Common ownership, market power, and innovation

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A B S T R A C T

I examine the effects of overlapping ownership on market power when there are external effects across firms. This is done in an oligopoly model with cost-reducing innovation with technological spillovers where firms have an overlapping ownership structure based largely on López and Vives (2019). The model allows for Cournot competition with homogeneous product and for Bertrand with differentiated products as well as for strategic effects of R&D investment. It derives positive testable implications and normative results to inform policy.

1. Introduction

Overlapping ownership of firms in an industry (be it common ownership or cross-ownership across firms) is suspect of relaxing competition and contributing to augmenting the impact of market power in product markets.[1] At the same time it may help internalizing external effects that lead to outcomes suboptimal from the welfare point of view as for example technological spillovers that may be responsible for depressed R&D investment.[2] In this paper I will connect the current debate on the impact of common ownership to the structure-conduct-performance studies of the 1960s and 1970s, and try to assess under what circumstances common ownership is detrimental or beneficial to innovation and welfare, deriving some antitrust implications.

The rise of institutional stock ownership has increased dramatically in the last 35 years, ending the world of dispersed ownership in the US of Berle and Means (1932). Institutional investors such as pension or mutual funds, now have the lion share of publicly traded US firms with a large concentration on the four largest assets managers (BlackRock, Vanguard, State Street and Fidelity). The evolution of the asset management industry, which has become more concentrated and with a shift from active to passive investors, who are more diversified, has changed the ownership structure of firms.[3] Now it is

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[1] That common/cross ownership may lead to relaxed competition was already pointed out by Rubinstein and Yaari (1983).

[2] Socially optimal level of R&D is estimated to be between two and three times as high as the level of observed R&D because of non-internalized technological spillovers (Bloom et al., 2013).

[3] The first three asset managers have increased their market share adopting passive investment strategies.

common for large firms in any industry to have common shareholders with significant shares (see, e.g., Azar et al., 2018). Minority cross-ownership is prevalent among many industries as well.[4]

There is vivid debate on whether common ownership relaxes competition. This has been found to hold for the airline and banking industries (Azar et al., 2018), and has been the cause of concern (Elhauge, 2016; Baker, 2016) resulting in recommendations of antitrust policies that can mitigate the effects of augmenting common ownership (e.g., Elhauge, 2016; Elhauge, 2017 on the Clayton Act (S.7) and Sherman Act (S.1)), or that will restrain ownership in oligopolistic industries, so that institutional investors can benefit from a safe harbor (e.g., enforcement of the Clayton Act, Posner et al., 2017).[5] At the same time, antitrust authorities are worried about the impact of mergers on innovation. Indeed, in the decade 2004–2014, the US Department of Justice and the US Federal Trade Commission identified a third of the mergers that they challenged to be detrimental to innovation, while more than 80% of the challenged mergers were in industries of high R&D intensity (Gilbert and Greene, 2015). More so, "partial" mergers via common ownership are also suspect according to the European Commission (EC).[6] There is a lively debate on whether and when mergers may decrease innovation.[7]

The backdrop of those concerns are trends of increasing aggregate product market concentration (Grullon et al., 2018; Autor et al., 2017; Head and Spencer, 2017) and potential increase in market power, resulting in increased economic profits and markups (De Loecker et al., 2018; Hall, 2018). There is also the perception of lack of dynamism in Western economies in terms of entry and exit, investment, and innovation (CEA, 2016 reports). More in general, the "weak" recovery after the Great Recession associated with the financial crisis has been linked to a potential secular stagnation of advanced economies, declining labor share (Barkai, 2016; Autor et al., 2017), and increased market power (Summers, 2016; Stiglitz, 2017).[8]

In this paper I survey first in Section 2 the potential impact of the changes in ownership structure on the objective of the firm and corporate governance. In Section 3, I discuss the debate on the effects of common ownership taking the perspective of the structure-conduct-performance (SCP) paradigm. In Section 4, I present the oligopoly innovation model with spillovers and flexible ownership structure developed in López and Vives (2019) with its positive and normative results. Section 5 is devoted to antitrust implications and Section 6 concludes with some open issues.

2. Corporate governance and overlapping ownership

While the objective of the firm is clear in a (perfectly) competitive context, to maximize profits for shareholders, in other contexts there is no simple objective function for the firm since high prices may harm shareholders as consumers and firms large in factor and product markets care about price impact.[9] If there is overlapping ownership across firms, the manager of a firm should account for both profits and external effects on other firms. Diversified shareholders want a policy of portfolio value maximization and should induce managers to internalize any externality on commonly owned firms (Hansen and Lott, 1996; Gordon, 2003). Indeed, common owners in an industry may have the ability and incentive to influence management (Posner et al., 2017). This applies also to passive investors (large asset managers) since they are not passive owners as indicated, for example, by the CEO of BlackRock, Larry Fink and available evidence.[10] The issue arises of how strong are the incentives of asset managers to comply with the interests of their clients taking into account they have a fiduciary duty to them. Antón et al. (2019) find that in industries with higher degrees of common ownership, there are weaker incentives for managers to compete (managerial wealth is less sensitive to firm performance).[11]

We make the parsimonious assumption that the manager of a firm maximizes a weighted average of shareholders' utilities.[12] Salop and O'Brien (2000) develop a simple model of common ownership that differentiates between cash flow and control rights, where each investor cares about the total profit of his portfolio. The manager of each firm takes this into consideration by maximizing a weighted (by control weights) average of the shareholders' portfolio profits.

Consider an industry with n firms and I owners/investors. Let υ_{ij} be the ownership share (cash flow rights) of firm j accruing to investor i and γ_{ij} the control rights of firm j held by owner i. The total portfolio profits of investor i are $\sum_{k=1}^{n} \upsilon_{ik}\pi_k$, where π_k are the profits of firm k. The manager of firm j maximizes a weighted average of its shareholders'

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[4] See Gilo et al. (2006),Brito et al. (2018) and Nain and Wang (2018). Dietzenbacher et al. (2000) examine the effect of silent cross-shareholdings on the price-cost margin in the Dutch financial sector. They find an increase of up to 8% under the assumption of a Cournot market and up to 2% under the assumption of a Bertrand market.

[5] These views have been questioned by Rock and Rubinfeld (2017).

[6] The EC in the Dow-Dupont merger decision in 2017 (European Commission, 2017) stated that "the Commission is of the view that (i) a number of large agrochemical companies have a significant level of common shareholding, and that (ii) in the context of innovation competition, such findings provide indications that innovation competition in crop protection should be less intense as compared with an industry with no common shareholding".

[7] See Motta and Tarantino (2018) and Federico et al. (2017).

[8] Azar and Vives (2018) and Azar and Vives (2019) provide a general equilibrium model to check the macroeconomic effects of common ownership.

[9] According to the Fisher Separation Theorem (Fisher, 1930), when firms are price-takers shareholders agree on the profit maximization objective (Hart, 1979 extends the result to incomplete markets).

[10] See his 2018 annual letter to CEOs. See the evidence of active corporate governance by asset managers in Brav et al. (2018) and Gilje et al. (2018). Appel et al. (2016) find that passive investors are long term, have voice, and improve ROA.

[11] See also Gordon (2003).

[12] Rotemberg (1984) proposed the assumption. This can be rationalized by voting on management strategies/power indexes of shareholders (Azar, 2017; Brito et al., 2018). There is evidence that shareholder dissent hurts directors and that director elections matter because of career concerns (Fos and Tsoutsoura, 2014; Agarwal, 2017). See also Brav et al. (2018).

Table 1
Edgeworth simpathy coefficient (different ownership structures).

