WHAT THE CYCLICAL RESPONSE OF ADVERTISING REVEALS ABOUT MARKUPS AND OTHER MACROECONOMIC WEDGES

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Federal Reserve Bank of San Francisco

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Theorem:

Let $R$ be the ratio of advertising expenditure to the value of output. Let $-\epsilon$ be the residual elasticity of demand. Let $m$ be an exogenous multiplicative shift in the profit margin. Then the elasticity of $R$ with respect to $m$ is $\epsilon - 1$, which is a really big number.
PAPERS ON VARIATIONS IN MARKET POWER

- Rotemberg and Woodford (1999)
- Bils and Kahn (2000)
- Chevalier and Scharfstein (1996)
- Edmond and Veldkamp (2009)
Literature on advertising

- Dorfman and Steiner (1954)
Wedges

Profit-margin wedge $m$ raises the markup of price over cost—for example, lowers residual elasticity of demand.
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Profit-margin wedge $m$ raises the markup of price over cost—for example, lowers residual elasticity of demand.

Product-market wedge $f$ raises the purchaser’s price relative to the seller’s price—for example, a sales tax.
The elasticity of the advertising ratio $R$ with respect to the profit-margin wedge $m$ at the point $f = m = 1$ is $\epsilon - 1$. 

The elasticity of the labor share $\lambda$ with respect to the profit-margin wedge $m$ is $-1$. 

The elasticity of the labor share with respect to the product-market wedge $f$ is $-1$. 

·
Propositions

The elasticity of the advertising ratio $R$ with respect to the profit-margin wedge $m$ at the point $f = m = 1$ is $\epsilon - 1$.

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From these propositions,

\[ \log R = (\epsilon - 1) \log m - \log f + \mu_R \]
From these propositions,

\[ \log R = (\epsilon - 1) \log m - \log f + \mu_R \]

and

\[ \log \lambda = -\log m - \log f + \mu_{\lambda}, \]

where \( \mu^R \) and \( \mu^\lambda \) are constant and slow-moving influences apart from \( m \) and \( f \).
SOLVING FOR $\log m$ AND $\log f$ YIELDS

$$\log m = \frac{\log R - \log \lambda}{\epsilon} + \mu_m$$
SOLVING FOR $\log m$ AND $\log f$ YIELDS

$$\log m = \frac{\log R - \log \lambda}{\epsilon} + \mu_m$$

and

$$\log f = -\log \lambda - \frac{\log R - \log \lambda}{\epsilon} + \mu_f$$

Here $\mu_m$ and $\mu_f$ are constant and slow-moving influences derived in the obvious way from $\mu_R$ and $\mu_\lambda$. 
Advertising is a capital stock

\[ A_t = a_t + (1 - \delta)A_{t-1}. \]
Advertising is a capital stock

\[ A_t = a_t + (1 - \delta)A_{t-1}. \]

\[ \kappa_t = \frac{r + \delta}{1 + r} \nu_t. \]
Profit-margin wedge

-0.08
-0.06
-0.04
-0.02
0.00
0.02
0.04
0.06
0.08

1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Periodicity: number of years between one peak and the next in a cyclical component
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Periodicity of a component at frequency $\omega$ is $2\pi/\omega$. 
Filtering out higher periodicities

Baxter and King, 1999
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Baxter and King, 1999

Linear filter $\phi(L)$
Filtering out higher periodicities

Baxter and King, 1999

Linear filter $\phi(L)$

The time series $\hat{x}_t = \phi(L)x_t$, with adroit choice of $\phi(L)$, can emphasize business-cycle periodicities—ranging from once every two years to once every 5 years—and attenuate higher periodicities.
Filtering out higher periodicities

Baxter and King, 1999

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The time series $\hat{x}_t = \phi(L)x_t$, with adroit choice of $\phi(L)$, can emphasize business-cycle periodicities—ranging from once every two years to once every 5 years—and attenuate higher periodicities

Gain applied to a periodicity with frequency $\omega$ is $|\phi(e^{i\omega})|$.
Gain functions for filters that emphasize cyclical movements
Calculated Filtered Time Series for the Profit-Margin Wedge
Calculated Filtered Time Series for the Product-Market Wedge
### Regressions of the Filtered Markup Wedge on the Employment Rate

<table>
<thead>
<tr>
<th>Employment timing</th>
<th>Filter</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Years</th>
<th>Upper-tail p-value for coefficient = -0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First difference</td>
<td>0.02</td>
<td>(0.05)</td>
<td>1951-2010</td>
<td>0.004</td>
</tr>
<tr>
<td>Contemporaneous</td>
<td>Symmetric</td>
<td>0.01</td>
<td>(0.04)</td>
<td>1952-2008</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>First difference</td>
<td>0.00</td>
<td>(0.05)</td>
<td>1952-2010</td>
<td>0.014</td>
</tr>
<tr>
<td>Lagged one year</td>
<td>Symmetric</td>
<td>0.00</td>
<td>(0.04)</td>
<td>1953-2008</td>
<td>0.006</td>
</tr>
</tbody>
</table>
Regressions of the filtered product-market wedge on the employment rate

