

The dynamics of international trade invoicing

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Discussion

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Contribution of paper

- Develops a very elegant model of international trade currency invoicing
 - Intuitive results
- Extends model to bargaining environment between exporters and domestic purchasers
- Tests model on a very large and unique data set on invoicing of Canadian imports
 - Substantial support for basic implications of model
- Great blend of theory and empirical application

My comments

- Where does paper fit in the literature?
- Comments on the basic model (without bargaining)
- Alternative interpretations of model
- How to model invoicing `dynamics`
- Possible extensions of model
- Comments on bargaining model
- Comments on empirics

Literature

- Grassman (JIE 1973) `Law`?
- Giovannini (JIE 1988) invoicing, pass-through
- Friberg (JIE 1998) pass-through
- Bachetta, van Wincoop (JIE 2005) Currency choice
- Devereux Engel Stoorgaard (JIE 2003) LCP, PCP
- Goldberg Tille (JIE 2008) VCP
- Friberg Wilander (JIE 2008) Questionnaire
- Engel (JEEA 2005) Duality
- Gopinath et al. (AER, forthc.) dynamic pricing/invoicing

Look at the model

- Choice of price, invoicing currency

$$P_d(i) S_1^{\beta_{1d}} S_2^{\beta_{2d}} \left(\frac{P_d(i) S_1^{\beta_{1d}} S_2^{\beta_{2d}}}{S_1 P_d} \right)^{-\lambda} C_d - W \left(\frac{P_d(i) S_1^{\beta_{1d}} S_2^{\beta_{2d}}}{S_1 P_d} \right)^{-\frac{\lambda}{\alpha}} C_d^{\frac{1}{\alpha}}$$

- Firm chooses price, and invoicing in two currencies
- Conditional on preset price, choose invoicing
(continuous)

$$\beta_1 = 0 \quad \beta_2 = 0 \quad \text{PCP}$$

$$\beta_1 = 1 \quad \beta_2 = 0 \quad \text{LCP}$$

$$\beta_1 = 0 \quad \beta_2 = 1 \quad \text{VCP}$$

Solution

- Basic trade-off

$$\beta_{1d}^d = \Omega \eta_d^d + (1 - \Omega) M_{1d}^d$$

$$\beta_{1d}^2 = \Omega \eta_d^2 + (1 - \Omega) M_{1d}^2$$



'Coalescing'



'Hedging'

Invoicing decisions are interdependent

- e. g. say that hedging motive is zero

$$\beta_{1d}^d = \frac{\Omega(1 - \omega_{1d} - \omega_{2d})}{1 - \Omega(\omega_{1d} + \omega_{2d})} \quad \text{LCP}$$

$$\beta_{1d}^2 = \frac{\omega_{2d}\Omega(1 - \Omega)}{1 - \Omega(\omega_{1d} + \omega_{2d})} \quad \text{VCP}$$

$$\beta_{1d}^1 = 1 - \beta_{1d}^d - \beta_{1d}^2 \quad \text{PCP}$$

Invoicing proportional to market share

- Total invoicing in local currency;

$$\eta_d^d = \frac{(1 - \omega_{1d} - \omega_{2d})}{1 - \Omega(\omega_{1d} + \omega_{2d})}$$

- ‘Multiplier effect’ – domestic LCP is greater than share of domestic sector because of coalescing

No network externalities though

- There is unique equilibrium
 - Cannot get use of currency simply because others use it
- But assumption here is that firms will choose an intermediate value of indexing
- This seems inconsistent with data
 - In data, seem to observe only one currency used in invoicing

When choice is discrete

- Fictitious choice of β to determine firms discrete decision (Engel 2005)

$$\beta_{1d}^d = \beta_{2d}^d = \Omega \eta_d^d = \Omega > 0.5 \quad \text{LCP} \Rightarrow \hat{\beta}_{1d}^d = \hat{\beta}_{2d}^d = 1$$

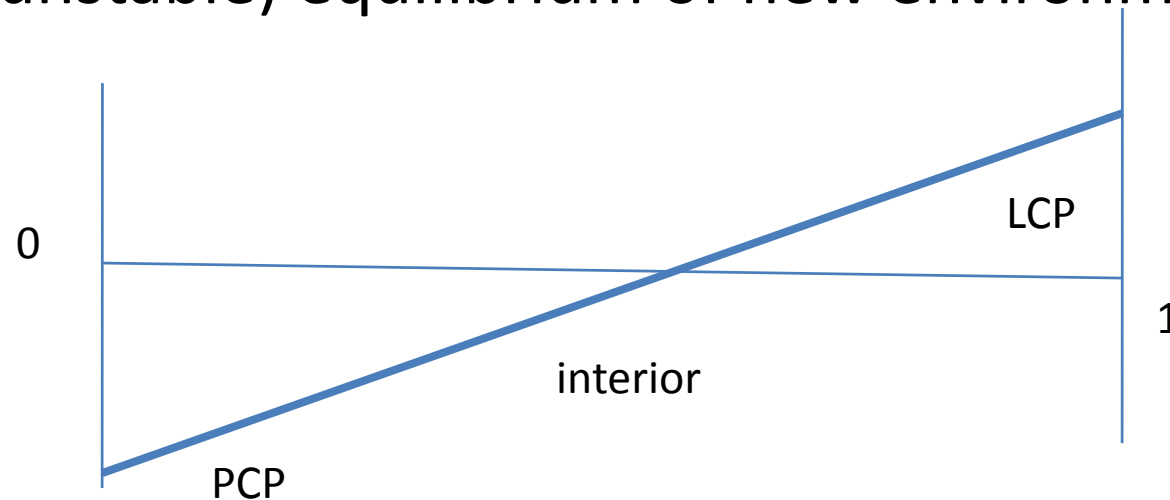
$$\beta_{1d}^d = \beta_{2d}^d = \Omega \eta_d^d = \Omega(1 - \omega_{1d} - \omega_{2d}) < 0.5$$

$$\text{PCP} \Rightarrow \hat{\beta}_{1d}^d = \hat{\beta}_{2d}^d = 0$$

- May be an equilibrium with LCP (stable price level is self-confirming)
- Also an equilibrium with PCP (or VCP) (need to offset shocks from variable price level)