	Common Ownership, $\upsilon_{ik} = \alpha, \gamma_{ik} = 0$ Silent Financial Interests (SFI)	Common Ownership, $\upsilon_{ij} = \gamma_{ij}$ Proportional Control (PC)	Cross-ownership (by firms, CO)
λ	$\frac{\alpha}{1-(I-1)\alpha}$	$\frac{2\alpha[1-(I-1)\alpha]+(I-2)\alpha^2}{[1-(I-1)\alpha]^2+(I-2)\alpha^2}$	$\frac{\alpha}{1-(n-2)\alpha}$

portfolio profits (with weights given by the control rights γ_{ij}): $\sum_{i=1}^{I} \gamma_{ij} \sum_{k=1}^{n} \upsilon_{ik}\pi_k$, which is proportional to $\pi_j + \sum_{k \neq j} \lambda_{jk}\pi_k$ where $\lambda_{jk} \equiv \left(\sum_i \gamma_{ij}\upsilon_{ik}\right) / \left(\sum_i \gamma_{ij}\upsilon_{ij}\right)$ is the degree of internalization (Edgeworth's coefficient of effective sympathy) of firm k's profits by the manager of firm j.[13] It is the weight of the profit of firm k in the objective function of the manager of firm j relative to the own profit of firm j. The relative concentration of ownership and control in firm k versus firm j is what determines the coefficient's value, which represents the relative weight placed by the manager of firm j on the profit of firm k compared to the weight placed on the own firm's profit; it reflects the extent to which investors with financial interests in firms j and k control firm j.

With proportional control $\gamma_{ij} = \upsilon_{ij}$ a firm's manager takes into account the firm's shareholders' interests in other firms to an extent that is analogous to their stakes in the own firm. Then $\lambda_{jk} = \left(\sum_i \upsilon_{ij}\upsilon_{ik}\right)/\left(\sum_i \upsilon_{ij}^2\right)$ where the denominator is the Herfindahl-Hirschman Index ("HHI") for the investors in firm j. The less concentrated investors in firm j are, and the more concentrated investors in firm k are, the higher is λ_{jk} and the more aligned are investors' stakes in the two firms.[14]

We provide here a stylized symmetric ownership model that encompasses both common ownership and cross-ownership (López and Vives, 2019). Let there be $I \geq n$ owners/investors holding common ownership firms' stakes. The model nests cases of silent financial interests (SFI), where there is ownership without control, and of proportional control (PC).[15] In both cases we assume that there is a reference shareholder for every firm and every investor owns a share α of the firms that are out of his control.[16] With cross-ownership (CO), each of the n firms may own shares of rival firms without control rights (e.g., nonvoting shares), in which case α represents a firm's ownership stake in another firm, and the controlling shareholder makes the decisions.[17]

In every case, when stakes are symmetric, the manager of firm j maximizes

$$\phi_j = \pi_j + \lambda \sum_{k \neq j} \pi_k, \tag{1}$$

where λ depends on the ownership structure (in the classical profit maximizing case $\lambda = 0$, in a cartel or after a full merger $\lambda = 1$). With common-ownership λ reaches its upper bound $\lambda = 1$ when $\alpha = 1/I$. For $\alpha < 1/I$, λ increases with I and α.[18] With cross-ownership λ is the ratio of the stake of firm j in firm k over the claims of firm j on its own and on firm k's profits. With cross-ownership λ reaches its upper bound $\lambda = 1$ when $\alpha = 1/(n-1)$, and again it holds that λ increases with n and α.

Table 1 presents the value of λ for each type of overlapping ownership (SFI, PC, or CO). Notice that more investors and higher investment stakes imply higher λ. In addition, for a given stake α, $\lambda^{PC} > \lambda^{SFI}$ and that for $I = n$, $\lambda^{SFI} > \lambda^{CO}$. More control leads to more internalization of rivals' profits and, for given silent financial interests, cross-ownership yields the lowest internalization.[19]

There is evidence that the weights on rivals' profits (the lambdas) have increased markedly in the US economy (under the assumption of proportional control). Indeed, for the US 1500 largest firms according to market capitalization the estimated average lambdas double from about 0.35 in 1985 to about 0.70 in 2015 (Azar and Vives, 2019). Banal-Estanol et al. (2018) find that passive investors increased their holdings relative to active shareholders post-crisis (with data for 2004–2012 of all publicly listed firms in the U.S.). In principle, and other things equal, this need not lead to a higher degree of internalization of rivals' profits since passive investors should exert less control than active ones. However, passive shareholders are more diversified and have become more concentrated in the asset management industry. This shift has led to more interconnected networks of common ownership and a potentially higher degree of internalization of rivals' profits. According to Banal-Estanol et al. (2018) the rise in passive investors drives the increase in the lambdas.

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[13] Edgeworth used it among consumers in an exchange economy. Also used by Cyert and DeGroot (1973).

[14] See section A.1.1 in the online appendix to López and Vives (2019).

[15] The model accommodates any structure featuring symmetry. Preserving symmetry, Banal-Estanol et al. (2018) modify the model to allow for a partition of active and passive investors, where the latter's control is lower than their firm stakes.

[16] The reference shareholder has an interest $1 - (I-1)\alpha$ in his firm. Assuming $\alpha I < 1$ we have that $1 - (I-1)\alpha > \alpha$.

[17] This setting features a chain-effect interaction between the profits of firms (see Gilo et al., 2006).

[18] The driving force of the comparative statics result is the decline in the interest in the own firm (undiversified stake) of reference investors $1 - (I-1)\alpha$ as I or α increase.

[19] In accordance with our results, Antón et al. (2019) show that in industries with increased common ownership (i.e., higher α) measures of relative performance are not as commonly used in manager incentivization schemes, which implies that rivals' profits are more strongly internalized.

3. The structure-conduct-performance paradigm revisited

The structure-conduct-performance ("SCP") paradigm in Industrial Organization, which is associated to Bain (1951), was dominant in 1960s and 1970s. According to the market power hypothesis developed by this approach, firms in concentrated markets protected by barriers to entry earn high price/cost margins and profits. It was found in cross section studies of industries that the relation between concentration (measured for example by the HHI) and profitability was statistically weak and the estimated effect of concentration usually small. This approach was criticized by the Chicago school for not modeling the conduct of firms. The apparent correlation between concentration and profitability could be due to the fact, according to the efficiency hypothesis postulated by Demsetz (1973), that large firms are more efficient, command larger price/cost margins and earn higher profits, and therefore concentration and industry profitability go together. Indeed, modern IO analysis points out that margins, market shares, and concentration are jointly determined (see Bresnahan, 1989; Schmalensee, 1989) and opens the way to careful empirical industry studies. A foundation of the SCP hypothesis can be provided by the Cournot model. The model can be augmented easily to accommodate for overlapping ownership (Reynolds and Snapp, 1986; Bresnahan and Salop, 1986). The Lerner index of firm j is given by

$$L_j \equiv \frac{p - C'_j}{p} = \frac{s_j + \sum_{k \neq j} \lambda_{jk} s_k}{\eta},$$

where C'_j is the marginal cost of firm j, η is the elasticity of demand, and s_k the market share of firm k. Firm j enjoys a larger margin when its manager puts more weight on the profits of firms with high market share. In equilibrium, the market share-weighted industry Lerner index is

$$\sum_j s_j \left(p - C'_j \right)/p = \text{MHHI}/\eta,$$

where MHHI is the modified HHI:

$$\text{MHHI} \equiv s' \Lambda s = \sum_j \sum_k \lambda_{jk} s_j s_k = \text{HHI} + \Delta,$$

with $\Delta \equiv \Sigma_j \Sigma_{k \neq j} \lambda_{jk} s_j s_k$ a measure of the unilateral anti-competitive incentives due to common ownership.[20]

We can formulate a revised market power hypothesis as follows: Firms in markets with high levels of common/overlapping ownership earn high price/cost margins and profits because of reduced competitive pressure. This amounts to augmenting the traditional SCP regression of margins on the HHI concentration index (and potentially market share) with a MHHI that accounts for overlapping ownership.

