Asymmetric Inflation Expectations, Downward Wage Rigidity, and Asymmetric Business Cycles

David Rezza Baqaeel
LSE

September 23, 2015
Introduction

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- What are the normative and positive consequences of such rigidities?
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What are the normative and positive consequences of such rigidities?
1 Basic Model

2 Evidence
   - Evidence on Beliefs
   - Evidence on Prediction

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Outline

1 Basic Model

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   - Evidence on Prediction

3 Conclusion
Workers observe their nominal wages perfectly and their price level imperfectly.
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If workers are more sensitive to inflationary news (because it’s bad) than disinflationary news (because it’s good), this can show up as downward rigidity of nominal wages.
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Distrustful workers will, to the extent that they can, refuse wage cuts in the presence of deflation, but demand wage increases in the presence of inflation.
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Distrustful workers will, to the extent that they can, refuse wage cuts in the presence of deflation, but demand wage increases in the presence of inflation.
There is an employer and a worker. The worker has log utility in his real wage, a 1 unit endowment of effort, and a reservation utility $d$.

$$u(w_t/p_t, x_t) = \log(w_t/p_t) \mathbf{1}(x_t = 1) + d \mathbf{1}(x_t = 0),$$

where $x_t$ is a binary variable for whether or not he works, $w_t$ is the nominal wage, $p_t$ is the price level in period $t$ and $d$ is an exogenous outside option.
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- Exogenous public signal about the price level.
- Employer makes wage offer.
- Worker chooses whether or not to work.
The worker chooses to work if

$$E_t \left( \log \left( \frac{w_t}{p_t} \right) \right) \geq d,$$

where the expectation is taken with respect to the worker’s information set.
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Rearrange this to get

$$w_t = \exp (d + E_t(\log(p_t))). \quad (1)$$

Suppose that workers receive a public signal $s_t$ about the inflation rate. Then we can rewrite (1) as

$$\log(w_t) = d + \log(p_{t-1}) + E_t(\log(\pi_t) | s_t),$$

where $\pi_t$ is the inflation rate and workers are assumed to know the price level in the previous period. If households' expectations are asymmetric (they rise more quickly than they fall), then the wage will also behave asymmetrically.
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w_t = \exp \left( d + E_t(\log(p_t)) \right). \tag{1}
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Think of $\pi_{t+12} - \pi_t$ as a proxy for $s_t$. 
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**Figure**: Forecast revisions of the annual inflation rate by the median household in the Michigan Survey of Inflation Expectations from 1983-2015, plotted against realized changes in the annual inflation rate as measured by the CPI.
Figure: Forecast revisions by the median professional forecaster in the SPF from 1983-2012, plotted against realized changes in the annual inflation rate as measured by the CPI.
Use structure of Epstein and Schneider (2008), suppose that the price level $p_t$ is given by

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Note that

$$\varepsilon_t | s_t, \sigma^2, \sigma_s^2 \sim \mathcal{N} \left( \frac{\sigma^2}{\sigma^2 + \sigma_s^2} s_t, \frac{\sigma^2 \sigma_s^2}{\sigma^2 + \sigma_s^2} \right).$$
Ambiguity-Aversion

- Use structure of Epstein and Schneider (2008), suppose that the price level $p_t$ is given by
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- Note that
  \[
  \varepsilon_t | s_t, \sigma^2, \sigma_s^2 \sim \mathcal{N}\left(\frac{\sigma^2}{\sigma^2 + \sigma_s^2} s_t, \frac{\sigma_s^2 \sigma^2}{\sigma^2 + \sigma_s^2}\right).
  \]

- This means we can rewrite the work condition as
  \[
  w_t = \exp \left( d + \frac{\sigma^2}{\sigma^2 + \sigma_s^2} s_t \right).
  \]
Now suppose the signal-to-total variance ratio $\frac{\sigma^2}{\sigma^2 + \sigma_s^2}$ is unknown. For example, suppose that the worker knows only that $\sigma_s \in [\sigma_s, \bar{\sigma}_s]$. 
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Knightian uncertainty about statistics, monetary policy, or idiosyncratic consumption baskets.
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Knightian uncertainty about statistics, monetary policy, or idiosyncratic consumption baskets.

Gilboa and Schmeidler (1989) framework implies that the cutoff nominal wage is

$$w_t = \max_{\sigma_s \in [\sigma_s, \sigma_s]} \exp \left( d + E(\log(\varepsilon_t) | s_t) \right)$$

$$= \exp \left( d + \tilde{E}(\log(\varepsilon_t) | s_t) \right),$$

(2)

where $\tilde{E}$ is a short-hand.
Figure: Critical wage as a function of $\varepsilon$.

\[
w = \max_{\sigma_s} \exp \left( d + \frac{\sigma^2}{\sigma^2 + \sigma_s^2} s \right),
\]

where $\sigma_s = \sigma_s$ when $s_t \geq 0$, and $\sigma_s = \bar{\sigma}_s$ when $s_t < 0$. 
Simple Model

Figure: Critical wage as a function of $\varepsilon$.

$$w = \max_{\sigma_s} \exp \left( d + \frac{\sigma^2}{\sigma^2 + \sigma_s^2} s \right),$$

where $\sigma_s = \underline{\sigma}_s$ when $s_t \geq 0$, and $\sigma_s = \overline{\sigma}_s$ when $s_t < 0$. 
In the paper, I show that this intuition survives in general equilibrium.

