

How to Solve the Price Puzzle?

A Meta-Analysis

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CNB Research Open Day, 21 May 2012

Outline

- 1 Motivation
- 2 Data
- 3 Heterogeneity
- 4 Best Practice

1 Motivation

2 Data

3 Heterogeneity

4 Best Practice

Definition of the Price Puzzle

- The central bank increases the interest rate:
 - Prices should fall.
 - × But a half of all empirical studies show otherwise.
 - Price puzzle—the short-run increase in prices after monetary tightening.
- Explanation 1: Caused by the cost channel (real increase in prices).
- Explanation 2: Caused by omitted variables (econometric misspecifications).

Definition of the Price Puzzle

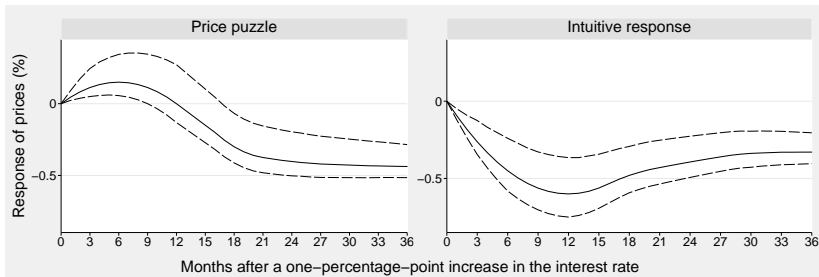
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Estimating the Effects of Monetary Policy

- Workhorse tool: vector autoregression (VAR).
- Results reported graphically → impulse response functions.



Meta-Analysis: More than a Literature Survey

Meta-Analysis

We collect available impulse responses and ask:

- 1 What is the average response of prices to monetary tightening?
- 2 Do results systematically depend on the methodology?
- 3 If so, what is the average response implied by best-practice methodology?

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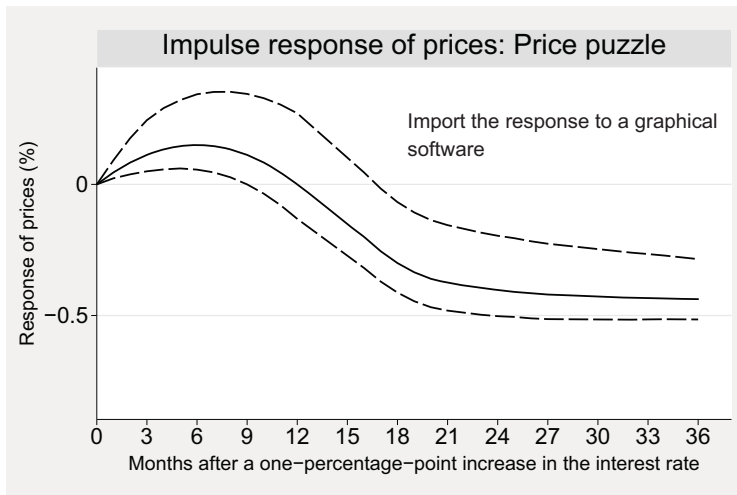
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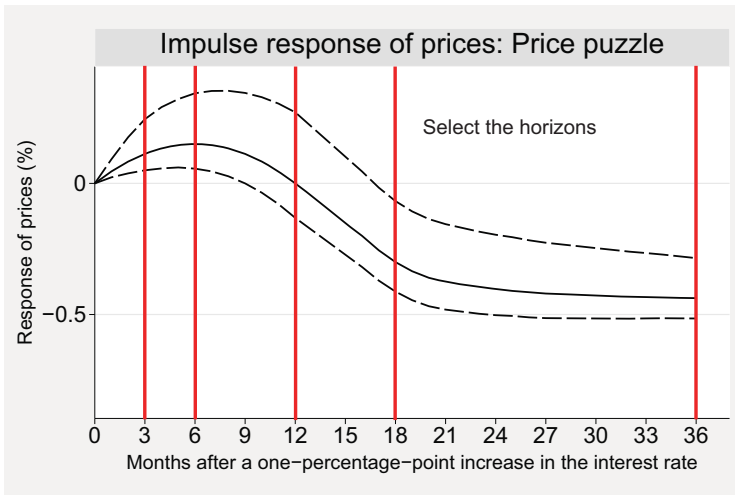
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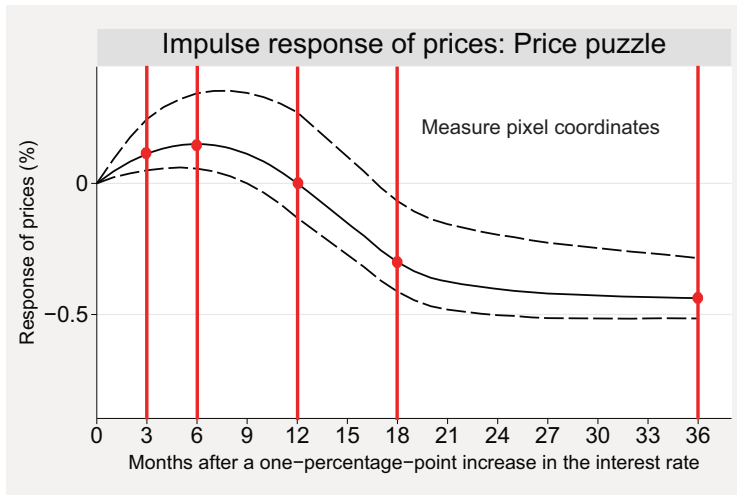
Coding of Impulse Responses



