Rethinking the Link Between Exchange Rates & Inflation: Misperceptions and New Approaches

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Bank of England

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Currency Wars

China's second-day devaluation raises fears of currency war as markets fall

Fears mount over currency war

China fires new currency salvo as investors run for cover

China sparks fears of a currency war

FTSE loses £24bn as angry US calls for law change

China moves to calm fears over global currency war
Sterling Exchange Rate

Sterling trade-weighted exchange rate index
Comments Today

1. What do we Know?: Current Evidence on How Exchange Rate Movements Affect Inflation

2. Misperceptions?
   - Pass-Through is Greater in Sectors with a Greater Import Content
   - Pass-through is Greater in Sectors that are More Tradable and Internationally Competitive
   - Pass-Through is Constant Across Time

3. A New Approach: Consider The Shock Driving the Initial Movement in the Exchange Rate

4. Conclusions
Preview: New Approach Needed

• Independent research project with Ida Hjortsoe and Tsveti Nenova at BOE
  – Also draws from recent speech at MMF conference in Cardiff, “Much Ado About Something Important…."
  – Does not represent official BoE views

• Improves our framework for thinking about how exchange rates affect prices
  – Need to start with the source of the shock
  – Similar to thinking about oil price movements
  – Intuitive that companies respond differently
  – Can explain different pass-through at different times (crisis vs. today)

• Important implications for how we forecast inflation and set monetary policy
• COMMENTS APPRECIATED!
What do we Know?: Current Evidence on How Exchange Rate Movements Affect Inflation
Extensive Academic Literature

- Many contributions to different aspects of pass-through
  - Gopinath (2015): currency of invoicing
  - Burnstein and Gopinath (2014) for overview
  - Evidence that changes over time in different countries: Marazzi et al. (2005), Gagnon and Ihrig (2004), Fleer et al. (2015)

- Many contributions to factors behind exchange rate movements

- Papers suggesting different exchange-rate shocks have different effects on economy
  - Klein (1990), Astley, Pain and Smith (2009)
  - Theoretical model: Corsetti, Leduc, and Dedola (2009)
Exchange rate pass-through:
After movements in the sterling/euro exchange rate
Rough Rules of Thumb

• BOE rough estimates:
  – 1st stage pass-through to import prices: 60 – 90%, quick (about 1 year)
  – 2nd stage pass-through to CPI: 30% based on import intensity of CPI, slow (about 3-5 years)
  – Overall pass-through coefficient: 20% - 30%
    • Recent 17% appreciation → CPI↓ by 3% to 5% over several years

• But a closer looks suggests this is missing something….
  – Some assumed patterns don’t hold up well in the data
  – Rate of pass-through seems to change sharply over short-periods of time
3 Misperceptions

1. Pass-Through is Greater in Sectors with a Greater Import Content
Check Using Micro Data

- Price data for 85 goods and services in UK headline CPI index from 1996 through 2008

- Component-level regressions to calculate price sensitivity in each sector to movements in sterling
  - Controlling for changes in oil prices, foreign export prices, UK output gap
  - Estimate “sterling sensitivity” coefficient

- Are sectors with a higher import content more sensitive to sterling’s fluctuations?
Sterling Sensitivity & Import Intensity

Confirmed with more formal regression analysis: negative correlation
3 Misperceptions

1. Pass-Through is Greater in Sectors with a Greater Import Content
2. Pass-Through is Greater in Sectors that are More Tradable and Internationally Competitive
Check Using Micro Data

• Use same measure of sterling sensitivity

• Calculate “tradability” by comparing price levels of goods for 30 different CPI components in the UK and the EU15
  – 2 measures of law-of-one price (LOOP), focusing on average price levels and deviations

• Are sectors that are more tradable also more sensitive to sterling’s fluctuations?
Tradability (x-axis) and sterling sensitivity (y-axis)

Note: LOOP1 on x-axis (the lower the measure the more tradable is the good); price sensitivity to sterling on y-axis (the higher is the coefficient, the more sensitive is the price of the good to sterling). If LOOP2 was a good measure of tradability you should get a negative relationship.

