Comment on J. Kilponen and T. Santavirta: When do R&D subsidies boost innovation? Revisiting the inverted-U shape

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Background

- Schumpeter (1934,1942): competition should decrease firms' innovating activities by pinning down their profits
- Aghion et al. (2001, 2005): the impact of competition on innovation is also driven by an "escape from competition" effect: more competition fosters innovation by reducing more firms' pre-innovation rents than post-innovation rents, thus inciting firms' innovation
- Aghion et al. (2001, 2005) derive an inverted-U relationship between competition and innovation: the escape from competition effect dominates first, but the Schumpeterian effect is stronger at high levels of competition
- The existence of that inverted-U shape is confirmed by different empirical papers, focusing on different countries

Kilponen and Santavirta (2007)

- Introduce R&D subsidies into the Aghion et al. (2001, 2005) model
- R&D subsidies increase innovation at all degree of competition (since they reduce the cost of innovation)
- At high degrees of competition, this positive effect is smaller because of a strategic substitutability effect becoming stronger: any factor that increase the innovation of the neck-and-neck firm decrease the innovation of the follower
- The slope of the inverted U curve is unchanged at low levels of competition, but larger in absolute value when competition is hard
- Follow the empirical methodology of Aghion et al. (2005) to test this prediction
- Provide mixed empirical evidence about both existence of the inverted-U relationship and the effect of R&D subsidies at different levels of competition

General Comments

- Very interesting paper, clear, which contains simple and important policy implications
- Both the theoretical and the empirical methodology come from Aghion et al. (2001, 2005)
- Need however, to my point of view, to be more convinced by the empirical results

Comments: Theory

- R&D subsidies decreases the cost of innovation
- Intuitively : the more costly innovation is, the lower the response of innovation to changes in competition
- By decreasing the cost of innovation, R&D subsidies should increase the slope of the inverted-U curve whatever the degree of competition
- Different finding here: the slope is only magnified at higher degrees of competition.
- Askenazy et al. (2007) : within the same framework, find that making innovation more costly decreases the sensitiveness of innovation to changes in competition
- Results have to be compared to the above intuition

Comments: Empirics (1)

- Estimate using a Poisson estimator the following specification:

$$E(p_{ijt}|c_{j,t-1}, \rho_{ij,t-1}, x_{ij,t-1}) = exp(\alpha + \beta_1 c_{jt} + \beta_2 (c_{j,t-1})^2 + \beta_3 \rho_{ij,t-1}$$
$$+ \beta_4 \rho_{ij,t-1} c_{j,t-1} + \beta_5 (c_{j,t-1})^2 \rho_{ij,t-1} + x_{ij,t-1}\gamma + \tau_t + \eta_j)$$

- Where c is the level of competition (inverse of lerner index), ρ is the level of R&D subsidies (relative to expenditures)

- Expect $\beta_1 > 0, \beta_2 < 0, \beta_3 > 0, \beta_4 \simeq 0, \beta_5 < 0$

Comments: Empirics (2)

- R&D subsidies variable: problem of selection, since subsidies are certainly given to firms for which successful innovations are expected...
- May bias the estimation of $\beta_3, \beta_4, \beta_5$. Gonzalez et al., Rand JE 2005 propose a methodology to correct this bias
- Problem of interpretation of interacted effect in non-linear models (Ai and Norton (2003)) - Here the interacted term between competition (instrumented or not) and R&D subsidies
- According to Ai and Norton (2003), both the sign, the magnitude and the standard errors may be wrong: at least to check the results, need to compute the true interacted effect following their methodology

Comments: Empirics (3)

- Table 1 : find no inverted-U curve at all, with or without instrumentation! All coefficients but the patent stock are insignificant. But the comment says the reverse!
- Why different number of observations in column 1 and 2?
- May run the estimations of table 1 on the same sample than table 2 (moreover better results in table 2, column 1 for the inverted U curve)
- What is the share of 0 values for the dependent variable (more than 50% since the median is 0)? If really high, perhaps useful to check the results with a Tobit or an Heckman selection model.

Comments: Empirics (4)

- Table 2 : nothing significant on the interaction term, cannot conclude about that point
- Try with more lags? As the dependent variable is the number of patents, perhaps it takes a longer time for competition to translate into real innovation...
- Would be useful to see the exact significance, or at least to see more clearly what is significant at the 1, 5 and 10% levels
- Possible to plot graphs with the results obtained (as in Aghion et al. 2005)? If so, would be interesting to plot different graphs for different samples, according the importance of R&D subsidies (quartiles) (At least possible to do the corresponding estimations)
- Industry dummies? Different measure of competition, i.e. firm or industry level lerner index?

Minor comments

- Literature: focus only on competition and innovation
- Very little about the impact of R&D subsidies on innovation, both theoretically and empirically
- The impact of R&D subsidies on innovation - and therefore the optimal R&D subsidy - may depend on the degree of competition, but also may differ according to the nature of competition (international or domestic) (Impullitti 2007)
- More insertion in existing literature is needed
- More descriptive statistics needed (quartiles, especially for patents)
- Bibliography : Aghion et al. (2005)? Howitt in Aghion et al. (2001)?