Online Appendices for "A Cross-Sectional Analysis of Individual Goods Inflation Rates"

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Abstract

This document contains supplementary material, additional studies, and robustness checks that are relevant or briefly discussed in the main paper. Precisely, it consists of four sets of further analyses: Appendix A reports supplementary material and more details to the article; Appendix B provides the results based on individual inflation rates (IIR), in contrast with those of the individual excess inflation rates (IEIR); Appendix C presents the analysis of 142 goods and services (142 out of the 146 categories in the paper); finally, Appendix D shows the analysis of investment assets (based on the six benchmark factors) and compares them to those of consumer goods.

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Appendix A Supplemental details

A.1 Real GDP per capita growth

To measure the cyclicity of our selected factors, we use the correlations between the actual factors[1] and the real GDP per capita growth rate. Figure A1 shows that the real GDP per capita growth rate captures the business cycles when a recession hits (marked by shaded NBER recessions)[2], the real GDP growth rate falls, followed by the recovery, corresponding to the GDP increasing after a contraction and a trough in the business cycle.

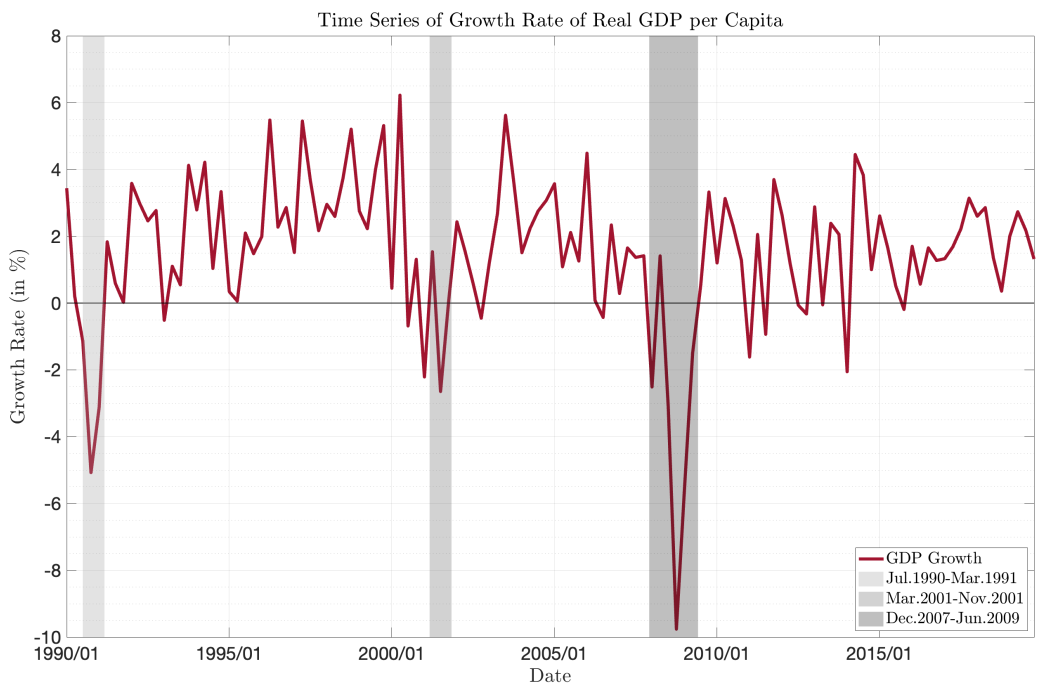


Figure A1: **Growth Rate of real GDP per Capita**

[1]Actual factors should be considered innovations in the original variables since economic agents are primarily concerned with deviations from their predictions about economic variables. We measure factor innovations by the residuals from univariate ARMA(1,1) models estimated on the original factors, so actual factors are ARMA(1,1) residuals of original factors.

[2]In the United States, it is generally accepted that the National Bureau of Economic Research (NBER) is the final arbiter of the dates of the peaks and troughs of the business cycle. The NBER identifies a recession as “a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production."

A.2 The original six benmark factors

In Table A2, Panel A reports the descriptive statistics of the original six benchmark factors, their correlations with the real per capita GDP growth rate, and their implied cyclicality. The three factors, $\pi_t^{(\mathrm{LTE})} - \pi_{0,t-1}^*$, w_t and s_t are pro-cyclical factors with correlations of 0.43, 0.34, and 0.40, respectively, with GDP growth rate. The other three factors, $u_t - u_t^*$, pu_t and fc_t are counter-cyclical factors with correlations of -0.17, -0.35 and -0.60, respectively, with real GDP growth. Also, from the column labeled AR(1) we can see, that the factors' first-order autocorrelation coefficients are big and near to 1, to avoid the potential unit root problem, we use their ARMA(1,1) innovations as the actual factors, and their cyclicality of the original factors is consistent with the cyclicality of their ARMA(1,1) innovations which we used as the actual factors in our analysis. Also, pro-cyclical factors are negatively skewed while counter-cyclical factors are positively skewed. Moreover, the first-order autocorrelation coefficients for five factors are very high, which implies that those factors are predictable by their past values. Panel B of Table A2 displays the correlations between the six benchmark factors, which shows that, in general, pro-cyclical factors are negatively correlated with counter-cyclical factors.

Table A2: **Descriptive Statistics and Correlations for Original Benchmark Factors**

Panel A in this table presents the time-series mean, median, minimum (Min), maximum (Max), standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.), first-order autocorrelation coefficient (AR(1)), the correlation with log real GDP per capita growth rate and the cyclicity of the corresponding original six benchmark factors. All statistics are annualized values. The mean, median, minimum, maximum, and standard deviation are in percentage units. Panel B presents correlations between the corresponding factors. All factors are annualized monthly data, and the sample period is from January 1990 to December 2019.

Panel A: Descriptive Statistics for Original Factors

	Mean	**Median**	**Min**	**Max**	**Std.Dev.**	**Skew.**	**Kurt.**	**AR(1)**	**corr**(f, gdp)	**cyclicity**
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	0.04	0.08	-2.50	2.64	0.86	-0.08	0.14	0.97	0.43	pro
$u_t - u_t^*$	0.79	0.34	-1.41	5.14	1.62	1.12	0.44	1.00	-0.17	counter
w_t	3.18	3.70	-6.93	8.19	2.40	-1.54	3.52	0.94	0.34	pro
s_t	0.11	1.03	-41.37	30.64	12.12	-0.64	1.26	0.82	0.40	pro
pu_t	1.21	1.74	-73.50	91.74	28.28	0.18	-0.06	0.69	-0.35	counter
fc_t	-0.41	-0.54	-1.05	2.74	0.50	3.20	13.81	0.95	-0.60	counter

Panel B: Correlations Between Original Factors

	$u_t - u_t^*$	w_t	s_t	pu_t	fc_t
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.04	0.09	0.44	-0.19	-0.36
$u_t - u_t^*$		-0.59	0.15	-0.06	0.22
w_t			0.14	-0.09	-0.48
s_t				-0.46	-0.48
pu_t					0.44

A.3 Betas

The paper defines the consumer good's excess inflation rate (IEIR) as the individual good inflation rate minus the general inflation rate. We document considerable heterogeneity in IEIR across goods and services, which we explain by the heterogeneity in IEIR loadings on a set of economic factors capturing common sources of variation in the prices of consumer goods. In this section, we analyze the time-varying estimates of factor loadings based on the univariate model and the six-factor model defined by equation (5) through Fama and MacBeth (1973, henceforth FM) 1st stage time-series regressions. We adopted two types of rolling windows: the 60-month and the 120-month window, respectively. The factor loadings depend on consumer good i, on factor k, but also on time t.

Table A3 shows that the average cross-sectional correlations between the betas of the six-factor model over the sample period are, in general, lower than those between the univariate betas. It implies that when other factors are controlled, the magnitudes of correlations (absolute values of the correlations) are reduced. Hence, using these multivariate betas in the cross-sectional regressions in the 2nd stage FM procedure reduces the problem of multicollinearity. Figure A3-1 plots the 146 sorted time-series averages of factor loadings from the six-factor model, derived from the FM through 60-window (top panel) and 120-window (bottom panel). The figure illustrates well the considerable variation of these factor loadings in the cross-section explained in the paper, regardless of the chosen estimation window. Figure A3-2 plots the time series of betas based on the 60-month window (top panel) and 120-month window (bottom panel). Each of the six plots represents goods' exposures to the corresponding benchmark economic factors. It shows significant time-series and cross-sectional variations in those betas, especially the substantial changes around the 2008 financial crisis. Specifically, the factor loadings on long-term inflation expectations, unemployment gap, consumer sentiment, and economic uncertainty jumped around 2008; on the contrary, the factor loading on wage and salary disbursements had a sudden drop around the financial crisis, while the decrease was relatively mild for the factor loading on the National Financial Conditions Index.

Table A3: **Correlation of Factor Loadings**

This table presents the average cross-sectional correlations between univariate β (left sub-tables) and six-factor-model β defined by equation (5) (right sub-tables), the description of the factors is reported in Table 2. At every month $t \geq h$, we calculate the cross-sectional correlations between the estimated risk measures using daily data from month $t-h+1$ to t. The reported values are the time-series averages of these cross-sectional correlations over the sample. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on $h = 60$ month rolling window analysis. Panel B is based on $h = 120$ month rolling window analysis. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

Panel A: 60-month window

univariate β

	$u_t - u_t^*$	w_t	s_t	pu_t	fc_t
$\pi^{\text{LTE}} - \pi_{0,t-1}^*$	0.22	-0.25	0.56	-0.26	-0.10
$u_t - u_t^*$		-0.56	0.03	0.07	-0.25
w_t			0.08	-0.14	0.13
s_t				-0.55	-0.26
pu_t					0.30

six-factor-model β

	$u_t - u_t^*$	w_t	s_t	pu_t	fc_t
$\pi^{\text{LTE}} - \pi_{0,t-1}^*$	0.24	-0.33	0.43	0.04	0.28
$u_t - u_t^*$		-0.43	0.15	0.18	0.01
w_t			-0.05	-0.05	0.02
s_t				0.01	0.13
pu_t					-0.04

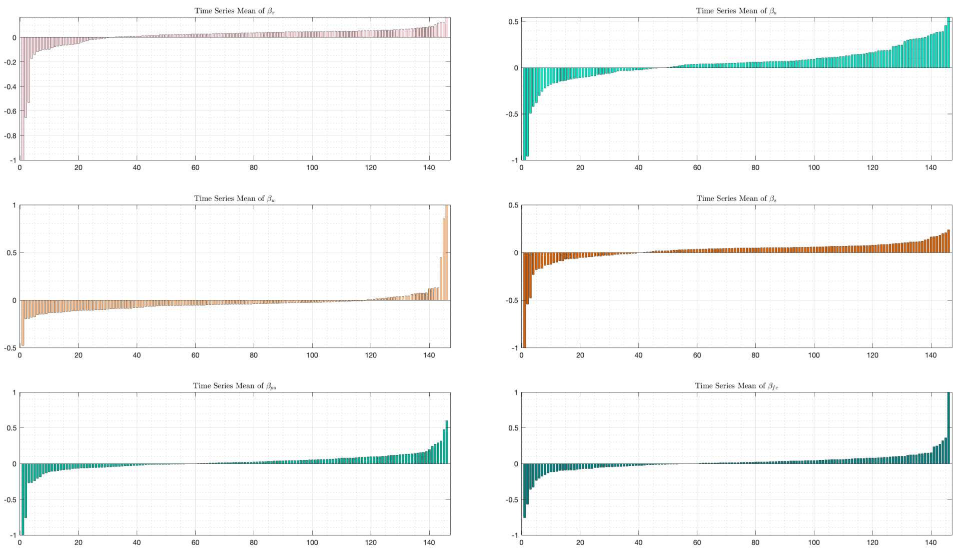
Panel B: 120-month window

univariate β

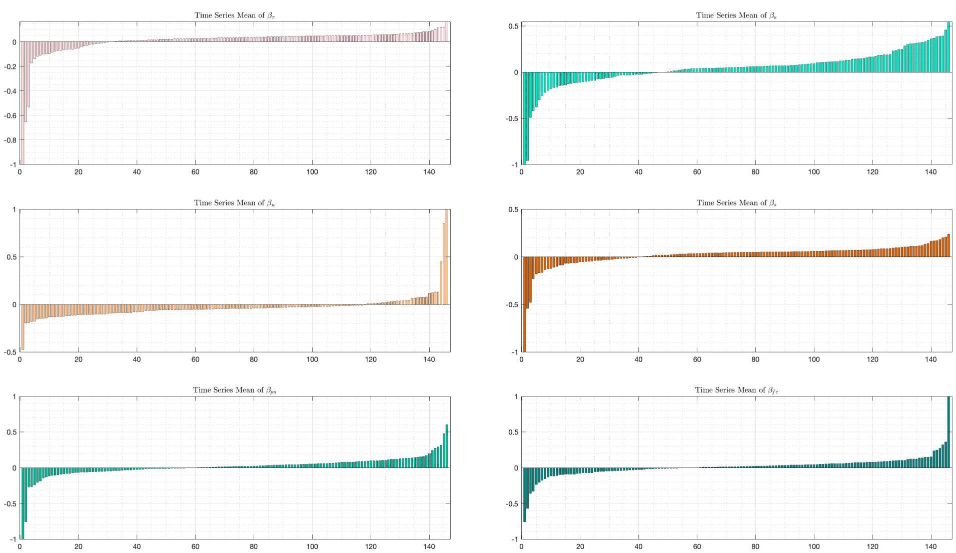
	$u_t - u_t^*$	w_t	s_t	pu_t	fc_t
$\pi^{\text{LTE}} - \pi_{0,t-1}^*$	0.39	-0.54	0.79	-0.61	-0.54
$u_t - u_t^*$		-0.71	0.20	0.12	-0.29
w_t			-0.26	0.07	0.34
s_t				-0.69	-0.55
pu_t					0.47

six-factor-model β

	$u_t - u_t^*$	w_t	s_t	pu_t	fc_t
$\pi^{\text{LTE}} - \pi_{0,t-1}^*$	0.34	-0.53	0.57	-0.13	-0.07
$u_t - u_t^*$		-0.49	0.31	0.23	0.17
w_t			-0.34	0.01	0.01
s_t				0.18	-0.03
pu_t					-0.01

