Aggregation and the PPP Puzzle in a sticky price model

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Aggregation: an important research agenda

Microeconomic data

Heterogeneity in dynamics

Macroeconomic data
Slow speed of adjustment (persistence)

Cross-Sectoral Dynamic Aggregation Bias in aggregate econometric estimates

Application to PPP: Heterogeneity is key

Slow adjusting sectors
Fast adjusting sectors

Aggregate persistence
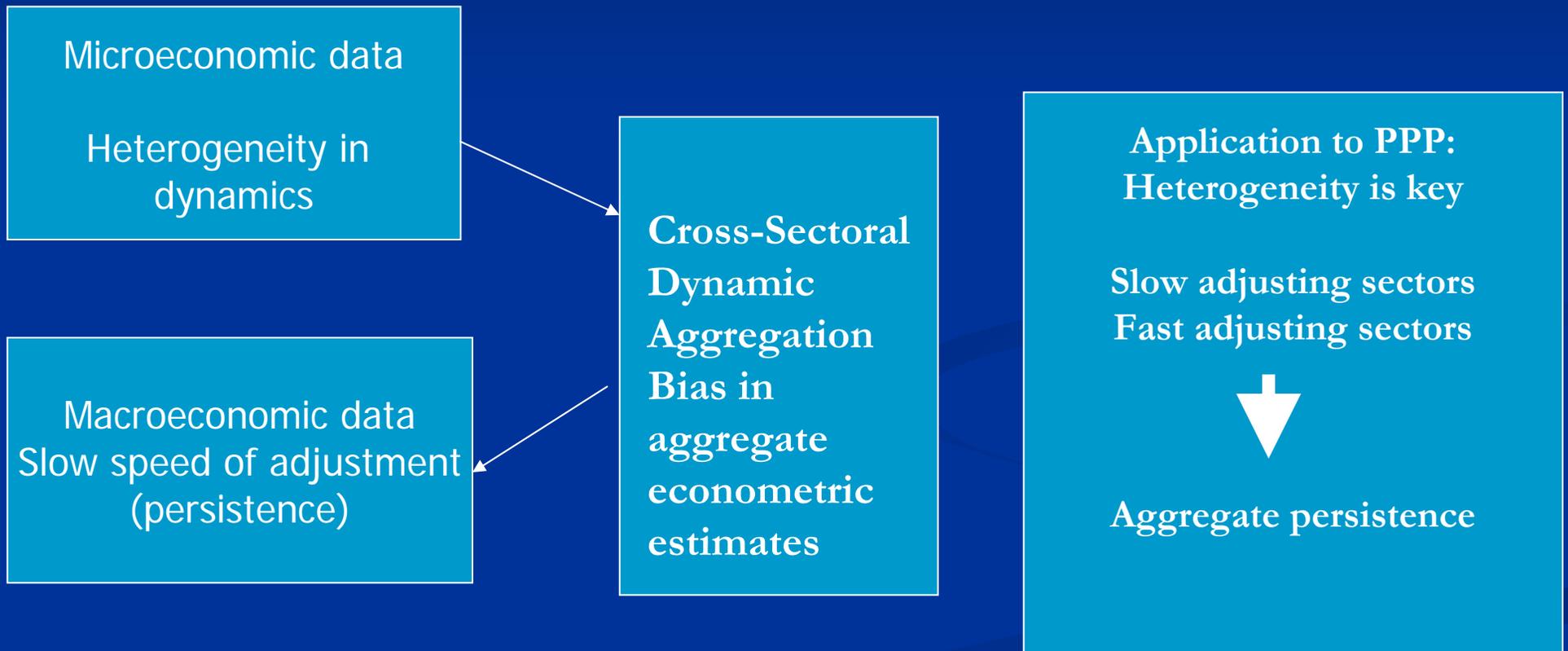
One sector models and aggregate data

- Trying to replicate aggregate persistence data using one-sector models is misguided.