Note: LOOP2 on x-axis (the lower the measure the more tradable is the good); price sensitivity to sterling on y-axis (the higher is the coefficient, the more sensitive is the price of the good to sterling). If LOOP2 was a good measure of tradability you should get a negative relationship.
Tradability (x-axis) and sterling sensitivity (y-axis): excluding energy, fruit and vegetables

Note: Narrow LOOP1 excluding energy and fruit and vegetables and sterling sensitivity on x-axis.

Note: Narrow LOOP2 excluding energy and fruit and vegetables and sterling sensitivity on x-axis.
3 Misperceptions

1. Pass-Through is Greater in Sectors with a Greater Import Content
2. Pass-Through is Greater in Sectors that are More Tradable and Internationally Competitive
3. Pass-through is Constant over Time
Rolling 10-year Estimated Pass-Through to Inflation

Note: A higher coefficient implies that prices fall more in response to an appreciation, i.e. greater exchange rate pass-through.

Calculation:
rolling 10-year exchange rate coefficient from aggregate CPI Phillips curve
Rolling 10-year Estimated Pass-Through to Import Prices

Note: A higher coefficient implies that prices fall more in response to an appreciation, i.e. greater exchange rate pass-through.

Calculation: rolling 10-year exchange rate coefficient from OLS regression of UK import prices on the exchange rate and foreign export prices.
Where do we stand?
--not in a good place!

3 puzzles
Extremely frustrating
Are we missing something?
A New Approach: Consider Why the Exchange Rate Moved in the First Place

Approach

- SVAR model, quarterly data from 1993q1 to 2015q1
- 6 domestic & global shocks which can effect the ER & other variables
  - UK supply
  - UK demand
  - UK monetary policy
  - Exogenous exchange rate
  - Global supply
  - Global demand (broadly defined)
- Look at impact on 6 variables
  - Exchange rate (nominal ERI)
  - Consumer prices
  - Interest rates (shadow)
  - Import prices
  - GDP
  - Foreign export prices
- Identification criteria
  - Based on economic theory & small-open economy DSGE model (see paper)
  - Zero short- and long-run restrictions plus sign restrictions
### Identification Restrictions

**UK**

**UK supply shock**

**UK demand shock**

**UK monetary policy shock**

**Exogenous exchange rate shock**

**Global supply shock**

**Global demand shock**

#### Short-run restrictions

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<th>World (ex-UK) export prices</th>
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#### Long-run restrictions

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<td>UK nominal ERI</td>
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<td>UK import prices</td>
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</table>

**Note:** A '+' ('-') sign indicates that the impulse response of the variable in question is restricted to be positive (negative) in the quarter the shock considered hits. A '0' indicates that the response of the variable in question is restricted to be zero (either on impact or in the long run).
Scenario

- Sterling appreciates 1% after 4 quarters
  - Set magnitude of shocks as needed
- Estimation details
  - Bayesian methods with standard Minnesota priors
  - Standard error, percentiles & confidence intervals based on Gibbs sampling procedure, 10,000 repetitions
  - 2 lags of endogenous variables
    - preferred by Schwartz information criteria
    - Results robust to 1 lag
  - Sign restrictions imposed for 2 periods
UK supply shock
UK demand shock

- GDP
- CPI
- Shadow BR
- Exchange rate
- Import prices
- Foreign export prices
UK monetary policy shock

- GDP
- CPI
- Shadow BR
- Exchange rate
- Import prices
- Foreign export prices
UK exchange rate shock

GDP

CPI

Shadow BR

Exchange rate

Import prices

Foreign export prices
Global supply shock
Global “demand” shock
Pass-through to import prices by shock*

* Median ratio of import price response to exchange rate response
Pass-through to consumer prices by shock*

*Median ratio of CPI response to exchange rate response
## Forecast error variance decomposition

