Has Globalization Changed the Inflation Process?

Comments
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Examine the relationship between inflation and domestic versus global economic factors.

Motivation: Relationship between domestic inflation and domestic slack appears to have weakened.

Is this because of increased globalization?

- Trade.
- Global supply chains.
- Global growth and commodity price cycle.
- Common monetary policy.
Broader Context

- Missing deflation puzzle during Great Recession in the U.S.
- Similar evidence of missing deflation during eurozone crisis.
- Missing inflation during the recent recovery and expansion?
Approach

- Global factor analysis.
- Phillips curve estimation
- Trend-cycle decomposition of inflation.
Findings: Global Factor Analysis

- Global factor accounts for 40-50% of variation in CPI and PPI Inflation.
- Global factor accounts for only 20% of variation in both core and wage inflation.
- Post 2000:
  - Dramatic increase in importance of global factor for CPI (from 30 to 60 percent).
  - Suggests global cycle matters primarily for food and energy.
Full-sample estimation:

- Domestic and global output gaps are important determinants of both CPI and Core Inflation.
- Real exchange rate and commodity prices have significant but economically modest effects.

Post 2000:

- World output gap and commodity price effects become much more important for CPI inflation.
- World output gap and commodity price effects become much less important for Core inflation.

Results are broadly consistent with global factor analysis.
Price dispersion has positive effect but only matters in pre 2000 period – is this consistent with increased global competition?

Domestic slack matters much less for core inflation during post 2000 period.

Country level analysis results vary widely – hints at power of using cross-section for identification.

Trend-cycle results also imply strong response of cyclical component to inflation expectations and domestic slack.

- Can we distinguish inflation expectations from trend – two-sided filter?
- World output gap only matters for core inflation and only in post-2000 sample – consistency with Phillips curve estimates?
Why is inflation process so hard to identify?

- Mix of supply and demand shocks drive inflation-output dynamics.
- Inflation expectations are sluggish and self-fulfilling.
- Country-level data may suffer from endogeneity with monetary policy (Tenreyro 2018).
- Financial factors cloud the relationship.
Customer markets – sell more today and build customer base for tomorrow.
  - Reducing price is an investment in future market share.

When financial conditions deteriorate, firms raise markups to increase current cash flow at the expense of future market share.

Implications: financial frictions attenuate the relationship between economic slack and inflation – Phillips curve is flatter.
NOTE: Weighted average monthly inflation relative to industry (2-digit NAICS) inflation.
Exhibit 4: Is This a One-Off Event?

- Use detailed industry-level PPIs to examine the sensitivity of inflation to changes in aggregate financial conditions during the 1973 - 2013 period.
- Current and lagged inflation
- Current and lagged growth in industry-level industrial production
- Current commodity price inflation measured by GSCI

Coefficients on EBP and commodity price inflation vary across 4-digit industry groups.

Is variation in industry-specific EBP coefficients related to the likelihood of financial constraints across industries?

Empirical approach

Regress industry-specific year-ahead inflation on:
- Indicator of current financial conditions - excess bond premium (EBP)
- Use industry-specific size-age index to identify the likelihood of financial constraints

![12-month PPI inflation and financial conditions](chart.png)

By industry-specific indicator of financial constraints

- Coefficient on EBP (4-digit NAICS)
- Median Size-Age Index (4-digit NAICS)

| p | $\beta$ | $|t|$ | R-sq |
|---|---|---|---|
| <= .10 | 1.11 | 4.88 | 0.29 |
| >= .10 | |

Note: Smaller values of the size-age index indicate a smaller likelihood of financial constraints.
Figure 7: Sensitivity of Industry-Level Output to Financial Conditions, 1973–2013

(By Industry-Specific Indicator of Financial Conditions)

-12 -10 -8 -6 -4 -2 0 2 4 6

-3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5

Median Size-Age Index

Coefficient on EBP

|p| = -1.88

|t| = -3.77

R-sq = 0.22

Note: No. of (4-digit NAICS) industries = 52. The figure shows the relationship between the median SA-index of financing constraints at the 4-digit NAICS level during the 1973–2013 period and the corresponding industry-specific estimates of the coefficient on the EBP; the dependent variable is ∆12 log IPi,t+12, the log-difference of IP in (5- or 6-digit NAICS) industry i from t to t+12 (see the text and notes to Table 3 for details).

Observations plotted as diamonds (♦) indicate coefficients that are different from zero at the 10-percent, or lower, significance level; observations plotted as stars (★) are statistically not different from zero at the 10-percent level. Smaller values of the size-age index indicate a smaller likelihood of financial constraints.

3.1.1 Subsample Stability

The results reported in Table 2 are based on the behavior of producer prices from 1973 to 2013, a period encompassing several distinct inflation regimes. This period also saw significant changes in the conduct of monetary policy, which—in addition to breaking the inflationary spiral of the 1970s—have ultimately led to the stabilization of inflation expectations, a crucial determinant of the firms' pricing behavior. To ensure that our results are robust to this change in inflation expectations, this section repeats the above analysis for post-1985 period.