Preliminary evidence consistent with such hypothesis, using a modified HHI which accounts for overlapping ownership, is in the work of Azar et al. (2016) and Azar et al. (2018) for airlines and banking. Those authors use variation in geographic markets and exogenous variation in common ownership patterns due to the acquisition of Barclays Global Investors by BlackRock in 2009. The problem with using the MHHI is that it depends on both the lambdas and the market shares and therefore does not adequately detect causal effects of ownership structure on market power. The early results on airlines and banking have been contested by O'Brien and Waehrer (2017), Dennis et al. (2018), Kennedy et al. (2017) and Gramlich and Grundl (2017). A main idea is that the relation to isolate is between the Edgeworth (1881) sympathy coefficients (out of the ownership structure) and prices/margins. This idea is pursued in a cross section of industries in the work of Banal-Estanol et al. (2018).

Several authors have found economy-wide increases in price/cost margins since the 1980s. De Loecker et al. (2018) find an extraordinary large increase in markups from 21% in 1980 to 61% in 2017 for publicly traded firms; Hall (2018) finds a more moderate increase of markups of about 23% from 1.12 in 1988 to 1.38 in 2015. Common ownership has the potential to explain the increase in markups given the reported increases in profit internalization. For example, and for illustrative purposes, a calibration by Azar and Vives (2018) and Azar and Vives (2019) of the Edgeworth sympathy coefficients in the US economy in the period 1985–2015 for 1500 public firms yields that the intra-industry average sympathy coefficient went from around 0.4 in 1985 to around 0.7 in 2015. Under the maintained assumption of Cournot competition among firms and accounting for oligopsony power in the labor market, markups have increased from 1988 to 2015 over a 20% increase according to the López and Vives (2019) analysis, a similar amount that the Hall (2018) estimate.

Gutiérrez and Philippon (2016, 2017) find underinvestment (relative to standard valuation measures such as Tobin's Q) in the US since early 2000s and that firms owned by quasi-indexers and belonging to industries that have high concentration and high common ownership drive the investment gap.

Continuing with the analogy with the SCP paradigm (see Vives, 2017), we can also formulate a revised efficiency hypothesis as follows: High levels of common/overlapping ownership and efficiency are associated because common/overlapping ownership improves information sharing, firm collaboration, corporate governance (because of, among other reasons, the presence of economies of scale in information production and monitoring an industry), and induces managers to reduce cost and/or improve performance. Large firms have more links due to overlapping ownership, better corporate governance, are more efficient, command larger price/cost margins and earn higher profits. The result is that overlapping ownership

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[20] The matrix Λ of sympathy coefficients can accommodate both common and cross-ownership patterns to yield a generalized HHI, GHHI.

and high price/cost margins and industry profits go together. Autor et al. (2017) argue that globalization and technological change lead to concentration and the rise of "superstar" firms, which have low costs (and a low labor share) and high profits. Furthermore, there is some evidence that cross-held firms have higher market share growth and profitability due to efficiency gains and enhanced innovation productivity. He and Huang (2017) find that US cross-held public firms (1980–2010) have higher market share growth and profitability due to efficiency gains and enhanced innovation productivity (patents per $ spent in R&D). Geng et al. (2016) find that vertical common ownership links improve the internalization of patent complementarities.

In the next section we present a model that combines the market power impact of overlapping ownership together with a potential internalization effect of technological spillovers.

4. A model of innovation with spillovers

The question we want to address is whether overlapping ownership arrangements (OOAs) can help firms to internalize technological spillovers and countervail the reduced incentives they may have to compete.

Consider a symmetric model of cost-reducing R&D investments with spillovers in Cournot or Bertrand oligopoly with (symmetric) overlapping ownership (López and Vives, 2019). In the central scenario each firm $j = 1, \ldots, n$ chooses simultaneously R&D x_j and output (in a homogeneous product market) q_j or price (in a differentiated products market) p_j, and the manager of the firm maximizes

$$\phi_j = \pi_j + \lambda \sum_{k \neq j} \pi_k,$$

where λ depends on the type of common/cross-ownership in the industry.

Marginal production cost $c(\cdot)$ for each firm j is constant with respect to output and depends on own R&D effort x_j and rivals' aggregate effort $\sum_{k \neq j} x_k$:

$$c(x_j + \beta \sum_{k \neq j} x_k) \text{ with } c' < 0, c'' \geq 0 \ (j \neq k),$$

where $\beta \in [0, 1]$ is the spillover coefficient of the R&D activity. According to Bloom et al. (2013) the average sensitivity of the stock of knowledge of firm j in relation to the R&D investment of $k \neq j$ is between 0.4 to 0.5.[21] The cost of investment is given by $\Gamma(x_j)$ with $\Gamma' > 0$ and $\Gamma'' \geq 0$. The profit of firm j (producing output q_j) is thus given by

$$\pi_j = \text{Revenue} - c(x_j + \beta \sum_{k \neq j} x_k) q_j - \Gamma(x_j).$$

We assume that there is a unique regular symmetric interior equilibrium with quantity (q^*, x^*) or price (p^*, x^*) competition.[22] The FOC with respect to R&D at a symmetric equilibrium is

$$-c'(Bx^*)(1 + \lambda \beta (n - 1)) q^* = \Gamma'(x^*),$$

where $B \equiv 1 + \beta(n - 1)$; Bx^* is the effective investment that lowers the cost of a firm in a symmetric equilibrium.

With quantity (Cournot) competition we assume that there is a homogeneous good with smooth inverse demand function $f(Q)$, $f' < 0$, where Q is the total output, with constant relative degree of convexity $Qf''/f' = \delta$. This formulation allows for log-concave and log-convex demands (e.g., linear, as in d'Aspremont and Jacquemin, 1988; Kamien et al., 1992 constant elasticity as in Dasgupta and Stiglitz, 1980). The revenue of firm j is given by $R(q_j; q_{-j}) = f(Q)q_j$ and the FOC with respect to output yields the modified Lerner formula

$$\frac{f(Q^*) - c(Bx^*)}{f(Q^*)} = \frac{\text{MHHI}}{\eta(Q^*)},$$

where η as before is the elasticity of demand, MHHI = HHI + Δ and $\Delta = \frac{\lambda(n-1)}{n}$ yielding

$$\text{MHHI} = \frac{1 + \lambda(n - 1)}{n}.$$

Our general model nests the R&D model specifications of: (i) d'Aspremont Jacquemin (AJ), where demand is linear (and thus log-concave), as is the marginal production cost function $c(\cdot)$, and the R&D cost function $\Gamma(\cdot)$ is quadratic, (ii) Kamien Muller Zang (KMZ), and (iii) a constant elasticity (CE) model with log-convex demand similar to Dasgupta and Stiglitz (1980) but including R&D spillovers. In both KMZ and CE, $c(\cdot)$ is strictly convex and $\Gamma(\cdot)$ linear. In all cases (with inverse elasticity of demand less than one for CE) outputs are strategic substitutes given that $\delta > -2$.

With price (Bertrand) competition we assume that the industry has n differentiated products, each produced by one firm. The demand for good j is given by $q_j = D_j(\mathbf{p})$, where $\mathbf{p}$ is the price vector, and for any j, $D_j(\cdot)$ is smooth whenever positive, downward sloping, with strict gross substitutes $\partial D_k / \partial p_j > 0$, $k \neq j$, and the demand system $D(\cdot)$ is symmetric with negative definite Jacobian. The revenue of firm j is given by $R(p_j; p_{-j}) = p_j D_j(\mathbf{p})$ and the FOC with respect to price yields a modified

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[21] See also Irwin and Klenow (1994) for evidence of learning-by-doing spillovers in the semiconductor industry.
[22] We assume that the Jacobian of the FOC at the symmetric solution is negative definite.