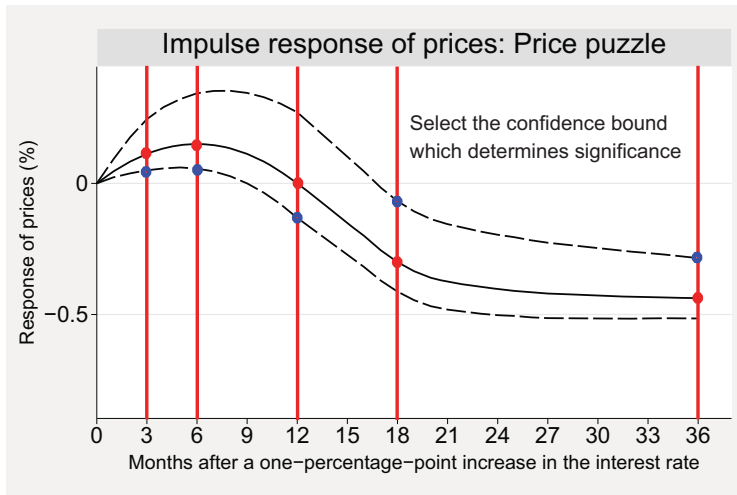
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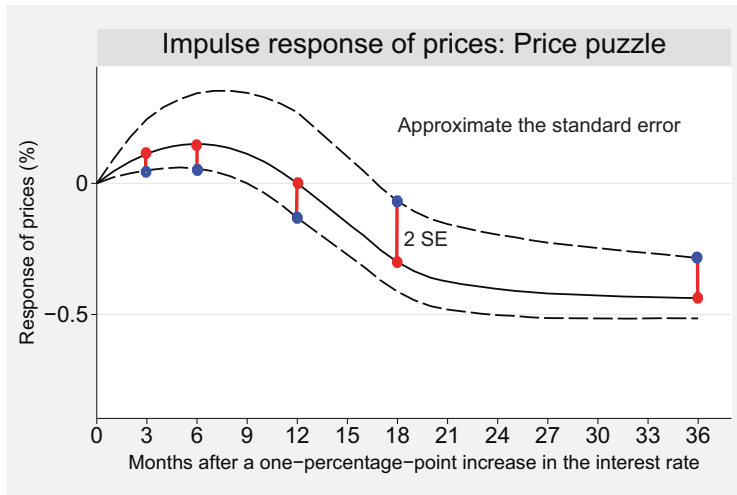
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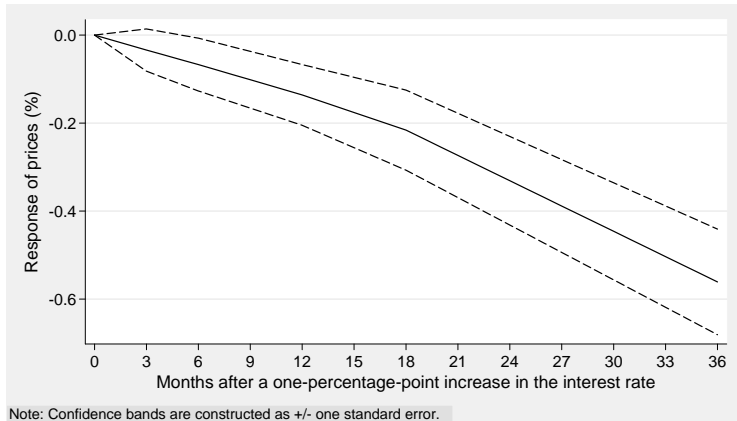
Coding of Impulse Responses