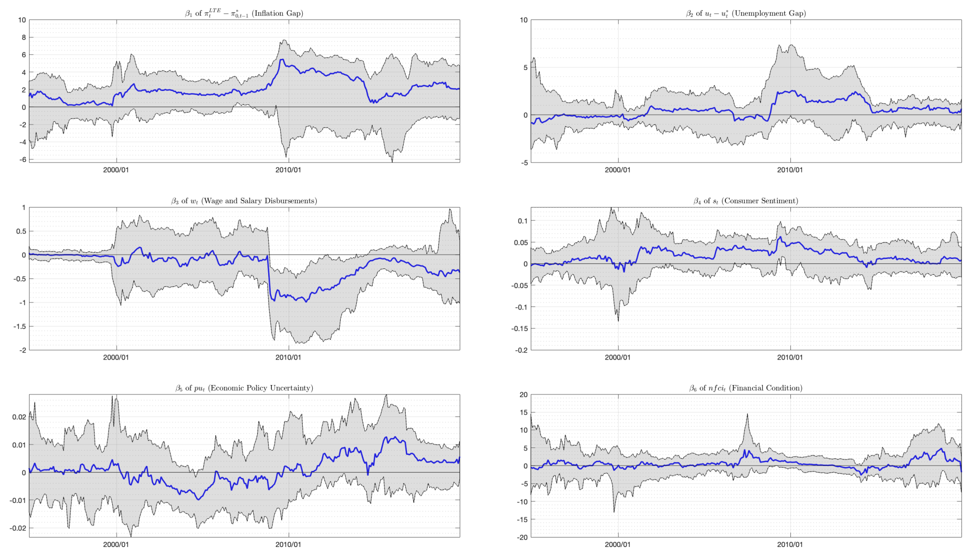


(a) Sorted Time Series Mean of the Six-factor-model β (Based on 60-month Window)

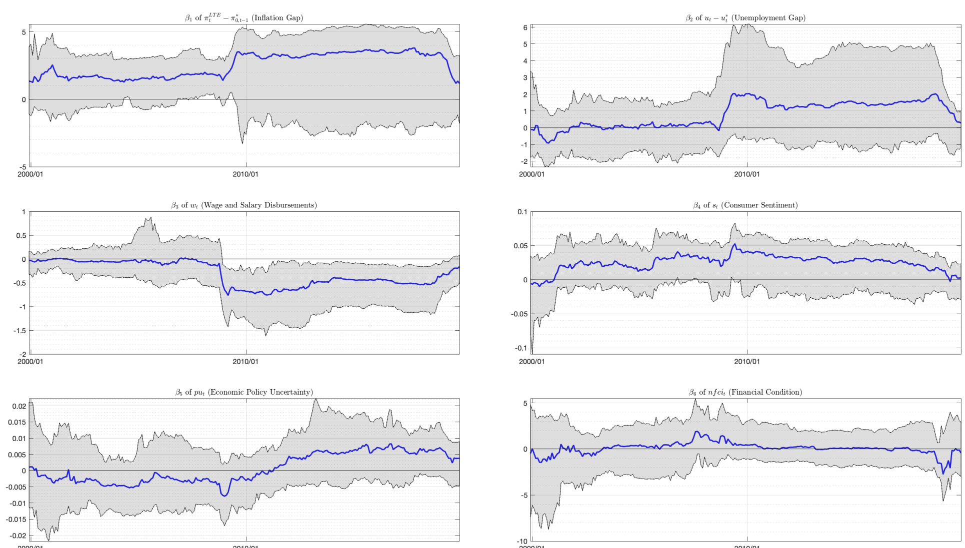


(b) Sorted Time Series Mean of the Six-factor-model β (Based on 120-month Window)

Figure A3-1: **Sorted Time Series Mean of the Six-Factor-Model Factor Loadings**
Factor loadings (βs) are scaled to 1 for easier comparison. The 146 categories of goods and services are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.



(a) Six-factor-model β (Based on 60-month Window)



(b) Six-factor-model β (Based on 120-month Window)

Figure A3-2: **Time Varying Beta**
In each plot, we draw the time series of the 20th, 50th and 80th percentile across i. The 146 categories of goods and services are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

A.4 Economic magnitudes of factors

Table A4-1 and Table 4-2 report for every factor f the annualized spread $\hat{E}\left[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\right]$ between two hypothetical goods with different betas on the factor f, everything else equal. We refer to this number as the factor's interquartile spread (IQS). The first good's beta is the 75th percentile, while the second is the 25th percentile of the cross-sectional distribution of individual good betas on factor f. The IQS thus represents how much the prices of low beta goods grow more or less than the prices of high beta goods on average. It would be complicated to create baskets of goods that differ only in one of the multivariate betas, with everything else equal. So we look at the IQS only as an indicative number to help interpret the economic magnitude of the factor lambda reported in the FM regressions. The IQS are interpretable like the high-minus-low spreads reported in Table 5 in the paper for basket sorts. However, they are based on multivariate betas rather than univariate betas.

Each column of Table A4-1 (60-month window) and Table 4-2 (120 month window) are corresponding to the model specification in Table 6 (60-month window) and Table 7 (120-month window)in the paper.

Table A4-1 shows that, in economic terms, the IQS of the unemployment gap is 0.27%, and its value is 0.44% for the economic policy uncertainty. Also, the IQS of the long-term inflation expectations is -0.11%, and its value is -0.20% for the wages. Notice that these IQS values are sizeable relative to the average IEIR of -0.50% for the typical consumer good as reported in Table 3. For single-factor specifications, in absolute value, the IQS of the benchmark counter-cyclical factors tend to be higher than the IQS for the benchmark pro-cyclical factors. These results are also consistent with the basket sorts of Table 5.

Table A4-2 shows that, in terms of economic magnitude, there is a noticeable increase in the IQS for almost all the single-factor specifications ($\mathbf{1}'$ to $\mathbf{6}'$) when longer estimation window (120-month rolling window) are used for the estimation. The economic magnitudes more or less double for unemployment gap (from 0.27% to 0.57%), wages (from -0.20% to -0.37%), consumer sentiment (from -0.16% to -0.33%), and financial conditions (from 0.09% to 0.17%) in single-factor specifications. Overall, there is also a noticeable increase in the IQS of long-term inflation expectations, unemployment gap, and financial conditions in multifactor model specifications ($\mathbf{I}'$ to $\mathbf{XVI}'$) when the longer rolling window is used for factor loadings estimation. Especially, the economic magnitudes of long-term inflation expectations range between -0.07% and -0.23% in our baseline results and between -0.10% and -0.32% with the longer rolling window. For the unemployment gap, these two ranges are between 0.17% and 0.41%, and between 0.31% and 0.58%, respectively. Likewise, for financial conditions, the economic magnitudes range between 0.18% and 0.32% for the 60-month window scenario. The figures are between 0.27% and 0.42% for the 120-month window scenario. Once again, These IQS values are sizeable if compared to the average IEIR of -0.50% for the real price of the typical consumer good, as reported in Table 3 or relative to high-minus-low IEIR spreads reported in Table 5 for the corresponding factors.

Table A4-1: **Fama-MacBeth Regressions for Benchmark Factors (60-Month Rolling Window)**

This table presents the factor annualized interquartile spread $\hat{E}\left[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\right]$ between two hypothetical goods with different betas on the factor f, everything else equal (lower panel). The first portfolio's beta is the 75th percentile, while that of the second is the 25th percentile of the cross-sectional distribution of individual betas on factor f. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 60-month rolling window. The description for the six benchmark factors is reported in Table 2. The model specifications are the same as in Table 6 in the paper. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	1	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$\pi_t^{(\mathrm{LTE})} - \pi^*_{0,t-1}$	-0.11						-0.10	-0.09	-0.11	-0.16	-0.21
$u_t - u_t^*$		0.27					0.41	0.31	0.31	0.26	0.19
w_t			-0.20					-0.17	-0.16	-0.18	-0.17
s_t				-0.16					-0.12	-0.19	-0.19
pu_t					0.44					0.20	0.21
$nfci_t$						0.09					0.29
	VI	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**	**XV**	**XVI**
$\pi_t^{(\mathrm{LTE})} - \pi^*_{0,t-1}$	-0.07	-0.21	-0.13	-0.20	-0.12	-0.17	-0.13	-0.23	-0.17	-0.22	-0.21
$u_t - u_t^*$	0.38	0.32	0.37	0.23	0.27	0.31	0.32	0.26	0.26	0.17	0.22
w_t				-0.17	-0.16				-0.15	-0.17	-0.20
s_t	-0.11					-0.17	-0.15		-0.12		
pu_t		0.18		0.14		0.23		0.21		0.17	0.25
$nfci_t$			0.22		0.27		0.22	0.18	0.32	0.24	0.20

Table A4-2: **Fama-MacBeth Regressions for Benchmark Factors (120-Month Rolling Window)**

This table presents the factor annualized interquartile spread $\hat{E}\left[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\right]$ between two hypothetical goods with different betas on the factor f, everything else equal (lower panel). The first portfolio's beta is the 75th percentile, while that of the second is the 25th percentile of the cross-sectional distribution of individual betas on factor f. The actual factors are the ARMA(1,1) residuals of the corresponding original factors, and the analysis is based on the 120-month rolling window. The description for the six benchmark factors is reported in Table 2. The model specifications are the same as in Table 7 in the paper. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	1′	**2′**	**3′**	**4′**	**5′**	**6′**	**I′**	**II′**	**III′**	**IV′**	**V′**
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.14						-0.22	-0.21	-0.16	-0.30	-0.25
$u_t - u_t^*$		0.57					0.58	0.52	0.49	0.44	0.34
w_t			-0.37					-0.16	-0.16	-0.11	-0.09
s_t				-0.33					-0.18	-0.15	-0.13
pu_t					0.20					0.23	0.17
$nfci_t$						0.17					0.39
	VI′	**VII′**	**VIII′**	**IX′**	**X′**	**XI′**	**XII′**	**XIII′**	**XIV′**	**XV′**	**XVI′**
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.16	-0.26	-0.12	-0.26	-0.10	-0.32	-0.11	-0.24	-0.11	-0.22	-0.28
$u_t - u_t^*$	0.53	0.53	0.44	0.46	0.36	0.47	0.38	0.44	0.31	0.37	0.37
w_t				-0.14	-0.16				-0.17	-0.14	-0.12
s_t	-0.16					-0.13	-0.13		-0.12		
pu_t		0.11		0.17		0.19		0.07		0.13	0.13
$nfci_t$			0.35		0.38		0.40	0.27	0.42	0.32	0.37

Appendix B Analysis on 146 Individual Inflation Rates (IIR)

This section replicates the analysis based on individual inflation rates (IIR), $\pi_{i,t} \equiv \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right)$, which is defined by Equation (1) in the paper. The goods and services are the same as the 146 categories of goods and services in the paper, and the sample period is also the same from January 1990 to December 2019. Unsurprisingly, the IIR, like the IEIR, differs significantly in cross-section. Figure B1 plots the sample averages of the 146 IIR time series that we analyze in the paper and their histogram. The minimum and maximum average IIR are -16.11% and 5.59%, respectively. The figure illustrates well the considerable variation of these values in the cross-section of IIR.

Table B1 presents the descriptive statistics of the 146 IIR series. A typical good price grows annually at 1.91%, and the 5th percentile averages -5.45% while the 95th percentile averages 8.70% through time, a difference of 14.15% (for IEIR, the difference is 14.14%), and these 5th and 95th percentiles are very large compared to the median IIR that averages to 2.18% through time, illustrating that an IIR of a consumer good is likely to be more extreme than normal, and this is again confirmed by the large IIR cross-sectional excess kurtosis that averages 9.24 through time.

In Figure B2, we plot the time series patterns of the cross-sectional moments of the IEIRs and highlight the NBER recessions. These cross-sectional moments show substantial time-series variations, as confirmed by their descriptive statistics in Table B1.

Based on the six benchmark factors selected in the paper, the two-group univariate beta sorting results shown in Table B2 and FM cross-section regression results through the 60-month and 120-month rolling windows shown in Table B3 and Table B4, respectively, confirmed the theory again that pro-cyclical factors: long-term inflation expectations, wages, and consumer sentiment have significant and robust negative factor lambdas, while counter-cyclical factors: unemployment, economic policy uncertainty, and financial conditions have significant and robust positive factor lambdas, regardless of the model specification. The findings are robust and stronger when using a longer rolling window of 120 months in estimating the conditional betas. Also, the economic magnitudes are considerable compared to the reference point of

1.68%.

Further robustness checks of eight pro-cyclical factors shown in Table B5 and six counter-cyclical factors shown in Table B6 reconfirm the findings based on IEIR, whether the analysis is based on the 60-month rolling window or 120-month window. However, the univariate factor lambdas for the three alternatives of financial conditions: corporate bond spread, credit spread, and excess bond premium, are not significant, but when we consider them in the six-factor model, besides cbs based on the 120-month rolling window analysis, the factor lambdas are all positive and significant as shown in Table B7.

Table B8 reports the regression results of changes in our inflation risk and risk premium proxies on changes in the median beta corresponding to each economic factor. In general, they are consistent with IEIR results, besides the slope of wages turned negative and significant.

Figure B3 shows a similar pattern but lower in magnitude than that in Figure 4 of the paper: the average explanatory power is the highest (a median adjusted goodness of fit, R^2_{adj}, between 24% and 33% across consumer goods) during the period corresponding to the four rounds of quantitative easing (QE) lanched by the FED to fight against the financial crisis.

In conclusion, the cross-sectional analysis based on IIR is highly consistent with that on IEIR; IIR is like the "nominal" individual inflation rate without taking the general inflation rate into consideration, and, in this sense, IEIR is analogous to the "real" individual inflation rate, furthermore, no matter in "nominal" terms or "real" terms, we document sizeable cross-sectional heterogeneity individual inflation rate among goods and services, which we explain by the heterogeneity in the exposure to a set of economic factors capturing common sources of variation in the prices of consumer goods. The empirical findings are significant and robust, confirming that goods with counter-cyclical price fluctuations have a higher inflation rate on average, and goods with pro-cyclical price fluctuations have a lower inflation rate than others. In addition, economic factors that explain this heterogeneity include pro-cyclical factors, such as long-term inflation expectations, wages, and consumer sentiment; counter-cyclical factors, such as the unemployment gap, economic policy uncertainty, and financial condition measures.

Table B1: **Descriptive Statistics of Individual Inflation Rate (IIR)**

This table presents the mean, standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.) and the real per capita GDP growth correlations of the cross-sectional mean, standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.), and 5%, 25%, 50%(median), 75% and 95% percentiles among the 146 individual inflation rates (IIR), which is constructed as $\pi_{i,t} \equiv \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right)$ (defined by Equation (1) in the paper). The 146 individual price indices included in our study are downloaded from the U.S. Bureau of Labor Statistics (BLS), and the names of which are summarized in Table 1 in the paper. The mean, standard deviation, and percentiles are in percentage units. IIRs are annualized monthly data, and the sample period is from January 1990 to December 2019.