Lerner formula

$$\frac{p^* - c(Bx^*)}{p^*} = \frac{1}{\eta_j - \lambda(n-1)\eta_{jk}},$$

where $\eta_j = -\frac{\partial D_j(\mathbf{p}^*)}{\partial p_j} \frac{p^*}{D_j(\mathbf{p}^*)}$ is the own elasticity of demand and $\eta_{jk} = \frac{\partial D_k(\mathbf{p}^*)}{\partial p_j} \frac{p^*}{D_k(\mathbf{p}^*)} > 0, k \neq j$ the cross-elasticity.[23]

An example is provided by the analogous to the d'Aspremont and Jacquemin (1988) model with (symmetric) product differentiation:

$$D_i(p) = a - bp_i + m \sum_{j \neq i} p_j$$

with a, b, $m > 0$, arising from a representative consumer with quasilinear utility, innovation function $c_i = \bar{c} - x_i - \beta \sum_{j \neq i} x_j$, and investment cost $\Gamma(x) = (\gamma/2)x^2$.[24]

4.1. The comparative statics of profit internalization

For a given x, λ has a negative (positive) effect on quantity (price) because products are gross substitutes:[25]

$$\partial_{\lambda q_j} \phi_j < 0 \text{ and } \partial_{\lambda p_j} \phi_i > 0.$$

This is the relaxing effect of profit internalization of rivals on competition. For a given quantity/price, λ has a positive effect on investment if there are spillovers, $\beta > 0$:

$$\partial_{\lambda x} \phi_j = -\beta q(n-1)c' > 0.$$

This is the internalization effect of overlapping ownership on R&D effort in the presence of spillovers. The total impact of λ on the equilibrium values of quantity/price and R&D will depend on which of the two effects dominates.

We have also that

$$\partial x^*/\partial \lambda \leq 0 \implies \partial q^*/\partial \lambda < 0, \partial p^*/\partial \lambda > 0,$$

because price (output) and R&D are substitutes (complements) for a firm.

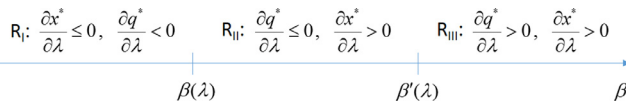Let E denote an index of equilibrium effectiveness of R&D. When $\Gamma''(x^*) > 0$, let

$$E \equiv \xi(q^*, x^*) \left(1 + \frac{\chi(Bx^*)}{y(x^*)}\right)^{-1} > 0,$$

where

- $\chi(Bx^*) \equiv -c''(Bx^*)Bx^*/c'(Bx^*) \geq 0$ is the elasticity of the slope of the innovation function (relative convexity of $c(\cdot)$).
- $y(x^*) \equiv \Gamma''(x^*)x^*/\Gamma'(x^*) \geq 0$ is the elasticity of the slope of the investment cost function $\Gamma(\cdot)$.
- $\xi(q^*, x^*) \equiv -(c'(Bx^*))^2/(f'(Q^*)\Gamma''(x^*)) > 0$ is the relative effectiveness of R&D (Leahy and Neary, 1997).

The effectiveness of R&D is increasing the ratio of the relative convexities of $\Gamma(\cdot)$ and $c(\cdot)$, and with the Leahy and Neary index of relative effectiveness of R&D. The index E will prove important for comparative statics results. A higher effectiveness of R&D will be associated with a larger impact of industry profit internalization on output and R&D.

We assume that $E(\beta, \lambda)\beta$ is increasing in β and $E(\beta, \lambda)$ decreasing in λ (which holds in the model specifications). López and Vives (2019) show that we can partition then spillovers in potentially three regions, with thresholds $\underline{\beta}(\lambda) < \beta'(\lambda)$ as a function of λ, which have different comparative statics:

$$R_I: \frac{\partial x^*}{\partial \lambda} \leq 0, \; \frac{\partial q^*}{\partial \lambda} < 0 \qquad R_{II}: \frac{\partial q^*}{\partial \lambda} \leq 0, \; \frac{\partial x^*}{\partial \lambda} > 0 \qquad R_{III}: \frac{\partial q^*}{\partial \lambda} > 0, \; \frac{\partial x^*}{\partial \lambda} > 0$$

$$\xrightarrow{\hspace{2cm} \underline{\beta}(\lambda) \hspace{3cm} \beta'(\lambda) \hspace{3cm} \beta}$$

We have that the thresholds $\underline{\beta}(\lambda)$ and $\beta'(\lambda)$ are increasing in the level of market concentration in the Cournot case; $\beta'(\lambda)$ is weakly increasing in λ and decreasing in the effectiveness of R&D E. Furthermore, in all the model specifications we have that the degree of profit internalization and the degree of spillovers are complements in fostering R&D, $\partial x^*/\partial \lambda \partial \beta > 0$. A higher level of spillovers makes raising λ more effective in increasing x^*. As an illustration, Fig. 1 presents the regions for the spillovers in the linear Bertrand model in the space (λ, β) (in the figure $\bar{\beta}$ is a welfare threshold below which no common ownership is optimal, see Section 4.2). We see how for a given level of profit internalization λ, increasing the level of spillovers β we obtain more positive effects of increasing λ moving from R_I to R_{II} and to R_{III}. We see how the boundaries

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[23] See López and Vives (2019)

[24] See Section 5 in López and Vives (2019) for a constant elasticity example with non-quasilinear utility.

[25] Second-order derivatives are denoted by $\partial_{z_i z_j} \phi_i \equiv \partial^2 \phi_i/\partial z_i \partial z_j$ and $\partial_{h z_i} \phi_i \equiv \partial^2 \phi_i/\partial h \partial z_i$ (with $h = \beta$, λ, and $z = q, p, x$).
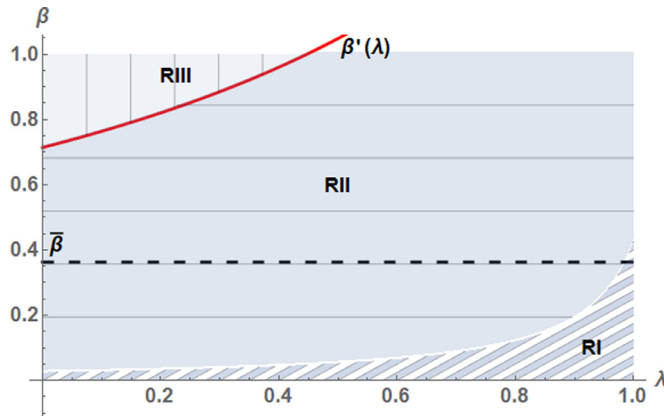
Fig. 1. Regions for spillover thresholds in the space (λ, β) for the linear Bertrand model.[26]

of the regions are increasing in λ implying that increasing λ from a higher level becomes more and more difficult to have an expansive effect in investment and/or output.