Data Properties

- We collected **published** papers using VARs to estimate the effects of a shock to the **interest rate** on the **price level**.
- 70 articles contained all necessary information.
- We use all impulse responses: more than 1,000 estimates collected.
- Evidence on 31 countries produced by 103 researchers.

Average Impulse Response: Slow Transmission



Outline

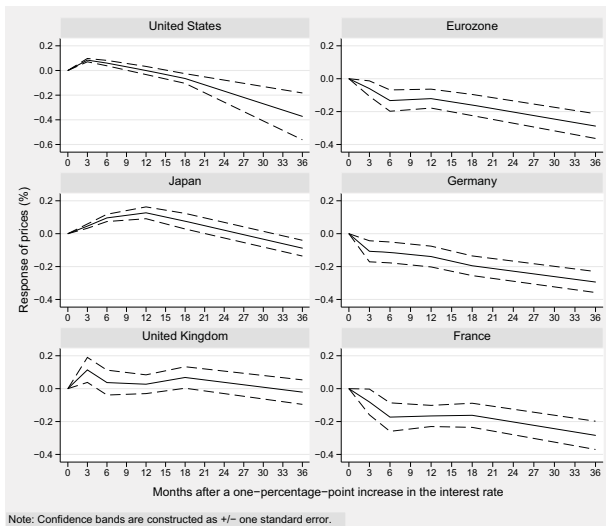
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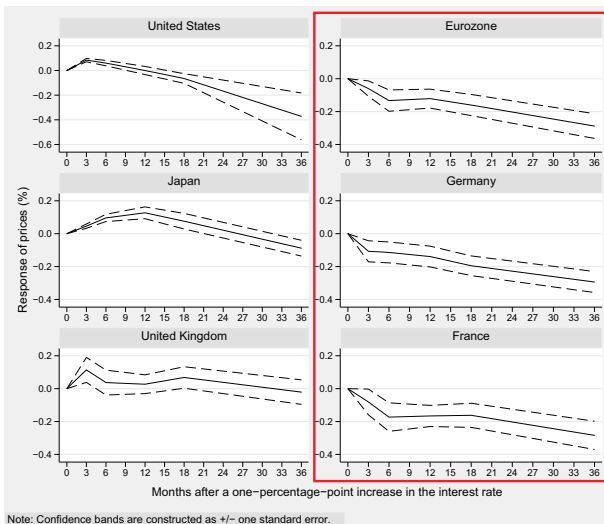
3 Heterogeneity

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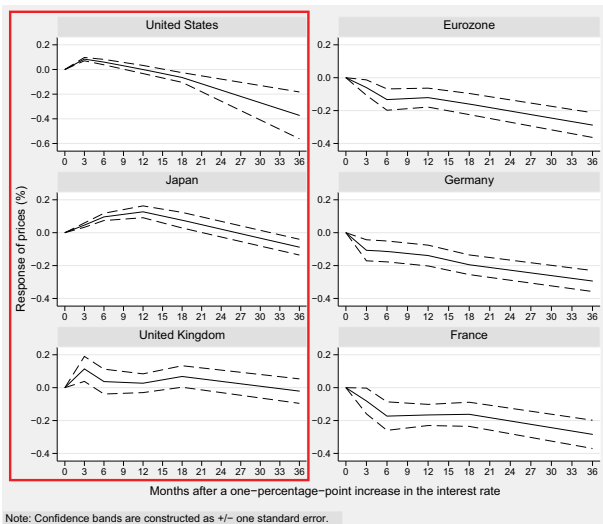
Monetary Transmission Differs Across Countries.