	Mean	**Std.Dev.**	**Skew.**	**Kurt.**	**5%**	**25%**	**50%**	**75%**	**95%**
Mean	1.91	5.31	-0.42	9.24	-5.45	-0.03	2.18	4.10	8.70
Std.Dev.	1.52	1.60	1.84	6.89	2.67	1.24	1.18	1.39	3.30
Skew.	0.89	1.57	0.08	1.67	-2.01	0.24	0.58	1.05	1.64
Kurt.	2.04	3.43	0.50	3.14	7.35	1.34	0.76	1.49	3.36
corr(IIR, gdp)	-0.18	-0.31	0.15	-0.06	0.12	-0.18	-0.24	-0.31	-0.35

Table B2: **Univariate Beta Sorting**

This table presents the univariate beta sorting results based on the six benchmark factors, the description for which is reported in Table 2. Individual consumer goods and services are sorted into two baskets (H, L) by the corresponding medians of the six univariate beta on the individual inflation rate (IIR). Panel A is based on the 60-month rolling window analysis. Panel B is based on the 120-month rolling window analysis. Actual factors are the ARMA(1,1) residuals of the corresponding original factors. Average IIRs ($\mathbb{E}(IIR)$) and standard errors (S.E.) are in percentage units. All factors are annualized monthly data, and the sample period is from January 1990 to December 2019.

Panel A: 60-Month Window

f1 ($\pi_t^{\text{LTE}} - \pi^*_{0,t-1}$)

	L	**H**	**H-L**
β_1	-6.52	2.29	
$\mathbb{E}(IIR)$	1.82	1.81	-0.02
S.E.	0.05	0.04	0.03

f2 ($u_t - u_t^*$)

	L	**H**	**H-L**
β_2	-2.65	3.18	
$\mathbb{E}(IIR)$	1.52	2.11	0.58
S.E.	0.05	0.04	0.03

f3 (w_t)

	L	**H**	**H-L**
β_3	-0.83	0.71	
$\mathbb{E}(IIR)$	1.98	1.65	-0.33
S.E.	0.04	0.05	0.03

f4 (s_t)

	L	**H**	**H-L**
β_4	-0.08	0.04	
$\mathbb{E}(IIR)$	1.87	1.76	-0.11
S.E.	0.04	0.05	0.04

f5 (pu_t)

	L	**H**	**H-L**
β_5	-0.01	0.02	
$\mathbb{E}(IIR)$	1.55	2.10	0.55
S.E.	0.06	0.04	0.04

f6 ($nfci_t$)

	L	**H**	**H-L**
β_6	-4.70	6.91	
$\mathbb{E}(IIR)$	1.80	1.83	0.03
S.E.	0.05	0.04	0.05

Panel B: 120-Month Window

f1 ($\pi_t^{\text{LTE}} - \pi^*_{0,t-1}$)

	L	**H**	**H-L**
β_1	-6.91	1.81	
$\mathbb{E}(IIR)$	1.96	1.74	-0.23
S.E.	0.04	0.03	0.03

f2 ($u_t - u_t^*$)

	L	**H**	**H-L**
β_2	-2.70	3.73	
$\mathbb{E}(IIR)$	1.50	2.16	0.66
S.E.	0.04	0.03	0.04

f3 (w_t)

	L	**H**	**H-L**
β_3	-0.88	0.63	
$\mathbb{E}(IIR)$	2.06	1.63	-0.43
S.E.	0.03	0.03	0.03

f4 (s_t)

	L	**H**	**H-L**
β_4	-0.09	0.03	
$\mathbb{E}(IIR)$	2.00	1.68	-0.31
S.E.	0.03	0.03	0.03

f5 (pu_t)

	L	**H**	**H-L**
β_5	-0.01	0.02	
$\mathbb{E}(IIR)$	1.50	2.18	0.68
S.E.	0.05	0.03	0.05

f6 ($nfci_t$)

	L	**H**	**H-L**
β_6	-2.25	6.44	
$\mathbb{E}(IIR)$	1.70	1.98	0.29
S.E.	0.04	0.04	0.05

Table B3: **Fama-MacBeth Regressions for 6 Benchmark Factors (60-Month Rolling Window)**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (upper panel), and the annualized spread $\hat{E}\left[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\right]$ between two hypothetical goods with different betas on the factor f, everything else being equal (lower panel). The first portfolio's beta is the 75th percentile, while that of the second is the 25th percentile of the cross-sectional distribution of individual betas on factor f. The actual factors are the ARMA(1,1) residuals of the corresponding factors, and the analysis is based on the 60-month rolling window. The description for the six benchmark factors is reported in Table 2. Columns **1** to **6** of this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding the two Phillips curve factors, $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$ and $u_t - u_t^*$, fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	1	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$	1.64^{***}	1.51^{***}	1.50^{***}	1.51^{***}	1.46^{***}	1.56^{***}	1.57^{***}	1.54^{***}	1.53^{***}	1.55^{***}	1.56^{***}
	(30.79)	(25.41)	(24.30)	(28.17)	(26.16)	(27.65)	(34.61)	(35.42)	(37.43)	(39.81)	(40.14)
1. $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.04^{***}						-0.03^{**}	-0.03^{**}	-0.03^{***}	-0.05^{***}	-0.06^{***}
	(-2.75)						(-2.24)	(-2.43)	(-2.35)	(-3.55)	(-4.30)
2. $u_t - u_t^*$		0.13^{***}					0.17^{***}	0.15^{***}	0.15^{***}	0.12^{***}	0.11^{***}
		(4.48)					(6.82)	(5.81)	(5.85)	(4.60)	(4.27)
3. w_t			-0.45^{***}					-0.68^{***}	-0.62^{***}	-0.60^{***}	-0.70^{***}
			(-3.93)					(-3.62)	(-3.53)	(-3.94)	(-3.61)
4. s_t				-1.32^{*}					-2.41^{***}	-3.13^{***}	-3.43^{***}
				(-1.38)					(-2.96)	(-3.98)	(-4.12)
5. pu_t					17.42^{***}					9.11^{***}	10.62^{***}
					(5.89)					(3.23)	(3.71)
6. $nfci_t$						0.01					0.04^{***}
						(0.45)					(3.61)
R^2_{adj}	0.18	0.15	0.13	0.15	0.13	0.13	0.26	0.30	0.34	0.38	0.41
Economic magnitudes (in %) (IIR^{75th} − IIR^{25th} $= 1.68\%$)											
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.09						-0.08	-0.07	-0.08	-0.14	-0.18
$u_t - u_t^*$		0.26					0.39	0.31	0.30	0.26	0.19
w_t			-0.20					-0.15	-0.14	-0.16	-0.14
s_t				-0.17					-0.13	-0.20	-0.21
pu_t					0.45					0.18	0.20
$nfci_t$						0.08					0.26

Table B3: continued from previous page

	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
$Intercept$	1.55^{***}	1.56^{***}	1.56^{***}	1.55^{***}	1.54^{***}	1.55^{***}	1.55^{***}	1.57^{***}	1.52^{***}	1.56^{***}	1.57^{***}
	(35.67)	(36.36)	(35.77)	(37.75)	(36.85)	(37.04)	(36.49)	(37.22)	(38.05)	(38.59)	(37.84)
1. $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.02^{**}	-0.06^{***}	-0.04^{***}	-0.06^{***}	-0.04^{***}	-0.05^{***}	-0.04^{***}	-0.07^{***}	-0.05^{***}	-0.07^{***}	-0.06^{***}
	(-1.85)	(-4.09)	(-3.08)	(-4.15)	(-3.23)	(-3.63)	(-3.02)	(-4.59)	(-3.49)	(-4.69)	(-4.44)
2. $u_t - u_t^*$	0.16^{***}	0.13^{***}	0.16^{***}	0.11^{***}	0.14^{***}	0.12^{***}	0.15^{***}	0.12^{***}	0.14^{***}	0.10^{***}	0.11^{***}
	(6.52)	(5.23)	(6.39)	(4.23)	(5.47)	(5.04)	(6.14)	(4.62)	(5.48)	(3.83)	(4.42)
3. w_t				-0.66^{***}	-0.58^{***}				-0.55^{***}	-0.56^{***}	
				(-3.77)	(-3.17)				(-3.40)	(-3.30)	
4. s_t	-2.22^{**}					-2.99^{***}	-2.72^{***}		-2.53^{***}		-3.46^{***}
	(-2.72)					(-3.80)	(-3.21)		(-2.95)		(-4.19)
5. pu_t		10.03^{***}		7.32^{***}		11.34^{***}		11.35^{***}		8.88^{***}	13.53^{***}
		(3.60)		(2.60)		(4.05)		(3.85)		(3.01)	(4.65)
6. $nfci_t$			0.03^{***}		0.04^{***}		0.03^{***}	0.03^{**}	0.05^{***}	0.04^{***}	0.03^{***}
			(2.53)		(3.32)		(2.60)	(2.37)	(3.87)	(3.18)	(2.57)
R^2_{adj}	0.30	0.30	0.30	0.35	0.34	0.34	0.34	0.34	0.38	0.38	0.37
Economic magnitudes (in %) (IIR^{75th} − IIR^{25th} $= 1.68\%$)											
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.05	-0.20	-0.12	-0.18	-0.11	-0.15	-0.11	-0.22	-0.15	-0.21	-0.19
$u_t - u_t^*$	0.37	0.31	0.34	0.23	0.26	0.30	0.31	0.25	0.24	0.16	0.22
w_t				-0.15	-0.15				-0.14	-0.16	-0.22
s_t	-0.13					-0.19	-0.16		-0.14		
pu_t		0.18		0.14		0.22		0.20		0.16	0.24
$nfci_t$			0.21		0.26		0.21	0.17	0.30	0.23	0.18

Table B4: **Fama-MacBeth Regressions for 6 Benchmark Factors (120-Month Rolling Window)**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (upper panel), and the annualized spread $\hat{E}\left[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\right]$ between two hypothetical goods with different betas on the factor f, everything else being equal (lower panel). The first portfolio's beta is the 75th percentile, while that of the second is the 25th percentile of the cross-sectional distribution of individual betas on factor f. The actual factors are the ARMA(1,1) residuals of the corresponding factors, and the analysis is based on the 120-month rolling window. The description for the six benchmark factors is reported in Table 2. Columns **1** to **6** of this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding the two Phillips curve factors, $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$ and $u_t - u_t^*$, fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	1′	**2′**	**3′**	**4′**	**5′**	**6′**	**I′**	**II′**	**III′**	**IV′**	**V′**
$Intercept$	1.45***	1.34***	1.42***	1.39***	1.37***	1.42***	1.34***	1.35***	1.33***	1.30***	1.29***
	(26.93)	(20.08)	(20.76)	(26.55)	(26.41)	(25.77)	(29.95)	(33.11)	(34.63)	(34.78)	(35.99)
1. $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	−0.06***						−0.07***	−0.07***	−0.05***	−0.09***	−0.09***
	(−4.01)						(−5.19)	(−5.25)	(−3.77)	(−5.66)	(−5.45)
2. $u_t - u_t^*$		0.19***					0.19***	0.17***	0.17***	0.16***	0.13***
		(9.83)					(11.74)	(9.57)	(9.14)	(8.71)	(6.88)
3. w_t			−0.54***					−0.28***	−0.32***	−0.25***	−0.23***
			(−7.28)					(−3.66)	(−4.20)	(−3.30)	(−3.15)
4. s_t				−5.16***					−4.13***	−3.29***	−2.97***
				(−4.84)					(−4.45)	(−3.81)	(−3.40)
5. pu_t					13.08***					14.52***	12.25***
					(3.98)					(4.44)	(3.91)
6. $nfci_t$						0.02*					0.10***
						(1.35)					(6.46)
R^2_{adj}	0.19	0.12	0.13	0.16	0.09	0.14	0.23	0.27	0.29	0.33	0.35
Economic magnitudes (in %) ($\mathbf{IIR}^{75th} - \mathbf{IIR}^{25th} = 1.68\%$)											
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	−0.12						−0.18	−0.19	−0.11	−0.26	−0.22
$u_t - u_t^*$		0.55					0.56	0.50	0.48	0.45	0.34
w_t			−0.35					−0.13	−0.13	−0.08	−0.07
s_t				−0.34					−0.20	−0.17	−0.15
pu_t					0.20					0.20	0.14
$nfci_t$						0.15					0.38

Table B4: continued from previous page

	VI′	VII′	VIII′	IX′	X′	XI′	XII′	XIII′	XIV′	XV′	XVI′
Intercept	1.32^{***}	1.31^{***}	1.30^{***}	1.33^{***}	1.32^{***}	1.29^{***}	1.29^{***}	1.30^{***}	1.30^{***}	1.31^{***}	1.28^{***}
	(30.29)	(30.14)	(31.41)	(33.56)	(34.45)	(30.46)	(31.30)	(31.67)	(35.37)	(35.15)	(31.70)
1. $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.05^{***}	-0.10^{***}	-0.06^{***}	-0.10^{***}	-0.06^{***}	-0.10^{***}	-0.05^{***}	-0.10^{***}	-0.05^{***}	-0.10^{***}	-0.10^{***}
	(-3.67)	(-6.02)	(-4.18)	(-6.01)	(-3.88)	(-6.05)	(-3.43)	(-6.03)	(-3.40)	(-5.83)	(-6.10)
2. $u_t - u_t^*$	0.17^{***}	0.18^{***}	0.15^{***}	0.17^{***}	0.12^{***}	0.16^{***}	0.13^{***}	0.15^{***}	0.11^{***}	0.13^{***}	0.13^{***}
	(10.64)	(11.21)	(8.97)	(9.20)	(6.21)	(9.72)	(7.91)	(9.48)	(5.96)	(7.02)	(8.01)
3. w_t				-0.24^{***}	-0.30^{***}				-0.36^{***}	-0.27^{***}	
				(-3.19)	(-4.02)				(-4.86)	(-3.61)	
4. s_t	-3.11^{***}					-2.65^{***}	-2.37^{***}		-2.65^{***}		-2.56^{***}
	(-3.49)					(-2.92)	(-2.51)		(-2.94)		(-2.81)
5. pu_t		7.05^{**}		11.10^{***}		12.36^{***}		6.04^{**}		9.46^{***}	9.92^{***}
		(2.06)		(3.28)		(3.73)		(1.87)		(3.00)	(3.12)
6. $nfci_t$			0.08^{***}		0.09^{***}		0.09^{***}	0.06^{***}	0.10^{***}	0.08^{***}	0.09^{***}
			(5.28)		(6.20)		(6.35)	(4.40)	(7.04)	(5.60)	(5.97)
R^2_{adj}	0.26	0.27	0.26	0.31	0.30	0.29	0.29	0.29	0.32	0.33	0.32
Economic magnitudes (in %) (IIR^{75th} − IIR^{25th} $= 1.68\%$)											
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.12	-0.24	-0.12	-0.24	-0.09	-0.28	-0.10	-0.23	-0.09	-0.22	-0.26
$u_t - u_t^*$	0.51	0.51	0.42	0.46	0.34	0.45	0.37	0.42	0.30	0.35	0.35
w_t				-0.11	-0.14				-0.15	-0.12	-0.13
s_t	-0.19					-0.14	-0.14		-0.13		
pu_t		0.09		0.16		0.16		0.05		0.11	0.10
$nfci_t$			0.34		0.37		0.40	0.27	0.42	0.32	0.37