When choice is discrete

- In this case, previous equilibrium is a mixed strategy (unstable) equilibrium of new environment



- Fact that partial invoicing not observed then may affect approach to testing

How to model invoicing dynamics?

- Model itself is static (both market and bargaining model)
- Prices are pre-set for just one period
- To model dynamics, might want to allow for gradual price adjustment (Calvo, Rotemberg)
- But even in this case, up to 1st order approximation, invoicing is constant
 - e.g. Gopinath et al. 2008

How to model invoicing dynamics?

- In the true (non-approximated) model, invoicing is governed by a decision rule like

$$\beta_{t+1} = G(\beta_t, P_t, A_t, \theta_t)$$

- This can be approximated by

$$\beta_{t+1} \approx G(\bar{\beta}, \bar{P}, \bar{A}, \bar{\theta}) + G_1(\bar{\beta}, \bar{P}, \bar{A}, \bar{\theta})(\beta_t - \bar{\beta}) + \dots$$

- Current solution determines the zero order component of invoicing, i.e.

$$G(\bar{\beta}, \bar{P}, \bar{A}, \bar{\theta})$$

using 2nd order approximation of optimal invoicing FOC (acts as a constant coefficient in 1st order approximation)

How to model invoicing dynamics?

- But in order to capture invoicing dynamics, i.e. the term

$$G_1(\bar{\beta}, \bar{P}, \bar{A}, \bar{\theta})$$

we would need 3rd order approximation of invoicing FOC,
and 2nd order approximation of the model

- Principle is the same as in portfolio selection (Devereux and Sutherland 2008, Tille Van Wincoop 2008)
- Could solve the model in this way, and describe the dynamics of invoicing
- Should invoicing be more variable than in data?
 - Almost surely, yes – why? Same principle same as portfolio choice – need lots of adjustment to respond to changing conditional covariances.

How important can dynamics be?

- Currency invoicing can be very important for macro outcomes (business cycles and welfare – e.g. Devereux, Engel, Tille 2002)
- But, up to 1st order approximation, invoicing is constant.
- Changes in invoicing affect outcomes only to 2nd order
- Thus, probably not important for business cycle dynamics (but maybe for welfare)

Dynamics again

- But, even if you are ignoring higher order dynamics of invoicing: dynamic environment still of key importance
- Engel (2005), Gopinath, Itskoki, Rigobon (2008)
 - Close relationship between pricing and invoicing
- In GIR, invoicing determines immediate response, of LCP, pricing the delayed response
- Invoicing will be determined by differences in medium term price dynamics
- Here we have only 1 period pricing model – dynamics of pricing not incorporated

Pricing again

- Bargaining model
 - Some questions about the setup – status quo is sell to household B, bargain with household A
 - Conditions under which more LCP in bargaining
- Viane and De Vries (OER, 1992) Bargaining model of invoicing
- Key assumption – no bargaining over price
 - How would this affect the outcome?
- Role of bargaining is to explain how size of order can affect LCP?
 - Alternative – have a very low elasticity demand good

Pricing again

- Low elasticity demand good

$$C_d \left(P_d(i) S_1^\beta \left(\frac{P_d(i) S_1^\beta}{S_1 P_d} \right)^{-\lambda} - W \left(\frac{P_d(i) S_1^\beta}{S_1 P_d} \right)^{-\lambda} \right)$$

- Profits concave in exchange rate under PCP – ceteris paribus want LCP
- Need some way to determine price – mixed strategy?

Empirics: Amazing data base

- How to test the model?
 - Testing cross section implications in panel data
- For a full test, would need the time series (higher order) predictions for invoicing
- Very little time series movements in invoicing in data
- Probably inconsistent with the model?

Alternative perspective

- Need sample which displays big structural change in market shares, or stochastic environment
 - Invoicing in post euro EU?
 - Pre and post NAFTA?

Empirics

- Don't use prices, as in GIR
 - Drawback, since can't look at GIR selection effect
 - Can look at invoicing but not pass-through
- Key interesting result – use of LCP for large value transactions
 - Explanation here is due to bargaining (but may be other explanations)
 - Might it be due to government procurement?
- Testing model of discrete choice for invoicing

My own empirical work

- Ask your UAL business class neighbour
 - What currency does your supplier invoice in?
- Answer 1.
 - Where are the lawyers situated?
- Answer 2.
 - Which have better banks?
 - Financial system depth should be key – not really in the literature
 - See Lighthart and Da Silva 2007

Conclusions

- Really innovative paper
- Could extend by making model dynamic
- Might want to look at higher order implications of invoicing
- Surprising feature is lack of dynamics in invoicing
 - Perhaps more inertia in invoicing than model suggests?
- Interesting to focus on alternative samples with more structural change