we show that global inflation expectations became more correlated with other commodity prices as well, implying that this is a broader phenomenon. In this section, we support this claim by repeating our analysis using the decomposition of copper prices instead of oil prices. We first estimate the following regression:

$$\Delta log(copper_t) = \alpha_0 + \alpha_1 pc_t^{\Delta cmd} + \alpha_2 \Delta log(dxy_t) + u_t$$

and define the idiosyncratic component of copper prices $idio_t^{cop} = \hat{u}_t$. We then repeat the estimation of Equations (2), (8), and (11) from the main text using this variable instead of $idio_t$. The instruments we use for this variable are its own two lags and the anomalous weather variables. Again, we do not find a significant change in the effect of the idiosyncratic component, while the effect of global conditions increases after the global financial crisis (Table A.1).

A.2 Alternative Oil Price Decomposition

In this section, we explore alternative specifications for the decomposition of oil prices. Recall that the baseline specification is

$$\Delta log(oil_t) = \alpha_0 + \alpha_1 pc_t^{\Delta cmd} + \alpha_2 \Delta log(dxy_t) + u_t. \quad \text{(A.1)}$$

Ordinary least squares estimation results of the baseline model and several other specifications are summarized in Table A.2. We

Table A.1. Estimation with the Idiosyncratic Component of Copper Prices (dep. var.: Δpc_t^{beir}, 2003–18)

	Basic	Model with Optimal Policy Rule	Model without Policy Rule
Const.	0.018	0.023	0.018
	(0.013)	(0.016)	(0.014)
$globdem_t$	2.335***	1.976***	2.253***
	(0.513)	(0.542)	(0.676)
$globdem_t \times D_t^{pre}$	−1.752***	−1.356**	−1.770**
	(0.472)	(0.540)	(0.692)
$idio_t^{cop}$	0.547	−1.035	−0.335
	(0.497)	(1.425)	(1.435)
$idio_t^{cop} \times D_t^{pre}$	−0.807	0.775	0.146
	(0.540)	(1.463)	(1.484)
D_t^{pre}	−0.016	−0.026	0.002
	(0.019)	(0.020)	(0.023)
Δpc_{t-1}^{beir}		0.244**	0.329***
		(0.106)	(0.118)
$\Delta pc_{t-1}^{beir} \times D_t^{pre}$		−0.001	−0.029
		(0.165)	(0.172)
Δpc_{t-1}^{π}		−0.090	0.035
		(0.095)	(0.059)
$\Delta pc_{t-1}^{\pi} \times D_t^{pre}$		0.125	−0.043
		(0.109)	(0.084)
$pc_t^{\Delta i}$			−0.694***
			(0.218)
$pc_t^{\Delta i} \times D_t^{pre}$			0.191
			(0.325)
Obs.	178	173	173
Adj. R-sq.	0.38	0.35	0.29
F-stat.	22.81	12.40	10.92

Note: The table reports 2SLS estimation results of Equations (2), (8), and (11) from the main text, where $idio_t^{cop}$, the idiosyncratic component of copper prices, replaces $idio_t$. The instruments for this variable are its own two lags and anomalous weather variables. Other instruments are as in the baseline estimation. Newey-West standard errors are reported in parentheses (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).

Table A.2. Alternative Specifications of Oil-Price Decomposition (dep. var. $\Delta log(oil_t)$, 2000:M1–2008:M12)

	Baseline (1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**Real Prices (7)**	**Real Prices (8)**
Const.	0.004	0.003	0.003	0.019	0.004	0.002	0.002	0.002
	(0.005)	(0.004)	(0.005)	(0.012)	(0.005)	(0.005)	(0.005)	(0.005)
$pc_t^{\Delta cmd}$	0.024***	0.023***	0.023***	0.023***				
	(0.003)	(0.002)	(0.002)	(0.003)				
$pc_t^{\Delta ne}$					0.017***	0.016***		
					(0.004)	(0.002)		
$pc_t^{\Delta rcmd}$							0.022***	
							(0.003)	
$pc_t^{\Delta rne}$								0.015***
								(0.004)
$\Delta log(dxy_t)$	0.234	0.240	0.256	0.215	−0.252	−0.210	0.109	−0.386
	(0.274)	(0.257)	(0.272)	(0.277)	(0.342)	(0.291)	(0.290)	(0.347)
$\Delta log(oil_{t-1})$		0.175***				0.231***		
		(0.059)				(0.061)		
$pc_{t-1}^{\Delta cmd}$			0.003					
			(0.002)					
VIX_t				−0.001				
				(0.001)				
Obs.	227	226	226	227	227	226	227	227
Adj. R-sq.	0.42	0.44	0.42	0.42	0.23	0.27	0.36	0.19
F-stat.	82.06	60.22	55.79	55.60	34.30	29.05	65.44	26.72