Table B5: **Robustness Check: Eight Pro-Cyclical Univariate Factors**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the eight pro-cyclical factors for additional robustness checks, the description of which is reported in Table 2. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on the 60-month rolling window analysis. Panel B is based on the 120-month rolling window analysis. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

		Panel A: 60-month window								**Panel B: 120-month window**							
8 factors	**corr(fr,gdp)**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**7′**	**8′**	**9′**	**10′**	**11′**	**12′**	**13′**	**14′**
$Intercept$		1.61^{***}	1.59^{***}	1.56^{***}	1.52^{***}	1.50^{***}	1.58^{***}	1.56^{***}	1.50^{***}	1.45^{***}	1.40^{***}	1.36^{***}	1.41^{***}	1.36^{***}	1.39^{***}	1.39^{***}	1.38^{***}
		(29.94)	(25.49)	(28.28)	(28.46)	(26.50)	(25.37)	(30.56)	(30.61)	(22.76)	(20.01)	(22.42)	(28.79)	(25.77)	(20.92)	(29.46)	(28.55)
7. $\pi_t^{(I)} - \pi_{0,t}$	0.14	−0.22								−0.10							
		(−0.98)								(−0.32)							
8. $\pi_t^{(O)} - \pi_{0,t}$	0.18		-5.89^{***}								-2.89^{**}						
			(−4.12)								(−1.83)						
9. ind_t	0.27			-0.64^{***}								-0.69^{***}					
				(−5.51)								(−6.80)					
10. ipc_t	0.23				-0.74^{***}								-0.78^{***}				
					(−5.74)								(−7.10)				
11. ipd_t	0.23					-1.09^{***}								-1.92^{***}			
						(−3.08)								(−6.77)			
12. inc_t	0.10						0.09								-0.78^{***}		
							(0.54)								(−4.07)		
13. cg_t	0.25							-0.14^{**}								-0.60^{***}	
								(−2.12)								(−7.22)	
14. bbk_t	0.21								-19.88^{***}								-20.57^{***}
									(−5.10)								(−6.10)
R^2_{adj}		0.14	0.14	0.16	0.12	0.12	0.09	0.10	0.16	0.12	0.07	0.08	0.07	0.08	0.08	0.08	0.11

Table B6: **Robustness Check: Six Counter-Cyclical Univariate Factors**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the six counter-cyclical factors for additional robustness checks, the description of which is reported in Table 2. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on the 60-month rolling window analysis. Panel B is based on the 120-month rolling window analysis. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

		Panel A: 60-month window						**Panel B: 120-month window**					
6 factors	**corr(fr,gdp)**	**15**	**16**	**17**	**18**	**19**	**20**	**15′**	**16′**	**17′**	**18′**	**19′**	**20′**
$Intercept$		1.53^{***}	1.52^{***}	1.54^{***}	1.47^{***}	1.56^{***}	1.51^{***}	1.43^{***}	1.44^{***}	1.46^{***}	1.41^{***}	1.46^{***}	1.42^{***}
		(28.63)	(28.03)	(27.24)	(26.50)	(29.08)	(28.13)	(27.01)	(26.12)	(26.31)	(28.07)	(27.44)	(27.88)
15. cat_t	-0.17	26.02^{***}						13.95^{***}					
		(5.06)						(2.51)					
16. $eput_t$	-0.14		31.20^{***}						28.98^{***}				
			(4.68)						(4.00)				
17. $epum_t$	-0.08			41.65^{***}						16.73^{*}			
				(3.73)						(1.33)			
18. cbs_t	-0.26				0.04^{*}						0.04^{*}		
					(1.42)						(1.32)		
19. cs_t	-0.20					-0.03						0.05	
						(-0.71)						(1.12)	
20. ebp_t	-0.19						0.01						0.03
							(0.36)						(0.87)
R^2_{adj}		0.13	0.13	0.16	0.15	0.16	0.16	0.10	0.11	0.12	0.11	0.14	0.13

Table B7: **Robustness Check: Three Alternatives to Financial Condition Factor,** $nfci$

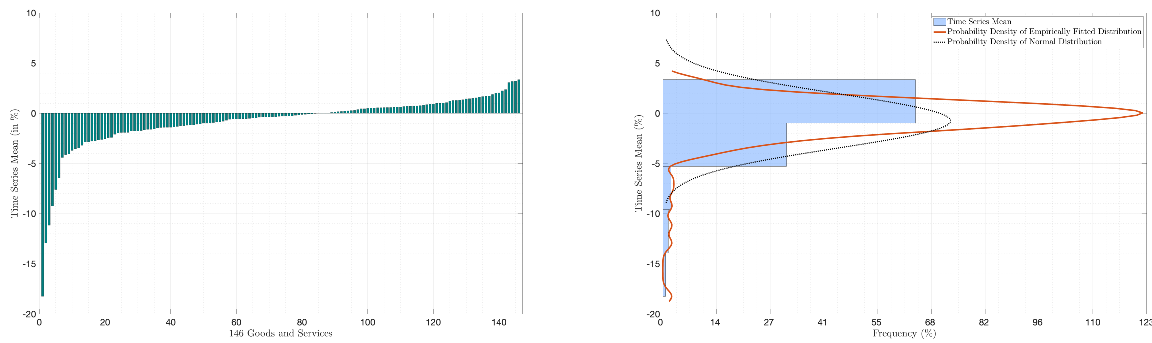
This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 3 alternatives, cbs, cs and ebp, to the financial condition factor $nfci_t$ in the benchmark model, for additional robustness checks, the description of which is reported in Table 2. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on 60-month rolling window analysis. Panel B is based on 120-month rolling window analysis. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	Panel A: 60-month window			**Panel B: 120-month window**		
	cbs	**cs**	**ebp**	**cbs**	**cs**	**ebp**
$Intercept$	1.58^{***}	1.58^{***}	1.58^{***}	1.34^{***}	1.34^{***}	1.33^{***}
	(42.13)	(40.15)	(41.81)	(36.73)	(36.99)	(36.02)
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^{*}$	-0.03^{**}	-0.03^{**}	-0.02^{*}	-0.09^{***}	-0.07^{***}	-0.06^{***}
	(-1.94)	(-1.84)	(-1.53)	(-5.75)	(-4.09)	(-3.54)
$u_t - u_t^{*}$	0.11^{***}	0.13^{***}	0.11^{***}	0.15^{***}	0.16^{***}	0.15^{***}
	(4.65)	(5.26)	(4.43)	(8.07)	(8.47)	(8.03)
w_t	-0.72^{***}	-0.61^{***}	-0.76^{***}	-0.26^{***}	-0.25^{***}	-0.21^{***}
	(-4.46)	(-3.64)	(-4.42)	(-3.75)	(-3.49)	(-2.91)
s_t	-2.63^{***}	-2.47^{***}	-2.51^{***}	-3.92^{***}	-3.36^{***}	-3.52^{***}
	(-3.37)	(-3.06)	(-3.25)	(-4.69)	(-4.07)	(-4.37)
pu_t	7.43^{***}	8.38^{***}	6.45^{***}	17.93^{***}	14.98^{***}	13.61^{***}
	(2.52)	(3.11)	(2.49)	(5.48)	(4.90)	(4.68)
fc_t	0.08^{***}	0.12^{***}	0.10^{***}	-0.02	0.09^{**}	0.08^{**}
	(2.91)	(3.92)	(2.90)	(-0.61)	(2.39)	(2.25)
R^2_{adj}	0.42	0.42	0.42	0.35	0.35	0.35

Table B8: **Link to Inflation Risk and Risk Premium (60-Month Rolling Window)**

This table presents the results of the regression of changes in the inflation risk premium proxies on the beta changes corresponding to the six benchmark factors. Dependent variables are two proxies: **BEIR**, which is the log change of 10-year breakeven inflation, and **BondMkt**, which is the change of rolling window beta from regressing the log price change of the 10-Year Treasury Bond on the log index change of S&P500. Independent variables are the changes in median $\Delta\beta_t^{50th}$ and changes in "interquartile" $\Delta(\beta_t^{80th} - \beta_t^{20th})$ of the corresponding actual factors. The analysis is based on the 60-month rolling window. Estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, the sample period of **BEIR** is from January 2003 to December 2019, and the sample period of **BondMkt** is from January 1990 to December 2019.

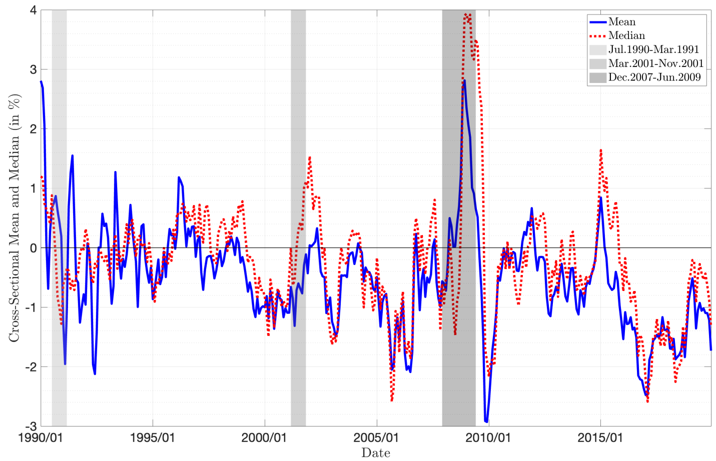
Factor	**Regressor**	**BEIR**	**BondMkt**
	$Intercept$	0.00 (-6.02)	-0.15^{***} (-5.74)
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	$\Delta\beta_{\pi,t}^{50th}$	0.06^{***} (6.03)	-1.91^{***} (-11.73)
$u_t - u_t^*$	$\Delta\beta_{u,t}^{50th}$	-0.08^{***} (-5.35)	-0.36 (-3.78)
w_t	$\Delta\beta_{w,t}^{50th}$	-0.29 (-15.99)	5.01 (7.06)
s_t	$\Delta\beta_{s,t}^{50th}$	2.11^{***} (5.75)	10.56^{***} (2.25)
pu_t	$\Delta\beta_{pu,t}^{50th}$	-4.62^{***} (-6.56)	-55.02^{***} (-4.01)
$nfci_t$	$\Delta\beta_{fc,t}^{50th}$	-0.03^{***} (-4.32)	0.52^{***} (7.48)
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	$\Delta\left(\beta_{\pi,t}^{80th} - \beta_{\pi,t}^{20th}\right)$	0.01^{**} (3.32)	-0.16^{***} (-3.25)
$u_t - u_t^*$	$\Delta\left(\beta_{u,t}^{80th} - \beta_{u,t}^{20th}\right)$	0.04^{***} (11.13)	-0.38^{***} (-7.59)
w_t	$\Delta\left(\beta_{w,t}^{80th} - \beta_{w,t}^{20th}\right)$	-0.06^{***} (-5.51)	3.31^{***} (11.56)
s_t	$\Delta\left(\beta_{s,t}^{80th} - \beta_{s,t}^{20th}\right)$	3.69^{***} (15.68)	-10.67^{***} (-5.18)
pu_t	$\Delta\left(\beta_{pu,t}^{80th} - \beta_{pu,t}^{20th}\right)$	-1.11^{***} (-3.34)	22.27^{***} (3.61)
$nfci_t$	$\Delta\left(\beta_{fc,t}^{80th} - \beta_{fc,t}^{20th}\right)$	0.01^{***} (6.53)	0.03^{***} (1.32)
R_{adj}^2		0.09	0.16



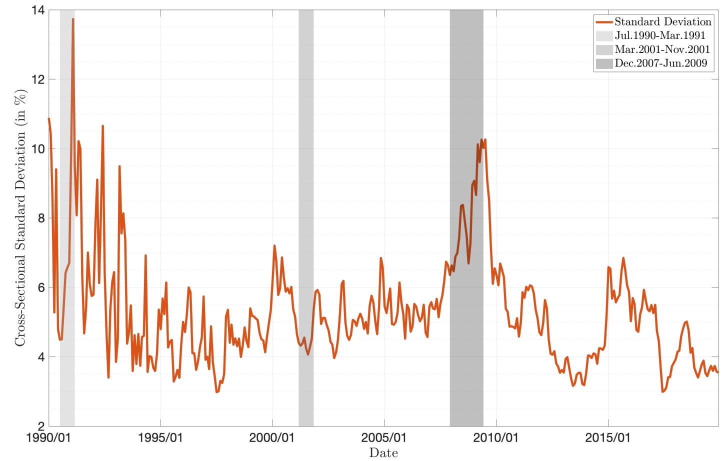
(a) Sorted Time Series Mean of IIR

(b) Time Series Mean of IIR Histogram

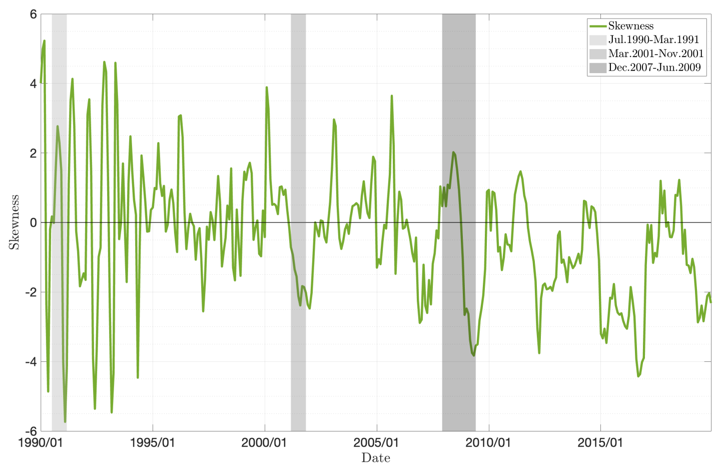
Figure B1: **Time Series Mean of Individual Inflation Rate (IIR)**
The 146 categories of goods and services are reported in Table 1 in the paper. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.