Equilibrium profits $\pi^*(\lambda)$ are increasing in λ. In the Cournot case we can show that

$$\text{sign}\{\pi^{*\prime}(\lambda)\} = \text{sign}\left\{ -\beta c'(Bx^*)\frac{\partial x^*}{\partial \lambda} + f'(Q^*)\frac{\partial q^*}{\partial \lambda} \right\}. \tag{2}$$

In R_{II} the result is clear since then $\partial x^*/\partial \lambda > 0$ and $\partial q^*/\partial \lambda < 0$. In R_I the positive effect on price dominates the negative effect on R&D, and conversely in R_{III}, so that profits in both regions rise with the level of overlapping ownership. Investors and firms always have incentives to increase their interdependence provided the agreements are *binding*. With dynamic interaction in a symmetric case, Gilo et al. (2006) find that with stakes high enough tacit collusion is facilitated by cross-ownership deals, as incentives to deviate are attenuated. In the Bertrand case profits can also be checked to be increasing in λ for the linear or constant elasticity specifications. We see, therefore, that in general the results are robust to Bertand competition.

The following testable predictions follow:

- a positive relationship between overlapping ownership and R&D is expected in industries with high enough spillovers and low enough concentration;
- this positive relationship should also hold for output in industries with high effectiveness of R&D;
- the impact of overlapping ownership on R&D should be higher when spillovers are high;
- industry profits should increase with the extent of overlapping ownership.

It is worth noting that we may have that while margins go up, prices go down because R&D investment grows and marginal production costs diminish. This tends to happen when spillovers (β) are large.

4.2. Welfare analysis

Let $W(\lambda)$ denote total surplus (TS) and $CS(\lambda)$ consumer surplus (CS) evaluated at the equilibrium for a given λ. We can obtain then that

$$\text{sign}\{W'(\lambda)\} = \text{sign}\left\{ \upsilon(q^*; \lambda)\frac{\partial q^*}{\partial \lambda} + (1-\lambda)\beta(n-1)|c'(Bx^*)|\frac{\partial x^*}{\partial \lambda} \right\},$$

where $\upsilon(q^*; \lambda) > 0$ (equal to $-(1 + \lambda(n-1))f'(nq^*)$ in Cournot and to $-(\partial D_i/\partial p_i + \lambda(n-1)\partial D_j/\partial p_i)^{-1}$ for $j \neq i$ in Bertrand competition). In R_I we have that $W'(\lambda) < 0$ because $\partial x^*/\partial \lambda \leq 0$ and $\partial q^*/\partial \lambda < 0$; in R_{III}, $W'(\lambda) > 0$ because $\partial x^*/\partial \lambda > 0$ and $\partial q^*/\partial \lambda > 0$. In R_{II}, however, the effect of λ on welfare is positive or negative according to whether the positive effect of overlapping ownership on R&D does or does not dominate its negative effect on the output level. Moreover, the effect of λ on CS is positive (i.e., $CS'(\lambda) > 0$) only when $\partial q^*/\partial \lambda > 0$ (i.e., in R_{III}).

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[26] For $a = 700$, $\bar{c} = 600$, $b = 1.4$, $m = 0.12$ and $n = 8$ (Fig. B1 in online appendix of López and Vives (2019)).
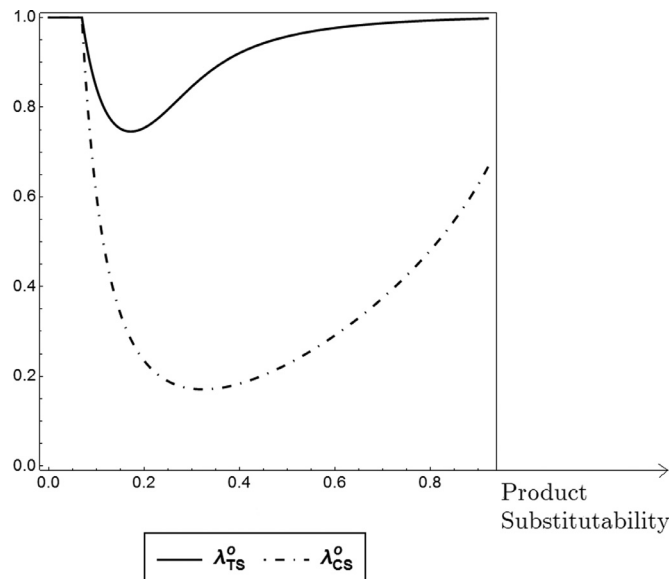
Fig. 2. Optimal λ_{TS}^o and λ_{CS}^o in the linear Bertrand model.[27]

López and Vives (2019) obtain the following result. In the Cournot case, if $\delta > -2$, total welfare is single peaked in λ, and under the regularity assumptions on R&D effectiveness there are threshold values $\bar{\beta} < \beta'(0)$ such that:

$$\underbrace{\lambda_{TS}^o = \lambda_{CS}^o = 0}_{\bar{\beta}} \quad \underbrace{\lambda_{TS}^o > \lambda_{CS}^o = 0}_{\beta'(0)} \quad \underbrace{\lambda_{TS}^o \geq \lambda_{CS}^o > 0}_{\beta}$$

where λ_{TS}^o and λ_{CS}^o are respectively the socially optimal values of λ according to the total surplus (TS) and consumer surplus (CS) standard. In all cases, the CS standard is more stringent than the TS standard. That is, the former allows less rivals' profit internalization than the latter: $\lambda_{TS}^o \geq \lambda_{CS}^o$. Furthermore, whenever $\lambda_{TS}^o \in (0, 1)$ and $\lambda_{CS}^o \in (0, 1)$, then

- λ_{TS}^o and λ_{CS}^o are both strictly increasing in β;
- λ_{TS}^o is positively associated with R&D effectiveness;
- λ_{TS}^o increases with n, the elasticity of demand and of the innovation function (according to simulations in the models).

In the model specifications, both $\bar{\beta}$ and $\beta'(0)$ are decreasing in n.

The picture that emerges is that a higher level of spillovers makes optimal a higher degree of rivals' profit internalization. More concentrated markets call for less profit internalization.

It is worth noting that increases in λ can be understood as partial mergers and that $\lambda = 1$ represents a full merger to monopoly (or cartelization). In some circumstances the latter is welfare-optimal. In AJ and KMZ, the consumer surplus solution is a corner (either 0 or 1) under either model specification and we get $\lambda_{TS}^o = \lambda_{CS}^o = 1$ for β large. This is not the case in the CE model. We can also look into the scope for a Research Joint Venture (RJV). An RJV can be interpreted as a case of full spillovers (i.e., $\beta = 1$). Then, an RJV can be optimal only given existence of R_{III} for β large and provided that $\partial q^*/\partial \beta > 0$ and $\partial x^*/\partial \beta > 0$ (which holds if the innovation function's curvature is not too large). In those circumstances a cartelized RJV ($\lambda = \beta = 1$) is optimal in terms of consumer and total surplus. This is the case in the AJ and KMZ models when R_{III} exists, however $\lambda = 1$ is never optimal in the CE model.[28]

Similar results obtain for Bertrand models (linear and constant elasticity). The Bertrand model also allows us to check the effect of product differentiation. In this case competition can be intensified through an increase in the degree of substitutability among the products, while the number of firms is kept constant. In this way we can identify the effect of the degree of rivalry. In Fig. 2 we see that both λ_{TS}^o and λ_{CS}^o have a U-shaped relationship with respect to the degree of product substitutability in the linear case. Indeed, both λ_{TS}^o and λ_{CS}^o tend to 1 as products become independent and they both increase also as they tend to perfectly homogeneity. Indeed, when products are independent (with well-defined local monopolies) and $\beta > 0$ we have that $\lambda_{TS}^o = \lambda_{CS}^o = 1$. This is so since with local monopolies, increasing λ does not affect the degree of monopoly and helps firms internalize the investment externality provided that there are spillovers $\beta > 0$. When

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[27] For $\beta = 0.9$, $n = 8$, $a = 700$, $\tilde{c} = 500$, and $\gamma = 60$ (Fig. B6b in online appendix of López and Vives, 2019).