Note: In columns 1–6, the dependent variable is the differenced log of nominal oil price. In columns 7–8, the dependent variable is the differenced log of real oil price (oil prices divided by U.S. CPI). $pc_t^{\Delta ne}$ is the first principal component of non-energy commodity prices, $pc_t^{\Delta rcmd}$ is the first principal component of real commodity prices, $pc_t^{\Delta rne}$ is the first principal component of non-energy real commodity prices. Newey-West standard errors are reported in parentheses. Asterisks represent significance levels (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).

examine different lag structures of the equation (columns 2–3) and control for financial uncertainty using the VIX index (column 4). We also use the first principal component of *non-energy* commodities instead of $pc_t^{\Delta cmd}$ (columns 5–6).

In column 7 of Table A.2, we present estimation results for real prices. We extract the first principal component of commodity prices, all divided by U.S. CPI, $pc_t^{\Delta rcmd}$, and use it to decompose *real* oil prices. In the final column of Table A.2, we perform another robustness check and use the real prices of oil prices and a principal component of real prices of commodities excluding energy, $pc_t^{\Delta rne}$.

In all specifications, we find that the coefficient of the first principal component of commodity prices is around 0.02.

A.3 Idiosyncratic Components of Oil Prices

In this section, we add to the oil-price decomposition (A.1) the proxy for OPEC's operation and weather variables:

$$\Delta log(oil_t) = \alpha_0 + \alpha_1 pc_t^{\Delta cmd} + \alpha_2 \Delta log(dxy_t) + \alpha_3 opecref_t + \vec{\Gamma}_1 \cdot \vec{w}_t + \sum_{s=2}^{4} \vec{\Gamma}_s \cdot \vec{w}_t \, d_{s,t} + \sum_{s=2}^{4} \varphi_s d_{s,t} + u_t, \quad \text{(A.2)}$$

where $opecref_t$ is the OPEC "net references" proxy, $\vec{w}_t$ is a vector of the temperatures measured in the five continents, $\vec{\Gamma}_s$, $s = 1,..,4$ are vectors of coefficients, and $d_{s,t}$ is a dummy variable for the season of the year.[1] We also consider a variation of this specification using dummy variables for calendar months instead of seasons. Table A.3 compares estimation results of the baseline decomposition (A.1) with these two specifications. We see that the coefficient of $pc_t^{\Delta cmd}$ is estimated at around 0.02 in all models, indicating that the oil-specific variables are essentially orthogonal to $pc_t^{\Delta cmd}$.

Figure A.1 depicts the contribution of all elements in Equation (A.2) to the annual rate of change in oil prices. We see that the proxy for OPEC's operation explains a substantial portion of the price changes in several periods (admittedly, the weather component

[1]We use the following partition of the year to seasons: December–February, March–May, June–August, September–November.

Table A.3. Different Specifications of Idiosyncratic Components of Oil Prices (dep. var.: $\Delta log(oil_t)$, 2000–18)

	Baseline (1)	(2)	(3)	(4)
Const.	0.004	−0.014	0.086	−0.013
	(0.005)	(0.038)	(0.082)	(0.039)
$pc_t^{\Delta cmd}$	0.024***	0.024***	0.021***	0.024***
	(0.003)	(0.002)	(0.003)	(0.002)
$\Delta log(dxy_t)$	0.234	0.322	0.285	0.316
	(0.274)	(0.244)	(0.265)	(0.246)
$opecref_t$		−0.006***	−0.008***	−0.006***
		(0.001)	(0.001)	(0.001)
$shaleref_t$				0.002
				(0.004)
Temperature Vars.		√	√	√
Season Dummy Vars.		√		√
Calendar Month Dummy Vars.			√	
Obs.	227	226	226	226
Adj. R-sq.	0.42	0.50	0.52	0.50
F-stat.	82.06	9.66	4.30	9.27