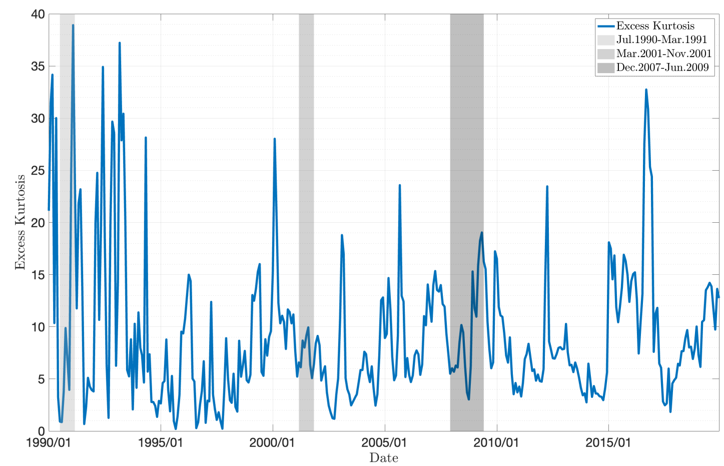
(a) Cross-Sectional Mean and Median of IIR



(b) Cross-Sectional Standard Deviation of IIR



(c) Cross-Sectional Skewness of IIR



(d) Cross-Sectional Excess Kurtosis of IIR

Figure B2: **Time Series Plots of Cross-Sectional Moments of Individual Inflation Rate (IIR)**
The 146 categories of goods and services are reported in Table 1 in the paper. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

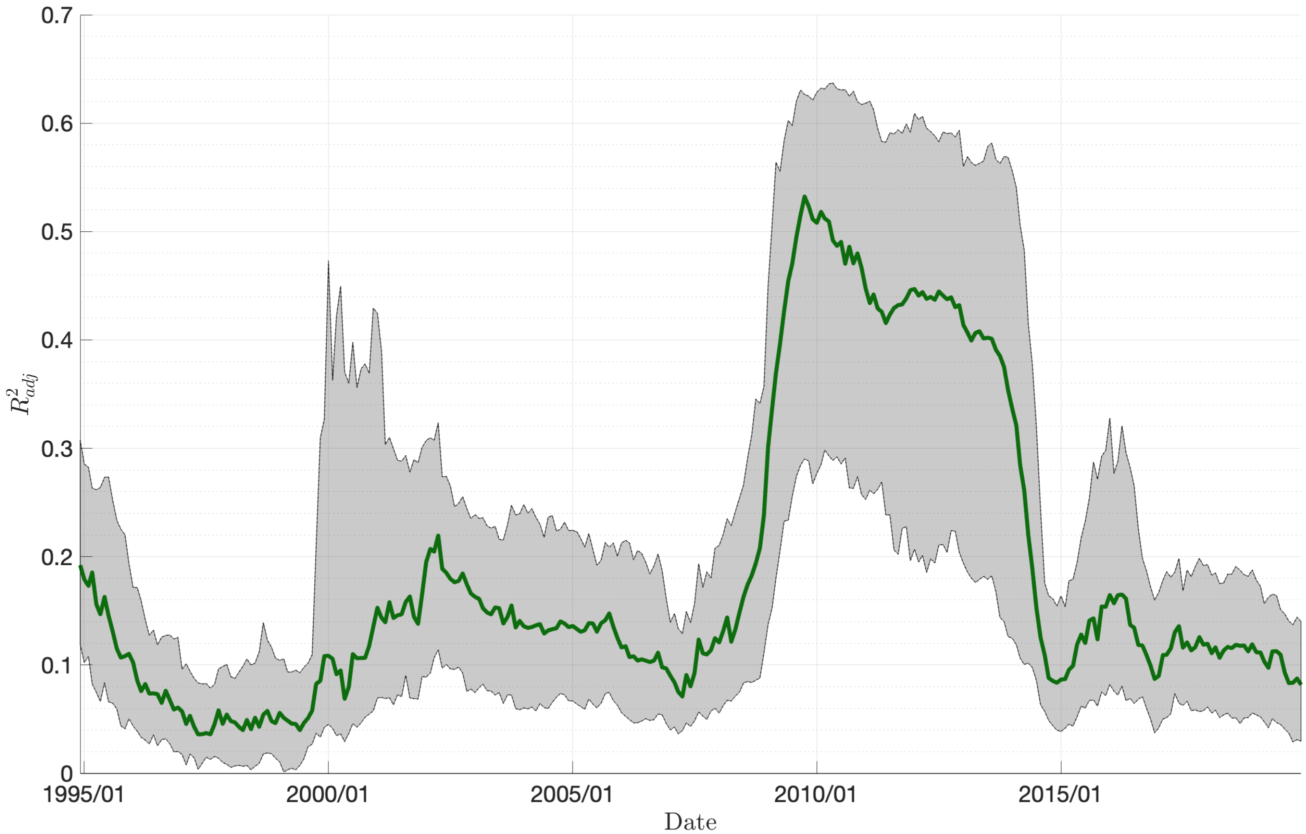


Figure B3: **Time Series Plot of Goodness of Fit (R^2_{adj}) from Time Series Regressions**
The plot of R^2_{adj} (across 146 goods and services) is the median of the adjusted goodness of fit from Fama-MacBeth (1973) 1^{st} stage time-series regressions of model **V** (based on the 60-month rolling window), with shaded 1st and 5th quintile confidence bound.

Appendix C Analysis of IEIR on 142 Goods and Services

From Figure 1 in the paper, we see there are approximate four categories of goods or services that have significantly more extensive IEIR than others, so in this section, we remove the 4 "extreme" goods or services from our sample and present a similar cross-sectional analysis of IEIR based on the remaining 142 goods and services (out of the 146 categories in the paper). The sample period is the same from January 1990 to December 2019.

Panel A of Figure C1 plots the sample averages of the 142 IEIR time series that we analyze in the section, as well as their histogram; Panel (a) shows that the sorted times-series mean of the 142 IEIR is more even than that of the 146 IEIR, the minimum and maximum average IEIR among the 142 goods and services are -7.60% and 3.36%, respectively. Panel (b) illustrates that the fitted probability density function (pdf) is much closer to the pdf of normal distribution than that of the 146 IEIR shown in Figure 1 in the paper. The figure illustrates well the considerable variation of these values in the cross-section of the 142 IEIR.

We follow a similar procedure as in the paper; Table C2 presents the descriptive statistics of the 142 IEIR series. A typical good price now grows annually at 0.25% less than the general inflation rate (which is 0.50% based on 146 IEIR). The 5th percentile averages -6.94% while the 95th percentile averages 6.35% through time, a difference of 13.29% (for 146 IEIR, the difference is 14.14%), and these 5th and 95th percentiles are still very large compared to the median IEIR that averages to -0.17% through time (for 146 IEIR, it is -0.24%), illustrating that an IEIR of a consumer good is likely to be more extreme than normal, and this is again confirmed by the large IEIR cross-sectional excess kurtosis that averages 9.44 through time (similar as that of 146 IEIR, which is 9.24).

In Figure C2, we plot the time series patterns of the cross-sectional moments of the IEIRs and highlight the NBER recessions. These cross-sectional moments show substantial time-series variations, as confirmed by their descriptive statistics in Table C2.

Based on the six benchmark factors selected in the paper, the two-group univariate beta sorting results shown in Table C3, and FM cross-section regression results through the 60-month and 120-month rolling windows shown in Table C4 and Table C5, respectively, shows the similar results in general that pro-cyclical factors: long-term inflation expectations, wages, and consumer sentiment have significant and robust negative factor lambdas, while counter-cyclical factors: unemployment, economic policy uncertainty have significant and robust positive factor lambdas, regardless of the model specification, besides for the factor of financial conditions, it changes signs in the two-group beta sorting exercise and no longer significant based on the 60-month rolling window analysis, but when extend the window to 120-month, the factor lambda of financial condition is still positive, significant and robust no matter the model specifications, which is consistent with the results of 146 IEIRs and confirm our theory again. In conclusion, the findings are robust and stronger when using a longer rolling window of 120 months in estimating the conditional betas. Also, the economic magnitudes are considerable compared to the reference point of 0.69%.

Further robustness checks of eight pro-cyclical factors shown in Table C6 and six counter-cyclical factors shown in Table C7 reconfirm the findings based on 146 IEIRS, no matter the analysis is based on the 60-month rolling window or 120-month window. However, the univariate factor lambdas for the three alternatives of financial conditions: corporate bond spread, credit spread, and excess bond premium, are not significant, but when we consider them in the six-factor model, besides cs based on the 60-month rolling window analysis, is positive and significant as shown in Table C8.

Table C9 reports the regression results of changes in our inflation risk and risk premium proxies on changes in the median beta corresponding to each economic factor. In general, the estimation on $\beta_{50^{th},t}$ is consistent with the results from IEIR, but the estimation on slopes turned negative besides consumer sentiment and financial conditions.

Figure C3 shows a very similar pattern to that in Figure 4 of the paper: the average explanatory power is the highest (a median adjusted goodness of fit, R^2_{adj}, between 42% and 54% across 142 consumer goods) during the period corresponding to the four rounds of quantitative easing (QE) lanched by the FED to fight against the financial crisis.

So the cross-sectional analysis based on 142 IEIRs is highly consistent with that on 146 IEIRs.

Table C1: **142 Goods and Services**

This table reports the 142 categories of goods and services included in the analysis, the four goods marked with strikethrough in the table: 1) Computers, peripherals, and smart home assistant devices, 2) Other video equipment, 3) Photographic equipment, 4) Televisions, are excluded from the 142 goods and services in the original analysis, since they are extreme values that may affect the conclusion, these 142 categories cover general goods and services in consumers' daily lives that are typically consumed quickly and therefore have no holding or resale value. Data are downloaded from the U.S. Bureau of Labor Statistics (BLS) on 17 November 2021.

#	Goods and Services	IEIR	#	Goods and Services	IEIR
1	Hospital services	3.36	***36***	Salt and other seasonings and spices	0.67
2	Delivery services	3.20	***37***	Food at employee sites and schools	0.65
3	College tuition and fees	3.18	***38***	Rent of primary residence	0.63
4	Elementary and high school tuition and fees	3.06	***39***	Admission to movies, theaters, and concerts	0.61
5	Veterinarian services	2.36	***40***	Laundry and dry cleaning services	0.58
6	Water and sewerage maintenance	2.24	***41***	Motor vehicle repair	0.58
7	Technical and business school tuition and fees	2.04	***42***	Other lodging away from home including hotels and motels	0.57
8	Housing at school, excluding board	1.99	***43***	Fresh biscuits, rolls, muffins	0.57
9	Cigarettes	1.88	***44***	Tomatoes	0.56
10	Fuel oil and other fuels	1.70	***45***	Other fresh vegetables	0.52
11	Motor vehicle insurance	1.69	***46***	Apples	0.52
12	Nursing homes and adult day services	1.67	***47***	Full service meals and snacks	0.49
13	Day care and preschool	1.60	***48***	Owners' equivalent rent of primary residence	0.46
14	Postage	1.55	***49***	Potatoes	0.46
15	Dental services	1.49	***50***	Moving, storage, freight expense	0.38
16	Admission to sporting events	1.46	***51***	Other condiments	0.29
17	Prescription drugs	1.45	***52***	Bacon, breakfast sausage, and related products	0.28
18	Garbage and trash collection	1.36	***53***	Frankfurters	0.24
19	Legal services	1.31	***54***	Other fats and oils including peanut butter	0.22
20	Funeral expenses	1.29	***55***	Fruits and vegetables	0.18
21	Cable and satellite television service	1.28	***56***	Pet food	0.17
22	Citrus fruits	1.23	***57***	Cakes, cupcakes, and cookies	0.11
23	Butter and margarine	1.07	***58***	Canned fruits and vegetables	0.09
24	Fresh fish and seafood	1.03	***59***	Services by other medical professionals	0.05
25	Fees for lessons or instructions	1.00	***60***	Cereals and bakery products	0.04
26	Other food away from home	1.00	***61***	Sauces and gravies	0.03
27	Pet services	0.93	***62***	Meats, poultry, fish, and eggs	-0.01
28	Parking and other fees	0.92	***63***	Rice, pasta, cornmeal	-0.01
29	Food at elementary and secondary schools	0.87	***64***	Other bakery products	-0.06
30	Gasoline (all types)	0.80	***65***	Airline fares	-0.08
31	Bread	0.77	***66***	Snacks	-0.11
32	Alcoholic beverages away from home	0.75	***67***	Processed fruits and vegetables	-0.12
33	Beef and veal	0.74	***68***	Flour and prepared flour mixes	-0.17
34	Physicians' services	0.71	***69***	Cheese and related products	-0.19
35	Financial services	0.70	***70***	Coffee	-0.26

Table C1: **continued from previous page**

#	Goods and Services	IEIR	#	Goods and Services	IEIR
71	Soups	-0.26	***109***	Miscellaneous household products	-1.40
72	Dairy and related products	-0.29	***110***	Tires	-1.41
73	Energy services	-0.29	***111***	Frozen and freeze dried prepared foods	-1.47
74	Poultry	-0.30	***112***	Sewing machines, fabric and supplies	-1.55
75	Intercity train fare	-0.34	***113***	Watches	-1.60
76	Processed fish and seafood	-0.35	***114***	Jewelry	-1.60
77	Lettuce	-0.36	***115***	Stationery, stationery supplies, gift wrap	-1.67
78	Other uncooked poultry including turkey	-0.37	***116***	New vehicles	-1.72
79	Sugar and sweets	-0.37	***117***	Household cleaning products	-1.75
80	Ice cream and related products	-0.39	***118***	Internet services and electronic information providers	-1.76
81	Lunchmeats	-0.46	***119***	Music instruments and accessories	-1.78
82	Other dairy and related products	-0.46	***120***	Men's footwear	-1.90
83	Other food at home	-0.50	***121***	Fresh milk other than whole	-1.91
84	Frozen fruits and vegetables	-0.53	***122***	Used cars and trucks	-1.92
85	Fresh whole milk	-0.54	***123***	Women's footwear	-1.98
86	Ham	-0.56	***124***	Women's underwear, nightwear, swimwear and accessories	-2.09
87	Club membership for shopping clubs, fraternal, or other organizations, or participant sports fees	-0.56	***125***	Infants' and toddlers' apparel	-2.41
88	Alcoholic beverages at home	-0.56	***126***	Men's pants and shorts	-2.42
89	Eggs	-0.60	***127***	Women's outerwear	-2.53
90	Whiskey at home	-0.70	***128***	Women's dresses	-2.61
91	Eyeglasses and eye care	-0.79	***129***	Outdoor equipment and supplies	-2.66
92	Other fresh fruits	-0.84	***130***	Nonelectric cookware and tableware	-2.74
93	Other pork including roasts, steaks, and ribs	-0.89	***131***	Men's suits, sport coats, and outerwear	-2.78
94	Carbonated drinks	-0.92	***132***	Leased cars and trucks	-2.83
95	Pork chops	-0.97	***133***	Major appliances	-2.85
96	Nonalcoholic beverages and beverage materials	-0.98	***134***	Ship fare	-3.20
97	Salad dressing	-0.99	***135***	Men's shirts and sweaters	-3.43
98	Bananas	-1.07	***136***	Women's suits and separates	-3.53
99	Car and truck rental	-1.08	***137***	Sports equipment	-3.70
100	Sports vehicles including bicycles	-1.16	***138***	Other furniture	-4.05
101	Distilled spirits, excluding whiskey, at home	-1.17	***139***	Other appliances	-4.12
102	Other beverage materials including tea	-1.18	***140***	Window coverings	-4.40
103	Other motor fuels	-1.23	***141***	Toys, games, hobbies and playground equipment	-6.42
104	Nonfrozen noncarbonated juices and drinks	-1.23	***142***	Audio equipment	-7.60
105	Purchase of pets, pet supplies, accessories	-1.31	***143***	~~Photographic equipment~~	-9.24
106	Breakfast cereal	-1.35	***144***	~~Computers, peripherals, and smart home assistants~~	-11.15
107	Boys' and girls' footwear	-1.39	***145***	~~Other video equipment~~	-12.93
108	Men's underwear, nightwear, swimwear and accessories	-1.40	***146***	~~Televisions~~	-18.23

Table C2: **Descriptive Statistics of Individual Inflation Rate (EIR)**

This table presents the mean, standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.) and the real per capita GDP growth correlations of the cross-sectional mean, standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.), and 5%, 25%, 50%(median), 75% and 95% percentiles among the 142 individual inflation rates (EIR), which is constructed as $\pi_{i,t} \equiv \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right)$ (defined by equation (1) in the paper). The 142 individual price indices included in our study are downloaded from the U.S. Bureau of Labor Statistics (BLS), and the names of which are summarized in Table 1. The mean, standard deviation, and percentiles are in percentage units. IEIRs are annualized monthly data, and the sample period is from January 1990 to December 2019.