[28] Under alternate conditions, a RJV with no overlapping ownership ($\lambda = 0$ and $\beta = 1$) can be socially optimal in all three models.

products tend to be homogeneous competition is very intense and the impact of increasing λ in market power is small while the internalization effect large. The result is that in this case we are always in R_{III}, where increasing λ raises both output and investment effort. In short, the impact of competition intensity (i.e., the extent of product differentiation) on the optimal level of rivals' profit internalization is usually non-monotone.

5. Strategic commitment

On occasions R&D can be used as a strategic tool by a firm trying to influence market outcomes. This is so when the R&D of one firm is obervable by the rivals.[29] This is naturally modeled as a two-stage game where in the first stage, firm j commits to invest x_j in R&D and in the second stage, and for given R&D expenditures, firms compete in the product market (be it in quantities or prices). Let $\mathbf{z}^*(\mathbf{x})$ be the second-stage (quantity or price) equilibrium as a function of the vector $\mathbf{x}$ of R&D choices. We look for subgame-perfect equilibria (SPE) of the game. The FOC with respect to R&D is for $j = 1, \ldots, n$:

$$\frac{\partial}{\partial x_j} \phi_j(\mathbf{z}^*(\mathbf{x}), \mathbf{x}) + \underbrace{\sum_{k \neq j} \frac{\partial}{\partial z_k} \phi_j(\mathbf{z}^*(\mathbf{x}), \mathbf{x}) \frac{\partial}{\partial x_j} z_k^*(\mathbf{x})}_{\psi^J} = 0.$$

The term ψ^J is the strategic effect of investment with $J = C$, with $\partial \phi_j / \partial q_k < 0$, for Cournot and $J = B$, $\partial \phi_j / \partial p_k > 0$, for Bertrand, $k \neq j$ and when $\lambda < 1$. Evaluated a symmetric equilibrium,

$$\operatorname{sign} \psi^C = \operatorname{sign}\left\{-\partial q_j^* / \partial x_k\right\} = \operatorname{sign}\{\tilde{\beta}^C(\lambda) - \beta\}$$

$$\operatorname{sign} \psi^B = \operatorname{sign}\left\{\partial p_j^* / \partial x_k\right\} = \operatorname{sign}\{\tilde{\beta}^B(\lambda) - \beta\}$$

where $\tilde{\beta}^C(\lambda) \equiv \frac{\partial_{q_i q_j} \phi_i}{\partial_{q_i q_i} \phi_i}$, $j \neq i$, and $\tilde{\beta}^B(\lambda)$ is a more involved expression (see (84) in the online appendix of López and Vives (2019)). With Cournot we have that $\tilde{\beta}^C(\lambda) > 0$ if and only if quantities are strategic substitutes (with $\tilde{\beta}^C(\lambda)$ increasing with λ, $\tilde{\beta}^C(1) = 1$) and with Bertrand we have that $\tilde{\beta}^B(\lambda) < 0$ typically (e.g., for the linear and constant elasticity specifications, where $\tilde{\beta}^B(\lambda)$ is also increasing in λ).[30] The strategic effect is crucial to compare the simultaneous and two-stage models. With low spillovers (β) and/or a high degree of overlapping ownership in Cournot we have typically that $\psi > 0$ and there are incentives to overinvest (top dog strategy). In Cournot with high spillovers and/or a low degree of overlapping ownership and in Bertrand, we have that $\psi < 0$ typically and there are incentives to underinvest (puppy dog strategy). In the first (second) case output and R&D are higher (lower) in the two-stage model than in the simultaneous model. In summary, the strategic effect of investment leads to underinvestment incentives (puppy dog) with high spillovers in Cournot, and more generally for Bertrand competition (regardless of spillovers); and to overinvestment incentives (top dog) with a high degree of overlapping ownership for Cournot competition.

The welfare analysis is generally robust to the two-stage R&D commitment model with two caveats:

1. The two-stage $\lambda_{TS}^o, \lambda_{CS}^o$ tend to be higher than in the simultaneous model (larger when spillovers are high since then firms have incentives to underinvest. For example, in the AJ model we have always that λ_{TS}^o and λ_{CS}^o are weakly larger in the two-stage case.
2. We may have $\lambda_{CS}^o > \lambda_{TS}^o$ in the Cournot model when the strategic effect is positive (then there may be overproduction from the TS perspective due to overinvestment).

The marginal impact of λ on W (total surplus) adds a strategic investment term $\omega(\lambda)\big(\tilde{\beta}(\lambda) - \beta\big)$:

$$\operatorname{sign}\{W'(\lambda)\} =$$
$$\operatorname{sign}\left\{\upsilon(q^*; \lambda) \frac{\partial q^*}{\partial \lambda} + \left[(1-\lambda)\beta - \omega(\lambda)\big(\tilde{\beta}(\lambda) - \beta\big)\right](n-1)|c'(Bx^*)| \frac{\partial x^*}{\partial \lambda}\right\}$$

with $\upsilon, \omega > 0$, having different expressions for Cournot and Bertrand competition.

When the strategic effect is negative ($\beta > \tilde{\beta}(\lambda)$), the two-stage model behaves like the simultaneous model in the sense that $W'(\lambda) < 0$ in R_{I}, $W'(\lambda) > 0$ in R_{III}, and $W'(\lambda) \lessgtr 0$ (depending on the strength of spillovers) in R_{II}, but there are higher social incentives for increasing λ since the impact of λ on R&D and welfare is enhanced. When the strategic effect is positive ($\beta < \tilde{\beta}(\lambda)$) and spillovers are sufficiently low (but not necessarily close to zero) $W'(\lambda) < 0$ in R_{II}, and W' can be positive or negative in R_{I} and R_{III}. Then, the impact of λ on R&D is diminished and in contrast to the simultaneous model, with Cournot competition we may have that for some spillover values $\lambda_{CS}^o = 1 > \lambda_{TS}^o > 0$ (e.g., in the AJ model for intermediate values of spillovers, see Fig. 3). In the figure we plot the socially optimal levels of profit internalization in the AJ model

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[29] Although R&D investment typically precedes interaction in the market, this does not mean necessarily that it has strategic commitment value. This is so since R&D investment effort, or even contracts with managers that reward effort, need not be observable. In fact, the evidence on the strategic commitment value of R&D is scant (see Vives, 2008).

[30] Sufficient conditions for $\partial p_j^*(\mathbf{x})/\partial x_k < 0$ are that β is high and prices are strategic complements; then increasing x_k decreases the prices of rivals because a larger x_k shifts the price best reply of firm j inwards as $\partial^2 \phi_j / \partial x_k \partial p_j < 0$ as well as does to the price best reply of firm k since $\partial^2 \phi_k / \partial x_k \partial p_k < 0$.
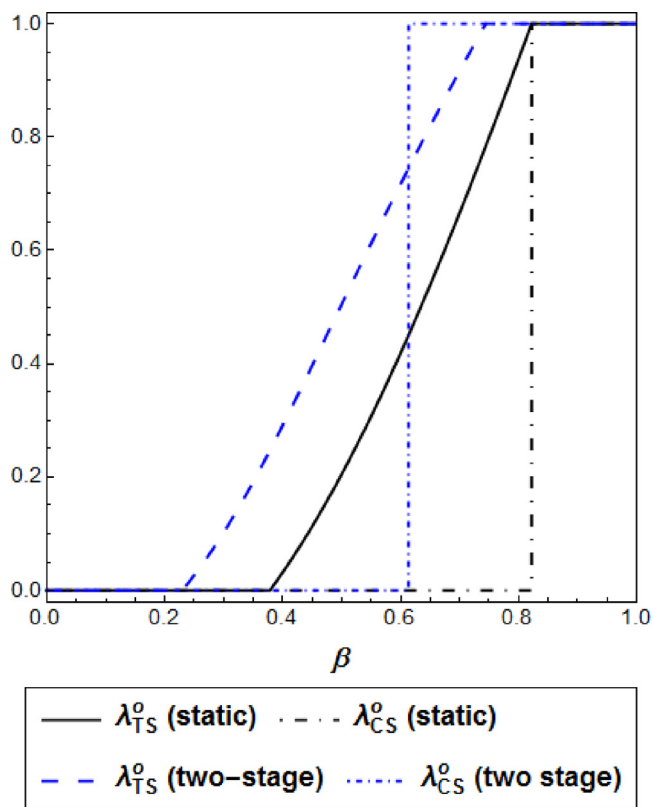
Fig. 3. Socially optimal level of overlapping ownership in the two-stage and simultaneous AJ model.[31]