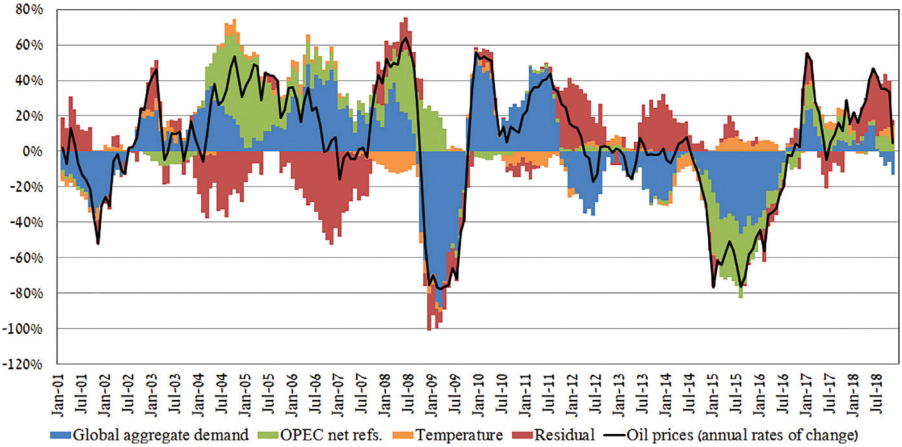
Note: Newey-West standard errors are reported in parentheses (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).

has less explanatory power). For example, we see that expansionary operations of OPEC since mid-2014 contributed considerably to the decline in prices. This is in line with our prior knowledge regarding the decreased ability of OPEC to collude in that period.

A leading topic in the public discussion regarding the 2014 oil-price decline was technological developments in the production of shale oil. As shale oil is a substitute for crude oil, technology developments in its manufacturing are expected to lower the prices of crude oil. To test this effect, we examined references for shale oil in the *London Times* (Figure A.2).[2] There are not many references of shale oil before 2009 (45 references in the period 2000:M1–2008:M12,

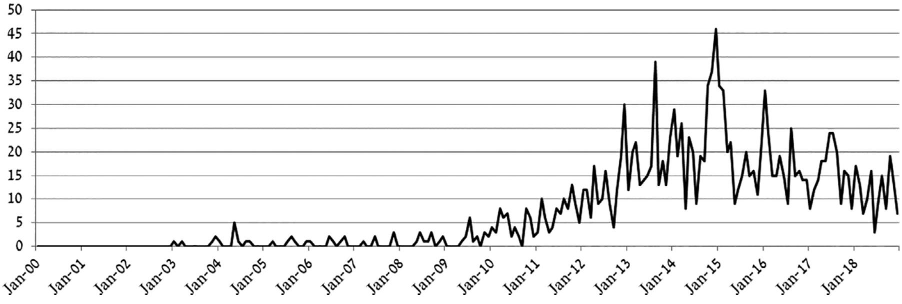
[2] We consider articles that mention the words "shale" and "oil" anywhere in the text, not necessarily adjacent.

Figure A.1. Detailed Decomposition of Annual Rates of Change in Oil Prices (2001–18)