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Country Heterogeneity

Why cross-country differences? For example:

- 1 High average **inflation** → the effect of monetary policy on prices gets weaker (lower credibility).
- 2 High **openness** → the effect on prices gets stronger (exchange rate channel).
- 3 High central bank **independence** → the effect on prices gets stronger (higher credibility).

Method Heterogeneity

Some methods may cause the price puzzle.

Literature suggests:

- 1 Omitted **commodity prices** (no forward-looking element).
- 2 GDP used instead of **output gap** (no information about potential output).
- 3 Recursive identification used instead of a **structural VAR** (consistence with theory).

What Explains Different Responses?

Meta-regression analysis

- Regress the collected responses (\hat{e}_{ij}) on method and country characteristics (X_{kij}).
- Control for dependence within studies j (mixed-effects weighted least squares).
- Correct for publication bias.

$$\hat{e}_{ij} = \underbrace{e}_{\text{response}} + \underbrace{\sum_k \beta_k X_{kij}}_{\text{heterogeneity}} + \underbrace{\beta_0 SE_{ij}}_{\text{publication bias}} + \mu_{ij}.$$

It Depends on the Horizon.

Results: short vs. long run

- Method heterogeneity → short-run response.
 - Misspecifications contribute to the price puzzle.
- Country heterogeneity → long-run response.
 - Signs for country-level variables are consistent with the above-mentioned intuition.

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Definition of Best Practice

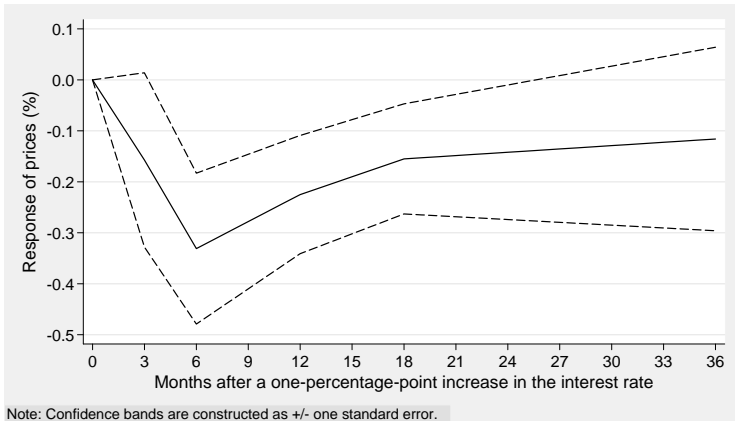
From the meta-regression:

- Misspecifications systematically influence the results.
- The number of observations and age of data are important.

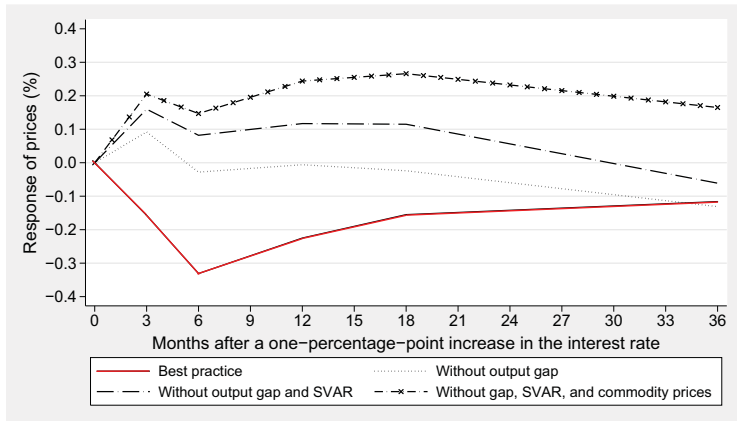
→ Let's use this information to improve our estimate of average impulse response.

- Plug in sample maximums for the number of observations, new data, . . . , control for all well-known misspecifications.