Figure: The nominal wage and employment as a function of shocks to money supply.
1. Basic Model

2. Evidence
   - Evidence on Beliefs
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3. Conclusion
Consider the following model for household inflation expectations

\[ \hat{\pi}_{t+12|i,t} = A \cdot \text{past info} + B^+ \cdot \text{new inflationary info} + B^- \cdot \text{new disinflationary info} + C_{it}, \]

- My measure of *Past information* is the lagged median SPF forecast, as well as lagged inflation.
- New information is considered *inflationary* if it is greater than last period’s forecasted inflation rate \( \pi_{t+12|t} \geq \pi_{t+8|t-4} \), else disinflationary.

\[
\begin{align*}
\text{expert}^+_t &= (\pi_{t+12|t} - \pi_{t+8|t-4})\mathbf{1}(\pi_{t+12|t} \geq \pi_{t+8|t-4}) \\
\text{expert}^-_t &= (\pi_{t+12|t} - \pi_{t+8|t-4})\mathbf{1}(\pi_{t+12|t} < \pi_{t+8|t-4})
\end{align*}
\]

- \( C_{it} \) is individual fixed effect, and year fixed effect.

<table>
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<tr>
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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<tbody>
<tr>
<td>$\hat{\pi}_{t+12</td>
<td>t}$</td>
<td>$0.524^{***}$</td>
<td>$0.396^{***}$</td>
</tr>
<tr>
<td>expert$^+$</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>$\hat{\pi}_{t+12</td>
<td>t}$</td>
<td>$0.197^{***}$</td>
<td>0.084</td>
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<tr>
<td>expert$^-$</td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>$\pi^e_{t+8</td>
<td>t-4}$</td>
<td>$0.574^{***}$</td>
<td>$0.350^{***}$</td>
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<tr>
<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.07)</td>
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<tr>
<td>$\pi_{t-1}$</td>
<td>$0.131^{***}$</td>
<td>$0.180^{***}$</td>
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<tr>
<td>(0.02)</td>
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<tr>
<td>Year FE</td>
<td>N</td>
<td>N</td>
<td>Y</td>
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<tr>
<td>Individual FE</td>
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<tr>
<td>Constant</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>Observations</td>
<td>126,659</td>
<td>126,659</td>
<td>126,659</td>
</tr>
</tbody>
</table>

Standard errors clustered at the individual level in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
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Literature has noted the asymmetric effects of monetary policy on output. This model implies there should also be an asymmetric effect on wage inflation.

Using local projections method of Jordà (2005), I estimate the impulse response function

$$\pi_{w_t+h} = \alpha_{h0} + \sum_{j=1}^{J} \alpha_{hj} \pi_{w_t-j} + \beta + \epsilon_{t+h} + \nu_t,$$

where $\pi_{w_t+h}$ is monthly wage inflation $h$ periods ahead, $\epsilon_{t+h}$ and $\epsilon_{-t}$ are positive and negative monetary shocks, and $\nu_t$ is the error term.

I use the Coibion et al. (2012) monetary shocks, with HAC standard errors for panel regressions with cross-sectional dependence from Driscoll and Kraay (1998).
Effect of Monetary Shocks

Literature has noted the asymmetric effects of monetary policy on output. This model implies there should also be an asymmetric effect on wage inflation. Using local projections method of Jordà (2005), I estimate the impulse response function

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\pi_{t+h}^w = \alpha_0^h + \sum_{j=1}^{J} \alpha_j^h \pi_{t-j}^w + \beta_+^h \varepsilon_+^t + \beta_-^h \varepsilon_-^t + \nu_t,
\]

where \( \pi_{t+h}^w \) is monthly wage inflation \( h \) periods ahead, \( \varepsilon_+^t \) and \( \varepsilon_-^t \) are positive and negative monetary shocks, and \( \nu_t \) is the error term.
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Effect of Monetary Shocks on Wage Inflation

Figure: Cumulative impact of a negative and positive shock to interest rates on the wage level with 90% Driscoll and Kraay (1998) confidence intervals.
Effect of Monetary Shocks on Price Inflation

Impulse Response Function

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- Inflation expectations of households are asymmetric.
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- Downward wage rigidity changes the characteristics of business cycles.
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- Asymmetric beliefs about inflation can generate downward wage rigidity.

- Downward wage rigidity changes the characteristics of business cycles.

- In the paper, I show that this can change the nature of optimal policy.