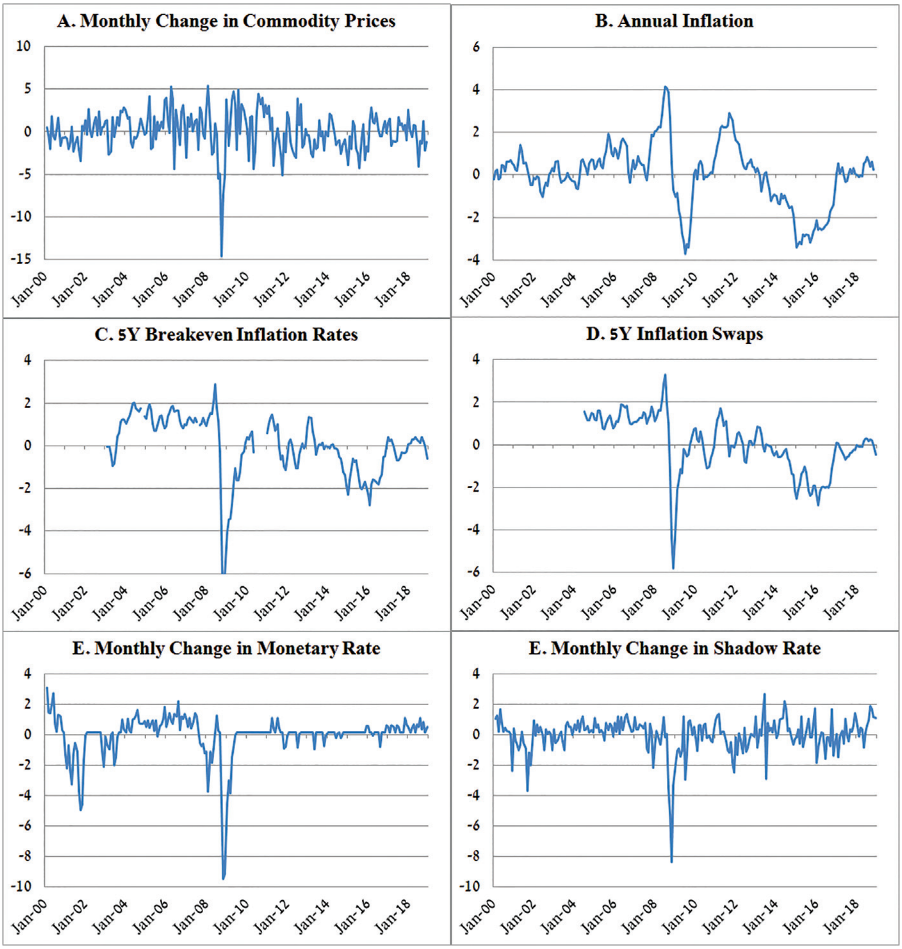
Note: The graph depicts annual rates of change in oil prices, together with the cumulative contribution of global aggregate demand and idiosyncratic elements, i.e., the 12-month moving sum of the right-hand-side elements in Equation (A.2).

Figure A.2. References of Shale Oil in the *London Times* (2000–18)



Source: The *London Times* website (http://www.thetimes.co.uk/tto/search/).
Note: The series is constructed of the number of articles in the *London Times* that mention the words "shale" and "oil" somewhere in the text, not necessarily adjacent.

Figure A.3. First Principal Components (2000–18)



Note: Panel A depicts the first principal component of commodity prices ($pc_t^{\Delta cmd}$) extracted from monthly rates of change in prices of 20 commodities. Panels B–F depict first principal components of the respective variable in the United States, the euro area, and the United Kingdom (in panel C, French breakeven rates are used for the euro area).

relative to 1,317 in 2009:M1–2017:M8), and since 2014 the series of shale oil references, $shaleref_t$, is correlated with $opecref_t$ (partially by construction since some articles mention both OPEC and shale oil). Thus it is not surprising that shale oil references do not contribute to the estimation of oil-price changes (column 4 in Table A.3).

A.4 The Energy Component of Commodity Prices

To support the interpretation of the first principal component of commodity prices as a proxy for global aggregate demand, we show that the energy component contained in the agriculture and metal industries is small. Thus, it does not dominate the first principal component of commodity prices. We examine data from the U.S. Department of Commerce regarding six industries that best match the S&P non-energy commodities.[3] In each of these six industries, we calculate the value of energy-intensive inputs as a share of total output in that industry. We find that the share of total output that can be associated with energy-intensive inputs is lower than 17 percent in all six industries (Table A.4).

A.5 Inflation Swaps

In this section, we complement the analysis from the main text regarding the effect of oil prices on inflation swaps. Table A.5 shows estimation results of Equations (2), (8), and (11) from the main text with the principal component of inflation swaps as a dependent variable. All equations are estimated for the period 2004:M8–2018:M12 (according to availability of inflation swaps data), and the breakpoint for the crisis is 2008:M8 (instead of 2008:M9 in the baseline model). The results are compared to a similar estimation with the first principal component of breakeven rates as a dependent variable.[4]

The basic model (2) shows a significant increase in the effect of global aggregate demand on inflation swaps since the crisis, similarly to the effect on breakeven rates. Furthermore, the effect of the idiosyncratic component on both measures of inflation expectations remained stable. The results of the structural models (8) and (11) for

[3] We extract the data from the 2007 input-output use table. Industry classifications follow those of the Bureau of Economic Analysis.