<table>
<thead>
<tr>
<th>Employment timing</th>
<th>Filter</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Years</th>
<th>Upper-tail p-value for coefficient = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemporaneous</td>
<td>First difference</td>
<td>-0.09</td>
<td>(0.18)</td>
<td>1951-2010</td>
<td>0.298</td>
</tr>
<tr>
<td></td>
<td>Symmetric</td>
<td>-0.06</td>
<td>(0.17)</td>
<td>1952-2008</td>
<td>0.368</td>
</tr>
<tr>
<td>Lagged one year</td>
<td>First difference</td>
<td>-0.84</td>
<td>(0.14)</td>
<td>1952-2010</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Symmetric</td>
<td>-0.82</td>
<td>(0.14)</td>
<td>1953-2008</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Role of the two wedges in employment volatility

\[ L_t = \theta \log m_t + \rho \log f_t + x_t \]
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Master wedge = \( mf \frac{\epsilon}{\epsilon - 1} \)
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Reasonable to take \( \theta = \rho \)
Role of the two wedges in employment volatility

\[ L_t = \theta \log m_t + \rho \log f_t + x_t \]

Master wedge = \( mf \frac{\epsilon}{\epsilon - 1} \)

Reasonable to take \( \theta = \rho \)

From Hall, JPE, 2009, I take \( \theta = -1 \) as the main case, but examine the consequences of lower and higher values.
Contributions of Wedges to Employment Movements as Functions of the Parameter $\theta$
Conclusions about the profit-margin wedge

The profit-margin wedge extracted from the advertising/GDP ratio $R$ and the labor share $\lambda$ has low volatility and no apparent cyclical movements.
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The wedge is close to uncorrelated with both this year’s employment and last year’s.

The evidence against a countercyclical profit-margin mechanism for cyclical movements of employment seems strong.
CONCLUSIONS ABOUT THE PRODUCT-MARKET WEDGE

The product-market wedge $f$ is *not* correlated with current-year employment change, but is strongly correlated with previous-year employment change.
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The wedge’s adverse effect operates not in the year of a recessionary employment contraction, but rather in the following year.
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The wedge’s adverse effect operates not in the year of a recessionary employment contraction, but rather in the following year.

The product-market wedge is responsible for the fall in the advertising/GDP ratio $R$ and for the decline in the labor share $\lambda$, in the aftermath of an employment contraction.
Other influences

- A Hicks-neutral productivity index, $h$
- A labor wedge or measurement error, $f_L$
- A capital wedge or measurement error, $f_K$
- An advertising wedge or measurement error, $f_A$
Model with other influences

\[ R = \frac{\kappa A}{pQ} = \frac{\alpha}{f_A f_Q m} \frac{(m - 1)\epsilon + 1}{\epsilon} \]
Model with other influences

\[ R = \frac{\kappa A}{pQ} = \frac{\alpha}{f_A f_Q m} \frac{(m - 1)\epsilon + 1}{\epsilon} \]

\[ \lambda = \frac{W}{pQ} = \frac{1}{f_L f_Q m} \gamma \frac{\epsilon - 1}{\epsilon} \]
Conclusions

▶ The Hicks-neutral productivity index $h$ and the capital wedge or measurement error $f_K$ affect neither the advertising/sales ratio $R$ nor the labor share $\lambda$.

▶ The new wedge $f_A$ affects $R$ with an elasticity of $-1$ and the new wedge $f_L$ affects $\lambda$ with an elasticity of $-1$; the margin wedge $m$ remains the only wedge that has a high elasticity.

▶ The advertising wedge or measurement error, $f_A$, lowers $R$ in the same way that $f_Q$ does.

▶ The labor wedge or measurement error, $f_L$, lowers $\lambda$ in the same way that $f_Q$ does.

▶ Equal values of $f_A$ and $f_L$ have the same effect as $f_Q$ of the same value.
Role of the two wedges in employment volatility

\[ L_t = -\theta \log m_t - \delta \log f_t + x_t \]
Role of the two wedges in employment volatility

\[ L_t = -\theta \log m_t - \delta \log f_t + x_t \]

Prior: \( \theta = \delta = 1 \)