	Mean	**Std.Dev.**	**Skew.**	**Kurt.**	**5%**	**25%**	**50%**	**75%**	**95%**
Mean	-0.25	4.92	0.15	9.44	-6.94	-2.29	-0.17	1.73	6.35
Std.Dev.	0.87	1.66	2.05	8.31	1.90	0.91	1.01	1.06	2.71
Skew.	0.65	1.67	-0.42	1.49	-2.01	0.76	1.18	1.21	1.63
Kurt.	2.24	3.76	0.20	2.15	6.36	3.18	4.17	3.87	3.23
$\mathbf{corr}(\pi^e, gdp)$	-0.25	-0.26	0.13	-0.06	0.11	-0.16	-0.19	-0.32	-0.39

Table C3: **Univariate Beta Sorting**

This table presents the univariate beta sorting results based on the six benchmark factors, the description for which is reported in Table 2. Individual consumer goods and services are sorted into two baskets (H, L) by the corresponding medians of the six univariate beta on the individual inflation rate (EIR). Panel A is based on the 60-month rolling window analysis. Panel B is based on the 120-month rolling window analysis. Actual factors are the ARMA(1,1) residuals of the corresponding original factors. Average IEIRs ($\mathbb{E}(\pi_i)$) and standard errors (S.E.) are in percentage units. All factors are annualized monthly data, and the sample period is from January 1990 to December 2019.

Panel A: 60-Month Window

f1 ($\pi_t^{\textbf{LTE}} - \pi_{0,t-1}^*$)

	L	H	H-L
β_1	-3.93	4.87	
$\mathbb{E}(\pi^e)$	-0.26	-0.15	0.11
S.E.	0.03	0.02	0.03

f2 ($u_t - u_t^*$)

	L	H	H-L
β_2	-2.21	2.99	
$\mathbb{E}(\pi^e)$	-0.29	-0.12	0.16
S.E.	0.03	0.02	0.03

f3 (w_t)

	L	H	H-L
β_3	-0.85	0.48	
$\mathbb{E}(\pi^e)$	-0.13	-0.27	-0.14
S.E.	0.02	0.02	0.03

f4 (s_t)

	L	H	H-L
β_4	-0.05	0.07	
$\mathbb{E}(\pi^e)$	-0.18	-0.22	-0.04
S.E.	0.03	0.02	0.03

f5 (pu_t)

	L	H	H-L
β_5	-0.02	0.02	
$\mathbb{E}(\pi^e)$	-0.35	-0.06	0.29
S.E.	0.02	0.03	0.03

f6 ($nfci_t$)

	L	H	H-L
β_6	-4.59	5.63	
$\mathbb{E}(\pi^e)$	-0.13	-0.27	-0.14
S.E.	0.03	0.03	0.04

Panel B: 120-Month Window

f1 ($\pi_t^{\textbf{LTE}} - \pi_{0,t-1}^*$)

	L	H	H-L
β_1	-3.58	4.72	
$\mathbb{E}(\pi^e)$	-0.12	-0.23	-0.10
S.E.	0.02	0.01	0.03

f2 ($u_t - u_t^*$)

	L	H	H-L
β_2	-1.83	3.43	
$\mathbb{E}(r)$	-0.25	-0.11	0.14
S.E.	0.02	0.01	0.03

f3 (w_t)

	L	H	H-L
β_3	-0.89	0.33	
$\mathbb{E}(\pi^e)$	-0.20	-0.13	0.07
S.E.	0.02	0.02	0.03

f4 (s_t)

	L	H	H-L
β_4	-0.04	0.06	
$\mathbb{E}(\pi^e)$	-0.07	-0.26	-0.19
S.E.	0.02	0.01	0.02

f5 (pu_t)

	L	H	H-L
β_5	-0.01	0.01	
$\mathbb{E}(\pi^e)$	-0.21	-0.13	0.08
S.E.	0.02	0.02	0.03

f6 ($nfci_t$)

	L	H	H-L
β_6	-3.01	3.79	
$\mathbb{E}(\pi^e)$	-0.18	-0.17	0.01
S.E.	0.01	0.02	0.03

Table C4: **Fama-MacBeth Regressions for 6 Benchmark Factors (60-Month Rolling Window)**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (upper panel), and the annualized spread $\hat{E}\big[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\big]$ between two hypothetical goods with different betas on the factor f, everything else being equal (lower panel). The first portfolio's beta is the 75th percentile, while that of the second is the 25th percentile of the cross-sectional distribution of individual betas on factor f. The actual factors are the ARMA(1,1) residuals of the corresponding factors, and the analysis is based on the 60-month rolling window. The description for the six benchmark factors is reported in Table 2. Columns **1** to **6** of this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding the two Phillips curve factors, $\pi_t^{(\text{LTE})} - \pi^*_{0,t-1}$ and $u_t - u_t^*$, fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	1	**2**	**3**	**4**	**5**	**6**	**I**	**II**	**III**	**IV**	**V**
$Intercept$	-0.20^{***}	-0.33^{***}	-0.35^{***}	-0.26^{***}	-0.30^{***}	-0.29^{***}	-0.26^{***}	-0.28^{***}	-0.28^{***}	-0.30^{***}	-0.28^{***}
	(-4.86)	(-7.93)	(-8.87)	(-6.08)	(-6.60)	(-6.93)	(-7.79)	(-8.90)	(-9.60)	(-11.25)	(-11.02)
1. $\pi_t^{(\text{LTE})} - \pi^*_{0,t-1}$	-0.03^{**}						-0.01	-0.01	-0.02	-0.02^{*}	-0.03^{**}
	(-2.30)						(-0.93)	(-1.12)	(-1.23)	(-1.53)	(-2.21)
2. $u_t - u_t^*$		0.08^{***}					0.09^{***}	0.08^{***}	0.09^{***}	0.06^{***}	0.07^{***}
		(2.70)					(3.89)	(3.31)	(3.50)	(2.44)	(2.91)
3. w_t			-0.34^{***}					-0.55^{***}	-0.49^{***}	-0.59^{***}	-0.47^{***}
			(-2.94)					(-2.91)	(-2.74)	(-3.25)	(-2.78)
4. s_t				-0.82					-2.13^{***}	-3.02^{***}	-3.23^{***}
				(-0.84)					(-2.51)	(-3.72)	(-3.83)
5. pu_t					12.97^{***}					3.77^{*}	4.43^{*}
					(4.29)					(1.35)	(1.57)
6. $nfci_t$						0.00					0.00
						(-0.18)					(-0.18)
R^2_{adj}	0.21	0.17	0.15	0.17	0.14	0.14	0.29	0.35	0.39	0.44	0.48
Economic magnitudes (in %) (EIR^{75th} − EIR^{25th} $= 0.69\%)$											
$\pi_t^{(\text{LTE})} - \pi^*_{0,t-1}$	-0.06						0.00	0.02	0.00	0.00	-0.03
$u_t - u_t^*$		0.15					0.20	0.14	0.13	0.12	0.12
w_t			-0.11					-0.07	-0.05	-0.06	-0.04
s_t				-0.12					-0.11	-0.18	-0.19
pu_t					0.33					0.10	0.11
$nfci_t$						0.03					0.12

Table C4: continued from previous page

	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
$Intercept$	-0.27^{***}	-0.28^{***}	-0.27^{***}	-0.30^{***}	-0.28^{***}	-0.29^{***}	-0.28^{***}	-0.27^{***}	-0.28^{***}	-0.28^{***}	-0.28^{***}
	(-8.59)	(-9.45)	(-8.46)	(-10.57)	(-9.59)	(-10.02)	(-9.22)	(-9.47)	(-10.38)	(-10.49)	(-9.88)
1. $\pi_t^{(\mathrm{LTE})} - \pi_{0,t-1}^*$	-0.01	-0.03^{**}	-0.03^{**}	-0.03^{**}	-0.03^{**}	-0.03^{**}	-0.03^{**}	-0.04^{***}	-0.03^{**}	-0.03^{**}	-0.04^{***}
	(-1.02)	(-2.04)	(-1.82)	(-2.00)	(-1.77)	(-2.01)	(-1.92)	(-2.48)	(-2.10)	(-2.37)	(-2.58)
2. $u_t - u_t^*$	0.09^{***}	0.06^{***}	0.10^{***}	0.05^{**}	0.10^{***}	0.06^{**}	0.10^{***}	0.06^{***}	0.10^{***}	0.06^{***}	0.06^{**}
	(3.66)	(2.50)	(4.16)	(2.05)	(3.82)	(2.28)	(3.94)	(2.58)	(4.05)	(2.45)	(2.33)
3. w_t				-0.56^{***}	-0.44^{**}				-0.40^{***}	-0.43^{***}	
				(-3.10)	(-2.36)				(-2.44)	(-2.45)	
4. s_t	-1.50^{**}					-2.41^{***}	-2.20^{***}		-2.44^{***}		-2.76^{***}
	(-1.81)					(-3.05)	(-2.59)		(-2.77)		(-3.36)
5. pu_t		6.07^{**}		2.45		7.48^{***}		5.73^{**}		2.94	8.02^{***}
		(2.21)		(0.87)		(2.72)		(1.93)		(0.99)	(2.77)
6. $nfci_t$			-0.01		0.00		-0.01	-0.02	0.00	-0.01	-0.02
			(-0.62)		(-0.17)		(-0.99)	(-1.13)	(0.17)	(-0.64)	(-1.25)
R^2_{adj}	0.34	0.35	0.34	0.40	0.39	0.39	0.39	0.39	0.44	0.44	0.43
Economic magnitudes (in %) (EIR^{75th} − EIR^{25th} $= 0.69\%$)											
$\pi_t^{(\mathrm{LTE})} - \pi_{0,t-1}^*$	0.01	-0.07	-0.04	-0.04	-0.01	-0.04	-0.03	-0.09	-0.04	-0.05	-0.07
$u_t - u_t^*$	0.17	0.13	0.23	0.08	0.18	0.12	0.20	0.14	0.17	0.10	0.10
w_t				-0.08	-0.05				-0.03	-0.06	-0.16
s_t	-0.08					-0.15	-0.13		-0.13		
pu_t		0.11		0.06		0.16		0.11		0.07	0.16
$nfci_t$			0.05		0.10		0.04	0.01	0.13	0.07	0.02

Table C5: **Fama-MacBeth Regressions for 6 Benchmark Factors (120-Month Rolling Window)**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 6 benchmark factors (upper panel), and the annualized spread $\hat{E}\big[(\beta_{75^{th}f,t} - \beta_{25^{th}f,t})\lambda_{f,t}\big]$ between two hypothetical goods with different betas on the factor f, everything else being equal (lower panel). The first portfolio's beta is the 75th percentile, while that of the second is the 25th percentile of the cross-sectional distribution of individual betas on factor f. The actual factors are the ARMA(1,1) residuals of the corresponding factors, and the analysis is based on the 120-month rolling window. The description for the six benchmark factors is reported in Table 2. Columns **1** to **6** of this table report the univariate estimation for the corresponding factors, and columns **I** to **XVI** report the corresponding estimations for all the sixteen ($2^4 = 16$) possible multi-variate specifications while holding the two Phillips curve factors, $\pi_t^{(\text{LTE})} - \pi^*_{0,t-1}$ and $u_t - u_t^*$, fixed. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	1′	**2′**	**3′**	**4′**	**5′**	**6′**	**I′**	**II′**	**III′**	**IV′**	**V′**
$Intercept$	−0.29***	−0.41***	−0.41***	−0.29***	−0.28***	−0.37***	−0.29***	−0.31***	−0.30***	−0.31***	−0.32***
	(−6.17)	(−9.45)	(−9.15)	(−6.03)	(−5.84)	(−7.74)	(−8.40)	(−10.16)	(−9.99)	(−10.83)	(−11.33)
1. $\pi_t^{(\text{LTE})} - \pi^*_{0,t-1}$	−0.05***						−0.04***	−0.05***	−0.04***	−0.05***	−0.05***
	(−3.19)						(−3.15)	(−3.52)	(−2.56)	(−3.24)	(−3.10)
2. $u_t - u_t^*$		0.10***					0.07***	0.05***	0.06***	0.06***	0.04***
		(5.33)					(4.69)	(2.87)	(3.02)	(3.17)	(1.94)
3. w_t			−0.26***					−0.13***	−0.11***	−0.10***	−0.06***
			(−3.76)					(−1.78)	(−1.15)	(−1.46)	(−0.94)
4. s_t				−3.64***					−3.30***	−3.31***	−2.88***
				(−3.41)					(−3.49)	(−3.71)	(−3.28)
5. pu_t					4.12***					6.42***	4.76***
					(1.21)					(2.12)	(1.63)
6. $nfci_t$						0.01*					0.03***
						(0.33)					(2.22)
R^2_{adj}	0.22	0.13	0.14	0.18	0.10	0.15	0.26	0.31	0.34	0.37	0.39
Economic magnitudes (in %) (EIR^{75th} − EIR^{25th} $= 0.69\%$)											
$\pi_t^{(\text{LTE})} - \pi^*_{0,t-1}$	−0.10						−0.09	−0.11	−0.07	−0.14	−0.10
$u_t - u_t^*$		0.31					0.20	0.13	0.14	0.14	0.08
w_t			−0.19					−0.11	−0.08	−0.06	−0.03
s_t				−0.23					−0.15	−0.15	−0.13
pu_t					0.00					0.07	0.05
$nfci_t$						0.07					0.15