[4] The specification is similar to the baseline estimation in the main text, but with a shorter sample and a later breakpoint for the crisis.

Table A.4. Value of Energy-Intensive Inputs as a Share of Total Output in Non-energy Industries

Intermediate Industries/Final Product Industries	Petroleum (1)	Transportation (2)	Electric Power & Natural Gas (3)	Chemical Products of Petroleum & Gas (4)	Support Activities of Mining (5)	Total
Oilseed Farming	4.21%	1.99%	0.69%	—	—	6.89%
Grain Farming	9.78%	4.24%	2.11%	—	—	16.13%
Other Crop Farming	6.24%	1.34%	1.55%	—	—	9.13%
Beef Cattle Ranching and Farming	5.74%	4.15%	0.76%	—	—	10.65%
Iron, Gold, Silver, and Other Metal Ore Mining	8.99%	1.25%	4.09%	1.14%	1.26%	16.73%
Copper, Nickel, Lead, and Zinc Mining	3.76%	1.23%	3.21%	0.51%	1.06%	9.77%

Source: U.S. Department of Commerce (2007 input-output use table) and authors' calculations.

Note: (1) Includes petroleum refineries and other petroleum and coal products manufacturing. (2) Includes the following forms of transportation: air, rail, water, truck, and pipeline. (3) Includes natural gas distribution, and electric power generation, transmission, and distribution. (4) Includes petrochemical manufacturing and industrial gas manufacturing. (5) Includes drilling oil and gas wells, and other support activities for mining.

Table A.5. 2SLS Estimation Results of Two Semi-structural Models of Inflation Swaps and Breakeven Inflation Rates (2004:M8–2018:M12)

	Basic		Structural with Monetary Rule		Structural without Monetary Rule	
Dependent Var.	**ISwap (1)**	**BEIR (2)**	**ISwap (3)**	**BEIR (4)**	**ISwap (5)**	**BEIR (6)**
Const.	0.005	0.017	0.006	0.013	0.005	0.012
	(0.012)	(0.014)	(0.010)	(0.012)	(0.011)	(0.015)
$globdem_t$	1.743***	2.185***	1.508***	1.962***	1.768***	2.224***
	(0.418)	(0.480)	(0.329)	(0.521)	(0.482)	(0.694)
$globdem_t \times D_t^{pre}$	−1.073**	−1.416***	−0.506	−1.172**	−0.818	−1.711**
	(0.471)	(0.534)	(0.372)	(0.558)	(0.521)	(0.748)
$idio_t$	0.672**	1.038	0.377	1.062	0.332	1.031
	(0.322)	(0.739)	(0.263)	(0.811)	(0.342)	(0.887)
$idio_t \times D_t^{pre}$	0.070	−0.521	0.281	−0.626	0.266	−0.840
	(0.429)	(0.819)	(0.380)	(0.878)	(0.433)	(0.970)
D_t^{pre}	−0.009	−0.035*	−0.024*	−0.031*	−0.015	0.003
	(0.018)	(0.019)	(0.014)	(0.017)	(0.023)	(0.032)

(*continued*)

Table A.5. (Continued)

	Basic		Structural with Monetary Rule		Structural without Monetary Rule	
Dependent Var.	**ISwap (1)**	**BEIR (2)**	**ISwap (3)**	**BEIR (4)**	**ISwap (5)**	**BEIR (6)**
$\Delta pc_{t-1}^{beir/iswap}$			0.310***	0.136	0.393***	0.273**
			(0.081)	(0.107)	(0.120)	(0.108)
$\Delta pc_{t-1}^{beir/iswap} \times D_t^{pre}$			−0.046	−0.076	−0.077	−0.131
			(0.137)	(0.276)	(0.185)	(0.269)
Δpc_{t-1}^{π}			0.001	−0.100	0.103	0.053
			(0.066)	(0.126)	(0.065)	(0.063)
$\Delta pc_{t-1}^{\pi} \times D_t^{pre}$			0.124	0.132	−0.002	−0.082
			(0.079)	(0.133)	(0.076)	(0.096)
$pc_t^{\Delta i}$					−0.567**	−0.800***
					(0.238)	(0.287)
$pc_t^{\Delta i} \times D_t^{pre}$					0.401	0.295
					(0.333)	(0.441)
Obs.	171	159	171	156	171	156
Adj. R-sq.	0.43	0.40	0.51	0.40	0.38	0.30
F-stat.	23.44	22.15	19.39	12.72	13.93	10.29

