<u>Report on the PhD thesis in economics of Olena Senyuta, entitled "Essays in Industrial</u>

<u>Organization" to be submitted to Charles University, Prague. Advisor: Kresimir Zigic.</u>

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The PhD thesis of Olena Senyuta consists of three chapters that will be dealt with in order.

Chapter 1, co-authored with Kresimir Zigic, is entitled "Managing Spillovers: an Endogenous Sunk Cost Approach". It has appeared as joint paper #472 in the Working Paper Series of CERGE-EI.

The chapter builds on work of John Sutton (1991, 2001) who presents an "Endogenous Sunk Cost model" to provide answers to regulatory questions such as: "What are the important determinants for the level of concentration of a particular industry?". Here the classical models of Bertrand and Cournot competition produce only very stark results. Whereas Sutton (1991) focuses on investments in advertising (and perceived quality) to cause such sunk costs, Sutton (2001) extends the focus to learning by doing and network effects (and thus objective quality). Here spillover externalities can change the predictions of the original model as investigated in my own paper, Behringer (2014).

A similar idea motivates the present chapter. The model allows for a direct (R&D) investment in quality that may, via spillovers, also benefit the quality of other firms, e.g by reverse-engineering. A difference to my paper is that there the quality parameter is determined indirectly by the choice of output (learning by doing) whereas here it is determined directly at some given linear cost.

Two model variants are presented that investigate the cases where (the prevention of) spillovers are exogenous and then endogenous choices for the firms. If firms can (partly) protect themselves from such spillovers (e.g. by secrecy, patents, or copyrights) the remaining spillovers are termed "ex-post spillovers".

In the first variant, too large a degree of exogenous spillovers can lead to the non-existence of a lower-bound to market concentration, i.e. as an industry gets large, it may become incrementally fragmented. Here I think that the common motivation with Behringer (2014) deserves to be specified a little more carefully than is done on p.7.

In the second variant firms may protect from such spillovers. In this extension the firms face an additional stage following the quality choice stage where they may decrease all spillovers discretely to zero (hence spillovers cannot be continuously reduced) again at some given linear cost. The possibility of protection may then re-establish the existence of a lower bound to concentration in line with the original endogenous sunk cost model that does not allow for spillovers.

Due to this timing of the model in section 1.4, the "all-protection equilibrium" quality is a function of the cost of protection alpha but no longer of the spillover parameter theta that is reduced to zero and the "no-protection equilibrium" quality is a function of the theta only. This translates into deviation conditions at the protection stage that are plotted for a parametric example in Figure 1.4. for two choices of alpha.

This plot reveals parameter regions for protection and non-protection equilibria. I am aware that the underlying calculations involver an implicit form of N(delta) from the zero-profit conditions (1.8 and 1.11) but it would be interesting to see this in a 3d plot for continuous alpha and check whether any interesting comparative statics can be detected.

Also for the regions where one has a co-existence (or non-existence) of the two regimes it would be interesting to take into account the neglected integer constraint on N and see if these regions are meaningful.

The symmetry assumptions made in this optimal deviation setting as well as the inability to continuously reduce spillovers (leading to discontinuous jumps in other key endogenous variable of the model) are quite stark when looked at for applied purposes. Also the strict stage-game logic of this now 4-stage game and its implied timing are demanding in this respect. Some more discussion in the text of how such a setting may be alternatively investigated in a dynamic context (there is some in the footnotes) would be good.

It would also be helpful for the reader if this chapter was more rigid w.r.t. the standard proposition-proof structure of academic articles. It is often hard to see where propositions/lemmata are formally established (this should be done in addition to, but separate from the intuitive discussion in the text that could then contain less formalism) and, on the other hand, where the proofs in the Appendix relate to in the text. This should be easily feasible.

Also I would suggest numbering and emphasizing the empirical hypotheses that appear at various points in the text of Chapter 1 more clearly, in particular where they emanate from the model. This would clarify also the way they are tackled in the following chapter.

Chapter 2 is entitled "Endogenous Sunk Costs, Spillovers and R&D incentives: An Empirical Analysis" and aims to bring hypotheses of the previous model to cross-sectional data from the Mannheim Innovation Panel dataset.

The chapter provides some tests of basic elements of the endogenous sunk cost theory in the presence of spillovers, in particular that these should affect the escalation of R&D expenditures as markets get larger. The exercise is thus not to be seen as a test of Sutton's overall theory of concentration levels in the presence of spillovers. The hypothesis is rather that spillovers have a dis-incentivizing effect on individual firms R&D decision.

The most important challenge of empirical studies of this kind is probably to find good proxies for knowledge spillovers as these may be, to a large extent, endogenous. Previous empirical papers remain inconclusive about the relationship between R&D and knowledge spillovers. As argued by Cohen and Walsch (2000) this should not be surprising however, given that such spillovers may be both complements as well as substitutes for own R&D.

