Compatibility, Intellectual Property, Innovation and Efficiency in Durable Goods Markets with Network Effects

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Motivation

- Should dominant firms supply interoperability information to smaller rivals in software markets?
- No consensus.
EU mandates the supply of interoperability information: one example is Microsoft with respect to the supply of interoperability regarding its Office file format (OOXML).

Article 102 of the EC Treaty: Non supply of interoperability is considered as potential abuse of a dominant position.
US Department of Justice: "Antitrust Liability for mere unilateral, unconditional refusal to license will not play a meaningful part in the interface between patent rights and antitrust protection".
Research questions

Part of a broader project regarding Innovation, Compatibility and Social Efficiency in Software (Durable, Network Goods) Markets. Specifically, here we focus on deterministic innovation:

1. Under what conditions do dominant firms selling durable, network goods refuse to supply interoperability information to smaller rivals who have valuable ideas for future improvements?

2. What is the role of forward looking consumers in firms’ choices?

3. Even if incompatibility prevails in the market, does this necessarily mean that it is socially undesirable? If not, which is the market that leads to social efficiency?
What do we know?

- In simultaneous two-stage games, the dominant firm chooses not to supply interoperability information to smaller rivals (Katz and Shapiro (1985), Cremer, Rey and Tirole (2000), Malueg and Schwartz (2006)), Chen, Doraszelski and Harrington (2009).

- Viecens (2009) differentiates between compatibility in platform and applications. She finds that the dominant firm will never offer compatibility in applications but will offer platform compatibility.

- Sequential innovation: (e.g Scothmer (1996)) The literature focuses mostly on the length and breadth of patent protection as well as the division of future profit through licensing.

- Social Welfare: Compatibility enhances social welfare (e.g Economides (2006)). In a static environment, Viecens (2009) concludes that compatibility in the applications may be harmful for users and social welfare, particularly when asymmetries are strong. Moreover, inter-network compatibility should not be supported by consumers.
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2. Social efficiency is always obtained under a laissez faire Competition Law with respect to IPR holders when network effects are present and relatively weak.

3. Old consumers are not better-off when compatibility is mandatory.
t=0: The dominant firm spends a fixed cost to substantially improve his software (durable, network) product quality (quality improvement $\Delta q$).

t=1: A smaller innovative rival’s decision is whether to invest into improving the quality further ($\Delta q^e < \Delta q$).

t=1 (second stage): The dominant firm decides on compatibility and prices of his goods.

Compatibility requires both parties’ consent/ No inter-firm payments for compatibility.

Even if compatibility is not supported, there is an alternative route for product innovation.
Under compatibility, all new versions are backward compatible. Under no compatibility, the rival cannot use the dominant firm's network.

Old versions are not forward compatible.

In the second period (t=2), firms set their prices à la Bertrand.

Zero marginal cost for all product versions.

All products are durable for two periods.
Identical consumers arrive in constant flows.

Linear utility partially dependent on network effects.

Customers incur a cost of learning how to use the initial and a smaller cost of learning to use the subsequent version of the software.

New consumers in the first period \((t=1)\) cannot postpone their purchasing decision.

Old customers in any period may keep the version they own and after observing the prices, they coordinate to the Pareto optimal outcome.

Upgrade prices for the old users (both firms can price discriminate).
History of the game: initial customers $\lambda_0$ buy $q_0$

$t=0$

Dominant firm

F

$q_1$

$t=1$ ($\lambda_0 + \lambda_1$ customers)

Rival

F

No Investment

The dominant firm chooses prices / whether to support compatibility

$q_2$

$q_1$

$t=2$ ($\lambda_0 + \lambda_1 + \lambda_2$ customers): Firms set their prices
A1: The market size and the cost of development are such that they allow the innovators to generate positive profits.

A2: Consumers present in the first period expect to buy the superior product in the second period.

A3: The first period quality improvement is large.

Proposition 1: Under assumptions A1, A2, A3 and in equilibrium, the dominant firm decides to stop selling the old version of quality $q_0$ in the first period. Instead, he sells the product $q_1$ to the new and the old first period customers. In the second period, the product of quality $q_2$ is sold by the rival to the whole market. In particular, old customers $(\lambda_0 + \lambda_1)$ upgrade for free.

If the dominant firm could choose whether to invest, we also show that there are parameter values (important first period quality improvement) under which the firm would invest even if it knew it would be succeeded.
A2': If incompatibility prevails, first period customers expect not to buy the superior product in the second period.

Proposition 2: a) If the expected quality improvement is relatively small ($\Delta q^e < \alpha(\lambda_0 + \lambda_1)$), the smaller rival is deterred to invest and the dominant firm remains the sole supplier of the product of quality $q_1$ in the market, b) If the expected quality differential is relatively large ($\Delta q^e \geq \alpha(\lambda_0 + \lambda_1)$), both competitors support compatibility. In the first period, all customers use $q_1$ and in the second, the whole market purchases the rival’s product of quality $q_2$. 
Why does the dominant firm support compatibility? When the expected quality differential is large, the market leader’s optimal strategy is to offer connectivity because it can absorb today more of the higher expected surplus which is higher when compatibility is present.
A4: The Social cost from the new product is greater than the Social benefit (A5 is the opposite).

**Proposition 3:** It is socially efficient if (a) the product of quality $q_1$ is sold for two periods when assumptions A2 and A4 hold, (b) the product of quality $q_2^e$ is introduced and purchased by the whole market if assumptions A2 and A5 hold.
Proposition 4: (a) If A4 holds and unlike the market that operates under a laissez faire Competition Law towards IPRs, a regime of mandatory interoperability leads to the inefficient introduction of the product of quality $q^e_2$. (b) There is no inefficiency in the market where refusals to support interoperability are possible if the network parameter is bounded and smaller than the cost of upgrading ($\alpha < c_u$). (c) If network effects are strong ($\alpha \geq c_u$), the market that operates under a laissez faire Competition Law towards IPRs may lead to an inefficient technological slowdown when A5 holds and the dominant firm does not supply interoperability information ($\Delta q^e < \alpha(\lambda_0 + \lambda_1)$).
Microsoft refused to supply interoperability information regarding its Office Suite (2007).

Complain from ECIS to the European Commission which mandated compatibility.

Microsoft Office 2007 was followed by Corel’s WordPerfect Office suite in 2008 that introduced negligible quality improvements with a high upgrading cost.

Proposition 4 suggests that compatibility may have been socially harmful.

When network effects are present and not particularly strong, efficiency is obtained under a laissez faire Competition Law.
A dominant and a smaller firm choose compatibility for their durable, network goods as well as their R&D spending which is quadratic in the probability of successfully improving product quality.

Difference with this paper: Both firms are potential second period innovators.

Results:

1. Both firms support compatibility when the size of the potential market is growing sufficiently fast. Intuition: More balanced R&D incentives for both firms when compatibility is present ⇒ the dominant firm supports compatibility because his expected second period profit is higher than when incompatibility prevails.

2. Overall, a laissez faire Competition Law is socially desirable.