Note: The table shows 2SLS estimation results of Equations (2), (8), and (11) from the main text. In the odd columns, the dependent variable is Δpc_t^{iswap} and in the even columns, it is Δpc_t^{beir}. All equations are estimated for the period 2004:M8–2018:M12 (according to data availability of inflation swaps), and the breakpoint for the crisis is 2008:M8 (instead of 2008:M9 in the baseline model). The instruments used in the first four columns are the net measure of OPEC references in the *London Times* and a component of weather variables. In columns 5–6, we also use the lag of the principal component of monetary rates. All the instruments are interacted with the pre-crisis dummy. Newey-West standard errors are reported in parentheses (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).

inflation swaps show a quantitatively similar picture to the results with breakeven rates. However, the change in the effect global aggregate demand is no longer significant.

A.6 Alternative Data Frequencies

In this section, we test the sensitivity of our results to data frequency. In the baseline estimation, we use monthly averages of daily data. This frequency conversion applies to the estimation of the first principal component, the decomposition of oil prices, and the analysis of breakeven inflation rates. We now repeat all the steps of our analysis using higher-frequency (daily) data, as well as lower-frequency (quarterly) data.

The estimation results of oil-price decomposition and breakeven inflation rates analysis (Equations (1) and (2) in the main text, respectively) are summarized in Table A.6. In panel A we observe that $pc_t^{\Delta cmd}$ has a positive and statistically significant coefficient in all three frequencies. In panel B, we observe that in all three frequencies, the effect of global aggregate demand is higher in the post-crisis period. Except for the daily frequency, the effect of the idiosyncratic component $idio_t$ is stable throughout the sample period.

Table A.6. Estimation Results for Alternative Frequencies

	Monthly (Baseline)	Daily	Quarterly
A. Decomposition of Oil Prices (dep. var. $\Delta\log(oil_t)$, 2000–18)			
Const.	0.004	0.0002	0.012
	(0.005)	(0.0003)	(0.011)
$pc_t^{\Delta cmd}$	0.024***	0.0053***	0.041***
	(0.003)	(0.0002)	(0.006)
$\Delta log(dxy_t)$	0.234	0.028	−0.109
	(0.274)	(0.072)	(0.458)
Obs.	227	4,565	75
Adj. R-sq.	0.42	0.31	0.55
F-stat.	82.06	1,026	47.07
B. Global Inflation Expectations on Decomposed Oil Prices (dep. var. Δpc_t^{beir}, 2003–18)			
Const.	0.017	−0.0003	0.078*
	(0.014)	(0.0006)	(0.043)
$globdem_t$	2.223***	0.670***	2.956***
	(0.513)	(0.089)	(0.538)
$globdem_t \times D_t^{pre}$	−1.525***	−0.321***	−1.050*
	(0.487)	(0.112)	(0.590)
$idio_t$	0.983	0.367***	0.749
	(0.685)	(0.042)	(0.592)
$idio_t \times D_t^{pre}$	−0.646	−0.120**	0.392
	(0.747)	(0.060)	(0.814)
D_t^{pre}	−0.022	−0.0002	−0.165*
	(0.019)	(0.001)	(0.086)
Obs.	177	3,031	60
Adj. R-sq.	0.40	0.17	0.62
F-stat.	23.60	126.90	21.39

Note: Newey-West standard errors are reported in parentheses. Asterisks represent significance levels (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$). In panel B, $globdem_t = \hat{\alpha}_1 pc_t^{\Delta cmd}$ and $idio_t$ is the residual estimated in panel A. For the monthly and quarterly frequencies, estimation in panel B is 2SLS with instrument variables for $idio_t$ as specified in the main text (the instruments are not available at a daily frequency, so the model was estimated with OLS).