.
Optimal price

\[
\max_{p,A} \left( \frac{p}{f} - c \right) p^{-\epsilon} \bar{p}^{\bar{\epsilon}} A^\alpha \bar{A}^{-\bar{\alpha}} - \kappa A
\]
Optimal price

$$\max_{p,A} \left( \frac{p}{f} - c \right) p^{\epsilon} \bar{p}^{\bar{\epsilon}} A^{\alpha} \bar{A}^{-\bar{\alpha}} - \kappa A$$

$$p^* = \frac{\epsilon}{\epsilon - 1} f c$$
Profit-margin shock

\[ p = m p^* \]
Profit-margin shock

\[ p = m p^* \]

\[ p = m f \frac{\epsilon}{\epsilon - 1} c \]

.
Optimal Advertising

\[ \frac{\alpha}{A} Q \left( \frac{p}{f} - c \right) = \kappa \]
Optimal advertising

\[ \frac{\alpha}{A} Q \left( \frac{p}{f} - c \right) = \kappa \]

\[ \frac{\kappa A}{pQ} = \alpha \frac{p/f - c}{p} \]
Optimal advertising

\[
\frac{\alpha}{A} Q \left( \frac{p}{f} - c \right) = \kappa
\]

\[
\frac{\kappa A}{pQ} = \alpha \frac{p/f - c}{p}
\]

\[
R = \frac{\kappa A}{pQ} = \alpha \frac{(m-1)\epsilon + 1}{f m \epsilon}
\]
Optimal advertising

\[
\frac{\alpha}{A} Q \left( \frac{p}{f} - c \right) = \kappa
\]

\[
\frac{\kappa A}{pQ} = \alpha \frac{p/f - c}{p}
\]

\[
R = \frac{\kappa A}{pQ} = \alpha \frac{(m - 1)\epsilon + 1}{f m \epsilon}
\]

With \( f = m = 1 \), \( R = \frac{\alpha}{\epsilon} \).
Labor share

\[ \lambda = \frac{W}{pQ} \]
Labor share

\[ \lambda = \frac{W}{pQ} \]

\[ \lambda = \frac{\gamma c Q}{pQ} = \gamma \frac{\epsilon - 1}{\epsilon} \frac{1}{f m} \]
**Implications of Alternative Values of the Residual Elasticity of Demand, with \( \theta = -1 \)**

<table>
<thead>
<tr>
<th>Employment timing</th>
<th>Filter</th>
<th>Implied contributions of wedges to cyclical movements in the employment rate</th>
<th>( \varepsilon ), residual elasticity of demand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>( \theta \beta_m )</td>
<td>( \theta \beta_f )</td>
</tr>
<tr>
<td></td>
<td>First difference</td>
<td>-0.05</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.09)</td>
<td>(0.18)</td>
</tr>
<tr>
<td>Contemporaneous</td>
<td>Symmetric</td>
<td>-0.02</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.08)</td>
<td>(0.17)</td>
</tr>
<tr>
<td></td>
<td>First difference</td>
<td>-0.01</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.09)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Lagged one year</td>
<td>Symmetric</td>
<td>0.00</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.08)</td>
<td>(0.14)</td>
</tr>
</tbody>
</table>
## Implications of Alternative Values of the Depreciation Rate

The table below presents the implied contributions of wedges to cyclical movements in the employment rate for different values of the annual rate of depreciation ($\delta$) and various filter types:

<table>
<thead>
<tr>
<th>Employment timing</th>
<th>Filter</th>
<th>$\delta$, annual rate of depreciation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\theta \beta_m$</td>
<td>$\theta \beta_f$</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Contemporaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First difference</td>
<td>-0.15</td>
<td>0.22</td>
</tr>
<tr>
<td>(0.07)</td>
<td>(0.17)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Symmetric</td>
<td>-0.16</td>
<td>0.21</td>
</tr>
<tr>
<td>(0.06)</td>
<td>(0.17)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Lagged one year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First difference</td>
<td>0.14</td>
<td>0.69</td>
</tr>
<tr>
<td>(0.07)</td>
<td>(0.15)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Symmetric</td>
<td>0.17</td>
<td>0.65</td>
</tr>
<tr>
<td>(0.06)</td>
<td>(0.15)</td>
<td>(0.04)</td>
</tr>
</tbody>
</table>
Covariance decomposition

\[ V(L_t) = \theta \text{Cov}(m_t, L_t) + \theta \text{Cov}(f_t, L_t) + \text{Cov}(x_t, L_t) \]
Covariance decomposition

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\[ 1 = \theta \frac{\text{Cov}(m_t, L_t)}{V(L_t)} + \theta \frac{\text{Cov}(f_t, L_t)}{V(L_t)} + \frac{\text{Cov}(x_t, L_t)}{V(L_t)}. \]
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\[ 1 = \theta \frac{\operatorname{Cov}(m_t, L_t)}{V(L_t)} + \theta \frac{\operatorname{Cov}(f_t, L_t)}{V(L_t)} + \frac{\operatorname{Cov}(x_t, L_t)}{V(L_t)}. \]

\[ 1 = \theta \beta_m + \theta \beta_f + \beta_x. \]