both in its static (simultaneous) and two-stage versions. We observe that while in the static case $\lambda^o_{TS} \geq \lambda^o_{CS}$ always, in the two-stage case there is a region of spillovers for which $\lambda^o_{CS} = 1 > \lambda^o_{TS} > 0$. Furthermore, we also observe that λ^o_{TS}(two-stage) $\geq \lambda^o_{TS}$(static) and λ^o_{CS}(two-stage) $\geq \lambda^o_{CS}$(static).

6. Antitrust implications

The antitrust concerns on overlapping ownership arrangements (OOAs) has arisen out of the rapid growth of common ownership in industries with stakes in competing firms as well as the growth of private equity investment firms holding partial ownership interests in competing firms. Some high profile cross-ownership cases, such as Ryanair's acquisition of Aer Lingus's stock have also attracted attention. In the US, OOAs can be challenged under the Clayton Act (S. 7) and the Hart-Scott-Rodino Act if they substantially lessen competition. The EU Merger Regulation is limited to acquisitions that confer control and is narrower than Section 7 of the Clayton Act. The EC has proposed extending the scope of merger regulation to examine the acquisition of minority shareholdings. The jury is still out on the potential anticompetitive effects of common ownership. The key to having a holistic view is to look not only at prices and quantities but also at innovation and other strategic variables of firms.

In Section 4 we have found that OOAs may be welfare improving in particular when spillovers are high and R&D investment has commitment value since in this case firms have strong incentives to underinvest. When spillovers are high and the curvature of the innovation function low, a cartelized RJV (or full merger with internalization of technological spillovers) may be welfare-optimal. Inspection of OOAs by antitrust authorities is most warranted for industries with high concentration, since increased concentration (i.e., HHI) expands the region of spillover values for which OOAs are welfare-decreasing, thus, making it more likely that OOAs will be so. Thorough examination of OOAs is also required for low-spillover industries (which can typically be identified as those industries that have low R&D levels or tight patent protection), as in such industries the spillover is more likely to be below the spillover threshold (below which OOAs are welfare-decreasing). In most cases a consumer surplus standard tightens the conditions for OOAs to be welfare-improving, which can exacerbate the tension in competition policy given that authorities follow a consumer surplus standard but at the same time permit high degrees of OOAs and R&D collaboration. Even though mergers can lead to technological spillovers internalization,

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[31] In the AJ model: $f(Q) = a - bQ$, a, $b > 0$, $c = \bar{c} - x_i - \beta \sum_{j \neq i} x_j$, and $\Gamma(x_i) = \gamma x_i^2/2$. We have that $a = 700$, $b = 0.6$, $\bar{c} = 500$, $\gamma = 7$ and $n = 6$ (Fig. A12 in online appendix of López and Vives, 2019).

they increase concentration, which renders OOAs having anti-competitive effects more likely. Therefore, proposals of softer competition policy regarding mergers when overlapping ownership is high (e.g., Posner et al., 2017) should be carefully examined.

Finally, competition policy should distinguish among cases of overlapping ownership according to the degree of control they imply and to whether they stem from common or cross ownership. This is so because the same extent of shareholding will lead to different degrees of internalization of rivals' profits for the different cases above. In the symmetric ownership structure considered, if the regulator wants to establish a cap on the degree of sympathy between firms, this will imply a more strict cap on shareholdings that confer more control than those with silent financial interests, and in turn with those that are (non-controlling) cross-shareholdings among firms. A caveat must be added that this recommendation may not hold when allowing for asymmetric ownership structures. In this case it is possible to achieve a similar degree of profit internalization with symmetric non-controlling stakes than with one way ownership stake with control (see Salop and O'Brien, 2000 for horizontal structures and Hunold and Schlütter, 2019 for vertical structures). This means than in this type of environment a stricter cap on controlling stakes could be circumvented by using mutual non-controlling stakes. In summary, close attention to the network structure of ownership and control is crucial to fine tune potential regulations of overlapping ownership arrangements to avoid anticompetitive outcomes.

7. Open issues

Work on common ownership has progressed a lot recently but much more needs to be done. First, we need to have a better understanding of the channels of transmission of ownership patterns into competitive outcomes, via corporate governance; both in terms of theory and empirics we need to understand how cash flow rights translate into control rights. Second, on the theoretical front, we need to deal with asymmetries in firms' characteristics and ownership structure, endogenizing it, and consider general equilibrium implications of common ownership (see Azar and Vives, 2018; Azar and Vives, 2019). Third, we need to refine the empirical methods and draw from the state of the art empirical IO literature to study both specific industries and a cross-section of them (see Banal-Estanol et al., 2018) since it does not seem enough for policy design to thoroughly study industries with a minor impact in the economy.

Acknowledgment

References

Agarwal, N., 2017. Policy analysis in matching markets. Am. Econ. Rev. 107 (5), 246–250.

Antón, M., Ederer, F., Giné, M., Schmalz, M., 2019. Common ownership, competition, and top management incentives. Working Paper.

Appel, I.R., Gormley, T.A., Keim, D.B., 2016. Passive investors, not passive owners. J. Finan. Econ. 121 (1), 111–141.

Autor, D., Dorn, D., Katz, L. F., Patterson, C., Reenen, J. V., 2017. The fall of the labor share and the rise of superstar firms. Working paper MIT and National Bureau of Economic Research (No. 23396).

Azar, J., 2017. Portfolio diversification, market power, and the theory of the firm. Working paper.

Azar, J., Raina, S., Schmalz, M., 2016. Ultimate ownership and bank competition. Working paper.

Azar, J., Schmalz, M.C., Tecu, I., 2018. Anti-competitive effects of common ownership. J. Finan. 73 (4), 1513–1565.

Azar, J., Vives, X., 2018. Oligopoly, macroeconomic performance, and competition policy. CEPR Discussion Paper 13000, CESifo Working Paper 7189.

Azar, J., Vives, X., 2019. Common ownership and the secular stagnation hypothesis. AEA Pap. Proc. 109, 322–326.

Bain, J.S., 1951. Relation of profit rate to industry concentration: american manufacturing 1936–1940. Quart. J. Econ. 65 (3), 293–324.

Baker, J., 2016. Overlapping financial investor ownership, market power, and antitrust enforcement: my qualified agreement with professor Elhauge. Harvard Law Rev. 129, 212–232.

Banal-Estanol, A., Seldeslachts, J., Vives, X., 2018. Common ownership-product market consequences of a shift from active to passive investors. Mimeo.

Barkai, S., 2016. Declining labor and capital shares. Stigler Center for the Study of the Economy and the State New Working Paper Series, 2.

Berle, A.A., Means, G.C., 1932. The Modern Corporation and Private Property. Macmillan Editor, New York.

Bloom, N., Schankerman, M., Reenen, J.V., 2013. Identifying technology spillovers and product market rivalry. Econometrica 81, 1347–1393.