Table C5: continued from previous page

	VI′	VII′	VIII′	IX′	X′	XI′	XII′	XIII′	XIV′	XV′	XVI′
Intercept	-0.28^{***}	-0.30^{***}	-0.30^{***}	-0.33^{***}	-0.32^{***}	-0.29^{***}	-0.28^{***}	-0.31^{***}	-0.30^{***}	-0.33^{***}	-0.29^{***}
	(-8.30)	(-9.06)	(-8.54)	(-10.89)	(-10.50)	(-8.96)	(-8.36)	(-9.65)	(-10.51)	(-11.47)	(-9.25)
1. $\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.04^{***}	-0.06^{***}	-0.04^{***}	-0.06^{***}	-0.04^{***}	-0.06^{***}	-0.03^{**}	-0.06^{***}	-0.03^{**}	-0.06^{***}	-0.06^{***}
	(-2.66)	(-3.52)	(-2.66)	(-3.87)	(-2.60)	(-3.54)	(-2.20)	(-3.72)	(-1.99)	(-3.67)	(-3.65)
2. $u_t - u_t^*$	0.06^{***}	0.07^{***}	0.05^{***}	0.05^{***}	0.02	0.06^{***}	0.04^{**}	0.06^{***}	0.02	0.03^{**}	0.04^{***}
	(4.06)	(5.02)	(3.14)	(2.94)	(1.25)	(4.06)	(2.26)	(3.70)	(1.10)	(1.70)	(2.61)
3. w_t				-0.15^{**}	-0.12^{*}				-0.14^{**}	-0.12^{*}	
				(-2.05)	(-1.58)				(-1.94)	(-1.74)	
4. s_t	-2.18^{**}					-2.32^{***}	-1.87^{**}		-2.56^{***}		-2.17^{***}
	(-2.27)					(-2.58)	(-2.03)		(-2.87)		(-2.42)
5. pu_t		3.80^{*}		4.18^{*}		6.88^{**}		2.22		2.65	5.29^{**}
		(1.19)		(1.35)		(2.19)		(0.73)		(0.91)	(1.75)
6. $nfci_t$			0.03^{**}		0.03^{**}		0.04^{**}	0.02	0.04^{***}	0.03^{**}	0.03^{**}
			(1.83)		(2.12)		(2.36)	(1.16)	(2.69)	(1.77)	(1.98)
R^2_{adj}	0.30	0.30	0.30	0.34	0.34	0.33	0.33	0.33	0.37	0.37	0.36
Economic magnitudes (in %) (EIR^{75th} − EIR^{25th} $= 0.69\%$)											
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	-0.08	-0.11	-0.03	-0.14	-0.03	-0.15	-0.03	-0.11	-0.03	-0.11	-0.13
$u_t - u_t^*$	0.18	0.20	0.14	0.13	0.06	0.17	0.10	0.15	0.03	0.08	0.11
w_t				-0.10	-0.09				-0.08	-0.09	-0.10
s_t	-0.10					-0.11	-0.10		-0.12		
pu_t		0.04		0.04		0.08		0.01		0.02	0.06
$nfci_t$			0.16		0.16		0.18	0.10	0.19	0.13	0.15

Table C6: **Robustness Check: Eight Pro-Cyclical Univariate Factors**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the eight pro-cyclical factors for additional robustness checks, the description of which is reported in Table 2. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on the 60-month rolling window analysis. Panel B is based on the 120-month rolling window analysis. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

		Panel A: 60-month window								Panel B: 120-month window							
8 factors	**corr(fr,gdp)**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**7′**	**8′**	**9′**	**10′**	**11′**	**12′**	**13′**	**14′**
$Intercept$		-0.32^{***}	-0.32^{***}	-0.33^{***}	-0.29^{***}	-0.36^{***}	-0.31^{***}	-0.27^{***}	-0.32^{***}	-0.42^{***}	-0.42^{***}	-0.32^{***}	-0.28^{***}	-0.32^{***}	-0.36^{***}	-0.25^{***}	-0.35^{***}
		(-8.71)	(-9.56)	(-10.19)	(-8.10)	(-10.35)	(-7.28)	(-6.30)	(-8.31)	(-9.37)	(-10.83)	(-8.81)	(-6.69)	(-8.67)	(-7.83)	(-5.41)	(-7.13)
7. $\pi_t^{(I)} - \pi_{0,t}$	0.14	-0.08								0.00							
		(-0.37)								(0.00)							
8. $\pi_t^{(O)} - \pi_{0,t}$	0.18		-4.60^{***}								-1.77						
			(-3.22)								(-1.14)						
9. ind_t	0.27			-0.62^{***}								-0.54^{***}					
				(-5.32)								(-5.37)					
10. ipc_t	0.23				-0.59^{***}								-0.45^{***}				
					(-4.58)								(-4.27)				
11. ipd_t	0.23					-1.12^{***}								-1.42^{***}			
						(-3.15)								(-5.14)			
12. inc_t	0.10						0.23^{*}								-0.37^{**}		
							(1.40)								(-1.91)		
13. cg_t	0.25							-0.05								-0.35^{***}	
								(-0.78)								(-4.29)	
14. bbk_t	0.21								-17.66^{***}								-13.36^{***}
									(-4.59)								(-3.97)
R^2_{adj}		0.16	0.15	0.18	0.12	0.14	0.11	0.11	0.17	0.14	0.08	0.08	0.07	0.08	0.09	0.10	0.13

Table C7: **Robustness Check: Six Counter-Cyclical Univariate Factors**

This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the six counter-cyclical factors for additional robustness checks, the description of which is reported in Table 2. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on the 60-month rolling window analysis. Panel B is based on the 120-month rolling window analysis. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

		Panel A: 60-month window						**Panel B: 120-month window**					
6 factors	**corr(fr,gdp)**	**15**	**16**	**17**	**18**	**19**	**20**	**15′**	**16′**	**17′**	**18′**	**19′**	**20′**
$Intercept$		-0.26^{***}	-0.25^{***}	-0.27^{***}	-0.30^{***}	-0.25^{***}	-0.28^{***}	-0.30^{***}	-0.30^{***}	-0.37^{***}	-0.35^{***}	-0.34^{***}	-0.35^{***}
		(-5.90)	(-5.91)	(-6.47)	(-7.20)	(-5.92)	(-6.62)	(-6.05)	(-6.10)	(-8.17)	(-7.43)	(-7.09)	(-7.44)
15. cat_t	-0.17	19.21^{***}						3.63					
		(3.69)						(0.64)					
16. $eput_t$	-0.14		19.40^{***}						6.05				
			(2.89)						(0.81)				
17. $epum_t$	-0.08			33.81^{***}						3.13			
				(2.99)						(0.25)			
18. cbs_t	-0.26				0.03						0.02		
					(1.04)						(0.63)		
19. cs_t	-0.20					-0.04						0.00	
						(-1.16)						(0.09)	
20. ebp_t	-0.19						0.00						0.01
							(0.01)						(0.14)
R^2_{adj}		0.14	0.14	0.18	0.16	0.17	0.17	0.11	0.13	0.14	0.12	0.16	0.15

Table C8: **Robustness Check: Three Alternatives to Financial Condition Factor,** $nfci$

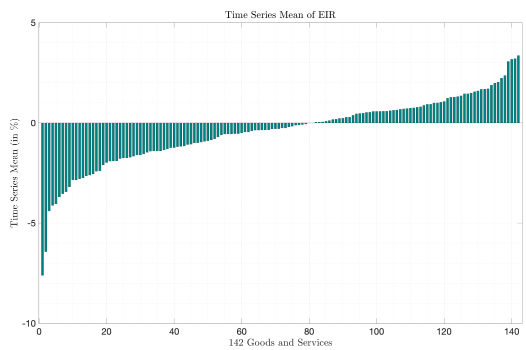
This table presents the results of Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions of the 3 alternatives, cbs, cs and ebp, to the financial condition factor $nfci_t$ in the benchmark model, for additional robustness checks, the description of which is reported in Table 2. The actual factors are the ARMA(1,1) residuals of the corresponding factors. Panel A is based on 60-month rolling window analysis. Panel B is based on 120-month rolling window analysis. Factor lambda estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

	Panel A: 60-month window			**Panel B: 120-month window**		
	cbs	**cs**	**ebp**	**cbs**	**cs**	**ebp**
$Intercept$	-0.28^{***}	-0.25^{***}	-0.27^{***}	-0.29^{***}	-0.29^{***}	-0.29^{***}
	(-11.88)	(-9.50)	(-10.84)	(-10.23)	(-9.96)	(-9.85)
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^{*}$	-0.02	-0.01	-0.01	-0.05^{***}	-0.03^{**}	-0.02
	(-1.22)	(-0.45)	(-0.54)	(-3.07)	(-2.02)	(-1.28)
$u_t - u_t^{*}$	0.05^{**}	0.07^{***}	0.05^{**}	0.04^{**}	0.05^{***}	0.05^{***}
	(2.14)	(3.06)	(2.18)	(2.21)	(2.70)	(2.76)
w_t	-0.61^{***}	-0.48^{***}	-0.66^{***}	-0.10^{*}	-0.13^{**}	-0.08
	(-3.77)	(-2.77)	(-3.73)	(-1.61)	(-1.98)	(-1.16)
s_t	-2.23^{***}	-2.60^{***}	-2.27^{***}	-3.58^{***}	-3.11^{***}	-3.01^{***}
	(-2.83)	(-3.15)	(-2.90)	(-4.18)	(-3.61)	(-3.62)
pu_t	1.37	3.52	0.93	7.35^{***}	8.39^{***}	6.59^{***}
	(0.47)	(1.30)	(0.36)	(2.51)	(3.00)	(2.51)
fc_t	0.02	0.06^{**}	0.03	-0.03	0.01	0.04
	(0.89)	(1.79)	(0.77)	(-0.84)	(0.16)	(1.01)
R^2_{adj}	0.48	0.48	0.49	0.40	0.40	0.40

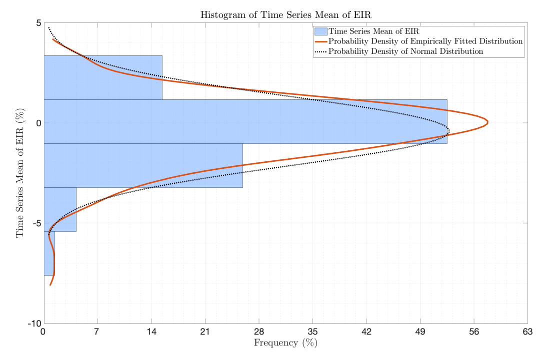
Table C9: **Link to Inflation Risk and Risk Premium (60-Month Rolling Window)**

This table presents the results of the regression of changes in the inflation risk premium proxies on the beta changes corresponding to the six benchmark factors. Dependent variables are two proxies: **BEIR**, which is the log change of 10-year breakeven inflation, and **BondMkt**, which is the change of rolling window beta from regressing the log price change of the 10-Year Treasury Bond on the log index change of S&P500. Independent variables are the changes in median $\Delta\beta_t^{50th}$ and changes in "interquartile" $\Delta(\beta_t^{80th} - \beta_t^{20th})$ of the corresponding actual factors. The analysis is based on the 60-month rolling window. Estimations are displayed in percentage units and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annualized monthly data, the sample period of **BEIR** is from January 2003 to December 2019, and the sample period of **BondMkt** is from January 1990 to December 2019.

Factor	**Regressor**	**BEIR**	**BondMkt**
	$Intercept$	0.00^{*}	-0.17^{***}
		(-1.64)	(-7.37)
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	$\Delta\beta_{\pi,t}^{50th}$	0.06^{***}	-0.40^{***}
		(8.90)	(-4.54)
$u_t - u_t^*$	$\Delta\beta_{u,t}^{50th}$	-0.04^{***}	0.07
		(-3.93)	(0.67)
w_t	$\Delta\beta_{w,t}^{50th}$	0.09^{**}	-0.80^{**}
		(1.96)	(-2.33)
s_t	$\Delta\beta_{s,t}^{50th}$	3.37^{***}	-50.79^{***}
		(4.36)	(-11.17)
pu_t	$\Delta\beta_{pu,t}^{50th}$	-5.82^{***}	130.50^{***}
		(-5.08)	(7.83)
$nfci_t$	$\Delta\beta_{fc,t}^{50th}$	-0.05^{***}	-0.09^{***}
		(-6.35)	(-2.51)
$\pi_t^{(\text{LTE})} - \pi_{0,t-1}^*$	$\Delta\left(\beta_{\pi,t}^{80th} - \beta_{\pi,t}^{20th}\right)$	0.00	0.30^{***}
		(-0.17)	(7.60)
$u_t - u_t^*$	$\Delta\left(\beta_{u,t}^{80th} - \beta_{u,t}^{20th}\right)$	-0.01^{***}	-0.30^{***}
		(-5.03)	(-6.19)
w_t	$\Delta\left(\beta_{w,t}^{80th} - \beta_{w,t}^{20th}\right)$	-0.01	0.68^{***}
		(-0.68)	(5.07)
s_t	$\Delta\left(\beta_{s,t}^{80th} - \beta_{s,t}^{20th}\right)$	3.90^{***}	-8.24^{***}
		(24.51)	(-5.71)
pu_t	$\Delta\left(\beta_{pu,t}^{80th} - \beta_{pu,t}^{20th}\right)$	-5.41^{***}	0.68
		(-12.60)	(0.10)
$nfci_t$	$\Delta\left(\beta_{fc,t}^{80th} - \beta_{fc,t}^{20th}\right)$	0.00^{**}	0.17^{***}
		(1.68)	(6.39)
R_{adj}^2		0.21	0.15

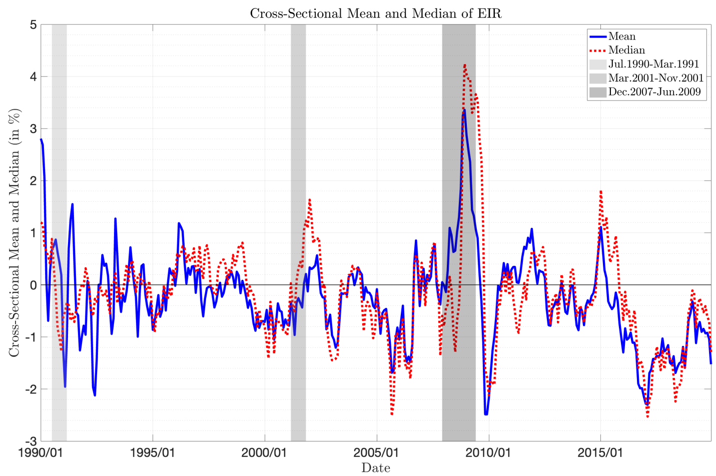


(a) Sorted Time Series Mean of IEIR

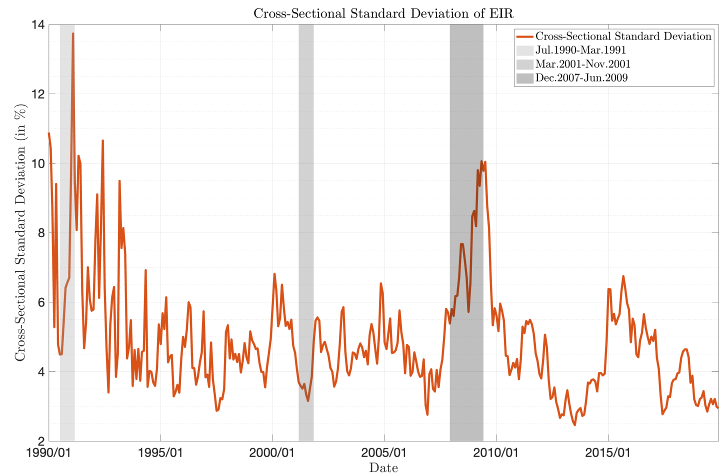


(b) Time Series Mean of IEIR Histogram

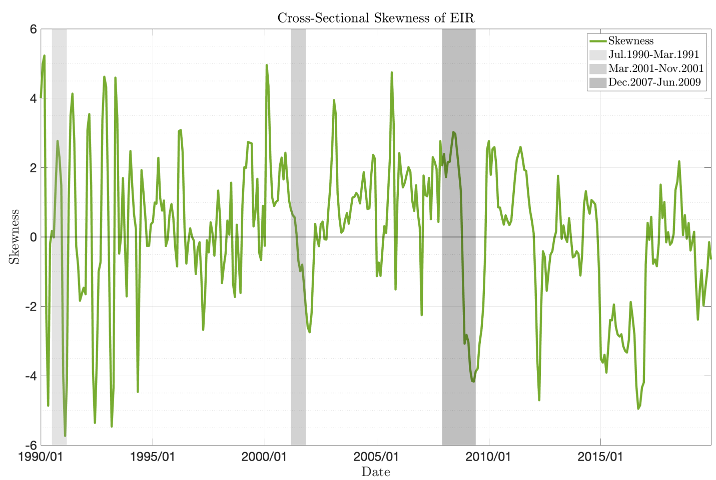
Figure C1: **Time Series Mean of Individual Inflation Rate (EIR)**
The 142 categories of goods and services are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.