Table A.7. Panel Estimation (dep. var.: $\Delta beir_{i,t}$, 2003–18)

	Basic	**Structural with Monetary Rule**	**Structural without Monetary Rule**
Estimated Equation →	**(15)**	**(16)**	**(17)**
Const.	0.010***	0.010***	−0.001
	(0.003)	(0.003)	(0.005)
$globdem_t$	1.957***	1.849***	1.872***
	(0.213)	(0.231)	(0.277)
$globdem_t \times D_t^{pre}$	−1.312***	−1.066***	−0.751***
	(0.205)	(0.233)	(0.101)
$idio_t^{cop}$	0.961***	0.888***	2.483***
	(0.217)	(0.192)	(0.804)
$idio_t^{cop} \times D_t^{pre}$	−0.644***	−0.469***	−0.890***
	(0.247)	(0.163)	(0.316)
D_t^{pre}	−0.016**	−0.020***	−0.020**
	(0.007)	(0.005)	(0.009)
$\Delta beir_{i,t-1}$		0.030	0.045
		(0.135)	(0.043)
$\Delta beir_{i,t-1} \times D_t^{pre}$		−0.047	−0.103
		(0.170)	(0.245)
$\Delta\pi_{i,t-1}$		0.109	0.026
		(0.231)	(0.022)
$\Delta\pi_{i,t-1} \times D_t^{pre}$		−0.005	0.055***
		(0.236)	(0.012)
$\Delta\pi_{i,t-2}$		−0.128	−0.098***
		(0.105)	(0.020)
$\Delta\pi_{i,t-2} \times D_t^{pre}$		0.091	0.090
		(0.134)	(0.068)
$\Delta\iota_{i,t}$			−0.218
			(0.169)
$\Delta\iota_{i,t} \times D_t^{pre}$			−0.019
			(0.180)
Obs.	605	598	598
Adj. R-sq.	0.252	0.267	0.054
F-stat.	28.064	17.275	23.245

Note: The table reports results of 2SLS panel estimations of Equations (15)–(17) from the main text with country fixed effects (see Section 5.5.1 in the main text). Country clustered standard errors are reported in parentheses (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).

Table A.8. Estimation with GDP-Weighted Averages as Estimators of Global Components (dep. var.: wa_t^{beir}, 2003–18)

	Basic	Structural with Monetary Rule	Structural without Monetary Rule
Estimated Equation →	**(2)**	**(8)**	**(11)**
Const.	0.014	0.010	0.046**
	(0.011)	(0.009)	(0.020)
$globdem_t$	1.918***	1.657***	1.508***
	(0.341)	(0.339)	(0.236)
$globdem_t \times D_t^{pre}$	−1.178***	−1.068***	−0.921***
	(0.321)	(0.350)	(0.273)
$idio_t$	0.711	0.647	0.770*
	(0.443)	(0.459)	(0.450)
$idio_t \times D_t^{pre}$	−0.252	−0.428	−0.619
	(0.532)	(0.522)	(0.534)
D_t^{pre}	−0.022	−0.019	−0.025
	(0.019)	(0.015)	(0.039)
Δwa_{t-1}^{beir}		0.194**	0.151*
		(0.086)	(0.090)
$\Delta wa_{t-1}^{beir} \times D_t^{pre}$		0.398***	0.415***
		(0.123)	(0.146)
Δwa_{t-1}^{π}		−0.019	−0.026
		(0.059)	(0.065)
$\Delta wa_{t-1}^{\pi} \times D_t^{pre}$		0.066	0.080
		(0.070)	(0.077)
Δwa_{t-2}^{π}		−0.073*	−0.079*
		(0.040)	(0.046)
$\Delta wa_{t-2}^{\pi} \times D_t^{pre}$		−0.036	−0.028
		(0.056)	(0.060)
Δwa_t^{i}			−0.067**
			(0.033)
$\Delta wa_t^{i} \times D_t^{pre}$			0.057*
			(0.035)
Obs.	177	173	173
Adj. R-sq.	0.47	0.54	0.54
F-stat.	29.13	18.16	16.18

Note: The table presents 2SLS estimation results of Equations (2), (8), and (11) from the main text with GDP-weighted averages replacing principal components (see Section 5.5.2 in the main text). Namely, $wa_t^x \equiv \Sigma_{i=1}^3 w_{t,i} x_{t,i}$ is the GDP-weighted average of variable x at time t, where $w_{t,i}$ is the portion of country i's GDP (U.S. dollars, current prices, and current PPP; Source: OECD Stat). Newey-West standard errors are reported in parentheses (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).