Brav, A., Jiang, W., Li, T., 2018. Picking friends before picking (proxy) GHTS: How mutual fund voting shapes proxy contests. Working Paper Columbia Business School Research Paper No. 18-16.

Bresnahan, T., 1989. Empirical studies of industries with market power. In: Schmalensee, R., Willig, R. (Eds.), Handbook of Industrial Organization, 2. chapter 17

Bresnahan, T.F., Salop, S.C., 1986. Quantifying the competitive effects of production joint ventures. Int. J. Ind. Organ. 4, 155–175.

Brito, D., Osório, A., Ribeiro, R., Vasconcelos, H., 2018. Unilateral effects screens for partial horizontal acquisitions: the generalized HHI and GUPPI. Int. J. Ind. Organ. 59, 127–189.

CEA, 2016. Benefits of competition and indicators of market power. Council of Economic Advisers Issue Brief. April.

Cyert, R.M., DeGroot, M.H., 1973. An analysis of cooperation and learning in a duopoly context. Am. Econ. Rev. 63 (1), 24–37.

Dasgupta, P., Stiglitz, J., 1980. Industrial structure and the nature of innovative activity. Econ. J. 90, 266-293.

d'Aspremont, C., Jacquemin, A., 1988. Cooperative and noncooperative r&d in duopoly with spillovers. Am. Econ. Rev. 78, 1133–1137.

De Loecker, J., Eeckhout, J., Unger, G., 2018. The rise of market power and the macroeconomic implications. NBER Working Paper No. 23687.

Demsetz, H., 1973. Industry structure, market rivalry, and public policy. J. Law Econ. 16 (1), 1–9.

Dennis, P. J., Gerardi, K., Schenone, C., 2018. Common ownership does not have anti-competitive effects in the airline industry. Working paper.

Dietzenbacher, E., Smid, B., Volkerink, B., 2000. Horizontal integration in the dutch financial sector. Int. J. Ind. Organ. 18, 1223–1242.

Edgeworth, F.Y., 1881. Mathematical Physics: An Essay on the Application of Mathematics to the Moral Sciences. Kegan Paul, London.

Elhauge, E., 2016. Horizontal shareholding. Harvard Law Rev. 109, 1267–1317.

Elhauge, E., 2017. Tackling horizontal shareholding: an update and extension to the sherman act and EU competition law. Background Paper for 128th meeting of the OECD Competition Committee.

European Commission, 2017. Decision, Case M.7392, Dow/Dupont, 27 March.

Federico, G., Langus, G., Valletti, T., 2017. A simple model of mergers and innovation. Econ. Lett. 157, 136–140.

Fisher, I., 1930. The theory of interest. New York, 43.

Fos, V., Tsoutsoura, M., 2014. Shareholder democracy in play: career consequences of proxy contests. J. Financ. Econ. 114 (2), 316–340.

Geng, H., Hau, H., Lai, S., 2016. Technological progress and ownership structure, pp. 15–39.

Gilbert, R., Greene, H., 2015. Merging innovation into antitrust agency enforcement of the clayton act. George Wash. Law Rev. 83, 1919–1947.

Gilje, E., Gormley, T. A., Levit, D., 2018. Who's paying attention? measuring common ownership and its impact on managerial incentives. NBER Working Paper No. w25644.

Gilo, D., Moshe, Y., Spiegel, Y., 2006. Partial cross ownership and tacit collusion. RAND J. Econ. 37, 81–99.

Gordon, R.H., 2003. Do publicly traded corporations act in the public interest? The B.E. J. Econ. Anal. Pol. 0 (1), 2. Berkeley Electronic Press

Gramlich, J., Grundl, S., 2017. Estimating the competitive effects of common ownership. FEDS Working Paper No. 2017-029.

Grullon, G., Larkin, Y., Michaely, R., 2018. Are US industries becoming more concentrated. Working Paper.

Gutiérrez, G., Philippon, T., 2016. Investment-less growth: An empirical investigation. Mimeo.

Gutiérrez, G., Philippon, T., 2017. Declining competition and investment in the US. National Bureau of Economic Research working paper (No. w23583).

Hall, R. E., 2018. New evidence on the markup of prices over marginal costs and the role of Megafirms in the US economy. NBER Working Paper No. 24574.

Hansen, R., Lott, 1996. Externalities and corporate objectives in a world with diverified shareholder/consumers. J. Financ. Quant. Anal. 31, 43–68.

Hart, O., 1979. On shareholder unanimity in large stock market economies. Econometrica 47, 1057–1083.

He, J.J., Huang, J., 2017. Product market competition in a world of cross ownership: evidence from institutional blockholdings. Rev. Financ. Stud. 30, 2674–2718.

Head, K., Spencer, B.J., 2017. Oligopoly in international trade: rise, fall and resurgence. Canad. J. Econ. Revue Canadienne d'économique 50 (5), 1414–1444.

Hunold, M., Schlütter, F., 2019. Vertical financial interest and corporate influence. DICE discussion papers 309, University of Düsseldorf, Düsseldorf institute for competition economics (DICE).

Irwin, D., Klenow, P., 1994. Learning-by-doing spillovers in the semiconductor industry. J. Pol. Econ. 102 (6), 1200–1227.

Kamien, M., Muller, E., Zang, I., 1992. Research joint ventures and r&d cartels. Am. Econ. Rev. 82, 1293–1306.

Kennedy, P., O'Brien, D., Song, M., Waehrer, K., 2017. The competitive effects of common ownership: Economic foundations and empirical evidence. Mimeo.

Leahy, D., Neary, P., 1997. Public policy towards r&d in oligopolistic industries. Am. Econ. Rev. 87, 642–662.

López, A., Vives, X., 2019. Overlapping ownership, R&D spillovers and antitrust policy. J. Pol. Econ.

Motta, M., Tarantino, E., 2018. The effect of horizontal mergers, when firms compete in investments and prices. Universitat Pompeu Fabra Working paper 1579.

Nain, A., Wang, Y., 2018. The product market impact of minority stake acquisitions. Manag. Sci. 64 (2), 825–844.

O'Brien, D. P., Waehrer, K., 2017. The competitive effects of common ownership: We know less than we think. Working Paper.

Posner, E., Morton, F.S., Weyl, E.G., 2017. A proposal to limit the anti-competitive power of institutional investors. Antitrust Law J. 81 (3), 669–728.

Reynolds, R.J., Snapp, B.R., 1986. The competitive effects of partial equity interests and joint ventures. Int. J. Ind. Organ. 4, 141–153.

Rock, E. B., Rubinfeld, D. L., 2017. Antitrust for institutional investors. NYU School of Law, WP NO. 17–23.

Rotemberg, J., 1984. Financial transaction costs and industrial performance. Working Paper, Alfred P. Sloan School of Management.

Rubinstein, A., Yaari, M. E., 1983. The competitive stock market as cartel maker: Some examples, Technical Report, Suntory and Toyota International Centres for Economics and Related Disciplines (No 84), LSE.

Salop, S.C., O'Brien, D.P., 2000. Competitive effects of partial ownership: financial interest and corporate control. Antit. Law J. 67, 559–614.

Schmalensee, R., 1989. Chapter 16 inter-industry studies of structure and performance. In: Volume 2 of Handbook of Industrial Organization. Elsevier, p. 951.

Stiglitz, J., 2017. Inequality, stagnation, and market power. Roosevelt Institute Technical Report. Working Paper

Summers, L., 2016. Corporate profits are near record highs. Here's why that's a problem. Washington Post, March 30.

Vives, X., 2008. Innovation and competitive pressure. J. Ind. Econ. 56, 419–469.

Vives, X., 2017. Institutional investment, common ownership and antitrust. Antit. Chron. June 3. CPI