<table>
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<tr>
<th>Variable</th>
<th>Horizon (quarters)</th>
<th>Proportion of variance explained by shocks to:</th>
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<td>CPI</td>
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<td>Shadow BR</td>
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<td></td>
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<td>0.21</td>
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<tr>
<td>Exchange rate</td>
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<td>0.09</td>
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<tr>
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<td>20</td>
<td>0.11</td>
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<tr>
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<tr>
<td>Foreign export prices</td>
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<tr>
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<td>20</td>
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Historical Shock Decomposition of Changes in Sterling ERI

- Global demand
- Monetary policy
- Demand
- Supply
- Global supply
- Exchange rate
- Base level and trend
- Sterling ERI

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### Shock decomposition of large exchange rate changes and implied pass-through coefficients

<table>
<thead>
<tr>
<th>Shocks</th>
<th>1996/7 appreciation</th>
<th>2007/8 depreciation</th>
<th>2013 appreciation</th>
<th>Full sample FEVD*</th>
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<tr>
<td>Supply</td>
<td>10%</td>
<td>21%</td>
<td>14%</td>
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<tr>
<td>Demand</td>
<td>33%</td>
<td>20%</td>
<td>22%</td>
<td>25%</td>
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<tr>
<td>Monetary policy</td>
<td>19%</td>
<td>11%</td>
<td>17%</td>
<td>17%</td>
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<tr>
<td>Exchange rate</td>
<td>24%</td>
<td>13%</td>
<td>0%</td>
<td>21%</td>
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<tr>
<td>Global supply</td>
<td>6%</td>
<td>18%</td>
<td>25%</td>
<td>14%</td>
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<td>Global demand</td>
<td>8%</td>
<td>17%</td>
<td>23%</td>
<td>13%</td>
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<tr>
<td><strong>Implied ERPT to import prices</strong> (not controlling for world export prices)</td>
<td>-0.67</td>
<td>-0.86</td>
<td>-0.99</td>
<td>-0.79</td>
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<td><strong>Implied ERPT to consumer prices</strong> (not controlling for world export prices)</td>
<td>-0.08</td>
<td>-0.16</td>
<td>-0.18</td>
<td>-0.13</td>
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<tr>
<td><strong>Implied ERPT to import prices</strong> (assuming 60% pass-through from world export prices to import prices)**</td>
<td>-0.69</td>
<td>-0.90</td>
<td>-0.63</td>
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<tr>
<td><strong>Implied ERPT to consumer prices</strong> (with additional assumption of 30% CPI import intensity)**</td>
<td>-0.09</td>
<td>-0.17</td>
<td>-0.08</td>
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</table>

* Average FEV contribution of each shock over first eight quarters.

** Based on the actual peak-to-trough or trough-to-peak changes in sterling ERI and corresponding changes in world export prices including oil.
Key Points

• Challenges predicting how exchange rate movements affect inflation
  – Some basic priors do not hold well
  – Pass-through can change sharply over time

• Our approach puts more emphasis on the underlying reason why the exchange rate moves
  – Not the full story—especially for differences across countries
  – More work needed (apprec./deprec, non-linearities, time shifts)
  – But important progress explaining changes in pass-through across time
    • Particularly helpful to understand recent UK puzzles

• Should improve our ability to forecast inflation and adjust monetary policy appropriately in the future
Extra
Historical shock decomposition of changes in UK import prices
Historical shock decomposition of CPI inflation
Historical shock decomposition of UK GDP growth
Historical shock decomposition of shadow Bank Rate (detrended)
Historical shock decomposition of world (ex-UK) export prices
## Pass-through to import prices by shock (detailed table)

<table>
<thead>
<tr>
<th>Period</th>
<th>Percentile</th>
<th>Supply</th>
<th>Demand</th>
<th>Monetary policy</th>
<th>Exchange rate</th>
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Pass-through to consumer prices by shock (detailed table)

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