As shown in Table 4, the effect of changes in financial conditions on the subsequent behavior of producer prices during the 1985–2013 period is very similar to that estimated over the full sample period. Imposing a restriction of a common coefficient on the EBP (Panel (a)) yields estimates that

Moreover, as emphasized by Dynan, Elmendorf, and Sichel (2006), the rapid pace of financial innovation since the mid-1980s—namely, the deepening and emergence of lending practices and credit markets that have enhanced the ability of households and firms to borrow and changes in government policy such as the demise of Regulation Q—may have also changed the way economic agents respond to changes in financial conditions.
## Phillips Curve Estimates: U.S. Industry-Level Data

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>((Y_{jt} - \bar{Y}_{jt}))</td>
<td>0.077</td>
<td>0.071</td>
<td>0.068</td>
<td>0.078</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>(EPB_t)</td>
<td>-1.566</td>
<td>-3.505</td>
<td>-1.123</td>
<td>-2.966</td>
</tr>
<tr>
<td></td>
<td>(0.143)</td>
<td>(0.375)</td>
<td>(0.197)</td>
<td>(0.502)</td>
</tr>
<tr>
<td>(EBP_t \times SA_j)</td>
<td>3.506</td>
<td></td>
<td>3.381</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.627)</td>
<td></td>
<td>(0.847)</td>
<td></td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.107</td>
<td>0.114</td>
<td>0.115</td>
<td>0.098</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.100</td>
<td>0.101</td>
<td></td>
</tr>
</tbody>
</table>

Note: \(SA_j\) varies between 0 (least constrained) to 1 (most constrained).

\[
\pi_{jt+1} = \rho \pi_{jt} + \alpha (Y_{jt} - \bar{Y}_{jt}) + \beta EBP_t + \gamma EBP_t SA_j + \varepsilon_{j,t}
\]
Panel-versions of price and wage Phillips Curves:

\[ \pi_{it} = \alpha_i + \beta \pi_{i,t-1} + \lambda (u_{it} - \bar{u}_{it}) + \phi \Delta \text{VAT}_{it} + \psi 1[i \in ] + \epsilon_{it}; \]

\[ \Delta w_{it} = \alpha_i + \beta \pi_{i,t-1} + \lambda (u_{it} - \bar{u}_{it}) + \phi \Delta \tilde{z}_{it} + \psi 1[i \in ] + \epsilon_{it}; \]

Countries: AUT, DEU, BEL, FIN, FRA, NLD, GRC, IRL, ITA, ESP, PRT

### Estimated Euro Area Phillips Curves

**Gilchrist, Schoenle, Sim and Zakrajsek (2018)**

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<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Prices</th>
<th>Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td>((u_{it} - \bar{u}_{it}))</td>
<td>(1) -0.273 ( (0.117) )</td>
<td>(2) -0.529 ( (0.127) )</td>
</tr>
<tr>
<td>(\pi_{i,t-1})</td>
<td>0.845 ( (0.046) )</td>
<td>0.813 ( (0.046) )</td>
</tr>
<tr>
<td>(\Delta z_{it})</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

**Adj. \(R^2\)**

<table>
<thead>
<tr>
<th>Prices</th>
<th>Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.839</td>
<td>0.845</td>
</tr>
<tr>
<td>0.858</td>
<td>0.872</td>
</tr>
</tbody>
</table>

**NOTE:** Time-clustered standard errors in parentheses.
## Financial Conditions and PC Prediction Errors
### With time fixed effects, 2008–2013

<table>
<thead>
<tr>
<th>PC Prediction Error</th>
<th>$\ln CDS_{i,t-1}$</th>
<th>$\ln CDS_{i,t-1} \times 1[i \in P]$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Prices (homogeneous)</td>
<td>0.044</td>
<td>0.453</td>
<td>0.329</td>
</tr>
<tr>
<td></td>
<td>$[-0.239, 0.327]$</td>
<td>$[0.092, 0.814]$</td>
<td></td>
</tr>
<tr>
<td>(2) Prices (heterogeneous)</td>
<td>0.684</td>
<td>0.275</td>
<td>0.419</td>
</tr>
<tr>
<td></td>
<td>$[0.369, 0.999]$</td>
<td>$[0.031, 0.519]$</td>
<td></td>
</tr>
<tr>
<td>(4) Wages (homogeneous)</td>
<td>-1.364</td>
<td>-0.495</td>
<td>0.352</td>
</tr>
<tr>
<td></td>
<td>$[-2.221, -0.506]$</td>
<td>$[-1.359, 0.369]$</td>
<td></td>
</tr>
<tr>
<td>(5) Wages (heterogeneous)</td>
<td>-2.196</td>
<td>-1.469</td>
<td>0.542</td>
</tr>
<tr>
<td></td>
<td>$[-2.731, -1.661]$</td>
<td>$[-2.550, -0.389]$</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Bootstrapped 95% confidence intervals in brackets.
Price Markups
Euro area, 2000–2015

Periphery countries

Core countries

NOTE: The markup is equal to minus (100 times) the log or real unit labor costs (2008 = 1).
SOURCE: AMECO database.
### Financial Conditions and Price Markups

**Euro area, 2008–2013, with time fixed effects**

<table>
<thead>
<tr>
<th>Specification</th>
<th>ln CDS(_{i,t-1})</th>
<th>ln CDS(_{i,t-1} \times 1[i \in P])</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Aggregate markups</strong></td>
<td>-0.312</td>
<td>1.148</td>
<td>0.681</td>
</tr>
<tr>
<td></td>
<td>([-0.528, -0.095])</td>
<td>([0.926, 1.372])</td>
<td></td>
</tr>
<tr>
<td><strong>B. Sectoral markups</strong></td>
<td>-0.331</td>
<td>1.974</td>
<td>0.152</td>
</tr>
<tr>
<td></td>
<td>([-1.915, 1.254])</td>
<td>([1.244, 2.704])</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Bootstrapped 95% confidence intervals in brackets.
Summary

- Rich paper documenting relationship between inflation and domestic vs global factors.
- Domestic slack and inflation expectations are prime drivers of inflation in pooled-regressions.
- Global factors appear to primarily matter for CPI rather than core inflation.
- Financial factors and inflation attenuate inflation dynamics and help explain missing deflation – are there implications for the global financial cycle and inflation dynamics?