- Aggregate data are persistent because they reflect the aggregation of heterogeneous dynamics

- If one builds one-sector models, one should expect to reproduce an "average one-sector economy", not observed macro aggregates.

The empirical side of the coin "PPP strikes back"

- Persistence estimates based on aggregate data give "Rogoff-type" half-lives.

- Persistence estimates purged of heterogeneous dynamics give much shorter half-lives (MG estimators allowing for correlated components in error term (MG-CCE)). Compatible with calibration of a one-sector economy with realistic impediments to price adjustment.

- Hence in that (limited) sense the PPP Puzzle is solved.

The theoretical side of the coin

- "Are models with non-trivial sectoral heterogeneity capable of mimicking aggregate data? Should such models prove unsuccessful at generating persistent real exchange rates, there would indeed still be a PPP Puzzle". [PPP Strikes Back]

- In other words: Is it possible to build a DSGE model with sectoral heterogeneity that can reproduce aggregate persistence data while being calibrated on microeconomic data?

- This is the challenge taken up in the Carvalho-Nechio paper.

Theoretical Setting

- Multi sector economy with heterogeneous price setting.

- One sector "average" economy where frequency of price changes is the average of the frequencies.

- One shock: nominal aggregate demand follows AR(1). Uncorrelated across countries.

- Robustness checks. Interest rate rule. "Productivity" shock.

Remarks on the model

- Important parameter is the degree of strategic complementarity or substitutability in price setting

- Symmetry assumed in price setting distribution. Could use euro area frequency distribution instead.

- Could use other pricing assumptions (different frequency for domestic and foreign adjustments)

- Introducing capital

Results of the calibrated model

- Calibrated versions of multi-sector economy able to generate persistence of aggregate series (baseline calibration HL=45 months)

- Calibrated version of "average one sector" economy able to generate persistence of MG estimator with CCE (baseline calibration HL=14 months)

- Very nice!

Other dimensions

- Model does very well on the persistence dimension

- Not so well on the volatility dimension. But baseline model has only one shock. So promising.

- Should report other straightforward measures: correlation and volatility of real GDPs, consumptions.

- Properties of net exports

- Would be very interesting to report, in an extended model with capital, the covariance of real exchange rate and equity return differentials (home bias implications)

Robustness

- It would be desirable to:

- examine robustness when shocks are correlated across countries

- use sector-specific productivity shocks

- compare lag structure of the model versus lag structure implied by the data: when dynamics non-linear, some non-linearity picked up by higher order AR(p)

Semantic debate around PPP strikes back

- "Aggregation of heterogeneous dynamics processes effect" [which they call "total heterogeneity effect"] becomes an "aggregation effect" and "a misspecification effect".

- Persistence P(multi-sector model)

  $\downarrow$

- weighted sum P(sectors of the economy)

  $\downarrow$

- P(one-sector "average" economy). They call this the "mis-specified economy".

Decomposition I

- From an estimation point of view: issue is that the weighted sum P(sectors of the economy) does not allow for common shocks in sectoral real exchange rates.

- Ideally should implement a SURE estimator on the panel of sectoral exchange rates. Dimensionality of the data makes this impossible (alternative is to allow for a common component in the error term)

Decomposition II

- So paper's "weighted sum of sectors economy" is a bit of a fictitious step:

- For an estimation point of view, it is misspecified since it does not allow for common shocks across sectors (which are important).

- This implies that all the "aggregation effect" results of the paper come from regressions which are rejected by the data.

- From a modelling point of view: artificial concept since one wants to compare a multi-sector model to a one-sector "average" economy.

Bottom line

- Carvalho-Nechio results are fully compatible with 'PPP Strikes Back' results

- There is a semantic issue that should not be allowed to confuse the underlying economic issue

Conclusions

- Paper makes a very significant contribution to the aggregation literature (micro/macro divide): shows that one can build a multi-sector model that replicates persistence of real exchange rate

- Important to show that the model matches other stylized facts

- Exposition could be clarified

- The closest we have ever been to PPP definitely striking back.