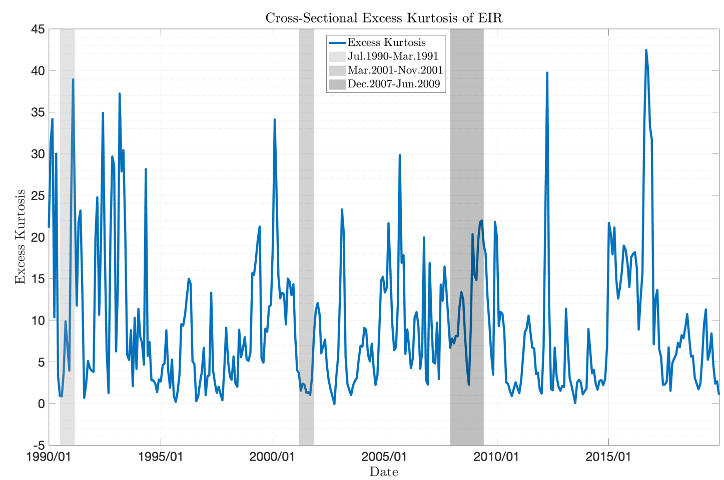
(a) Cross-Sectional Mean and Median of IEIR



(b) Cross-Sectional Standard Deviation of IEIR



(c) Cross-Sectional Skewness of IEIR



(d) Cross-Sectional Excess Kurtosis of IEIR

Figure C2: **Time Series Plots of Cross-Sectional Moments of Individual Inflation Rate (EIR)**
The 142 categories of goods and services are reported in Table 1. Data are annualized monthly data, and the sample period is from January 1990 to December 2019.

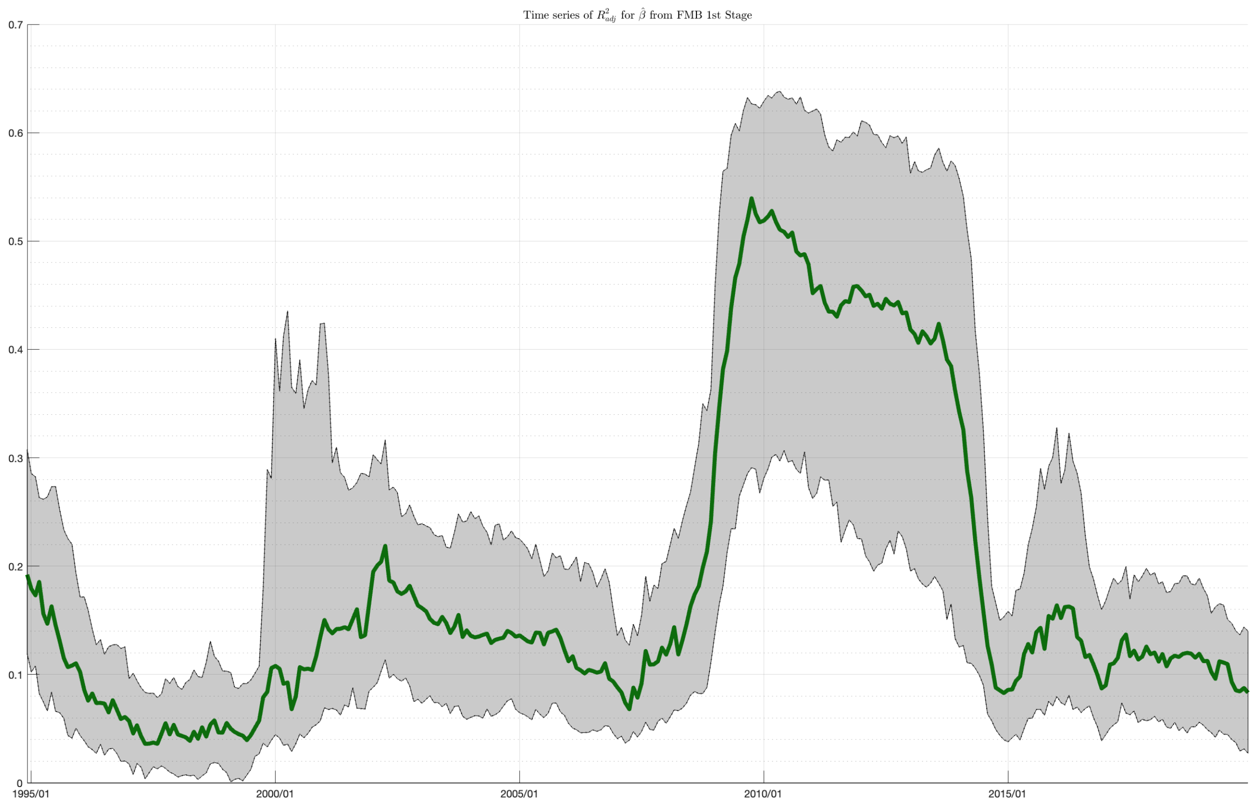


Figure C3: **Time Series Plot of Goodness of Fit (R^2_{adj}) from Time Series Regressions**
The plot of R^2_{adj} (across 142 goods and services) is the median of the adjusted goodness of fit from Fama-MacBeth (1973) 1^{st} stage time-series regressions of model **V** (based on the 60-month rolling window), with shaded 1st and 5th quintile confidence bound.

Appendix D Tests on Financial Asset Returns

In this section, we conduct a similar analysis on investment assets based on the six-benchmark factors; according to the cross-sectional asset pricing theory, in rational factor asset pricing models, the discrepancy in risk premia across different assets should be linked to a corresponding dispersion of sensitivities (factor loadings, or betas) to common risk factors. In most cases, these factors capture business cycle movements well. The main findings suggest that investors demand higher returns on average for assets whose returns tend to move more procyclical than other assets, which implies that the factor price (lambda) for pro-cyclical factors should be positive and for counter-cyclical factors should be negative. It has the opposite implication for the factor lambdas on consumer goods.

We test the returns of six portfolios: 49, 48, 38, 30, 17, and 12 industry portfolios on our six benchmark factors. The monthly data of return on the six industry portfolios are from Kenneth R. French's online data library. The dependent variables are annualized real returns of the corresponding six industry portfolios. The sample period is the same, from January 1990 to December 2019.

Table D1 presents the descriptive statistics of the real annualized returns on the 49 Industry Portfolios. A typical asset return grows annually at 9.26%, (for 146 IEIR, it is -0.5% of IEIR) and the 5th percentile averages -17.16% (for 146 IEIR, it is -7.86%) while the 95th percentile averages 39.45% (for 146 IEIR, it is 6.28% of IEIR) through time, a difference of 56.61% (for 146 IEIR, the difference is 14.14%), and these 5th and 95th percentiles are very large compared to the median IEIR that averages to 8.36% (for 146 IEIR, it is -0.24%) through time, illustrating that an IIR of a consumer good is likely to be much more extreme than normal (much more extreme than IEIR), and this is confirmed by the large cross-sectional standard deviation that averages 17.58% (for 146 IEIR, it is 5.31%) through time.

Figure D1 shows considerable heterogeneity of factor loadings (betas) among the 49 industry portfolios; the interesting finding is that for the three counter-cyclical factors: unemployment gap, economic policy uncertainty, and financial conditions, factor loadings are almost all negative, and factor loading on pro-cyclical factors: wage and consumer sentiment are mostly positive while it is more like evenly distributed on long-term inflation expectation.

Although we expected the opposite factor lambdas on investment assets, and despite the theoretical importance of macroeconomic risk factors in explaining the cross-section of expected asset returns, empirical evidence on the existence of risk premia on macro-factors is mixed and not robust to the different econometric methodologies used. As summarized by Li (2016) that one of the most influential papers is by Chen et al. (1986), who finds exposures to five macroeconomic factors, including industrial production growth, the change in expected inflation, unexpected inflation, the yield spread between a long-term and a short-term government bond, and the yield spread between low credit rating and high credit rating bonds are priced in the cross-section of stock returns. Shanken and Weinstein (2006), however, find that the results of Chen et al. (1986) are not robust to alternative test assets and the way the betas are estimated. Macro factor-based asset pricing models also fail to explain certain cross-sectional stock return anomalies such as momentum (Griffin et al. (2003)) and profitability premium (Wang and Yu (2013)). Most studies commonly attribute the empirical failure of the macro factor-based asset pricing model to the large measurement errors in macroeconomic factors, the difference between a theoretical definition and its empirical counterpart, or the low frequency in reporting macroeconomic variables.

Hong and Sraer (2016) argue that the speculative nature of high beta stocks offsets the risk-sharing effect, leading to the high beta-low return puzzle.

Most macro-factors models are not successful in explaining cross-sectional risk premia, with the conditional CAPM offering the highest fit, alternative multifactor models, based on the interest rate and bond yield factors, outperform the macro models, factors related to asset prices seem to provide better information for equity risk premia than “pure" macro variables.

Table D2 shows the estimated factor prices (lambdas) based on the 60-month rolling window, from which we could see that the estimate of factor price for pro-cyclical factors: long-term inflation expectation is positive and significant on the 17 industry portfolios and wages is positive and significant on the 12 industry portfolios, but consumer sentiment is still negative and significant in all six portfolios; for counter-cyclical factors: unemployment gap turned to negative and significant on 49, 48 and 38 industry portfolios, policy uncertainty are negative and significant in all six industry portfolios; and financial condition turn to negative and significant on 30, 17, 12 industry portfolios. These results, in general, verify the risk-return tradeoff theory that pro-cyclical factors have positive factor prices while counter-cyclical factors have negative factor prices.

Table D1: **Descriptive Statistics of Real Excess Annual Return of 49 Industry Portfolios**

This table reports the time-series mean, standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.) and the real per capita GDP growth correlations of the cross-sectional mean, standard deviation (Std.Dev.), skewness (Skew.), excess kurtosis (Kurt.), and 5%, 25%, 50%(median), 75% and 95% percentiles among the real excess annual return of 49 Industry Portfolios. The mean, standard deviation and percentiles are in percentage units. The sample period is from January 1990 to December 2019.

	Mean	**Std.Dev.**	**Skew.**	**Kurt.**	**5%**	**25%**	**50%**	**75%**	**95%**
Mean	9.26	17.58	0.35	2.16	−17.16	−0.96	8.36	18.39	39.45
Std.Dev.	15.22	5.70	1.03	3.63	16.30	15.20	15.07	15.90	22.04
Skew.	−0.36	1.50	0.82	4.56	−0.59	−0.63	−0.20	−0.02	0.49
Kurt.	2.22	2.49	2.91	31.50	0.61	1.35	2.13	2.72	2.33
corr(gdp)	0.44	−0.03	0.06	0.00	0.46	0.44	0.42	0.42	−0.32

Table D2: **Industry Portfolios (60-month window)**

This table presents the factor lambda estimation from Fama-MacBeth (1973) 2^{nd} stage cross-sectional regressions. The dependent variables are annulized real returns of the corresponding six industry portfolios from Kenneth R. French online data library. The actual factors are the ARMA(1,1) residuals of the corresponding factors and the analysis is based on 60-month rolling window. Factor lambda estimations are displayed (in %) and t-statistics are shown in parentheses. *, **, and *** indicate statistical significance of the factor lambdas at the 90%, 95%, and 99% levels respectively. Data are annulized monthly data, the sample period is from January 1990 to December 2019.

	P49	**P48**	**P38**	**P30**	**P17**	**P12**
$Intercept$	6.32^{***}	6.33^{***}	6.46^{***}	6.26^{***}	4.46^{***}	5.27^{***}
	(12.10)	(12.12)	(10.75)	(11.50)	(7.38)	(7.80)
$\pi_t^{(\text{LTE})} - \pi^*_{0.t-1}$	-0.02	-0.02	-0.01	-0.03	0.04^{*}	-0.05
	(-1.02)	(-1.15)	(-0.48)	(-1.41)	(1.57)	(-1.42)
$u_t - u_t^*$	-0.07^{**}	-0.08^{**}	-0.06^{*}	0.02	-0.03	-0.03
	(-2.06)	(-2.43)	(-1.65)	(0.64)	(-0.67)	(-0.52)
w_t	0.21	0.32	-0.25	0.11	0.44	1.04^{**}
	(0.74)	(1.10)	(-1.23)	(0.28)	(1.60)	(2.01)
s_t	-4.87^{***}	-4.88^{***}	-7.09^{***}	-4.33^{***}	-1.90	-0.73
	(-4.48)	(-4.45)	(-5.98)	(-3.62)	(-1.48)	(-0.35)
pu_t	-10.95^{***}	-10.99^{***}	-12.82^{***}	-11.80^{***}	-8.27^{*}	-34.80^{***}
	(-3.37)	(-3.39)	(-3.39)	(-2.98)	(-1.55)	(-4.67)
$nfci_t$	-0.02	-0.02	-0.04	-0.05^{**}	-0.08^{***}	-0.09^{***}
	(-1.08)	(-1.09)	(-1.40)	(-1.97)	(-2.61)	(-3.51)
R^2_{adj}	0.55	0.56	0.57	0.63	0.72	0.79

Figure D1. Time Series of Univariate Beta (Based on 60-month Window)

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