The first testable hypothesis is then given on p.49 based on the equations underlying Proposition 1. It is thus based on free entry (zero profit) and discrete stages of the underlying game where firms take spillovers as exogenous. The presence of such spillovers may then lower the lower bound to concentration or even dispose with it.

As an empirical consequences (Testable hypothesis 1) it is argued that when spillovers are large an increase in market size leads to an increase in the number of firms and to market fragmentation.

It should be emphasized that this hypothesis is different from Sutton's original empirical strategy where these relations are couched in terms of bounds. Because the simple underlying stage game neglects many real world features, in larger market a larger set of concentration indices is argued to be possible in equilibrium. Immediate empirical predictions of the model only result in the counterfactual cases, i.e. what configurations *cannot* constitute equilibria. Thus neither a fall of concentration in particular markets for type I nor for type II markets would be predicted. The differences of the current approach to the original bounds paradigm should be made more explicit. Only late on p.60 some issues are addressed.

Table 2.1 presents results that are consistent with the predictions about the concentration ratios for exogenous (type I, with low R&D intensity) and endogenous (type II) sunk costs markets (with a funny outlier at the 17% level).

Aside: p.61 I would write "This fact seems to contradict…" as a possible solution (low S) for this finding is given just on the following page.

Table 2.6 (may be moved into the main text) gives regression results allowing for a differentiation of low and high spillovers for each market type. It finds market size to be significant for fragmentation only in the type I markets but insignificant for type II markets which again is consistent with Testable hypothesis 1.

Again it should be made clearer how this approach differs from the more modest bounds paradigm. It would also be interesting to construct scatter diagrams as in Sutton (1991, p.118) for the different spillover sets if the descriptive data allows for this.

As Testable hypothesis 2 (a corollary of 1) it is argued that from the optimality condition for investment in quality (equation (1.7)) one should expect that expenditures in R&D and advertising should decline in (ex-post) spillovers and increase in market size.

As argued in Behringer (2014) one may expect a qualitative difference and the possibility to prevent spillovers when looking at R&D versus advertising however. Also significant identification problems remain in this context (see the discussion on p.50, e.g. of Acemoglu & Linn (2004)).

The source of Testable hypothesis 3 in the model is not explicit but seems straightforward. If there is a need for protective measures, i.e. the industry is such that there is potential for large (ex-ante) spillovers then one should see investment in protective measures.

Aside: Regarding the critical choice for measures of the counterfactual ex-ante and ex-post spillovers, p.54 claims that within the data there are "lots of variables that can be used as some measures of knowledge spillovers" but I do not understand those given as info(x) in Table 2.12. Sources …"important" for what? Also this chapter is weakest in terms of readability and could be improved substantially by some native proofreading.

Chapter 3 is entitled "Delegation and Performance".

After reading the chapter I found the title a little misleading. The chapter consists of an empirical investigation of banking industry. As noted in the introduction, despite being couched within the literature on delegation and authority its focus is rather tangential.

The aim of the investigation is to study "how the level of authority delegation affects organizational performance" and it demonstrates that "more authority delegated to the local branch might increase the importance of relationship banking". (p.87). The use of the word "might" may be surprising, but this careful formulation turns out to be necessary.

After a review of the empirical studies of decision making in the banking industry it is found (p.91) that: "it would be interesting to measure whether different levels of delegation would result in differences in performance".

I fully agree but would find the closely related question for bank loans even more interesting: "(how) do different mixes of soft- and hard-information used in loan decisions affect the performance of such loans?" Inasmuch as a more decentralized organization structure directly implies that more soft information is used in loan decisions the two questions are clearly isomorphic.

The dataset is novel and looks promising. The data on "the level of lending authority delegated to regional branches" turns out to be captured in a "Limits" variable, i.e. the highest loan size for which the branch can make an independent decision. This is indeed a measure of "delegation" even if quite specific to the banking loan industry.

The major problem with this interesting variable from the side of the econometrician is that it is endogenous. Hence good instruments have to be found. The author chooses "distance" (the distance of a regional branch from its headquarter) and "duration" (the number of month that a bank was present in the region) as instruments in order to use an IV regression to correct for the endogeneity. Data on loan performance, both quantitative and qualitative is available.

The empirical results cast some doubt on whether the instruments (particularly "distance") are able to overcome the identification problems. The IV estimations often produce insignificant coefficients and so the conclusions have to remain very modest in particular with the effect of "Limits" on the qualitative performance of loans.

This is unfortunate as it clearly precludes a simple answer about the (optimal) soft-hard information mix (or the role of relationship banking) for loan performance too but maybe the former allows for alternative instruments.

The thesis meets the necessary standards for a PhD in economics at Charles University and hence I recommend the dissertation for defence as my comments have been adequately considered.

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