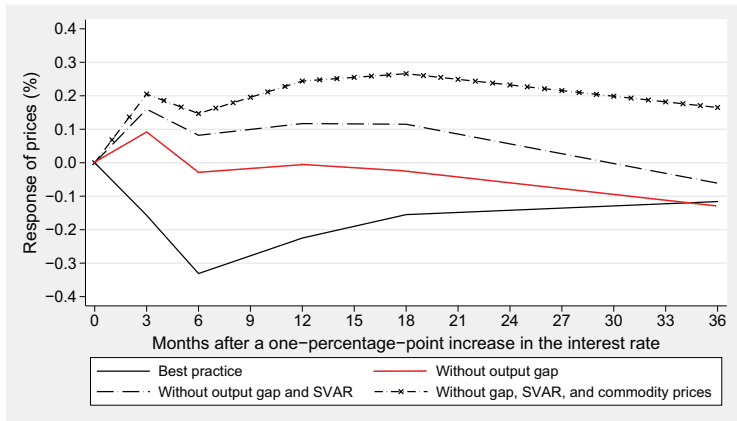
Best-Practice Impulse Response: Fast Transmission



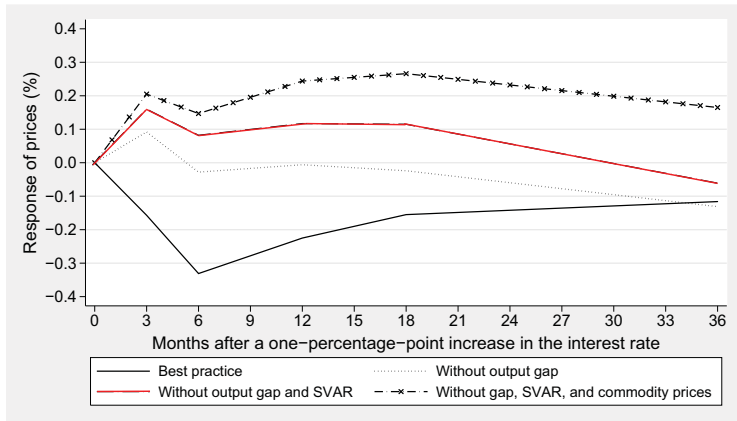
Misspecifications Cause the Price Puzzle.



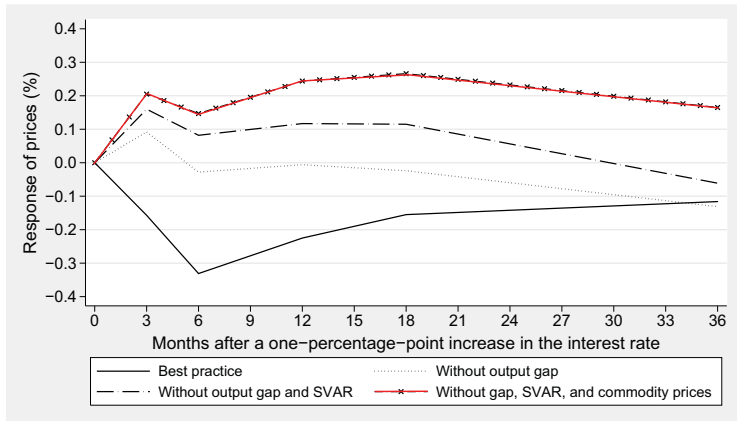
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Conclusion

Main Findings

- 1 The reported price puzzle is due to misspecifications.
- 2 The long-run response of prices is driven by country-specific characteristics.
- 3 On average, the transmission of monetary policy shocks seems to be fast.

Project Website

www.meta-analysis.cz/price_puzzle

Interested in Meta-Analysis?

-  Stanley, T. D. & C. Doucouliagos (2012): *Meta-Regression Analysis in Economics and Business*.
Routledge, 1st. edition.
-  Havranek, T. & Z. Irsova (2011): Estimating Vertical Spillovers from FDI: Why Results Vary and What the True Effect Is.
Journal of International Economics **85(2)**: pp. 234–44.
-  Card, D., J. Kluge, & A. Weber (2010): Active Labour Market Policy Evaluations: A Meta-Analysis.
The Economic Journal **120(548)**: pp. F452–F477.

Reading list on RePEc: ideas.repec.org/k/metaana.html