Table A.9. Alternative Specifications of the Structural Models (dep. var.: Δpc_t^{beir}, 2003–18)

	Expanded Samples for PC Inflation and Monetary Rates		**Shadow Rates**	**Including Instruments for *globdem***	
Equation →	**With Rule (8)**	**Without Rule (11)**	**Without Rule (11)**	**With Rule (8)**	**Without Rule (11)**
Const.	0.010	0.008	0.003	0.055	0.053
	(0.013)	(0.012)	(0.021)	(0.036)	(0.033)
$globdem_t$	1.970***	2.199***	2.432**	5.033***	5.227***
	(0.532)	(0.567)	(0.937)	(1.692)	(1.408)
$globdem_t \times D_t^{pre}$	−1.333**	−1.432**	−1.668*	−4.133**	−4.524***
	(0.529)	(0.573)	(0.944)	(1.732)	(1.434)
$idio_t$	1.028	0.961	1.141	0.082	0.157
	(0.773)	(0.771)	(1.156)	(0.912)	(0.930)
$idio_t \times D_t^{pre}$	−0.852	−0.852	−0.866	0.119	0.070
	(0.831)	(0.817)	(1.201)	(0.968)	(0.977)
D_t^{pre}	0.154	0.195**	0.009	−0.067*	−0.040
	(0.101)	(0.084)	(0.035)	(0.036)	(0.037)

(*continued*)

Table A.9. (Continued)

Equation →	Expanded Samples for PC Inflation and Monetary Rates		Shadow Rates	Including Instruments for *globdem*	
	With Rule (8)	**Without Rule (11)**	**Without Rule (11)**	**With Rule (8)**	**Without Rule (11)**
Δpc_{t-1}^{beir}	0.093	0.008	0.289***	−0.257	−0.142
	(0.186)	(0.171)	(0.105)	(0.262)	(0.272)
$\Delta pc_{t-1}^{beir} \times D_t^{pre}$	−0.100	−0.049	0.006	0.458	0.413
	(0.103)	(0.103)	(0.207)	(0.327)	(0.328)
Δpc_{t-1}^{π}	0.110	0.097	−0.020	−0.016	0.106
	(0.105)	(0.108)	(0.082)	(0.125)	(0.104)
$\Delta pc_{t-1}^{\pi} \times D_t^{pre}$	−0.016	0.013	0.041	0.066	−0.107
	(0.017)	(0.020)	(0.093)	(0.130)	(0.112)
$pc_t^{\Delta i}$		−0.185	−1.022*		−0.662**
		(0.170)	(0.587)		(0.310)
$pc_t^{\Delta i} \times D_t^{pre}$		−0.310	0.355		0.141
		(0.208)	(0.875)		(0.404)
Obs.	173	173	173	173	173
Adj. R-sq.	0.41	0.41	−0.05	−0.08	−0.15
F-stat.	14.47	12.18	6.99	6.84	5.97

Note: The first two columns present 2SLS estimation results of Equations (8) and (11) from the main text where the principal components pc^{π} and $pc^{\Delta i}$ are calculated for a larger set of countries (see Section 5.5.3 in the main text). The extended sample includes 13 advanced economies with inflation-targeting central banks: Australia, Canada, Czech Republic, euro area, Israel, Japan, Korea, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States. The third column presents the estimation results of Equation (11), where the principal component of monetary rates is extracted from shadow rates in the United States, the United Kingdom, and the euro area (Wu and Xia 2016, 2017) (see Section 5.6 in the main text). The fourth and fifth columns present estimation of Equations (8) and (11), including additional instrument variables, for $globdem_t$, following Lewbel (2012) (see Section 5.7 in the main text). Newey-West standard errors are reported in parentheses (*** $p < 1\%$, ** $p < 5\%$, * $p < 10\%$).